Technical Guidance Document: Compliance Assurance Monitoring

Revised Draft

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Measurement Center

MRI Project No. 4701-05

August 1998

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PREFACE

This document was prepared by Midwest Research Institute (MRI) for the Office of Air Quality Planning and Standards (OAQPS), U. S. Environmental Protection Agency (EPA), under Contract No. 68-D2-0165, Work Assignment No. 4-06 and Contract No. W6-0048, Work Assignment No. 2-05. Mr. Dan Bivins is the work assignment manager.

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1.0 OVERVIEW

1.1 PURPOSE OF CAM

Compliance assurance monitoring (CAM) is intended to provide a reasonable assurance of compliance with applicable requirements under the Clean Air Act (CAA) for large emission units that rely on pollution control device equipment to achieve compliance. Monitoring is conducted to determine that control measures, once installed or otherwise employed, are properly operated and maintained so that they continue to achieve a level of control that complies with applicable requirements. The CAM approach establishes monitoring for the purpose of: (1) documenting continued operation of the control measures within ranges of specified indicators of performance (such as emissions, control device parameters, and process parameters) that are designed to provide a reasonable assurance of compliance with applicable requirements; (2) indicating any excursions from these ranges; and (3) responding to the data so that the cause or causes of the excursions are corrected.

1.2 CAM PROCESS

This section provides an overview of the process of implementing CAM. The overall process can be represented by four major steps: (1) CAM applicability determination, (2) CAM submittal, (3) review and approval of CAM submittal, and (4) CAM implementation. The following paragraphs describe each of these four major steps of the CAM process in more detail. Figure 1-1 presents a flow diagram for this process. The important steps and decision blocks in these figures are labeled with a number enclosed in brackets (e.g., **[23]**) that is cross-referenced to the description of the CAM process that follows.

1.2.1 Applicability Determination

The first major step in the CAM process is the determination of the applicability of CAM **[1]** to each pollutant-specific emissions unit (hereafter referred to as "emissions unit," or simply "unit"). Section 64.2 of the CAM rule specifies the criteria for making this determination, and Table 1-1 summarizes the applicability requirements for Part 64. If the unit satisfies all of the applicability requirements listed in Table 1-1, the unit is subject to CAM. Otherwise, Part 64 does not apply to the emissions unit. Essentially, for a unit to be subject to Part 64, the unit must: be located at a major source for which a Part 70 or 71 permit is required; be subject to an emission limitation or standard; use a control device to achieve compliance; have potential precontrol emissions of at least 100 percent of the major source amount; and must not otherwise be exempt from CAM. If the unit does not meet all of these requirements, the unit is not subject to CAM **[2]**. It should be emphasized that the applicability determination is made on a pollutant-by-pollutant basis for each emissions unit.

The term "emission limit or standard" is defined in § 64.1 to mean any applicable requirement that constitutes an emission limitation, emission standard, standard of performance, or means of emission limitation as defined under the Act. Part 64 states that the term "applicable requirement," shall have the same meaning as provided under Part 70. Therefore, Part 64 establishes that only those emission limitations or standards that are applicable requirements as defined in Part 70 and included as Federally enforceable permit conditions in a Part 70 permit are subject to the requirements of Part 64. Additional language in the Part 64 definition of "emission limitation or standard" clarifies that, for the purposes of Part 64, the definition of "emission limitation or standard" does not include general operation requirements that an owner or operator may be required to meet, such as requirements to obtain a permit, to operate and maintain sources in accordance with good air pollution control practices, to develop and maintain a malfunction abatement plan, or to conduct monitoring, submit reports or keep records. The complete definition of a major source is provided in Figure 1-2.

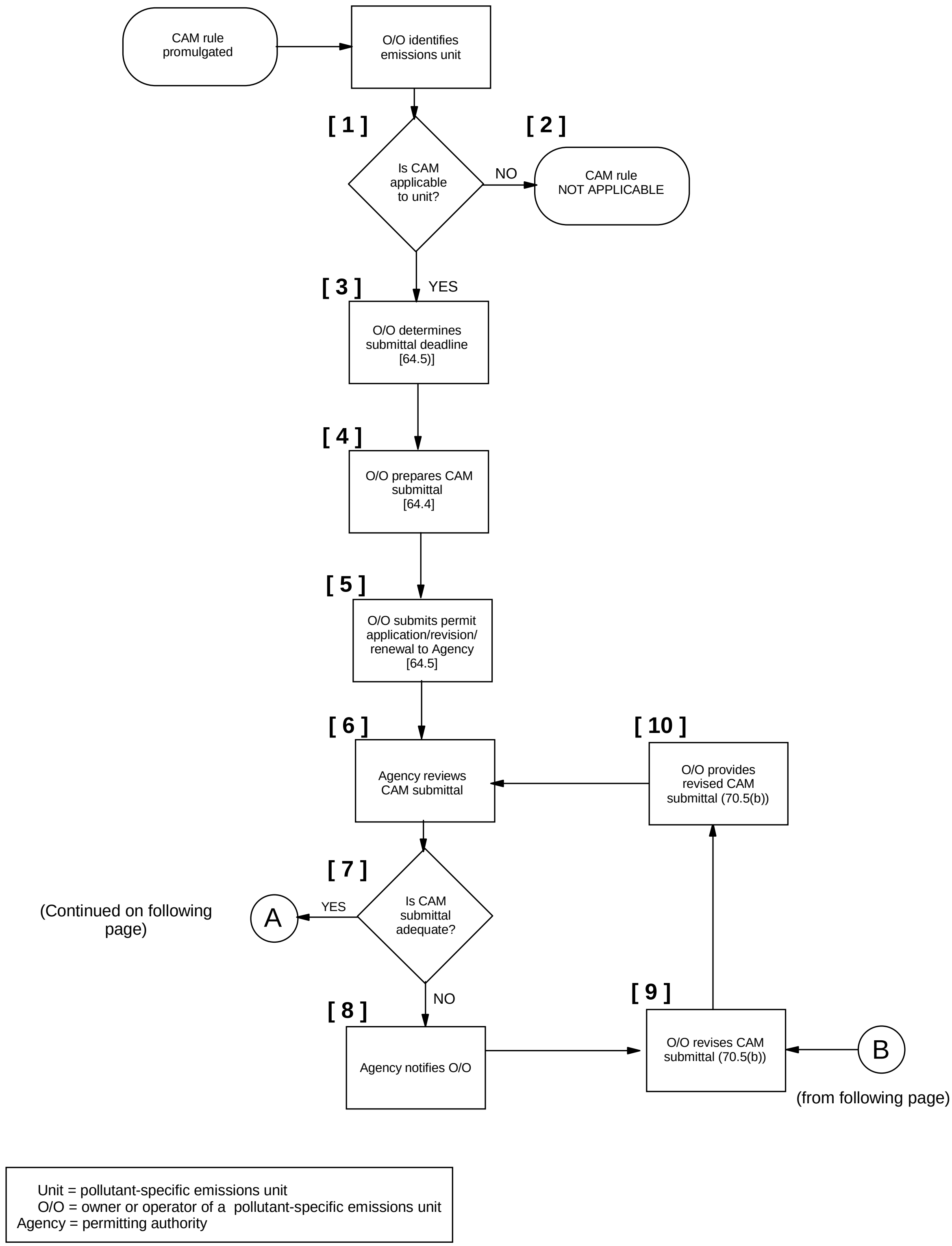

Figure 1-1. Flow diagram for CAM process.

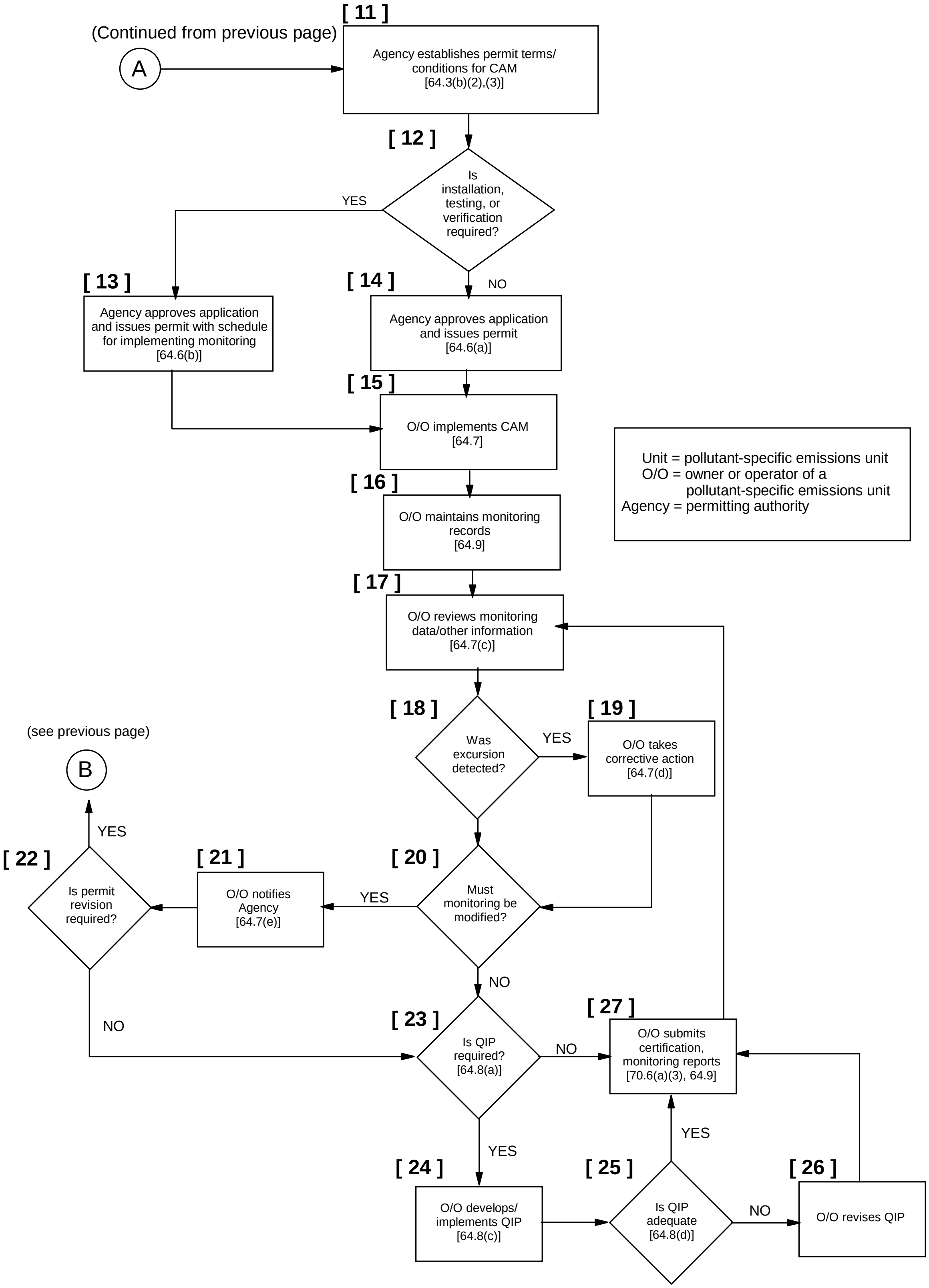

Figure 1-1. (continued)

TABLE 1-1. APPLICABILITY REQUIREMENTS FOR CAM

Part 64 reference	Requirement
§ 64.2(a)	Unit is located at major source that is required to obtain Part 70 or 71 permit
§ 64.2(a)(1)	Unit is subject to emission limitation or standard for the applicable pollutant
§ 64.2(a)(2)	Unit uses a control device to achieve compliance (See § 64.1 for definition of control device.)
§ 64.2(a)(3)	Potential precontrol emissions of applicable pollutant from unit are at least 100 percent of major source amount
§ 64.2(a)(b)	Unit is not otherwise exempt (See Table 1-2 for list of specific exemptions.)

Major source means any stationary source (or any group of stationary sources that are located on one or more contiguous or adjacent properties, and are under common control of the same person (or persons under common control) belonging to a single major industrial grouping and that are described in paragraph (1), (2), or (3) of this definition. For the purposes of defining "major source," a stationary source or group of stationary sources shall be considered part of a single industrial grouping if all of the pollutant emitting activities at such source or group of sources on contiguous or adjacent properties belong to the same Major Group (i.e., all have the same two-digit code) as described in the Standard Industrial Classification Manual, 1987.

(1) A major source under Section 112 of the Act, which is defined as:

(I) For pollutants other than radionuclides, any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit, in the aggregate, 10 tons per year (tons/yr) or more of any hazardous air pollutant which has been listed pursuant to Section 112(b) of the Act, 25 tons/yr or more of any combination of such hazardous air pollutants, or such lesser quantity as the Administrator may establish by rule. Notwithstanding the preceding sentence, emissions from any oil or gas exploration or production well (with its associated equipment) and emissions from any pipeline compressor or pump station shall not be aggregated with emissions from other similar units, whether or not such units are in a contiguous area or under common control, to determine whether such units or stations are major sources; or

(ii) For radionuclides, "major source" shall have the meaning specified by the Administrator by rule.

(2) A major stationary source of air pollutants, as defined in Section 302 of the Act, that directly emits or has the potential to emit, 100 tons/yr or more of any air pollutant (including any major source of fugitive emissions of any such pollutant, as determined by rule by the Administrator). The fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source for the purposes of Section 302(j) of the Act, unless the source belongs to one of the following categories of stationary source:

(I) Coal cleaning plants (with thermal dryers);
(ii) Kraft pulp mills;
(iii) Portland cement plants;
(iv) Primary zinc smelters;
(v) Iron and steel mills;
(vi) Primary aluminum ore reduction plants;
(vii) Primary copper smelters;
(viii) Municipal incinerators capable of charging more than 250 tons of refuse per day;
(ix) Hydrofluoric, sulfuric, or nitric acid plants;
(x) Petroleum refineries;
(xi) Lime plants;
(xii) Phosphate rock processing plants;

Figure 1-2. Definition of major source.

(xiii) Coke oven batteries
(xiv) Sulfur recovery plants;
(xv) Carbon black plants (furnace process);
(xvi) Primary lead smelters;
(xvii) Fuel conversion plants;
(xviii) Sintering plants;
(xix) Secondary metal production plants;
(xx) Chemical process plants;
(xxi) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per hour heat input;
(xxii) Petroleum storage and transfer units with a total storage capacity exceeding 3,000,000 barrels;
(xxiii) Taconite ore processing plants;
(xxiv) Glass fiber processing plants;
(xxv) Charcoal production plants;
(xxvi) Fossil-fuel-fired steam electric plants of more than 250 million British thermal units per hour heat input; or
(xxvii) All other stationary source categories regulated by a standard promulgated under Section 111 of 112 of the Act, but only with respect to those air pollutants that have been regulated for that category;

(3) A major stationary source as defined in Part D of title I of the Act, including:

(I) For ozone nonattainment areas, sources with the potential to emit 100 tons/yr or more of volatile organic compounds or oxides of nitrogen in areas classified as "marginal" or "moderate," 50 tons/yr or more in areas classified as "serious," 25 tons/yr or more in areas classified as "severe," and 10 tons/yr or more in areas classified as "extreme"; except that the references in this paragraph to 100, 50, 25 and 10 tons/yr of nitrogen oxides shall not apply with respect to any source for which the Administrator has made a finding, under Section 182(f) (1) or (2) of the Act, that requirements under Section 182(f) of the Act do not apply;

(ii) For ozone transport regions established pursuant to Section 184 of the Act, sources with the potential to emit 50 tons/yr or more of volatile organic compounds;

(iii) For carbon monoxide nonattainment areas:

(A) That are classified as "serious," and

(B) in which stationary sources contribute significantly to carbon monoxide levels as determined under rules issued by the Administrator, sources with the potential to emit 50 tons/yr or more of carbon monoxide; and

(iv) For particulate matter (PM-10) nonattainment areas classified as "serious," sources with the potential to emit 70 tons/yr or more of PM-10.

Figure 1-2. (continued)

Section 64.1 defines the term "control device" as it pertains to the CAM rule. The following sections discuss procedures for estimating potential precontrol device emissions and exemptions to CAM, respectively.

1.2.1.1 Estimating Potential Precontrol Device Emissions

In order to determine the applicability of Part 64, owners and operators of emissions units that may be subject to the CAM rule must estimate potential precontrol device emission rates for the regulated pollutant (§ 64.2). The two basic approaches to performing this estimate are based on: (1) the controlled potential to emit and the control device efficiency for the subject emissions unit; or (2) uncontrolled emission test data from measurements taken prior to the control device inlet or uncontrolled emission factors. Guidance on estimating potential to emit is provided in the *White Paper for Streamlined Development of Part 70 Permit Applications* (White Paper No. 1), published by EPA in July 1995. White Paper No. 1 specifies the types of information that can be used to estimate potential to emit. These types of information, which also are recommended as the basis for estimating potential precontrol device emissions, include the following:

1. Emission test data;
2. Emission factors published in EPA documents and data bases such as *Compilation of Air Pollutant Emission Factors* (AP-42), the locating and estimating (L&E) documents, and the factor information and retrieval (FIRE) data base;
3. Emission factors from other publications, such as the *Air Pollution Engineering Manual* and vendor literature;
4. Emission factors developed by State and local regulatory agencies; and
5. Reasonable engineering estimates, such as mass balances.

As stated previously, the first approach to estimating potential precontrol device emissions uses the potential to emit and the control device control efficiency for the subject control device. The information sources listed above provide control device efficiencies explicitly and/or information that can be used to estimate control device efficiency. For example, for many types of emissions units, AP-42 provides both controlled and uncontrolled emission factors, from which control efficiencies can be calculated. The second approach to estimating potential precontrol device emissions requires test data on uncontrolled emissions or the emission factor for uncontrolled emissions and the annual production rates used to calculate the potential to emit for the subject emissions unit.

In general, the use of available information is adequate for estimating potential emissions. Although emissions test data would be useful for estimating potential precontrol device emissions, conducting emissions tests for the sole purpose of making an applicability determination is not expected. Figure 1-3 provides examples of how precontrol device emissions can be estimated. Figure 1-4 lists some technical references that may be useful for estimating emissions for the purpose of determining CAM applicability.

1.2.1.2 Exemptions to Part 64

Section 64.2(b) lists several specific exemptions to the CAM rule. These exemptions are summarized in Table 1-2. First, certain emission limitations or standards are exempted, including: new source performance standards (NSPS) or national emission standards for hazardous air pollutants (NESHAP) proposed after November 15, 1990, stratospheric ozone requirements, Acid Rain Program requirements, requirements that apply solely under an emissions trading program that allows emission credit trading or selling, requirements that cap total emissions in accordance with § 70.4(b)(12), and limits or standards for which the Part 70 or 71 permit specifies a continuous compliance determination method that does not use an assumed control factor.

Table 1-3 includes NSPS and NESHAP proposed after November 15, 1990. This table does not include rules that were amended after Nov. 15, 1990. It includes only those NSPS and NESHAP with an original proposal date after Nov. 15, 1990. Whether emission standards amended after Nov. 15, 1990 are exempt from CAM would depend on the nature of the amendment and whether the amended rule includes monitoring requirements that satisfy CAM. Currently, only one such rule has been identified. An amendment to subpart L of Part 61 (National Emission Standard for Benzene Emissions from Coke By-Product Recovery Plants) was published in the *Federal Register* on September 19, 1991, that added provisions for the use of carbon adsorbers and vapor incinerators as alternative means of complying with the standards for process vessels, storage tanks, and tar-intercepting sumps. The added provisions include testing, monitoring, recordkeeping, and reporting requirements for the alternative controls. Therefore, emissions units subject to the amended part of this rule are exempt from the CAM rule.

The term "continuous compliance determination method" is defined in § 64.1 of the rule. A continuous compliance determination method is a method which (1) is used to determine compliance with an emission limitation or standard on a continuous basis, consistent with the averaging period established for the emission limitation or standard, and (2) either provides data in units of the standard or is correlated directly with the compliance limit. Table 1-4 lists examples of continuous compliance determination methods and identifies some specific regulations that incorporate these continuous compliance determination methods. Note that for a monitoring method to be a continuous compliance method it must incorporate items (1) and (2) identified above (and specified in the Part 64 definition of continuous compliance determination); the examples cited in Table 1-4 incorporate these two items. If a unit is subject to both exempt and nonexempt emission limitations or standards, Part 64 still applies to the unit.

Second, § 64.2(b)(2) exempts backup utility power emissions units that are owned by a municipality and for which the owner or operator provides documentation in the Part 70 or 71 permit application that: the unit is exempt from all Part 75 monitoring requirements; the unit is operated solely to provide electricity during peak demand or emergency periods; and the average annual emissions for the three previous years is less than 50 percent of the major source amount and emissions are expected to remain below the 50 percent level.

EXAMPLE I:	**Potential Precontrol Device Emissions Based on Potential to Emit and Estimated Control Efficiency**
Emissions unit:	Container glass melting furnace
Control device:	Venturi scrubber
Pollutant:	SO_2
Potential to emit:	10.6 tons/yr (based on title V applicability determination for subject emissions unit)
Control efficiency:	94 % (based on AP-42, Table 11.15-1)
Potential precontrol device emissions	10.6 × 100/(100-94) = 177 tons/yr
EXAMPLE II:	**Potential Precontrol Device Emissions Based on Uncontrolled Emission Factor From AP-42**
Emissions unit:	Hot mix asphalt dryer, drum mix process
Control device:	Fabric filter
Pollutant:	PM-10
Basis for potential to emit:	
Production rate:	210 tons/hr
Operating capacity:	8,760 hr/yr
Uncontrolled emission factor:	4.3 lb/ton (AP-42, Table 11.1-5)
Potential precontrol device emissions:	210 × 8,760 × 4.3 = 7,910,000 lb = 3,960 tons/yr

Figure 1-3. Examples of potential precontrol device emission estimates.

For potential to emit:

1. *White Paper for Streamlined Development of Part 70 Permit Applications*, U. S. Environmental Protection Agency, Research Triangle Park, NC, July 10, 1995.

For emission factors and control efficiencies:

1. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, AP-42, Fifth Edition*, U. S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.
2. Buonicore, A. and W. Davis (ed.), *Air Pollution Engineering Manual*, Air and Waste Management Association, Van Nostrand Reinhold, New York, NY, 1992.
3. *APTI Course 413, Control of Particulate Emissions, Student Manual*, EPA 450/2-80-086, U. S. Environmental Protection Agency, Research Triangle Park, NC, October 1981.
4. *APTI Course 415, Control of Gaseous Emissions, Student Manual*, EPA 450/2-81-005, U. S. Environmental Protection Agency, Research Triangle Park, NC, December 1981.
5. *APTI Course SI: 431, Air Pollution Control Systems for Selected Industries, Self-Instructional Guidebook*, EPA 450/2-82-006, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1983.

Figure 1-4. Useful references for estimating potential precontrol device emissions.

TABLE 1-2. SUMMARY OF CAM RULE EXEMPTIONS

Part 64 reference	
	EXEMPTED EMISSION LIMITATIONS OR STANDARDS[a]
§ 64.2(b)(1)(I)	Post-11/15/90 NSPS or NESHAP (see Table 1-3)
§ 64.2(b)(1)(ii)	Stratospheric ozone protection requirements
§ 64.2(b)(1)(iii)	Acid Rain Program requirements
§ 64.2(b)(1)(iv)	Emission limitations, standards, or other requirements that apply solely under an approved emission trading program
§ 64.2(b)(1)(v)	Emissions cap that meets requirements of § 70.4 (b) (12)
§ 64.2(b)(1)(vi)	Emission limitations or standards for which a Part 70 or 71 permit specifies a continuous compliance determination method that does not use an assumed control factor (see Table 1-4 for examples.)
	EXEMPTED EMISSIONS UNITS
§ 64.2 (c) (2)	Backup utility power units that: • are owned by a municipality; • are exempt from all monitoring requirements in Part 75; • are operated solely for providing electricity during peak periods or emergency situations; and • for which actual emissions for the previous 3 years are less than 50 percent of the major source cutoff and are expected to remain so.

[a]Note: If nonexempt emission limitations or standards apply to the emissions unit, the unit is not exempt.

TABLE 1-3. PART 60 AND 63 RULES PROPOSED AFTER NOVEMBER 15, 1990

Source category	Subpart	Affected facility
New Source Performance Standards--40 CFR 60		
Municipal Solid Waste Landfills	Cc	Existing landfills
Municipal Waste Combustor Emissions	Cb, Eb	Medical waste combustors
Medical Waste Incinerators	Ec, Ce	Medical waste incinerators
Phosphate Fertilizer Industry	X	Granular triple superphosphate production
Municipal Solid Waste Landfills	WWW	New, modified MSW Landfills
SOCMI Wastewater	YYY	New, modified, and reconstructed facilities
National Emission Standards for Hazardous Air Pollutants–40 CFR 63		
HON	F,G,H,I, J, K	Process vents storage vessels, transfer racks, wastewater streams, and equipment leaks used to produce one or more of 396 SOCMI chemicals
Coke Oven Batteries and Source Categories	L	Coke Oven Batteries
Dry Cleaning	M	Dry Cleaning Machines (at major and area sources)
Chromium Electroplating	N	Electroplating or Anodizing Tank
Ethylene Oxide	O	Ethylene Oxide Sterilizers and Fumigators
Sterilizers Industrial Process Cooling Towers	Q	Industrial Process Cooling Towers using Chromium
Gasoline Distribution	R	Total Bulk Terminal and Breakout Station
Pulp and Paper	S	Pulp and Paper and Paperboard
Halogenated Solvent Cleaning	A,T	Halogenated Solvent Cleaning Machines at Major and Area Sources
Polymers and Resins Group I	U	Existing and new facilities that manufacture elastomers
Epoxy Resins Production and Non-nylon Polyamides Production	W	Existing and new facilities that manufacture polymers and resins
Secondary Lead Smelters	X	New and existing sec. lead smelters
Marine Tank Vessel Loading and Unloading Operations	Y	New and existing marine tank vessel loading and unloading operations
Phosphoric Acid Manufacturing and Phosphate Fertilizers Production	AA	New and existing major sources in phosphoric acid manufacturing and phosphate fertilizer production plants
Petroleum Refineries	CC	Petroleum Refinery Processes
Offsite Waste Recovery Operations	DD	Offsite Waste and Recovery Operations

TABLE 1-3. (CONTINUED)

Source category	Subpart	Affected facility
Magnetic Tape Manufacturing Operations	EE	Magnetic Tape Products
Aerospace Manufacturing and Rework	GG	New and existing commercial, civil, and military aerospace OEM and rework facilities that are major sources of HAPS
Shipbuilding and Ship Repair	II	Surface coating operations from new or existing shipbuilding or ship repair facilities
Wood Furniture	JJ	Existing and new wood furniture mfg. operations
Printing and Publishing	KK	Existing and new sources
Primary Aluminum Reduction Plants	LL	New or existing potline paste production operation, and anode bake furnace
Steel Pickling	CCC	New and existing facilities that pickle steel using acid
Mineral Wool	DDD	New or existing sources in mineral wool production plants
Flexible Polyurethane Foam Production	lll	New and existing major sources of HAP; applies to manufacture of molded, slabstock, and rebond foam
Pharmaceuticals	GGG	HAPS from new and existing facilities that manufacture pharmaceuticals
Polymers and Resins IV	JJJ	Existing and new facilities that manufacture one or more Group IV polymers and resins
Pesticide Active Ingredient Production	MMM	New and existing facilities that manufacture Pesticide Active Ingredients (PAI)
Wool Fiberlgass	NNN	New and existing sources in wool fiberglass
Polyether Polyols Production	PPP	Existing and new facilities that manufacture Polyether polyols located at major source plant sites.

Note: This table does not include rules that were amended after Nov. 15, 1990. It includes only those NESHAP and NSPS with an original proposal date after Nov. 15, 1990. Whether emission limitations or standards amended after Nov. 15, 1990 are exempt from CAM would depend on the nature of the amendment and whether the amended rule includes monitoring requirements that satisfy CAM. See Chapter 3 for a discussion of presumptively acceptable CAM.

TABLE 1-4. EXAMPLES OF CONTINUOUS COMPLIANCE DETERMINATION METHODS

Monitoring method	Specific example
Continuous emission monitoring systems (CEMS) which are used to determine compliance with an emission limitation or standard on a continuous basis, consistent with the averaging period established for the emission limitation or standard and provide data in units of the standard	NO_x and SO_2 CEMS specified in Part 60 subpart Da, Standards of Performance for Electric Utility Steam Generating Units for which Construction is Commenced after September 18, 1978
	NO_x and SO_2 CEMS specified in Part 60, subpart Db, Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units
	NO_x CEMS specified in Part 60, subpart Dc, Standards of Performance for Small-Industrial-Commercial-Institutional Steam Generating Units
	NO_x and SO_2, and CO CEMS specified in Part 60, subpart Ea, Standards of Performance for Municipal Waste Combustors
	SO_2 CEMS for Fluid Catalytic Cracking Units Regenerators specified in Part 60, subpart J, Standards of Performance for Petroleum Refineries.

1.2.2 CAM Submittals

The next major step is the preparation and submittal of the required information for CAM. However, before preparing the submittals, owners or operators of affected units should determine the submittal date for units that are subject to CAM **[3]**. Deadlines for CAM submittals are addressed in § 64.5. In specifying submittal deadlines, the CAM rule distinguishes between large emissions units and other units. Large units are those with the (postcontrol) potential to emit the applicable pollutant at least 100 percent of the major source amount. Beginning April 20, 1998, owners or operators of large units that are subject to Part 64 must submit the required information as part of the application of a Part 70 or 71 permit if, by that date, the application has not been filed or has not yet been determined to be complete. In addition, beginning that same date, if the owner or operator of a large unit is required to submit a significant permit revision for that unit, the CAM submittal for that unit must be submitted as part of the permit revision application. For all other large units and for all other affected emission units, CAM submittals are to be included with the renewal of the Part 70 or 71 permit for the unit. Section 64.5(b) further specifies that a permit reopening is not required to submit the information required by Part 64. However, if the permit is reopened for cause by EPA or the permitting authority, the applicable agency may require the submittal of information for CAM as part of the permit reopening process.

Section 64.4 (a) requires owners or operators of affected units to prepare **[4]** and submit **[5]** several items that define the monitoring procedures that will be used to comply with the rule. Table 1-5 summarizes these required submittal items. Chapter 2 of this document describes the contents of CAM monitoring approach submittals and provides additional details on CAM submittal requirements; several example submittals are provided in Appendix A.

1.2.3 Review and Approval of CAM Submittal

As part of the process of issuing or denying Part 70 or 71 permit applications, the permitting authority reviews the CAM submittal (§ 64.6) **[6]**. To process the CAM submittal, the permitting authority follows the procedures specified in § 70.5 for Part 70 permit applications. First, the CAM submittal is reviewed for completeness and adequacy **[7]**. If additional information is needed or corrections are required, the permitting authority notifies the owner or operator **[8]**. Section 70.5(b) requires the owner or operator of the unit to revise or supplement the CAM submittal **[9]** and “promptly” provide the additional or revised information to the permitting authority **[10]**. Once the CAM submittal is determined to be acceptable, the permitting authority establishes permit terms or conditions for the affected emissions unit **[11]**. Table 1-6 summarizes the requirements that must, at a minimum, be specified in the permit.

If the monitoring proposed for the affected emissions unit requires installation, testing, or final verification of operational status **[12]**, the permitting authority may issue a permit with a schedule for completing the installation and testing, establishing applicable indicator ranges, or completing other required activities **[13]**.

1.2.4 CAM Implementation

Following approval and incorporation of the CAM requirements in the Part 70 or 71 permit **[13, 14]**, owners and operators of affected units must implement the monitoring **[15]** upon issuance of the permit, unless the permit specifies a later date (§ 64.7(a)). In such cases, monitoring must be implemented by the specified date. With the exception of periods when the monitoring system is under repair, maintenance, or QA/QC procedures, the monitoring must be conducted continuously or intermittently, as specified in the permit, during all periods when the emissions unit is in operation. In addition, § 64.7(b) requires owners and operators of units subject to CAM to maintain spare parts for routine repairs of monitoring instruments and equipment. Spare parts may be maintained by local vendors if there is no significant impact on immediate availability.

TABLE 1-5. SUMMARY OF SUBMITTAL REQUIREMENTS FOR CAM

Part 64 reference	Requirement[a]
§ 64.4(a)	Information on indicators, indicator ranges or process by which indicators are to be established, and performance criteria
§ 64.4(b)	Justification for the proposed elements of the monitoring
§ 64.4(c)	Control device operating data recorded during performance test, supplemented by engineering assessments or manufacturer's recommendations to justify the proposed indicator range
§ 64.4(d)	Test plan and schedule for obtaining data, if performance test data are not available
§ 64.4(e)	Implementation plan, if monitoring requires installation, testing, or other activities prior to implementation

[a] Sections 64.4 (f) and (g) do not specify additional items to be submitted, but allow owners and operators of affected units to provide one submittal for multiple units that are served by a single control device, and one submittal for an emission unit that is served by multiple control devices.

TABLE 1-6. SUMMARY OF REQUIRED PERMIT CONDITIONS OR TERMS

Part 64 reference	Requirement
§ 64.6(c)(1)	The approved monitoring approach, including the indicators to be monitored, the method of measuring the indicators, and the performance criteria specified in § 64.3 of the CAM rule
§ 64.6(c)(2)	The means of defining exceedances or excursions, the level which constitutes an exceedance or excursion or the means by which that level will be defined, the averaging period that associated with exceedances or excursions, and the procedures for notifying the permitting authority of the establishment or reestablishment of any exceedance or excursion level
§ 64.6(c)(3)	The obligation to conduct monitoring and satisfy the requirements of the §§ 64.7 through 64.9
§ 64.6(c)(4)	If appropriate, the minimum data availability requirement for valid data collection for each averaging period and, if appropriate, the minimum data availability requirement for the averaging periods in a reporting period

Section 64.9 specifies the reporting and recordkeeping requirements for CAM **[16]**. Monitoring reports must be submitted and records must be maintained in accordance with § 70.6(a)(3)(iii). As an alternative to paper records, § 64.9(b)(2) allows owners and operators of affected units to maintain records on alternate media, such as microfilm, computer files, magnetic tape disks, or microfiche provided that the records are readily accessible and the use of

such alternative media does not conflict with other recordkeeping requirements. Table 1-7 summarizes the reporting and recordkeeping requirements for CAM.

As CAM is implemented, owners and operators of affected emissions units periodically should review the monitoring data **[17]** to determine the need for additional measures to assure compliance with the applicable emission standards or limits. If an excursion or exceedance is detected **[18]**, the owner or operator must take the corrective actions **[19]** necessary to return the emissions unit and control system to normal operation and minimize the likelihood that similar excursions or exceedances recur. If the owner or operator determines that deviations occurred that the monitoring did not indicate as an excursion or exceedance, or the results of a subsequent compliance test indicate that the indicator ranges must be modified **[20]**, § 64.7(e) requires the owner or operator of the emissions unit to notify the permitting authority promptly **[21]**. If a permit revision is required **[22]**, the owner or operator of the unit must identify proposed revisions to the CAM submittal **[9]** and submit the proposed revisions to the permitting authority **[10]** for review and approval prior to implementing the plan.

After reviewing the report of excursions or exceedances, subsequent corrective actions taken, monitoring data, and other relevant information, the permitting authority or Administrator may require **[23]** the source to develop and implement a QIP **[24]**. In some cases, the Part 70 or 71 permit also may specify the threshold for requiring a source to implement a QIP. Quality improvement plans are discussed in Section 3.4 of this document.

If required by the permitting authority, owners or operators of affected units may be required to maintain written QIP's on file for inspection and review. When a QIP is required, owners or operators must develop and implement the QIP as quickly as possible and must notify the permitting authority if more than 180 days will be required for completing the improvements specified. If it is determined that the QIP was inadequate **[25]**, the permitting authority also may require the source to modify the QIP **[26]**.

TABLE 1-7. SUMMARY OF REPORTING AND RECORDKEEPING REQUIREMENTS FOR CAM

Part 64 reference	Requirement
MONITORING REPORT REQUIREMENTS	
§ 64.9(a)(2)(I)	Summary of the number, duration, and cause of excursions or exceedances and the corrective actions taken
§ 64.9(a)(2)(ii)	Summary of the number, duration, and cause of monitoring equipment downtime incidents, other than routine downtime for calibration checks
§ 64.9(a)(2)(iii)	Description of the actions taken to implement a QIP, and, upon completion of the QIP, documentation that the plan was completed and reduced the likelihood of similar excursions or exceedances
COMPLIANCE CERTIFICATIONS	
§ 70.69(a)(3)(iii)(A)	Identification of each term or condition of the permit that is the basis of the certification
§ 70.69(a)(3)(iii)(B)	Identification of the methods or other means used by the owner or operator for determining the compliance status with each term and condition during the certification period, and whether such methods or other means provide continuous or intermittent data
§ 70.69(a)(3)(iii)(C)	Status of compliance with the terms and conditions of the permit for the period covered by the certification and identification of each deviation and, as possible exceptions to compliance, any periods during which compliance was required and an excursion or exceedance occurred
§ 70.69(a)(3)(iii)(D)	Any other information required by the permitting authority
RECORDKEEPING REQUIREMENTS	
§ 64.9(b)	Records of monitoring data, monitor performance data, corrective actions taken, written QIP's, actions taken to implement a QIP, and other supporting information

In addition to the reporting requirements specified in § 64.9, § 70.6(a)(3)(iii) requires owners or operators of affected emissions units to submit monitoring reports with the required compliance certifications to the permitting authority at least semiannually **[27]**. Table 1-7 lists the types of information that must be included in the monitoring reports and compliance certifications.

2.0 MONITORING APPROACH SUBMITTALS

Part 64 requires all owners or operators of affected facilities to submit information about the monitoring approach to be used to comply with the rule. The information to be submitted is compiled in what is referred to in this guidance document as a monitoring approach submittal, or CAM submittal.

A monitoring approach submittal is required for each pollutant-specific emissions unit (PSEU). If a single control device is common to more than one PSEU, the facility owner or operator may provide a monitoring approach submittal for the control device that identifies the PSEU's affected and any process or associated capture device conditions that must be maintained or monitored to comply with the CAM general criteria. Similarly, if a single PSEU is controlled by more than one control device that are similar in design and operation, the owner or operator may provide a monitoring approach submittal that applies to all the control devices. The CAM submittal must identify the affected control devices and any process or associated capture device conditions that must be maintained or monitored to comply with the general monitoring criteria.

This chapter provides guidance on preparing monitoring approach submittals. Section 2.1 presents the objectives of a CAM submittal. Section 2.2 presents and discusses the submittal requirements. Section 2.3 discusses the process of selecting a monitoring approach and appropriate indicator range(s) for the parameters that are to be monitored. Section 2.4 discusses QIP's.

Example monitoring approach submittals are provided in Appendix A.

2.1 MONITORING APPROACH SUBMITTAL OBJECTIVES

The objectives of a monitoring approach submittal are to identify the monitoring approach that will be used, the indicator range(s) to be maintained, and the rationale for selecting the monitoring approach and indicator range(s).

Part 64 identifies specific information that must be submitted to the permitting authority. As mentioned above, the compilation of this information is called a CAM submittal. The submittal requirements are identified and discussed in the following section. If the CAM submittal includes all of the necessary elements, it should provide sufficient information to allow the permitting authority to determine if the owner or operator of the affected emissions unit is monitoring in a manner that complies with Part 64. The CAM submittal will provide a succinct summary of the monitoring requirements necessary for compliance with Part 64 for both facility personnel and the permitting agency. Providing detailed Standard Operating Procedures (SOP's) or a detailed Quality Assurance/Quality Control (QA/QC) manual is not the intended objective of a CAM submittal. The justification for the CAM submittal must include documentation that describes the rationale for how the requirements of Part 64 are satisfied.

The information included in the CAM submittal is extensive and covers all aspects of the monitoring approach and how it complies with Part 64. Once the permitting authority approves a facility's proposed monitoring, the facility's operating permit must establish permit terms or conditions that specify the required monitoring. The information included in the permit, however, need not be as all inclusive as the information contained in the CAM submittal presented to the permitting authority for approval. Only certain types of information contained in the CAM submittal must be incorporated directly into the facility's operating permit. These minimum requirements are discussed further in Section 2.2.

2.2 ELEMENTS OF A MONITORING APPROACH SUBMITTAL

Suggested outlines for CAM submittals that incorporate the elements required by the rule are presented in Figures 2-1a and 2-1b. Figure 2-1a pertains to facilities using a monitoring approach that does not involve the use of continuous emission monitoring systems (CEMS), continuous opacity monitoring systems (COMS), or predictive emission monitoring systems (PEMS) and Figure 2-1b pertains to facilities using CEMS, COMS, or PEMS as the monitoring approach. For clarification purposes the information is presented in two separate outlines. However, a facility using a combination of methods should compile all the necessary information pertaining to each monitoring method into one CAM submittal. In the figures, the required elements are presented in bold type. Each element is addressed in the following sections. An example CAM submittal format that may be used to provide the necessary information is presented in Figure 2-2.

As mentioned above in Section 2.1, only some of the information included in the CAM submittal need be incorporated directly into the facility's operating permit. Section 64.6(c) of the rule states that, at a minimum, the facility's operating permit must specify: (1) the approved monitoring approach, including the indicator(s) to be monitored, the means or device to measure the indicator(s), and the monitoring approach performance specifications; (2) the indicator range(s), including appropriate averaging periods; (3) a general statement of the owner or operator's obligation to conduct the monitoring and to satisfy the requirements for quality improvement plans and reporting and recordkeeping requirements; and (4) if appropriate, minimum data availability requirements for valid data collection for each averaging period and for each reporting period. Items 1 and 2 above are required to be addressed in the CAM submittal. Based on the outline presented in Figure 2-1a and the example format presented in Figure 2-2, the information contained in item II--Monitoring Approach would cover items 1 and 2 of the minimum operating permit requirements listed above. As shown in Figure 2-2, this information is compiled in a table. This table, along with a general statement of obligation and minimum data availability requirements, would be a convenient format for incorporation into a facility's operating permit. For completed example CAM submittals using this format refer to Appendix A.

Monitoring Approach Submittal[a]

I. Background

A. Emissions unit identification
B. Applicable regulation, emission limits, and monitoring requirements
C. Control technology description

II. Monitoring Approach

A. General Criteria

1. Performance indicator(s)
2. Indicator range(s) or designated condition(s)

B. Performance Criteria

1. Data representativeness
2. Verification of operational status (new or modified equipment)
3. QA/QC practices
4. Monitoring frequency and data collection procedures

Justification[a]

I. Monitoring approach and indicator

II. Indicator range(s)

A. Compliance test data and indicator data supporting range, or
B. Compliance test plan and schedule, or
C. Rationale and documentation for indicating that ranges can be established without the need for compliance test data

---

[a]Items in bold are specific elements required by the rule [§ 64.4].

Figure 2-1a. Outline for monitoring approach submittal and justification.

Monitoring Approach Submittal[a]

I. Background

A. Emissions unit identification
B. Applicable regulation, emission limits, and monitoring requirements
C. Control technology description

II. Monitoring Approach

A. General Criteria

1. Performance indicator(s)
2. Indicator range(s) for COMS used to assure compliance with a PM standard

B. Performance Criteria

1. Exceedance reporting required by regulation
2. Exceedance period to be used for CAM

Justification[a]

I. Monitoring approach and indicator

II. Indicator range(s) for CEMS and PEMS: reference the most recent certification test for the monitor

III. Indicator range(s) for COMS used to assure compliance with a PM standard

A. Compliance test data and indicator data supporting range, or
B. Compliance test plan and schedule, or
C. Rationale and documentation for indicating that ranges can be established without the need for compliance test data

---

[a]Items in bold are specific elements required by the rule [§ 64.3].

Figure 2-1b. Outline for monitoring approach submittal and justification for CEMS, COMS, and PEMS.

MONITORING APPROACH SUBMITTAL

I. Background

A. Emissions Unit

Description: ______________________________
(Type of emission point)

Identification: ______________________________
(Emission point number)

Facility: ______________________________
(Location)

B. Applicable Regulation, Emission Limits, and Monitoring Requirements

Regulation No.:

Pollutant: ______________________ ______________________________
(Emission limit)

Pollutant: ______________________ ______________________________
(Emission limit)

Monitoring Requirements:

C. Control Technology
(Describe control technology)

II. Monitoring Approach

The key elements of the monitoring approach are presented in Table 1.

JUSTIFICATION

(Present justification for selection of monitoring approach and indicator range(s).)

Figure 2-2. Monitoring approach submittal example format.

TABLE 1. MONITORING APPROACH

	Indicator No. 1	Indicator No. 2
I. Indicator		
Measurement Approach		
II. Indicator Range QIP Threshold (optional)		
III. Performance Criteria A. Data Representativeness		
B. Verification of Operational Status		
C. QA/QC Practices and Criteria		
D. Monitoring Frequency		
Data Collection Procedures		
Averaging Period		

Figure 2-2. (continued)

2.2.1 Background

This section of the CAM submittal provides background information on the pollutant-specific emissions unit to which the submittal applies. The pollutant-specific emissions unit is identified and briefly described. The applicable emission limitation or standard(s) and pollutant(s) also are identified. If applicable, any existing monitoring requirements that apply to the pollutant-specific emissions unit also are described. Finally, the emissions control technology for the unit is identified and briefly described.

2.2.2 Monitoring Approach

This section of a CAM submittal presents a description of the monitoring approach to be used. Section 64.3 of the rule specifies design criteria that the monitoring approach must address to satisfy Part 64. These criteria are categorized as general criteria, performance criteria, and special criteria where CEMS, COMS or PEMS are to be used; and are summarized in Table 2-1. The description of the monitoring approach must address how each of the applicable design criteria are satisfied. Thus, the description should include the following:

1. General criteria: performance indicator(s) and indicator range(s);
2. Performance criteria: data representativeness, verification of operational status, QA/QC procedures, and monitoring frequency and data collection procedures; and
3. Special criteria (if applicable for use of CEMS, COMS, or PEMS): performance indicator(s), indicator range(s), performance criteria, and reporting of exceedances.

Each of these elements to be included in the CAM submittal are described in the following sections.

2.2.2.1 General Criteria: Performance Indicator(s) and Indicator Range(s)

The monitoring approach must be designed to provide data for one or more indicators of performance of the control device, any associated capture system, and/or any processes significant to achieving compliance. Such indicators can include a measured or predicted emissions level, such as total hydrocarbon concentration, nitrogen oxides (NO_x) concentration, opacity, or visible emissions; a pollution control device operating parameter, such as temperature or pressure drop; a process operating parameter, such as temperature or flow; a recordkeeping item, such as pounds of volatile organic compound per gallon of coating; a work practice activity, such as records of solvent usage for cleaning activities; recorded findings of inspection and maintenance activities, such as an internal fabric filter baghouse inspection; or a combination of these types of indicators.

TABLE 2-1. MONITORING DESIGN CRITERIA

Part 64 reference	Description
GENERAL CRITERIA	
§ 64.3 (a) (1)	Must be designed to obtain data for one or more indicators of performance of the control device, any associated capture system, and processes necessary to assure compliance.
§ 64.3 (a) (2)	Must be based on establishing appropriate indicator ranges or designated conditions such that operation within the ranges provides a reasonable assurance of ongoing compliance with the applicable requirement over the anticipated range of operations. Reasonable assurance of compliance will be assessed by maintaining performance within the indicator range(s) or designated conditions that reflect proper operation and maintenance of the control device (and associated capture system).
§ 64.3 (a) (3)	Ranges may be based on a minimum or maximum value; based on different values for different operating conditions; expressed as a function of process variables; expressed as maintaining the applicable indicator in a particular operational status; and established as interdependent between more than one indicator.
PERFORMANCE CRITERIA	
§ 64.3 (b) (1)	Data Representativeness: Detector location and installation specifications to provide for obtaining representative data.
§ 64.3 (b) (2)	Verification of Operational Status: Verification procedures, including installation, calibration, and operation in accordance with manufacturer's recommendations, to confirm the operational status of the monitoring prior to the commencement of required monitoring.
§ 64.3 (b) (3)	QA/QC Procedures: QA/QC practices to ensure continuing validity of data.
§ 64.3 (b) (4)	Frequency of Monitoring: Monitoring frequency, data collection, and averaging period consistent with the characteristics and typical variability of the emissions unit and commensurate with the time period over which an exceedance or excursion is likely to occur. Emissions units with postcontrol PTE ≥100 percent of the amount classifying the source as a major source must collect four or more values per hour to be averaged. Other emissions units must collect data at least once per 24 hour period.
EVALUATION FACTORS	
§ 64.3 (c)	Site-specific factors should be considered in designing monitoring to meet § 64.3(a) and (b). These factors include: applicability of existing monitoring procedures; ability of monitoring to account for process and control device operational variability; reliability and latitude built into control technology; and level of actual emissions compared to compliance limitation.
SPECIAL CRITERIA FOR USE OF CEMS, PEMS, OR COMS	
§ 64.3 (d) (1)	CEMS, PEMS, or COMS that are required by other authorities under the Clean Air Act, State, or local law must be used to satisfy the CAM rule.
§ 64.3 (d) (2)	CEMS, PEMS, or COMS that satisfy any of the following monitoring requirements are deemed to satisfy the general design and performance criteria: § 51.214 and Appendix P of 40 CFR 51; § 60.13 and Appendix B of 40 CFR 60; § 63.8 and applicable performance specifications of the applicable subpart of 40 CFR 63; 40 CFR 75; subpart H and Appendix IX of 40 CFR 266; or comparable requirements established by the permitting authority.
§ 64.3 (d) (3)	Must allow for reporting of exceedances (or excursions) consistent with any underlying requirement or with § 64.3(b)(4), and provide an indicator range consistent with § 64.3(a) for a COMS used to assure compliance with a PM standard.

The general criteria also require that the monitoring approach be based on establishing appropriate ranges for control performance indicators that provide a reasonable assurance of compliance with the applicable requirement within the anticipated range of operations. A reasonable assurance of compliance can be achieved when control device performance is maintained within the indicator ranges that reflect proper operation and maintenance of the control device. Except for CEMS, COMS, and PEMS that provide data in units of the applicable emissions standard, the CAM submittal must specify the range to be maintained for each monitored indicator. The indicator range may be a true range, comprised of upper and lower limits; (e.g., 3.5 to 5.0 in. w.c. for differential pressure); a single maximum or minimum value not to be exceeded (e.g., not less than 1650°F for a thermal incinerator temperature); different values for different operating conditions (e.g., different ranges for high vs. low process load); expressed as a function of process variables (e.g., maintaining condenser temperatures “x” degrees below the condensation temperature of the applicable compounds being processed); expressed as maintaining the applicable indicator in a particular operational status (e.g., maintaining the position of a damper controlling gas flow to the atmosphere through a bypass duct); or established as interdependent between more than one indicator.

Additional information on selection of operating ranges is presented in Section 2.3.

2.2.2.2 Performance Criteria

Monitoring approaches used to comply with Part 64 are subject to minimum performance criteria specified in § 64.3. Under § 64.6(c) of the rule, these minimum performance criteria are to be included in the facility’s operating permit. The minimum criteria assure that the data generated by the monitoring approach provide valid and sufficient information on the actual conditions being monitored. Detailed information that is not necessary to assure the data are representative need not be included in the facility’s operating permit. Unnecessary detail in the permit may restrict a facility from making minor changes to the monitoring approach without undergoing procedures for a permit revision. For example, details related to the types of monitoring devices and recording systems (e.g., specifying a “Type K” thermocouple) may be left out as long as the minimum accuracy of the monitoring device is specified (e.g., thermocouple with a minimum accuracy of ±4°F or ±0.75 percent, whichever is greater). This approach allows the owner or operator to change the type of thermocouple without triggering the need for a permit revision while providing minimum sensor specifications that assure representative data are obtained.

The performance criteria that are to be addressed by the monitoring approach are as follows:

1. Data Representativeness. The monitoring approach must include specifications that provide for obtaining data that are representative of the emissions or parameters being monitored. Typically these specifications should include, as a minimum, a brief description of: (1) detector location, (2) installation requirements (if applicable), and (3) minimum acceptable accuracy. For example, the specifications for a thermocouple used to measure thermal incinerator combustion chamber temperature could be as follows:

a. Detector location–exit of thermal incinerator combustion chamber;

b. Installation requirements–housed in a ceramic protection tube, shielded from flame;

c. Minimum acceptable accuracy–thermocouple sensor with a minimum accuracy of ±4°F or ±0.75 percent, whichever is greater, and a data recording system with a minimum resolution of 20°F.

2. Verification of Operational Status. For new or modified monitoring equipment, the monitoring approach must describe the verification procedures that will be used to confirm the operational status of the monitoring prior to the date by which the owner or operator must conduct monitoring for compliance with § 64.7. Verification procedures include procedures for installation, calibration, and operation of the monitoring equipment, and should be conducted in accordance with the monitoring equipment manufacturer's recommendations.

3. QA/QC Practices. The monitoring approach must identify the minimum QA/QC activities that will be used to assure the continuing validity of the data for the purpose of indicating potential adverse changes in control performance. Quality control activities are those routine activities included as a part of normal internal procedures such as periodic calibration checks (e.g., zero check of manometer), visual inspections by operating staff, routine maintenance activities (e.g., replacement of filters on COMS purge air system, weekly blowback purge of manometer lines), or training/certification of staff. Quality assurance activities are those activities that are performed on a less frequent basis, typically by someone other than the person(s) responsible for the normal routine operations. An example of a QA activity is quarterly or annual calibration verification/adjustments performed by an instrument technician.

In developing minimum QA/QC activities for monitoring equipment and instruments the owner or operator should take into account the calibration and maintenance requirements or recommendations specified by the instrument manufacturer or supplier. When establishing QA/QC activities, the desired precision and accuracy of the data should be considered; e.g., if greater inaccuracy can be tolerated for the application (i.e, ±20°F rather than ±2°F), less frequent calibrations and/or less stringent acceptance criteria may be necessary.

The CAM submittal should include a list of the primary QA/QC activities; their frequency; and, where appropriate, the acceptable limits. A tabular summary with brief explanations, as necessary, generally is sufficient. A separate, detailed Quality Assurance Plan is not required as a part of the CAM submittal. For example, for a thermocouple, the QA/QC activities could be specified as follows:

a. Visual inspection of thermocouple sensor and well (semiannually); and

b. Measurement of system accuracy using a thermocouple simulator (calibrated millivolt source) at the sensor terminal location (semiannually); specified accuracy limit of ±40°F at 1800°F.

4. Frequency of Monitoring. The monitoring approach must address specifications for monitoring frequency, data collection procedures, and if applicable, averaging periods for discrete data points to be used in determining whether an excursion or exceedance has occurred. The monitoring and data collection frequency (including associated averaging periods) must be designed to obtain data at such intervals that are, as a minimum, consistent with the time period over which an excursion is likely to occur based on the characteristics and typical variability of the emissions unit (including the control device and associated capture system).

Part 64 includes minimum acceptable frequency requirements for PSEU's with the potential to emit the applicable regulated pollutant, calculated including the effect of control devices (i.e., postcontrol), in an amount equal to or greater than 100 percent of the major source threshold level. For each parameter monitored, emissions units within this category must collect at least four data points equally spaced over each hour. The permitting authority may approve less frequent monitoring, if appropriate, based on information presented by the owner or operator concerning the data collection mechanisms available for a particular parameter for the particular PSEU. Approval of less frequent monitoring is appropriate where frequent monitoring is not feasible because of the available data collection mechanisms for the parameter (e.g., integrated raw material or fuel analysis data, noninstrumental measurement of feed rate or visible emissions, use of a portable analyzer or an alarm sensor). For other PSEU's (postcontrol potential to emit less than 100 percent of the major source threshold), monitoring may be less frequent but must include some data collection at least once per 24-hour period (e.g., a daily inspection of a carbon adsorber system in conjunction with a weekly or monthly check of emissions with a portable analyzer.)

The monitoring approach must specify the monitoring frequency (how often measurements will be taken and recorded), the data collection procedures (e.g., manual readings and data logging or use of a data acquisition system), and the data averaging period (if applicable) for each parameter. Examples of monitoring frequency include: (1) incinerator temperature at 1-minute intervals, (2) NO_x and oxygen (O_2) concentration at 15-minute intervals, (3) differential pressure at 1-hr intervals, and (4) opacity observations for 15 contiguous minutes per day. Where the measurement frequency and the recording frequency differ, both should be specified. Also, if the proposed parameter indicator will be an average value, the CAM submittal must clearly specify the averaging period that will be used to determine that the indicator range is maintained. For example: “The NO_x analyzer will measure the concentration at 10-second intervals, and the average value for each 15-minute period will be recorded. The 15-minute values for each clock-hour will be averaged to provide a 1-hour NO_x concentration to assess compliance with the indicator range.” For monitoring an operating parameter: “The thermocouple will measure thermal incinerator combustion chamber temperature at 1-minute intervals, and the average value for each 1-hour period will be recorded. The 1-hour values will be averaged over each 3-hour period to provide a 3-hour temperature to assess compliance with the indicator range.”

Data acquisition procedures should indicate the equipment or method and the frequency at which indicator values are to be recorded. Examples of data acquisition procedures include: (1) 24-hour circular chart--incinerator temperature at 1-minute intervals, (2) electronic data file via data acquisition system--incinerator temperature at 1-minute intervals, (3) electronic data file via data acquisition system--15-minute average NO_x and O_2 CEMS measurements, (4) written entry on log sheet--hourly differential pressure, and (5) completion of Reference Method 9 visible emission data form--daily opacity observations.

2.2.2.3 Special Criteria for the use of CEMS, COMS, or PEMS

Part 64 specifies that where CEMS, COMS, or PEMS are already required, the monitoring approach must incorporate such systems. Therefore, source owners and operators whose emissions units have had CEMS, COMS, and/or PEMS imposed by underlying regulations, emissions trading programs, judicial settlements, or through other circumstances must use those systems when developing a monitoring approach. The use of these systems in accordance with general monitoring requirements and performance specifications will be sufficient for the system to satisfy the Part 64 general and performance criteria discussed above in Sections 2.2.2.1 and 2.2.2.2.

An exception to this general rule is a COMS used to assure compliance with a particulate matter standard. Indicator range(s) need not be specified for CEMS and PEMS that provide data in units of the applicable emissions standard because the level of the standard is the level at which an excess emission occurs. However, when a COMS is used to monitor opacity as an indicator of compliance with a particulate matter standard, the indicator (opacity) is not in terms of the standard (gr/dscf, for example) and an indicator range for opacity must be specified in the CAM submittal. Consequently, for a source that has both an applicable particulate matter (PM) standard and a requirement to continuously monitor opacity, if the source chooses opacity as the indicator (or one of multiple indicators) for PM, it is conceivable (and probable) that the specified indicator range for PM would be established at a different (lower) level and a different averaging time than the opacity emission limit which establishes the excess emission level for opacity. It should be emphasized that even in cases where a COMS is required for opacity, the COMS need not be specified as part of CAM for particulate matter. Other appropriate indicators may be selected to satisfy CAM. The above discussion applies only in cases where a facility chooses to use a COMS to monitor opacity as an indicator of compliance with a particulate matter standard.

In addition to addressing performance criteria and indicator range(s) (when applicable), the owner or operator must present information with the CAM submittal on how the CEMS, COMS, or PEMS system is designed to allow for reporting of exceedances (or excursions if applicable to a COMS used to assure compliance with a particulate matter standard).

2.2.3 Justification for Selected Monitoring Approach and Indicator Range(s)

The essence of Part 64 is the requirement that the owner or operator monitor the indicator(s) of control technology performance necessary to ensure the detection of potential adverse changes in control performance that affect emissions. The selection of the monitoring approach is the responsibility of the owner/operator. However, as part of the information provided with the CAM submittal, the owner/operator must submit justification that describes how the proposed monitoring satisfies the minimum requirements of Part 64. Essentially, this means the owner/operator must present justification for the selection of the monitoring approach (the performance indicator) and the indicator ranges. The documentation for each of these items is discussed in the following sections.

2.2.3.1 Justification for Selected Monitoring Approach and Indicator(s)

The justification should briefly describe how the proposed monitoring approach satisfies the requirements of Part 64, that is, how the selected monitoring approach and performance indicator ranges are adequate to:

1. Demonstrate that the control device and processes significant to achieving compliance are operated and maintained in accordance with good air pollution practices that will minimize emissions at least to levels required by all applicable requirements; and

2. Provide reasonable assurance of compliance with emission limitations for the anticipated range of operations.

To support the justification the owner/operator may rely on:

1. Facility or corporate experience with monitoring control device or process operation performance;

2. Generally available sources of information (e.g., air pollution engineering manuals, EPA and permitting authority publications on monitoring, operation, and maintenance of pollution control devices); or

3. Regulatory precedents, such as the following:

a. Presumptively acceptable or required monitoring approaches established by the permitting authority to achieve compliance with the CAM rule for the particular pollutant-specific emissions unit;

b. Continuous emission, opacity, or predictive emission monitoring systems that satisfy applicable monitoring requirements and performance specifications as specified in the rule [64.3(d)];

c. Alternative monitoring methods allowed or approved pursuant to Part 75;

d. Monitoring included for standards exempt from CAM; and

e. Monitoring requirements established in other regulations for the same or similar type sources (e.g., a monitoring requirement in an NSPS).

Factors to consider in selecting the monitoring approach and indicator(s) of performance are discussed in Section 2.3.

2.2.3.2 <u>Justification for Selected Indicator Range(s)</u>

For CEMS and PEMS, the indicator range presumptively is the level of the standard. As a result, the justification provided with the CAM submittal may simply reference the most recent certification test for the monitor. Note that if a COMS is used as the monitoring approach for a particulate matter standard, justification should be provided for selection of the indicator (i.e., opacity) range and averaging time.

Parameter data collected during performance testing and other relevant information, such as engineering assessments, manufacturers' design criteria, and historical monitoring data are used to establish indicator ranges for other monitoring approaches. The selection of appropriate indicator ranges is further discussed in Section 2.3.2.

The justification for the selected indicator range(s) should include a summary (tabular or graphical format) of the data supporting the selected ranges, supplemented by engineering assessments or control device manufacturer's recommendations, if necessary. References for the appropriate compliance test report(s) also should be provided. If site-specific compliance data are not available, the documentation must include a test plan and schedule for obtaining such data. The test plan should identify the:

1. Pollutants to be measured and the compliance test methods to be used;
2. Number and duration of test runs to be conducted;
3. Proposed process operating conditions during the tests (e.g., percent of full load);

4. Proposed control device operating conditions and indicator ranges (e.g., venturi pressure drop, condenser temperature);

5. Process and control device parameters to be monitored during the test and reported; and

6. Whether indicator data will be collected over an extended time period and the process/control device data to be collected concurrently.

As an alternative to providing a compliance test plan, the owner/operator may propose other information as the basis for the indicator ranges proposed. However, in such cases, the documentation provided must demonstrate to the permitting authority's satisfaction that compliance testing is unnecessary to establish indicator ranges at levels that satisfy Part 64 criteria.

Other information that the owner/operator may consider in selecting operator ranges, in lieu of compliance test data, in order of preference includes:

1. Site-specific data from tests other than compliance tests;

2. Data from tests performed on similar units at the facility or similar facilities;

3. Empirical information concerning the assessment of control technology performance (e.g., empirical performance information from a scrubber control technology handbook);

4. Regulatory precedents involving appropriate monitoring of similar emissions units (e.g., NSPS requirement for same control technology at a similar source); and

5. Theoretical considerations based on generally accepted engineering practices (i.e., engineering judgement).

If the owner/operator bases the indicator ranges on any of the other types of available information listed above rather than on site-specific compliance test data, the documentation must include a concise explanation of the rationale for relying on information other than site-specific compliance data. The rationale must demonstrate that compliance testing is not necessary for the owner/operator to establish operating ranges so that excursions from the operating ranges can be addressed prior to potential emission exceedances. Factors to consider in the rationale for using information other than compliance test data include the ability to establish the appropriate operating ranges based upon engineering principles, and conservative assumptions with respect to the emissions variability and the margin of compliance associated with the emissions unit and control device.

2.3 SELECTION OF MONITORING APPROACH AND SELECTION OF INDICATOR RANGE

This section discusses the selection process for determining a monitoring approach that is acceptable for Part 64 and addresses selection of appropriate ranges for the indicators to be monitored.

2.3.1 Selection of Monitoring Approach

This section describes a selection process developed to assist facilities with selecting a monitoring approach. The basic concepts and principles used to design the State of Virginia CAM selection process were relied upon in designing this selection process.[1] The selection process itself is not a requirement of Part 64, rather it is a suggested strategy for identifying appropriate monitoring approaches. The purpose of the selection process is ultimately to arrive at the most cost-effective monitoring approach that is consistent with facility operations and provides sufficient data to indicate proper operation and maintenance of the control device such that there is a reasonable assurance of compliance with emission limitations or standards. The underlying concept of the selection process is to begin with the current monitoring practice used at a specific emissions unit within a facility, review this practice, and modify the practice when necessary to comply with the criteria established by Part 64. The selection process can be broken down into several steps as illustrated in Figure 2-3 and discussed in the following paragraphs. Figure 2-4, the Monitoring Approach Selection Process Worksheet, can be used to assist the facility with information gathering and decision making throughout the step-by-step selection process.

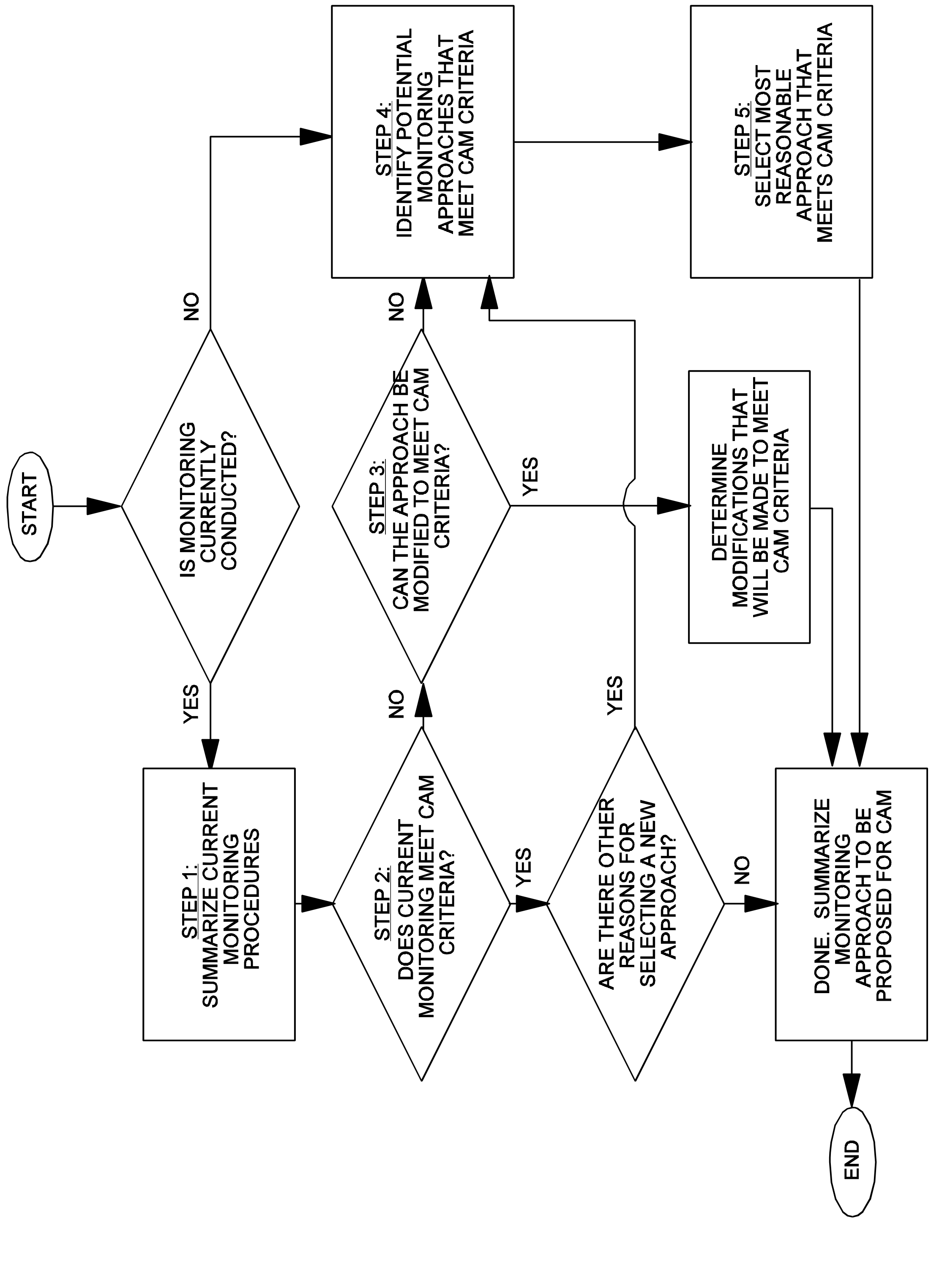

Figure 2-3. Monitoring approach selection process.

General Information

Facility Name: ____________________
Facility Location: ____________________
Date: ____________________
Emissions Unit: ____________________
Regulated Pollutant: ____________________

Applicable Requirements
Regulation and emission limit: ____________________
Monitoring requirement: ____________________

Step 1. Summarize Current Monitoring Procedures

Control Device: ____________________
Monitoring Method: ____________________
Indicator(s) tracked: ______ ______ ______
Frequency of measurements: ______ ______ ______
Rationale for indicators (check one or provide other rationale):
Required by rule ______ ______ ______
Direct measure of emissions ______ ______ ______
Indicator of emissions ______ ______ ______
Indicator of proper APCD performance, operation, and maintenance ______ ______ ______
Indicator of APCD inspection and maintenance ______ ______ ______
Recordkeeping procedures: ____________________
Reporting procedures: ____________________

Step 2. Evaluate Current Monitoring Procedures

Does design and performance of current procedures meet CAM criteria listed below?
(CAM criteria are summarized in Table 2-1)

	(Y/N)
Based on indicators and established indicator ranges	___
Data representativeness	___
Verification of operational status	___
QA/QC procedures	___
Frequency of monitoring	___
Special criteria for use of CEMS, PEMS, COMS	___

If yes (to all applicable), current monitoring procedures can be proposed as CAM. Complete "Proposed CAM Monitoring Approach" box (above right).
If no for any applicable criteria above, go to step 3.

Proposed CAM Monitoring Approach

Control Device: ____________________
Monitoring Method: ____________________
Indicator(s) tracked: ______ ______ ______
Frequency of measurements: ______ ______ ______
Rationale for indicators (check one or provide other rationale):
Required by rule ______ ______ ______
Direct measure of emissions ______ ______ ______
Indicator of emissions ______ ______ ______
Indicator of proper APCD performance, operation, and maintenance ______ ______ ______
Indicator of APCD inspection and maintenance ______ ______ ______
Recordkeeping procedures: ____________________
Reporting procedures: ____________________

Step 3. Evaluate Possible Modifications to Meet CAM Criteria

Can the current monitoring procedures be modified to meet CAM criteria? ____ (Y/N)
If no, go to step 4 (on page 2 of this form)
If yes, identify the modifications:
____
____

Does modified approach meet CAM criteria listed below:	(Y/N)
Based on indicators and established indicator ranges	___
Data representativeness	___
Verification of operational status	___
QA/QC procedures	___
Frequency of monitoring	___
Special criteria for use of CEMS, PEMS, COMS	___

Describe the revised monitoring approach to be proposed for CAM in box above.

Figure 2-4. Monitoring approach selection process worksheet.

Step 4. Identify Potential Monitoring Approaches that Meet CAM Criteria (Example for thermal incinerator)

	Option 1	Option 2	Option 3
Monitoring approach:			
Indicator(s)	Combustion chamber T	______	______
Frequency	Daily	______	______
CAM criteria:			
Based on indicator(s) and range(s)	✓	______	______
Data representativeness	✓	______	______
Verification of operational status	✓	______	______
QA/QC procedures	✓	______	______
Frequency of Monitoring	✓	______	______
Special criteria for use of CEMS, PEMS, COMS	✓	______	______

Step 5. Evaluate Options Identified in Step 4 and Select Most Reasonable[a] (Example for thermal incinerator)

Pros (Rate 1 to 3)	Option 1	Pros (Rate 1 to 3)	Option 2	Pros (Rate 1 to 3)	Option 3
1. Combustion T already measured at the facility	3	1.______	______	1.______	______
2. Frequency consistent with other measurements taken at facility	2	2.______	______	2.______	______
3. Low costs	3	3.______	______	3.______	______
4. Equipment needs are minimal	3	4.______	______	4.______	______

Cons (Rate -1 to -3)	Option 1	Cons (Rate -1 to -3)	Option 2	Cons (Rate -1 to -3)	Option 3
1. The confidence level is low, once daily not good indicator of operation	-3	1.______	______	1.______	______
2.	______	2.______	______	2.______	______
3.	______	3.______	______	3.______	______
4.	______	4.______	______	4.______	______

[a]For identifying pros and cons consider:

Is the approach consistent with process monitoring procedures or other APCD procedures on-site?
Monitoring frequency: Is it adequate to detect changes in control device performance for which corrective action is appropriate. Is it consistent with other measurements taken at the facility?
Level of confidence: Is it acceptable?
Equipment needs: Are they reasonable? Is the type of equipment currently being used elsewhere within the plant? Are plant personnel familiar with the use of the necessary equipment? Considering these needs, is the approach still feasible?
Costs: Considering production and O&M benefits, are the costs reasonable?

Figure 2-4. (continued)

Step 1: Summarize the current monitoring procedures

If monitoring is currently conducted, the first step in the selection process is to summarize the current monitoring procedures. This summary should include information on the affected emissions unit, the control device used on that unit, the monitoring methods that are currently used (e.g., manual monitoring, emission calculation procedures, operating parameter monitoring, PEMS, CEMS), the indicators that are tracked, the reasons for selecting the indicators currently monitored, the frequency of measurements, and any reporting and recordkeeping procedures.

If no monitoring procedures are currently in place, the owner or operator of the facility may follow the process of identifying potential monitoring approaches and selecting the most appropriate as outlined in Steps 4 and 5 of the selection process.

Step 2: Evaluate the current monitoring procedures

For those facilities with monitoring procedures in place, the next step is to determine if the design and performance of the current monitoring procedures satisfy the criteria established by Part 64. Monitoring design criteria required by Part 64 are discussed in detail in Section 2.2.2 and summarized in Table 2-1 of that section. If the current monitoring procedures meet these minimum Part 64 criteria, those procedures may be proposed as the monitoring approach. However, in some cases even though the current procedures satisfy Part 64, the facility owner or operator may have other reasons for proposing a new monitoring approach. For example, a facility owner or operator who currently monitors combustion temperature to ensure proper operation of a thermal incinerator and has addressed all the Part 64 criteria listed in Table 2-1 satisfies Part 64. This facility owner or operator may choose to propose the current monitoring procedures (e.g., use of strip chart recorder) or may choose to select a different approach (e.g., electronic data recording with hourly averaging) for other reasons.

On the other hand, if the current monitoring procedures fail to address all of the Part 64 criteria (e.g., if QA/QC procedures are not addressed, or if the monitoring frequency and averaging time are not sufficient to detect a change in control device performance), those procedures do not satisfy Part 64. The owner or operator would then be required to determine if modifications can be made to meet Part 64 criteria (Step 3) or if an alternative monitoring approach is preferable (step 4).

The rule specifies that if a facility is currently using a CEMS, COMS, or PEMS to comply with an applicable requirement, this system must also be used to satisfy Part 64. Special criteria for the use of CEMS, COMS, and PEMS to satisfy Part 64 are discussed in Section 2.2.2.

Step 3. Determine if current monitoring procedures can be modified to meet Part 64 criteria

If the current monitoring procedures do not meet Part 64 minimum criteria, but the procedures can be modified to do so, the owner or operator has two options. The owner or operator can either modify the current monitoring approach to meet the minimum Part 64 criteria or implement an alternative approach that satisfies all Part 64 requirements (as outlined in step 4).

If a facility chooses to modify the current approach, the owner or operator determines the modifications that will be made to satisfy Part 64 and incorporates these modifications along with the current monitoring practices into the revised monitoring approach. For example, a calciner using a wet scrubber to comply with a PM limit has current monitoring procedures that consist of monitoring pressure drop and liquid flow rate. To satisfy Part 64, this facility would need to expand the current monitoring practices to address performance criteria such as data representativeness and QA/QC procedures associated with the monitoring approach.

If the current monitoring system cannot be modified to meet Part 64 criteria, the owner or operator must consider alternative approaches, as outlined in step 4. For example, a facility with a thermal incinerator may currently monitor whether the burner is operating (flame "on" indicator). This indicator is not considered to be an adequate indicator of control device performance and cannot be modified to meet Part 64. The facility owner or operator would need to monitor other parameters that are better indicators of control device performance, such as combustion chamber temperature with an appropriate monitoring frequency and averaging time. Similarly, a medical waste incinerator using a baghouse to control particulate emissions may currently monitor charge weight, hourly charge rate, and secondary combustion chamber temperature. To meet Part 64 requirements, the facility would need to monitor additional parameters that are indicators of control device performance, such as baghouse pressure drop and visible emissions.

Step 4. Identify potential indicators and/or combinations of indicators to meet Part 64 criteria

If a facility is not currently monitoring emissions or control device performance or if the current monitoring approach does not meet the Part 64 criteria and cannot be modified to meet the criteria, the owner or operator of the facility must select an alternative monitoring approach to comply with Part 64. Appendix B presents illustrations of some of the alternative monitoring approaches applicable to different combinations of control devices, pollutants, and sources. Appendix B does not provide an all inclusive list of monitoring techniques and is intended only as a guide to assist owners/operators with identifying alternative monitoring approaches. Other sources of information include monitoring requirements for same or similar sources specified in Federal, State, and/or local regulations, State guidance, in-house expertise, and manufacturers' recommendations. In addition, Chapter 5 provides an annotated bibliography of monitoring reference materials.

Using these or other appropriate sources of information as guidance, the owner/operator of the facility identifies potential monitoring approaches. The approaches may include monitoring measured or predicted emissions (such as THC, opacity, or visible emissions); process and/or control device operating parameters that affect control device performance (such as production rate or thermal incinerator operating temperature); recorded findings of inspection and maintenance activities related to maintaining the performance of the control device; or a combination of these types of indicators.

Step 5: Select most reasonable approach that meets Part 64 criteria

Of the approaches identified, the owner/operator can select the most reasonable for the situation. Factors to be considered in making this determination are described below. Considering these factors and others that may be appropriate to each specific emissions unit, the owner or operator selects and proposes a monitoring approach.

As illustrated in the Monitoring Approach Selection Process Worksheet (Figure 2-2), to facilitate the selection process the facility could use a pro/con approach. The factors that are considered in making a determination can be classified as either a pro or con and assigned a rating. Factors that are considered a pro can be assigned a rating of 1 (a weak pro) to 3 (a strong pro). Similarly, factors that are considered a con can be assigned a rating of -1 (a weak con) to -3 (a strong con). The sum of the ratings for each option is a rough measure of reasonableness of the approach; the higher the value, the more reasonable the option. For all the options considered, this sum can be compared to help select the most reasonable option.

Frequency of monitoring. Monitoring frequency (including data collection and data averaging periods) should be designed to obtain data at intervals that are consistent with the time period over which a change in control device performance is likely to be observed. Data measurement frequency should be sufficient to allow calculation over averaging periods that are short enough to observe significant changes in control device performance, and to allow early detection of problems so that timely corrective action is possible. At the same time, averaging periods should not be so short that minor perturbations as a result of normal variations in a parameter are flagged as exceedances. Also, for manual measurements, the facility should consider the frequency of other measurements taken at the plant and try to minimize the number of times the operator must take readings, while still meeting the minimum frequency requirements.

Level of confidence. Level of confidence is a subjective measure of how appropriate the selected monitoring approach is with respect to ensuring that the control device is operating properly, and, as a result, there is a reasonable assurance that the emissions unit is in compliance with the applicable emission limit. For example, there are numerous options available for monitoring indicators of performance for a facility that uses a thermal incinerator for volatile organic compound (VOC) control. The indicators that could be monitored include visible emissions, burner flame on indicator, combustion chamber temperature, carbon monoxide (CO) emissions measured with a CEMS, and VOC emissions measured with a CEMS. As shown in Table 2-2, a level of confidence, although subjective, can be associated with each monitoring approach. If the level of confidence in an approach is low, the owner or operator may consider monitoring other parameters that may be better indicators of control device performance, increasing the frequency of measurements (if applicable), or selecting more than one indicator to be monitored.

Equipment needs. In selecting a monitoring approach, equipment needs also should be considered. In addition to investigating the costs of such equipment, the logistics of locating, installing, and maintaining the equipment, the familiarity of plant personnel with the use of the equipment, and the use of the equipment on other processes at the facility should also be considered. For example, a facility that uses a wet scrubber on a hot exhaust stream may propose to monitor water flow to the scrubber as an indicator of control device performance. Because a water flow meter provides a direct measure of the parameter, it is preferred. However, in some cases, measuring outlet temperature as an indicator of water flow to the scrubber may be adequate and may be easier to maintain. If the facility owner or operator is currently measuring temperatures for other processes at the plant, using a thermocouple to monitor temperature is more straight-forward than introducing a new piece of equipment that plant personnel may not be familiar with. Also, water flow meters are more susceptible to malfunctions and require more frequent inspections to ensure they are operating properly. However, if the facility owner or operator is currently using water flow meters, there is likely a program in place for regular inspection and maintenance of the equipment and the addition of one more flow meter would not be inconsistent with plant operations.

Costs. The purpose of the selection process is to arrive at a cost-effective monitoring option that meets Part 64 criteria. In evaluating the costs associated with the proposed monitoring approach, it is recommended that, in addition to determining the capital and operating costs associated with monitoring, the cost benefit of operating and maintaining the control equipment in good working condition be considered as well. The monitoring costs can then be compared to possible benefits associated with employing better monitoring practices or using diagnostic systems to monitor the operating condition of the control equipment.

TABLE 2-2. LEVEL OF CONFIDENCE

Control device: Thermal incinerator for VOC control

Indicator	Level of confidence
Daily VE for "haze"	Low
Auxiliary burner flame on	Low
Comb. chamber T, daily	Low
Comb. chamber T, once/shift	Low to moderate
Comb. chamber T, hourly	Moderate to high
Comb. chamber T, continuous (averaged hourly)	High
Comb. chamber T, continuous (averaged hourly); and CO CEMS	Very high
Comb. chamber T, continuous (averaged hourly); and VOC CEMS	Very high

1. Production benefits--Improved monitoring may be cost-effective. In many cases, improved monitoring provides better process knowledge, which results in increased product yield. For example, carbon adsorbers can be used to control solvent emissions and recover solvent for reuse in a specific process. Using analyzers to measure inlet and outlet solvent concentrations as a monitoring approach would benefit the solvent recovery process. To maintain high recovery, solvent recovery efficiency can be calculated continuously and corrective action can be taken when the efficiency falls below a certain level. The savings gained by improved solvent recovery may offset the cost of monitoring.

2. Operation and maintenance (O&M) benefits--Operating and maintaining the control device in top condition may result in long-term cost savings. This can be achieved through the implementation of regular inspections of equipment to ensure that it is operated and maintained properly. Diagnostic systems (e.g., bag leak detectors) provide the ability to monitor equipment condition in real time and to spot trends that predict problems or failures. This capability may reduce O&M costs and production losses by making timely maintenance possible and by avoiding costly production losses, unnecessary maintenance, and equipment failures.

2.3.2 Selection of Indicator Range

The Part 64 monitoring approach is designed to provide the owner or operator of an affected emissions unit with information about the performance of control measures. Indicator ranges are critical to the validity of this approach. The owner or operator establishes appropriate ranges for selected control device performance indicators such that operating within the established ranges will provide a reasonable assurance of compliance with applicable requirements. Monitoring the indicators allows the owner or operator to identify problems with the operation and/or maintenance of the control device. An excursion or exceedance of an indicator range signals a potential problem with the operation or maintenance of the control equipment and alerts the owner or operator of the need to determine whether corrective action is necessary to restore operations to normal conditions.

Parameter data collected during performance testing are key in establishing indicator ranges that represent good operating conditions. However, other relevant information, such as engineering assessments, manufacturers' design criteria, and historical monitoring data, also may be used. For example, engineering specifications for a venturi scrubber installed to control particulate matter from an affected emissions unit may include design operational ranges for liquid flow rate and pressure drop across the venturi. For this example, it is assumed that the scrubber design conditions are intended to achieve the desired emission reductions for uncontrolled emission rates that correspond to 120 percent of the affected unit's process design rate. The results of a performance test during which the scrubber is operated within these design conditions and the process is operated at conditions representative of high load (near 100 percent design rate) would be used to confirm that operating within the scrubber design conditions achieves the emission reduction desired and provides a reasonable assurance of compliance across the anticipated range of process conditions for ongoing operation.

In many cases, historical monitoring data, in addition to parameter data collected during compliances tests, are useful or even necessary for establishing indicator ranges. Typically, compliance tests are of short duration; three 1-hr test runs, for example. Use of only 3 hours of parameter data may not be sufficient to fully characterize parameter values during normal operation. Specifically, these data may be insufficient to identify normal short-term fluctuations in the indicator parameters. Furthermore, if the owner/operator desires to use statistics in establishing the indicator range, a larger body of data would be necessary. Historical monitoring data should be collected during periods of normal operation when the emissions unit and associated control device are properly operated and maintained. These data are referred to as the baseline data. The baseline data for establishing an indicator range should be collected over a sufficient period of normal operation such that normal perturbations and ranges can be identified. Providing a summary of 1 to 3 months of parameter data in addition to the parameter data obtained simultaneously with the compliance test methods is recommended, whether these data are used to establish the indicator range or not. If these data are not used to establish the indicator range, they will serve to verify that the range can be maintained over an extended time period.

The baseline data, results from performance tests, and other information are evaluated to establish appropriate indicator ranges. Several factors impact the choice of data evaluation procedures and analytical methods used to select appropriate indicator ranges. These factors include: (1) type of data collected (data that are conducive to numeric manipulation such as averaging vs. data that are not; e.g., continuous temperature or pressure drop measurements vs. equipment inspections); (2) frequency of measurements (continuously measured data vs. intermittently measured data; e.g., temperature measured at 1-minute intervals vs. temperature measured daily); (3) quantity of data that are available for analysis (e.g., temperature measurements recorded at 1-minute intervals during the compliance test [three, 3-hour runs] vs. 3 months of historical temperature measurements recorded at 1-minute intervals); and (4) variability among the data (e.g., small variability vs. significant variability). Considering these factors, and others that may be appropriate, the facility owner or operator determines an appropriate data evaluation procedure and establishes an indicator range.

The selected range must meet the following criteria: (1) the range should be selected such that parameter data from the most recent performance test, if available, fall within the range; (2) the range should be indicative of the normal operating range under good operation and maintenance practices; (3) the range should be sensitive enough such that changes in control device performance can be identified, yet not so sensitive that minor variations which are a part of normal operation are continually signaled as potential problems; and (4) the range and averaging period/data reduction technique should account for routine operating functions at the facility (e.g., flushing of WESP once per hour causes kV to drop below the normal operating range for up to 6 minutes per flush).

In addition to establishing indicator range(s), affected facilities may choose to propose threshold levels that trigger the requirement for a QIP. Part 64 provides that a QIP may be required if it is determined that the source owner or operator has failed to meet the obligation of properly operating and maintaining the source. For the purpose of determining when a QIP is needed, Part 64 provides that a threshold level may be set in the facility's permit, but does not require it. Where such a trigger is established, a level of 5 percent of the operating time is suggested as a potentially appropriate threshold.

Although establishing a threshold level is not required by Part 64, in many cases it may benefit the facility to propose a threshold level rather than to leave it to the permitting authority to make a determination of whether the facility is meeting the obligation to properly operate and/or maintain the source. The facility could evaluate historical data to determine how often the selected indicator range was exceeded during periods of normal operation. These data could be used to establish an appropriate threshold level that triggers the need for a QIP. For example, if historical monitoring data for a facility indicate that the indicator range was exceeded ten times in a 6-month period, the threshold could be established at no more than 10 excursions outside the indicator range during a 6-month reporting period. This threshold level is based on the number of excursions identified in a reporting period. As suggested by Part 64, threshold levels also could be established based on the duration of excursions as a percentage of operating time.

The selection of indicator ranges and threshold levels are inherently related. Source owners may select a broad indicator range thereby avoiding excursions. The selection of a broad range would result in a lower number of excursions encountered during the monitoring period over which data were collected. As a result, the threshold level selected based on the historical monitoring data would allow few excursions during a reporting period. On the other hand, if a tighter indicator range is selected, the number of excursions encountered during the monitoring period would be higher and a more lenient threshold level could be established (the threshold level would allow more excursions from the indicator range). An indicator range should be selected that is representative of normal operating conditions and that would allow the owner or operator to identify potential problems with control device and/or process operation in a timely manner. Consequently, it may benefit a facility to establish a tighter range that is more representative of normal operation such that changes in control device performance can be observed. At the same time, the facility could establish a threshold level that allows for excursions that are considered part of normal operation.

This section is divided into three subsections. Section 2.3.2.1 presents several factors that affect the choice of data evaluation procedures for selecting the indicator range; Section 2.3.2.2 presents various general data analysis approaches that could be used in determining an indicator range; and Section 2.3.2.3 presents a flow chart of a general decision process that might be useful to a facility when selecting indicator ranges. This section also presents two examples of the selection of indicator ranges. For each example, the procedures for evaluating the data, determining an appropriate data analysis approach, and selecting the specific indicator range are outlined.

2.3.2.1 Data Evaluation Factors to be Considered in Selecting an Indicator Range

2.3.2.1.1 Type of data. Most measurements are conducive to averaging and other data manipulations. As a result, the indicator range may be calculated as a numeric limit. Some methods for determining this numeric limit are discussed in Section 2.3.2.3; they include plotting the data and making a qualitative determination of an acceptable range, calculating an “x”th percentile, and using other simple statistical methods to determine an acceptable range.

Approaches to establishing an indicator range include: (1) a range never to be exceeded, (2) a range not to be exceeded over a certain averaging period, (3) a range not to be exceeded for periods greater than “x” amount of time, or (4) a range not to be exceeded for periods greater than “x” percent of the operating time.

Some measurements are not conducive to data manipulations that result in a numeric value. For example, the results of equipment inspections are either acceptable or are unacceptable. Similarly, in some cases a “visible” or “no visible” measurement of emissions is used. For these types of data, a “pass/fail” approach is most appropriate for determining when an exceedance has occurred. If the facility is not operating within the selected indicator range (e.g., if visible emissions are found during the routine VE test or if bag leaks are detected during the routine equipment inspection), the facility would be required to take corrective action to restore the emissions unit and control device to normal operating conditions.

2.3.2.1.2 Frequency of measurements. As discussed in Section 3.3.1, the frequency of indicator measurements (including data collection and averaging periods) should be adequate to identify changes in the performance of control equipment in a timely manner. The averaging period used in evaluating the data will directly impact the selection of an indicator range. In selecting an averaging period, the owner or operator should consider variability among the data that are a part of normal process and/or control device operation. An averaging period should be selected that is long enough to allow this normal variability among the data without identifying them as exceedances. At the same time, if the selected averaging period is too long, deviations from normal operation may not be identified in a timely manner to allow the owner or operator to take corrective action. The frequency of measurements should be sufficient to allow calculation over the selected averaging period and to account for variability among the data. For example, if a 3-hour average is selected, measurements can be taken at 1-hour, 15-minute, or 1-minute intervals and averaged over a 3-hour period. If the data are fairly consistent, three 1-hour measurements may be sufficient. However, if there is significant variability among the data, 1-minute or 15-minute measurement intervals may be more appropriate.

2.3.2.1.3 Amount of data. The amount of data available for manipulation has a significant impact on the methods used to analyze the data. Statistical analyses have little or no meaning when the data set is limited to a few data points. If the available data are not sufficient for statistical methods, the data could be plotted and a qualitative determination of an acceptable range can be made based on these plots. However, if the facility owner or operator has a reasonable amount of data, statistical analyses can be conducted to determine an appropriate indicator range. Some methods for analyzing data are presented in Section 2.4.2.2.

2.3.2.1.4 Variability among data. Variability among the data can range from little or no variability (very consistent data) to significant variability. The effect of variability among the data on selecting an appropriate averaging period and measurement frequency are discussed above in Section 2.3.2.1.2. The amount of variability among the data should also be considered in selecting an appropriate indicator action level or range. For data that are fairly consistent with little or no variability, selecting a narrow indicator range or an indicator level that is fairly close to the data may be appropriate. On the other hand, if there is significant variability among the data, a broader indicator range or an indicator level with a substantial "buffer" may be selected. For example, consider a vent condenser where outlet coolant temperature is monitored once every 2 hours. Over a 1 month period, the range of values observed is between 5° and 8°C, with all but two of the data points between 6° and 8°C. One option for selecting the indicator range would be to establish a value at the maximum value plus a "buffer" such that significant changes in operation are evident. The maximum value observed is 8°C. Because there is very little variability among the data, only a small "buffer" is necessary. The facility could set the maximum level at 9. If, for this same example, the range of values observed was larger and the data points were more evenly scattered within this range, a larger "buffer" could be used to account for the increased variability.

2.3.2.2 Approaches for Determining Indicator Range

Numerous approaches are available for analyzing the data and selecting an indicator range. Some of the more common approaches are identified in this section. These approaches are intended only as examples and are not all inclusive. Other approaches also are acceptable.

1. Plotting the data and making a qualitative determination of an acceptable range:
   a. mean value observed
   b. mean value ± a "buffer" (e.g., "x"% of the mean, a set value (±50°F))
   c. max/min value observed
   d. max/min value ± a "buffer" (e.g., "x"% of the max/min, a set value (±50°F))
2. Calculating the "x"th percentile:

A range is selected based upon a given percent of the observed data; e.g., the range encompassing the 10th to 90th percentiles of the observed data.

3. Conducting other simple statistical methods for cases where sufficient data are available for analysis:
   a. mean value ± standard deviation (or multiple standard deviations)
   b. confidence intervals (mean value $\pm t_{1-\alpha} \frac{s}{\sqrt{n}}$)

where:

$t_{1-\alpha}$ is the t-statistic and α is the decimal representation of the confidence level (e.g., for a 90 percent confidence level, $t_{0.1}$).

4. Specifying the process for determining the indicator range, instead of specifying an actual numerical range (e.g., basing the range on the most recent source test, as below):

a. mean value observed during the most recent performance test demonstrating compliance with the applicable emission limit
b. mean value observed during the most recent performance test demonstrating compliance with the applicable emission limit ± a “buffer” (e.g. for a thermal incinerator, “corrective action is triggered by a temperature more than 50°F below the average temperature during the most recent performance test demonstrating compliance with the emission limitation for VOC”)
c. max/min value observed during the most recent performance test demonstrating compliance with the applicable emission limit
d. max/min value observed during the most recent performance test demonstrating compliance with the applicable emission limit ± a “buffer”

2.3.2.3 <u>Selection Process Flow Chart and Examples</u>

Figure 2-5 presents a flow chart of a typical decision process for selecting an indicator range. The first step is to determine whether the measurements are conducive to data manipulations. If not, a pass/fail approach, as discussed in Section 2.3.2.1.1, may be used. If the data can be manipulated numerically, the facility owner or operator should consider whether existing regulations establish data reduction techniques that could be used to evaluate the data. The facility owner or operator would also determine if the existing regulation establishes indicator ranges, if these ranges comply with Part 64 criteria, and if these ranges meet the facility’s needs for establishing performance. In many cases, a regulation may establish or suggest data reduction techniques yet not include a range for the selected indicator. A facility owner or operator in this situation could use the suggested data reduction techniques to evaluate the data and determine a range. If the regulation includes an established indicator range, the facility owner or operator should determine if the required range meets Part 64 criteria. If so, this range may be proposed. In cases where the regulation does not establish either data reduction procedures or a range or in cases where the range established by the regulation does not meet Part 64 criteria, the facility owner or operator should consider the data analysis options discussed in Section 2.3.2.2 or other approaches believed to be appropriate, and select a range.

The following paragraphs present examples of approaches used to evaluate data and select appropriate indicator ranges. The examples address some of the factors that impact the selection of data reduction and data analysis procedures: data type, measurement frequency, amount of available data, and variability among the data. For each example, the procedures for evaluating the data, determining an appropriate data analysis approach, and selecting the specific indicator range are outlined. The examples are intended only to address the selection of an appropriate indicator range for individual operating parameters that are indicators of control device performance. These examples are not complete in terms of satisfying Part 64 requirements and are not intended to imply that single parameter monitoring meets Part 64 requirements. In many cases, monitoring a single parameter may not be sufficient to ensure proper operation of the control device.

Example 1: Baghouse pressure drop (limited data)

This example presents an approach used to evaluate available data and select an appropriate indicator range for a single parameter. The parameter data to be evaluated in this example are pressure drop measurements across the pulse-jet baghouse, an indicator of proper performance of the bag-cleaning cycle. For a more complete monitoring approach, other indicators of baghouse performance that could be monitored include periodic visible emissions observations and periodic inspections.

The bag cleaning cycle is designed to keep the differential pressure across the fabric filter between 3 and 4 inches of water column (in. w.c.). When the differential pressure reaches 4 in. w.c., one row is pulsed. If, after 15 seconds, the differential pressure is still above 3 in. w.c., a second row is pulsed. During the most recent performance test, the pressure drop was recorded at 15-minute intervals. Over 6 days, a total of 78 pressure drop readings were taken. Table 2-3 summarizes the daily minimum, maximum, and average readings. Figure 2-6 graphically presents the daily readings. Although the individual data can be averaged, either on an hourly or daily basis, because the pressure drop is expected to vary over a range during the normal operation of the baghouse and cleaning cycle, it makes more sense to track the pressure drop and assure it remains within the normal operating range rather than calculate an average value. Several options could be used for selecting the actual range including:

1. The minimum and maximum values observed;
2. The “x”th percentile of the observed values; or
3. The minimum and maximum values observed plus a set value.

The observed data set is limited; it includes only 6 days of operation. Consequently, the third option was selected--the observed range of values plus a set value as a “buffer.” The observed range comprised of the minimum and maximum values observed is 2.3 to 4.2 in. w.c. A set value of 0.5 in. w.c. was added to this range to yield a range of 1.8 to 4.7 in. w.c., and this range was rounded to the nearest 0.5 in. to yield the recommended indicator range of 2.0 to 4.5 in. w.c.

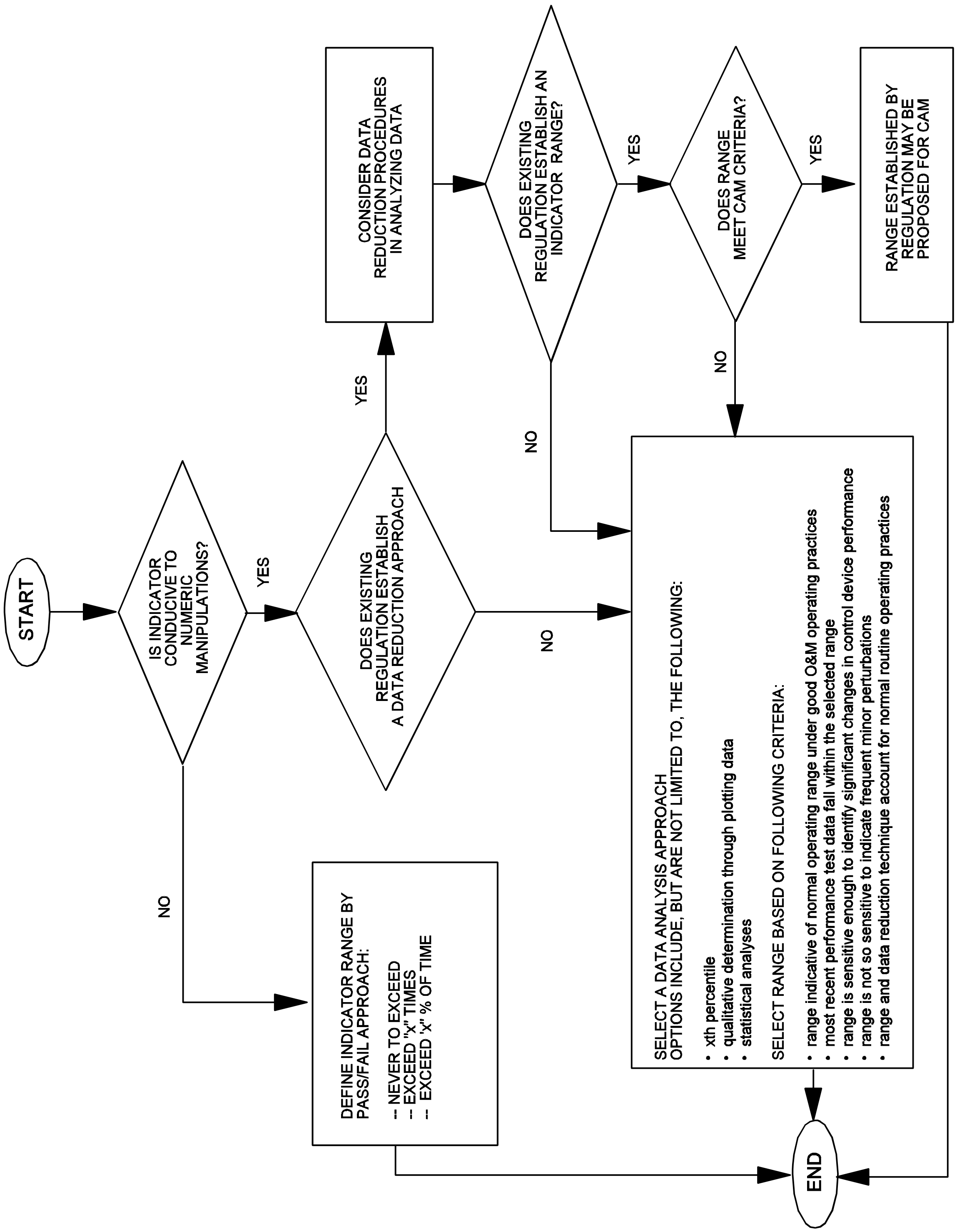

Figure 2-5. Indicator range selection process flow chart.

TABLE 2-3. BAGHOUSE PRESSURE DROP READINGS

Date	Test No.	Time	No. of readings	Daily minimum value, in. w.c.	Daily maximum value, in. w.c.	Daily average value, in w.c.
11/18	1	0918-1840	14	2.6	3.9	3.4
11/19	2	1550-2158	13	2.8	4.1	3.5
11/20	3	1230-2250	14	2.6	4.1	3.5
11/21	4	1230-1750	12	2.3	4.1	3.3
11/22	5	1045-1845	15	3.0	4.2	3.5
11/23	6	0930-1350	10	3.0	3.9	3.4
	Average			2.7	4.1	3.4

Number of values:	78
Range of all values:	2.3 -4.2
5th percentile:	2.7
10th percentile:	2.8
90th percentile:	3.9
95th percentile	4.1

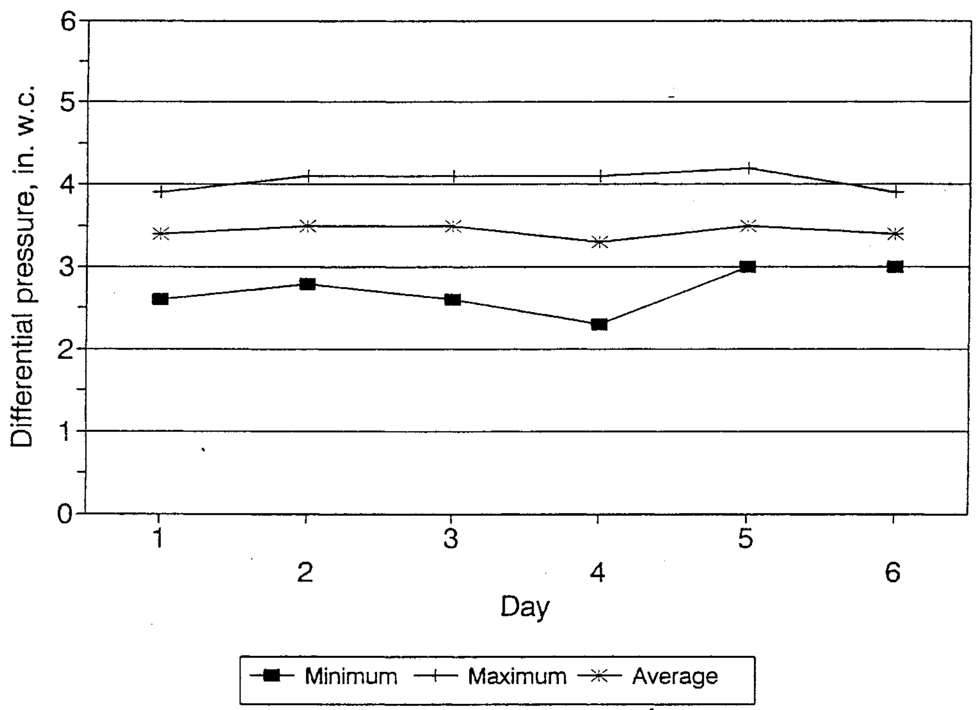

Figure 2-6. Baghouse differential pressure by day.

Simply using the minimum and maximum values observed was not done because of the very limited size of the data set. A larger data set for establishing indicator ranges is desirable. The use of the range comprised of the 5th to 95th percentile (2.7 to 4.1 in. w.c.) was examined, but this approach does not make sense. Ten percent of the observed data during the performance test when the baghouse was properly operating would fall outside the established range.

Example 2: Vent Condenser coolant temperature (extended operating data)

This example presents an approach used to evaluate available data and select appropriate indicator ranges for two parameters. The parameter data to be evaluated in this example are inlet and outlet coolant temperature measurements, which are indicators of condenser performance. Other indicators of condenser performance that could be monitored include outlet VOC concentration and outlet gas temperature.

The vent condenser uses brine solution as the cooling medium. Temperature limits specified in the operating permit allow a maximum inlet coolant temperature of 46°F (8°C) and a maximum outlet coolant temperature of 49°F (9°C). These maximum inlet and outlet coolant temperatures were estimated based on the outlet vent gas stream temperature that must be achieved to condense the pollutants. The outlet gas stream temperature was calculated using vapor pressure versus temperature data. Four months of historical monitoring data for the vent condenser are available. These data include monitoring of the inlet and outlet coolant temperature once every 2 hours. The facility permit requires monitoring once per day. A cursory review of the 4 months of data indicate that the temperature is very constant. Consequently, only 1 month's data were plotted and reviewed in detail. Figures 2-7 and 2-8 graphically present time series plots of the 2-hour readings for the brine supply and brine return temperatures, respectively.

Several options could be used for selecting the indicator range, including:

1. The maximum values observed for the temperatures;
2. The “x”th percentile of the observed values;
3. The values observed plus a set amount; or
4. A calculated design limit.

The indicator ranges were selected based on calculated design limits evaluated in conjunction with maximum values observed during the month. For the brine return temperature, the maximum observed value was 8ºC; the calculated value to achieve compliance is 9ºC. Consequently, the indicator range selected is ≤9ºC. For the brine inlet temperature, the calculated value to achieve compliance is 8ºC. The range of values observed was between 5° and 9.5ºC, with the majority of the values between 6° and 8ºC. During the month, only 3 values of the 326 recorded values exceeded 8ºC. Consequently, the indicator range selected is ≤8ºC, which is consistent with the calculated value to achieve compliance. A qualitative review of the data for the remaining 3 months that were not plotted indicates similar results would be obtained.

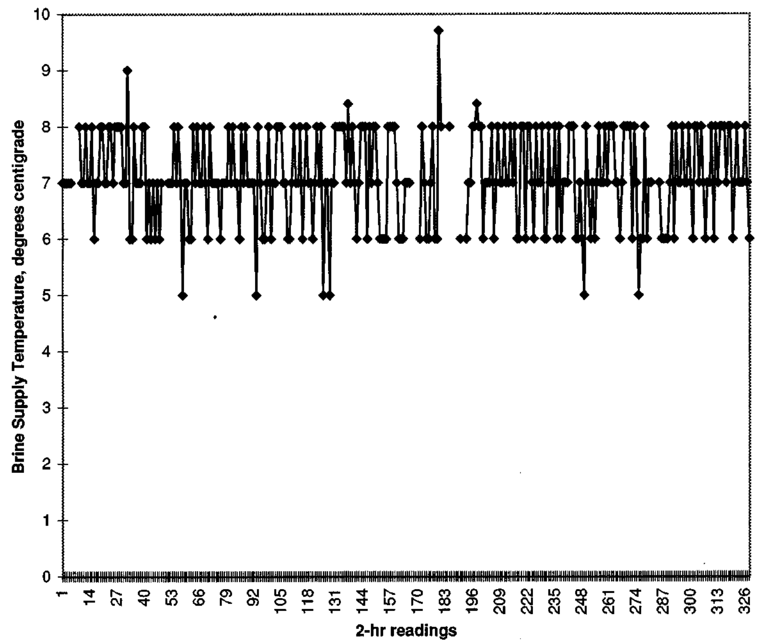

Figure 2-7. Recorded brine supply temperature for May.

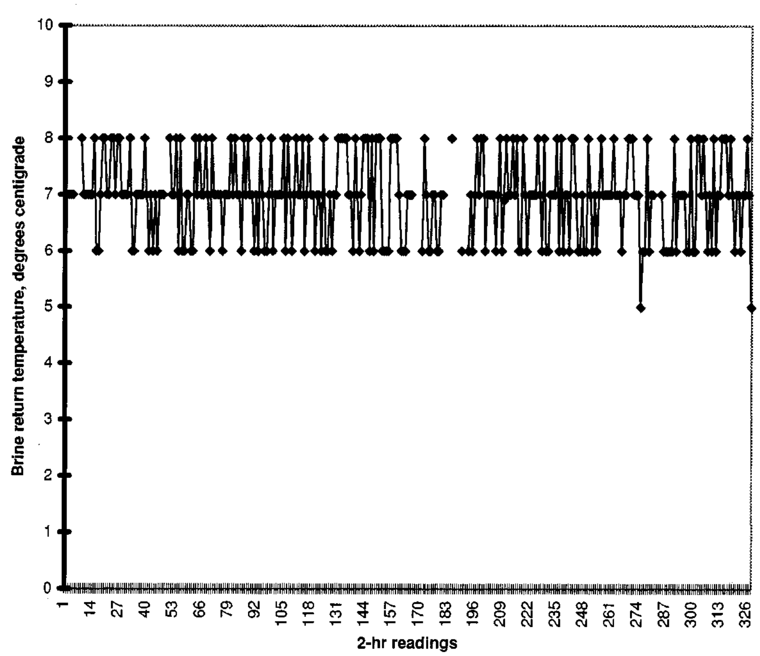

Figure 2-8. Recorded brine return temperature values for May.

2.4 QUALITY IMPROVEMENT PLANS (QIP's)

A QIP is a written plan that outlines the procedures that will be used to evaluate problems that affect the performance of control equipment. The permitting authority or the Administrator may require a source to develop and implement a QIP after a determination that the source has failed to use acceptable procedures in responding to an excursion or exceedance. Also, the rule provides, but does not require, that the Part 70 or 71 permit may specify an appropriate threshold level for requiring the implementation of a QIP. Where a threshold level is used, the rule recommends the level at which the total duration of excursions or exceedances at the affected emissions unit is greater than 5 percent of the unit's total operating time. The threshold level may be set at a higher or lower percent or may rely entirely on other criteria that indicate whether the emissions unit and control device are being operated and maintained properly. Once required, the written QIP must be maintained by the owner or operator, and must be available for inspection upon request.

The QIP is developed in two basic components. First, an initial QIP would include evaluation procedures to determine the cause of control device performance problems. Based on these findings, the QIP is then modified to include procedures to improve the quality of control performance. This second component would include the procedures that will be implemented to reduce the probability of a recurrence of the problem, and the schedule for making such improvements. Depending on the nature of the problem, the modified QIP could include procedures for conducting one or more of the following, as appropriate:

1. Improved preventative maintenance practices;
2. Process operation changes;
3. Appropriate improvements to control methods; and/or
4. Other steps appropriate to correct problems affecting control performance.

In conjunction with these procedures, the QIP also may include more frequent or improved monitoring procedures.

An example QIP has been developed as guidance. The example is for a baghouse used on a dry malt milling operation at a brewery. The example QIP includes a section titled "Background Information," which is not required by the rule but is included to provide additional information about the emissions unit, the control device, the monitoring procedures, and the excursions or exceedances that have triggered the need for a QIP. Sections II and III of the example QIP represent the two components of QIP's described above and required by the rule.

Example Quality Improvement Plan

I. Background Information

The affected emissions unit is the material handling system for the malt mills and ground malt storage hoppers at XYZ Brewery. The process stream exhaust is controlled by a pulse-jet baghouse operated under negative pressure. The baghouse is a single compartment unit containing 11 rows with 11 bags per row (121 bags total). The bag cleaning system is designed to keep the differential pressure across the fabric filter between 3 and 4 in. w. c. The facility currently monitors differential pressure on a daily basis and conducts daily visible emissions (VE) tests to satisfy CAM requirements.

The facility's Title V permit for this emissions unit specifies a threshold level for requiring the implementation of a QIP. This threshold is defined as the level at which the total duration of excursions (from the indicator ranges specified in the permit) is greater than 5 percent of the emission unit's total operating time during that reporting period. During this reporting period, the emissions unit/control device exceeded the 5 percent duration allowed for excursions from the indicator ranges. For 5 of the 90 operating days during the reporting period the baghouse pressure drop was above the high end of the 2.0 to 4.5 in. w.c. indicator range that was established by the facility for monitoring pursuant to the CAM rule.

II. Initial Investigation Procedures

The initial investigation will be conducted within ___ days of the last excursion that triggered the need for a QIP. The initial investigation will include:

1. Inspection of the baghouse discharge hopper/rotary valve system for blockage;
2. Inspection of the fan operation;
3. External inspection of the baghouse for signs of corrosion/air leakage;
4. Verification of pulse-jet cleaning system operation;
5. Hourly differential pressure readings until readings are within the established indicator range; and
6. Hourly VE inspections until the VE readings are withing the established indicator range.

Based on the results of this initial investigation, the QIP will be modified to include procedures for enhancing the current monitoring approach to avoid similar problems in the future. These procedures will be described in Section III.

III. Modifications to Enhance Current CAM Practices

Based on the results of the initial investigation it was found that ineffective cleaning of the filter bags resulted in excessively high pressure drop. The following preventative maintenance practices will be implemented to prevent similar problems with the cleaning system in the future:

1. Check all cleaning system components daily;
2. Monitor discharge hopper daily to ensure dust is removed as needed;
3. Check compressed-air lines weekly;
4. Check bag cleaning sequence weekly; and
5. Check high-wear parts on cleaning system annually and replace as necessary.

These practices will be implemented on _____ (insert date).

2.5 REFERENCES

1. Virginia State Advisory Board on Air Pollution, Sub-Committee Report on Compliance Assurance Monitoring (CAM), October 16, 1995.

3.0 CAM ILLUSTRATIONS

This chapter introduces illustrations of the types of monitoring that generally satisfy the requirements of the CAM rule. Sections 3.1 and 3.2 describe the purpose and format of the illustrations, Section 3.3 presents general information about the illustrations and their use. Section 3.4 discusses presumptively acceptable CAM. The illustrations of CAM are presented in Appendix B.

3.1 PURPOSE OF ILLUSTRATIONS

The purpose of the illustrations is to give examples of the types of monitoring (i.e., indicators or combinations of indicators) that may be used in conjunction with specific types of emission control methods to provide a reasonable assurance of compliance with emission limitations. Each illustration corresponds to a specific combination of pollutant, control method, and monitoring approach.

The combinations of pollutant and control device type have been designated as "categories" for organizational purposes. Table 3-1 provides a list of potential categories of CAM illustrations. The control devices listed are based on controls identified in the Aerometric Information Retrieval System (AIRS) data base; selected control devices and their AIRS identification codes are given in Table 3-2. For each illustration category or designation, the list includes examples of emissions units to which the illustration may apply. The table also indicates which illustrations have been drafted to date. This list of illustrations is not meant to be all-inclusive. Emission units with control technologies other than those listed in Table 3-1 may be subject to CAM, and monitoring approaches other than those addressed in these **nonprescriptive** illustrations may be acceptable for satisfying the requirements of Part 64. Facilities are encouraged to consider not only the monitoring approaches included in the CAM illustrations presented but other options that provide a reasonable assurance of compliance.

The CAM illustrations presented in Appendix B are not meant to be examples of monitoring approach submittals; CAM submittals are addressed in Chapter 2 and Appendix A of this document. A CAM submittal provides all the monitoring information that is required [§ 64.4] to be submitted to the permitting authority for a PSEU.

TABLE 3-1. POTENTIAL CAM ILLUSTRATIONS

Control	Pollutant	Emissions units	Category
Fabric filter	PM	Furnace, kiln, dryer, incinerator, material processing & handling, industrial process vents	1 (a,b,c,d,e) *
ESP	PM	Furnace, kiln, dryer, incinerator, material processing & handling	2 *
Wet ESP	PM	Insulation mfg.	3
Wet scrubber	PM	Furnace, kiln, dryer, incinerator, material processing & handling	4 (a)*
Wet scrubber	SO_2	Combustor	5*
Spray drying	SO_2	Combustors, furnaces, boilers	6 *
Wet scrubber	TRS	Smelt dissolving tank, furnace	7
Wet scrubber	Fluorides	Phosphate fertilizer manufacturing, primary aluminum processing	8
Absorber	VOC	Polymer mfg., distillation units, air oxidation units, misc. reactors	9
Afterburner	PM	Saturator, blowing still	10
Thermal incinerator	CO	FCCU catalyst regeneration, petroleum refining	11 (a,b) *
Oxidation control	SO_2	Sulfur recovery, sweetening units	12
Reduction and incineration	SO_2	Sulfur recovery, sweetening units	13
Combustion	TRS	Furnaces, combustors	14
Incinerator	TRS	Smelt dissolving tank, kraft pulp wall processes	15
Thermal incinerator	VOC	Coating, spraying, printing, polymer mfg., distillation units, wastewater treatment units, equipment leaks, air oxidation units, misc. SOCMI units	16(a,b,c)*
Catalytic combustor	PM	Wood heater	17
Catalytic oxidizer	VOC	Coating, spraying, printing, polymer mfg., distillation units, wastewater treatment units, equipment leaks, air oxidation units, misc. SOCMI units	18*
Flare	CO, VOC	EAF, coke oven batteries, misc. SOCMI units	19
Condenser	VOC	Coating, polymer mfg., distillation units, equipment leaks air oxidation units, misc. reactors, pharmaceuticals	21*
Gravel bed filter	PM	Kiln, cooler, dryer	22
Carbon adsorber	VOC	Coating, spraying, printing, polymer mfg., distillation units, wastewater treatment units, dry cleaning, degreasing, pharmaceuticals, leaks	23*
Cyclone	PM	Combustors, mineral processing, furnaces, kilns	24 (a,b)*
Gravity collector	PM	Combustors, mineral processing, furnaces, kilns	25 *
Flue gas desulfurization	SO_2	Boiler	26
Acid plant neutralization	SO_2	Furnace	27
Dual absorption system	SO_2	Sulfuric acid production	28
Dry sorbent injection	SO_2	Combustor	29
Water injection	NO_x	Turbines	30
Ext. column absorption	NO_x	Nitric acid production	31
Selective cat. reduction	NO_x	Nitric acid production	32(a,b)

*Indicates illustrations already drafted.

TABLE 3-2. SELECTED AIRS IDENTIFICATION CODES FOR CONTROL DEVICES

AIRS Code		Description of control method
001 002 003	Wet scrubber:	High efficiency Medium efficiency Low efficiency
004 005 006	Gravity collector:	High efficiency Medium efficiency Low efficiency
007 008 009	Centrifugal collector:	High efficiency Medium efficiency Low efficiency
010 011 012	Electrostatic Precipitator (ESP):	High efficiency Medium efficiency Low efficiency
013	Gas scrubber, general	
014 015	Mist eliminator:	High Velocity Low Velocity
016 017 018	Fabric filter:	High Temperature Medium Temperature Low Temperature
019 020	Catalytic:	Afterburner Heat Exchanger
021 022	Direct flame:	Afterburner Heat Exchanger
023	Flaring	
026	Flue gas recirculation	
028 032	Injection:	Steam or Water Ammonia
034 035 036 037 038	Scrubbing:	Wellman-Lord/Sodium Sulfate Magnesium Oxide Dual Alkali Citrate Process Ammonia
039	Catalytic oxidation-flue gas desulfurization	
040	Alkalized alumina vapor space tank	
041 042	Limestone injection:	Dry Wet
043 044	Sulfuric acid plant:	Contact Process Double Contact Process
045	Sulfur plant	
047	Vapor recovery system	
048	Activated carbon adsorption	
049	Liquid filtration system	

TABLE 3-2. (continued)

AIRS Code		Description of control method
050 051	Gas absorber column:	Packed Tray Type
052	Spray tower	
053 055	Scrubber:	Venturi Impingement plate
056 057	Dynamic separator:	Dry Wet
058 059 063 064	Filter - Mat or panel Metal fabric filter screen Filter:	 Gravel bed Annular ring
065	Catalytic reduction	
066	Molecular sieve	
067 068 069 070	Scrubbing:	Wet lime slurry Alkaline fly ash Sodium carbonate Sodium-alkali
071	Fluid bed dry scrubber	
072 073 074	Condenser:	Tube and shell Refrigerated Barometric
075 076 077	Cyclone: Single Multi without fly ash reinjection Multi with fly ash reinjection	
079	Dry electrostatic granular filter	
080	Chemical oxidation	
081	Chemical reduction	
082	Ozonation	
083	Chemical neutralization	
084	Activated clay adsorption	
085	Wet cyclonic separator	
086	Water curtain	
087	Nitrogen blanket	
098	Moving bed dry scrubber	
101	High Efficiency Particulate Air (HEPA) Filter	
107	Selective Noncatalytic Reduction (SNCR) for NO_x	

3.2 FORMAT OF ILLUSTRATIONS

Figure 3-1 presents the general format for CAM illustrations and provides a brief description of the elements that comprise an illustration.

1. APPLICABILITY

1.1 Control Technology
Type of control device (e.g., wet scrubber) or method to monitor (e.g., work practices). [The numbers listed in this section are the AIRS control device identification codes.]

1.2 Pollutants
Primary: The pollutant specified in the applicable requirement for the emissions unit (e.g., VOC).
Other: Other pollutants that may be controlled incidentally by the control device or method (e.g., organic HAP's)

1.3 Process/Emissions Unit
Some examples of types of emission units subject to the applicable requirement (e.g., boiler).

2. MONITORING APPROACH DESCRIPTION

2.1 Indicators Monitored
The indicators of control method performance that are to be monitored to satisfy CAM. In many cases, only one indicator (e.g., pressure drop) may be monitored to assure compliance with the applicable requirement. In other cases, two or more indicators may be monitored.

2.2 Rationale for Monitoring Approach
Short justification for the adequacy of the monitoring approach for assuring compliance with the applicable requirement (e.g., scrubber efficiency increases with pressure drop).

2.3 Monitoring Location
Suggested locations for monitoring the indicator of control technology performance (e.g., across venturi throat).

2.4 Analytical Devices Required
Examples of the instruments, devices, or other relevant equipment that could be used to perform the type of monitoring addressed in the illustration (e.g., differential pressure gauges). Information on various types of parameter measurement equipment are presented in Chapter 4, Monitoring Equipment Technical Reference.

2.5 Data Acquisition and Measurement System Operation
For each parameter that is to be monitored, the frequency of monitoring, applicable units of measurement, and options for recording the monitoring data.

2.6 Data Requirements
Types and amounts of data and other information needed to establish the indicator ranges.

2.7 Specific QA/QC Procedures
Calibration, maintenance and operation of instrumentation that would be required to assure proper QA/QC for the given monitoring.

2.8 References
Numbered references to the bibliography provided at the end of the CAM illustrations section, listing those that were used for the illustration and would be useful for generating a CAM plan.

3. Comments

Additional explanation or comments on the illustration.

Figure 3-1. CAM illustration format.

3.3 ILLUSTRATIONS

The CAM illustrations completed to date are presented in Appendix B. Additional illustrations will be added to the Appendix as they become available. The illustrations are organized by control method, according to the order presented in Table 3-1.

Section 3.3.1 presents general comments that pertain to the illustrations.

3.3.1 General Information

3.3.1.1 Multiple Monitoring Approaches

For some categories of control device/pollutant combinations, multiple CAM illustrations have been presented; that is, multiple monitoring approaches have been identified. The monitoring approach for a PSEU should be evaluated on a case-by-case basis. Depending upon the PSEU, any of the multiple approaches presented (or other approaches not presented) might be appropriate. In other cases, because of the specific design and operating conditions of the PSEU, not all of the approaches presented would be applicable to, or sufficient for, the specific unit. For example, for a thermal incinerator used for VOC control on a process where capture efficiency is not a factor, an illustration that presents monitoring of the temperature of the combustion chamber as the only parameter monitored might be appropriate. On the other hand, if the capture efficiency of the VOC fume is a factor in the control system performance, a monitoring approach that also incorporates an indicator for monitoring capture efficiency (such as flow) would be appropriate.

Also, approaches presented separately in different illustrations can be combined to establish a complete monitoring approach. For example, for the fabric filter/PM category, periodic (daily) visible emission monitoring is presented as a separate illustration of a monitoring approach. This monitoring can be combined with other illustrations presented for baghouses, such as the continuous monitoring of baghouse pressure drop, (or other approaches not presented) to provide the overall monitoring approach selected for a PSEU for inclusion in a CAM submittal.

3.3.1.2 Frequency of Data Recording

For large pollutant specific emission units (i.e., PSEU's with the potential to emit, calculated including the effect of control devices, the applicable regulated air pollutant in an amount equal to or greater than 100 percent of the amount, in tons per year, required for a source to be classified as a major source), CAM requires the owner or operator to collect four or more data values equally spaced over each hour and average the values, as applicable, over the applicable averaging period, for each parameter monitored [§ 64.3(b)(4)(ii)].

Some of the illustrations presented in Appendix B may indicate a reduced data collection frequency. These monitoring approaches may not be acceptable for large units unless approved by the permitting authority or used in conjunction with the monitoring of other parameters for which the data collection frequency is at least four times per hour. However, the permitting authority may approve a reduced data collection frequency, if appropriate, based on information presented by the owner or operator concerning the data collection mechanisms available for a particular parameter for a particular pollutant-specific emissions unit (e.g., integrated raw material or fuel analysis data, noninstrumental measurement of waste feed rate or visible emissions, use of a portable analyzer or alarm sensor).

3.4 PRESUMPTIVELY ACCEPTABLE CAM

Monitoring identified by the Administrator as presumptively acceptable monitoring satisfies the requirements of the CAM Rule's Monitoring Design Criteria [§ 64.3]. These requirements include both general criteria [§ 64.3(a)] and performance criteria [§ 64.3(b)].

The general criteria set guidelines for:

(a) Designing an appropriate monitoring system; and

(b) Setting the appropriate parameter range(s).

The performance criteria require:

(a) Data representativeness;

(b) A method to confirm the operational status of the monitoring equipment (for new or modified monitoring equipment only);

(c) Quality assurance and quality control procedures; and

(d) Specifications for the monitoring frequency and data collection procedure.

The owner or operator may propose presumptively acceptable monitoring without additional permit content or justification, except that for new or modified monitoring systems the owner/operator must submit information on the method to be used to confirm operational status of the monitoring equipment.

The monitoring requirements for all NSPS and NESHAP in 40 CFR 60 and 40 CFR 61 were reviewed with respect to meeting each of the Part 64 criteria listed above, with the exception of the criterion for verifying operational status for new systems. Because this requirement applies only to new systems, it is not appropriate to include this criterion in the evaluation of presumptively acceptable monitoring. Instead the expectation is that an owner/operator proposing monitoring that involves a new system does need to provide information on the approach to be used for confirming operational status of a new system even for presumptively acceptable monitoring.

Table 3-3 lists the rules that incorporate presumptively acceptable monitoring. The monitoring approaches presented in the table are presumptively acceptable for the same type of emissions units for which the monitoring in the cited rules apply, with the caveat that all the elements of the monitoring approach presented in the rule are incorporated into the monitoring proposed by the source owner to satisfy CAM (e.g., setting of parameter ranges, frequency of measurement and data collection, averaging times, and quality assurance/control procedures and frequency).

Many of the rules that were reviewed have monitoring requirements that satisfy some or most of the criteria. An important criterion that is absent in all of the Part 60 and 61 rules is the establishment of monitoring requirements for capture efficiency, for rules in which capture efficiency is a factor in determining compliance with the regulation. Because establishing parameters for monitoring capture efficiency, if applicable, is an important criterion of CAM (see § 64.3), these regulations were not considered to be presumptively acceptable. Typically, the criterion that was not met for many of the other rules was the criterion for quality assurance and quality control procedures. Rules that simply stated: "calibrate according to manufacturer's recommendations" were not considered to satisfy the Part 64 QA/QC procedures requirement. As a minimum, the frequency of QA/QC procedures or calibrations should be specified.

Rules that are missing only one or two CAM performance criteria (e.g., acceptable calibration drift or calibration frequency) but are acceptable with respect to all other criteria have been identified as "Conditionally Presumptively Acceptable Rules" and are listed in Table 3-4. This means that information to address the criterion not included in the rule must be included with the CAM submittal. For new or modified monitoring equipment, verification procedures to confirm the operational status of the monitoring also must be included in the CAM submittal.

Rules that require flares to meet 40 CFR 60.18 (general control device requirements) have been determined to be presumptively acceptable for CAM. These rules do not specifically meet all of the Part 64 criteria (specifically, neither the rules nor Part 60.18 establish QA/QC practices or a frequency of calibration). Nonetheless, because the required monitoring is limited to the continuous monitoring of the presence of a pilot flame (yes/no) and because Part 60.18 stipulates design criteria for flares, the lack of specific QA/QC practices is not considered a deficiency for this control device/monitoring combination. If the sensor fails, the lack of a pilot flame will be indicated and corrective action will be required.

The use of CEMS that provide results in units of the standard for the pollutant of interest and meet the criteria presented in § 64.3.(d)(2) is presumptively acceptable CAM; specific regulations utilizing CEMS have not been listed in the table as a matter of convenience. Note, however, that rules using continuous VOC monitors have been included because (a) in many cases, the emission limit is not expressed as a concentration limit (the CEMS does not provide data in units of the standard), so consideration must be given to whether CAM monitoring design criteria (e.g., establishing an indicator range and averaging time) are addressed; and (b) some rules require parameter monitoring <u>or</u> continuous VOC emissions monitoring.

TABLE 3-3. PRESUMPTIVELY ACCEPTABLE MONITORING[a]

Subpart	Source category	Emissions unit	Control device	Pollutant	Required monitoring
NSPS (40 CFR 60)					
VV	Equipment leaks of VOC in the SOCMI	Equipment leaks captured by closed vent system	Flare	VOC	Continuous presence of pilot flame
DDD	VOC emissions from polymer industry	Process vents	Flare	VOC	Continuous presence of pilot flame
GGG	Equipment leaks of VOC in petroleum refineries	Equipment leaks captured by closed vent system	Flare	VOC	Continuous presence of pilot flame
III	SOCMI air oxidation unit processes with VOC emissions	Reactors and recovery systems	Flare	VOC	Continuous presence of pilot flame
KKK	Equipment leaks of VOC from onshore natural gas processing	Equipment leaks captured by closed vent system	Flare	VOC	Continuous presence of pilot flame
NNN	VOC emissions from SOCMI distillation operations	Distillation units	Flare	VOC	Continuous presence of pilot flame, and indicator of diversion of gas flow from flare
QQQ	VOC emissions from petroleum refinery wastewater systems	Wastewater systems	Flare	VOC	Continuous presence of pilot flame
RRR	VOC emissions from SOCMI reactor processes	Reactor processes	Flare	VOC	Continuous presence of pilot flame, and indicator of diversion of gas flow from flare
NESHAP (40 CFR 61)					
F	Vinyl chloride	Ethylene dichloride, vinyl chloride, and polyvinyl chloride plants	Flare on relief valve	VOC	Continuous presence of pilot flame
J	Equipment leaks of benzene	Equipment leaks captured by closed vent system	Flare	Benzene	Continuous presence of pilot flame
V	Equipment leaks	Equipment leaks captured by closed vent system	Flare	VHAP	Continuous presence of pilot flame
Y	Benzene from benzene storage vessels	Benzene storage vessels with closed vent system	Flare	Benzene	Continuous presence of pilot flame
BB	Benzene emissions from benzene transfer operations	Tank truck, rail, and marine vessel loading racks	Flare	Benzene	Continuous presence of pilot flame
FF	Benzene waste operations	Chemical manufacturing plants, coke by-product plants, and petroleum refineries	Flare	Benzene	Continuous presence of pilot flame

[a]Monitoring is presumptively acceptable only if it complies with all monitoring provisions stipulated in the subpart.

TABLE 3-4. CONDITIONALLY PRESUMPTIVELY ACCEPTABLE RULES

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
NSPS (40 CFR 60)						
DDD	VOC emissions from polymer industry	Polymer manufacturing processes	VOC	Thermal incinerator	Temperature (continuous)	Specify device calibration frequency
				Catalytic incinerator	Temperature differential across catalyst bed (continuous)	Specify device calibration frequency
				Boiler/ process heater[a]	Temperature (continuous)	Specify device calibration frequency
				Carbon adsorber	Outlet organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				Absorber	• Outlet organics concentration (continuous), or • Temperature (continuous), and • Liquid specific gravity (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperature and specific gravity monitored, Specify device calibration frequency
				Condenser	• Outlet organics concentration (continuous), or • Temperature (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperature monitored, Specify device calibration frequency
				All	Bypass: Flow indicator downstream of each valve that would allow bypass (15 min.) and/or check bypass valves/car seals monthly.	None

TABLE 3-4. (continued)

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
III	SOCMI air oxidation unit processes VOC emissions	Reactors and recovery systems	VOC	Thermal incinerator	• Temperature continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Catalytic incinerator	• Temperature differential across catalyst bed (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Boiler/ process heater[a]	• Temperature (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Carbon adsorber	Outlet organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				Absorber	• Outlet organics concentration (continuous), or • Temperature (continuous), and • Liquid specific gravity (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperature and specific gravity monitored, Specify device calibration frequency
				Condenser	• Outlet organics concentration (continuous), or • Temperature (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperature monitored, Specify device calibration frequency

TABLE 3-4. (continued)

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
LLL	On-shore natural gas processing: SO_2 emissions	Sweetening units	SO_2	Incinerator with oxidation or reduction system	• Outlet temperature (continuous • SO_2 concentration	Specify data collection procedures
NNN	VOC emissions for SOCMI distillation operations	Distillation units	VOC	Thermal incinerator	• Temperature (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Catalytic incinerator	• Temperature differential across catalyst bed (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Boiler/ process heater[a]	• Temperature (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Carbon adsorber	Outlet organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				Absorber	• Outlet organics concentration (continuous), or • Temperature (continuous), and • Liquid specific gravity (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperature and specific gravity monitored, Specify device calibration frequency
				Condenser	• Outlet organics concentration (continuous), or • Temperature (continuous)	If outlet organics concentration monitored, CEMS must meet PS 8 requirements If temperature monitored, Specify device calibration frequency

TABLE 3-4. (continued)

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
PPP	Wool Fiberglass Insulation Manufacturing Plants	Rotary spin wool fiberglass manufacturing lines	PM	WESP	• Primary and secondary current and voltage (4h), • Inlet water flow rate (4h), and • Total solids content of inlet water (daily)	• Increase monitoring frequency for large units • Data representativeness criteria (i.e., measurement location) • Data averaging period, if applicable
QQQ	VOC emissions from petroleum refinery wastewater systems	Oil-water separator tanks for >16 L/sec, drain systems	VOC	Thermal incinerator	Temperature (continuous)	Specify device calibration frequency
				Catalytic incinerator	Temperature differential across catalyst bed (continuous)	Specify device calibration frequency
				Carbon adsorber	Outlet organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				All	Bypass: Flow indicator on vent stream to control device to ensure vapors are being routed to device.	None
RRR	VOC emissions from SOCMI reactor processes	Reactors	VOC	Thermal incinerator	• Temperature (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Catalytic incinerator	• Temperature across catalyst bed (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Boiler/process heater[a]	• Temperature (continuous) • Bypass: hourly indication of flow	Specify device calibration frequency
				Carbon adsorber	• Outlet organics concentration (continuous)	If monitor does not meet PS 8, specify device calibration frequency and accuracy
				Adsorber	• Outlet organics concentration (continuous), or • Temperature (continuous), and • Liquid specific gravity (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8, specify device calibration frequency and accuracy If temperature and specific gravity monitored, Specify device calibration frequency
				Condenser	• Outlet organics concentration (continuous), or • Temperature (continuous), and • Liquid specific gravity (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8, specify device calibration frequency and accuracy If temperature and specific gravity monitored, Specify device calibration frequency
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TABLE 3-4. (continued)

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
L	Benzene from coke by-product recovery plants	Process vessels, storage tanks, tar intercepting sumps	Benzene	Thermal incinerator	• Temperature (continuous) • Bypass: Inlet gas flow indicator (hourly) or outlet gas flow indicator (15 min.) or monthly check of locked bypass valves (e.g., car seal)	Specify device calibration frequency
				Catalytic incinerator	• Temperature differential across catalyst bed (continuous) • Bypass: Inlet gas flow indicator (hourly) or outlet gas flow indicator (15 min.) or monthly check of locked bypass valves (e.g., car seal)	Specify device calibration frequency
				Regenerative carbon adsorber	Benzene or organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
BB	Benzene emissions from benzene transfer operations	Tank truck, rail, and marine vessel loading racks	Benzene	Thermal incinerator	Temperature (continuous)	Specify device calibration frequency
				Catalytic incinerator	Temperature differential across catalyst bed (continuous)	Specify device calibration frequency
				Boiler/ process heater[a]	Temperature (continuous)	Specify device calibration frequency
				Carbon adsorber	Outlet organics concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				All	Bypass: Flow indicator downstream of each valve that would allow bypass (15 min.) and/or check bypass valves/car seals monthly.	None

TABLE 3-4. (continued)

Subpart	Source category	Emissions unit	Pollutant	Control	Required monitoring	Additional conditions to be met (must be specified in CAM submittal)
FF	Benzene waste operations	Chemical manufacturing plants, coke by-product plants, & petroleum refineries	Benzene	Thermal incinerator	Temperature (continuous)	Specify device calibration frequency
				Catalytic incinerator	Temperature differential across catalyst bed (continuous)	Specify device calibration frequency
				Boiler/ process heater[a]	Temperature (continuous)	Specify device calibration frequency
				Carbon adsorber	Outlet organics or benzene concentration (continuous)	If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy
				Condenser	• Outlet organics or benzene concentration (continuous), or • Outlet temperature (continuous) and • Coolant exit temperature (continuous)	If outlet organics concentration monitored, If monitor does not meet PS 8 or PS 9, specify device calibration frequency and accuracy If temperatures monitored, Specify device calibration frequency Specify device accuracy
				All	Bypass: Flow indicator every 15 min. or locked bypass valves (e.g., car seal).	None

[a]Note that temperature monitoring is only required for boilers or process heaters with a design heat capacity of <150 million Btu/hr (44 MW).