Question 22.2

Topic: NO_x Apportionment Methodologies

Question: For an exhaust configuration in which NO_x affected units and NO_x nonaffected units share a common stack, are there any common stack NO_x apportionment methodologies that may be approved by petition?

Answer: EPA considers two common stack NO_x apportionment methodologies to be approvable for the configuration: (1) the subtractive apportionment methodology; and (2) the simple NO_x apportionment methodology.

A. Subtractive Apportionment Methodology

(1) Summary of Method and Basis for Approval

Under the subtractive apportionment methodology, the hourly NO_x emission rate, heat input rate, and operating time are monitored at both at the common stack and at the NO_x nonaffected unit(s).

These values are used to determine the total heat input and NO_x mass emissions at these locations. The hourly NO_x mass emissions and total heat input for the NO_x affected units are then determined by subtracting the measured NO_x mass emissions and total heat input values for the NO_x nonaffected units from the corresponding values measured at the common stack. Finally, the hourly NO_x emission rate for the NO_x affected units is calculated by dividing the NO_x mass emissions for the NO_x affected units by the total heat input for the NO_x affected units.

This methodology is approvable because it is based on a mass balance approach and uses Part 75 monitoring methodologies for both heat input and NO_x emission rate.

(2) Main Common Stack Monitoring Requirements

(a) Monitor the hourly NO_x emission rate at the main common stack using NO_x-diluent CEMS.

(b) Determine the hourly heat input rate at the common stack using a diluent monitor and a flow monitor.

(3) NO_x Nonaffected Unit NO_x Emission Rate and Heat Input Rate Monitoring Requirements

There are two options for monitoring NO_x emission rate at the NO_x nonaffected units:

(a) Option 1: You may install a NO_x-diluent CEMS in duct leading from each NO_x nonaffected unit to the main common stack. When this option is selected, determine the heat input rate for each NO_x nonaffected unit using one of the following

methods:

(i) Install a flow monitor and a diluent monitor in the duct leading from each NO_x nonaffected unit to the main common stack; or

(ii) Use *individual* fuel flowmeters and the procedures of Appendix D of 40 CFR Part 75 (oil or gas-fired units only) to determine the heat input rate at each NO_x nonaffected unit. Heat input rate apportionment from a common pipe is not allowed in this case; or

(iii)Use Equation F-21a or F-21b in Appendix F of 40 CFR Part 75 (see Table 22-1) to apportion the heat input rate measured at the main common stack to *all* units in the configuration (i.e., both NO_x affected and NO_x nonaffected units). Note that this method may only be used if the following three conditions are met:

(A) All units exhausting to the main common stack combust the same type of fuel and use the same F-factor;

(B) All units exhausting to the main common stack have similar combustion efficiencies (± 10%); and

(C) There is no suitable location for a flow monitor and diluent monitor in the existing ductwork where NO_x emission rate is monitored.

If none of these three methods can be used to determine heat input rate, contact EPA for guidance.

(b) Option 2: If the emissions from a group of NO_x nonaffected units are combined prior to exhausting to the main common stack, you may monitor the combined NO_x emission rate for the group of units using a single NO_x-diluent CEMS. When this option is selected, designate the monitored location as a "secondary common stack" (see Definitions, above) and determine the heat input rate at the secondary common stack *and* at each NO_x nonaffected unit using one of the following methods:

(i) Monitor the heat input rate at the secondary common stack directly, using a flow monitor and diluent monitor. If this option is selected, use Equation F-21a or F-21b to apportion the heat input rate measured at the secondary common stack to the individual units. Replace the term t_{CS} in Equation F 21a or F-21b with the term t_{CS*}, where t_{CS*} is the stack operating time at the secondary common stack.

Also, in the summation term in the denominator of Equation F-21a or F 21b, include only the hourly unit loads

for the units associated with the secondary common stack.

Note that the restrictions listed under Paragraph (A)(3)(a)(iii) of this Question on the use of Equations F-21a and F-21b do not apply in this case; or

(ii) Monitor the heat input rate at each NO_x nonaffected unit using a fuel flowmeter and the procedures of Appendix D (oil and gas-fired units only), and determine the heat input rate at the secondary common stack using Equation F-25 (see Table 22-1, below); or

(iii)Monitor the heat input rate at a common pipe which serves only the units associated with the secondary common stack, using a fuel flowmeter and the procedures of Appendix D (oil and gas-fired units, only). In this case, you must first determine the individual unit heat input rates using Equation F-21a or F-21b and then use these rates, in conjunction with Equation F-25, to derive the heat input rate at the secondary common stack. In using Equations F-21a and F-21b, replace the term "t_{CS}" with the term "t_f", which is the fuel usage time for the common pipe.

Note that the restrictions listed under Paragraph (A)(3)(a)(iii) on the use of Equations F-21a and F-21b do not apply in this case; or

(iv) Use Equation F-21a or F-21b to apportion the heat input rate measured at the main common stack to *all* units in the configuration (i.e., both NO_x affected and NO_x nonaffected units). Then use the apportioned unit level heat inputs and Equation F-25 to determine the heat input rate at the secondary common stack. Note that this option may only be used if the following three conditions are met:

(A) All units exhausting to the main common stack combust the same type of fuel and use the same F-factor;

(B) All units exhausting to the main common stack have similar combustion efficiencies (· ± 10%); and

(C) There is no suitable location for a flow monitor in the existing ductwork.
If none of these three methods can be used to determine the heat input rate for the NO_x nonaffected units, contact EPA for guidance.

(4) Hourly Heat Input Rate and Operating Time Reporting

Report hourly heat input rate and operating time for the main common stack, any secondary common stack(s), any common pipe(s) and for each unit in the configuration (i.e., for both NO_x

affected and NO_x nonaffected units). Determine the hourly heat input rates for the main common stack, secondary common stack(s), common pipe(s) and for the individual NO_x nonaffected units as described in paragraphs (A)(2) and (A)(3) of this question.

See Question 22.3 for a discussion of how to determine the hourly heat input rates for the NO_x affected units.

Table 22-1: Hourly Heat Input Rate Apportionment and Summation Formulas

Equation Code	Formula	Where
F-21a	$HI_i = HI_{CS}\left(\frac{t_{CS}}{t_i}\right)\left[\frac{MW_i t_i}{sumfromi=1?nMW_i t_i}\right]$	HI_i = Heat input rate for a unit (mmBtu/hr) HI_{CS} = Heat input rate at the common stack or pipe (mmBtu/hr) MW_i = Gross electrical output for a particular unit (MWe) t_i = Operating time at a particular unit (hour or fraction of an hour) t_{CS} = Operating time at common stack (hour or fraction of an hour) n = Total number of units using the common stack or pipe i = Designation of a particular unit
F-21b	$HI_i = HI_{CS}\left(\frac{t_{CS}}{t_i}\right)\left[\frac{SF_i t_i}{\sum_{i=1}^{n} SF_i t_i}\right]$	HI_i = Heat input rate for a unit (mmBtu/hr) HI_{CS} = Heat input rate at the common stack or pipe (mmBtu/hr) SF_i = Gross steam load for a particular unit (klb/hr) t_i = Operating time at a particular unit (hour or fraction of an hour) t_{CS} = Operating time at common stack (hour or fraction of an hour) n = Total number of units using the common stack or pipe i = Designation of a particular unit
F-25	$HI_{CS} = \frac{\sum_{all\text{-}units} HI_u t_u}{t_{CS}}$	HI_{CS} = Heat input rate at the common stack (mmBtu/hr) HI_u = Heat input rate for a unit (mmBtu/hr) t_u = Operating time at a particular unit (hour or fraction of an hour) t_{CS} = Operating time at common stack (hour or fraction of an hour)

(5) Determination of NO_x Affected Unit(s) NO_x Emission Rate

Calculate the hourly, quarterly, and year-to-date NO_x emission rates for the NO_x affected units as follows:

(a) Determine a single hourly NO_x emission rate which applies to all NO_x affected units using Equation NS-1 (see Table 22-2).

The terms NOX_{nonaff}, HI_{nonaff}, and t_{nonaff} in Equation NS-1, must be used consistently. For example, when NO_x emission rate and heat input rate are monitored at the unit level, NOX_{nonaff}, HI_{nonaff}, and t_{nonaff} are, respectively, the NO_x emission rate, heat input rate, and operating time for an individual NO_x nonaffected unit. When a group of NO_x nonaffected units is monitored at a secondary common stack, NOX_{nonaff}, HI_{nonaff}, and t_{nonaff} are, respectively, the NO_x emission rate, heat input rate, and operating time at the secondary common stack.

(b) Record, but do not report, the hourly NO_x emission rates determined from Equation NS-1 for the NO_x affected units. Maintain these data in a format suitable for inspection. It is sufficient to record these values in your DAHS if they can be retrieved upon request during an audit.

(c) Calculate the quarterly and year-to-date NO_x emission rate for each NO_x affected unit using Equation F-9 in Appendix F of 40 CFR Part 75. Report these values as described in Question 22.9.

B. Simple NO_x Apportionment

(1) Summary of Method and Basis for Approval

Under simple NO_x apportionment, the hourly NO_x emission rate and heat input rate are monitored at the common stack and the hourly heat input rates for the individual units in the configuration are determined by direct measurement or by apportionment. The hourly emission rate of the NO_x affected unit(s) is calculated by dividing the total NO_x mass emissions from all units (in lb) by the total heat input (in mmBtu) from *only* the NO_x affected units.

This methodology is environmentally beneficial because it assures compliance of the NO_x affected units, by overestimating the NO_x emission rates for these units. The method assumes that all of the NO_x mass emissions measured in the common stack come from the NO_x affected units (i.e., that the NO_x nonaffected units contribute zero NO_x emissions to the total NO_x emissions measured at the common stack). The methodology may also provide environmental benefits by encouraging owners and operators of NOX affected units to lower NO_x emissions at the NO_x affected units.

Despite these environmentally beneficial aspects, approval of this methodology must still be on a case-by-case basis. Section

75.17(a)(iii)(B) requires "complete and accurate" estimation of the regulated emissions (i.e., for the emissions from the NO_x affected units). EPA must therefore make a case-by-case determination of whether the assumption that all emissions come from the NO_x affected units will cause significant error that may preclude the use of this option.
EPA anticipates that simple NO_x apportionment will likely be used for common stack configurations involving low capacity, small, or low emitting NO_x nonaffected units.

(2) Main Common Stack Monitoring Requirements

(a) Monitor the hourly NO_x emission rate at the main common stack using a NO_x-diluent CEMS.

(b) Determine the hourly heat input rate at the main common stack using a flow monitor and a diluent monitor.

(3) Heat Input Rate Determination for the Individual Units

Determine the hourly heat input rate for each unit which exhausts to the main common stack (i.e., both NO_x affected and NO_x nonaffected units), using any of the following methods:

(a) Install a flow monitor and a diluent monitor in the duct leading from the unit to the main common stack; or

(b) Use a fuel flowmeter and the procedures of Appendix D (oil or gas-fired units only), to determine the heat input rate at the unit; or

(c) Monitor the heat input rate for a group of NO_x nonaffected units at a secondary common stack (see Definitions section, above) using a flow monitor and diluent monitor, and then apportion the heat input rate measured at the secondary common stack to the individual units, using Equation F-21a or F-21b.

Replace the term t_{CS} in Equation F-21a or F-21b with the term t_{CS*}, where t_{CS*} is the stack operating time at the secondary common stack. Also, in the summation term in the denominator of Equation F-21a or F-21b, include only the hourly unit loads for the units associated with the secondary common stack.

Note that the restriction under Paragraph (B)(3)(e) of this question on the use of Equations F-21a and F-21b does not apply in this case; or

(d) Monitor the heat input rate at a common pipe which serves a group of NO_x nonaffected gas or oil fired units using the procedures of Appendix D. In this case, determine the

individual unit heat input rates using Equation F-21a or F-21b. Note that the restriction under Paragraph (B)(3)(e), below, on the use of Equations F-21a and F-21b does not apply in this case; or

(e) Use Equation F-21a or F-21b to apportion the heat input rate measured at the main common stack to *all* units (i.e., both NO_x affected and NO_x nonaffected units.
Note that this method may only be used if the following condition is met: all units exhausting to the main common stack combust the same type of fuel and use the same F-factor.

(4) Hourly Heat Input Rate and Operating Time Reporting for all Units

Report hourly heat input rate and operating time for the main common stack, any secondary common stack(s), any common pipe(s) and for each unit in the configuration (i.e., both NO_x affected and NO_x nonaffected units). Determine the hourly heat input rates for the main common stack, secondary common stack(s), common pipe(s) and for the individual units as described in Paragraphs (B)(2) and (B)(3) of this question.

(5) Determination of NO_x affected Unit(s) NO_x Emission Rate
Calculate the hourly, quarterly and year-to-date NO_x emission rates for the NO_x affected unit(s) as follows:

(a) Determine the hourly NO_x emission rate for the NO_x affected units using Equation NS-2 (see Table 22-3). Equation NS-2 calculates a single NO_x emission rate which applies to all NO_x affected units.

(b) Record, but do not report, the hourly NO_x emission rates determined from Equation NS-2. Maintain these data in a format suitable for inspection. It is sufficient to record these values in your DAHS if they can be retrieved upon request during an audit.

(c) Calculate the quarterly and year-to-date NO_x emission rate for each NO_x affected unit using Equation F-9 in Appendix F of 40 CFR Part 75. Report these values as described in Question 22.9.

Table 22-3: Hourly NO_x Apportionment Formula for NO_x Affected Unites Using Simple NO_x Apportionment

Equation Code	Formula	Where
NS-2	$NO_{x_{aff}} = \frac{NO_{x_{cs}} \times HI_{cs} \times t_{cs}}{\sum_{all-affected} HI_{aff} \times t_{aff}}$	NOx_{aff} = Hourly NO_x emission rate for the NO_x affected unit(s) (lb/mmBtu) NOx_{CS} = Hourly NO_x emission rate at the common stack (lb/mmBtu) HI_{CS} = Hourly heat input rate at the common stack (mmBtu/hr) t_{CS} = Common stack operating time (hr) HI_{aff} = Hourly heat input rate for the NO_x affected unit(s) (mmBtu/hr) t_{aff} = NO_x affected unit operating time (hr)

References: § 75.17

History: First published in March 2000, Update #12