

# EMISSION TESTING REQUIREMENTS FOR THE REFRACTORY PRODUCTS NESHAP

## I. Introduction

The national emission standards for hazardous air pollutants (NESHAP) for refractory products manufacturers were finalized on April 16, 2003 (Federal Register Volume 68, Number 73, pages 18730–18785). The NESHAP include detailed requirements for emission testing for facilities that are subject to the standard. Because these requirements are complex, and vary by the type of product manufactured and the manufacturing process used for a particular product type, the U.S. Environmental Protection Agency (EPA) has developed this guidance on emission testing.

The guidance in this document is presented in two sections. The first section presents testing requirements for facilities that manufacture products containing organic hazardous air pollutants (HAP). The second section discusses testing requirements for facilities manufacturing clay refractory products. Each of these sections is further divided by manufacturing process. Both refractory products containing organic HAP and clay refractory products may be manufactured using either a continuous or batch process. Because the testing requirements vary depending upon the manufacturing process, we have included guidance for both continuous and batch processes. We have attempted to make each section self-contained, so that you do not have to search through a section that is not applicable to your operation for guidance. For example, if your facility only manufactures clay refractory products using a continuous process, all of the information you need should be contained in Section III.A.

Guidance for testing requirements for each product type and manufacturing process is presented in the form of a series of questions and responses. We have also incorporated tables and examples into the guidance. Where applicable, we have referenced the appropriate section of the rule that addresses each question so that you may also refer to the rule for additional information or clarification. Table 4 of the rule also summarizes testing requirements, so you may find additional guidance there.

It is important that before you begin any testing program that you perform a thorough maintenance check of your control device to ensure that it is operating correctly. You should also calibrate all monitoring systems that will be used to collect data for the purposes of establishing operating limits, such as temperature monitoring systems for an oxidizer or pressure drop monitoring systems for a scrubber. The performance test is critical for not only demonstrating compliance with the appropriate emission standards but also for establishing operating limits that you will use to demonstrate continuing compliance with the emission limits. Establishing operating limits that do not accurately reflect your operations may result in future violations of the standard. It is a good idea to do a “dry run” to ensure everything is operating correctly. This should help minimize problems when conducting the actual performance test.

**Tip for Meeting Your Reporting Requirements:**

The Office of Air Quality Planning and Standards is developing recommendations and options for electronic web-based reporting of environmental regulatory requirements and for direct reporting of data to EPA. As currently planned, CERTS will allow facilities to report NESHAP compliance requirements through EPA's Central Data Exchange (CDX) system. You can access more information on CERTS at the following website: <http://www.epa.gov/ttn/atw/certs/>

**II. Testing Requirements for Facilities Manufacturing Products Containing Organic HAP**

Facilities that are subject to these testing requirements include those manufacturing any of the following products:

- Resin-bonded refractory products
- Pitch-bonded refractory products
- Pitch-impregnated refractory products
- Other formed products that use additives that contain or form organic HAP.

The new and existing emission sources that are subject to these requirements include the following:

- Shape dryers
- Curing ovens
- Kilns
- Coking ovens
- Defumers.

New shape preheaters will also be subject to the emission limits presented in the rule and will therefore be subject to the same testing requirements.

As discussed earlier, testing requirements vary by the type of process used to manufacture the product. Testing procedures for facilities manufacturing the products listed above using a continuous process are presented in Section II.A. Facilities manufacturing products using a batch process have several options they may choose between to meet the testing requirements. Procedures and guidance for facilities manufacturing products using a batch process are presented in Section II.B.

**A. Guidance on Testing Requirements for Facilities Manufacturing Refractory Products Containing Organic HAP Using a Continuous Process**

Section 63.9824 of the NESHAP defines a continuous process as follows:

*“Continuous process means a process that operates continuously. In a continuous process unit, the materials or shapes that are processed are either continuously charged (fed) to and discharged from the process unit, or are charged and discharged at regular time intervals without the process unit being shut down. Continuous thermal process units, such as tunnel kilns, generally include temperature zones that are maintained at relatively constant temperature and through which the materials or shapes being processed are conveyed continuously or at regular time intervals.”*

Guidance on testing requirements for facilities manufacturing refractory products containing organic HAP using a continuous process is presented below.

1. Under what conditions should the testing be conducted?

For all emission tests, you are required to conduct the tests under conditions that result in the maximum organic HAP emissions. For continuous processes, the organic HAP emissions are a function of both the HAP content of the refractory product and the rate at which the refractory product is manufactured. The HAP content of the product is a function not only of the HAP content of the resin, binders, or other additives, but also of the amount of those constituents in the refractory mix. Following is an example calculation for a facility that manufactures two types of refractory products containing organic HAP.

*Example 1: Calculating the Organic HAP Processing Rate for a Continuous Process*

The example facility manufactures two types of resin-bonded refractory products. To determine which product they should manufacture during the test, the facility must determine the organic HAP processing rate for each product.

- Resin-bonded product 1—The curing rate for this product is 8,000 lbs/hr. The resin contains 10 percent phenol. The refractory mix contains 5 percent resin. Therefore, the total organic HAP processing rate is

$$8,000 \text{ lbs/hr} \times 5/100 \times 10/100 = 40 \text{ lbs/hr}$$

- Resin-bonded product 2—The curing rate for this product is 2,000 lbs/hr. The resin contains 5 percent phenol and 25 percent ethylene glycol. The refractory mix contains 3 percent resin. The organic HAP processing rate for phenol is

$$2,000 \text{ lbs/hr} \times 3/100 \times 5/100 = 3 \text{ lbs/hr}$$

- The organic HAP processing rate for ethylene glycol is

$$2,000 \text{ lbs/hr} \times 3/100 \times 25/100 = 15 \text{ lbs/hr}$$

Therefore, the total organic HAP processing rate for product 2 is 18 lbs/hour.

Of the two products, resin-bonded refractory product 1 has the higher organic HAP processing rate. Therefore, the facility should conduct all performance tests while manufacturing resin-bonded product 1, which is the product with the maximum organic HAP processing rate.

2. When is testing required?

Sections 63.9796 and 63.9798 of the rule specify when testing is required. If you own or operate an existing source, you must conduct your first emission test, known as the initial performance test, by October 14, 2006. New sources must conduct their initial performance test within 180 days of startup.

If you do not make any substantive changes to the operating limits established in your operation, maintenance, and monitoring plan; you are only required to conduct subsequent performance tests every five years. However, as a manufacturer of refractory products containing organic HAP, you are required to establish operating limits for the organic HAP processing rate and the control device operating parameters specified in your operation, maintenance, and monitoring plan. For example, if your affected source is controlled with a thermal oxidizer, you must establish an operating limit for the operating temperature of the thermal oxidizer combustion chamber; if your affected source is controlled with a catalytic oxidizer, you must establish an operating limit for the temperature at the inlet to the catalyst bed. If you change any of these operating limits you may be required to conduct an additional performance test.

If you begin to manufacture products with an organic HAP processing rate that exceeds the rate for the product you manufactured during your most recent performance test by more than 10 percent, you must conduct a new performance test while manufacturing that product. For example, if the example facility discussed above in Section II.A.1 begins manufacturing a product with an organic HAP processing rate of more than 44 lbs/hr (i.e.,  $40 \times 1.1$ ), then the facility would have to conduct a new performance test with that product. The performance test would establish a new operating limit for the maximum allowable organic HAP processing rate. This performance test should be done before the facility begins normal production of that product.

Other changes in operating limits may also trigger the need for a performance test. For example, if you established an operating limit for your thermal oxidizer of 1600°F and you decided to decrease the set point to 1500°F, then you would be required to conduct a performance test to ensure that you are still meeting the emission limits for that source at the reduced combustion chamber temperature.

The only other time you are required to conduct a performance test is if you have an uncontrolled kiln that is used to process products containing organic HAP and you decrease the operating temperature of the curing oven or shape dryer that precedes the kiln in the process line. If you decrease the operating temperature of the curing oven or shape dryer, fewer of the organics may be driven off or emitted from the oven or shape dryer. This may result in more of the organics being driven off in the kiln, thereby increasing kiln emissions. If the kiln is uncontrolled, total hydrocarbon (THC) emissions from the kiln could exceed 20 ppm. Therefore, you must retest the kiln to

ensure you are still meeting the emission limits. As is the case with all testing, you should retest the kiln while manufacturing the product with the maximum organic HAP processing rate. If the process changes to the curing oven or shape dryer have increased the THC concentration from the kiln to greater than 20 ppm, then you will have to add a control device to the kiln or make additional process changes to ensure the kiln is meeting the THC emission limit.

Table 1 summarizes the schedule for performance test requirements for facilities manufacturing refractory products containing organic HAP.

**Table 1. Performance Test Schedule For Facilities Manufacturing Products Containing Organic HAP**

Emission source	Reason for testing	Schedule
Each curing oven, shape dryer, kiln, coking oven, defumer, and new shape preheater	Initial performance test to demonstrate initial compliance with standard	For existing sources, must be conducted by October 14, 2006 For new sources, must be conducted within 180 days of startup
	Follow-up performance test to demonstrate continuing compliance with standard	At least every 5 years after initial performance test
	Demonstrate compliance after change in operating limits	Upon increase in maximum allowable organic HAP processing rate
	Demonstrate compliance after change in operating limits	Upon decrease in combustion chamber temperature of thermal oxidizer or catalyst bed inlet temperature of catalytic oxidizer
Uncontrolled kilns preceded by curing oven or shape preheater in the process line	Demonstrate compliance after change in process parameters	Upon decrease in operating temperature of curing oven or shape dryer that precedes the kiln in the process line

3. What pollutants and exhaust gas characteristics am I required to measure during the performance test and what test methods should I use?

The only pollutant you are required to measure during the test is THC. If you are planning to comply with the standard by meeting the THC concentration limits in the rule, you are required to measure the THC concentration only at the outlet of the control device or in the stack. However, if you are planning to comply with the standard by meeting the THC percentage reduction requirement in the rule, you must measure the THC concentration and determine the THC mass emissions rate at both the inlet and outlet of the control device.

During the test, you must also measure the gas velocity and volumetric flow rate, the gas molecular weight, and the gas moisture content. If you are demonstrating compliance with the THC concentration limits included in the rule, you must also measure the oxygen content of the exhaust gas. Table 2 presents the exhaust gas parameters that must be monitored during each test, the test method for each parameter, and the measurement frequency for each parameter.

**Table 2. Test Methods for Sources that Emit Organic HAP**

Exhaust gas parameter	Test method	Frequency
Total hydrocarbon concentration or mass emissions rate	EPA Method 25A <sup>a</sup>	Each minute during the test run
Gas velocity and volumetric flow rate	EPA Method 2, 2A, 2C, 2D, 2F, or 2G <sup>a</sup>	Each hour during the test run
Gas molecular weight	EPA Method 3, 3A, or 3B <sup>a</sup> ; or ASME PTC 19.10-1981-Part 10	As specified in the applicable test method
Gas moisture content	EPA Method 4 <sup>a</sup>	As specified in the applicable test method
Oxygen concentration <sup>b</sup>	EPA Method 3A <sup>a</sup>	Each minute during the test run

<sup>a</sup> Test methods can be found in 40 CFR part 60, appendix A.

<sup>b</sup> Only required for facilities choosing to comply with the standard by meeting the THC concentration limits.

4. How many test runs am I required to conduct?

For each performance test, you must conduct at least three test runs. Each test run must be at least 1 hour in duration.

5. What process parameters do I have to record for the test?

For each test run, you are required to record each of the following process parameters:

- The organic HAP content of all resins, binders, and additives used in the refractory product being manufactured using data from Method 311, material safety data sheets (MSDS), or product labels;
- The percentage by weight of each resin, binder, and additive in the refractory product being manufactured using data from MSDS or product labels;
- The production rate (e.g., pounds per hour) for the product being manufactured; and
- The operating temperature of the affected source (i.e., the oven, kiln, etc.) in the highest temperature zone using the thermocouple sensor of the affected source.

The organic HAP content of each constituent, the percentage of each constituent in the refractory product, and the production rate are all used to determine the organic HAP processing rate for the product being tested. The organic HAP content and percentage by weight of each resin, binder, and additive used in the refractory products to be processed generally are known prior to the start of the performance test. Therefore, you should record the value of these parameters prior to the start of the performance test. The actual production rate and operating temperatures of the affected source should be recorded during each test run of the performance test.

6. What control device parameters do I have to measure during each test?

If the emission source is equipped with a thermal oxidizer, you must measure and record the combustion chamber temperature of the oxidizer at least once every 15 minutes. If the source is equipped with a catalytic oxidizer, you must measure and record the temperature at the inlet of the catalyst bed at least once every 15 minutes. Note that this measurement must be performed at the inlet to the catalyst bed and not at the inlet to the oxidizer itself. After passing through the inlet to the oxidizer, the waste gases typically pass through a preheat zone, which raises the temperature to the minimum required for catalytic oxidization. You must monitor the catalyst bed inlet temperature between this preheat zone and the inlet to the catalyst bed.

7. How do I demonstrate compliance with the THC concentration limit using the data from the performance test?

To demonstrate compliance with the THC concentration limit using the performance test data, follow these steps:

- a. Calculate the average THC concentration for each hour of the performance test using the THC concentration values measured with EPA Method 25A.
- b. Calculate the average oxygen concentration for each hour of the test run.
- c. Using the average THC concentration and the average oxygen concentration for each hour, calculate the average THC concentration corrected to 18 percent oxygen, using the following equation (Equation 1, Section 63.9800(g)(1)):

$$C_{\text{THC-C}} = (2.9 \times C_{\text{THC}}) / (20.9 - C_{\text{O}_2})$$

where

$C_{\text{THC-C}}$  = THC concentration, corrected to 18 percent oxygen (parts per million by volume, dry basis [ppmvd])

$C_{\text{THC}}$  = THC concentration, uncorrected (ppmvd)

$C_{\text{O}_2}$  = oxygen concentration (percent)

Example 2 demonstrates the procedures you should follow using data from an example test run.

*Example 2: Demonstrating Compliance with the THC Concentration Limits Using the Performance Test Data for a Continuous Process*

Table 3 provides data for an example test run for a facility equipped with a thermal oxidizer. The data include the THC concentrations, the oxygen concentrations, and the combustion chamber temperature of the oxidizer during the 1-hour run.

Using the data presented in Table 3, calculate the hourly average THC concentration corrected to 18 percent oxygen. The uncorrected average THC concentration for the 1-hour test run is 14.9 ppmvd. The average oxygen concentration for the test run is 18.4 percent. Using Equation 1 provided in Section 63.9800(g)(1) of the rule, the corrected THC concentration for the test run is

$$C_{\text{THC-C}} = (2.9 \times 14.9)/(20.9-18.4) = 17.3 \text{ ppmvd}$$

Assuming the corrected THC concentrations for the other two runs are 15.2 ppmvd and 17.8 ppmvd, the average corrected THC concentration for the three test runs is 16.8 ppmvd. Therefore, the test indicates that the facility is in compliance with the emission limit of 20 ppmvd THC, corrected to 18 percent oxygen.

**Table 3. Example Test Run for Demonstrating Compliance With the THC Concentration Limits**

Time	THC concentration (ppmvd)	Oxygen concentration (percent)	Combustion chamber temperature (°F)
15:10	15	18	1540
15:11	16	19	
15:12	12	18	
15:13	18	17	
15:14	19	19	
15:15	20	17	
15:16	22	18	
15:17	21	18	
15:18	21	18	
15:19	22	19	
15:20	23	17	
15:21	20	17	
15:22	18	17	
15:23	17	17	
15:24	17	17	
15:25	16	19	1528
15:26	14	19	
15:27	14	20	
15:28	13	20	
15:29	10	20	
15:30	12	20	
15:31	12	18	
15:32	12	18	
15:33	12	18	
15:34	14	19	
15:35	14	17	
15:36	12	17	
15:37	9	17	

**Table 3. (continued)**

<b>Time</b>	<b>THC concentration (ppmvd)</b>	<b>Oxygen concentration (percent)</b>	<b>Combustion chamber temperature (°F)</b>
15:38	8	18	
15:39	8	19	
15:40	10	19	1538
15:41	12	19	
15:42	14	20	
15:43	15	21	
15:44	15	21	
15:45	17	18	
15:46	20	18	
15:47	21	19	
15:48	19	19	
15:49	18	19	
15:50	18	19	
15:51	16	19	
15:52	15	18	
15:53	15	17	
15:54	15	17	
15:55	14	17	1554
15:56	14	18	
15:57	13	18	
15:58	12	20	
15:59	12	19	
16:00	12	19	
16:01	11	19	
16:02	13	18	
16:03	13	17	
16:04	15	17	
16:05	15	19	
16:06	14	18	
16:07	12	18	
16:08	11	19	
16:09	10	17	1550
Average	14.9	18.4	1542

8. How do I demonstrate compliance with the percentage reduction requirement in the rule using the data from the performance test?

If you choose to meet the emission limits included in the rule by meeting the percentage reduction requirement of 95 percent, you must measure the THC concentration at the inlet and outlet of the control device. Using the 1-minute measurements for the test run and the volumetric flow rate values, calculate the pounds of THC emitted per hour for each hour of the test run at both the inlet and outlet. Using the inlet and outlet mass emission rates, calculate the percentage reduction

achieved by the control device using Equation 2 in Section 63.9800(g)(2). Following are two example calculations.

Example 3: Calculating the Percentage Reduction for the Control Device for a Continuous Process

Run 1

THC emission rate at inlet = 8.2 lb/hr

THC emission rate at outlet = 0.27 lb/hr

Percentage reduction =  $(8.2 - 0.27)/8.2 = 96.7$  percent reduction

Assuming percentage reductions for Runs 2 and 3 of 95.2 and 96.1 respectively, the average percentage reduction for the three test runs is 96 percent. Therefore, the results from the performance test demonstrate the facility is in compliance with the rule.

Example 4: Results from Compliance Test Indicate Noncompliance with the Percentage Reduction Limits for a Continuous Process

Run 1

THC emission rate at inlet = 4.5 lb/hr

THC emission rate at outlet = 0.51 lb/hr

Percentage reduction =  $(4.5 - 0.51)/4.5 = 88.7$  percent

Run 2

THC emission rate at inlet = 4.9 lb/hr

THC emission rate at outlet = 0.48 lb/hr

Percentage reduction =  $(4.9 - 0.48)/4.9 = 90.2$  percent

Run 3

THC emission rate at inlet = 5.3 lb/hr

THC emission rate at outlet = 0.47 lb/hr

Percentage reduction =  $(5.3 - 0.47)/5.3 = 91.1$  percent

In this example, the average THC percentage reduction for the three test runs is only 90.0 percent. This is less than the required reduction of 95 percent, so the performance test indicates the facility is not in compliance with the standard. This example demonstrates the importance of conducting a “dry run” to ensure everything is operating correctly. For example, the facility may need to operate its oxidizer at a higher temperature to ensure that it is achieving the 95 percent reduction requirement.

If the results of your performance test indicate that you are not complying with the emission limits, you should contact your permitting authority immediately. The permitting authority will address any failed compliance tests on a case-by-case basis.

9. What operating limits do I have to establish using the data from the performance test?

To demonstrate continuing compliance with the standard you must establish operating limits for the maximum organic HAP processing rate and the control device operating parameters specified in your operation, maintenance, and monitoring plan (OM&M plan). If your affected source is controlled with a thermal oxidizer, you must establish an operating limit for the operating temperature of the thermal oxidizer combustion chamber; if your affected source is controlled with a catalytic oxidizer, you must establish an operating limit for the temperature at the inlet to the catalyst bed. These operating limits must be established using the data collected during the performance test.

Section 63.9794 of the rule specifies what you should include in your OM&M plan. In summary, the OM&M plan should include a list of each affected source and its associated control device, monitoring system specifications, monitoring schedule, operating limits established for each parameter during the most recent performance test, maintenance procedures for the control device and CPMS components, and calibration procedures for the CPMS. The purpose of the OM&M plan is to establish routine procedures for you to use that will help you anticipate problems and identify problems quickly when they do arise. This should help you avoid violations of the standard.

10. How do I establish the operating limit for the maximum allowable organic HAP processing rate using the performance test data?

An example of how to calculate the organic HAP processing rate is provided in Section II.A.1 (Example 1). For each test run conducted during the performance test, you should calculate the organic HAP processing rate using the formulation data for any resins, binders, or additives used in the refractory product; the percentage of the HAP containing constituent in the refractory product; and the process feed rate (i.e., the pounds of product per hour). The maximum allowable organic HAP processing rate is the average of the organic HAP processing rates for the three test runs plus 10 percent. Following is an example of how to calculate the maximum organic HAP processing rate.

Example 5: Calculating the Maximum Allowable Organic HAP Processing Rate for a Continuous Process

Following up on the example provided earlier in Section II.A.1 (Example 1), the refractory product manufactured by the example facility that has the greatest potential HAP emission rate is resin-bonded refractory product 1. Therefore, the facility conducts the performance test while manufacturing this product. Although the concentration of phenol in the resin and the concentration of resin in the product is the same for each of the three test runs, the production rate varies slightly for each run. The organic HAP processing rate for each run is calculated as follows:

Run 1

Production rate is 8,100 lbs/hr

Organic HAP processing rate =  $8,100 \times 5/100 \times 10/100 = 40.5$  lbs/hr

Run 2

Production rate is 7,800 lbs/hr

Organic HAP processing rate =  $7,800 \times 5/100 \times 10/100 = 39$  lbs/hr

Run 3

Production rate is 8,250 lbs/hr

Organic HAP processing rate =  $8,250 \times 5/100 \times 10/100 = 41.3$  lbs/hr

Based on the average from the three test runs, the maximum organic HAP processing rate for the facility is 40.3 lbs/hr. Therefore, to demonstrate continuing compliance with the rule, the 3-hour average for the maximum allowable organic HAP processing rate must not exceed 44.3 lbs/hr. This is equivalent to the average for the three test runs, 40.3 lbs/hour, plus 10 percent ( $40.3 \times 1.1$ ). If you exceed the operating limit for the maximum allowable organic HAP processing rate, you must conduct another performance test to establish a new operating limit.

11. How do I establish the operating limit for the oxidizer temperature?

As discussed earlier, you must monitor the oxidizer temperature during each test run. If the emission source is controlled by a thermal oxidizer, you must monitor the combustion chamber temperature. If the emission source is controlled by a catalytic oxidizer, you must monitor the temperature at the inlet to the catalyst bed. You must monitor and record the temperature at least every 15 minutes during each test run.

The operating limit for the oxidizer temperature is based on the average temperature for the three test runs. For example, Table 3 (in Example 2, Section II.A.7) shows the combustion chamber temperatures for an example test run. The average temperature for the test run (i.e., Run 1) is 1542°F. If the average temperature for Run 2 is 1565°F and the average temperature for Run 3 is 1555°F, the average for the three test runs is 1554°F. The operating limit for the combustion chamber temperature is 1529°F, or 1554°F minus 25°F. The 25°F factor allows for minor fluctuations in thermal oxidizer operating temperature without triggering a violation of the operating limit. To demonstrate continuous compliance with the standard, the average combustion chamber temperature for any 3-hour rolling period must not be less than 1529°F.

12. My facility is planning to use either process changes or an alternative control device (i.e., not a thermal or catalytic oxidizer) to meet the emission limits. What are the testing requirements for my facility and how do I establish operating limits for my facility?

In general, the testing requirements for your facility are the same as those for other continuous processes presented in this section. However, the parameters for which you establish operating limits may be different than those discussed above (maximum organic HAP processing rate and oxidizer temperature). Section 63.9800(i)(2) of the rule addresses the requirements for facilities that plan to use process changes or a control device other than an oxidizer to meet the emission limits.

If you choose to use an alternative control device or you wish to propose an alternative monitoring method, it is your responsibility to develop a testing and continuous compliance plan. The test plan must include provisions for an emission test that clearly demonstrates that you are meeting the emission limits specified in the rule. If you propose an alternative monitoring method, the method must allow you to clearly demonstrate that you are in continuous compliance with the emission limits specified in the rule.

If you are planning to use alternative methods to meet the emission limits, you must submit a request for approval of alternative monitoring methods to the Administrator. This request must include a list of the operating parameters that will be monitored during the performance test and a description of how you will establish operating limits using the operating parameter data from the performance test. If you exceed those operating limits, you will have to perform another performance test to demonstrate that you are still in compliance with the emission limits.

## **B. Guidance on Testing Requirements for Manufacturers of Products Containing Organic HAP Using a Batch Process**

Section 63.9824 of the NESHAP defines a batch process as follows:

*“Batch process means a process in which a set of refractory shapes is acted upon as a single unit according to a predetermined schedule, during which none of the refractory shapes being processed are added or removed. A batch process does not operate continuously.”*

If you are manufacturing refractory products containing organic HAP using a batch process, you may choose from several options in meeting the performance test requirements of the rule. These options and other guidance on testing requirements are presented below.

1. Under what conditions should testing be conducted?

For all emission tests, you are required to conduct the tests under conditions that will result in the maximum organic HAP emissions. For batch processes, the organic HAP emissions are a function of the HAP content of the refractory product, the amount of product produced during the batch, the process temperature, and the batch cycle time. However, in the rule, the only parameters that you must consider in determining the organic HAP processing rate are the HAP content of the product and the amount of product produced during the batch.

The HAP content of the refractory product is a function not only of the HAP content of the resins, binders, or other additives but also of the amount of those constituents in the refractory mix. Following is an example calculation for a facility that manufactures two types of refractory products containing organic HAP using a batch process.

*Example 6: Calculating the Organic HAP Processing Rate for a Batch Process*

The facility manufactures two types of pitch-bonded refractory products. To determine which product it should manufacture during the test, the facility must determine the organic HAP processing rate for each product.

- Pitch-bonded product 1—Each batch of pitch-bonded product 1 is 8.5 tons or 17,000 lbs. The pitch is assumed to consist of 100 percent polycyclic organic matter (POM). The refractory mix contains 8 percent pitch. The organic HAP processing rate for POM is

$$17,000 \text{ lbs/batch} \times 8/100 = 1,360 \text{ lbs/batch}$$

- Pitch-bonded product 2—Each batch of pitch-bonded product 2 is 12 tons or 24,000 lbs. The pitch is assumed to consist of 100 percent POM. The refractory mix contains 5 percent pitch. Therefore, the total organic HAP processing rate is

$$24,000 \text{ lbs/batch} \times 5/100 = 1,200 \text{ lbs/batch}$$

Of the two pitch-bonded products, product 1 has the highest organic HAP processing rate. Therefore, the facility should conduct all performance tests

while manufacturing pitch-bonded product 1, which is the product with the maximum organic HAP processing rate.

2. When is testing required?

Sections 63.9796 and 63.9798 of the rule specify when testing is required. If you own or operate an existing source, you must conduct your first emission test, known as the initial performance test, by October 14, 2006. New sources must conduct their initial performance test within 180 days of startup.

If you do not make any substantive changes to the operating limits established in your OM&M (see Section 63.9794 for details on what information should be included in your OM&M plan), you are only required to conduct subsequent performance tests every 5 years. However, as a manufacturer of refractory products containing organic HAP, you are required to establish operating limits for the maximum allowable organic HAP processing rate and the control device operating parameters specified in your operation, maintenance, and monitoring plan. For example, if your affected source is controlled with a thermal oxidizer, you must establish an operating limit for the operating temperature of the thermal oxidizer combustion chamber; if your affected source is controlled with a catalytic oxidizer, you must establish an operating limit for the temperature at the inlet to the catalyst bed. If you change any of these operating limits you will be required to conduct a new performance test.

If you begin to manufacture a product with an organic HAP processing rate that exceeds the rate for the product that you manufactured during your most recent performance test by more than 10 percent, that is, the organic HAP processing rate is greater than the maximum allowable organic HAP processing rate, you must conduct a new performance test while manufacturing that product. For example, if the example facility discussed above in II.B.1 (Example 6) begins manufacturing a product with an organic HAP processing rate that is 10 percent or more greater than pitch-bonded product 1 (in this example, 1,360 x 1.1 or 1,496 lbs/batch) the facility would have to conduct a new performance test with that product. The performance test would be used to establish a new operating limit for the maximum allowable organic HAP processing rate. The facility would have to conduct the performance test before they begin normal production of the product.

Other changes in operating limits may also trigger the need for a new performance test. For example, if you established an operating limit for your thermal oxidizer of 1560°F and you decided to decrease the set point to 1475°F, you would be required to conduct a new performance test to ensure that you are still meeting the emission limits for that source at the reduced combustion chamber temperature.

The only other time you are required to conduct a performance test is if you have an uncontrolled kiln that is used to process refractory products containing organic HAP and you decrease the operating temperature or batch cycle time of the curing oven or shape dryer that precedes the kiln in the process line. If you decrease the operating

temperature or batch cycle time of the curing oven or shape dryer, fewer of the organics may be driven off or emitted from the oven or dryer. This may result in more of the organics being driven off in the kiln, thereby increasing kiln emissions. If the kiln is uncontrolled, the total hydrocarbon (THC) concentration from the kiln could exceed 20 ppm. Therefore, you must retest the kiln to ensure you are still meeting the emission limits. As is the case with all testing, you should retest the kiln while manufacturing the product with the maximum organic HAP processing rate. If the process changes to the curing oven or shape dryer have increased the THC concentration from the kiln to greater than 20 ppm, then you will have to add a control device to the kiln or make additional process changes to ensure the kiln is meeting the THC emission limit.

Table 4 summarizes the schedule for the performance test requirements for facilities manufacturing refractory products containing organic HAP using a batch process.

**Table 4. Performance Test Schedule for Manufacturers of Products Containing Organic HAP**

Emission source	Reason for testing	Schedule
Each curing oven, shape dryer, kiln, coking oven, defumer, and new shape preheater	Initial performance test to demonstrate initial compliance with standard	For existing sources, must be conducted by October 14, 2006 For new sources, must be conducted within 180 days of startup
	Follow-up performance test to demonstrate continuing compliance with standard	At least every 5 years after initial performance test
	Demonstrate compliance after change in operating limits	Upon increase in maximum organic HAP processing rate of more than 10 percent
	Demonstrate compliance after change in operating limits	Upon decrease in combustion chamber temperature of thermal oxidizer or catalyst bed inlet temperature of catalytic oxidizer
Uncontrolled kilns preceded by curing oven or shape preheater	Demonstrate compliance after change in process parameters	Upon decrease in operating temperature or batch cycle of curing oven or shape dryer that precedes the kiln in the process line

3. What pollutants and exhaust gas characteristics am I required to measure during the performance test, and what test methods should I use?

The only pollutant you are required to measure during the test is THC. If you are planning to comply with the standard by meeting the THC concentration limits in the rule (that is, 20 ppm corrected to 18 percent oxygen), you are required to measure the THC concentration only at the outlet of the control device or in the stack. However, if you are planning to develop an emissions profile (Section II.B.5, Example 7), you will have to measure the THC mass emission rate at the inlet of the control device during the run that is used to develop the emissions profile.

If you are planning to comply with the standard by meeting the THC percentage reduction requirement in the rule, you are required to measure the THC concentration and determine the THC mass emissions rate at both the inlet and outlet of the control device.

During the test, you must also measure the gas velocity and volumetric flow rate, the gas molecular weight, and the gas moisture content. If you are demonstrating compliance with the THC concentration limits included in the rule, you must also measure the oxygen content of the exhaust gas. Table 5 presents the exhaust gas parameters that must be monitored during each test, the test method for each parameter, the monitoring frequency for each parameter, and the sampling location for each compliance option.

**Table 5. Test Methods for Sources that Emit Organic HAP**

Test parameters	Compliance option	
	THC concentration limit of 20 ppmvd corrected to 18 percent oxygen	THC percentage reduction limit of 95 percent
Testing location	Outlet of control device only unless developing emissions profile; must test inlet and outlet if developing emissions profile	Inlet and outlet of control device
THC Concentration	EPA Method 25A <sup>a</sup> each minute during the test run.	EPA Method 25A <sup>a</sup> each minute during the test run
Oxygen concentration	EPA Method 3A <sup>a</sup> each minute during the test run.	Not required
Gas molecular weight	EPA Method 3, 3A, or 3B <sup>a</sup> or ASME PTC 19.10-1981-Part 10	EPA Method 3, 3A, or 3B <sup>a</sup> or ASME PTC 19.10-1981-Part 10
Gas velocity and volumetric flow rate	EPA Method 2, 2A, 2C, 2D, 2F or 2G <sup>a</sup> each hour during the test run	EPA Method 2, 2A, 2C, 2D, 2F, or 2G <sup>a</sup> each hour during the test run
Gas moisture content	EPA Method 4 <sup>a</sup> as specified in the applicable test method	EPA Method 4 <sup>a</sup> as specified in the applicable test method

<sup>a</sup> Test methods can be found in 40 CFR part 60, appendix A

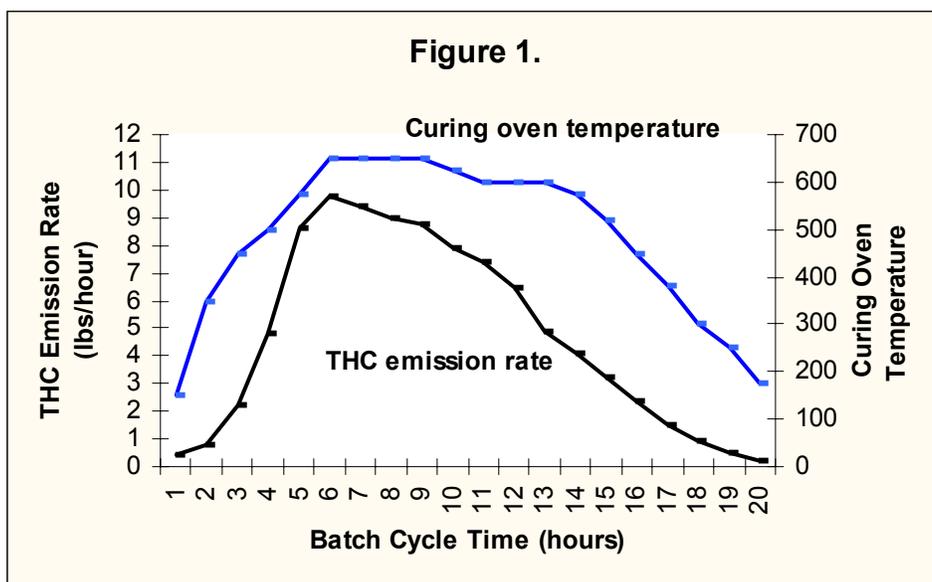
4. How many test runs am I required to conduct?

You must conduct at least two test runs. In most cases, you must conduct the two test runs over separate batch cycles. However, the rule includes a provision (see Section 63.9800(f)(3)) that allows facilities to conduct the two runs over the same batch cycle under certain conditions.

As discussed earlier, you are required to conduct each performance test while manufacturing the product that will generate the highest HAP emissions. In the example presented earlier in Section II.B.1 (Example 6), the facility must conduct the performance test while manufacturing pitch-bonded product 1, because that product has the highest organic HAP processing rate of the two products the facility manufactures. However, assume in this case that the facility only manufactures pitch-bonded product 1 on rare occasions, and it never manufactures consecutive batch cycles of that product. Manufacturing two consecutive batches of the product would disrupt the facility's production schedule to the point that it could not meet its production goals for the other refractory products. In this case, the facility may conduct the two test runs simultaneously over the same batch. That is, the facility can set up two separate sampling trains and collect two sets of data. Each data set is considered a separate test run. If you are planning to follow this approach (i.e., conduct the two test runs simultaneously), you must include the request and explanation in your Notification of Performance Test.

5. Each batch cycle for my curing oven lasts 25 hours. Do I have to test over the entire 25 hours? What options are available for testing my batch process?

We recognize that some of the batch cycles for the emission sources covered by this rule may last a day or more and that testing over the entire batch cycle could be very expensive. However, emissions for a batch operation also tend to be much more variable than for a continuous operation. As shown in Figure 1, the emission rate for a batch operation typically increases as the process temperature of the emission source, for example, the curing oven, increases. As the oven reaches its maximum temperature, the emission rate also reaches its maximum level. In the rule, this period of maximum emissions is known as the peak emissions period. Finally, the emission rate typically decreases as the curing oven temperature is decreased.



In an attempt to balance the potential cost of testing an entire batch against the need to ensure that the facility is meeting the emission limits during periods of highest emissions, we have included three options in the rule for facilities with batch operations. These options are

- Conduct testing over the entire batch
- Develop an emissions profile
- Meet specific conditions for terminating the test before the end of the batch cycle.

Each of these options is discussed in more detail below.

*Option 1: Conduct testing over the entire batch.* You may choose to conduct each of your two test runs over the entire batch cycle. If you choose this option, testing must begin when the source’s burners are ignited and testing cannot end until the batch is ended (i.e., when the product is removed from the curing oven).

*Option 2: Develop an emissions profile.* If you choose to develop an emissions profile, you must test one batch cycle from the beginning of the batch until the end. As with all performance tests, the emissions profile should be developed when you are manufacturing the product with the highest organic HAP processing rate. The THC mass emission rates for this batch will be used to establish the peak emissions period for THC for that source. The peak emissions period is the period of 3 consecutive hours over which the total THC emission rate at the control device inlet is greater than any other 3 consecutive hours of the batch.

Example 7 demonstrates how to develop an emissions profile using data from an example test run.

*Example 7: Developing an Emissions Profile for Facilities Manufacturing Products Containing Organic HAP*

Table 6 presents the results of an example test run for a batch operation. In the example, testing was conducted over the entire 25 hours of the batch. Note that the right-hand column in the table represents the total emission rate for the 3-hour period ending at that hour.

**Table 6. Example Test Data for Developing an Emissions Profile**

Hour	THC Emission Rate at Control Device Inlet (lb/hour)	Total Emission Rate for 3-Hour Period (lb)
1	3.2	
2	5.1	
3	5.5	13.8
4	6.5	17.1
5	8.5	20.5
6	10.7	25.7
7	12.7	31.9
8	16.8	40.2
9	17.9	47.4
10	18.4	53.1
11	17.5	53.8
12	16.2	52.1
13	16.1	49.8
14	15.1	47.4
15	14.0	45.2
16	11.2	40.3
17	11.1	36.3
18	9.4	31.7
19	8.8	29.3
20	5.9	24.1
21	4.2	18.9
22	3.5	13.6
23	2.1	9.8
24	1.2	6.8
25	1.5	4.8

Using the data presented in Table 6, the highest total emission rate for any 3-hour period of the test is 53.8 lb. This peak emission rate occurs between hours 9 and 11 of the test. Therefore, the peak THC emissions period for this emission source is hours 9 through 11.

As long as you do not begin to manufacture a product that exceeds the operating limit established for the maximum allowable organic HAP processing rate, you may limit all future testing of this emission source to hours 9 through 11 of the batch. You must

begin testing at the beginning of hour 9 and you may end testing at the end of hour 11. However, if you begin manufacturing a product with an organic HAP processing rate that is greater than the operating limit established for the maximum allowable organic HAP processing rate, you must develop a new emissions profile for the source.

Option 3: Terminate testing before the end of the batch. If you decide that you do not want to develop an emissions profile, but you would like to terminate testing before the end of the batch, there are conditions under which you may do so. At a minimum, you must continue the test run until the operating temperature of the emission source has been at its maximum level for at least 3 hours. For example, if the maximum operating temperature for your curing oven during a batch is 650°F and you reach that temperature 6 hours into the batch, then you would have to test for a minimum of 9 hours.

At the end of the 9 hours, you can terminate testing under the following conditions:

- a. The hourly average THC mass emission rate at the outlet of the control device or in the stack has not increased during that 3-hour period (i.e., in this example, the hourly average THC emission rate did not increase between hours 6 and 9), and one of the following two conditions is met:
  - The hourly THC concentration at the outlet of the control device has not exceeded 20 ppmvd, corrected to 18 percent oxygen, during the 3-hour period (in this example, between hours 6 and 9); or
  - The hourly average THC percentage reduction during the 3-hour period has been at least 95 percent.
- b. If the emission source is equipped with a thermal or catalytic oxidizer, at least 1 hour must have passed since the oxidizer temperature was reduced (see Section II.B.6 below).

Example 8 demonstrates the conditions under which you may terminate testing using an example test run.

Example 8: How to Terminate Testing Before the End of the Batch

Table 7 presents data from an example test run that will be used to illustrate when the testing may be terminated.

**Table 7. Example Test Run for Terminating Batch Testing**

<b>Clock time</b>	<b>Batch cycle hour</b>	<b>THC emission rate at control device inlet (lbs THC/hr)</b>	<b>THC emission rate at control device outlet (lbs THC/hr)</b>	<b>THC percentage reduction (%)</b>	<b>Curing oven temperature (°F)</b>
1100	1	0.2	0.05	75.0	150
1200	2	0.4	0.07	82.5	350
1300	3	1.1	0.09	91.8	450
1400	4	2.4	0.11	95.4	500
1500	5	4.3	0.12	97.2	575
1600	6	4.9	0.14	97.1	650
1700	7	4.7	0.13	97.2	650
1800	8	4.1	0.12	97.1	650
1900	9	3.6	0.11	96.9	650
2000	10	NR <sup>a</sup>	NR <sup>a</sup>	NR <sup>a</sup>	600
2100	11	NR	NR	NR	600
2200	12	NR	NR	NR	600
2300	13	NR	NR	NR	600
0000	14	NR	NR	NR	600
0100	15	NR	NR	NR	520
0200	16	NR	NR	NR	450
0300	17	NR	NR	NR	380
0400	18	NR	NR	NR	300
0500	19	NR	NR	NR	250

<sup>a</sup> Testing is not required for remainder of batch.

In this example, the batch lasts for 19 hours, from 1100 hours one day to 0500 the following day. However, at 1600 hours, the curing oven reaches its maximum temperature of 650°F. Over the next 3 hours, the THC emission rate at the outlet decreases from 0.14 lbs/hour to 0.06 lbs/hr, and the average THC percentage reduction is at least 95 percent. Therefore, the facility may terminate testing at 1900 hours. Note that, although the THC percentage reduction was less than 95 percent during the period between 1100 and 1300 hours, it would not be considered a violation of the standard because that period is not the peak emissions period. For this example, the peak emissions period occurs between hours 1500 and 1700.

For the example test run presented in Table 7, the facility could have also terminated testing at 1900 hours if the THC concentration at the control device outlet was no greater than 20 ppmvd, corrected to 18 percent oxygen.

6. If I use a thermal or catalytic oxidizer to control emissions from my batch process source, do I have to maintain the oxidizer temperature at the same level for the entire test?

The rule includes provisions that allow you to reduce the temperature of the oxidizer or even shut the oxidizer off at a certain point in the test (see item 13 of Table 4 of the rule). However, you must meet several conditions to do so. These conditions are as follows:

- a. You are not using an emissions profile to limit testing to the 3-hour peak emissions period;
- b. It has been at least 3 hours since the source you are testing (kiln, defumer, etc.) reached the maximum operating temperature;
- c. During each of the three 1-hour periods that has passed since the source reached its maximum operating temperature, you have achieved the emission limits for that source (THC concentration no greater than 20 ppmvd or THC percentage reduction of at least 95 percent);
- d. The hourly average THC mass emissions rate did not increase during the 3-hour period; and
- e. During each of the four 15-minute periods following the reduction in the oxidizer temperature, you met the emission limits for that source (THC concentration no greater than 20 ppm or THC percentage reduction of at least 95 percent).

If the source did not meet condition (e), then you must return the temperature of the oxidizer to its normal operating temperature as soon as possible. You must then maintain the oxidizer at that temperature for at least 1 hour. Following this 1-hour period, you should continue the test run until condition (e) is met. This would be considered a violation of the emission limit if you did not return the oxidizer to the temperature at which the oxidizer was operating during the peak emissions period when compliance with the emission limit was demonstrated.

7. What process parameters do I have to record for the test?

For each test, you are required to record each of the of following process parameters:

- The organic HAP content of all resins, binders, and additives used in the refractory product being manufactured using data from Method 311, MSDS, or product labels;
- The percentage by weight of each resin, binder, and additive in the refractory product being manufactured from MSDS or product labels;
- The production rate, in pounds of product per batch, for the product being manufactured;

- The batch time; and
- The hourly operating temperature of the affected source (i.e., the oven, kiln, defumer, etc.) using the thermocouple sensor of the affected source.

The organic HAP content of each constituent, the percentage of each constituent in the refractory product, and the production rate are all used to determine the organic HAP processing rate for the product being tested. The organic HAP content and percentage by weight of each resin, binder, and additive used in the refractory products to be processed generally are known prior to the start of the batch cycle. The production rate (i.e., the weight of the batch) and the batch cycle time also are determined before the start of the batch cycle. Therefore, you should record the value of these parameters prior to the start of the performance test. The hourly operating temperature of the affected batch process source should be recorded during each hour of each test run of the performance test.

8. What control device parameters do I have to measure during each test?

If the emission source is equipped with a thermal oxidizer, you must monitor and record the combustion chamber temperature of the oxidizer at least once every 15 minutes. If the source is equipped with a catalytic oxidizer, you must monitor and record the temperature at the inlet of the catalyst bed at least once every 15 minutes. Note that this measurement must be performed at the inlet to the catalyst bed and not at the inlet to the oxidizer itself. After passing through the inlet to the oxidizer, the waste gases typically pass through a preheat zone, which raises the temperature to the minimum required for catalytic oxidization. You must monitor the catalyst bed inlet temperature between this preheat zone and the inlet to the catalyst bed.

9. How do I demonstrate compliance with the THC concentration limit using the data from the performance test?

Follow these steps to demonstrate compliance with the THC concentration limits:

- For each test run, calculate the average THC concentration for each hour of the performance test using the 1-minute measurements.
- For each test run, calculate the average oxygen content for each hour of the performance test using the 1-minute measurements.
- Calculate the average hourly THC concentration corrected to 18 percent oxygen using Equation 1 of Section 63.9800(g)(6).

For example, if the average hourly THC concentration is 11 ppmvd and the average oxygen concentration for that same hour is 19, the corrected THC concentration is as follows:

$$\text{Corrected THC} = 2.9 \times 11 / (20.9 - 19) = 16.8 \text{ ppmvd}$$

- d. Using the corrected average hourly THC concentrations, determine the period of 3 consecutive hours during which the sum of the corrected THC concentrations is greater than any other 3-hour period of the test run.
- e. Calculate the average corrected THC concentration for the peak 3-hour period for each test run.
- f. Calculate the average peak THC concentration for the two test runs.

The following example demonstrates how you can show compliance with the THC concentration limits using data from an example test run.

*Example 9: Demonstrating Compliance with the THC Concentration Limits for a Batch Process*

Table 8 presents data from an example test run for a batch process; these data demonstrate how to determine compliance with the THC concentration limits using the test data. Note that the right-hand column of the table represents the total THC concentration for the 3-hour period ending at that hour.

**Table 8. Example Test Run for Demonstrating Compliance with THC Concentration Limits for a Batch Process**

Hour	Average THC concentration (ppmvd)	Average oxygen concentration (percent)	Average THC concentration corrected to 18% oxygen (ppmvd)	3-hour total of corrected THC concentrations
1	10	18.5	12.1	
2	9	18.6	11.3	
3	8	19	12.2	35.6
4	11	19.2	18.8	42.3
5	12	19.1	19.3	50.3
6	9	19.5	18.6	56.7
7	8	19.4	15.5	53.4
8	6	19.3	10.9	45
9	5	19.3	9.1	35.5
10	3	18.8	4.1	24.1
11	2	18.5	2.4	15.6
12	2	18.6	2.5	9

Based on the results for the example test run in Table 8, the 3-hour peak occurred between hours 4 and 6. The average hourly-corrected THC concentrations for those three hours are 18.8, 19.3, and 18.6. Therefore, the average THC concentration for the peak period for the test run is 18.9 ppmvd, corrected to 18 percent oxygen.

Assuming that the average THC concentration for the peak period for the second test run was 16.5 ppmvd, the average for the performance test is 17.7 ppmvd, corrected to 18 percent oxygen. This is less than the limit of 20 ppmvd, so the results of the performance test indicate the facility is in compliance with the standard.

10. How do I demonstrate compliance with the percentage reduction requirement in the rule using the data from the performance test?

To demonstrate compliance with the percentage reduction requirements, follow these steps:

- a. Calculate the hourly THC mass emission rate (lbs THC/hr) at the inlet and outlet of the control device for each hour of the test run.
- b. Using the hourly THC mass emission rates at the control device, determine the 3-hour period during the test when the sum of the emission rates is greater than any other 3-hour period.
- c. Calculate the average THC percentage reduction for that 3-hour period for each test run using Equation 2 of Section 63.9800(g)(2). This represents the average THC percentage reduction for that test run.
- d. Calculate the average percentage reduction for both test runs.

Note that you are not required to continuously measure the oxygen concentration if you are meeting the percentage reduction limits specified in the rule.

Following is an example demonstrating how you may show compliance with the THC percentage reduction requirements using data from an example test run.

*Example 10: Demonstrating Compliance with the THC Percentage Reduction Limits for a Batch Process*

Using the data in Table 9, we have provided an example for demonstrating compliance with the 95 percent reduction requirement in the rule.

**Table 9. Example Test Run for Demonstrating Compliance with the Percentage Reduction Requirement for Batch Process**

Hour	THC emission rate, inlet (lbs/hr)	3-hour total emission rate, inlet (lbs/hr)	THC emission rate, outlet (lbs/hr)	Percentage reduction
1	5		0.2	96
2	6		0.3	95
3	8	19	0.35	95.6
4	9	23	0.4	95.6
5	12	29	0.5	95.8
6	11	32	0.4	96.4
7	7	30	0.3	95.7
8	6	24	0.3	95
9	5	18	0.2	96
10	3	14	0.1	96.7
11	3	11	0.1	96.7

The highest 3-hour total for the example test run occurs between hours 4 and 6, with a total emission rate at the inlet of 32. The percentage reductions for hours 4, 5, and 6 are 95.6, 95.8, and 96.4 percent, respectively. Therefore, the average percentage reduction for the test run is 95.9 percent.

Assuming the average percentage THC reduction for the second test run was 96.4 percent, the average percentage THC reduction for the performance test would be 96.2 percent. Therefore, the results of the performance test demonstrate the facility is in compliance with the rule.

11. What operating limits am I required to establish using the data from the performance test?

To demonstrate continuing compliance with the standard you must establish operating limits for the maximum allowable organic HAP processing rate and the control device operating parameters specified in your operation, maintenance, and monitoring plan. If your affected source is controlled with a thermal oxidizer, you must establish an operating limit for the operating temperature of the thermal oxidizer combustion chamber; if your affected source is controlled with a catalytic oxidizer, you must establish an operating limit for the temperature at the inlet to the catalyst bed. These operating limits must be established using the data collected during the most recent performance test.

12. How do I establish the operating limit for the maximum allowable organic HAP processing rate for my batch process?

Section II.B.1 provides an example (see Example 6) of how to calculate the organic HAP processing rate for a batch operation. For each test run conducted during the performance test, calculate the organic HAP processing rate using the formulation data for any binders, resins, or additives used in the refractory product; the percentage of the HAP containing constituent in the refractory product; and the production rate for the batch. The operating limit for the maximum allowable organic HAP processing rate is the average of the organic HAP processing rate for the two test runs plus 10 percent. Following is an example of how to calculate the operating limit for the maximum allowable organic HAP processing rate.

Example 11: Calculating the Maximum Allowable Organic HAP Processing Rate for a Batch Process

Following up on Example 6 provided in II.B.1, pitch-bonded product 1 is the product manufactured by the facility that has the greatest potential HAP emission rate. Therefore, the facility conducts the performance test while manufacturing that product. Although the concentration of pitch in the product is the same for each test run, the production for each batch varies slightly. The organic HAP processing rate for each test run is calculated as follows:

Run 1

The pitch is 100 percent POM. The refractory product mix contains 8 percent pitch. The actual production during the test run is 17,250 lbs/batch.

$$17,250 \text{ lbs/batch} \times 8/100 = 1,380 \text{ lbs POM/batch}$$

Total organic HAP processing rate for Run 1 is 1,380 lbs/batch.

Run 2

During this run, the production was only 16,900 lbs/batch.

$$16,900 \text{ lbs/batch} \times 8/100 = 1,352 \text{ lbs POM/batch}$$

Total organic HAP processing rate for Run 2 is 1,352 lbs/batch

The operating limit for the maximum allowable organic HAP processing rate is the average of the two test runs (i.e., 1,366 lbs/batch), plus 10 percent. Therefore, the operating limit for the maximum allowable organic HAP processing rate for this example is 1,503 lbs/batch. If the facility plans to begin manufacturing a product with a higher organic HAP processing rate than 1,503 lbs/batch, then the facility must conduct another performance test to establish a new operating limit and to demonstrate that it is still in compliance with the standard.

13. How do I establish the operating limit for the oxidizer temperature?

As discussed earlier, you must monitor the oxidizer temperature during each test run. If the source is controlled by a thermal oxidizer, you must monitor the combustion chamber temperature. If the source is controlled by a catalytic oxidizer, you must monitor the temperature at the inlet to the catalyst bed. You must monitor and record the temperature at least every 15 minutes during each test run.

For a batch operation, the operating limit for the oxidizer is based on the temperature of the oxidizer during the peak 3-hour emissions period. (See Sections II.B.9 and II.B.10, Examples 9 and 10, for information on how to determine the peak emissions period). For each test run, calculate the average hourly oxidizer temperature for each hour of the peak 3-hour period. Then calculate the average temperature for that 3-hour period using the hourly averages.

The operating limit is based on the average for the two test runs. Following is an example demonstrating how to calculate the operating limit for the oxidizer temperature for a batch process.

Example 12: Establishing the Operating Limit for Oxidizer Temperature

In this example, the facility is using a thermal oxidizer to control emissions. Therefore, they are required to measure and record the combustion chamber temperature during each test run.

Run 1

The peak 3-hour emissions period for the batch occurs between the beginning of hour 4 and the end of hour six. The average combustion chamber temperature for each hour is

Hour 4 – 1575°F  
Hour 5 – 1560°F  
Hour 6 – 1565°F

The average combustion chamber temperature for the peak 3-hour period is 1567°F.

Run 2

Again, the peak emissions period is between hours 4 and 6 of the batch. The average combustion chamber temperature for each hour is

Hour 4 – 1550°F  
Hour 5 – 1565°F  
Hour 6 – 1570°F

The average combustion chamber temperature for Run 2 during the peak 3-hour period is 1562°F.

The average combustion chamber temperature for the two test runs is 1565°F. The operating limit for the oxidizer combustion chamber temperature is the average for the two test runs, 1565°F, minus 25°F, or 1540°F. Therefore, the thermal oxidizer must be operated at a temperature of at least 1540°F. The facility is in continuous compliance with the standard as long as they maintain the minimum temperature of the thermal oxidizer at 1540°F. If the temperature of the thermal oxidizer falls below 1540°F, it is a violation of the standard.

14. My facility is planning to use either process changes or an alternative control device (i.e., not a thermal or catalytic oxidizer) to meet the emission limits. What are the testing requirements for my facility and how do I establish operating limits for my facility?

In general, the testing requirements for your facility are the same as those for other batch processes that are presented in this section. However, the parameters for which you establish operating limits may be different than those discussed above (i.e., maximum organic HAP processing rate and oxidizer temperature). Section 63.9800(I)(2) of the rule addresses the requirements for facilities that plan to use process changes or a control device other than an oxidizer to meet the emission limits.

If you choose to use an alternative control device or you wish to propose an alternative monitoring method, it is your responsibility to develop a testing and continuous compliance plan. The test plan must include provisions for an emission test that clearly demonstrates that you are meeting the emission levels included in the rule. If you propose an alternative monitoring method, the method must allow you to clearly demonstrate that you are in continuous compliance with the emission limits included in the rule.

If you are planning to use alternative methods to meet the emission limits, you must submit a request for approval of alternative monitoring methods to the Administrator. This request must include a list of the operating parameters that will be monitored during the performance test and a description of how you will establish operating limits using the operating parameter data from the performance test to demonstrate compliance with the emission limits. If you exceed those operating limits, you will have to perform another performance test to demonstrate that you are still in compliance with the emission limits.

### III. Testing Requirements for Facilities Manufacturing Clay Refractory Products

These testing requirements apply to new kilns used to manufacture clay refractory products using uncalcined clay. If you have an existing kiln that manufactures clay refractory products or you use only calcined clay, then you are not subject to these testing requirements.

If you are an existing major source using uncalcined clay, you are still subject to the rule and you must meet the notification, reporting, and recordkeeping requirements and the requirement to use natural gas as the kiln fuel, as specified in item 4 of Table 3 of the rule.

Section 63.9824 of the NESHAP defines a clay refractory product as follows:

*“Clay refractory product means a refractory product that contains at least 10 percent uncalcined clay by weight prior to firing in a kiln. In this definition, the term ‘clay’ means any of the following six classifications of clay defined by the U.S. Geologic Survey: ball clay, bentonite, common clay and shale, fire clay, fuller’s earth, and kaolin.”*

Testing requirements for kilns processing clay refractory products vary by the type of process used to manufacture the product. Testing procedures for facilities manufacturing clay refractory products using a continuous process are presented in Section III.A. Procedures and guidance for facilities manufacturing clay refractory products using a batch process are presented in Section III.B.

#### A. Guidance on Testing Requirements for Facilities Manufacturing Clay Refractory Products Using a Continuous Process

Section 63.9824 of the NESHAP defines a continuous process as follows:

*“Continuous process means a process that operates continuously. In a continuous process unit, the materials or shapes that are processed are either continuously charged (fed) to and discharged from the process unit, or are charged and discharged at regular time intervals without the process unit being shut down. Continuous thermal process units, such as tunnel kilns, generally include temperature zones that are maintained at relatively constant temperature and through which the materials or shapes being processed are conveyed continuously or at regular time intervals.”*

Guidance on testing requirements for kilns used to manufacture clay refractory products using a continuous process is presented below.

1. Under what conditions should testing be conducted?

Sections 63.9796 and 63.9798 of the rule specify when testing is required. For all emission tests, you are required to conduct the tests under the conditions that will result in the maximum emissions of HF and HCl. For facilities manufacturing clay refractory products using a continuous process, this means you should conduct testing while the

kiln is operating at its maximum production rate and while you are manufacturing the product with the highest percentage of uncalcined clay.

2. When is testing required?

You must conduct the initial performance test on your new kiln within 180 days of startup.

If you do not make any substantive changes to the operating limits established in your operation, maintenance, and monitoring plan, you are only required to conduct subsequent performance tests every five years. The operating limits for facilities manufacturing clay refractory products vary by the type of control device you are using to control emissions. These limits are established during the performance test. If you modify your process or control device in such a way that the operating limits you have established are no longer valid, then you need to conduct testing to establish new operating limits and to demonstrate that you are still in compliance with the emission limits while using the new operating limits.

Table 10 summarizes the schedule for performance test requirements for kilns used to manufacture refractory clay products.

**Table 10. Performance Test Schedule for Clay Refractory Products Kilns**

<b>Emission source</b>	<b>Reason for testing</b>	<b>Schedule</b>
Each new kiln	Initial performance test to demonstrate initial compliance with the standard	Must be conducted within 180 days of startup of kiln
	Follow-up performance test to demonstrate continuing compliance with the standard	Five years after initial performance test
Each kiln equipped with a dry limestone adsorber (DLA)	Demonstrate compliance after change in operating limits	Upon decrease in pressure drop across DLA
	Demonstrate compliance after change in operating limits	Upon decrease in limestone feeder rate
	Demonstrate compliance after change in operating limits	Upon change in grade of limestone used
Each kiln equipped with a dry injection fabric filter (DIFF) or dry lime scrubber/ fabric filter (DLS/FF)	Demonstrate compliance after change in operating limits	Upon decrease in lime feeder setting
Each kiln equipped with a wet scrubber	Demonstrate compliance after change in operating limits	Upon decrease in average pressure drop across the scrubber
	Demonstrate compliance after change in operating limits	Upon decrease in pH of scrubber liquid
	Demonstrate compliance after change in operating limits	Upon decrease in liquid flow rate
	Demonstrate compliance after change in operating limits	Upon decrease in chemical feed rate

3. What pollutants am I required to measure during the performance test and what test methods should I use?

You must measure the mass emissions rates of both hydrogen fluoride (HF) and hydrochloric acid (HCl) during the performance test. If you are planning to comply with the standard by meeting the production-based emission rates for HF and HCl included in the rule, you are required to measure these pollutants only at the outlet of the control device. However, if you are planning to comply with the HF and HCl percentage reduction requirements in the standard, you must measure the mass emissions rates of HF and HCl at both the inlet and outlet to the control device.

EPA has developed three test methods for measuring HF and HCl. These methods are

- Method 26A of 40 CFR part 60, appendix A
- Method 26 of 40 CFR part 60, appendix A
- Method 320 of 40 CFR part 63, appendix A.

You can choose to use either Method 26A or Method 320. You may also use Method 26, but only if no acid particulate matter (PM) (for example, HF or HCl dissolved in water droplets emitted by sources controlled by a wet scrubber) is present in the exhaust gas.

If you choose to use Method 320, you must follow the analyte spiking procedures that are presented in Section 13 of that method, unless you can demonstrate that the complete spiking procedure has been conducted at a source similar to the kiln you are testing.

During the test, you must also measure the gas velocity and volumetric flow rate, the gas molecular weight, and the gas moisture content. Table 11 presents the exhaust gas parameters that must be monitored during each test, the test method for each parameter, and the monitoring frequency for each parameter.

**Table 11. Test Methods for Clay Refractory Products Kilns**

Exhaust gas parameter	Test method <sup>a</sup>	Frequency
Mass emission rates of HF and HCl	EPA Method 26 or 26A, or	Each hour during the test run
	EPA Method 320	As specified in the test method
Gas velocity and volumetric flow rate	EPA Method 2, 2A, 2C, 2D, 2F, or 2G	Each hour during the test run
Gas molecular weight	EPA Method 3, 3A, or 3B; or ASME PTC 19.10-1981-Part 10	As specified in the applicable test method
Gas moisture content	EPA Method 4	As specified in the applicable test method

<sup>a</sup> All EPA test methods can be found in 40 CFR part 60, appendix A.

4. How many test runs am I required to conduct?

For each performance test, you must conduct at least three test runs. Each test run must be at least 1 hour in duration.

5. What process parameters do I have to record for the test?

For each test, you are required to record each of the following process parameters:

- Production rate in tons per hour of fired product;
- Formulation data that includes the mass fraction of uncalcined clay in the products that are manufactured during the performance test; and
- The processing rate for uncalcined clay (tons per hour) based on the production rate and formulation data.

6. What control device parameters do I have to measure during each test run?

The control device parameters that you are required to measure during the test vary depending upon the type of control device you are using. Following are the list of parameters presented by control device.

- a. DLA—If the kiln is equipped with a dry lime adsorber, you must measure and record the pressure drop across the DLA every 15 minutes during the test. At least one week prior to the test, you must also establish the limestone feeder setting. During that one-week period and during the performance test, you must record the feeder setting. During the test, you must inspect the feed hopper, silo, and DLA to ensure that the limestone is free-flowing at all times during the test.
- b. DIFF or DLS/FF—If the kiln is equipped with a dry injection fabric filter or a dry lime scrubber/fabric filter, you must record the lime feeder setting for each of the three test runs. You must also inspect the feed hopper and silo during the performance test to ensure that lime is free-flowing at all times.
- c. Wet scrubber—If the kiln is equipped with a wet scrubber, you must measure and record each of the following parameters at least once every 15 minutes during the test run:
  - Pressure drop across the scrubber
  - Scrubber liquid pH
  - Scrubber liquid flow rate
  - Scrubber chemical feed rate if you use a chemical, such as lime or sodium bicarbonate, in your wet scrubber.

7. How do I demonstrate compliance with the production-based HF and HCl emission limits using the data from the performance test?

If you have chosen to demonstrate compliance with the standard by meeting the production-based emission limits, follow these steps:

- a. Using the production data and product formulation data, calculate the average rate at which you processed uncalcined clay (tons per hour) during each test run.
- b. Using the calculations presented in the applicable test method, calculate the HF and HCl mass emission rates for each test run.
- c. Calculate the hourly production-based emission rate for HF and HCl using the following equation

$$MP = ER/P \quad (\text{Equation 3, Section 63.9798(g)(3)})$$

where

MP = mass per unit of production of uncalcined clay processed (lb/ton)  
ER = mass emission rate of HF or HCl during each performance test (lb/hr)  
P = average uncalcined clay processing rate for the performance test (tons of uncalcined clay processed/hr).

- d. Calculate the 3-hour block average of the emission rate for each pollutant as the average emission rate for the three test runs.

If the 3-hour block average for HCl does not exceed 0.18 lb/ton of uncalcined clay processed, then you are in compliance with the HCl emission limit. If the 3-hour block average for HF does not exceed 0.038 lb/ton of uncalcined clay processed, then you are in compliance with the HF emission limit.

Example 13 illustrates the procedure for demonstrating compliance with the HF and HCl emission limits using data from an example performance test.

*Example 13: Demonstrating Compliance with the Production-Based Emission Limits for HF and HCl*

During the first test run, the production rate for the example facility is 4 tons/hr. The refractory product manufactured during the test run has an uncalcined clay fraction of 50 percent by weight. Therefore, the processing rate for the uncalcined clay is 2 tons/hr.

The facility used Method 26A to measure HF and HCl. Based on the results from Method 26A, the emission rate for HCl during the first test run was 0.052 lb/hr. The

emission rate for HF during the first test run was 0.070 lb/hr. Therefore, the production-based emission rates for HCl and HF can be calculated as follows:

$$0.070 \text{ lbs/hr} / 2 \text{ tons/hr} = 0.035 \text{ lbs HF/ton of uncalcined clay}$$

$$0.052 \text{ lbs/hr} / 2 \text{ tons/hr} = 0.026 \text{ lbs HCl/ton of uncalcined clay}$$

For HF, the production-based emission rate for Run 2 was 0.036 lbs/ton, and the rate for Run 3 was 0.038 lbs/ton. Therefore, the 3-hour block average for the performance test was 0.036 lbs HF/ton of uncalcined clay. This is less than the standard of 0.038 lbs/ton, so the facility is in compliance with the HF emission rate.

Assuming that the production-based emission rate for HCl was 0.040 lbs/ton for Run 2 and 0.035 lbs/ton for Run 3, the 3-hour block average for the performance test is 0.034 lbs HCl/ton of uncalcined clay. This is less than the standard of 0.18, so the facility is in compliance with the HCl emission rate.

8. How do I demonstrate compliance with the HF and HCl percentage reduction requirements using data from the performance test?

If you have chosen to demonstrate compliance with the standard by meeting the percentage reduction requirements, follow these steps:

- a. Determine the mass emission rates for HF and HCl at both the inlet and outlet of the control device by following the calculations included in the applicable test method.
- b. Calculate the hourly HF and HCl percentage reduction using the following equation (Equation 2, Section 63.9800(g)(2)):

$$PR = (ER_i - ER_o) / ER_i \times 100$$

where

- PR = percentage reduction (percent)  
ER<sub>i</sub> = mass emission rate of HF or HCl entering the control device (lb/hr)  
ER<sub>o</sub> = mass emission rate of HF or HCl exiting the control device (lb/hr).

- c. Calculate the 3-hour block average as the average of the percentage reductions for each test run.

Example 14 demonstrates how to show compliance with the percentage reduction requirements for HF and HCl using data from an example test run.

Example 14: Demonstrating Compliance with the HF and HCl Percentage Reduction Requirements

The facility conducts three test runs using Method 26A.

Run 1

HF inlet emission rate = 0.80 lbs/hr  
HF outlet emission rate = 0.040 lbs/hr  
HCl inlet emission rate = 0.40 lbs/hr  
HCl outlet emission rate = 0.080 lbs/hr

The percentage reduction for HF for Run 1 can be calculated as follows:

$$(0.80 - 0.04)/0.8 \times 100 = 95 \text{ percent}$$

The percentage reduction for HCl for Run 1 can be calculated using the same equation:

$$(0.4 - 0.080/0.4) \times 100 = 80 \text{ percent}$$

For HF, the percentage reductions for Runs 2 and 3 were 91.5 and 92.3 percent, respectively. Therefore, the 3-hour block average for the performance test was 92.9 percent. This is greater than the percentage reduction requirement of 90 percent for HF, so the facility is in compliance with the HF standard.

For HCl, the percentage reductions for Runs 2 and 3 were 72 percent and 84 percent, respectively. Therefore, the 3-hour block average for the performance test was 78.7 percent. This is greater than the percentage reduction requirement of 30 percent for HCl, so the facility is also in compliance with the HCl standard.

Suppose you operate a kiln that is controlled with a DLA, and the surface of the limestone needs to be abraded. However, you are unaware of this condition, you conduct the performance test, and the test indicates noncompliance with the emission limit. In this case, you must repeat the performance test. This example illustrates the importance of proper maintenance in avoiding violations of the standard. As explained previously, you should consider performing a dry run of the performance test to ensure that control devices are working properly and to help recognize other potential problems that could result in a failed compliance test.

9. Emissions from the kiln at my facility are controlled by a DLA. How do I establish operating limits using the data from the performance test?

To demonstrate continuing compliance with the standard, you must establish operating limits for pressure drop and limestone feeder setting during the performance test. The procedures you need to follow for each operating limit are presented below.

- a. *Establishing the operating limit for pressure drop across the DLA.* As discussed earlier, you are required to monitor and record the pressure drop across the DLA at least every 15 minutes during each test run. For each hour of the test run, calculate the average pressure drop. The operating limit for the pressure drop is based on the average of the hourly average pressure drops for the three test runs.
- b. *Establishing the operating limit for limestone feeder setting.* You are required to establish the limestone feeder setting one week before you begin the performance test. During this 1-week period preceding the test, you must record and maintain the limestone feeder setting. You must also maintain the feeder setting at the same rate during the performance test and ensure that the limestone in the feed hopper, silo, and DLA is free-flowing at all times during the test. The setting used during the performance test will represent the operating limit for the limestone feeder.

10. How do I establish the operating limits if my kiln is equipped with a DIFF or DLS/FF?

To demonstrate continuous compliance with the standard if your facility is equipped with a DIFF or DLS/FF, you must follow all EPA guidance and specifications for bag leak detection systems. You must also establish the operating limit for the lime feeder setting.

To establish the operating limit for the lime feeder setting, you must record the setting for each of the three test runs. The operating limit for the setting is the average feed rate for the three test runs.

11. How do I establish the operating limits if my kiln is equipped with a wet scrubber?

If your kiln is equipped with a wet scrubber, you must establish operating limits for

- Minimum scrubber pressure drop
- Minimum scrubber liquid pH
- Minimum scrubber liquid flow rate
- Minimum scrubber chemical feed rate if you use a chemical, such as lime or sodium bicarbonate, in your wet scrubber.

The procedure for establishing these operating limits is detailed below. The procedure is the same for each parameter.

- a. Monitor and record each parameter at least once every 15 minutes during the test run.
- b. Calculate the hourly average for each parameter for each hour of the test run.

- c. Calculate the average of each of the hourly averages for each parameter. This is the operating limit for that parameter.
12. What if I want to change the operating limits I have established due to changes in my process or changes in the operation of my control device?

As explained previously, if you wish to change the operating limit you have established for a particular parameter, you must conduct a new performance test. Even if you have made process changes, such as a reduction in the production rate, that you believe justify lowering the operating limit for a parameter, you must conduct a new performance test to demonstrate that you are still in compliance with the standard at the lower operating limit. For example, if your kiln is controlled by a wet scrubber and you wish to operate at a lower liquid flow rate than the minimum level established during the performance test, you must conduct a new performance test to establish a new operating limit. If the results from the new performance test indicate you are still in compliance with the standard, then you may establish a new operating limit for the liquid flow rate based on the data from that performance test.

## **B. Guidance on Testing Requirements for Clay Refractory Batch Processes**

Section 63.9824 of the NESHAP defines a batch process as follows:

*“Batch process means a process in which a set of refractory shapes is acted upon as a single unit according to a predetermined schedule, during which none of the refractory shapes being processed are added or removed. A batch process does not operate continuously.”*

Guidance for facilities manufacturing clay refractory products using a batch process is presented below.

1. Under what conditions should testing be conducted?

For all emission tests, you are required to conduct the tests under the conditions that will result in the maximum emissions of HF and HCl. For facilities manufacturing clay refractory products using a batch process, this means you should conduct testing while the kiln is operating at its maximum production rate and while you are manufacturing the product with the highest percentage of uncalcined clay.

2. When is testing required?

Sections 63.9796 and 63.9798 of the rule specify when testing is required. You must conduct the initial performance test on your new kiln within 180 days of startup.

If you do not make any substantive changes to the operating limits established in your operation, maintenance, and monitoring plan, you are only required to conduct subsequent performance tests every five years. The operating limits for facilities

manufacturing clay refractory products vary by the type of control device you are using to control emissions. These limits are established during the performance test.

If you modify your process or control device in such a way that the operating limits you have established are no longer valid, then you must conduct testing to establish new operating limits and to demonstrate that you are still in compliance with the emission limits while using the new operating limits.

Table 12 summarizes the schedule for performance test requirements for kilns used to manufacture refractory clay products.

**Table 12. Performance Test Schedule for Clay Refractory Products Kilns**

Emission source	Reason for testing	Schedule
Each new kiln	Initial performance test to demonstrate initial compliance with the standard	Must be conducted within 180 days of startup of kiln
	Follow-up performance test to demonstrate continuing compliance with the standard	Five years after initial performance test
Each kiln equipped with a dry limestone adsorber (DLA)	Demonstrate compliance after change in operating limits	Upon decrease in pressure drop across DLA
	Demonstrate compliance after change in operating limits	Upon decrease in limestone feeder rate
	Demonstrate compliance after change in operating limits	Upon change in grade of limestone used
Each kiln equipped with a dry injection fabric filter (DIFF) or dry lime scrubber/fabric filter (DLS/FF)	Demonstrate compliance after change in operating limits	Upon decrease in lime feeder setting
Each kiln equipped with a wet scrubber	Demonstrate compliance after change in operating limits	Upon decrease in average pressure drop across the scrubber
	Demonstrate compliance after change in operating limits	Upon decrease in pH of scrubber liquid
	Demonstrate compliance after change in operating limits	Upon decrease in liquid flow rate
	Demonstrate compliance after change in operating limits	Upon decrease in chemical feed rate if you use a chemical, such as lime or sodium bicarbonate, in your wet scrubber

3. What pollutants am I required to measure during the performance test and what test methods should I use?

You must measure both HF and HCl at both the inlet and outlet of the control device during the performance test.

EPA has developed three test methods that may be used for measuring HF and HCl. These methods are

- Method 26A of 40 CFR part 60, appendix A
- Method 26 of 40 CFR part 60, appendix A
- Method 320 of 40 CFR part 63, appendix A.

You can choose to use either Method 26A or Method 320. You may also use Method 26, but only if no acid particulate matter (PM) (for example, HF or HCl dissolved in water droplets emitted by sources controlled by a wet scrubber) is present in the exhaust gas.

If you choose to use Method 320, you must follow the analyte spiking procedures that are presented in Section 13 of that method, unless you can demonstrate that the complete spiking procedure has been conducted at a source similar to the kiln you are testing.

During the test, you must also measure the gas velocity and volumetric flow rate, the gas molecular weight, and the gas moisture content. Table 13 presents the exhaust gas parameters that must be monitored during each test, the test method for each parameter, and the monitoring frequency for each parameter.

**Table 13. Test Methods for Clay Refractory Products Kilns**

Exhaust gas parameter	Test method <sup>a</sup>	Frequency
Mass emission rates of HF and HCl	EPA Method 26 or 26A, or	Each hour during the test run
	EPA Method 320	As specified in the test method
Gas velocity and volumetric flow rate	EPA Method 2, 2A, 2C, 2D, 2F, or 2G	Each hour during the test run
Gas molecular weight	EPA Method 3, 3A, or 3B; or ASME PTC 19.10-1981-Part 10	As specified in the applicable test method
Gas moisture content	EPA Method 4	As specified in the applicable test method

<sup>a</sup>All EPA test methods can be found in 40 CFR part 60, appendix A.

4. How many test runs am I required to conduct?

You must conduct at least two test runs. In most cases, you must conduct the two test runs over separate batch cycles. However, Section 63.9800(f)(3) and (4) contains a provision that allows facilities to conduct the two runs over the same batch cycle under certain conditions.

As discussed earlier, you must conduct the performance test while the kiln is operating at its maximum production rate. For example, the kiln may operate at a rate of 4,000 tons/batch for most clay refractory products, but the facility manufactures one product where the kiln operates at 5,000 tons/batch. Therefore, the facility should conduct the performance test while manufacturing the product with a production rate of 5,000 tons/batch. However, the facility rarely manufactures the product that is produced at a rate of 5,000 tons/batch and it never manufactures consecutive batch cycles of the product. Manufacturing two consecutive batches of that product would disrupt the facility's production schedule. In this case, the facility may conduct the two test runs simultaneously over the same batch. That is, the facility can set up two separate sampling trains and collect two sets of data. Each data set is considered a separate test run.

If you do wish to conduct the two test runs simultaneously over the same batch, you must include the request and the rationale in your Notification of Performance Test.

5. Each batch cycle for my kiln lasts 15 hours. Do I have to test over the entire 15 hours? What options are available for testing my batch process?

We recognize that some of the batch cycles for clay refractory kilns may be quite long and that testing over the entire batch cycle could be very expensive. However, emissions for a batch operation also tend to be much more variable than for a continuous operation.

For those facilities manufacturing clay refractories using a batch process, we have included two options for testing in the rule. The first option is to test over the entire batch cycle. If you choose this option, you must conduct a series of 1-hour runs that begin with the start of the batch cycle and continue until the end of the batch cycle.

The second option is to develop an emissions profile. The purpose of the emissions profile is to identify the peak emissions period for the batch. For clay refractories, this peak emissions period is based on the hourly HF emission rates at the inlet of the control device.

If you elect to develop an emissions profile, you must test one batch cycle from the beginning of the batch until the end with a series of 1-hour test runs. The data from this batch will be used to identify the peak emissions period for HF. The peak emissions period is the period of 3 consecutive hours over which the total HF mass emission rate is greater than any other 3 consecutive hours of the batch. Once you have identified the peak HF emissions period, you only have to test during that 3-hour period when conducting future tests.

Example 15 demonstrates the procedure for developing an emissions profile using data from an example test run.

*Example 15: Developing an Emissions Profile for a Clay Refractory Kiln*

Table 14 presents the results of an example test run for a clay refractory kiln that operates as a batch process. In the example, testing was conducted over the entire 18 hours of the batch. Note that the total emission rate in the right-hand column represents the total emission rate for the 3-hour period ending at that hour.

**Table 14. Example Test Data for Developing an Emissions Profile for a Clay Refractory Kiln**

Hour	HF emission rate at control device inlet (lbs/hour)	Total emission rate for 3-hour period (lbs)
1	0.4	
2	0.5	
3	0.65	1.55
4	0.82	1.97
5	0.96	2.43
6	1.25	3.03
7	1.08	3.29
8	0.87	3.20
9	0.78	2.73
10	0.63	2.28
11	0.51	1.92
12	0.42	1.56
13	0.37	1.3
14	0.29	1.08
15	0.15	0.81
16	0.11	0.55
17	0.07	0.32
18	0.04	0.22

Using the data presented in Table 14, the highest total emission rate for any 3-hour period of the test run is 3.29. This peak emission rate occurs between hours 5 and 7. Therefore, the peak HF emissions period for this emission source is hours 5 through 7.

For all future testing of this kiln, you only have to conduct testing during hours 5 through 7 of the batch. You must begin testing at the beginning of hour 5 and you may end testing at the end of hour 7.

6. What process parameters do I have to record for the test?

For batch operations, the only process parameters you must record for the test is the production rate (tons/batch) for each test run and the percentage of uncalcined clay in the product for each test run..

7. What control device parameters do I have to monitor during each test?

The control device parameters that you are required to measure during the test vary depending upon the type of control device you are using. Following are the list of parameters presented by control device.

- a. DLA—If the kiln is equipped with a dry lime adsorber, you must measure and record the pressure drop across the DLA every 15 minutes during the test. At least one week prior to the test, you must also establish the limestone feeder setting. During that one-week period and during the performance test, you must record the feeder setting. During the test, you must inspect the feed hopper, silo, and DLA to ensure that the limestone is free-flowing at all times during the test.
  - b. DIFF or DLS/FF—If the kiln is equipped with a dry injection fabric filter or a dry lime scrubber/fabric filter, you must record the lime feeder setting for each of the three test runs. You must also inspect the feed hopper and silo during the performance test to ensure that lime is free-flowing at all times.
  - c. Wet scrubber—If the kiln is equipped with a wet scrubber, you must measure and record each of the following parameters at least once every 15 minutes during the test run:
    - Pressure drop across the scrubber
    - Scrubber liquid pH
    - Scrubber liquid flow rate
    - Scrubber chemical feed rate if you use a chemical, such as lime or sodium bicarbonate, in your wet scrubber.
8. How do I demonstrate compliance with the HF and HCl percentage reduction requirements in the rule using the data from the performance test?

Follow these steps to demonstrate compliance with the percentage reduction requirements in the rule.

- a. Determine the hourly HF and HCl mass emission rates (lbs/hr) at the inlet and outlet of the control device by following the calculations included in the applicable test method.
- b. Identify the period of 3 consecutive hours during the test run when the sum of the hourly HF mass emission rates at the inlet to the control device is greater than any

other period of 3 consecutive hours. This 3-hour period is referred to as the peak HF emissions period.

- c. Calculate the HF and HCl percentage reduction for each hour of the peak emissions period using Equation 2 of 63.9800(g)(2).
- d. For each test run, calculate the average percentage reduction for HF and HCl for the 3-hour peak HF emissions period.
- e. Calculate the average HF and HCl percentage reduction for the two test runs. This is the percentage reduction for the performance test.

Example 16 demonstrates how to show compliance with the percentage reduction requirements for HF and HCL using data from an example test run.

*Example 16: Demonstrating Compliance with the Percentage Reduction Requirements for a Clay Refractory Batch Process*

Table 15 presents data from an example test run that will be used to show how to demonstrate compliance with the percentage reduction requirements.

**Table 15. Example Test Run for Demonstrating Compliance with the Percentage Reduction Requirements for a Clay Refractory Batch Process**

Hour	HF emission rate, inlet (lbs/hour)	3-hour total HF emission rate, inlet (lbs/hr)	HF emission rate, outlet (lbs/hr)	HF percentage reduction	HCl emission rate, inlet (lbs/hr)	HCl emission rate, outlet (lbs/hr)	HCl percentage reduction
1	0.5		0.05	90	0.11	0.07	36.4
2	0.6		0.054	91	0.13	0.09	30.8
3	0.92	2.02	0.072	92.2	0.21	0.14	33.3
4	1.03	2.55	0.075	92.7	0.32	0.22	31.3
5	1.16	3.11	0.078	93.3	0.35	0.23	34.3
6	1.23	3.42	0.083	93.3	0.38	0.25	34.2
7	1.09	3.48	0.077	92.9	0.38	0.26	31.6
8	0.87	3.19	0.073	91.6	0.31	0.21	32.3
9	0.63	2.59	0.055	91.3	0.19	0.13	31.6
10	0.48	1.98	0.043	91.0	0.12	0.08	33.3
11	0.28	1.39	0.027	90.4	0.08	0.05	37.5

The peak HF emissions period for the example test run presented in Table 15 occurs between hours 5 and 7. Therefore, you must determine the average reduction for both HF and HCl during that 3-hour period.

For HF, the percentage reductions for hours 5, 6, and 7 are 93.3, 93.3, and 92.9, respectively. Therefore, the average percentage reduction for HF for this test run is 93.2 percent.

For HCl, the percentage reductions for hours 5, 6 and 7 are 34.3, 34.2 and 31.6, respectively. Therefore, the average percentage reduction for HCl for this test run is 33.4 percent.

Assuming that the average percentage reduction for HF for the second test run was 91.8, the average for the performance test is 92.4. This is greater than the required percentage reduction of 90 percent, so the results from the performance test indicate the facility is in compliance with the emission limit for HF.

Assuming that the average percentage reduction for HCl for the second test run was 31.8 percent, the average for the performance test is 32.6 percent. This is greater than the required percentage reduction of 30 percent, so the results from the performance test indicate that the facility is also in compliance with the emission limit for HCl.

9. Emissions from the kiln at my facility are controlled by a DLA. How do I establish operating limits using the data from the performance test?

To demonstrate continuing compliance with the standard you must establish operating limits for pressure drop and limestone feeder setting during the performance test. The procedures you need to follow for each operating limit are presented below.

- a. *Establishing the operating limit for pressure drop across the DLA.* As discussed earlier, you are required to monitor and record the pressure drop across the DLA at least every 15 minutes during each test run. For each hour of the test run, calculate the average pressure drop. The operating limit for the pressure drop is based on the average of the hourly average pressure drops for the two test runs.
  - b. *Establishing the operating limit for limestone feeder setting.* You are required to establish the limestone feeder setting one week before you begin the performance test. During this 1-week period preceding the test, you must record and maintain the limestone feeder setting. You must also maintain the feeder setting at the same rate during the performance test and ensure that the limestone in the feed hopper, silo, and DLA is free-flowing at all times during the test. The setting used during the performance test will represent the operating limit for the limestone feeder.
10. How do I establish the operating limits if my kiln is equipped with a DIFF or DLS/FF?

To demonstrate continuous compliance with the standard if your facility is equipped with a DIFF or DLS/FF, you must follow all EPA guidance and specifications for bag leak detection systems. You must also establish the operating limit for the lime feeder setting.

To establish the operating limit for the lime feeder setting, you must record the setting for each of the two test runs. The operating limit for the setting is the average feed rate for the two test runs.

11. How do I establish the operating limits if my kiln is equipped with a wet scrubber?

If your kiln is equipped with a wet scrubber, you must establish operating limits for

- Minimum scrubber pressure drop
- Minimum scrubber liquid pH
- Minimum scrubber liquid flow rate
- Minimum scrubber chemical feed rate if you use a chemical, such as lime or sodium bicarbonate, in your wet scrubber.

The procedure for establishing each of these operating limits is detailed below. The procedure is the same for each parameter:

- a. Monitor and record each parameter at least once every 15 minutes during the test run.
  - b. Calculate the hourly average for each parameter for each hour of the test run.
  - c. Calculate the average of each of the hourly averages for each parameter. This is the operating limit for that parameter.
12. What if I want to change the operating limits I have established due to changes in my process or changes in the operation of my control device?

As stated previously, if you wish to change the operating limit you have established for a particular parameter, you must conduct another performance test. For example, if your kiln is controlled by a wet scrubber and you wish to operate at a lower liquid flow rate than the minimum level established during the performance test, you must conduct a new performance test to establish a new operating limit. Your kiln may be equipped with a DIFF and you believe can still achieve the emission limits if you operate at a lower lime feeder setting. You would also have to conduct a new performance test in this situation to establish a new operating limit for the lime feeder setting and to ensure that you are still meeting the emission limits at the lower setting. If the results from the new performance test indicate you are still in compliance with the standard, then you may establish a new operating limit for the liquid flow rate or the lime feeder setting based on the data from that performance test.