

## Engineering Guide #20: Determination of Compliance with Visible Emission Limitations for Stack Sources

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### Question:

How should compliance with the 20% and 60% opacity limitations in paragraphs (A)(1)(a) and (A)(1)(b) of rule 3745-17-07 be determined?

### Answer:

OAC rule 3745-17-07(A)(1)(a) states in part that “visible particulate emissions from any stack shall not exceed 20% opacity, as a 6-minute average.”

OAC rule 3745-17-07(A)(1)(b) goes on to provide an exemption by stating that “visible particulate emissions from any stack may exceed 20% opacity, as a 6-minute average, for not more than 6 consecutive minutes in any 60 minutes, but shall not exceed 60% opacity, as a 6-minute average, at any time.”

The procedure for determining compliance with the above limitation, as specified in OAC rule 3745-17-03(B)(1) is USEPA Reference Method 9 (See Visible Emission Observation Form in Appendix A). This method involves the visual determination of plume opacity by a qualified observer. OAC rule 3745-17-03(B)(2) allows for the use of a continuous opacity monitor (COM) as an alternative to using Method 9 to demonstrate compliance for coal-fired boilers with heat inputs greater than or equal to 250 MMBtu/hr and controlled with either a baghouse or ESP, provided that the COM complies with the requirements of USEPA Performance Specification 1.

When performing a Method 9 reading, the observer shall stand at a distance sufficient to provide a clear view of the stack with the sun oriented in the 140-degree sector to the observer’s back (This usually cannot be accomplished between the hours of 11 AM and 1 PM). The observer shall make observations from a position such that the line of vision is approximately perpendicular to the plume direction.

The observations are made at the point of the plume with the greatest opacity; however, no condensed water vapor should be present at the point of observation. When water vapor is present within the plume as it emerges from the stack, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible (attached steam plume). When water vapor in the plume condenses and becomes visible at a distinct distance from the stack, the opacity should be evaluated at the stack outlet prior to the condensation of water vapor and the formation of the steam plume (detached steam plume).

The observer records readings to the nearest 5% opacity at 15-second intervals, taking a minimum of 24 readings, but more readings may be required depending on the opacity of the observations (See Engineering Guide #73). In accordance with Reference Method 9, the opacity (as a set) shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Sets need not be consecutive in time and in no case shall

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two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. The calculated average for the data set is then compared to the regulatory standard to determine compliance.

Figure 1 is an example of a completed Method 9 observation showing the highest 6-minute averaging period.

Opacity Readings					
Min\Sec	0	15	30	45	Comments
1	10	15	10	5	
2	10	15	25	25	
3	30	40	35	35	
4	40	30	35	35	Average = 32.5%
5	15	25	25	40	
6	40	40	30	35	
7	35	40	30	35	
8	30	30	20	15	
9	10	15	5	10	

Figure 1

While the above example does show opacity in excess of 20% as a 6-minute average, it does not adequately document noncompliance with OAC rule 3745-17-07 due to only showing one non-overlapping period, and as the opacity was less than 60%, the source could have met the exemption in OAC rule 3745-17-07(A)(1)(b). In Figure 2, the observation data now demonstrates a violation of both OAC rule 3745-17-07(A)(1)(a) and OAC rule 3745-17-07(A)(1)(b).

Opacity Readings					
Min\Sec	0	15	30	45	Comments
1	10	15	10	5	
2	10	15	25	25	
3	30	40	35	35	
4	40	30	35	35	Average = 32.5%
5	15	25	25	40	
6	40	40	30	35	
7	35	40	30	35	
8	30	30	20	15	
9	10	15	5	10	
10	10	15	5	5	
11	10	25	40	35	
12	45	30	25	40	
13	35	45	30	35	Average = 35.0%
14	40	40	30	35	
15	35	30	40	30	
16	25	35	45	40	
17	30	15	20	10	

Figure 2

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In short, noncompliance with 3745-17-07 would occur if any 6-minute period in a 1-hour observation period exceeds 60% opacity at any time, or if any two non-overlapping 6-minute periods in a 1-hour observation period exceed 20% opacity.

EPA  
VISIBLE EMISSION OBSERVATION FORM 1

Method Used (Circle One)  
Method 9    203A    203B    Other \_\_\_\_\_

Company Name \_\_\_\_\_  
Facility Name \_\_\_\_\_  
Street Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

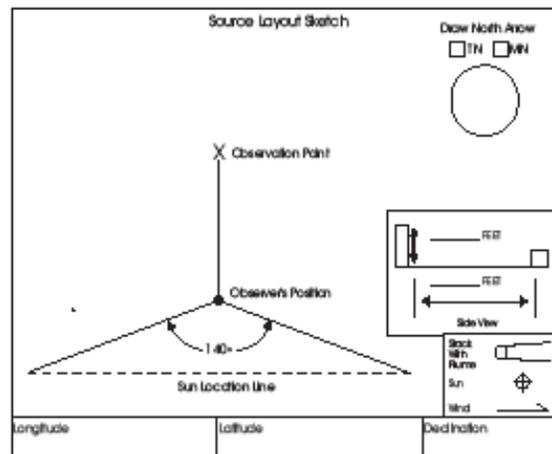
Process \_\_\_\_\_ Unit # \_\_\_\_\_ Operating Mode \_\_\_\_\_  
Control Equipment \_\_\_\_\_ Operating Mode \_\_\_\_\_

Describe Emission Point  
Height of Emis. Pt. \_\_\_\_\_ Height of Emis. Pt. Rel. to Observer \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_  
Distance to Emis. Pt. \_\_\_\_\_ Direction to Emis. Pt. (Degrees) \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_

Vertical Angle to Obs. Pt. \_\_\_\_\_ Direction to Obs. Pt. (Degrees) \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_  
Distance and Direction to Observation Point from Emission Point  
Start \_\_\_\_\_ End \_\_\_\_\_

Describe Emissions  
Start \_\_\_\_\_ End \_\_\_\_\_  
Emission Color \_\_\_\_\_ Water Droplet Plume  
Start \_\_\_\_\_ End \_\_\_\_\_ Attached  Detached  None

Describe Plume Background  
Start \_\_\_\_\_ End \_\_\_\_\_  
Background Color \_\_\_\_\_ Sky Conditions \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_  
Wind Speed \_\_\_\_\_ Wind Direction \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_  
Ambient Temp. \_\_\_\_\_ Wet Bulb Temp. \_\_\_\_\_ RH Percent \_\_\_\_\_  
Start \_\_\_\_\_ End \_\_\_\_\_ Start \_\_\_\_\_ End \_\_\_\_\_



Additional Information  
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\_\_\_\_\_

Form Number \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_  
Continued on VEO Form Number \_\_\_\_\_

Sec Min	Time Zone				Start time	End time	Comments
	0	15	30	45			
1							
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Observer's Name (Print) \_\_\_\_\_  
Observer's Signature \_\_\_\_\_ Date \_\_\_\_\_  
Organization \_\_\_\_\_  
Certified by \_\_\_\_\_ Date \_\_\_\_\_

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