



# Continuous Emission Monitoring

An Online Continuing Education Course for Engineers

**Course Number: EN-8013**

**Credit: 8 Hours / 8 PDH / 8 CPD**

# Continuous Emission Monitoring

## 1.0 INTRODUCTION

### 1.1 Scope

This course serves as a "road map" to help interested parties navigate through the complex Part 75 continuous emission monitoring rule. It is applicable to engineers responsible for complying with the rule and others who want a general understanding of the emissions monitoring approach used in EPA's emissions trading programs.

### 1.2 What is Part 75 and who must comply with it ?

The Part 75 continuous emission monitoring rule, which is found in Volume 40 of the Code of Federal Regulations (CFR), was originally published in January, 1993. The purpose of the regulation was to establish continuous emission monitoring (CEM) and reporting requirements under EPA's Acid Rain Program (ARP), which was instituted in 1990 under Title IV of the Clean Air Act. The ARP regulates electric generating units (EGUs) that burn fossil fuels such as coal, oil and natural gas and that serve a generator > 25 megawatts. For these units, Part 75 requires continuous monitoring and reporting of sulfur dioxide (SO<sub>2</sub>) mass emissions, carbon dioxide (CO<sub>2</sub>) mass emissions, nitrogen oxides (NO<sub>x</sub>) emission rate, and heat input. The SO<sub>2</sub> component of the ARP is a "cap and trade" program, designed to reduce acid deposition by limiting SO<sub>2</sub> emission levels in the "lower 48" states of the U.S.

In October, 1998, EPA added Subpart H to Part 75, which provides a blueprint for the monitoring and reporting of NO<sub>x</sub> mass emissions and heat input under a State or Federal NO<sub>x</sub> emissions reduction program. The Agency anticipated that such programs were likely to come into existence, due to growing concern over health hazards associated with NO<sub>x</sub> emissions from power plants and large industrial sources. NO<sub>x</sub> is a precursor to ozone and fine particulate matter formation. Subpart H has since been adopted as the required monitoring methodology for NO<sub>x</sub> mass emissions and heat input under the NO<sub>x</sub> Budget Trading Program (NBP).

The NBP began in 2002 and ended in 2008. It was a NO<sub>x</sub> cap and trade program, designed to limit ground-level ozone formation during the ozone season (from May 1<sup>st</sup> through September 30<sup>th</sup>) in 19 states in the Eastern U.S. and the District of Columbia. The state regulations for the NBP applied mainly to large EGUs and industrial boilers, although certain states included other categories of NO<sub>x</sub>-emitting sources, such as cement kilns and refinery process heaters. The state rules were patterned after a model regulation developed by EPA (40 CFR Part 96), and required NO<sub>x</sub> mass emissions and heat input to be monitored and reported according to Subpart H of Part 75. The Program assigned a total NO<sub>x</sub> emissions budget (tons per ozone season) to each state, and was administered jointly by the states and EPA's Clean Air Markets Division (CAMD). The NBP was effective; it resulted in significant reductions of NO<sub>x</sub> emissions.

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On May 12 and May 18, 2005, EPA published two new air regulations, the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR). These regulations provide model rules for cap and trade programs that can be adopted by the states. The CAIR rule seeks to reduce fine particulate and ozone emissions by imposing tight emission caps on SO<sub>2</sub> and NO<sub>x</sub> mass emissions from EGUs in 28 states. CAIR includes annual SO<sub>2</sub> and NO<sub>x</sub> emissions caps for 23 of the 28 affected states and an ozone season cap on NO<sub>x</sub> emissions in 25 of the states. The CAMR rule seeks to achieve substantial reductions in mercury (Hg) mass emissions from coal-fired EGUs in all 50 states.

Both CAIR and CAMR require Part 75 monitoring. Under CAIR, monitoring systems for NO<sub>x</sub> mass emissions and heat input must be installed and certified by 2008, and monitoring systems for SO<sub>2</sub> mass emissions and heat input must be certified by 2009. Under CAMR, Part 75-compliant monitoring systems for Hg mass emissions and, if required, heat input must be installed and certified by January 1, 2009. For a further discussion of these new rules, see Appendix I of this course.

Part 75 specifies the types of continuous monitoring systems that may be used for each parameter (SO<sub>2</sub>, NO<sub>x</sub>, Hg, etc.) and sets forth the operation, maintenance and quality assurance/quality control (QA/QC) requirements for each system. In most cases, continuous emission monitoring systems (CEMS) are required, although in some instances, other monitoring methodologies are allowed.

Table 1 summarizes the various programs that require (or will require) Part 75 monitoring. Each of these programs requires certain parameters to be monitored over specified time periods. For each affected unit, the specific parameters that must be monitored, the units of measure, and the averaging (or accounting) periods depend on which program(s) apply.

Table 1 also shows that when the same pollutant is regulated under two different programs, the Part 75 monitoring and reporting requirements for the pollutant are not necessarily consistent between the two programs. For example, the ARP and NBP assess NO<sub>x</sub> compliance differently. The ARP requires the NO<sub>x</sub> emission rate to be monitored and reported in pounds per million Btu (lb/mmBtu) and specifies annual NO<sub>x</sub> emission rate limits for certain coal-fired EGUs, under 40 CFR Part 76. But the ARP does not have an emissions trading component for NO<sub>x</sub>, and therefore does not require NO<sub>x</sub> mass emissions to be reported<sup>1</sup>. Conversely, the NBP, which is a NO<sub>x</sub> cap and trade program, does require NO<sub>x</sub> mass emissions to be monitored and

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<sup>1</sup> There is one exception to this. For low mass emissions (LME) units in the Acid Rain Program, NO<sub>x</sub> mass emissions are reported in addition to NO<sub>x</sub> emission rate, to demonstrate that the unit continues to qualify for LME status from year-to-year. LME units are discussed in detail in Section 6 of this course.

**Table 1: Programs That Require Part 75 Monitoring**

<b>Program</b>	<b>Affected Sources</b>	<b>Parameter(s) Measured (units)</b>	<b>Accounting or Averaging Period</b>	<b>Data Used for Program Compliance ?</b>
Acid Rain Program	EGUs and other combustion sources that opt-in to the SO <sub>2</sub> cap and trade program	SO <sub>2</sub> (tons)	Annual (cumulative)	Yes <sup>a</sup>
		CO <sub>2</sub> (tons)	Annual (cumulative)	No <sup>b</sup>
		NO <sub>x</sub> (lbs/mmBtu)	Annual (average)	Certain units only <sup>c</sup>
		Heat input (mmBtu)	Annual (cumulative)	In some cases <sup>d</sup>
		Opacity <sup>g</sup> (%)	Varies <sup>h</sup>	No
NO <sub>x</sub> Budget Trading Program	EGUs , certain large industrial units, and units that opt in to the cap and trade program	NO <sub>x</sub> (tons)	Ozone season <sup>e</sup> (cumulative)	Yes <sup>a</sup>
		Heat input (mmBtu)	Ozone season <sup>e</sup> (cumulative)	In some cases <sup>f</sup>
Trading Programs under the CAIR Regulation <sup>g</sup>	EGUs and opt-in units	SO <sub>2</sub> and NO <sub>x</sub> (tons)	Annual (cumulative)—23 states	Yes <sup>a</sup>
		NO <sub>x</sub> (tons)	Ozone season <sup>e</sup> (cumulative)—25 states	
Trading Program under the CAMR Rule <sup>i</sup>	Coal-fired EGUs	Hg (ounces)	Annual (cumulative)	Yes <sup>a</sup>

<sup>a</sup> The cumulative annual tons of SO<sub>2</sub>, the cumulative annual or ozone season tons of NO<sub>x</sub> , or the cumulative annual ounces of Hg emitted must be less than or equal to the number of emission credits (allowances) held

<sup>b</sup> At present, CO<sub>2</sub> is not a regulated pollutant. Title IV of the Clean Air Act requires only an estimate of annual CO<sub>2</sub> mass emissions from electrical generating units.

<sup>c</sup> Under 40 CFR Part 76, certain coal-fired units are required to meet an annual NO<sub>x</sub> emission limit.

<sup>d</sup> If a unit exceeds its annual NO<sub>x</sub> emission rate limit under Part 76, the cumulative annual heat input is used to calculate the excess emission penalty

<sup>e</sup> The ozone season extends from May 1<sup>st</sup> through September 30<sup>th</sup>

<sup>f</sup> Heat input monitoring is required for most, but not all NO<sub>x</sub> Budget Trading Program sources. Heat input data is used by affected sources to calculate NO<sub>x</sub> mass emissions and may be used by State agencies to determine future NO<sub>x</sub> allowance allocations.

<sup>g</sup> Required only for coal-fired units and certain oil-fired units in the Acid Rain Program.

<sup>h</sup> Varies according to State and/or other Federal requirements

reported for allowance accounting purposes, but does not require compliance with NO<sub>x</sub> emission limits in lb/mmBtu. For sources subject to both the ARP and the NBP, the requirements of both programs must be met—therefore, NO<sub>x</sub> mass emissions and NO<sub>x</sub> emission rate must both be monitored and reported.

### 1.3 What is a cap and trade program?

A cap and trade program is a market-based approach to reducing emissions. The concept is simple: EPA caps, or limits, the total annual or seasonal mass emissions of a pollutant such as SO<sub>2</sub>, NO<sub>x</sub> or Hg. The cap is divided into emission allowances that are allocated to each affected source. Each emission allowance represents an authorization to emit one ton of SO<sub>2</sub> or NO<sub>x</sub>, or one ounce of Hg over a specified time period (i.e., calendar year or ozone season). To demonstrate compliance, a source is required to hold a number of allowances greater than or equal to its emissions in the regulated time period. Since the total number of allowances allocated to the affected sources is less than the pre-program (“baseline”) mass emissions from those sources, the program reduces the mass emissions of the regulated pollutant..

A cap and trade program does not specify traditional numerical emission limits (e.g. ppm, lb/mmBtu, etc.) for the regulated pollutant(s). Instead, compliance is demonstrated by holding enough allowances to cover the total mass emissions from the affected unit(s) during a specified time period. However, numerical emission limits imposed by other programs or by the operating permit still apply.

At the end of each compliance period, a reconciliation process takes place to verify that each affected source has enough allowances to cover its emissions. Automatic penalties for noncompliance are part of the U.S. cap and trade programs. For example, if an ARP unit does not have enough allowances to cover its annual SO<sub>2</sub> emissions, the owner or operator of the unit must pay an excess emissions penalty and must surrender future-year allowances to cover the shortfall. For a NBP unit, if its ozone season NO<sub>x</sub> emissions exceed its allowance holdings, the owner or operator of the unit must surrender at least 3 future-year allowances and, if required by state rules, pay additional penalties.

This market-based approach allows sources to determine the most cost-effective way to comply. Sources may reduce emissions by using pollution control technologies, employing energy conservation measures, reducing utilization, switching fuels, or other strategies. Sources also are allowed to buy and sell allowances from each other to ensure that each unit has enough allowance credits in its account to cover its emissions. In this manner, a cap and trade program reduces emissions at a lower cost than traditional pollution control regulations and policies, by setting a goal and allowing market forces to determine how the goal is met.

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<sup>3</sup> There is one exception to this. For low mass emissions (LME) units in the Acid Rain Program, NO<sub>x</sub> mass emissions are reported in addition to NO<sub>x</sub> emission rate, to demonstrate that the unit continues to qualify for LME status from year-to-year. LME units are discussed in detail in Section 6 of this course.

## 1.4 Why is continuous monitoring necessary?

Emissions monitoring and accounting are the backbone of cap and trade programs. Because the emission allowances are based on the total mass of a pollutant emitted over a certain time period, emissions must be monitored continuously during the compliance period. It is therefore essential to have a reliable measurement method for the commodity being regulated and traded---in this case, emissions--- to ensure that the goal of achieving actual, measurable emissions reductions in a cost-effective manner is met. Part 75 provides the necessary measurement method, and gives value to the traded commodity:

- Ensuring that emissions are consistently and accurately measured from one source is essential to the program.
- Emissions monitoring is required for each unit in the operation;
- Verification is required to ensure that emissions are being met.

## 1.5 How is the rule structured?

Part 75 consists of eleven Appendices, A through K<sup>3</sup>. A brief description of each Appendix is provided below.

### Subparts

- **Subpart A (§§75.10–75.19)** presents the general purpose of the regulation and the extent of its application. Subpart A also includes general Acid Rain Program provisions, compliance dates, prohibitions, and lists various methodologies (e.g., ASTM, ASME, etc.) that are incorporated into the rule by reference.
- **Subpart B (§§75.10–75.19)** presents the general emission monitoring requirements for each pollutant (SO<sub>2</sub>, NO<sub>x</sub>, etc.). Special instructions are given for monitoring at common stack and multiple stack exhaust configurations.

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<sup>2</sup> Or an ounce of emissions, for Hg

<sup>3</sup> Note that three of the Appendices (H, I, and J) are “reserved”. Appendix H was in the original January, 1993 rule, but was removed and reserved in May, 1999. Appendix I was proposed in 1998, but never finalized. Appendix J was removed and reserved in May, 1999.