United States Environmental Protection Agency
Office of Air Quality Planning and Standards Research Triangle Park, NC
EPA 340/1-86-017 January 1986
Stationary Source Compliance Training Series

EPA

INSTRUCTIONS FOR USE OF VISIBLE EMISSIONS OBSERVATION FORM

EPA Reference Method 9

EPA 340/1-86-017
January 1986

Instructions For Use of Visible Emission Observation Form

EPA Reference Method 9

Prepared by:

Entrophy Environmentalist, Inc.
PO Box 12291
Research Triangle Park, NC 27709

and

Eastern Technical Associates
PO Box 58495
Raleigh, NC 27658

EPA Project Officer: Kirk Foster

US. ENVIRONMENTAL PROTECTION AGENCY
Stationary Source Compliance Division
Office of Air Quality Planning and Standards
Washington, DC 20460

January 1986

FOREWORD

EPA Reference Method 9, as published in 40 CFR Part 60 in 1974, included a field data sheet and an example observational record sheet which can be used to record visible emission determinations made by qualified observers. Field experience gained from extensive use of Method 9 eventually lead to the development of a more efficient and practical visible emission field observation form. The form described in this document is recommended for recording and reporting Method 9 visible emission determinations conducted for the purposed of demonstrating compliance or non compliance with air pollution control standards and regulations. The form includes not only the data required by Method 9, but also more descriptive information on observation conditions which might be needed to settle questions of data interpretation or representativeness.

INSTRUCTIONS FOR USE OF THE VISIBLE EMISSION OBSERVATION FORM

INTRODUCTION

Federal Reference Method 9 - Visual Determination of the Opacity of Emissions from Stationary Sources (Federal Register 39 39872, November 12, 1974) requires the recording of certain specific information in the field documentation of a visible emission observation. The required information includes the name of the plant, the emission location, the type of facility, the observer's name and affiliation, the date, the time, the estimated distance to the emission location, the approximate wind direction, the estimated wind speed, a description of the sky conditions, the plume background, in addition to a minimum of 24 opacity observations.

Field experience gained from past use of Method 9 in determining compliance of sources subject to opacity standards has demonstrated a need for additional documentation when making visible emissions (VE) observations. The attached Visible Emission Observation Form was developed to assist in the collection of information required by Method 9 and suggested additional information. The form was developed after a review of the opacity forms in use in EPA Regional Offices and State and local air quality control agencies. The form includes not only the data required by Method 9, but also more descriptive information on observation conditions.

The Visible Emission Observation Form as designed is a three-part form; the top copy (original) goes to the agency files, the second copy is for the VE observer's file, and it is intended that the third copy be given to the appropriate facility personnel immediately following the on-site field observation if this is the agency policy or procedure. The forms are numbered serially with a 5-digit number and each copy of the three part form is imprinted with the same number. The form should be completed on-site and signed by the observer. It is recommended that water proof black ink always be used with these forms.

The Visible Emission Observation Form (see Figure 1) can be functionally divided into 10 major sections, with each section documenting one or two aspects of the opacity determination. An "additional information" section is included for notation of relevant information not covered elsewhere on the form. Spaces for temporal change entries (e.g. "start" "end" and the "comments" section of the data set) are used to record new information when the observation conditions change during the observation period.

The following guidelines discuss the major sections and each data element found on the VE Observation Form. This includes a short explanation of each section's purpose, an explanation of each data element, a description of the type of information being sought, and in some cases, examples of appropriate entries. Discussions are keyed to Figure 1 by corresponding capital letters, and starred items indicate that the information is required by Method 9.

Separate companion forms including a company notification record and sheets for data reduction calculations are being prepared to accompany the VE Observation Form. To tie all these forms together, all companion forms will include a space for recording the 5-digit number(s) of the VE Observation Form(s) to which they relate. Each companion form will be accompanied by a set of

instructions, which like the instructions which follow, will address each data element on the form and will include examples of appropriate entries.

A. COMPANY IDENTIFICATION. Provides information that uniquely identifies the company and permits the observer to locate or make contact with the company.

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

Company Name* - Include the facility's complete name. For positive identification of the facility, the parent company name, division, or subsidiary name should be included.

Street Address* - Indicate the street address of the facility (not the mailing address or the home office address) so that the exact physical location of the source is known. If necessary, the mailing address or home office address may be listed elsewhere.

Phone (Key Contact) - List the phone number for the appropriate contact person at the facility such as the plant manager or environmental officer.

Source Id Number - This space is provided for the use of agency personnel and may be used to enter the number the agency uses to identify that particular source, such as the State file number, Compliance Data System number, or National Emission Data System number.

B. PROCESS AND CONTROL DEVICE TYPE. Includes a several-word descriptor of the process and control device, indication of current process operating capacity or mode, and operational status of control equipment. Note: This section, in particular, includes information that will probably have to be obtained from a plant official. EPA personnel asking a plant official for information requires the approval of OMB, an active case investigation, or a prominent disclaimer that the official is under no obligation to answer. Since a facility may consider their production rate or other process information as proprietary, the inspector shall specifically inform them that they have a right to request that this information be submitted subject to the confidential business information provisions of 40 CFR 2 Subpart B.

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

Process Equipment* - Enter a description which clearly identifies the process equipment and type of facility that emits the plume or emissions to be read. The description should be brief, but should include as much information as possible, as indicated in the following examples:

* required by Reference Method 9; other items recommended.

Coal-Fired Blr - Unit 4/Power Plt
#2 Oil-Fired Blr/Chemical Plant
Wood Waste Conical Incinerator
Paint Spray Booth/Auto Plant
Primary Crusher at Rock Quarry
Fiberglass Curing Oven
Reverb Furnace/Copper Smelter
Basic Oxygen Furnace/Steel Mill
Cement Plant Kiln

Operating Mode - Depending on the type of process equipment, this information may vary from a quantification of the current operating rate or a description of the portion of a batch-type process for which the emission opacity is being read to an explanation of how the equipment is currently operating such as "upset conditions," "startup," or "shutdown." Other examples include "90 percent capacity" for a boiler or "85 percent production rate" for the shakeout area of a grey iron foundry. For a steel making furnace, entries should include the exact part of the process cycle for which readings are being made, such as "charging" or "tapping." In most cases, this information will have to be obtained from a plant official.

Control Equipment* - Specify the type(s) of control equipment being used in the system after the process equipment in question (e.g., "hot-side electrostatic precipitator").

Operating Mode - Indicate the manner in which the control equipment is being utilized at the time of the opacity observations (e.g., 1 field of 8 tripped on ESP, scrubber operating without water, shut down, off line) and the operating mode (e.g., automatic, manual, bypass). This information should be obtained from a plant official.

C. EMISSION POINT IDENTIFICATION. Contains information uniquely identifying the emission point and its spatial relationship with the observer's position. It is recommended that distances and heights in this section be noted in consistent units.

DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

Describe Emission Point* - Describe the type and physical characteristics of the emission point. The description must be specific enough so that the emission outlet can be distinguished from all others at the source. The description of the type of emission point should address whether it is (1) a specifically designed outlet such as stacks, vents, and roof monitors (having confined emissions) or (2) an emission source having unconfined emissions such as storage piles, chemical tanks, and non-ducted material handling operations. Description of the physical characteristics of the emission point should include the appearance (such as color, texture, etc.) and geometry (size, shape, etc.) of the stack or other outlet, and its location in relation to other recognizable facility landmarks.

* Required by Reference Method 9; other items recommended.

Any special identification codes the agency or source uses to identify a particular stack or outlet should be noted along with the description; the source of the code should also be recorded. A special identification code should not be used alone to describe the emission point, since they are sometimes incorrect and also require a secondary reference. The observer must be certain of the origin of the emissions that were being read. A description of the emission point coupled with the identification of the process equipment and control equipment should accomplish that purpose.

Height Above Ground Level* - Indicate the height of the stack or other emission outlet from its foundation base. This information is usually available from agency files, engineering drawings, or computer printouts (such as NEDS printouts). The information also may be obtained by using a combination of a rangefinder and an Abney level or clinometer. The height may also be estimated.

Height Relative to Observer* - Indicate an estimate of the height of the stack outlet (or of any other type of emission outlet) above the position of the observer. This measurement indicates the observer's position in relation to the stack base (i.e., higher or lower than the base) and is necessary if slant angle calculations are performed.

Distance From Observer* - Record the distance from the point of observation to the emission outlet. This measurement may be made by using a rangefinder. A map may also be used to estimate the distance.

This measurement must be reasonably accurate when the observer is close to the stack (within 3 stack heights). This is because it may be used in conjunction with the outlet height relative to the observer to determine the slant angle at which the observations were made (see Figure 2). A precise determination of the slant angle becomes important in calculating the positive bias inherent in opacity readings made when the observer is within three stack heights of the stack.

Direction From Observer* - Specify the direction of the emission point from the observer. It is suggested that this be done to the closest of the eight points of the compass (e.g., S, SE, NW, NE) and a compass be used to make the determination. To accomplish this: hold the compass while facing the emission point; rotate the compass until the North compass point lies directly beneath the needle (which will be pointing towards magnetic North); then the point of the compass closest to the emission outlet will indicate the direction (Figure 3). A map may also be used to make this determination.

D. EMISSIONS DESCRIPTION. Includes information that definitely establishes what was observed while making the visible emissions determination. Note: Items called for in this section may change a number of times during the observation period. It is recommended that these changes be noted in the comment space beside the appropriate opacity readings and reference to this be made in the corresponding space in this section.

DESCRIBE EMISSIONS	
Start End	
EMISSION COLOR	IF WATER DROPLET PLUME
Start End	Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	
Start End	

* Required by Reference Method 9; other items recommended.

Describe Emissions* - Include the physical characteristics and behavior of the plume (not addressed elsewhere on the form) and the distance it is visible. Physical descriptions may include such things as texture, gradation, and contents, examples are "lacy," "fluffy," "copious," "mushrooming," "spreading over horizon," and "detached nonwater vapor condensibles." The standard plume terminology illustrated in Figure 4 may be used to describe plume behavior. The behavior is generally used to determine the atmospheric stability on the day of the opacity observations.

Emission Color* - Note the color of the emissions. The plume color can sometimes be useful in determining the composition of the emissions and also serves to document the total contrast between the plume and its background as seen by the opacity observer. For emissions that change color a number of times during the observation period (such as those from a basic oxygen furnace), the color changes should be noted in the comments space next to the opacity readings themselves.

If Water Droplet Plume* - This box is only completed if visible water droplets are present. Check "attached" if condensation of the moisture contained in the plume occurs within the stack and the water droplet plume is visible at the stack exit. Check "detached" if condensation occurs some distance downwind from the stack exit and the water droplet plume and the stack appear to be unconnected.

Plumes containing condensed water vapor ("water droplet plumes" or "steam plumes") are usually very white and billowy, and then wispy at the point of dissipation, where the opacity decreases rapidly from a high value (usually 100%) to zero if there is no residual opacity contributed by contaminate in the plume.

To document the presence or absence of condensed water vapor in the plume, two points must be addressed. First, is sufficient moisture present (condensed or uncondensed) in the effluent to produce water droplets at in-stack or ambient conditions? Second, if enough moisture is present, are the in-stack and ambient conditions such that it will condense either before exiting the stack or after exiting (when it meets with the ambient air)? The first question can be answered by examining the process type and/or the treatment of the effluent gas after the process. Some common sources of moisture in the plume are:

- o Water produced by combustion of fuels,
- o Water from dryers,
- o Water introduced by wet scrubbers,
- o Water introduced for gas cooling prior to an electrostatic precipitator or other control device, and
- o Water used to control the temperature of chemical reactions.

If water is present in the plume, data from a sling psychrometer, which measures relative humidity, in combination with the moisture content and temperature of the effluent gas can be used to predict whether the formation of a steam plume is probable.

* required by Reference Method 9; other items recommended.

Point in the Plume at Which Opacity was Determined* - Describe as accurately as possible the physical location in the plume such as the distance from the emission point where the observations were made. This is necessary to establish that nothing interferred with the observer's clear view of the contaminant plume itself, such as condensed water vapor; it is also important in the case of secondary plume formation. Therefore, the observer must specify 1) if the readings were made prior to water droplet plume formation or after water droplet plume dissipation and 2) the distance from the emission point and/or water droplet plume. Descriptions such as "4 feet above outlet" and "80 feet downstream from outlet," "10 feet after steam dissipation" are appropriate. Figure 5 shows some examples of the correct location for making opacity readings in various steam plume and secondary plume situations.

E. OBSERVATION CONDITIONS. Covers the background and ambient weather conditions that occur during the observation period and could affect observed opacity.

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				

Describe Plume Background* - Describe the background that the plume is obscuring and against which the opacity is being read. When describing the background, include characteristics such as texture. Examples of background descriptions are "structure behind roof monitor," "stand of pine trees," "edge of jagged stony hill side," "clear blue sky," "stack scaffolding," and "building obscured by haze."

Background Color* - Describe the background color including the shade of the color (e.g., new leaf green, conifer green, dark brick red, sky blue, and light gray stone). In general, the background chosen to read against should contrast with the color of the plume.

Sky Conditions* - Indicate the percent cloud cover of the sky. This information can be indicated by using straight percentages (e.g., 10% overcast, 100% overcast) or by description, as shown below:

Term	Amount of cloud cover
Clear	<10%
Scattered	10% to 50%
Broken	50% to 90%
Overcast	>90%

Wind Speed* - Record the wind speed. It is recommended that it be measured or estimated to ±5 miles per hour. The wind speed may be measured using a hand-held anemometer (if available), or it can be estimated by using the Beaufort Scale of Wind Speed Equivalents shown in Table 1.

* Required by Reference Method 9; other items recommended.

TABLE 1. THE BEAUFORT SCALE OF WIND SPEED EQUIVALENTS

General description	Specifications	Limits of velocity 33 ft (10 m) above level ground, mph
Calm	Smoke rises vertically	Under 1
	Direction of wind shown by smoke drift but not by wind vanes	1 to 3
Light	Wind felt on face; leaves rustle; ordinary vane moved by wind	4 to 7
Gentle	Leaves and small twigs in constant motion; wind extends light flag	8 to 12
Moderate	Raises dust and loose paper; small branches are moved	13 to 18
Fresh	Small trees in leaf begin to sway; crested wavelets form on inland waters	19 to 24
	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	25 to 31

Wind Direction* - Indicate the direction from which the wind is blowing. It is suggested that the direction should be estimated to eight points of the compass. This can be accomplished by observing which way the plume is blowing. If this is not possible, the wind direction may be determined by observing a blowing flag or by noting the direction a few blades of grass or handful of dust are blown when tossed into the air. Keep in mind that the wind direction at the observation point may be different from that at the emission point; the wind direction at the emission point is the one of interest.

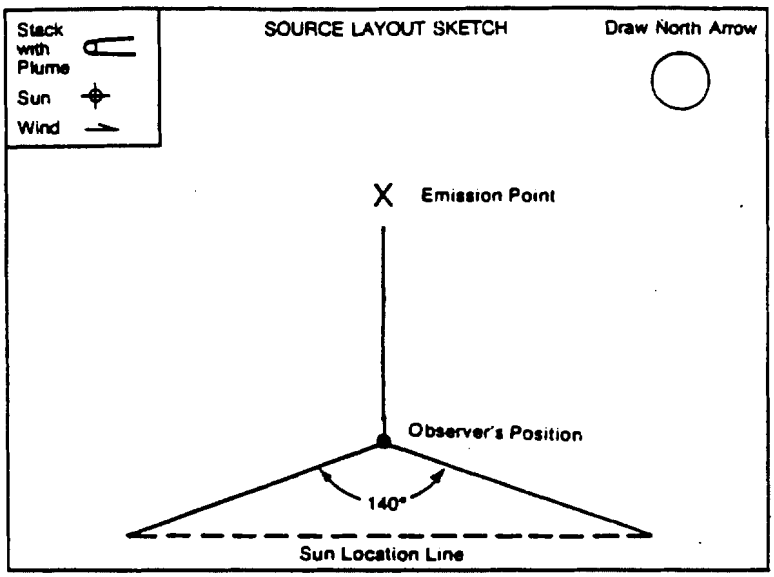
Ambient Temperature* - The outdoor temperature at the plant site is measured by a thermometer (in degrees Fahrenheit or centigrade). Be certain to note which temperature scale is used. The ambient temperature is used in conjunction with the wet bulb temperature when there are indications of a condensing water droplet plume.

Wet Bulb Temperature - Record the wet bulb temperature from the sling psychrometer. This is done when there is a possibility of a condensing water droplet plume.

Relative Humidity - Enter the relative humidity measured by using a sling psychrometer in conjunction with a psychrometric chart. This information is used to determine if water vapor in the plume will condense to form a steam plume.

* Required by Reference Method 9; other items recommended.

F. OBSERVER POSITION AND SOURCE LAYOUT. Clearly identifies the observer's position in relation to the emission point, plant landmarks, topographic features, sun position, and wind direction.



Source Layout Sketch* - This sketch should be drawn as a rough plan view and should include as many landmarks as possible. At the very least, the sketch should locate the relative positions of the observed outlet and associated buildings in such a way that they will not be confused with others at a later date, and clearly locate the position of the observer while making the VE readings. The exact landmarks will depend on the specific source, but they might include:

- o Other stacks
- o Hills
- o Roads
- o Fences
- o Buildings
- o Stockpiles
- o Rail heads
- o Tree lines
- o Background for readings
- o Interferring plumes from other sources

To assist in subsequent analysis of the reading conditions, sketch in the plume (indicate the direction of wind travel). The wind direction also must be indicated in the previous section.

Draw North Arrow - To determine the direction of north, point the line of sight in the source layout sketch in the direction of the actual emission point, place the compass next to the circle and draw an arrow in the circle parallel to the compass needle (which points north). A map may also be used to the determine direction to north.

* Required by Reference Method 9; other items recommended.

Sun's Location - It is important to verify this parameter before making any opacity readings. The sun's location should be within the 140° sector indicated in the layout sketch; this confirms that the sun is within the 140° sector to the observer's back.

To draw the sun's location, point the line of sight in the source layout sketch in the direction of the actual emission point, move a pen upright along the "sun location line" until the shadow of the pen falls across the observer's position. Then draw the sun at the point where the pen touches the "sun location line."

G. ADDITIONAL INFORMATION. Includes conditions and/or deviations of a factual nature that have bearing on the opacity observations and that cannot be addressed elsewhere on the form.

ADDITIONAL INFORMATION

Additional Information - Note conditions or deviations of a factual nature that cannot be addressed elsewhere on the form such as in the comments section of the data set. These must be purely factual in nature and specific to the particular source. Examples of information that may be included in this section are:

- Description of unusual stack configuration (to show multiple stacks or stack in relation to roof line); attach drawing, if necessary.
- References to attachments.
- Observed or reported changes to the emissions or process during observation that are not noted in the comments area of the form.
- Additional source identification information.

H. DATA SET. Opacity readings for the observation period, organized by minute and second. This section also includes the actual date and start and end times for the observation period and space next to each minute of readings for noting relevant comments.

OBSERVATION DATE			START TIME		END TIME
SEC / MIN	0	15	30	45	COMMENTS
1					
2					
3					
26					
27					
28					
29					
30					

* Required by Reference Method 9; other items recommended.

Observation Date* - Enter the date on which the opacity observations were made.

Start Time, End Time* - Indicate the times at the beginning and the end of the actual observation period. The times may be expressed in 12-hour or 24-hour time (i.e., 8:35 a.m. or 0835); however, 24-hour time tends to be less confusing.

Data Set* - Spaces are provided on one form for entering an opacity reading every 15 seconds for up to a 30-minute observation period. If observations continue beyond 30 minutes, a second form (and third, etc.) should be used to record additional readings. The readings should be in percent opacity and made to the nearest 5 percent. The readings are entered from left to right for each numbered minute, beginning at the upper left corner of the left-hand column, labeled row "MIN 1" (minute 1) and column "SEC 0" (0 seconds). The next readings are entered consecutively in the spaces labeled MIN 1, SEC 15; MIN 1, SEC 30; MIN 1, SEC 45; MIN 2, SEC 0; MIN 2, SEC 15; etc.

If for any reason, a reading is not made for a particular 15-second period, a dash (-) should be placed in the space showing that the space is not just an oversight. The comment section beside that reading should be used for an explanation of why the reading was missed.

Comments - Spaces for comments are provided next to the data for each minute of opacity readings. These are intended to provide space to note changing observation conditions and/or reasons for missed readings in direct conjunction with the readings themselves. Items to be noted include:

- o Changes in ambient conditions from the time of the start of readings
- o Changes in plume color, behavior, or other characteristics.
- o Presence of interferring plumes from other sources.
- o Changes in observer position and indication that a new form is initiated.
- o Conditions that might interfere with readings or cause them to be biased high or low.
- o Unusual process conditions.
- o Reasons for missed readings.

I. OBSERVER DATA. Information required to validate the opacity data.

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE	DATE
ORGANIZATION	
CERTIFIED BY	DATE

* Required by Reference Method 9; other items recommended.

Observer's Name* - Print observer's entire name.

Observer's Signature - Self-explanatory.

Date - Enter the date on which the form was signed.

Organization* - Provide the name of the agency or company that employs the observer.

Certified By - Identify the agency, company, or other organization that conducted the "smoke school" or VE training and certification course where the observer obtained his/her current certification.

Date* - Provide the date of the current certification.

J. FORMS INTERELATION. Provides space for recording another VE Observation Form number so that forms concerning the same observation can be interrelated.

CONTINUED ON VEO FORM NUMBER					

Continued on VEO Form Number - Fill in the 5-digit number of the VE Observation Form, if any, where the observations from the form in use are continued. Each form of a series that has a form coming after it will have the number of the next form noted in this section.

* Required by Reference Method 9; other items recommended.

VISIBLE EMISSION OBSERVATION FORM

No.

COMPANY NAME

STREET ADDRESS

(A)

CITY | STATE | ZIP

PHONE (KEY CONTACT) | SOURCE ID NUMBER

PROCESS EQUIPMENT | OPERATING MODE

(B)

CONTROL EQUIPMENT | OPERATING MODE

DESCRIBE EMISSION POINT

(C)

HEIGHT ABOVE GROUND LEVEL | HEIGHT RELATIVE TO OBSERVER: Start / End

DISTANCE FROM OBSERVER: Start / End | DIRECTION FROM OBSERVER: Start / End

DESCRIBE EMISSIONS: Start / End

EMISSION COLOR: Start / End | IF WATER DROPLET PLUME: Attached ☐ Detached ☐

(D)

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start / End

DESCRIBE PLUME BACKGROUND: Start / End

BACKGROUND COLOR: Start / End | SKY CONDITIONS: Start / End

(E)

WIND SPEED: Start / End | WIND DIRECTION: Start / End

AMBIENT TEMP: Start / End | WET BULB TEMP | RH, percent

Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow

(F)

X Emission Point

Observer's Position

140°

Sun Location Line

ADDITIONAL INFORMATION

(G)

OBSERVATION DATE	START TIME	END TIME

SEC / MIN	0	15	30	45	COMMENTS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

(H)

OBSERVER'S NAME (PRINT)

OBSERVER'S SIGNATURE | DATE

ORGANIZATION

(I)

CERTIFIED BY | DATE

CONTINUED ON VEO FORM NUMBER

(J)

Figure 1. Visible Emission Observation Form with functional sections indicated.

12

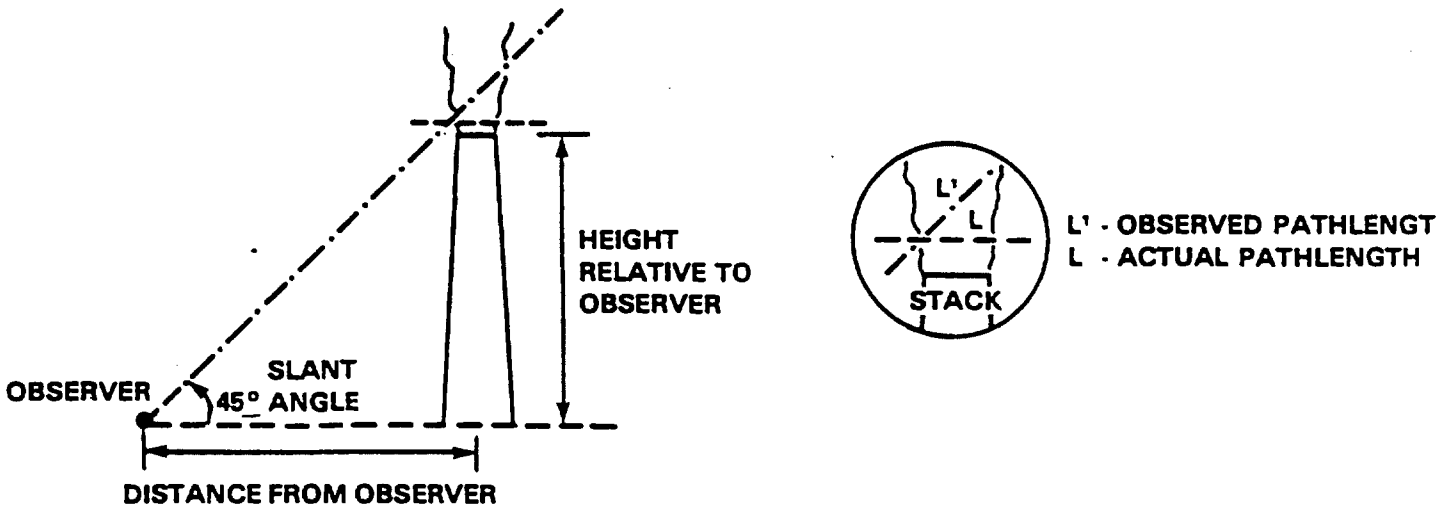


Figure 2. Slant angle relationships.

13

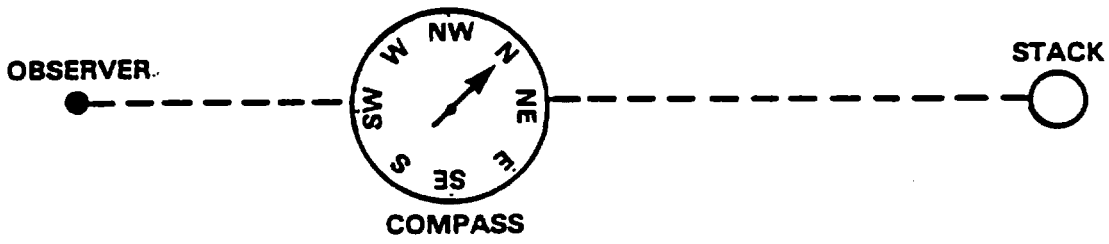


Figure 3. Direction of observation point from observer is NE.

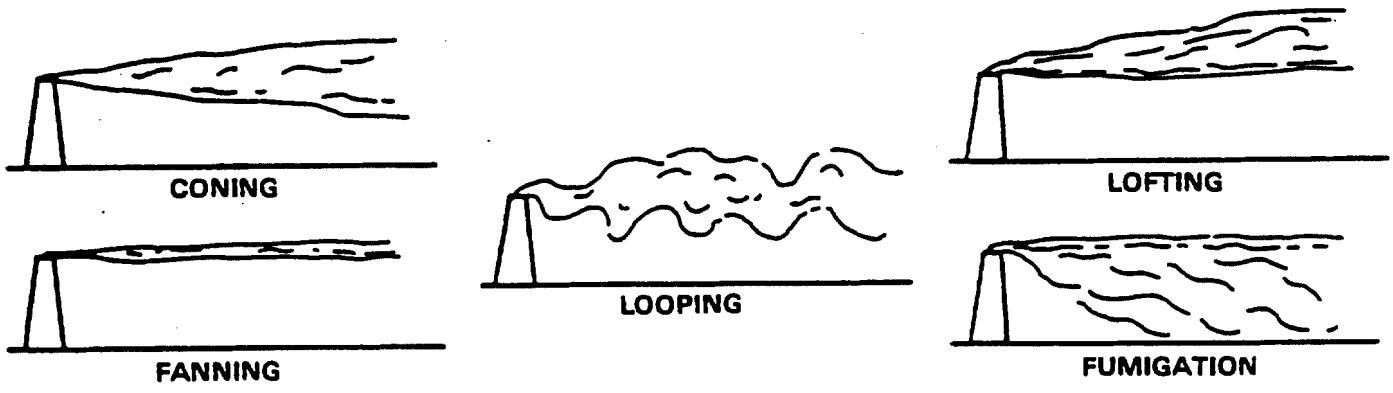
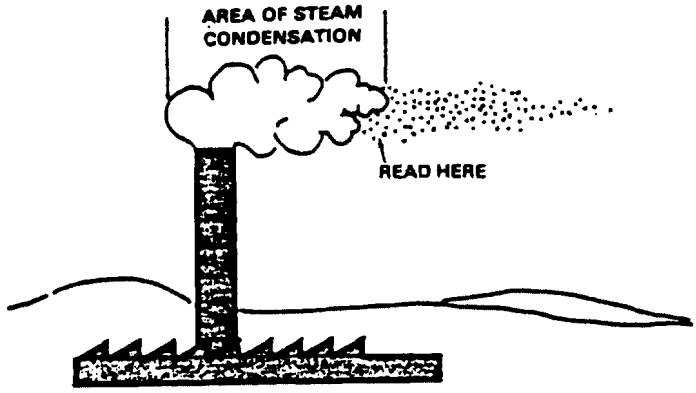
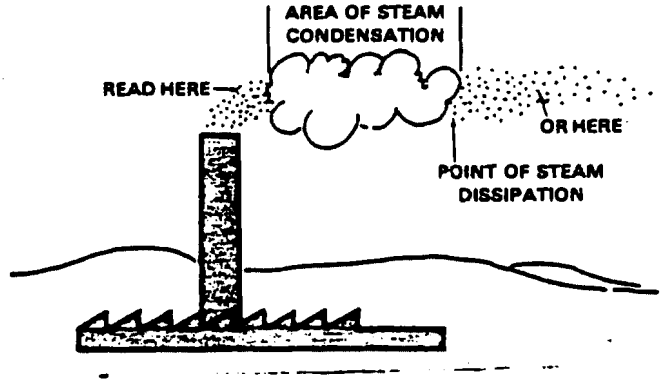


Figure 4. Recommended plume behavior descriptors.

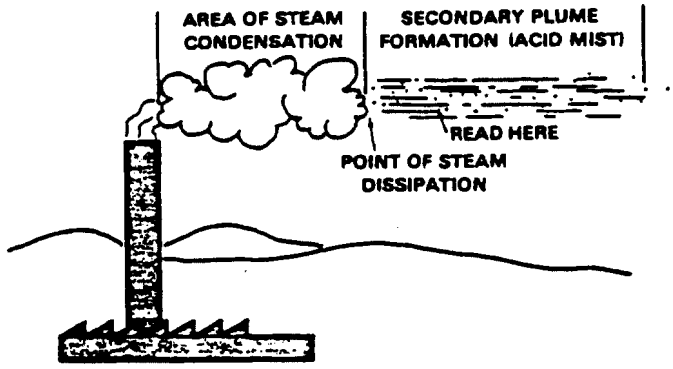
15



Attached steam plume.



Detached steam plume. In some cases, it may be necessary to make readings at the point of steam dissipation if the plume is more opaque at that point.



Plume from a sulfuric acid plant with detached steam plume. Plume is clear at stack exit. Secondary acid mist is formed in area of steam condensation.

Figure 5. Location for reading opacity under various conditions.

16

VISIBLE EMISSION OBSERVATION FORM

This form is designed to be used in conjunction with EPA Method 9, "Visual Determination of the Opacity of Emissions from Stationary Sources." Temporal changes in emission color, plume water droplet content, background color, sky conditions, observer position, etc. should be noted in the comments section adjacent to each minute of readings. Any information not dealt with elsewhere on the form should be noted under additional information. Following are brief descriptions of the type of information that needs to be entered on the form; for a more detailed discussion of each part of the form, refer to "Instructions for Use of Visible Emission Observation Form."

* Company Name - full company name, parent company or division or subsidiary information, if necessary.

* Street Address - street (not mailing or home office) address of facility where VE observation is being made.

Phone (Key Contact) - number for appropriate contact.

Source ID Number - number from NEDS, CDS, agency file, etc.

* Process Equipment, Operating Mode - brief description of process equipment (include type of facility) and operating rate, % capacity, and/or mode (e.g, charging, tapping, shut down).

* Control Equipment, Operating Mode - specify type of control device(s) and % utilization, control efficiency.

* Describe Emission Point - for identification purposes, stack or emission point appearance, location, and geometry; and whether emissions are confined (have a specifically designed outlet) or unconfined (fugitive).

* Height Above Ground Level - stack or emission point height relative to ground level; can use engineering drawings, Abney level, or clinometer.

Height Relative to Observer - indicate height of emission point relative to the observation point.

* Distance From Observer - distance to emission point; can use rangefinder or map.

* Direction From Observer - direction to emission point; can use compass or map to estimate to eight points of compass.

* Describe Emissions - include physical characteristics and plume behavior (e.g., looping, lacy, condensing, fumigating, secondary particle formation, distance plume visible, etc.).

* Emission Color - gray, brown, white, red, black, etc. Note color changes in comments section.

* If Water Droplet Plume - Check "attached" if water droplet plume forms prior to exiting stack, and "detached" if water droplet plume forms after exiting stack.

* Point in the Plume at Which Opacity was Determined - describe physical location in plume where readings were made (e.g., 1 ft. above stack exit or 10 ft. after dissipation of water plume).

* Describe Plume Background - object plume is read against, include texture and atmospheric conditions (e.g., hazy).

* Background Color - sky blue, gray-white, new leaf green, etc.

* Sky Conditions - indicate cloud cover by percentage or by description (clear, scattered, broken, overcast).

* Wind Speed - record wind speed; can use Beaufort wind scale hand-held anemometer to estimate.

* Wind Direction - direction from which wind is blowing; can u compass to estimate to eight points.

* Ambient Temperature - in °F or °C.

Wet Bulb Temperature - can be measured using a sling psychromete

Relative Humidity - can be measured using a sling psychrometer; u local U.S. Weather Bureau measurements only if nearby.

* Source Layout Sketch - include wind direction, sun position, associated stacks, roads, and other landmarks to fully identify locati of emission point and observer position.

Draw North Arrow - to determine, point line of sight in direction emission point, place compass beside circle, and draw in arro parallel to compass needle.

Sun's Location - point line of sight in direction of emission point, mo pen upright along sun location line, mark location of sun when pen shadow crosses the observer's position.

Additional Information - factual conditions or deviations n addressed elsewhere on form.

* Observation Date - date observations conducted.

* Start Time, End Time - beginning and end times of observation peri (e.g., 1635 or 4:35 p.m.).

* Data Set - percent opacity to nearest 5%; enter from left to rig starting in left column. Use a second (third, etc.) form, if readin continue beyond 30 minutes. Use dash (-) for readings not mad explain in adjacent comments section.

Comments - note changing observation conditions, plume charact eristics, and/or reasons for missed readings.

* Observer's Name - print in full.

Observer's Signature, Date - sign and date after performing observation.

* Organization - observer's employer.

* Certified By, Date - name of "smoke school" certifying observer a date of most recent certification.

Continued on VEO Form Number - note the 5-digit number of the Observation Form where the observations from the form in use continued.

---

* Required by Reference 9; other items recommended

VISIBLE EMISSION OBSERVATION FORM

No.

COMPANY NAME		
STREET ADDRESS		
CITY	STATE	ZIP
PHONE (KEY CONTACT)	SOURCE ID NUMBER	

PROCESS EQUIPMENT	OPERATING MODE
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT	
HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER Start End
DISTANCE FROM OBSERVER Start End	DIRECTION FROM OBSERVER Start End

DESCRIBE EMISSIONS	
Start	End
EMISSION COLOR Start End	IF WATER DROPLET PLUME Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED Start	End

DESCRIBE PLUME BACKGROUND		
Start	End	
BACKGROUND COLOR Start End	SKY CONDITIONS Start End	
WIND SPEED Start End	WIND DIRECTION Start End	
AMBIENT TEMP Start End	WET BULB TEMP	RH, percent

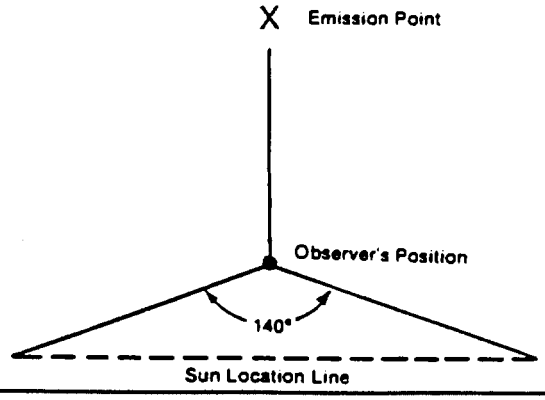
Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME

SEC / MIN	0	15	30	45	COMMENTS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	
OBSERVER'S SIGNATURE	DATE
ORGANIZATION	
CERTIFIED BY	DATE
CONTINUED ON VEO FORM NUMBER	