APPENDIX A.

EXAMPLE MONITORING APPROACH SUBMITTALS

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ACKNOWLEDGMENT

The cooperation of the corporate environmental staff, facility personnel, and state Agency personnel that voluntarily identified facilities, provided information and data, and answered numerous questions to support development of the example monitoring approach submittals presented in this Appendix is greatly appreciated.

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INTRODUCTION

The example compliance assurance monitoring (CAM) approach submittals presented in this Appendix are based upon “case studies” of the current monitoring approaches in use at actual facilities and historical data obtained from the monitoring system. The development process for these examples included: (1) identifying facilities which currently monitor control device parameters, had long-term monitoring data available for review, had conducted a performance/ compliance test, and were willing to participate, (2) obtaining information on the monitoring approach and monitoring data from the facility, (3) reviewing and analyzing the monitoring approach and data, (4) discussing the information with plant personnel and, in some cases, conducting a site visit, and (5) preparing an example monitoring approach submittal from the information.

The basic approach used was to evaluate the monitoring conducted by the facility against CAM general (design) and performance criteria. A monitoring approach submittal based upon the facility’s current monitoring, modified as necessary to comply with CAM requirements, was then drafted. If sufficient information was available to evaluate alternative approaches (e.g., different indicators, indicator ranges, or data averaging periods), alternative approaches also were investigated. Note that the resulting examples are not necessarily the only acceptable monitoring approaches for the facility or similar facilities; they are simply examples of approaches used by particular facilities. The owner or operator of a similar facility may propose a different approach that satisfies part 64 requirements. Also, the permitting authority may require additional monitoring.

One purpose of this appendix is to provide **nonprescriptive** examples of monitoring approaches that meet the CAM submittal requirements for the specific cases studied. Each example monitoring submittal contains background information (including identification of the pollutant specific emissions unit), a description of the monitoring approach, and the rationale for selecting the indicators and indicator ranges. Several of the examples also contain quality improvement plan (QIP) thresholds for particular indicators. The QIP is an optional tool for States and is not required to be included in the facility’s permit or CAM submittal. These examples represent the level of detail recommended by EPA, but States may develop their own guidance as to the level of detail (more or less) required in CAM monitoring approach submittals. Eleven examples have currently been drafted for the following control device types: thermal incinerator, wet scrubber, carbon adsorber, condenser, wet electrostatic precipitator, and fabric filter. Information has been collected for other control devices and monitoring approaches and example monitoring approach submittals for these cases are being prepared.

A separate background (Case Study) report which provides additional information is expected to be prepared for each example. Currently, one case study report has been prepared and is undergoing internal EPA review.

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A.1a. THERMAL INCINERATOR FOR VOC CONTROL–FACILITY A

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EXAMPLE COMPLIANCE ASSURANCE MONITORING

Thermal Incinerator for VOC Control: Facility A - Example 1

I. Background

A. Emissions Unit

Description:	Coater 1, Coater 2, and Coater 3
Identification:	Stack No. XXX/ Ct. YYYYY
Stack designation:	Incinerator
APC Plant ID No.	XXXXX
Facility:	Facility A Anytown, USA

B. Applicable Regulation, Emission Limit, and Monitoring Requirements

Regulation No.:	Permit
Regulated pollutant (PSEU):	VOC
Emission limit:	95 percent reduction
Monitoring requirements in permit:	Continuously monitor chamber temperature [NOTE 1]

C. Control Technology: Thermal oxidizer

II. Monitoring Approach

The key elements of the monitoring approach, including the indicators to be monitored, indicator ranges, and performance criteria are presented in Table A.1a-1.

Note that this CAM submittal is intended as an example of monitoring the operation of the incinerator and does not address capture efficiency. Capture efficiency is a critical component of the overall control efficiency of the air pollution control system, and indicators of the performance of the capture system should be incorporated into the monitoring approach. However, sufficient information was not available from this case study to include monitoring of the capture system performance.

III. Data Availability [NOTE 2]

The minimum data availability for each semiannual reporting period, defined as the number of hours for which monitoring data are available divided by the number of hours during which the process operated (times 100) will be:

Chamber temperature:	90 percent

The data availability determination will not include periods of control device start up and shut down. For an hour to be considered a valid hour of monitoring data, a minimum of 45 minutes of data must be available.

TABLE A.1a-1. MONITORING APPROACH

	Indicator No. 1	Indicator No. 2
I. Indicator	Chamber temperature	Work practice
Measurement Approach	The chamber temperature is monitored with a thermocouple.	Inspection and maintenance of the burner; observation of the burner flame.
II. Indicator Range	An excursion is defined as temperature readings less than 1500°F; excursions trigger an inspection, corrective action, and a reporting requirement.	An excursion is defined as failure to perform annual inspection or daily flame observation.
QIP Threshold[a]	No more than six excursions below the indicator range in any semi-annual reporting period.	Not applicable
III. Performance Criteria A. Data Representativeness[b]	The sensor is located in the incinerator chamber as an integral part of the incinerator design. The minimum tolerance of the thermocouple is ±4°F or ±0.75% (of temperature measured in degrees Celius), whichever is greater. The minimum chart recorder sensitivity (minor division) is 20°F.	Not applicable
B. Verification of Operational Status	Not applicable	Not applicable
C. QA/QC Practices and Criteria[b]	Accuracy of the thermocouple will be verified by a second, or redundant, thermocouple probe inserted into the incinerator chamber with a hand held meter. This validation check will be conducted at least annually. The acceptance criterion is ±30°F.	Not applicable
D. Monitoring Frequency	Measured continuously.	Annual inspection of the burner; daily observation of the burner flame.
Data Collection Procedure	Recorded continuously on a circular chart recorder.	Record results of annual inspections and daily observations.
Averaging Period	No average is taken.	Not applicable

[a] The QIP is an optional tool for States; QIP thresholds are not required in the CAM submittal.

[b] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

Note: Capture efficiency is a critical component of the overall control efficiency of the air pollution control system, and indicators of the performance of the capture system should be incorporated into the monitoring approach. However, sufficient information was not available from this case study to include monitoring of the capture system performance.

MONITORING APPROACH JUSTIFICATION

I. Background

This is a coating facility that performs polyester film coating and paper liner coating with solvent based coatings. Three coaters are operated at the facility. Emissions from the three coaters are vented to the thermal incinerator. Emissions from mixing, coating, and drying operations are vented to this incinerator; some mixing vessels can also be vented to other oxidizers. A total of 27 sources are connected to the thermal incinerator.

II. Rationale for Selection of Performance Indicators

The incinerator chamber temperature was selected because it is indicative of the thermal incinerator operation (combustion occurring within the chamber). If the chamber temperature decreases significantly, complete combustion may not occur.

It has been shown that the control efficiency achieved by a thermal incinerator is a function of its operating temperature, or outlet temperature. By maintaining the operating temperature at or above a minimum, a level of control efficiency can be expected to be achieved. Attachment 1 presents information from the literature on incinerator control efficiency as a function of temperature.

The work practice comprised of an annual inspection and tuning of the incinerator burner was selected because an inspection verifies equipment integrity and periodic tuning will maintain proper burner operation and efficiency. In addition, a daily observation of the burner flame selected to monitor proper operation of the burner (blue flame) is appropriate.

[Sufficient information regarding bypass of the control device is not available. The damper on the bypass line, or purge line, on each coater must be closed during coating process operation to ensure that the vent stream is routed to the thermal incinerator.]

III. Rationale for Selection of Indicator Ranges

The selected indicator range for the incinerator chamber temperature is “greater than 1500°F at all times.” When an excursion occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. Furthermore, if the duration of a temperature excursion exceeds 10 minutes, the coating line operation will be curtailed. All excursions will be documented and reported. The selected QIP threshold level is six excursions per semiannual reporting period [see NOTE 3]. This level is less than 0.05 percent of the process operating time (based on 2,800 operating hours). If the QIP threshold is exceeded in a semiannual reporting period, a QIP will be developed and implemented. This QIP threshold is supported by 6-months of monitoring data following the performance test.

The air pollution control permit issued by the State agency specifies that the incinerator must be designed to operate with a minimum operating temperature of 1500°F measured at the center of the incinerator chamber. Attachment 1 indicates that a thermal incinerator is expected to achieve 95 percent or greater destruction efficiency (DRE) at this temperature. The permit requirement is 95 percent DRE. The incinerator employs a temperature controller that maintains the desired chamber temperature by using a natural gas-fired auxiliary burner; the temperature controller is set to maintain a temperature of at least 1500°F.

Review of historical monitoring data for a 6-month period (July-December 1993) indicates that 1500°F can be maintained on a routine basis with some excursions. The historical monitoring data for temperature indicate that normal loading to the incinerator will result in chamber temperatures of 1500°F and higher loadings to the device will result in periods of higher operating temperatures for short durations, such as during the performance test. The historical monitoring data indicate that the indicator range was exceeded seven times in the 6-month period; two of the excursions were momentary.

The performance test confirms acceptable performance of the incinerator; the incinerator achieved the required DRE of 95 percent. During the performance test, the incinerator was operating with a temperature of at least 1500°F (in the range of 1540° to 1800°F). During the performance tests the incinerator temperature was generally nearer 1700°F than 1500°F. The higher temperatures during the performance test occurred because the facility was operated near the maximum production rate with higher VOC loadings to challenge the incinerator with maximum VOC loading. The higher operating temperatures during the performance test are not the result of a change in operation of the incinerator (i.e., changing the burner set point temperature).

The performance test of the thermal incinerator was conducted in October 1993 using EPA Reference Method 25. Three test runs (1 hour each) were conducted with 11 out of 27 sources operating and venting to the incinerator; this number of operating sources is considered normal. During the performance test, the chamber temperature was measured continuously and recorded on a circular chart (Attachment 2).

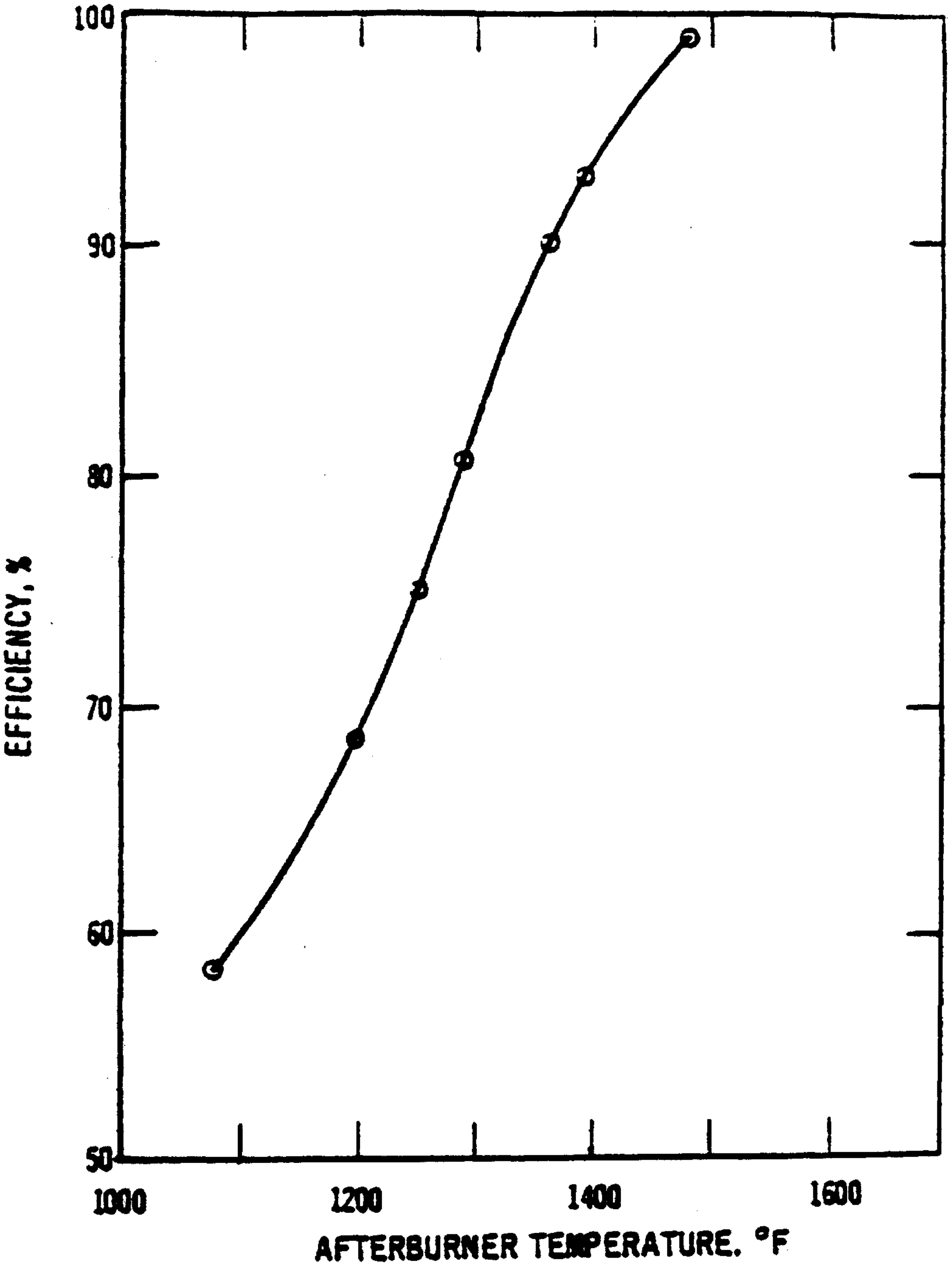
The total hydrocarbon (THC) emission limit is 154 pounds per hour (lb/hr); this limit was met. The facility's operating permit requires 95 percent reduction from the thermal incinerator. During the performance test, the thermal incinerator achieved a destruction efficiency of greater than 95 percent for all three runs (95.4, 95.5, and 97.8); average DRE for the three test runs is 96.2 percent).

The production rate during the performance test was representative of highest VOC loading to the incinerator. During the performance test, the VOC input calculated from coating usage and content was XXX lb/hr [facility requested coating usage not be presented]. By comparison, for the 6 month period for which monitoring data were reviewed, the average VOC loading to the system when all three coaters were operating (calculated as the sum of the average VOC input rate, lb/hr, of each coater) was 80 percent of the amount during the performance test.

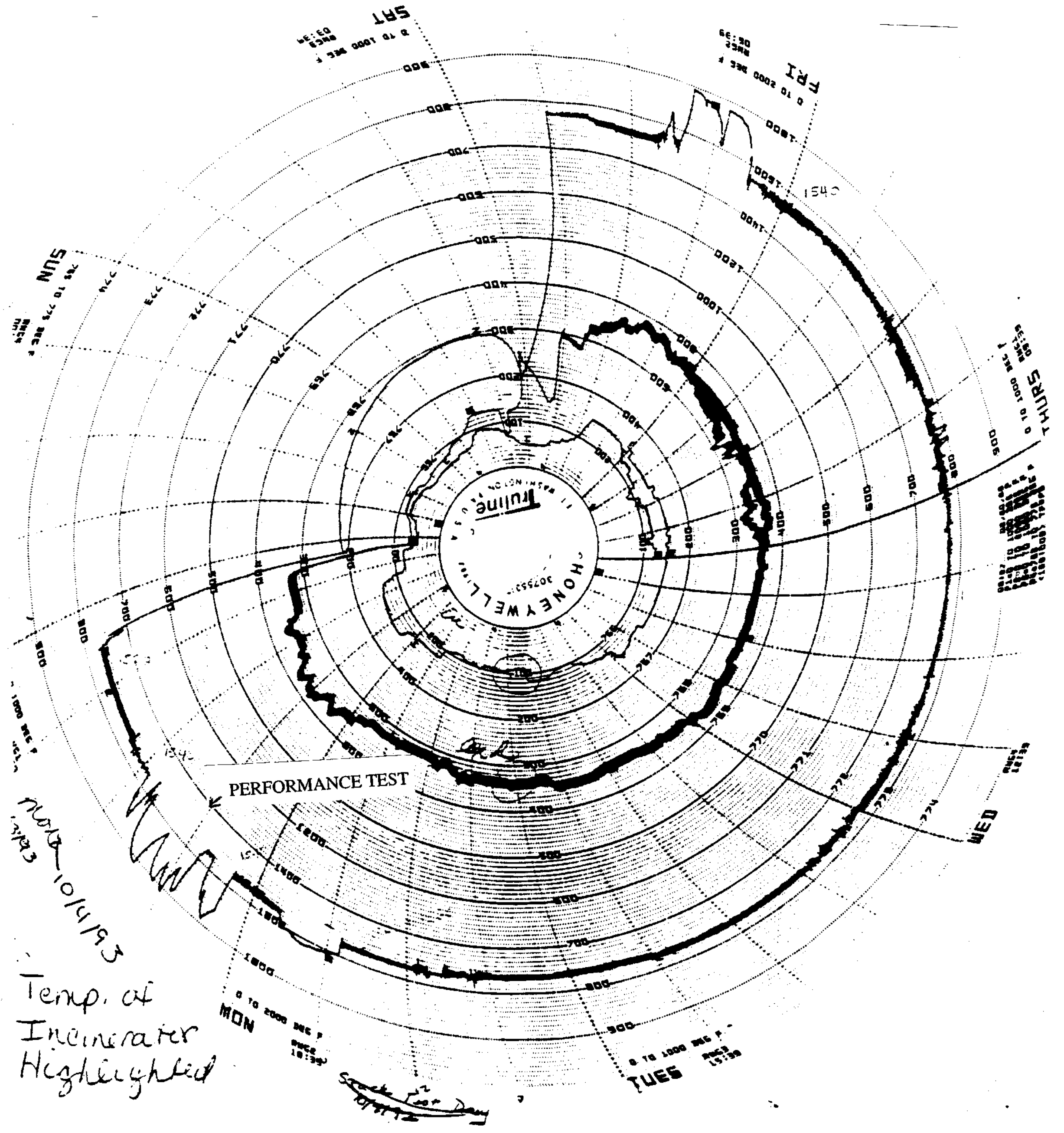
NOTE 1: CO monitoring also is a requirement in the facility’s permit; however, for the purposes of this example CAM Plan, CO monitoring was not selected as an indicator. See CAM plan No. A.1b.

NOTE 2: Submittal of proposed data availability is optional; it is not a requirement of a CAM submittal.

NOTE 3: Submittal of a QIP threshold is optional; it is not a requirement of a CAM submittal.



Attachment 1. Direct-flame afterburner efficiency as a function of temperature.
Air Pollution Engineering Manual, Chapter 5 - Control Equipment for Gases and Vapors.



PERFORMANCE TEST

10/4/93

Temp. of Incinerator Highlighted

Attachment 2. Temperature chart during October 1993 performance test.

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A.1b. THERMAL INCINERATOR FOR VOC CONTROL–FACILITY A

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EXAMPLE COMPLIANCE ASSURANCE MONITORING

Thermal Incinerator for VOC Control: Facility A - Example 1b

I. Background

A. Emissions Unit

Description:	Coater 1, Coater 2, and Coater 3
Identification:	Stack No. XXX/ Ct. YYYYY
Stack designation:	Incinerator
APC Plant ID No.	XXXXX
Facility:	Facility A Anytown, USA

B. Applicable Regulation, Emission Limit, and Monitoring Requirements

Regulation No.:	Permit
Regulated pollutant (PSEU):	VOC
Emission limit:	95 percent reduction
Monitoring requirements in permit:	Continuously monitor chamber temperature Continuously monitor CO concentration

C. Control Technology: Thermal oxidizer

II. Monitoring Approach

The key elements of the monitoring approach, including the indicators to be monitored, indicator ranges, and performance criteria are presented in Table A.1b-1.

Note that this CAM submittal is intended as an example of monitoring the operation of the incinerator and does not address capture efficiency. Capture efficiency is a critical component of the overall control efficiency of the air pollution control system, and indicators of the performance of the capture system should be incorporated into the monitoring approach. However, sufficient information was not available from this case study to include monitoring of the capture system performance.

III. Data Availability [NOTE 1]

The minimum data availability for each semiannual reporting period, defined as the number of hours for which monitoring data are available divided by the number of hours during which the process operated (times 100) will be:

Chamber temperature:	90 percent
Outlet CO concentration:	95 percent

The data availability determination does not include periods of control device start up and shut down. For an hour to be considered a valid hour of monitoring data, a minimum of 45 minutes of data must be available.

TABLE A.1b-1. MONITORING APPROACH

	Indicator No. 1	Indicator No. 2
I. Indicator	Chamber temperature	Outlet CO concentration
Measurement Approach	The chamber temperature is monitored with a thermocouple.	The CO concentration is measured with a CEMS meeting 40 CFR 60 Appendix B, Performance Specifications.
II. Indicator Range	An excursion is defined as temperature readings less than 1500°F; excursions trigger an inspection, corrective action, and a reporting requirement.	An excursion is defined as a 1-hr average greater than 50 ppm (emission limit); excursions trigger an inspection, corrective action, and a reporting requirement.
QIP Threshold[a]	No more than six excursions below the indicator range in any semiannual reporting period.	No more than 14 excursions above the indicator range in any semiannual reporting period.
III. Performance Criteria A. Data Representativeness[b]	The sensor is located in the incinerator chamber as an integral part of the incinerator design. The minimum tolerance of the thermocouple is ±4°F or ±0.75% (of temperature measured in degrees Celius), whichever is greater. The minimum chart recorder sensitivity (minor division) is 20°F.	The system meets 40 CFR 60 Appendix B, Performance Specification 4 criteria.
B. Verification of Operational Status	Not applicable	Not applicable
C. QA/QC Practices and Criteria[b]	Accuracy of the thermocouple will be verified by a second, or redundant, thermocouple probe inserted into the incinerator chamber with a hand held meter. This validation check will be conducted at least annually. The acceptance criterion is ±30°F.	Calibration drift will be automatically checked every 24 hours by zero air and span gas.
D. Monitoring Frequency	Measured continuously.	CO concentration is measured continuously.
Data Collection Procedure	Recorded continuously on a circular chart recorder.	The average of six 10-second readings are recorded once per minute by the DAS (electronic record).
Averaging Period	No average is taken.	1-hour average of 60 1-minute readings.

[a] The QIP is an optional tool for States; QIP thresholds are not required in the CAM submittal.

[b] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

Note: Capture efficiency is a critical component of the overall control efficiency of the air pollution control system, and indicators of the performance of the capture system should be incorporated into the monitoring approach. However, sufficient information was not available from this case study to include monitoring of the capture system performance.

MONITORING APPROACH JUSTIFICATION

I. Background

This facility performs polyester film coating and paper liner coating with solvent based coatings. Three coaters are operated. Emissions from the three coaters are vented to the thermal incinerator. Emissions from mixing, coating, and drying operations are vented to this incinerator; some mixing vessels can also be vented to other oxidizers. A total of 27 sources are connected to the thermal incinerator.

II. Rationale for Selection of Performance Indicators

The incinerator chamber temperature was selected because it is indicative of the thermal incinerator operation (combustion occurring within the chamber). If the chamber temperature decreases significantly, complete combustion may not occur.

It has been shown that the control efficiency achieved by a thermal incinerator is a function of its operating temperature, or outlet temperature. By maintaining the operating temperature at or above a minimum, a level of control efficiency can be expected to be achieved. Attachment 1 presents information from the literature on incinerator control efficiency as a function of temperature.

The CO concentration at the outlet of the thermal incinerator is an indicator of incomplete combustion. Significant increases in CO indicate that combustion efficiency has decreased and corrective action should be taken.

[Sufficient information regarding bypass of the control device is not available. The damper on the bypass line, or purge line, on each coater must be closed during coating process operation to ensure that the vent stream is routed to the thermal incinerator.]

III. Rationale for Selection of Indicator Ranges

A. Thermal Incinerator Temperature

The selected indicator range for the incinerator chamber temperature is “greater than 1500°F at all times.” When an excursion occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. Furthermore, if the duration of a temperature excursion exceeds 10 minutes, the coating line operation will be curtailed. All excursions will be documented and reported. The selected QIP threshold level is six excursions per semiannual reporting period (see NOTE 2). This level is less than 0.05 percent of the process operating time (based on 2,800 operating hours). If the QIP threshold is exceeded in a semiannual reporting period, a QIP will be developed and implemented. This QIP is supported by 6 months of monitoring data following the performance test.

The air pollution control permit issued by the State agency specifies that the incinerator must be designed to operate with a minimum operating temperature of 1500°F measured at the center of the incinerator chamber. Attachment 1 indicates that a thermal incinerator is expected to achieve 95 percent or greater destruction efficiency (DRE) at this temperature. The permit requirement is 95 percent DRE. The incinerator employs a temperature controller that maintains the desired chamber temperature by using a natural gas-fired auxiliary burner; the temperature controller is set to maintain a temperature of at least 1500°F.

Review of historical monitoring data for a 6-month period (July to December 1993) indicates that 1500°F can be maintained on a routine basis with some excursions. The historical monitoring data for temperature indicate that normal loading to the incinerator will result in chamber temperatures of 1500°F and higher loadings to the device will result in periods of higher operating temperatures for short durations, such as during the performance test. The historical monitoring data indicate that the indicator range was exceeded seven times in the 6-month period; two of the excursions were momentary.

The performance test confirms acceptable performance of the incinerator; the incinerator achieved the required DRE of 95 percent. During the performance test, the incinerator was operating with a temperature of at least 1500°F (in the range of 1540° to 1800°F). During the performance tests the incinerator temperature was generally nearer 1700°F than 1500°F. The higher temperatures during the performance test occurred because the facility was operated near the maximum production rate with higher VOC loadings to challenge the incinerator with maximum VOC loading. The higher operating temperatures during the performance test are not the result of a change in operation of the incinerator (i.e., changing the burner set point temperature).

The performance test of the thermal incinerator was conducted in October 1993 using EPA Reference Method 25. Three test runs (1 hour each) were conducted with 11 out of 27 sources operating and venting to the incinerator; this number of operating sources is considered normal. During the performance test, the chamber temperature was measured continuously and recorded on a circular chart (Attachment 2).

The THC emission limit is 154 pounds per hour (lb/hr); this limit was met during the test. The facility's operating permit requires 95 percent reduction from the thermal incinerator. During the performance test, the thermal incinerator achieved a destruction efficiency of greater than 95 percent for all three runs (95.4, 95.5, and 97.8); the average DRE for the three test runs is 96.2 percent. The average outlet CO concentration for each of the three performance test runs was 2.3, 10.2, and 1.6 ppmvd.

The production rate during the performance test was representative of highest VOC loading to the incinerator. During the performance test, the VOC input calculated from coating usage and content was XXX lb/hr [facility requested coating usage not be presented]. By comparison, for the 6-month period for which monitoring data were reviewed, the average VOC loading to the system when all three coaters were operating (calculated as the sum of the average VOC input rate, lb/hr, of each coater) was 80 percent of the amount during the performance test.

B. <u>Outlet CO Concentrations</u>

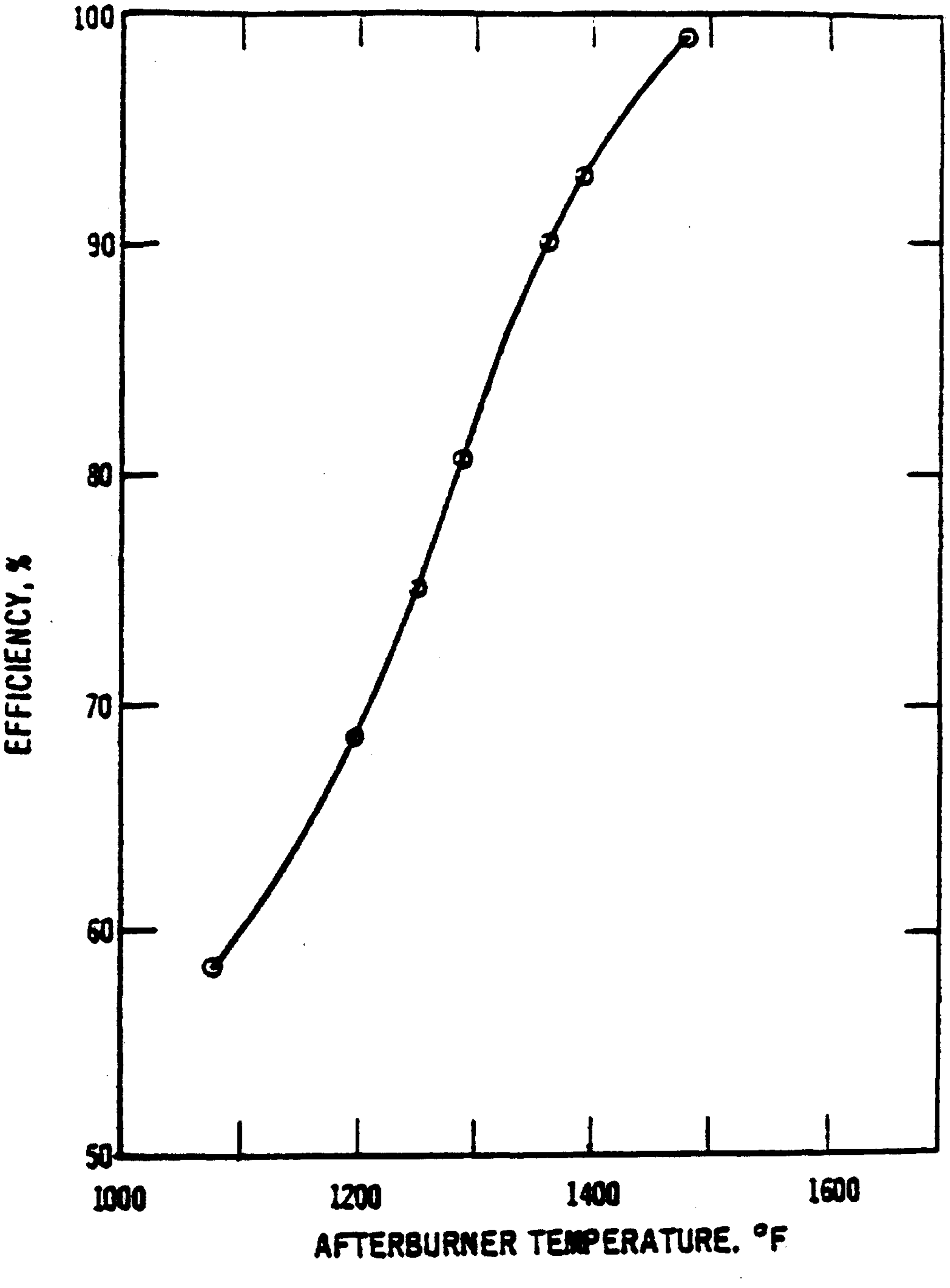
The selected indicator range for the 1-hour average CO concentration is “less than 50 ppmvd, as measured.” When an excursion occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported. The selected QIP threshold level is 14 excursions per semiannual reporting period. This level is less than 0.5 percent of the process operating time (based on 2,800 operating hours). If the QIP threshold is exceeded in a semiannual reporting period, a QIP will be developed and implemented. This QIP is supported by 3 months of monitoring data following the performance test.

Review of historical monitoring data for a 3-month period (September through December 1993) indicates that the 50 ppmvd CO concentration limit can be maintained on a routine basis with some excursions. The historical monitoring data indicate that the indicator range was exceeded eight times in the 3-month period. Based upon these historical data, the threshold for excursions is no more than 14 excursions above 50 ppmvd in a 6-month period (i.e., 7 excursions per quarter).

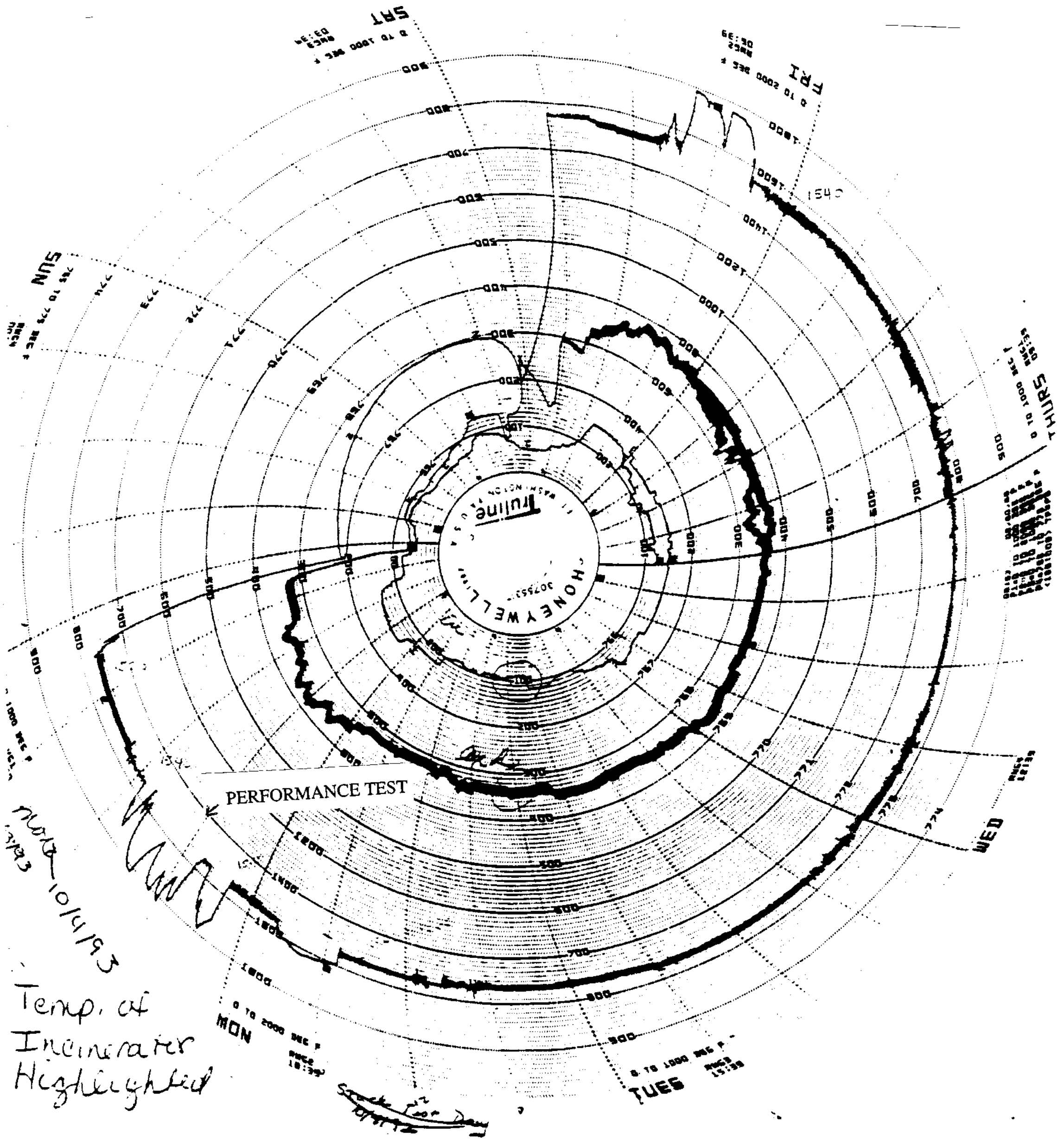
The performance test conducted in October 1993 is discussed above in section III.A. The CO concentrations were well under the 50 ppmvd limit (measured CO) for all three runs during the test.

NOTE 1: Submittal of proposed data availability is optional; it is not a requirement of a CAM submittal.

NOTE 2: Submittal of a QIP Threshold is optional; it is not a requirement of a CAM submittal.



Attachment 1. Direct-flame afterburner efficiency as a function of temperature.
Air Pollution Engineering Manual, Chapter 5 - Control Equipment for Gases and Vapors.



Attachment 2. Temperature chart during October 1993 performance test.

A.2 VENTURI SCRUBBER FOR PM CONTROL–FACILITY B

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EXAMPLE COMPLIANCE ASSURANCE MONITORING:
VENTURI SCRUBBER FOR PM CONTROL--FACILITY B

I. Background

A. Emissions Unit

Description:	FCCU catalyst regenerator
Identification:	
Facility:	Facility B Anytown, USA

B. Applicable Regulation, Emission Limits, and Monitoring Requirements

Regulation No.:	40 CFR 60 Subpart J
Regulated pollutant:	Particulate matter
Emission limit (particulate matter):	1 lb/1,000 lb coke burned
Monitoring requirements:	Coke burn rate, air blower rate, number of venturis online (permit) [Note: Although Subpart J requires a COMS, this alternate monitoring approach was approved by the State permitting authority and is reflected in the facility's permit.]

C. Control Technology:

Four parallel venturi scrubbers

II. Monitoring Approach

The key elements of the monitoring approach for particulate matter, including the indicators to be monitored, indicator ranges, and performance criteria are presented in Table A.2-1.

TABLE A.2-1. MONITORING APPROACH

	Indicator No. 1	Indicator No. 2	Indicator No. 3
I. Indicator	Liquid to gas ratio	Scrubber exhaust temperature	Coke burn rate
Measurement Approach	Water flow–magnetic flowmeter. Air rate–venturi flowmeter. L/G calculated.	Scrubber exhaust temperature measured using a thermocouple.	Calculated using NSPS (§ 60.106) equation.
II. Indicator Range[a]	An excursion is defined as a 3-hour average liquid to gas ratio less than 8. Excursions trigger an inspection, corrective action, and a reporting requirement.	An excursion is defined as a 3-hour average scrubber exhaust temperature greater than 165°F. Excursions trigger an inspection, corrective action, and a reporting requirement.	An excursion is defined as a 3-hour average coke burn rate greater than 56,000 lb/hr. Excursions trigger an inspection, corrective action, and a reporting requirement.
III. Performance Criteria A. Data Representativeness[b]	The magnetic flow meter (minimum accuracy of ±1.0% of flow rate) is located in the water inlet line. The venturi flowmeter (minimum accuracy of ±0.75% of flow rate) is located in the gas inlet duct.	Thermocouple located at scrubber exhaust with a minimum accuracy of ±3°F.	Analyzers and monitors are located in the regenerator inlet and exhaust duct.
B. Verification of Operational Status	Not applicable	Not applicable	Not applicable
C. QA/QC Practices	Magnetic water flowmeter and venturi flowmeter–calibrated once/ 6 months.	Thermocouple–calibrated once/ 6 months.	Gas analyzers: per 60.13 and Appendix B of 40 CFR 60. Flowmeter, thermocouple, and pressure indicator–calibrated once/ 6 months.
D. Monitoring Frequency	Water flow and air rate are measured continuously.	Temperature is measured continuously.	O_2, CO, CO_2, air rate, off gas temperature and pressure are measured continuously.
Data Collection Procedure	L/G is calculated and recorded each minute.	Temperature is recorded each minute.	A coke burn rate is calculated and recorded each minute.
Averaging Period	3-hour average.	3-hour average.	3-hour average.

[a] An excursion of any single indicator triggers an inspection, corrective action, and a reporting requirement.

[b] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

JUSTIFICATION

I. Background

The pollutant specific emissions unit is particulate matter from the catalyst regenerator of a fluid catalytic cracking unit (FCCU). The catalyst regenerator is equipped with a wet gas scrubber. The catalyst regenerator exhaust gases pass through four parallel venturi scrubbers. These scrubbers are the primary control devices for particulate matter emissions. After passing through the scrubbers, the off gases pass through a separating vessel and a spray grid prior to being vented to the atmosphere. The emission unit is regulated under 40 CFR 60 Subpart J--NSPS for petroleum refineries. The monitoring approach is reflected as a specific permit condition in the air permit. Based on the pollutant specific emissions unit design, bypass of the control device is not possible.

II. Rationale for Selection of Performance Indicators

The following parameters will be monitored:

- Liquid-to-gas (L/G) ratio;
- Scrubber exhaust temperature; and
- Coke burn rate.

The licensor of the wet scrubber provided a graph relating the number of operating scrubbers required to maintain the design liquid to gas ratio, to the FCCU regenerator air blower rate. The regenerator air rate and the number of venturis in operation are an indirect measure of liquid to gas ratio, which is an indicator of scrubber performance. The regenerator air rate and the number of venturis in operation are monitored to ensure that these limitations are met.

Although the air permit only requires monitoring of coke burn rate, air blower rate, and number of venturis online, L/G ratio and scrubber exhaust temperature were added to the monitoring approach in early 1997 as further indicators of control device performance. The L/G ratio is determined by measuring scrubber water flow rate and comparing it to the regenerator air blower rate. In addition, the scrubber temperature is monitored downstream of the spray grid. The scrubber exhaust gas temperature was selected because it is indicative of scrubber operation and adequate water flow. With the scrubber water off, the scrubber exhaust temperature would be noticeably higher.

The coke burn rate is an indication of the PM loading to the scrubber.

III. Rationale for Selection of Indicator Ranges

As mentioned above, a graph relating the regenerator air blower rate to the number of venturis necessary to maintain the design L/G ratio, was provided by the licensor of the scrubber. This graph, presented in Figure A.2-1, shows that at regenerator air rates of less than 100 kscfm at least two scrubbers must be operating to maintain the design L/G ratio. At regenerator air rates of greater than or equal to 100 kscfm to less than 136 kscfm, at least three scrubbers must be operating. At air rates of greater than 136 kscfm all four scrubbers must be operating. The facility monitors the regenerator air rate and the number of venturis in operation to ensure that these limitations are met.

The indicator range for L/G ratio is based on results of a January 1996 performance test and historical data. Three 1-hr test runs were conducted and the average measured PM emissions were

0.78 lb PM/1,000 lb coke burned, which is below the 1 lb/1,000 lb PM emission limit. During the performance test, L/G ratio was measured and recorded continuously, concurrent with each of the 1-hour test runs. The average L/G ratio for the three 1-hour test runs was 7.1. Hourly L/G ratio data for a 3-month period (October through December 1996) following the performance test were reduced to three-hour averages and evaluated to determine whether the L/G ratio during normal operation was above the minimum level selected based on the January 1996 performance test demonstrating compliance. Figure A.2-2 graphically presents these data. During the 3-month period, the 3-hour average L/G ratio ranged from 8.5 to 14.9, and averaged 11.4, showing consistent operation at a L/G ratio above the level where compliance was demonstrated. The indicator range selected is a minimum L/G ratio of 8. No QIP threshold has been established.

The maximum scrubber outlet temperature was selected based on data obtained during a performance test conducted at the facility and historical data. The scrubber exhaust gas temperatures during the test averaged 144°F. Hourly scrubber outlet temperature data over a 3-month period (October through December 1996) were reduced to 3-hour averages and are shown in Figure A.2-3. Scrubber outlet temperatures during this 3-month period generally ranged from 132° to 150°F, and averaged 137.5°F. As seen in Figure A.2-3, a significant drop in temperature occurred over a 24-hour period. During this 24-hour period, the thermocouple was reading ambient temperatures because it had been removed from its housing for testing purposes. These ambient readings were not included in the evaluation of the data.

The selected indicator range for scrubber outlet temperature is less than 165°F. This range was selected by adding a 15 percent buffer to the average temperature demonstrated during the performance test (144°F) to account for variability among the data; the 3-months of monitoring data indicate that this temperature operating range can be achieved consistently. No lower action level is necessary. No QIP threshold has been established.

To date, compliance has been demonstrated at a coke burn rate of 55.5 thousand (M) lb/hr. The performance test data obtained in January of 1996 indicate that while operating at a coke burn rate of 55.5 Mlb/hr (average of three 1-hour runs) the emissions unit was in compliance with the PM emission limit. The indicator range is established as less than 56 Mlb/hr. If operation at a higher coke burn rate is planned, additional testing will be conducted to demonstrate compliance with all emission limitations at the higher burn rate. No QIP threshold has been set for this indicator.

When an excursion of any of the indicator ranges occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported.

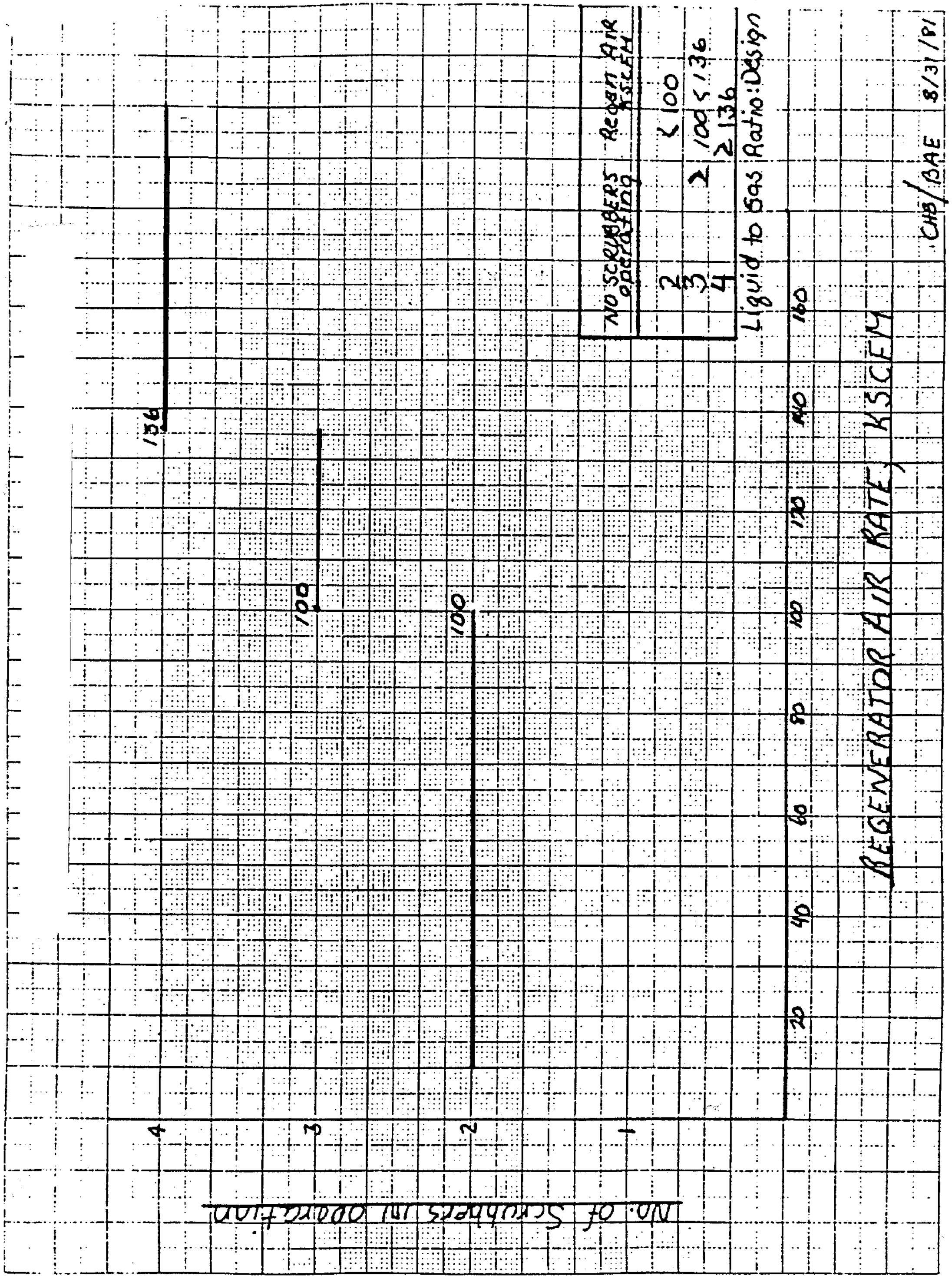

Figure A.2-1. Regenerator Air Rate vs. Number of Scrubbers in Operation.

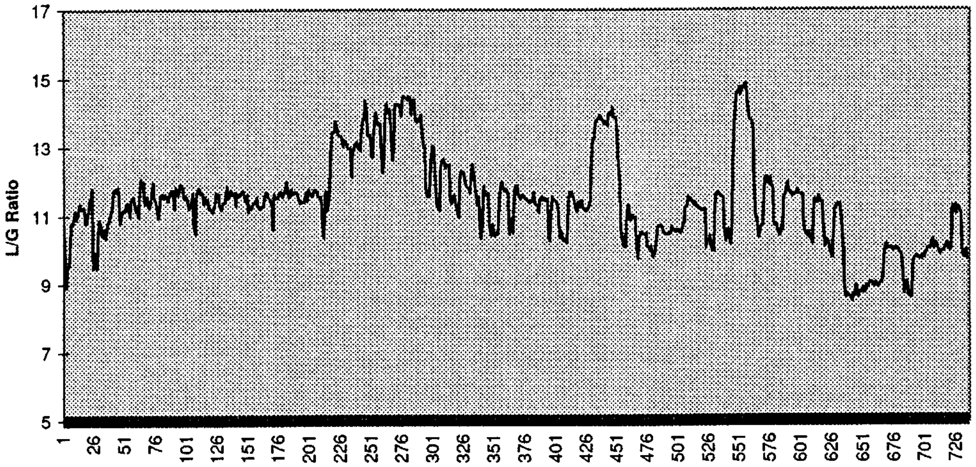

Figure A.2-2. Liquid to Gas Ratios (3-hour averages) for October-December 1996.

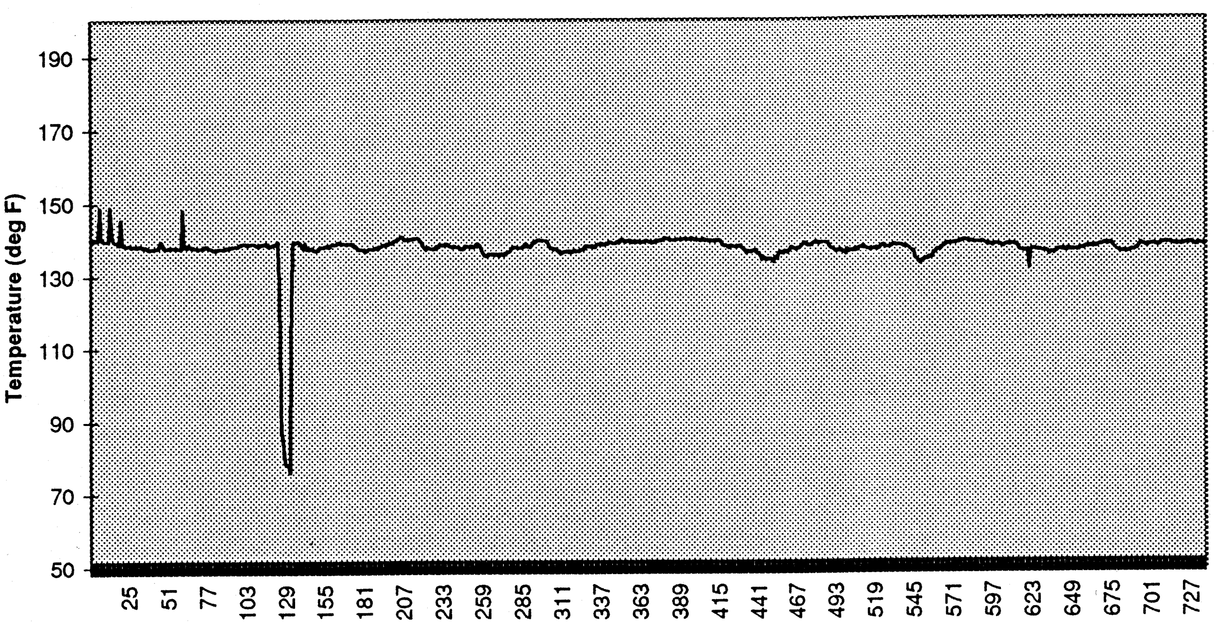

Figure A.2-3. Scrubber Outlet Temperatures (3-hour averages) for October-December 1996.

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A.3 CONDENSER FOR VOC CONTROL--FACILITY C

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EXAMPLE COMPLIANCE ASSURANCE MONITORING:
CONDENSER FOR VOC CONTROL--FACILITY C

I. Background

A. Emissions Unit

Description:	Storage tank
Identification:	T-200-7
Facility:	Facility C Anytown, USA

B. Applicable Regulation, Emission Limit, and Monitoring Requirements

Regulation No.:	40 CFR 63, Subpart G [Note 1]
Regulated pollutant (PSEU):	VOC
Emission limit:	95 percent reduction
Monitoring requirements:	Continuously monitor outlet vent temperature.

C. Control Technology: Two refrigerated condensers

II. Monitoring Approach

The key elements of the monitoring approach for VOC, including the indicators to be monitored, indicator ranges, and performance criteria, are presented in Table A.3-1.

TABLE A.3-1. MONITORING APPROACH

I. Indicator	Outlet vent temperature
Measurement Approach	The outlet vent temperature is monitored with a thermocouple.
II. Indicator Range	An excursion is defined as a daily average condenser outlet temperature of greater than -60°F. Excursions trigger an inspection, corrective action, and a reporting requirement.
III. Performance Criteria A. Data Representativeness[a]	The sensor is installed at the outlet vent of the condenser sufficiently close (within 2 feet) to the condenser to provide a representative outlet temperature. The minimum accuracy is ±4°F.
B. Verification of Operational Status	N/A
C. Quality Assurance and Control Practices	Annual calibration is performed: (1) on the thermocouple by measuring the voltage generated and (2) on the transmitter by attaching a calibrator to the input of the transmitter, generating a voltage, and checking the corresponding output of the transmitter.
D. Monitoring Frequency	Temperature is measured continuously.
Data Collection Procedures	15-minute data points are sent to the DCS.
Averaging Period	Hourly averages of four 15-minute temperature readings are calculated for tracking of the outlet temperature. A daily average of all 15-minute temperature readings is recorded for compliance purposes.

[a] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

JUSTIFICATION

I. Background

The pollutant specific emissions unit (PSEU) is the propionaldehyde storage tank (fixed roof). The storage tank capacity is 173,000 gallons. Emissions from the propionaldehyde storage tank are vented to two refrigerated condensers. The propionaldehyde emissions are vented to one of the two condensers at all times; one condenser is online while the other is defrosting on a 4-hour cycle. The condensers are used to reduce VOC emissions. Maximum uncontrolled emissions from this tank are estimated to vary from 154 lb/hr in the winter to 175 lb/hr in the summer. Based on the design of the PSEU, bypass of the control device cannot occur.

II. Rationale for Selection of Performance Indicators

Reduction of the emissions from storage tanks is required; these emissions are reduced with a refrigerated condenser. Monitoring of the outlet vent temperature indicates the level of condensation occurring in the condenser. Outlet vent temperature is a good indicator of the operation of the condenser because the concentration of the outlet vent stream can be determined based on temperature of the stream and vapor pressure equilibrium data. To achieve the outlet concentration, the outlet vent temperature must be maintained below a certain level (i.e., a maximum temperature). If the outlet vent temperature increases above the maximum temperature limit, condensation of the components to the level expected will not occur. An increase in outlet vent temperature indicates a reduction of performance of the condenser.

III. Rationale for Selection of Indicator Ranges

The indicator range was established based upon engineering calculations and historical monitoring data. The emission standard requires a 95 percent reduction efficiency. Maximum emission conditions for this tank are during tank loading at the highest ambient temperature the tank experiences (summer conditions). Engineering calculations were used to establish the required condenser vent temperature to achieve a 95 percent reduction under these conditions. The temperature of the vapor in the tank and at the inlet to the condenser were assumed to be ambient. The tank vapor was assumed to be at atmospheric pressure. The concentration of propionaldehyde in the vapor (calculated based on the vapor pressure of propionaldehyde at ambient conditions) and the fill rate during tank loading were used to determine the maximum uncontrolled emission rate. The emissions at a 95 percent reduction efficiency were calculated, and the corresponding temperature needed to achieve the allowed propionaldehyde concentration (vapor pressure) was determined. The maximum allowed outlet vent temperature was determined to be 7°F. The outlet vent temperature must be maintained at this temperature or lower to achieve 95 percent reduction in the summer. Under winter conditions, a 95 percent reduction is achieved at an outlet vent temperature of -50°F. No lower limit to the indicator range is necessary. No performance test has been performed on the control device, and no test is planned.

In addition to the engineering calculations performed, monitoring data were reviewed to determine whether the condenser temperature could be maintained during normal operation of the storage tank and condenser. Six weeks of monitoring data for outlet vent temperatures (April 23 through June 3, 1997) have been collected and reviewed. These outlet vent temperature data include hourly average temperatures for periods when the condensers were online (i.e., offline cycles, lasting 4 hours each, are not included on the graph). Figure A.3-1 presents these data. During the 6-week period, the hourly average outlet vent temperatures while online ranged from-85° to -64°F. Daily average temperatures while online for the 6-week period ranged from-80° to -78°F. The daily average temperatures are shown in Figure A.3-2. The condenser was consistently operating with both hourly and daily average outlet vent temperatures below the maximum temperature determined in calculations. Data for 15-minute temperature readings were also available for 4 days for both the online and offline cycles for both condensers. Two days of 15-minute readings are shown in Figure A.3-3, and 4 days of 15-minute readings are shown in Figure A.3-4. The 15-minute readings range from approximately -89° to -77°F.

The selected indicator range is "a daily average temperature of less than -60 °F." This range was selected by taking the highest daily average observed temperature value (-78°F) during the 6-week period for which monitoring data were available (April through June) and adding a 20 percent buffer. At the selected indicator range, the condenser will still be operating well below temperature required to achieve compliance (-50°F). When an excursion occurs, corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported. No QIP threshold has been selected.

NOTE 1: This source is exempt from CAM because 40CFR63, Subpart G was proposed after November 15, 1990. Nonetheless, a CAM plan was prepared from information and data obtained from this facility as an example of a monitoring approach and the selection of an indicator range.

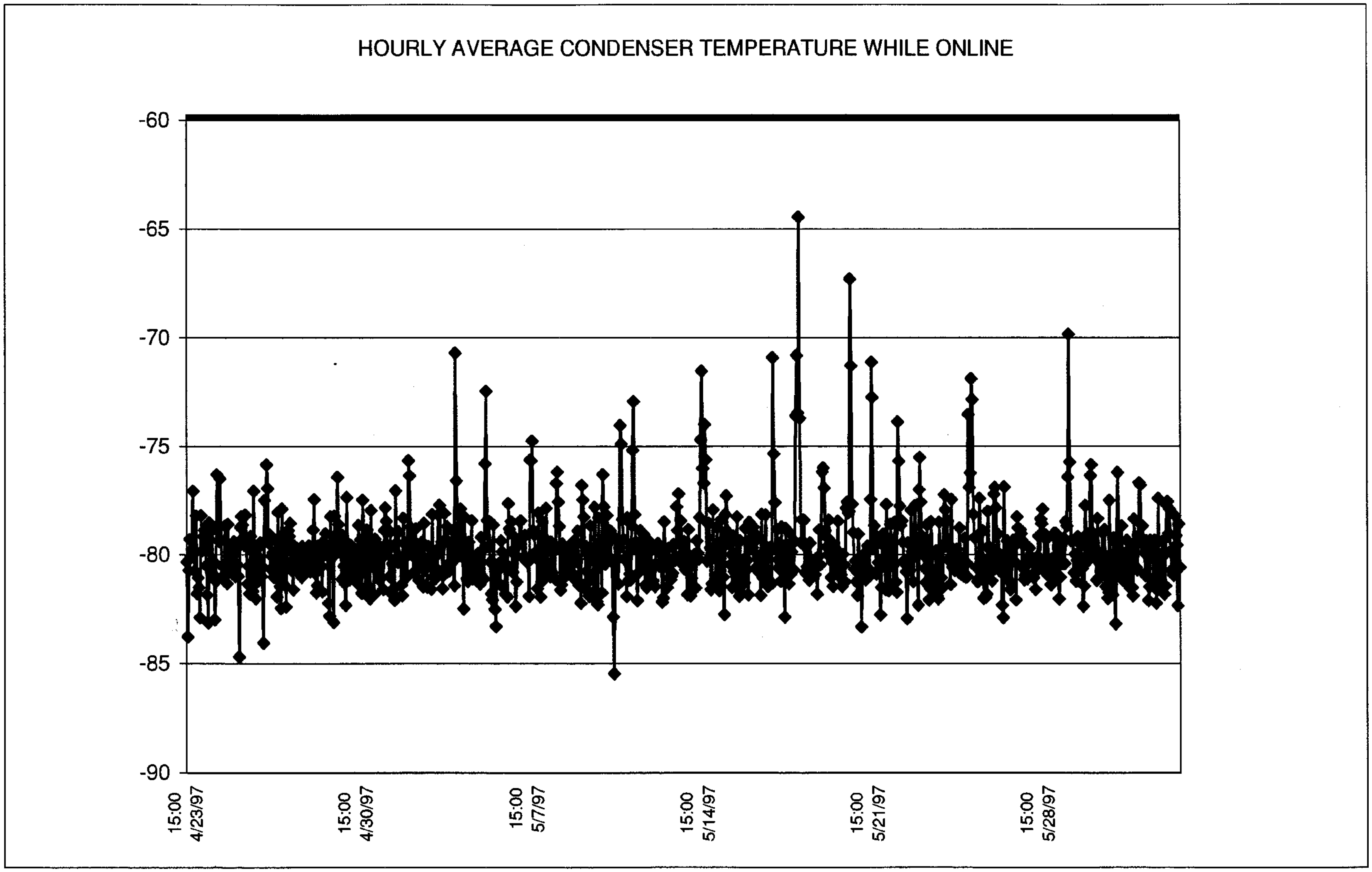
HOURLY AVERAGE CONDENSER TEMPERATURE WHILE ONLINE
-60
-65
-70
-75
-80
-85
-90
15:00 4/23/97
15:00 4/30/97
15:00 5/7/97
15:00 5/14/97
15:00 5/21/97
15:00 5/28/97

Figure A.3-1.

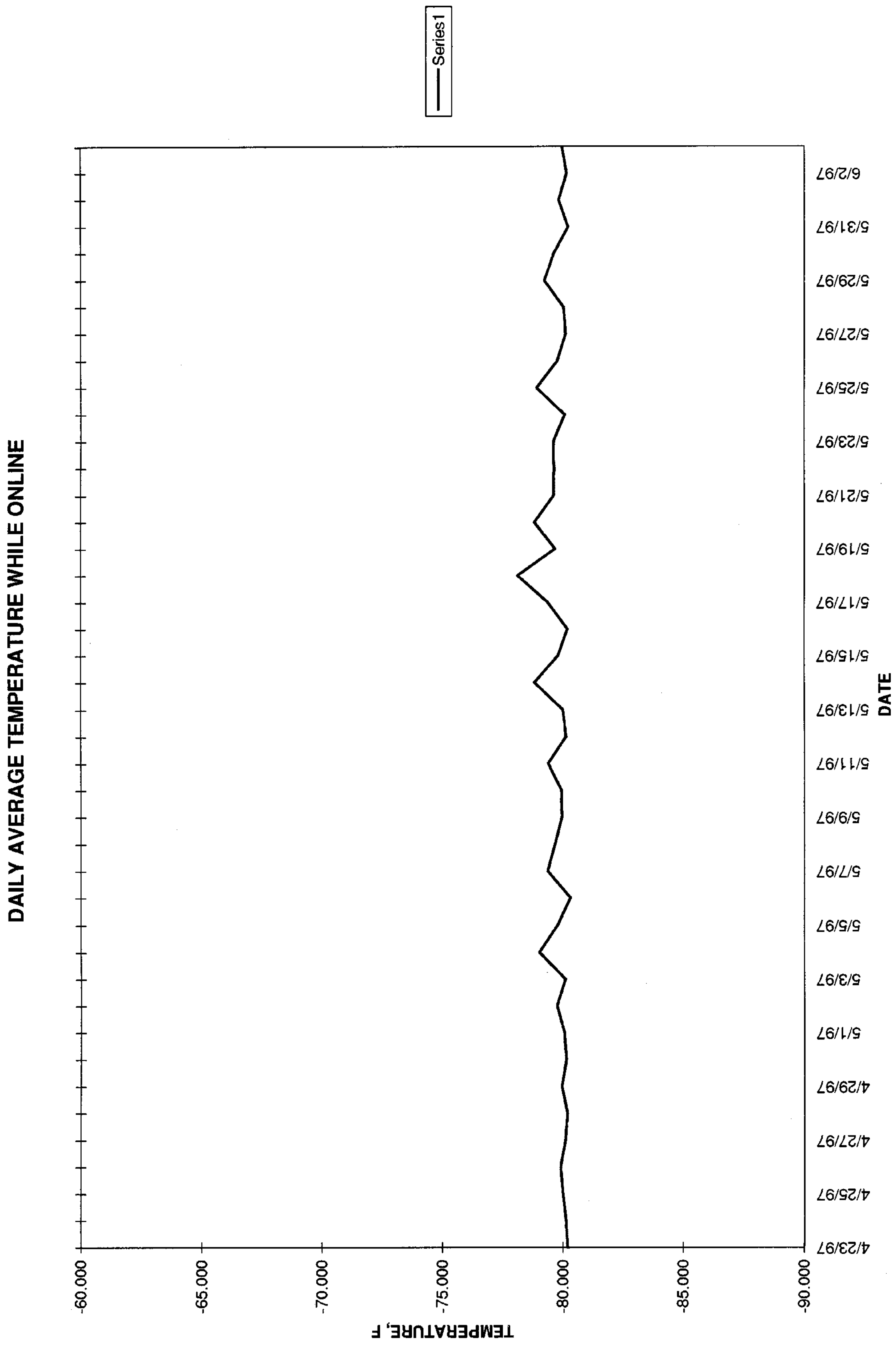
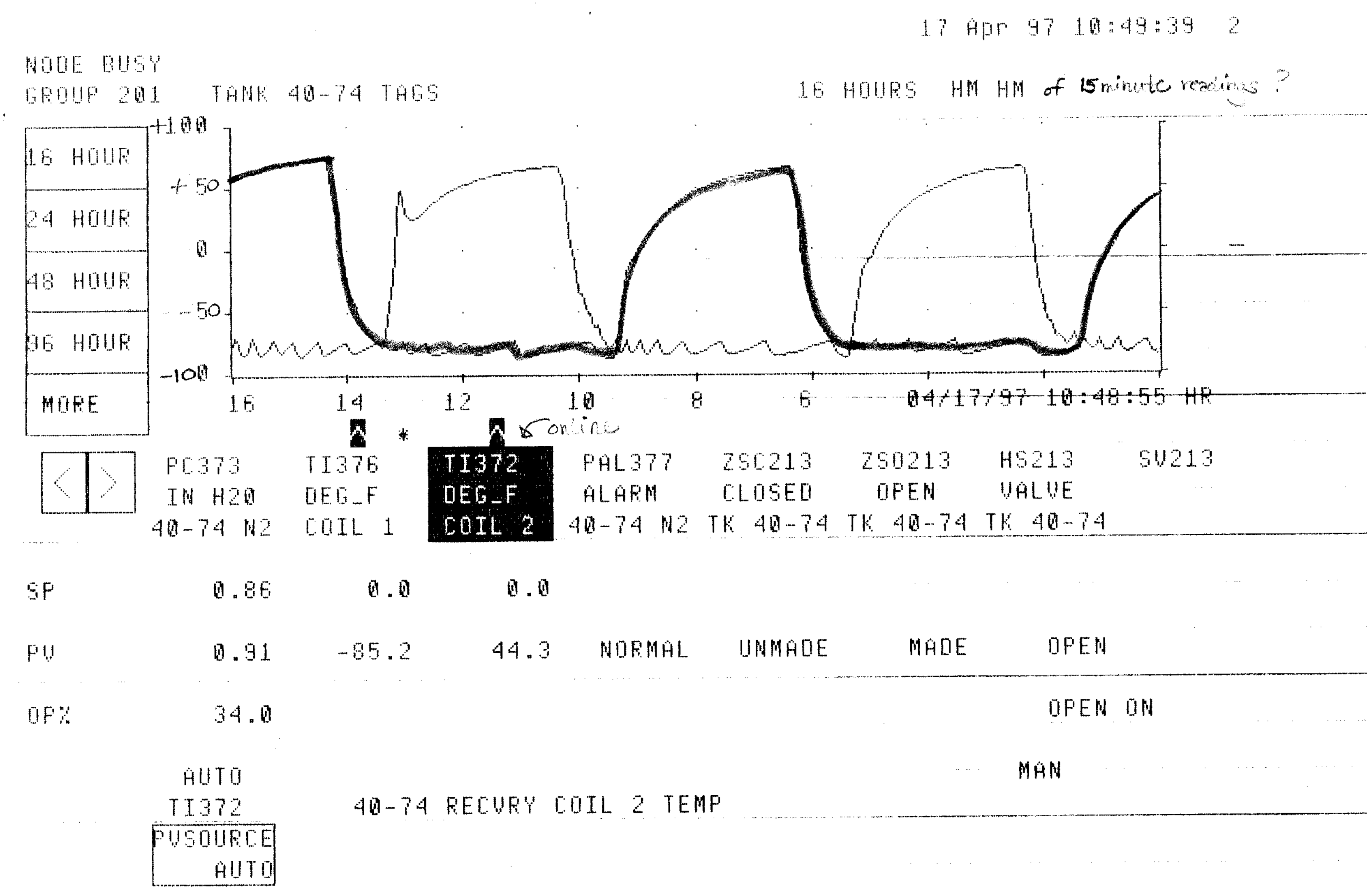

DAILY AVERAGE TEMPERATURE WHILE ONLINE
Series1
TEMPERATURE, F
-60.000
-65.000
-70.000
-75.000
-80.000
-85.000
-90.000
DATE
4/23/97
4/25/97
4/27/97
4/29/97
5/1/97
5/3/97
5/5/97
5/7/97
5/9/97
5/11/97
5/13/97
5/15/97
5/17/97
5/19/97
5/21/97
5/23/97
5/25/97
5/27/97
5/29/97
5/31/97
6/2/97

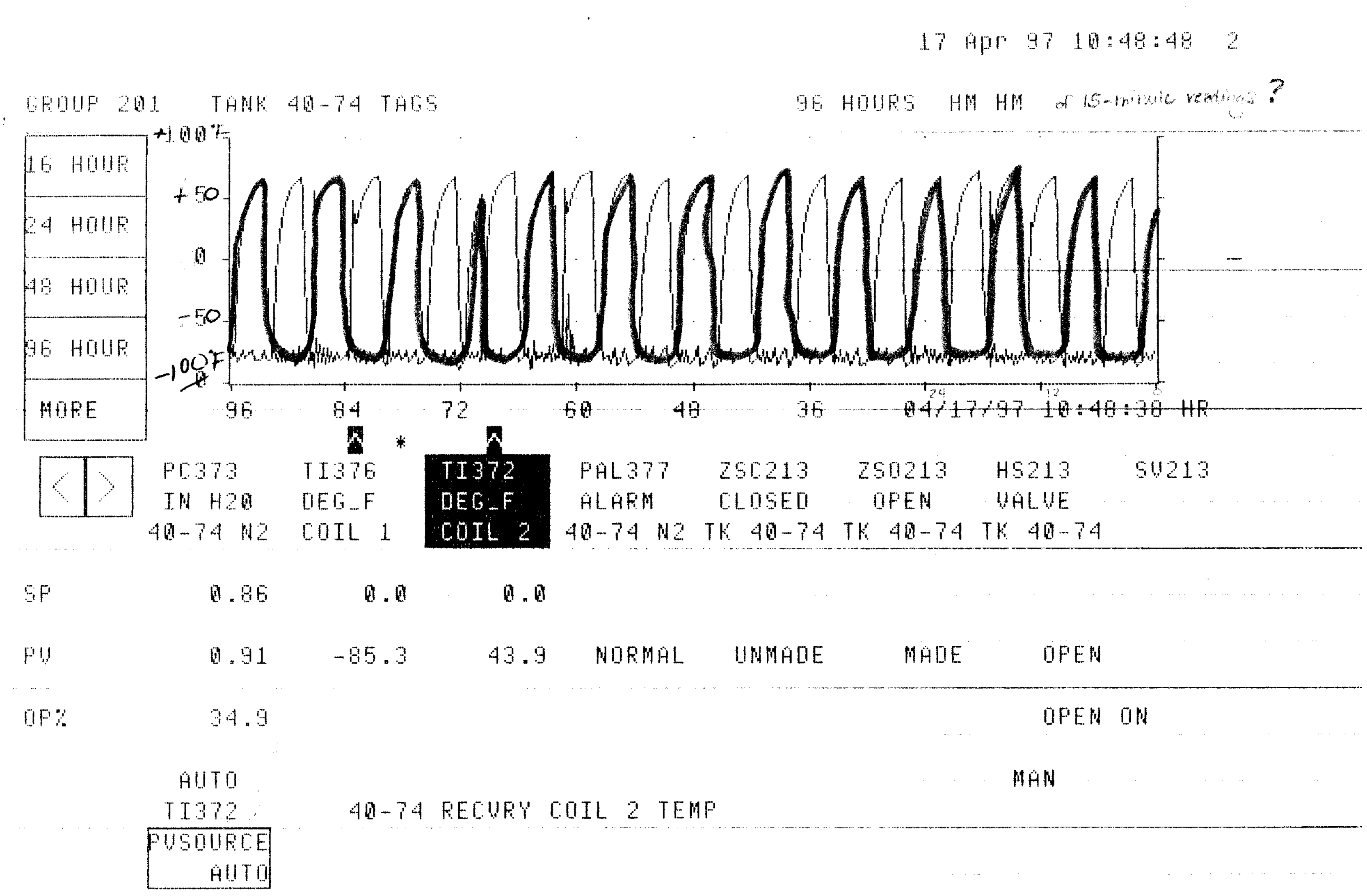
Figure A.3-2



```
                                                          17 Apr 97 10:49:39  2
NODE BUSY
GROUP 201   TANK 40-74 TAGS                             16 HOURS   HM HM

16 HOUR
24 HOUR
48 HOUR
96 HOUR
MORE
                                                04/17/97 10:48:55 HR

< >  PC373     TI376     TI372     PAL377    ZSC213    ZS0213    HS213     SV213
     IN H20    DEG_F     DEG_F     ALARM     CLOSED    OPEN      VALVE
     40-74 N2  COIL 1    COIL 2    40-74 N2 TK 40-74 TK 40-74 TK 40-74

SP       0.86      0.0       0.0

PV       0.91     -85.2      44.3     NORMAL    UNMADE    MADE      OPEN

OP%      34.0                                                       OPEN ON

         AUTO                                                      MAN
         TI372     40-74 RECVRY COIL 2 TEMP
        PVSOURCE
            AUTO
```

of 15 minute readings ?

Figure A.3-3.



17 Apr 97 10:48:48 2

GROUP 201 TANK 40-74 TAGS 96 HOURS HM HM

04/17/97 10:48:30

	PC373 IN H20 40-74 N2	TI376 DEG_F COIL 1	TI372 DEG_F COIL 2	PAL377 ALARM 40-74 N2 TK	ZSC213 CLOSED 40-74 TK	ZSO213 OPEN 40-74 TK	HS213 VALVE 40-74	SV213
SP	0.86	0.0	0.0					
PV	0.91	-85.3	43.9	NORMAL	UNMADE	MADE	OPEN	
OP%	34.9						OPEN ON	
	AUTO						MAN	

TI372 40-74 RECVRY COIL 2 TEMP

PVSOURCE AUTO

Figure A.3-4.

A.4 SCRUBBER FOR VOC CONTROL--FACILITY D

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EXAMPLE COMPLIANCE ASSURANCE MONITORING: SCRUBBER FOR VOC CONTROL--FACILITY D

I. Background

A. Emissions Unit

Description:	Process tanks
Identification:	B-352-1, Vent A
Facility:	Facility D Anytown, USA

B. Applicable Regulation, Emission Limit and Monitoring Requirements

Regulation No.:	Permit
Regulated pollutant (PSEU)	VOC
Emission limit:	99 percent reduction
Monitoring requirements:	Continuously monitor water flow rate.

C. Control Technology: Packed bed scrubber

II. Monitoring Approach

The key elements of the monitoring approach for VOC, including the indicators to be monitored, indicator ranges, and performance criteria, are presented in Table A.4-1.

TABLE A.4-1. MONITORING APPROACH

	Permit Indicator No. 1
I. Indicator	Water flow rate
Measurement Approach	The water flow rate is monitored with an orifice plate and differential pressure gauge.
II. Indicator Range	An excursion is defined as a daily average scrubber water flow rate of less than 1.2 gal/min. Excursions trigger an inspection, corrective action, and a reporting requirement.
III. Performance Criteria A. Data Representativeness[a]	The orifice plate is installed in the scrubber water inlet line. The minimum accuracy is ± 0.05 gal/min.
B. Verification of Operational Status	NA
C. Quality Assurance and Control Practices	Weekly zero and quarterly upscale pressure check of transmitter.
D. Monitoring Frequency	Measured continuously.
Data Collection Procedures	Recorded once per minute.
Averaging Period	Hourly averages of 60 1-minute flow rates are calculated. A daily average of all hourly readings is calculated and recorded.

[a] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

JUSTIFICATION

I. Background

The PSEU includes the tanks in the acetic anhydride department. Emissions from seven tanks are vented to a packed bed water scrubber. Six of these tanks are batch filled and one is continuously filled. The scrubber is used to reduce VOC emissions. Maximum emissions from these tanks are 39 lb/hr. Based on the PSEU design, bypass of the control device is not possible.

II. Rationale for Selection of Performance Indicators

The emissions from the process tanks are controlled using a packed bed water scrubber using once-through water. The performance indicator selected is liquid flow to the scrubber. To achieve the required emission reduction, a minimum water flow rate must be supplied to absorb the given amount of VOC in the gas stream, given the size of the tower and height of the packed bed. The L/G ratio is a key operating parameter of the scrubber. If the L/G ratio decreases belowz the minimum, sufficient mass transfer of the pollutant from the gas phase to the liquid phase will not occur. The minimum liquid flow required to maintain the proper L/G ratio at the maximum gas flow and vapor loading through the scrubber can be determined. Maintaining this minimum liquid flow, even during periods of reduced gas flow, will ensure the required L/G ratio is achieved at all times.

III. Rationale for Selection of Indicator Ranges

The minimum water flow is based on engineering calculations using ASPEN® programming and historical data. Computer simulation (modeling) of the scrubber system was performed for the maximum gas flow rate and VOC loading to the scrubber; the water flow rate necessary for achieving control at this gas flow rate was determined. The scrubber was modeled using an equilibrium-based distillation method and two ideal stages were assumed. Ideal behavior of the gas phase was assumed; liquid phase activity coefficients were estimated from an in-house vapor-liquid equilibria data base (parameters regressed from actual vapor-liquid equilibria data and UNIFAC) using the Wilson equations for binary systems. The minimum water flow rate to the scrubber (calculated based on maximum VOC emissions and gas flow rate) was determined to be 1.1 gal/min. The water flow rate to the scrubber must be maintained at this level or higher to achieve 99 percent emission reduction.

Monitoring data were reviewed to determine the minimum scrubber water flow rate maintained during normal operation of the process tanks and scrubber. Daily average data for a 60-day period (January 17 through March 17, 1997) were reviewed. The daily average flow rate ranges from 1.18 to 1.39 gal/min with 95 percent of the values equal to or greater than 1.2 gal/min; if values greater than 1.15 are rounded to 1.2, then 100 percent of the daily averages are equal to or greater than 1.2 gal/min. Attachment 1 lists the daily average values for the 60-day period. Hourly average data for a 30-day period (February 17 through March 17) also were reviewed. The hourly averages for this period range from 1.19 to 1.21. The scrubber has been consistently operated with both the hourly and daily average water flow rate equal to or greater than 1.2 gal/min.

The selected indicator range is a minimum daily average water flow rate of 1.2 gal/min (defined as greater than 1.15 gal/min). When an excursion occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported. The indicator range was selected by establishing the excursion level at the minimum water flow rate that has been established as the operational level and has been consistently maintained at all times as indicated by 2 months of monitoring data. This water flow rate is above the minimum level (1.1 gal/min) necessary to achieve compliance during maximum gas flow and VOC loading to the scrubber, as established through modeling. A daily average, rather than an hourly average, was selected for the indicator range because the historical data indicate that the flow rate is very constant with little hourly variation. Consequently, the daily average is a sufficient indicator of performance. No performance test has been conducted on the scrubber.

Attachment 1.
Daily average water flow to Vent A scrubber in gal/min.

DATE	TIME	32FC80
01/17/97	0:00	1.183
01/18/97	0:00	1.392
19/97	0:00	1.211
01/20/97	0:00	1.200
01/21/97	0:00	1.200
01/22/97	0:00	1.200
01/23/97	0:00	1.200
01/24/97	0:00	1.200
01/25/97	0:00	1.200
01/26/97	0:00	1.200
01/27/97	0:00	1.200
01/28/97	0:00	1.200
01/29/97	0:00	1.200
01/30/97	0:00	1.200
01/31/97	0:00	1.200
02/01/97	0:00	1.200
02/02/97	0:00	1.200
02/03/97	0:00	1.200
02/04/97	0:00	1.200
02/05/97	0:00	1.200
02/06/97	0:00	1.200
02/07/97	0:00	1.200
02/08/97	0:00	1.200
02/09/97	0:00	1.200
02/10/97	0:00	1.200
02/11/97	0:00	1.200
02/12/97	0:00	1.200
13/97	0:00	1.200
02/14/97	0:00	1.200
02/15/97	0:00	1.200
02/16/97	0:00	1.200
02/17/97	0:00	1.200
02/18/97	0:00	1.200
02/19/97	0:00	1.200
02/20/97	0:00	1.200
02/21/97	0:00	1.200
02/22/97	0:00	1.200
02/23/97	0:00	1.200
02/24/97	0:00	1.199
02/25/97	0:00	1.200
02/26/97	0:00	1.200
02/27/97	0:00	1.200
02/28/97	0:00	1.200
03/01/97	0:00	1.200
03/02/97	0:00	1.200
03/03/97	0:00	1.200
03/04/97	0:00	1.200
03/05/97	0:00	1.200
03/06/97	0:00	1.200
03/07/97	0:00	1.200
03/08/97	0:00	1.200
03/09/97	0:00	1.200
0/97	0:00	1.200
03/11/97	0:00	1.200
03/12/97	0:00	1.200
03/13/97	0:00	1.200
03/14/97	0:00	1.199
03/15/97	0:00	1.200
03/16/97	0:00	1.200
03/17/97	0:00	1.200

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A.5 CARBON ADSORBER FOR VOC CONTROL–FACILITY E

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EXAMPLE COMPLIANCE ASSURANCE MONITORING:
CARBON ADSORBER FOR VOC CONTROL--FACILITY E

I. Background

A. Emissions Unit

Description:	Chemical Process
Identification:	NA
Facility:	Facility E Anytown, USA

B. Applicable Regulation, Emission Limit, and Monitoring Requirements

Regulation No.:	Permit
Regulated pollutant (PSEU):	VOC
Emission limit:	95 percent reduction by cycle
Monitoring requirements:	Continuously monitor inlet and outlet VOC concentration.

C. Control Technology: Three carbon adsorbers

II. Monitoring Approach

The key elements of the monitoring approach for VOC, including the indicators to be monitored, indicator ranges, and performance criteria, are presented in Table A.5-1.

TABLE A.5-1. MONITORING APPROACH

I. Indicator	VOC removal efficiency
Measurement Approach	The inlet and outlet VOC concentrations are monitored with VOC analyzers.
II. Indicator Range	An excursion is defined as an efficiency less than 95.5 percent for each bed cycle. Excursions trigger an inspection, corrective action, and a reporting requirement.
QIP Threshold[a]	Six excursions per semiannual reporting period.
III. Performance Criteria	
A. Data Representativeness[b]	Two analyzers are installed on the carbon adsorber, one at the inlet and one at the outlet vent. The minimum accuracy is ±1 percent of span.
B. Verification of Operational Status	NA
C. Quality Assurance and Control Practices	Monthly calibration is performed on the analyzers using calibration gas. Maximum calibration drift is ±2.5 percent of span. Operators may request that additional calibration checks be performed in between the scheduled monthly checks. Monthly health checks of the monitors are also performed. Annual preventive maintenance procedures are performed.
D. Monitoring Frequency	VOC concentrations are measured every 2 minutes.
Data Collection Procedures	Efficiencies are determined (based on VOC concentration measurements) and recorded every 2 minutes.
Averaging Period	Average efficiencies are determined by cycle, per bed for tracking of the bed efficiency.

[a] Note: The QIP is an optional tool for States; QIP thresholds are not required in the CAM submittal.

[b] Values listed for accuracy specifications are specific to this example and are not intended to provide the criteria for this type of measurement device in general.

JUSTIFICATION

I. Background

Emissions from the chemical process are vented to three carbon adsorber beds in parallel. The emissions are vented to one or two of the three carbon adsorbers at all times; one or two beds are online while the other(s) is regenerating. The carbon adsorbers are used to recover VOC. Bypass of the control device is not possible based on the PSEU design.

II. Rationale for Selection of Performance Indicators

VOC emissions from the chemical process are recovered with three carbon adsorbers in parallel. Monitoring of the inlet and outlet VOC concentration to calculate the recovery efficiency of the control device has been selected as the monitoring approach. This monitoring method is a direct measure of the control device performance and provides the best assurance that the carbon beds are operating properly. A decline in recovery efficiency indicates reduced performance of the carbon adsorber. For this system, maintaining a high recovery efficiency is desirable because the recovered VOC is reused in the process. The facility opted to install VOC CEMS that provide a direct measure of recovery efficiency. This information allows the facility to maximize VOC recovery.

III. Rationale for Selection of Indicator Ranges

The selected indicator range is “greater than 95.5 percent efficiency for each carbon bed cycle.” No upper indicator range limit is necessary. When an excursion occurs corrective action will be initiated, beginning with an evaluation of the occurrence to determine the action required to correct the situation. All excursions will be documented and reported. The selected QIP threshold level is six excursions per bed per semiannual reporting period. (Note: Establishing a proposed QIP threshold in the monitoring submittal is optional.) This level is less than 0.5 percent of the number of bed cycles in a semiannual reporting period. If the QIP threshold is exceeded in a semiannual reporting period, a QIP will be developed and implemented.

To monitor and evaluate performance, the carbon bed efficiency of each cycle for each bed is charted and evaluated using statistical techniques. The average and the upper and lower control limits (±3 standard deviations) are graphed. The process target level is 96 percent efficiency. The indicator range has been established at a level that is above the emission limitation (95 percent efficiency) but below the lower control limit during normal operating conditions.

Monitoring data were reviewed to determine whether the control efficiency is maintained during normal operation of the process and carbon adsorber. The average recovery efficiency per online cycle and the average daily efficiency for a 16-day period (May 6 to May 21, 1997) were reviewed for carbon bed 12; a total of 181 cycles for bed 12 were completed in these 16 days.

The cycle efficiency data are presented in Figure A.5-1. The average cycle efficiency ranged from 95.5 to 96.6 percent.

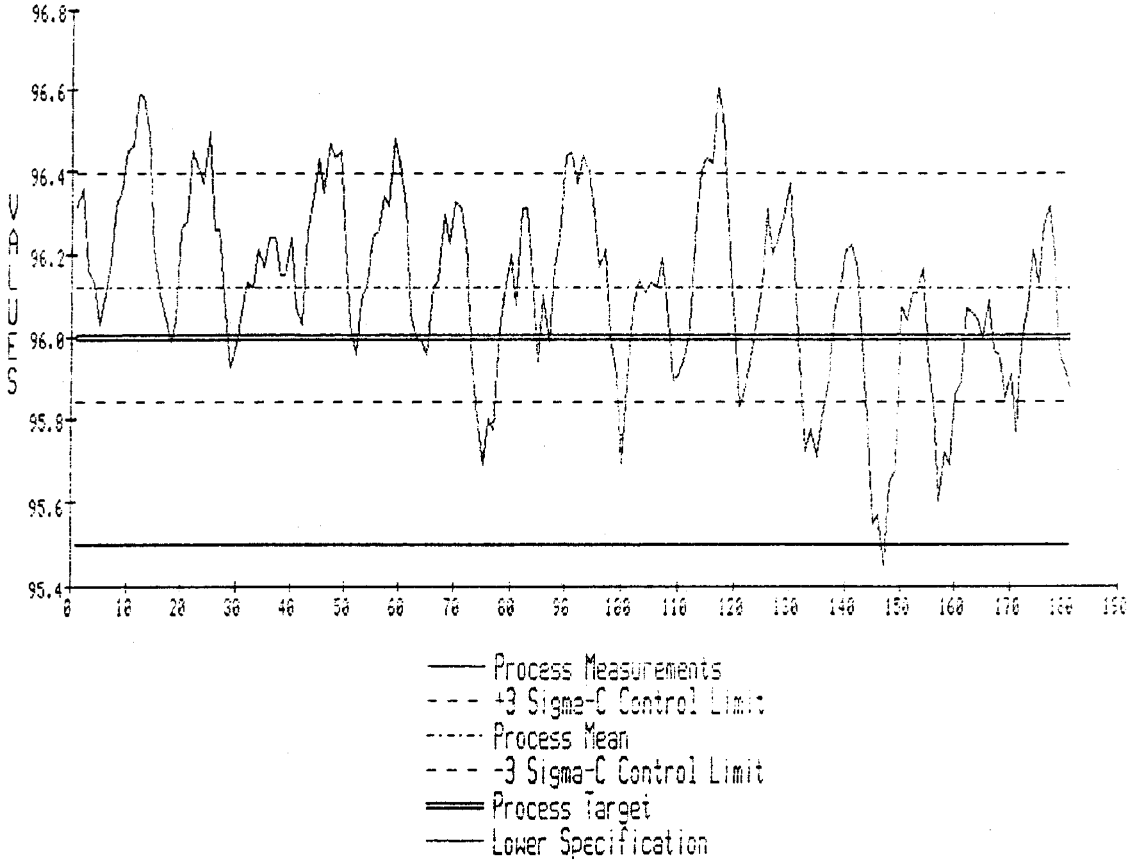
The upper and lower control limits (3 standard deviations) are 96.4 and 95.8 percent, respectively. During this 16-day period the selected indicator range of 95.5 percent (identified as the "lower specification" in Figure A.5-1) was exceeded once; i.e., one excursion occurred.

The daily average efficiencies are presented in Figure A.5-2. The daily average efficiencies ranged from 95.8 to 96.3 percent. During this 16-day period, the carbon adsorber bed was consistently operating with a recovery efficiency greater than or equal to 95 percent.

No performance test has been conducted on this control device and a performance test is not planned for the purpose of establishing the indicator range. The control efficiency is determined based upon the relative measurement of the inlet and outlet concentrations.

The monitors are calibrated monthly using calibration standards comprised of the single VOC present in the exhaust stream. Monthly calibrations were found to be sufficient based on calibration drift data collected over a 1 year period. These data indicate that calibration readings are consistent from month to month and rarely drift by more than ±2.5 percent of the span value.

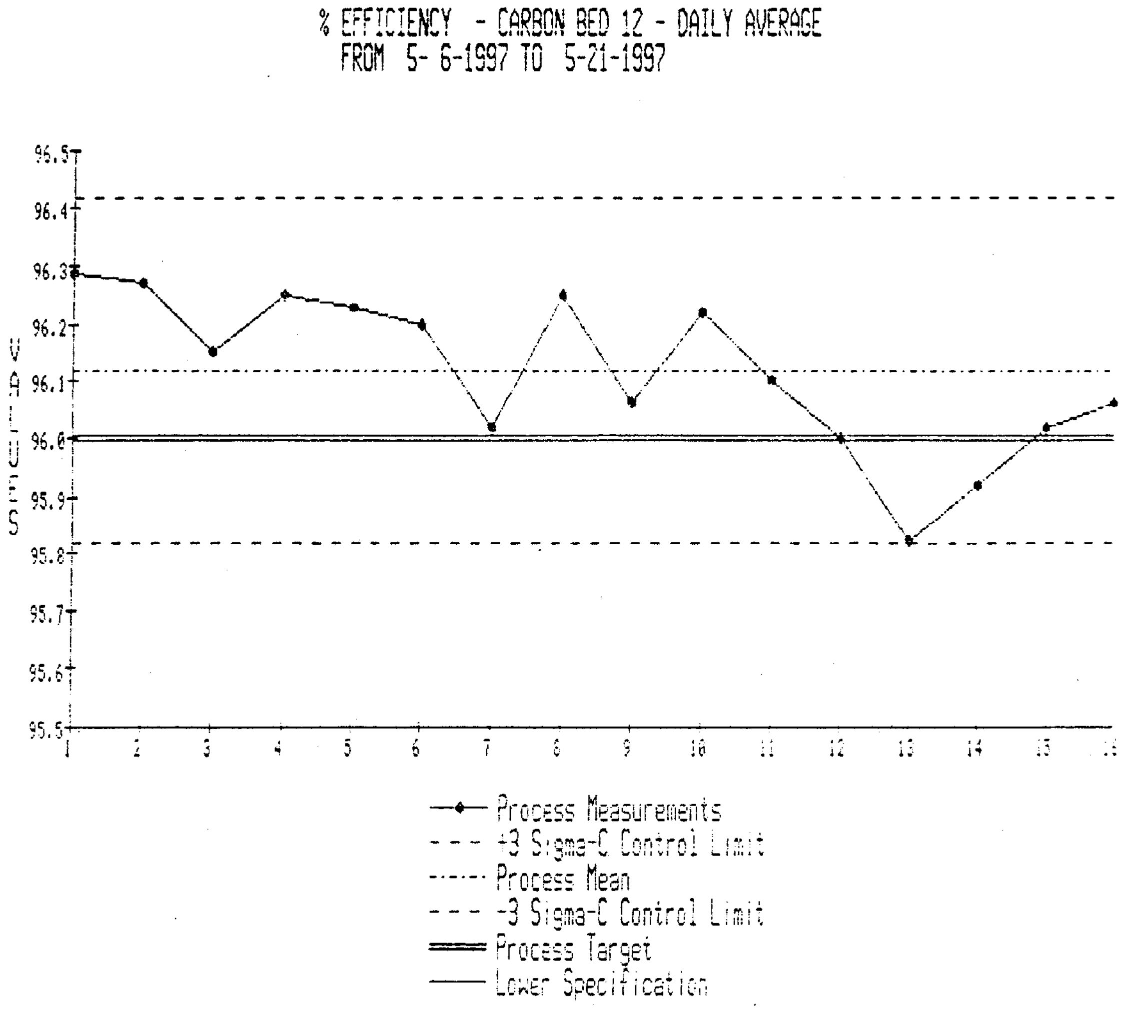
% EFFICIENCY - CARBON BED 12 - BY CYCLE
FROM 5- 6-1997 TO 5-21-1997



```
44 Points (24.3%) Out-of-Control: 10 11 12 13 14 22 23 25 45 47 48 49 59 60 74 75 76 77 90 91 93 94 100
1 Points (0.6%) Out-of-Spec: 147


Upper Control Limit     96.3931             Points > UCL   23
Process Average         96.1191             Points < LCL   21
Lower Control Limit     95.8451             Points > USL    0
Upper Specification        None             Points < LSL    1
Process Target          96.0000             Cycling ?     Yes
Lower Specification     95.5000             Run of 8 ?    Yes
Sigma-S                  0.2256
Sigma-C                  0.0913
Sigma-S / Sigma-C        2.4705
N                      181.0000
```

Figure A.5-1.



Points Out-of-Control: none
Points Out-of-Spec: none

Upper Control Limit	96.4159
Process Average	96.1162
Lower Control Limit	95.8166
Upper Specification	None
Process Target	96.0000
Lower Specification	95.5000
Sigma-S	0.1382
Sigma-C	0.0999
Sigma-S / Sigma-C	1.3834
N	16.0000

Points > UCL	0
Points < LCL	0
Points > USL	0
Points < LSL	0
Cycling ?	No
Run of 8 ?	No

Figure A.5-2.

A.6 CATALYTIC OXIDIZER FOR VOC CONTROL–FACILITY F (TO BE COMPLETED)

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A.7 CATALYTIC OXIDIZER FOR VOC CONTROL–FACILITY G
(TO BE COMPLETED)

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