**Section 219.APPENDIX G TRE Index Measurements for SOCMI Reactors and Distillation Units**

For purposes of Subpart Q, Sections 219.431 through 219.435, the following apply:

a) The following test methods shall be used to determine compliance with the total resource effectiveness ("TRE") index value:

1) Method 1 or 1A, incorporated by reference at Section 219.112 of this Part, as appropriate, for selection of the sampling site.

A) The sampling site for the vent stream molar composition determination and flow rate prescribed in subsections (a)(2) and (a)(3) of this Appendix shall be, except for the situations outlined in subsection (a)(1)(B), after the final recovery device, if a recovery system is present, prior to the inlet of any control device, and prior to any post-reactor or post-distillation unit introduction of halogenated compounds into the vent stream. No traverse site selection method is needed for vents smaller than 10 cm in diameter.

B) If any gas stream other than the reactor or distillation unit vent stream is normally conducted through the final recovery device:

i) 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 any nonreactor or nondistillation unit vent stream or stream from a nonaffected reactor or distillation unit is introduced. Method 18 incorporated by reference at Section 219.112 of this Part, shall be used to measure organic compound concentrations at this site.

ii) The efficiency of the final recovery device is determined by measuring the organic compound concentrations using Method 18, incorporated by reference at Section 219.112 of this Part, at the inlet to the final recovery device after the introduction of all vent streams and at the outlet of the final recovery device.

iii) The efficiency of the final recovery device determined according to subsection (a)(1)(B)(ii) of this Appendix shall be applied to the organic compound concentrations measured according to subsection (a)(1)(B)(i) of this Appendix to determine the concentrations of organic compounds from the final recovery device attributable to the reactor or distillation unit vent stream. The resulting organic compound concentrations are then used to perform the calculations outlined in subsection (a)(4) of this Appendix.

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

A) Method 18, incorporated by reference at Section 219.112 of this Part, to measure the concentration of organic compounds including those containing halogens;

B) ASTM D1946-77, incorporated by reference at Section 219.112 of this Part, to measure the concentration of carbon monoxide and hydrogen; and

C) Method 4, incorporated by reference at Section 219.112 of this Part, to measure the content of water vapor.

3) The volumetric flow rate shall be determined using Method 2, 2A, 2C, or 2D, incorporated by reference at Section 219.112 of this Part, as appropriate.

4) The emission rate of VOM (minus methane and ethane) (EVOM) in the vent stream shall be calculated using the following formula:



where:

|  |  |  |
| --- | --- | --- |
| EVOM | = | Emission rate of VOM (minus methane and ethane) in the sample, kg/hr. |
|  |  |  |
| K2 | = | Constant, 2.494 x 10-6 (1/ppmv)(g-mole/scm) (kg/g) (min/hr.), where standard temperature for (g-mole/scm) is 20°C. |
|  |  |  |
| Cj | = | Concentration of compound j, on a dry basis, in ppmv as measured by Method 18, incorporated by reference at Section 219.112 of this Part, as indicated in Section 219.433(c)(3) of this Part. |
|  |  |  |
| Mj | = | Molecular weight of sample j, g/g-mole. |
|  |  |  |
| Qs | = | Vent stream flow rate (scm) at a temperature of 20°C. |

5) The total 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, incorporated by reference at Section 219.112 of this Part.

6) The net heating value of the vent stream shall be calculated using the following:



where:

|  |  |  |
| --- | --- | --- |
| HT | = | Net heating value of the sample (MJ/scm), where the net enthalpy per mole of vent stream is based on combustion of 25°C and 760 mmHG, but the standard temperature for determining the volume corresponding to one mole is 20°C as in the definition of Qs (vent stream flow rate). |
|  |  |  |
| K1 | = | Constant, 1.740 x 10-7 (1/ppmv)-1 (g-mole/scm, (MJ/Kcal), where standard temperature for (g-mole/scm) is 20°C. |
|  |  |  |
| Bws | = | Water vapor content of the vent stream, proportion by volume; except that if the vent stream passes through a final stream jet and is not condensed, it shall be assumed that Bws = 0.023 in order to correct to 2.3 percent moisture. |
|  |  |  |
| Cj | = | Concentration on a dry basis of compound j in ppmv, as measured for all organic compounds by Method 18, incorporated by reference at Section 219.112 of this Part, and measured for hydrogen and carbon monoxide by using ASTM D1946-77, incorporated by reference at Section 219.112 of this Part. |
|  |  |  |
| Hj | = | Net heat of combustion of compound j, kCal/g-mole, based on combustion at 25°C and 760 mmHG. The heats of combustion of vent stream components shall be determined using ASTM D2382-83, incorporated by reference at Section 219.122 of this Part, if published values are not available or cannot be calculated. |

b)

1) The TRE index value of the vent shall be calculated using the following:



where:

|  |  |  |
| --- | --- | --- |
| TRE | = | TRE index value |
|  |  |  |
| EVOM | = | Hourly emission rate of VOM (kg/hr) as calculated in subsection (a)(4) of this Appendix. |
|  |  |  |
| Qs | = | Vent stream flow rate scm/min at a standard temperature of 20°C. |
|  |  |  |
| HT | = | Vent stream net heating value (MJ/sm), as calculated in subsection (a)(6) of this Appendix. |
|  |  |  |
| EVOM | = | Hourly emission rate of VOM (minus methane and ethane), (kg/hr) as calculated in subsection (a)(4) of this Appendix. |
|  |  |  |
| a,b,  c,d | = | Value of coefficients presented below are: |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Type of Stream | Control Device Basis | Value of Coefficients | | | |
| a | b | c | d |
|  |  |  |  |  |  |
| Nonhalogenated | Flare | 2.129 | 0.183 | -0.005 | 0.359 |
|  | Thermal incinerator zero (0) Percent heat Recovery | 3.075 | 0.021 | -0.037 | 0.018 |
|  | Thermal incinerator 70 Percent heat Recovery | 3.803 | 0.032 | -0.042 | 0.007 |
| Halogenated | Thermal incinerator and scrubber | 5.470 | 0.181 | -0.040 | 0.004 |

2) Every owner or operator of a vent stream shall use the applicable coefficients identified for values a, b, c and d in subsection (b)(1) of this Appendix to calculate the TRE index value based on a flare, a thermal incinerator with zero percent heat recovery, and a thermal incinerator with 70 percent heat recovery, and shall select the lowest TRE index value.

3) Every owner or operator of a reactor or distillation unit with a halogenated vent stream, determined as any stream with a total concentration of halogen atoms contained in organic compounds of 200 ppmv or greater, shall use the applicable coefficients identified for values a, b, c and d in subsection (b)(1) of this Appendix to calculate the TRE index value based on a thermal incinerator and scrubber.

c) Every owner or operator of a source seeking to comply with Section 219.432(b) of this Part shall recalculate the flow rate and VOM concentration for each affected vent stream whenever process changes are made. Examples of process changes include, but are not limited to, changes in production capacity, feedstock type, or catalyst type, or whenever there is replacement, removal, or addition of recovery equipment. The flow rate and VOM concentration shall be recalculated based on test data, or on best engineering estimates of the effects of the change to the recovery system.

d) Whenever a process change, as defined in Section 219.435(c) of this Subpart, yields a TRE index value of 1.0 or less, the owner or operator shall notify and submit a report to the Agency according to the requirements specified in Section 219.435(c) of this Subpart, within 180 calendar days after the process change and shall conduct a performance test according to the methods and procedures required by Section 219.433 of this Part.

e) For the purpose of demonstrating that a process vent stream has a VOM concentration below 500 ppmv, the following shall be used:

1) The sampling site shall be selected as specified in Section 219.433(c)(1) of this Part.

2) Method 18 or Method 25A of 40 CFR Part 60, Appendix A, incorporated by reference at Section 219.112 of this Part, shall be used to measure concentration; alternatively, any other method or data that has been validated according to the protocol in Method 301 of 40 CFR Part 63, Appendix A, incorporated by reference at Section 219.112 of this Part, may be used.

3) Where Method 18 is used, the following procedures shall be used to calculate ppmv concentration:

i) The minimum 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 approximately equal intervals in time, such as 15 minute intervals during the run.

ii) The concentration of VOM shall be calculated using Method 18 according to Section 219.433(c)(4) of this Part.

4) Where Method 25A is used, the following procedures shall be used to calculate ppmv VOM concentration:

i) Method 25A shall be used only if a single VOM is greater than 50 percent of total VOM, by volume, in the process vent stream.

ii) The vent stream composition may be determined by either process knowledge, test data collected using an appropriate Reference Method or a method of data collection validated according to the protocol in Method 301 of 40 CFR Part 63, Appendix A, incorporated by reference at Section 219.112 of this Part. Examples of information that constitute process knowledge include calculations based on material balances, process stoichiometry, or previous test results provided the results are still relevant to the current process vent stream conditions.

iii) The VOM used as the calibration gas for Method 25A shall be the single VOM present at greater than 50 percent of the total VOM by volume.

iv) The span value for Method 25A shall be 50 ppmv.

v) Use of Method 25A is acceptable if the response from the high-level calibration gas is at least 20 times the standard deviation of the response from the zero calibration gas when the instrument is zeroed on the most sensitive scale.

vi) The concentration of VOM shall be corrected to 3 percent oxygen using the procedures and equation in Section 219.433(c)(3) of this Part.

5) The owner or operator shall demonstrate that the concentration of VOM, including methane and ethane, measured by Method 25A is below 250 ppmv to qualify for the low concentration exclusion in Section 219.431 of this Part.

(Source: Amended at 20 Ill. Reg. 14462, effective October 28, 1996)