or ±0.5 °C, whichever is greater, both equipped with a continuous recorder;

(ii) An organic monitoring device used to indicate the concentration level of organic compounds exiting the recovery device based on a detection principle such as infra-red, photoionization, or thermal conductivity, each equipped with a continuous recorder.

(f) An owner or operator of an affected facility seeking to demonstrate compliance with the standards specified under § 60.612 with control devices other than an incinerator, boiler, process heater, or flare; or recovery devices other than an absorber, condenser, or carbon adsorber shall provide to the Administrator information describing the operation of the control device or recovery device and the process parameter(s) which would indicate proper operation and maintenance of the device. The Administrator may request further information and will specify appropriate monitoring procedures or requirements.

[55 FR 26922, June 29, 1990, as amended at 65 FR 61769, Oct. 17, 2000]

§ 60.614 Test methods and procedures.

(a) For the purpose of demonstrating compliance with § 60.612, all affected facilities shall be run at full operating conditions and flow rates during any performance test.

(b) The following methods in appendix A to this part, except as provided under § 60.8(b) shall be used as reference methods to determine compliance with the emission limit or percent reduction efficiency specified under § 60.612(a).

(1) Method 1 or 1A, as appropriate, for selection of the sampling sites. The control device inlet sampling site for determination of vent stream molar composition or TOC (less methane and ethane) reduction efficiency shall be prior to the inlet of the control device and after the recovery system.

(2) Method 2, 2A, 2C, or 2D, as appropriate, for determination of the volumetric flow rates.

(3) The emission rate correction factor, integrated sampling and analysis procedure of Method 3 shall be used to determine the oxygen concentration ($\%O_{2d}$) for the purposes of determining compliance with the 20 ppmv limit. The sampling site shall be the same as that of the TOC samples and the samples shall be taken during the same time that the TOC samples are taken. The TOC concentration corrected to 3 percent O_2 (C_c) shall be computed using the following equation:

$$C_c = C_{TOC} \frac{17.9}{20.9 - \%O_{2d}}$$

where:

C_c=Concentration of TOC corrected to 3 percent 0_2, dry basis, ppm by volume.

C_{TOC}=Concentration of TOC (minus methane and ethane), dry basis, ppm by volume.

$\%O_{2d}$=Concentration of O_2, dry basis, percent by volume.

(4) Method 18 to determine concentration of TOC in the control device outlet and the concentration of TOC in the inlet when the reduction efficiency of the control device is to be determined.

(i) The sampling time for each run shall be 1 hour in which either an integrated sample or four grab samples shall be taken. If grab sampling is used then the samples shall be taken at 15-minute intervals.

(ii) The emission reduction (R) of TOC (minus methane and ethane) shall be determined using the following equation:

$$R = \frac{E_i - E_o}{E_i} \times 100$$

where:

R=Emission reduction, percent by weight.

E_i=Mass rate of TOC entering the control device, kg/hr (lb/hr).

E_o=Mass rate of TOC discharged to the atmosphere, kg/hr (lb/hr).

(iii) The mass rates of TOC (E_i, E_o) shall be computed using the following equations:

$$E_i = K_2 \left(\sum_{j=1}^{n} C_{ij} M_{ij} \right) Q_i$$

$$E_o = K_2 \left(\sum_{j=1}^{n} C_{oj} M_{oj} \right) Q_o$$

Where:

C_{ij}, C_{oj}=Concentration of sample component ''j'' of the gas stream at the inlet and outlet of the control device, respectively, dry basis ppm by volume.

M_{ij}, M_{oj}=Molecular weight of sample component ''j'' of the gas stream at the inlet and outlet of the control device, respectively, g/g-mole (lb/lb-mole).

Q_i, Q_o=Flow rate of gas stream at the inlet and outlet of the control device, respectively, dscm/min (dscf/min).

$K_2 = 2.494 \times 10^{-6}$ (1/ppm)(g-mole/scm)(kg/g)(min/hr) (metric units), where standard temperature for (g-mole/scm) is 20 °C.

$= 1.557 \times 10^{-7}$ (1/ppm)(lb-mole/scf)(min/hr) (English units), where standard temperature for (lb-mole/scf) is 68 °F.

(iv) The TOC concentration (C_{TOC}) is the sum of the individual components and shall be computed for each run using the following equation:

$$C_{TOC} = \sum_{j=1}^{n} C_j$$

where:

C_{TOC}=Concentration of TOC (minus methane and ethane), dry basis, ppm by volume.

C_j=Concentration of sample components in the sample.

n=Number of components in the sample.

(c) When a boiler or process heater with a design heat input capacity of 44 MW (150 million Btu/hour) or greater is used to seek to comply with § 60.612(a), the requirement for an initial performance test is waived, in accordance with § 60.8(b). However, the Administrator reserves the option to require testing at such other times as may be required, as provided for in section 114 of the Act.

(d) When a flare is used to seek to comply with § 60.612(b), the flare shall comply with the requirements of § 60.18.

(e) The following test methods in appendix A to this part, except as provided under § 60.8(b), shall be used for determining the net heating value of the gas combusted to determine compliance under § 60.612(b) and for determining the process vent stream TRE index value to determine compliance under § 60.612(c).

(1)(i) Method 1 or 1A, as appropriate, for selection of the sampling site. The sampling site for the vent stream flow rate and molar composition determination prescribed in § 60.614(e)(2) and (3) shall be, except for the situations outlined in paragraph (e)(1)(ii) of this section, prior to the inlet of any control device, prior to any post-reactor dilution of the stream with air, and prior to any post-reactor introduction of halogenated compounds into the vent stream. No transverse site selection method is needed for vents smaller than 10 centimeters (4 inches) in diameter.

(ii) If any gas stream other than the air oxidation vent stream from the affected facility is normally conducted through the final recovery device.

(A) The sampling site for vent stream flow rate and molar composition shall be prior to the final recovery device and prior to the point at which the nonair oxidation stream is introduced.

(B) The efficiency of the final recovery device is determined by measuring the TOC concentration using Method 18 at the inlet to the final recovery device after the introduction of any nonair oxidation vent stream and at the outlet of the final recovery device.

(C) This efficiency is applied to the TOC concentration measured prior to the final recovery device and prior to the introduction of the nonair oxidation stream to determine the concentration of TOC in the air oxidation stream from the final recovery device. This concentration of TOC is then used to perform the calculations outlined in § 60.614(e)(4) and (5).

(2) The molar composition of the process vent stream shall be determined as follows:

(i) Method 18 to measure the concentration of TOC including those containing halogens.

(ii) D1946–77, or 90 (Reapproved 1994) (incorporation by reference as specified in § 60.17 of this part) to measure the concentration of carbon monoxide and hydrogen.

(iii) Method 4 to measure the content of water vapor.

(3) The volumetric flow rate shall be determined using Method 2, 2A, 2C, or 2D, as appropriate.

(4) The net heating value of the vent stream shall be calculated using the following equation:

$$H_T = K_1\left(\sum_{j=1}^{n} C_j H_j\right)$$

where:

H_T = Net heating value of the sample, MJ/scm (Btu/scf), where the net enthalpy per mole of vent stream is based on combustion at 25 °C and 760 mm Hg (77 °F and 30 in. Hg), but the standard temperature for determining the volume corresponding to one mole is 20 °C (68 °F).

K_1 = 1.74×10^{-7} (1/ppm)(g-mole/scm)(MJ/kcal) (metric units), where standard temperature for (g-mole/scm) is 20 °C.

= 1.03×10^{-11} (1/ppm)(lb-mole/scf)(Btu/kcal) (English units) where standard temperature for (lb/mole/scf) is 68 °F.

C_j = Concentration on a wet basis of compound j in ppm, as measured for organics by Method 18 and measured for hydrogen and carbon monoxide by ASTM D1946–77, 90, or 94 (incorporation by reference as specified in § 60.17 of this part) as indicated in § 60.614(e)(2).

H_j = Net heat of combustion of compound j, kcal/(g-mole) [kcal/(lb-mole)], based on combustion at 25 °C and 760 mm Hg (77 °F and 30 in. Hg).

(5) The emission rate of TOC in the process vent stream shall be calculated using the following equation:

$$E_{TOC} = K_2\left[\sum_{j=1}^{n} C_j M_j\right] Q_s$$

where:

E_{TOC} = Measured emission rate of TOC, kg/hr (lb/hr).

K_2 = 2.494×10^{-6} (1/ppm)(g-mole/scm)(kg/g)(min/hr) (metric units), where standard temperature for (g-mole/scm) is 20 °C.

= 1.557×10^{-7} (1/ppm)(lb-mole/scf)(min/hr) (English units), where standard temperature for (lb-mole/scf) is 68 °F.

C_j = Concentration on a wet basis of compound j in ppm, as measured by Method 18 as indicated in § 60.614(e)(2).

M_j = Molecular weight of sample j, g/g-mole (lb/lb-mole).

Q_s = Vent stream flow rate, scm/hr (scf/hr), at a temperature of 20 °C (68 °F).

(6) The total process vent stream concentration (by volume) of compounds containing halogens (ppmv, by compound) shall be summed from the individual concentrations of compounds containing halogens which were measured by Method 18.

(f) For purposes of complying with § 60.612(c), the owner or operator of a facility affected by this subpart shall calculate the TRE index value of the vent stream using the equation for incineration in paragraph (e)(1) of this section for halogenated vent streams. The owner or operator of an affected facility with a nonhalogenated vent stream shall determine the TRE index value by calculating values using both the incinerator equation in paragraph (e)(1) of this section and the flare equation in paragraph (e)(2) of this section and selecting the lower of the two values.

(1) The TRE index value of the vent stream controlled by an incinerator shall be calculated using the following equation:

$$TRE = \frac{1}{E_{TOC}}\left[a + b(Q_s)^{0.88} + c(Q_s) + d(Q_s)(H_T) + e(Q_s)^{0.88}(H_T)^{0.88} + f(Y_s)^{0.5}\right]$$

(i) Where for a vent stream flow rate that is greater than or equal to 14.2 scm/min (501 scf/min) at a standard temperature of 20 °C (68 °F):

TRE = TRE index value.

Q_s = Vent stream flow rate, scm/min (scf/min), at a temperature of 20 °C (68 °F).

H_T = Vent stream net heating value, MJ/scm (Btu/scf), where the net enthalpy per mole of vent stream is based on combustion at 25 °C and 760 mm Hg (68 °F and 30 in. Hg), but the standard temperature for determining the volume corresponding to one mole is 20 °C (68 °F) as in the definition of Q_s.

Y_s = Q_s for all vent stream categories listed in table 1 except for Category E vent streams where $Y_s = Q_s H_T/3.6$.

E_{TOC} = Hourly emissions of TOC, kg/hr (lb/hr). a, b, c, d, e, and f are coefficients.

The set of coefficients which apply to a vent stream shall be obtained from table 1.

TABLE 1. AIR OXIDATION NSPS TRE COEFFICIENTS FOR VENT STREAMS CONTROLLED BY AN INCINERATOR

DESIGN CATEGORY A1. FOR HALOGENATED PROCESS VENT STREAMS, IF 0 ≤ NET HEATING VALUE (MJ/scm) ≤ 3.5 OR IF 0 ≤ NET HEATING VALUE (Btu/scf) ≤ 94:

Q_s = Vent Stream Flow rate scm/min (scf/min)	a	b	c	d	e	f
$14.2 \le Q_s \le 18.8$	19.18370	0.27580	0.75762	-0.13064	0	0.01025
$(501 \le Q_s \le 664)$	(42.29238)	(0.017220)	(0.072549)	(-0.00030361)	(0)	(0.003803)
$18.8 < Q_s \le 699$	20.00563	0.27580	0.30387	-0.13064	0	0.01025
$(664 < Q_s \le 24,700)$	(44.10441)	(0.017220)	(0.029098)	(-0.00030361)	(0)	(0.003803)
$699 < Q_s \le 1400$	39.87022	0.29973	0.30387	-0.13064	0	0.01449
$(24,700 < Q_s \le 49,000)$	(87.89789)	(0.018714)	(0.029098)	(-0.00030361)	(0)	(0.005376)
$1400 < Q_s \le 2100$	59.73481	0.31467	0.30387	-0.13064	0	0.01775
$(49,000 < Q_s \le 74,000)$	(131.6914)	(0.019647)	(0.029098)	(-0.00030361)	(0)	(0.006585)
$2100 < Q_s \le 2800$	79.59941	0.32572	0.30387	-0.13064	0	0.02049
$(74,000 < Q_s \le 99,000)$	(175.4849)	(0.020337)	(0.029098)	(-0.00030361)	(0)	(0.007602)
$2800 < Q_s \le 3500$	99.46400	0.33456	0.30387	-0.13064	0	0.02291
$(99,000 < Q_s \le 120,000)$	(219.2783)	(0.020888)	(0.029098)	(-0.00030361)	(0)	(0.008500)

DESIGN CATEGORY A2. FOR HALOGENATED PROCESS VENT STREAMS, IF NET HEATING VALUE < 3.5 (MJ/scm) OR IF NET HEATING VALUE < 94 (Btu/scf):

Q_s = Vent Stream Flow rate scm/min(scf/min)	a	b	c	d	e	f
$14.2 \le Q_s \le 18.8$	18.84466	0.26742	-0.20044	0	0	0.01025
$(501 \le Q_s \le 664)$	(41.54494)	(0.016696)	(-0.019194)	(0)	(0)	(0.003803)
$18.8 < Q_s \le 699$	19.66658	0.26742	-0.25332	0	0	0.01025
$(664 < Q_s \le 24,700)$	(43.35694)	(0.016696)	(-0.024258)	(0)	(0)	(0.003803)
$699 < Q_s \le 1400$	39.19213	0.29062	-0.25332	0	0	0.01449
$(24,700 < Q_s \le 49,000)$	(86.40297)	(0.018145)	(-0.024258)	(0)	(0)	(0.005376)
$1400 < Q_s \le 2100$	58.71768	0.30511	-0.25332	0	0	0.01775
$(49,000 < Q_s \le 74,000)$	(129.4490)	(0.019050)	(-0.024258)	(0)	(0)	(0.006585)
$2100 < Q_s \le 2800$	78.24323	0.31582	-0.25332	0	0	0.02049
$(74,000 < Q_s \le 99,000)$	(172.4950)	(0.019718)	(-0.024258)	(0)	(0)	(0.007602)
$2800 < Q_s \le 3500$	97.76879	0.32439	-0.25332	0	0	0.02291
$(99,000 < Q_s \le 120,000)$	(215.5411)	(0.020253)	(-0.024258)	(0)	(0)	(0.008500)

DESIGN CATEGORY B. FOR NONHALOGENATED PROCESS VENT STREAMS, IF 0 ≤ NET HEATING VALUE (MJ/scm) ≤ 0.48 OR IF 0 ≤ NET HEATING VALUE (Btu/scf) ≤ 13:

Q_S = Vent Stream Flow rate scm/min(scf/min)	a	b	c	d	e	f
$14.2 \le Q_S \le 1340$	8.54245	0.10555	0.09030	-0.17109	0	0.01025
$(501 \le Q_S \le 47,300)$	(18.83268)	(0.0065901)	(0.008647)	(-0.00039762)	(0)	(0.003803)
$1340 < Q_S \le 2690$	16.94386	0.11470	0.09030	-0.17109	0	0.01449
$(47,300 < Q_S \le 95,000)$	(37.35443)	(0.0071614)	(0.008647)	(-0.00039762)	(0)	(0.005376)
$2690 < Q_S \le 4040$	25.34528	0.12042	0.09030	-0.17109	0	0.01775
$(95,000 < Q_S \le 143,000)$	(55.87620)	(0.0075185)	(0.008647)	(-0.00039762)	(0)	(0.00658

DESIGN CATEGORY C. FOR NONHALOGENTED PROCESS VENT STREAMS, IF 0.48 < NET HEATING VALUE (MJ/scm) ≤ 1.9 OR IF 13 < NET HEATING VALUE (Btu/scf) ≤ 51:

Q_S = Vent Stream Flow rate scm/min(scf/min)	a	b	c	d	e	f
$14.2 \le Q_S \le 1340$	9.25233	0.06105	0.31937	-0.16181	0	0.01025
$(501 \le Q_S \le 47,300)$	(20.39769)	(0.003812)	(0.030582)	(-0.00037605)	(0)	(0.003803)
$1340 < Q_S \le 2690$	18.36363	0.06635	0.31937	-0.16181	0	0.01449
$(47,300 < Q_S \le 95,000)$	(40.48446)	(0.004143)	(0.030582)	(-0.00037605)	(0)	(0.005376)
$2690 < Q_S \le 4040$	27.47492	0.06965	0.31937	-0.16181	0	0.01775
$(95,000 < Q_S \le 143,000)$	(60.57121)	(0.004349)	(0.030582)	(-0.00037605)	(0)	(0.006585)

DESIGN CATEGORY D. FOR NONHALOGENATED PROCESS VENT STREAMS, IF 1.9 < NET HEATING VALUE (MJ/scm) ≤ 3.6 OR IF 51 < NET HEATING VALUE (Btu/scf) ≤ 97:

Q_S = Vent Stream Flow rate scm/min(scf/min)	a	b	c	d	e	f
$14.2 \le Q_S \le 1180$	6.67868	0.06943	0.02582	0	0	0.01025
$(501 \le Q_S \le 41,700)$	(14.72382)	(0.004335)	(0.002472)	(0)	(0)	(0.003803)
$1180 < Q_S \le 2370$	13.21633	0.07546	0.02582	0	0	0.01449
$(41,700 < Q_S \le 83,700)$	(29.13672)	(0.004711)	(0.002472)	(0)	(0)	(0.005376)
$2370 < Q_S \le 3550$	19.75398	0.07922	0.02582	0	0	0.01775
$(83,700 < Q_S \le 125,000)$	(43.54962)	(0.004946)	(0.002472)	(0)	(0)	(0.00658

Q_S = Vent Stream Flow rate scm/min(scf/min)	a	b	c	d	e	f
$14.2 \le Y_S \le 1180$	6.67868	0	0	-0.00707	0.02220	0.01025
$(501 \le Y_S \le 41,700)$	(14.72382)	(0)	(0)	(-0.0000164)	(0.0001174)	(0.003803)
$1180 < Y_S \le 2370$	13.21633	0	0	-0.00707	0.02412	0.01449
$(41,700 < Y_S \le 83,700)$	(29.13672)	(0)	(0)	(-0.0000164)	(0.0001276)	(0.005376)
$2370 < Y_S \le 3550$	19.75398	0	0	-0.00707	0.02533	0.01775
$(83,700 < Y_S \le 125,000)$	(43.54962)	(0)	(0)	(-0.0000164)	(0.0001340)	(0.006585)

(ii) Where for a vent stream flow rate that is less than 14.2 scm/min (501 scf/min) at a standard temperature of 20 °C (68 °F):

TRE = TRE index value.
Q_s = 14.2 scm/min (501 scf/min).
H_T = (FLOW)(HVAL)/Q_s.

Where the following inputs are used:

FLOW = Vent stream flow rate, scm/min (scf/min), at a temperature of 20 °C (68 °F).

HVAL = Vent stream net heating value, MJ/scm (Btu/scf), where the net enthalpy per mole of vent stream is based on combustion at 25 °C and 760 mm Hg (68 °F and 30 in. Hg), but the standard temperature for

determining the volume corresponding to one mole is 20 °C (68 °F) as in the definition of Q_s.

Y_s = Q_s for all vent stream categories listed in table 1 except for Category E vent streams where $Y_s = Q_s H_T/3.6$.

E_{TOC} = Hourly emissions of TOC, kg/hr (lb/hr).

a, b, c, d, e, and f are coefficients.

The set of coefficients that apply to a vent stream can be obtained from table 1.

(2) The equation for calculating the TRE index value of a vent stream controlled by a flare is as follows:

$$TRE = \frac{1}{E_{TOC}}\left[a(Q_s) + b(Q_s)^{0.8} + c(Q_s)(H_T) + d(E_{TOC}) + e\right]$$

where:

TRE = TRE index value.

E_{TOC} = Hourly emissions of TOC, kg/hr (lb/hr).

Q_s = Vent stream flow rate, scm/min (scf/min), at a standard temperature of 20 °C (68 °F).

H_T = Vent stream net heating value, MJ/scm (Btu/scf), where the net enthalpy per mole of vent stream is based on combustion at 25 °C and 760 mm Hg (68 °F and 30 in. Hg), but the standard temperature for determining the volume corresponding to one mole is 20 °C (68 °F) as in the definition of Q_s.

a, b, c, d, and e are coefficients.

The set of coefficients that apply to a vent stream shall be obtained from table 2.

TABLE 2—AIR OXIDATION PROCESSES NSPS TRE COEFFICIENTS FOR VENT STREAMS CONTROLLED BY A FLARE

	a	b	c	d	e
H_T < 11.2 MJ/scm	2.25	0.288	−0.193	(−0.0051	2.08
(H_T < 301 Btu/scf)	(0.140)	(0.0367)	(−0.000448)	(−0.0051)	(4.59)
H_T ≥ 11.2 MJ/scm	0.309	0.0619	−0.0043	−0.0034	2.08
H_T ≥ 301 Btu/scf)	(0.0193)	(0.00788)	(−0.000010)	(−0.0034)	(4.59)

(g) Each owner or operator of an affected facility seeking to comply with § 60.610(c) or § 60.612(c) shall recalculate the TRE index value for that affected facility whenever process changes are made. Some examples of process changes are changes in production capacity, feedstock type, or catalyst type, or whenever there is replacement, removal, or addition of recovery equipment. The TRE index value shall be recalculated based on test data, or on best engineering estimates of the effects of the change to the recovery system.

(1) Where the recalculated TRE index value is less than or equal to 1.0, the owner or operator shall notify the Administrator within 1 week of the recalculation and shall conduct a performance test according to the methods and procedures required by § 60.614 to determine compliance with § 60.612(a). Performance tests must be conducted as soon as possible after the process change but no later than 180 days from the time of the process change.

(2) Where the initial TRE index value is greater than 4.0 and the recalculated TRE index value is less than or equal to 4.0, but greater than 1.0, the owner or operator shall conduct a performance test in accordance with § 60.8 and § 60.614 and shall comply with §§ 60.613, 60.614, and 60.615. Performance tests must be conducted as soon as possible after the process change but no later than 180 days from the time of the process change.

[55 FR 26922, June 29, 1990; 55 FR 36932, Sept. 7, 1990, as amended at 65 FR 61769, Oct. 17, 2000]

§ 60.615 Reporting and recordkeeping requirements.

(a) Each owner or operator subject to § 60.612 shall notify the Administrator of the specific provisions of § 60.612