



Handout version 13.1

www.opaquesmokeschool.com

913-825-3644

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 Emiss. Pt.		Height of Emiss. Pt. Rel. to Observer	
Start	End	Start	End
Distance to Emiss. Pt.		Direction to Emiss. 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 <input type="checkbox"/>	Detached <input type="checkbox"/> None <input type="checkbox"/>

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		

Source Layout Sketch		
Draw North Arrow <input type="checkbox"/> TN <input type="checkbox"/> MN		
Longitude	Latitude	Declination

Form Number						Page	Of
Continued on VEO Form Number							

Observation Date		Time Zone		Start Time	End Time	Comments
Sec	Min	0	15	30	45	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
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17						
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25						
26						
27						
28						
29						
30						

Observer's Name (Print)	
Observer's Signature	Date
Organization	

Additional Information	
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Date		Certified By
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Definitions

Visible Emissions - Any airborne particulate visible to the human eye that can obscure your line of site from a background.

Observation – quick momentary glance of a selected background behind a visible emission plume. Once every 15 seconds. How much of the background is blocked from your view?

Method 9 – Standard for quantifying visible emissions. One observation of a visible emission plume, every 15 seconds for a total of six minutes. 24 observations required.

Classroom training – First time students and recommended every 3 years.

Field training – Certification is valid for 6 months

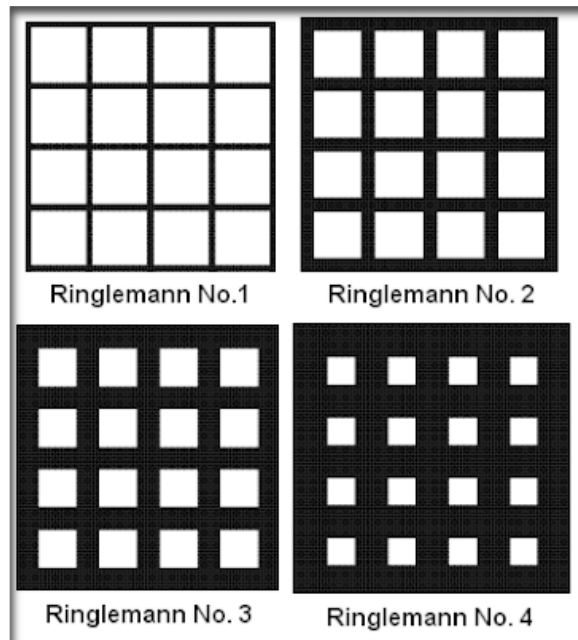
Follow up questions or comments?

Email: webmaster@opaquesmokeschool.com

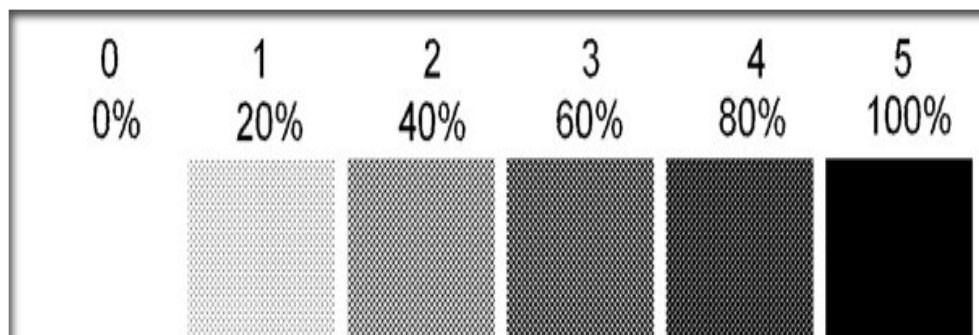
- Section 111 of the Clean Air Act requires the U.S (United States) Environmental Protection Agency to promulgate emission standards for pollutants that significantly affect air quality.
- The Federal opacity standards for various industries can be found in 40 CFR Part 60 (Standards of Performance for New and Modified Stationary Sources) and 40 CFR Part 61 and 62 (Emission Standards for Hazardous Air Pollutants).
 - Federal Opacity Standards and SIP Opacity Regulations are independently enforceable (per standard, per source, per violation, per day).
- Procedural Errors or Omissions (fields filled out incorrectly or left blank) on the visible emissions evaluation form or data sheet can invalidate the data or result in a violation.

Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



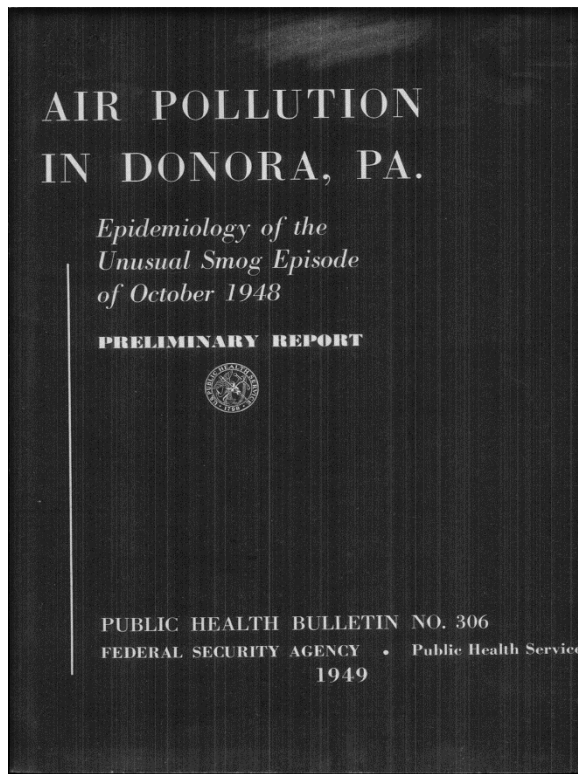
- The charts developed by Ringelmann consisted of a series of rectangular grids with a known amount of black ink covering a white background.
- Six charts were included. The first card (Ringelmann 0) was all white, the second card (Ringelmann 1) had 80% of the white exposed (or 20% obscured), the third had 60%, the fourth had 40%, the fifth had 20% exposed, and the sixth was all black.



- ▶ In 1904 the Missouri case of State vs Tower established; dense smoke was a public nuisance per se. (required proof from the community).
- ▶ In 1905 - In the case of Glucose Refining Company v. City of Chicago, the Chicago federal court upheld that dense smoke or opacity in urban areas was a public nuisance period. Burden of proof is no longer on community.
- ▶ 1916 Northwestern Laundry vs Des Moines – established that air regulations passed by local municipalities that seem harsh or unfair does not violate constitutional rights.
- ▶ 1947 – courts agree that Ringelmann charts are only valid when used with black smoke
- ▶ 1950 – Supreme court upholds position of Kingsport, TN vs Penn Dixie Cement and declares visible emissions a national health concern (see Moses v USA).
- ▶ 1976 Colorado vs Western Alfalfa – established speedy notification and inspector rights
- ▶ 1979 Donner-Hanna vs Costle – upheld the use of promulgated methods vs suggested methods.
- ▶ 1984 US (United States) vs Kaiser Steel – upheld the use of certified observations vs expert opinion.

The Question to Ask:
How much of my background is blocked from my view?





The fog started building up in Donora on October 27, 1948.

By the following day, it was causing coughing and other signs of respiratory distress for many residents of the community in the Monongahela River valley.

Many of the illnesses and deaths were initially attributed to asthma.

The smog continued until it rained on October 31, by which time 20 residents of Donora had died and approximately one third to one half of the town's population of 14,000 residents had been sickened.

Another 50 residents died of respiratory causes within a month after the incident

► In *Moses v. United States*, the court agreed that adapting regulations to meet specific conditions is within the province of legislatures. The courts can interfere only when regulation is not within police power and only when private rights have been violated. This case raised the issue of reasonableness.

Any statute or ordinance must be reasonable and must regulate something injurious to health, safety, and welfare.

► "Reasonable" is a word subject to various interpretations, and this latitude of interpretation has generated many cases. The following case review illustrates the courts' general interpretation of "reasonable." What is reasonable depends on the circumstances.

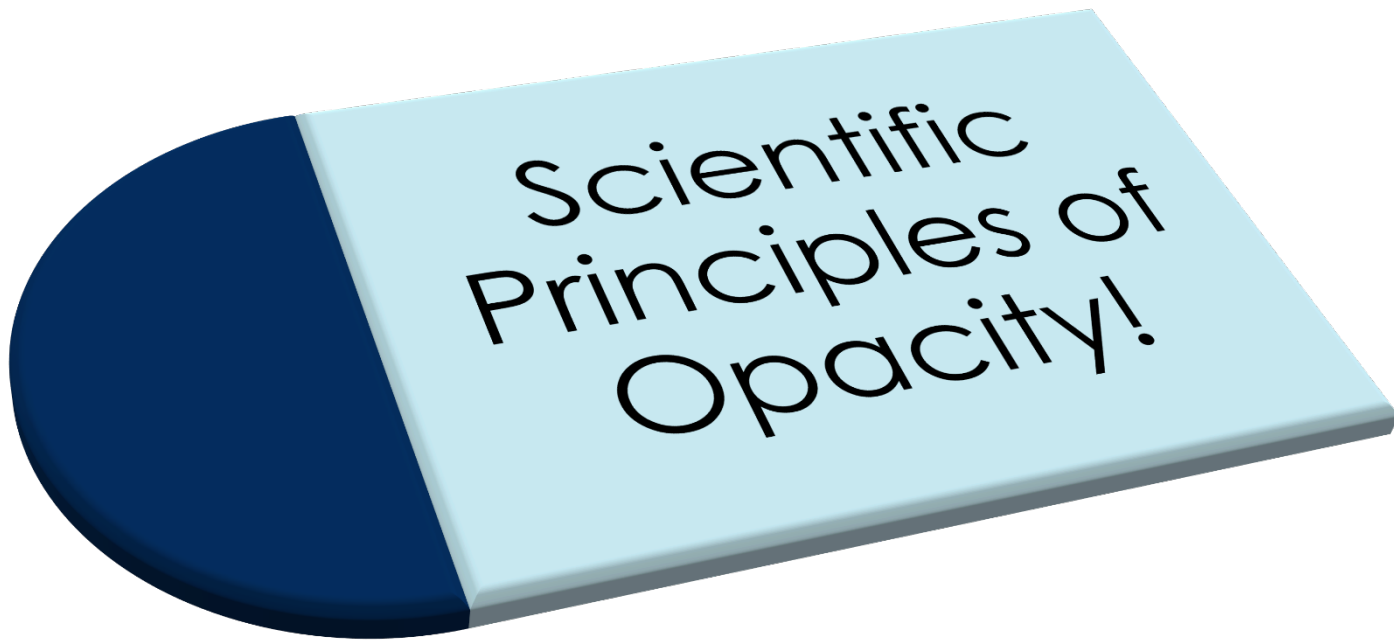
► In the 1884 case of *Harmon v. Chicago*, in the Illinois Supreme Court, the defendant argued that it was unreasonable to require the burning of expensive, clean fuel, such as anthracite coal, in place of locally available bituminous coal. "Not so," said the court. Although the holding in this case recognized that regulations could be inconvenient or costly, the court's place is not to address such issues. Cities have the authority to regulate.

Method 9

- ▶ Method 9 involves taking opacity observations or glances of a plume once every 15 seconds over a six-minute period.
- ▶ After six minutes, you should have 24 opacity values (unless some other time period is specified in the emission standard).
- ▶ You then calculate the average opacity of the 24 observations.
- ▶ This equals 1 opacity reading.
- ▶ Applies to any color of dust, smoke, or particulate matter.

- ▶ Method 9 is a Subjective Method, meaning your observations recorded are determined by relating to properties or specific conditions of the mind as distinguished from general or universal experience.
- ▶ Two different observers may record two different plume opacity readings, on the same source, at the exact same time.
- ▶ As long as these observers have valid certifications, both readings are valid, even in a deposition or in court.
- ▶ This illustrates the importance of paying close attention to the observation conditions and proper documentation when performing a visible emission inspection.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on the right side, suggesting it's resting on a surface.



Particle Density

Particle Size

Particle Size Distribution

Particle Refractive Index

Particle Color

Plume Background

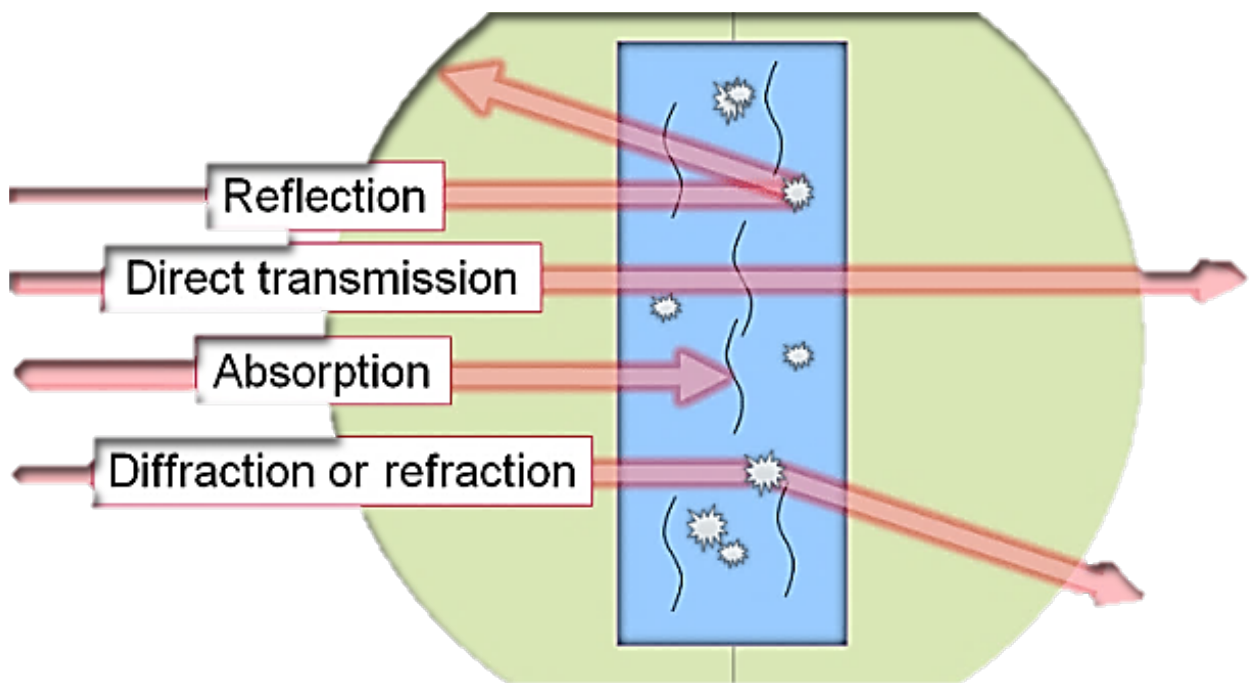
Distance and Relative Elevation to Stack Height

Sun Angle

Lighting Conditions

***Scientific
Principles
of Opacity***

Light Scattering Mechanics

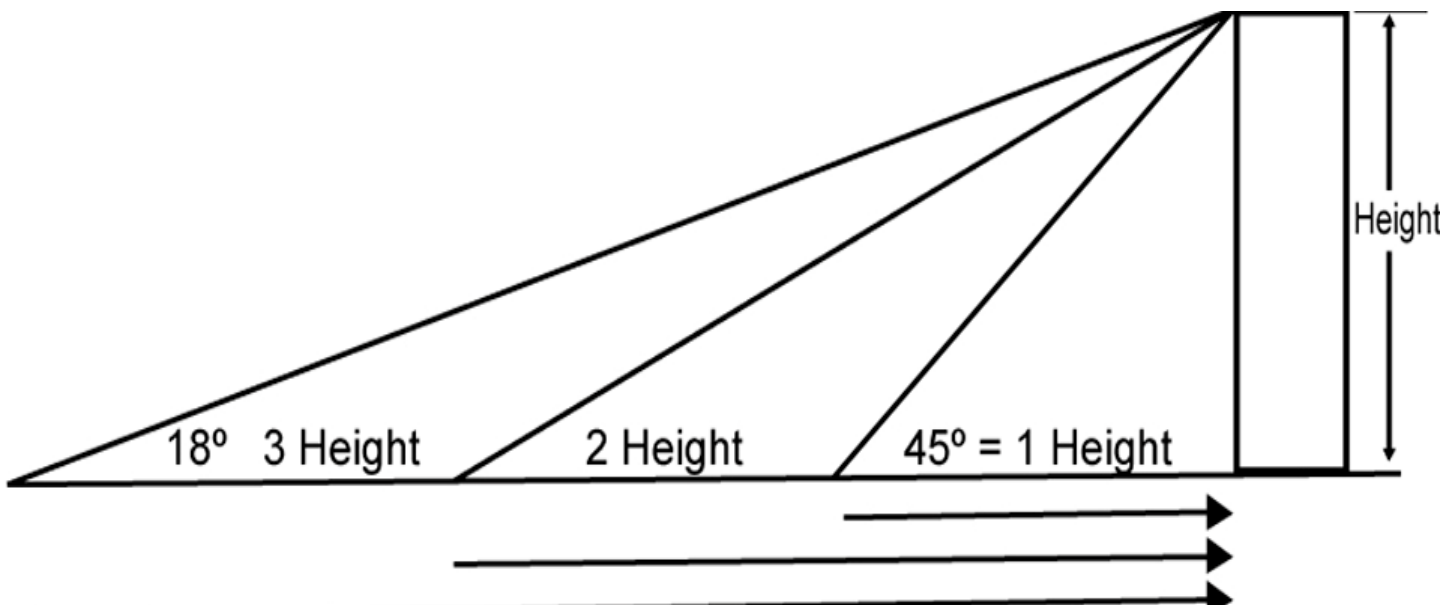


Plume Background

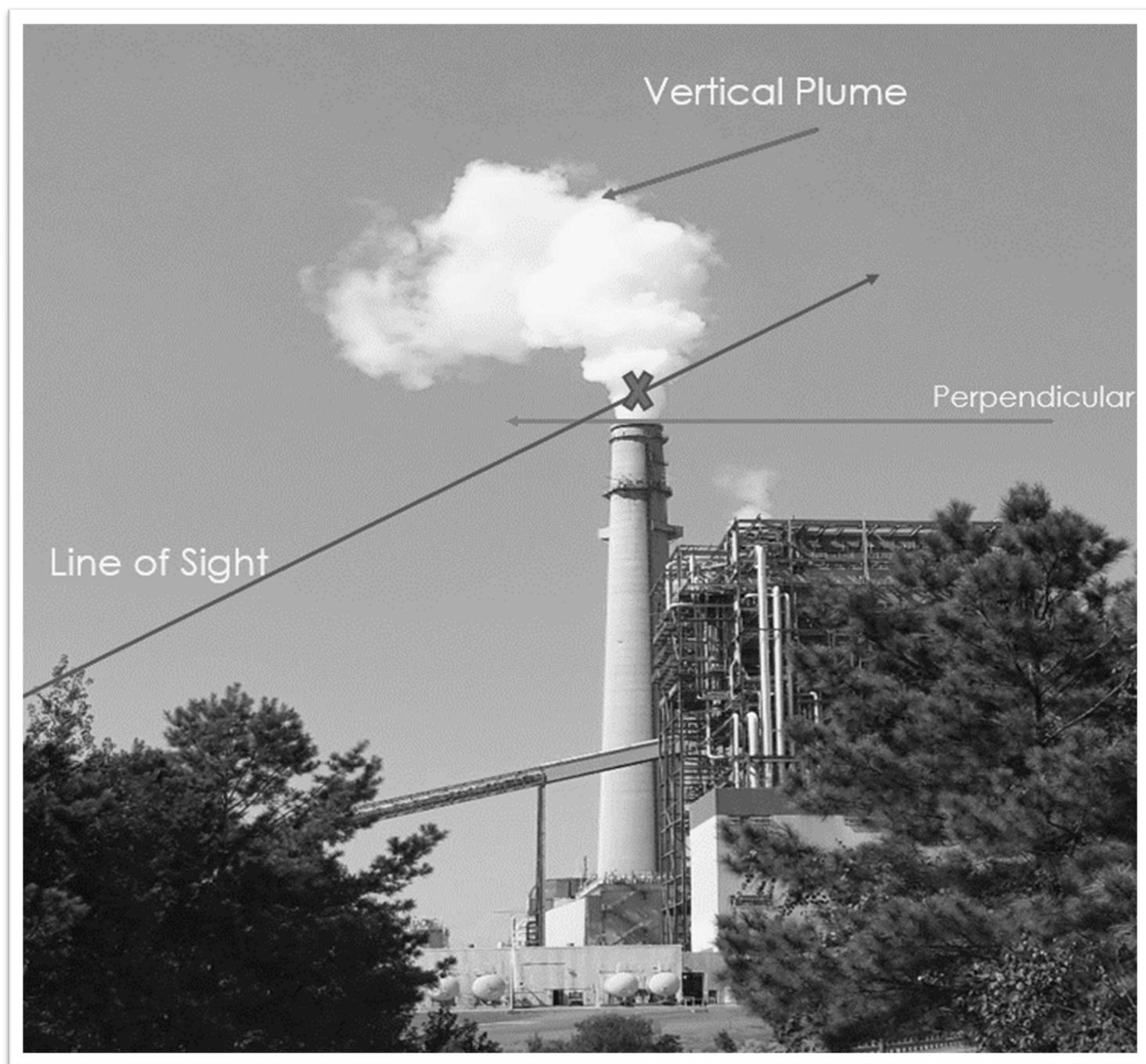
- ▶ A variable that might be controllable in the field is the luminous contrast and color contrast between the plume and the background against which the plume is viewed.
- ▶ A high contrasting background is desirable, as opacity values can be assigned with greater accuracy.
- ▶ Because green is the color most visible to the human eye, this type of background is most desirable when reading white plumes.
- ▶ An example of a high luminous contrast is reading a black plume against a light blue sky.

Pathlength and Distance

- ▶ If an observer's line of sight (angle of your head) varies more than 18 degrees from the perpendicular (viewing more than 1 x the diameter of the source) a positive error greater than 1 percent opacity occurs.
 - ▶ As the angle increases, the error increases.
- ▶ When viewing opacity from conventional sources, observers should stand at least three stack distances away from a vertically rising plume to meet this requirement.
- ▶ Distance can also obscure your vision, and it is our recommendation that the observer be between 15 feet and $\frac{1}{4}$ a mile, while adhering to the rules above.
 - ▶ Closer, and the observer is viewing through the emission (or standing in it).



- ▶ Farther, and the distance will obscure the emission.



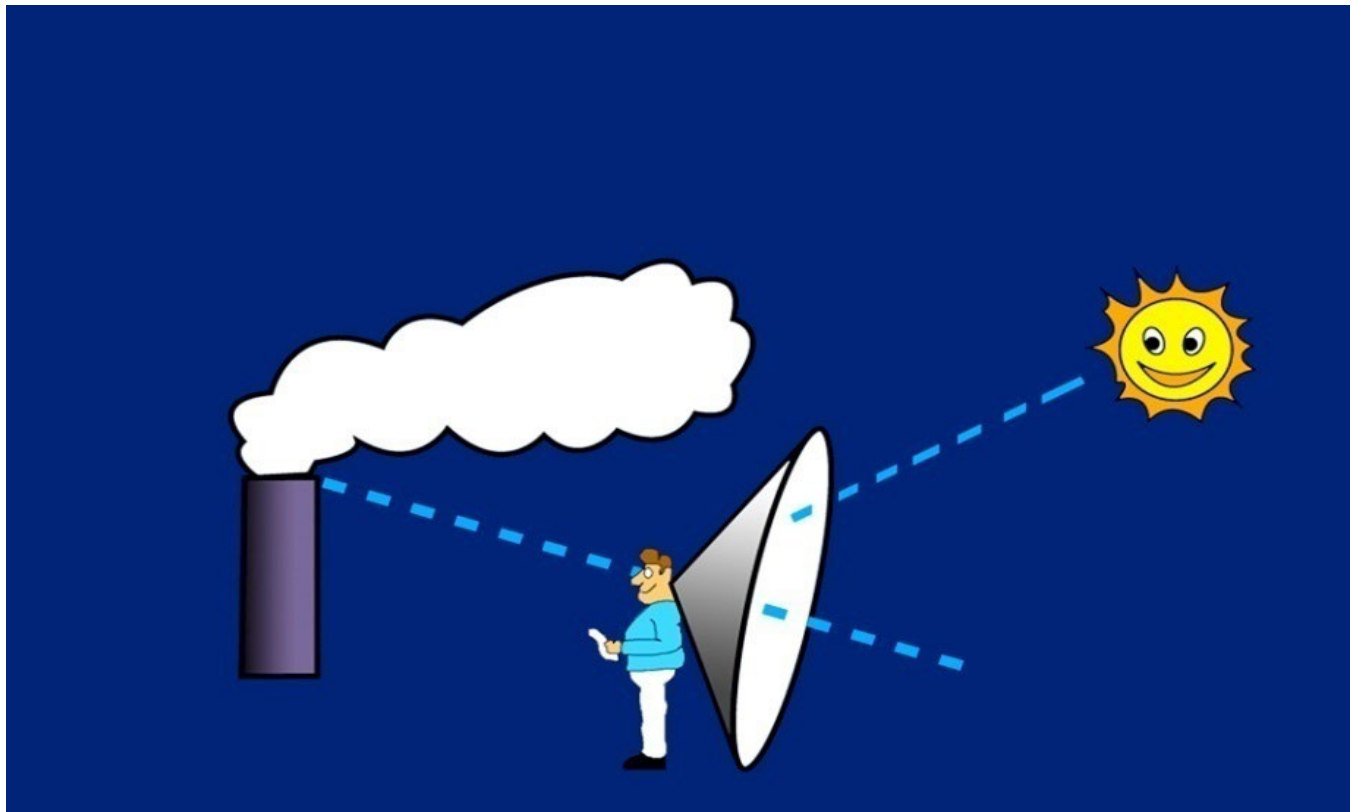
Observed Opacity	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20	4.7	9.4	14.2	18.9	23.7	28.5	33.3	38.1	43	47.9	52.8	57.7	62.7	67.7	72.8	78	83.2	88.5	94	100
21	4.7	9.4	14.1	18.9	23.6	28.3	33.1	37.9	42.8	47.6	52.5	57.5	62.5	67.5	72.6	77.7	83	88.3	93.9	100
22	4.6	9.3	14	18.8	23.4	28.2	32.9	37.7	42.6	47.4	52.3	57.2	62.2	67.3	72.3	77.5	82.8	88.2	93.8	100
23	4.6	9.2	13.9	18.7	23.3	28	32.7	37.5	42.3	47.2	52.1	57	62	67	72.1	77.3	82.6	88	93.7	100
24	4.6	9.2	13.8	18.6	23.1	27.8	32.5	37.3	42.1	46.9	51.8	56.7	61.7	66.7	71.8	77	82.3	87.8	93.5	100
25	4.5	9.1	13.7	18.4	23	27.6	32.3	37.1	41.8	46.6	51.5	56.4	61.4	66.4	71.5	76.7	82.1	87.6	93.4	100
26	4.5	9	13.6	18.3	22.8	27.4	32.1	36.8	41.6	46.4	51.2	56.1	61.1	66.1	71.2	76.5	81.8	87.1	92.7	100
27	4.5	9	13.5	18.2	22.6	27.2	31.9	36.6	41.3	46.1	50.9	55.8	60.8	65.8	70.9	76.2	81.6	87.1	93.1	100
28	4.4	8.9	13.4	18	22.4	27	31.6	36.3	41	45.8	50.6	55.5	60.4	65.5	70.6	75.9	81.2	86.9	92.9	100
29	4.4	8.8	13.3	17.9	22.2	26.8	31.4	36	40.7	45.5	50.3	55.1	60.1	65.1	70.3	75.5	80.7	86.1	92.7	100
30	4.3	8.7	13.1	17.7	22.1	26.6	31.1	35.7	40.4	45.1	49.9	54.8	59.7	64.7	69.9	75.2	80.4	86.4	92.5	100
31	4.3	8.6	13	17.6	21.9	26.3	30.9	35.5	40.1	44.8	49.6	54.4	59.3	64.4	69.5	74.7	80	86.1	92.3	100
32	4.3	8.5	12.9	17.4	21.6	26.1	30.6	35.2	39.8	44.4	49.2	54	58.9	64	69.1	74.2	79.3	85.8	92.1	100
33	4.2	8.5	12.7	17.2	21.4	25.9	30.3	34.8	39.4	44.1	48.8	53.6	58.5	63.6	68.7	73.7	79	85.5	91.9	100
34	4.2	8.4	12.6	17.1	21.2	25.6	30	34.5	39.1	43.7	48.4	53.2	58.1	63.1	68.2	73.2	78.3	85.2	91.7	100
35	4.1	8.3	12.5	16.9	21	25.3	29.7	34.2	38.7	43.3	48	52.8	57.7	62.7	67.7	72.8	78	84.8	91.4	100
36	4.1	8.2	12.3	16.7	20.8	25.1	29.4	33.9	38.3	42.9	47.6	52.4	57.2	62.2	67.2	72.3	77.5	84.5	91.1	99.9
37	4	8.1	12.2	16.5	20.5	24.8	29.1	33.5	38	42.5	47.2	51.9	56.8	61.8	66.9	72.3	78	84.1	90.9	99.9
38	4	8	12	16.3	20.3	24.5	28.8	33.1	37.6	42.1	46.7	51.4	56.3	61.3	66.5	71.9	77.6	83.7	90.6	99.9
39	3.9	7.9	11.9	16.1	20.1	24.3	28.5	32.8	37.2	41.6	46.2	50.9	55.8	60.8	65.9	71.4	77.1	83.3	90.3	99.9
40	3.9	7.8	11.7	15.9	19.9	24.1	28.3	32.6	36.9	41.3	45.8	50.4	55.3	60.3	65.4	70.9	76.6	82.9	89.9	99.9
41	3.8	7.7	11.5	15.7	19.7	23.9	28.1	32.4	36.7	41.2	45.7	50.3	55.2	60.2	65.3	70.8	76.5	82.8	89.6	99.9
42	3.7	7.5	11.4	15.5	19.2	23.3	27.4	31.6	35.9	40.3	44.8	49.4	54.1	58.9	63.7	68.8	74.6	81.9	89.2	99.9
43	3.7	7.4	11.2	15.3	19	23	27	31.2	35.4	39.8	44.2	48.8	53.6	58.5	63.7	69.2	75	81.4	88.8	99.9
44	3.6	7.3	11.1	15.1	18.8	22.6	26.6	30.8	35	39.3	43.7	48.3	53	57.9	63.1	68.6	74.5	80.9	88.4	99.9
45	3.6	7.2	11	14.9	18.6	22.3	26.3	30.3	34.5	38.7	43.1	47.7	52.4	57.3	62.5	68	73.9	80.4	88	99.9
46	3.5	7.1	10.9	14.7	18.4	22.1	25.9	29.9	34	38.2	42.6	47.1	51.8	56.7	61.8	67.3	73.2	79.8	87.5	99.8
47	3.4	6.9	10.5	14.4	17.8	21.6	25.5	29.4	33.5	37.7	42	46.5	51.1	56	61.1	66.6	72.6	79.3	87	99.8
48	3.4	6.8	10.3	14.1	17.5	21.2	25	29	33	37.1	41	45.8	50.5	55.3	60.5	65.9	71.9	78.6	86.5	99.8
49	3.3	6.7	10.1	13.9	17.2	20.9	24.6	28.5	32.4	36.5	40.8	45.2	49.8	54.6	59.7	65.2	71.2	77.9	86	99.8
50	3.2	6.5	9.9	13.6	16.9	20.5	24.2	28	31.9	36	40.1	44.5	49.1	53.9	59	64.5	70.5	77.2	85.4	99.7
51	3.2	6.4	9.7	13.4	16.6	20.1	23.7	27.5	31.4	35.4	39.5	43.8	48.3	53.1	58.2	63.7	69.7	76.5	84.8	99.7
52	3.1	6.3	9.5	13.1	16.2	19.7	23.3	27	30.8	34.7	38.8	43.1	47.6	52.3	57.4	62.9	68.9	75.8	84.2	99.7
53	3	6.1	9.3	12.8	15.9	19.3	22.8	26.5	30.2	34.1	38.2	42.4	46.8	51.5	56.6	62	68.1	75	83.5	99.6
54	2.9	5.9	9.1	12.6	15.6	18.9	22.4	25.9	29.6	33.5	37.5	41.6	46	50.7	55.7	61.2	67.2	74.2	82.8	99.6
55	2.9	5.8	8.9	12.3	15.2	18.5	21.9	25.4	29	32.8	36.7	40.9	45.2	49.9	54.8	60.3	66.3	73.3	82.1	99.5
56	2.8	5.7	8.7	12	14.9	18.1	21.4	24.8	28.4	32.1	36	40.1	44.4	49	53.9	59.3	65.4	72.4	81.3	99.4
57	2.8	5.6	8.5	11.7	14.5	17.7	20.9	24.3	27.8	31.4	35.3	39.3	43.5	48.1	53	58.4	64.4	71.5	80.4	99.3

SLANT ANGLE CORRECTION

- ▶ **O_o = Observed Opacity**
- ▶ **T_o = Observed Transmittance**
 - ▶ **F = Cosine of Theta**
- ▶ **O_c = Corrected Opacity in %**
 - ▶ **$1-(O_o/100) = T_o$**
 - ▶ **$(1-(T_o) f) \times 100 = O_c$**

► Method 9 states

- The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140-degree sector to their back,
- This includes both the vertical and horizontal sector, resulting in a 140-degree conical area that the sun can reside in.
- This also means that the line from the sun to the observer and a line from the observer to the observation point in the plume must form an angle of at least 110 degrees.
- When the sun is behind your plume, it becomes more luminous than the background and creates a high bias or positive error in your opacity reading.



Conducting a Visible Emission Inspection



SIP regulations often stipulate procedures that vary from Method 9.

A source could have a SIP requirement not documented in an operating permit.

Each source at a facility can have a different compliance status, a different rule, a different observation method, and a different data reduction method.

The status of a source can change over time.

Equipment check list

- ✓ Clipboard
- ✓ Pens
- ✓ VEO Forms
- ✓ Timer
- ✓ Smart Phone
- ✓ Compass
- ✓ Topographic Map
- ✓ Rangefinder
- ✓ Clinometer
- ✓ Sling Psychrometer
- ✓ Binoculars
- ✓ Digital Camera
- ✓ Video Camera

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		

Term	Percent
Clear	<10%
Scattered	10% to 50%
Broken	50% to 90%
Overcast	>90%

Field Operations

- ▶ Before making your observations, you need to:
 - ▶ Review records and Identify sources that need observations
 - ▶ Locate and identify sources at the facility
 - ▶ Determine the Position of the Sun
 - ▶ Select Background
 - ▶ Determine Point in the Plume to Evaluate
 - ▶ Determine Wind Direction
 - ▶ Determine Distance from Observation Point and Viewing Angle
 - ▶ Identify Potential Interferences
 - ▶ Determine Correct Viewing Position
- ▶ If you do not consider each factor in this section, the observation could be deemed invalid in a deposition or in court.

Determine the point in the plume to evaluate.

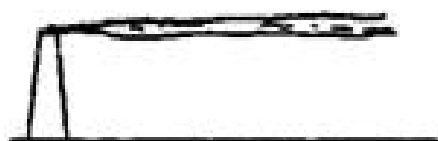
- ▶ Method 9 clearly states,
- ▶ Opacity observations shall be made at the point of greatest opacity in the portion of the plume where condensed water vapor is not present.
- ▶ There are 2 key elements that must be followed.
 - ▶ 1. Always read at the densest part of the plume.
 - ▶ 2. There cannot be condensed water vapor or steam at the point of observation (steam is not a visible emission).

When an observer is preparing to make an observation, they must consider the type of plume present in order to determine where in the plume to make observations. The observer must also document the type of plume observed on the veo form.

Describe Emissions			
Start		End	
Emission Color		Water Droplet Plume	
Start	End	Attached <input type="checkbox"/>	Detached <input type="checkbox"/> None <input type="checkbox"/>



CONING



FANNING



LOOPING



LOFTING



FUMIGATION

Source Layout Sketch

Draw North Arrow

☐ TN
 ☐ MN

_____ FEET
☐

FEET

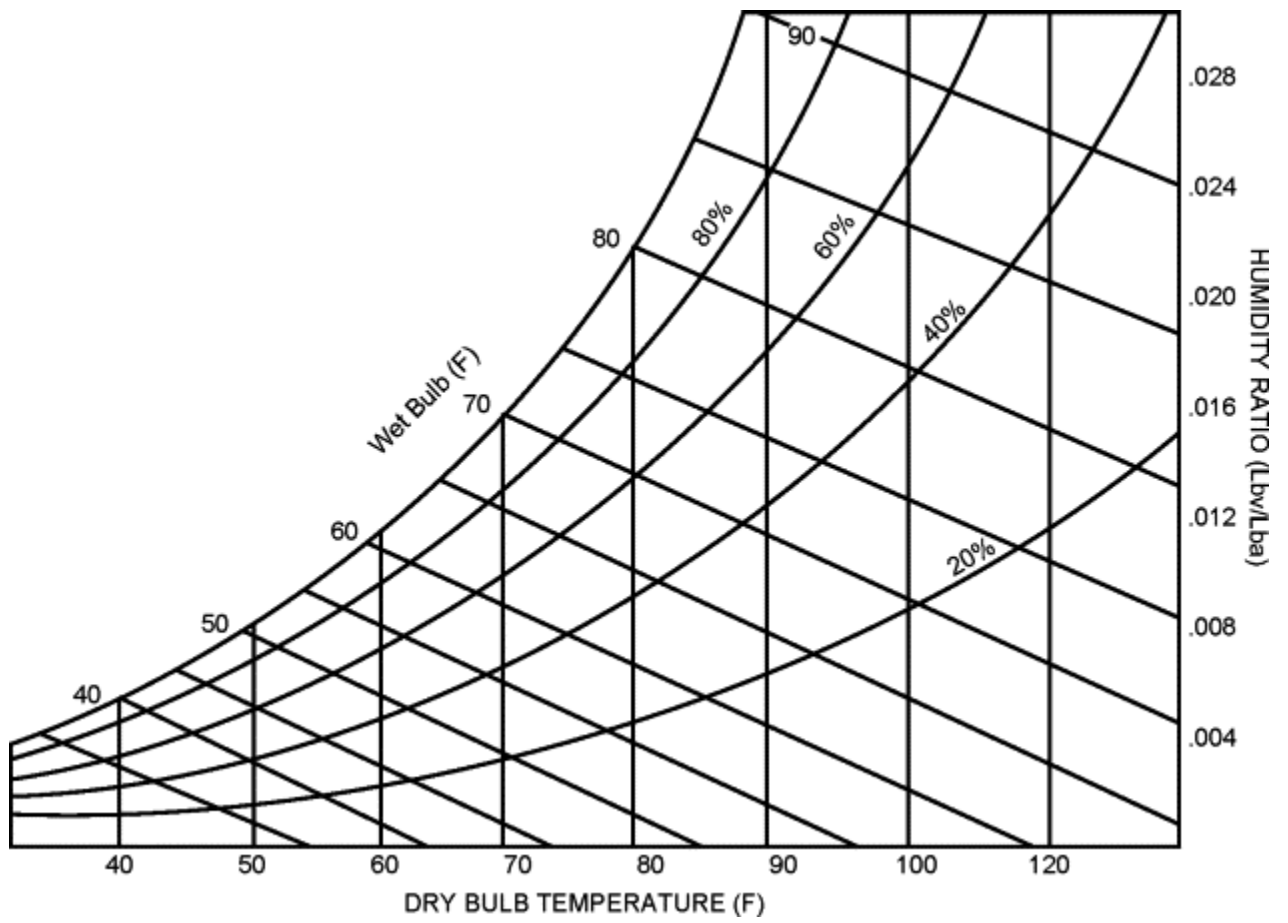
Side View

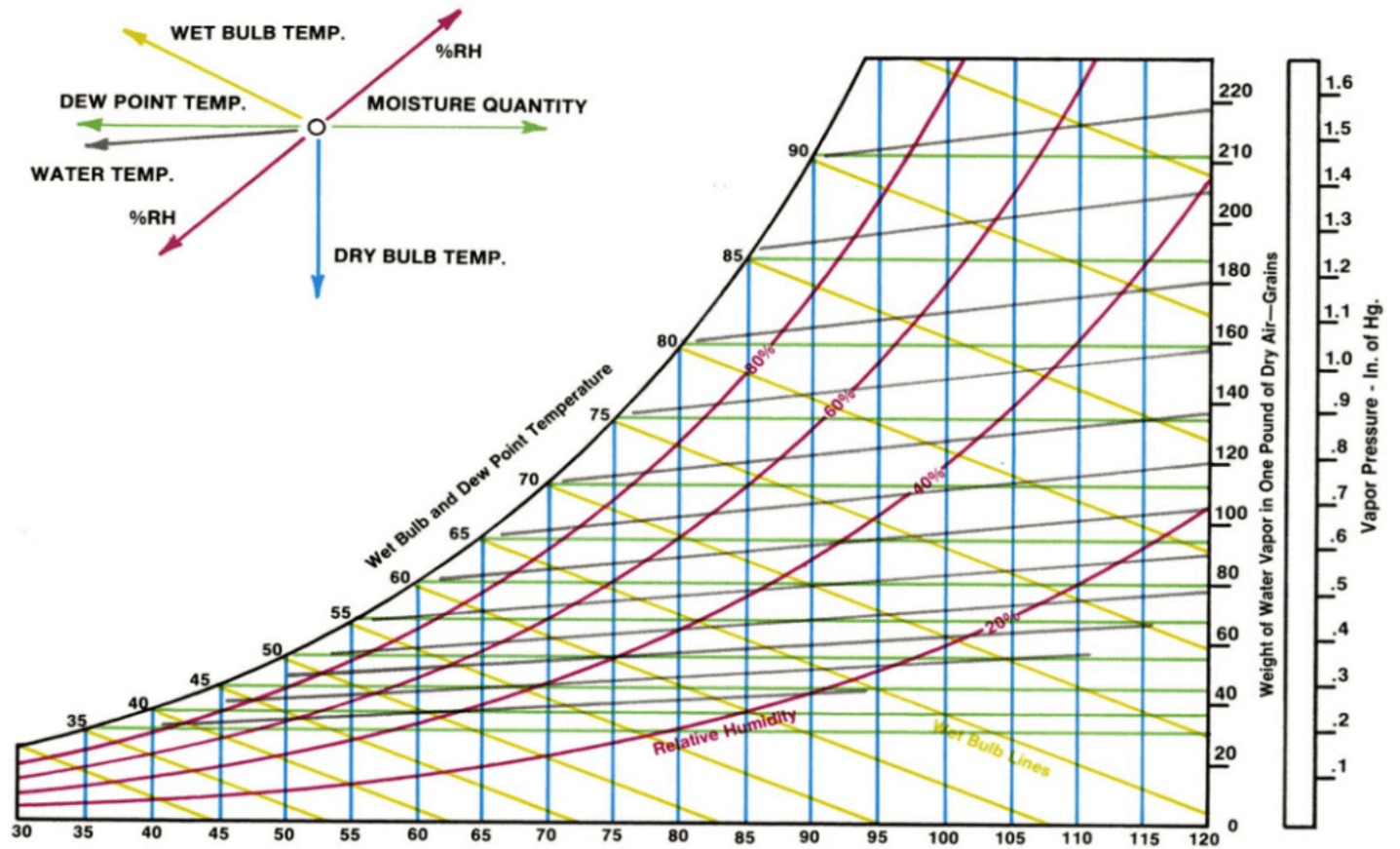
Stack
With
plume
Sun
Wind

Longitude

Latitude

Declination





Wind Direction

- ▶ Remember the method states
- ▶ The VE Observer should, as much as possible, make their observations from a position such that their line of sight is approximately perpendicular to the direction of plume travel.

For distance:

- ▶ Remember, you should be three “effective” stack heights away from the plume.
- ▶ Consider any rises or drops in the land that might affect the height of the outlet above your head.
 - ▶ The intent of this is to make sure your vertical viewing angle is 18 degrees or less.
- ▶ At 18 degrees or less, you are using the shortest path length through the plume.

Check	Correct	Remember
Double check all the factors concerning your point of observation.	If any one factor is off, correct for it.	Remember, Method 9 is a method of opportunity. It might be necessary to come back at a different time of day for all the factors to be acceptable.

Performing the observations

- ▶ Method 9 states
- ▶ The Observer shall not look continuously at the plume, but instead make observations, momentarily, at 15 second intervals.
- ▶ Document your answers in 5% opacity values working left to right starting at Min 1 and Sec 0, then Min 1 and 15 Sec, etc.
- ▶ Continue making observations every 15 seconds until you have completed the minimum number of required observations

Field Tips Checklist.

Do I have a clear view of my emission source and observation point?

Is the sun to my back?

What time of day is it?

Is vertical sun angle acceptable?

Is my line of sight approximately perpendicular to the direction of plume travel?

Am I at least “three effective stack heights” away from the plume?

What is my vertical viewing angle if I need to use slant angle correction?

Am I reading across the shortest axis?

What are my background options?

What is my wind direction?

Where is the densest part of the plume?

Are the weather conditions suitable for making an observation?

Am I only making momentary glances at 15 second intervals?

Method 9 has specific requirements for recording information. Double check your form to make sure you've included the following requirements.

- 1. Name of Plant**
- 2. Facility Name**
- 3. Type of Facility**
- 4. Observer's Name and Affiliation**
- 5. Date and Time of Observations**
- 6. Distance to Emission Point**
- 7. Wind Direction**
- 8. Estimated Wind Speed**
- 9. Description of Sky Conditions**
- 10. Plume Background**
- 11. Source Layout Sketch**
- 12. Distance and Direction from Emission Point to Observation Point**
- 13. Minimum Number of Required Observations**

- ▶ Before you leave the field, look over the form carefully.
- ▶ If anything is left blank, gather the missing information, and complete the form.
- ▶ DO NOT sign the form until you have entered all entries you intend to complete.
- ▶ Remember, this is a legal document.
- ▶ In the event you need to correct information on the form
- ▶ Make a single line mark out through the incorrect information,
 - ▶ Make the change above or below, and
Date and initial the change.

[illegible]

2. Procedures

The observer qualified in accordance with section 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

2.2 Field Records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, a sketch of the observer's position relative to the source, and the date on a field data sheet (Figure 9–1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background⁵³ are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead, shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached Steam Plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached Steam Plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording Observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9–2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall 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. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9–1 for an example.)

Specification Sheet for Classroom Example

Facility Information:

Name: Ecoline Power, River West Branch.

Address: 9901 Anthony Blvd, Kansas city, MO 64116

Regulatory Method: Method 9 (6 minute average)

Permit Compliance Limit:

The source shall not emit into the atmosphere emissions that, on evaluation, create a six (6) minute average data sequence equal to or greater than twenty percent (20%) opacity.

Emission Point information:

Smoke color: Black

Process Equipment: Super-Critical Pulverized Coal (SCPC) Boiler

Operating Mode: 90% of maximum capacity

Control Equipment: Wet Electrostatic Precipitator (Wet ESP)

Operating Mode: Only 1 of 4 fields on [First field reading; 323kV, 125 mA]

Stack Height: 200 ft

Latitude: 39.11; Longitude: -94.51

Compass Declination: 7° W

Meteorological Information:

Wind Speed: 5-10 MPH

Skies: Clear blue skies

Visible Emission Observations:

VEO Form Number: OPSS1

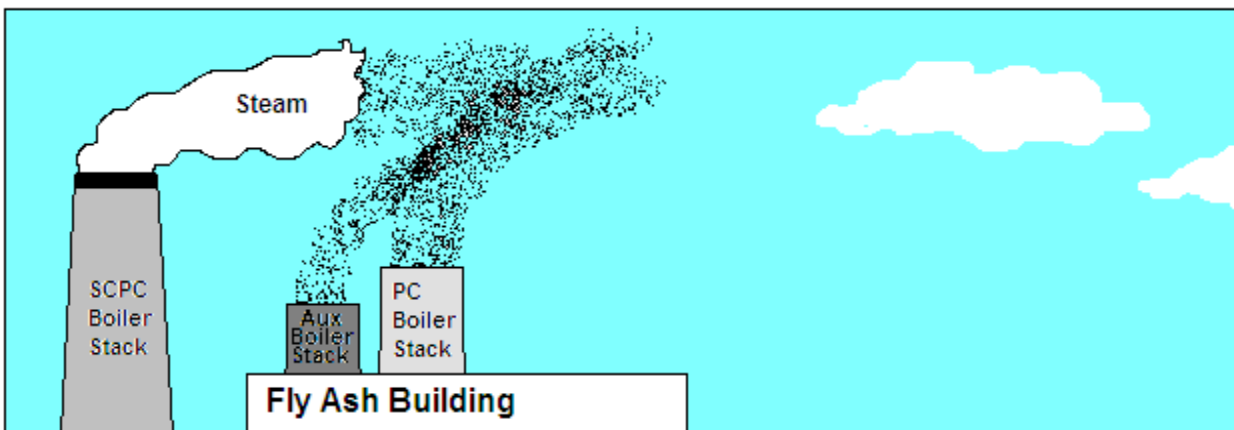
Opacity: The following opacities were observed during a ten minute observation period. Your start time is when you begin entering opacities.

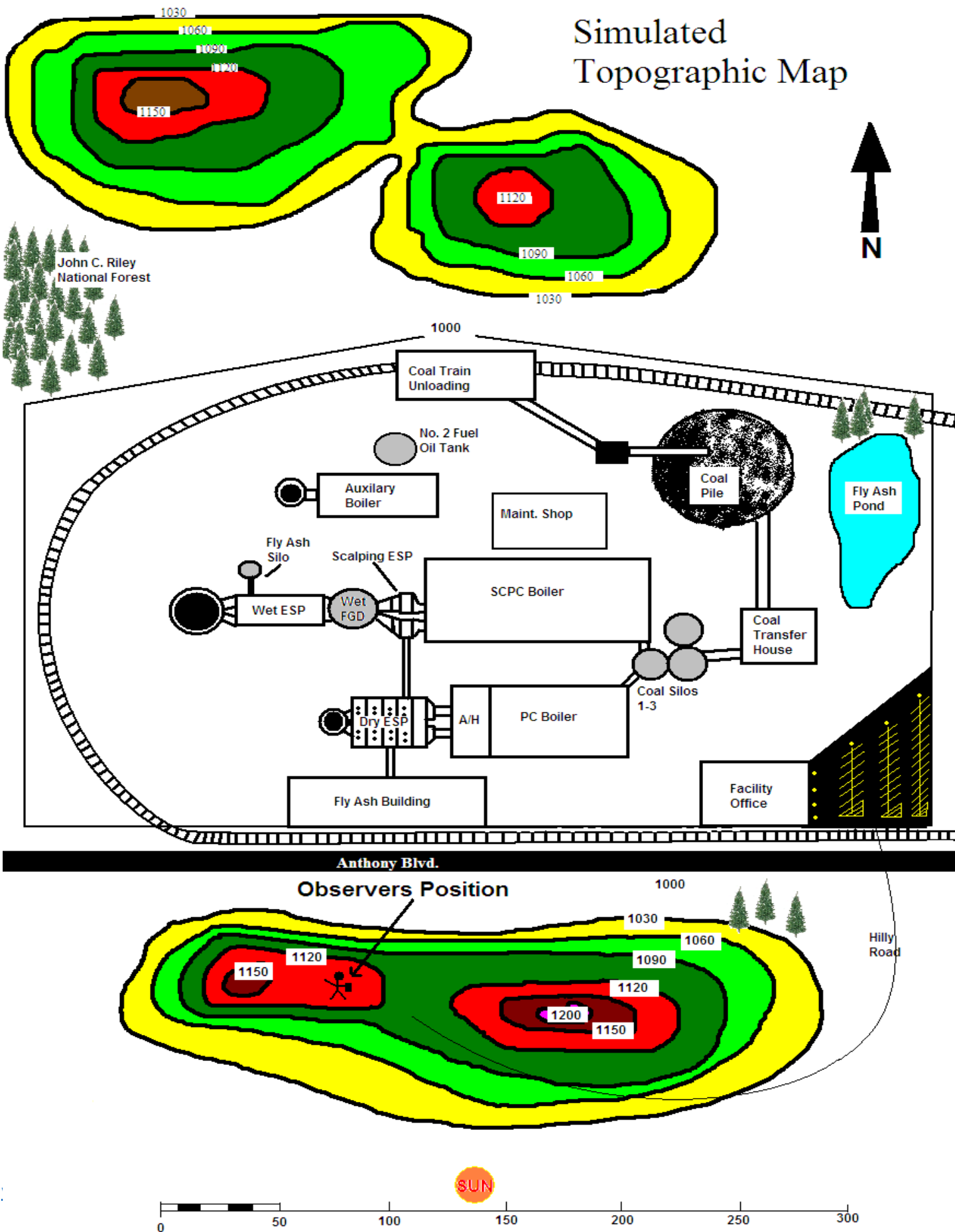
Min 1 [10-15-10-5], Min 2 [15-20-25-25], Min 3 [30-45-40-30], Min 4 [40-30-35-35]

Min 5 [15-25-30-40], Min 6 [40-45-30-30], Min 7 [35-40-35-35], Min 8 [30-30-20-10]

Min 9 [10-5-15-10], Min 10 [5-5-10-5]

Circle the 6-minute period with the highest opacity . Remember that this period does not have to start at the beginning of a minute. Then, complete the form including a source layout sketch, your actual organization name, a certification date (today) and lastly, your signature.





SLANT ANGLE	MEASURED Opacity																			
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
20	4.7	9.4	14.2	18.9	23.7	28.5	33.3	38.1	43	47.9	52.8	57.7	62.7	67.7	72.8	78	83.2	88.5	94	100
21	4.7	9.4	14.1	18.9	23.6	28.3	33.1	37.9	42.8	47.6	52.5	57.5	62.5	67.5	72.6	77.7	83	88.3	93.9	100
22	4.6	9.3	14	18.8	23.4	28.2	32.9	37.7	42.6	47.4	52.3	57.2	62.2	67.3	72.3	77.5	82.8	88.2	93.8	100
23	4.6	9.2	13.9	18.7	23.3	28	32.7	37.5	42.3	47.2	52.1	57	62	67	72.1	77.3	82.6	88	93.7	100
24	4.6	9.2	13.8	18.6	23.1	27.8	32.5	37.3	42.1	46.9	51.8	56.7	61.7	66.7	71.8	77	82.3	87.8	93.5	100
25	4.5	9.1	13.7	18.4	23	27.6	32.3	37.1	41.8	46.6	51.5	56.4	61.4	66.4	71.5	76.7	82.1	87.6	93.4	100
26	4.5	9	13.6	18.3	22.8	27.4	32.1	36.8	41.6	46.4	51.2	56.1	61.1	66.1	71.2	76.5	81.8	87.4	93.2	100
27	4.5	9	13.5	18.2	22.6	27.2	31.9	36.6	41.3	46.1	50.9	55.8	60.8	65.8	70.9	76.2	81.6	87.1	93.1	100
28	4.4	8.9	13.4	18	22.4	27	31.6	36.3	41	45.8	50.6	55.5	60.4	65.5	70.6	75.9	81.3	86.9	92.9	100
29	4.4	8.8	13.3	17.9	22.2	26.8	31.4	36	40.7	45.5	50.3	55.1	60.1	65.1	70.3	75.5	81	86.7	92.7	100
30	4.3	8.7	13.1	17.7	22.1	26.6	31.1	35.7	40.4	45.1	49.9	54.8	59.7	64.7	69.9	75.2	80.7	86.4	92.5	100
31	4.3	8.6	13	17.6	21.9	26.3	30.9	35.5	40.1	44.8	49.6	54.4	59.3	64.4	69.5	74.8	80.3	86.1	92.3	100
32	4.3	8.5	12.9	17.4	21.6	26.1	30.6	35.2	39.8	44.4	49.2	54	58.9	64	69.1	74.5	80	85.8	92.1	100
33	4.2	8.5	12.7	17.2	21.4	25.9	30.3	34.8	39.4	44.1	48.8	53.6	58.5	63.6	68.7	74.1	79.6	85.5	91.9	100
34	4.2	8.4	12.6	17.1	21.2	25.6	30	34.5	39.1	43.7	48.4	53.2	58.1	63.1	68.3	73.7	79.3	85.2	91.7	100
35	4.1	8.3	12.5	16.9	21	25.3	29.7	34.2	38.7	43.3	48	52.8	57.7	62.7	67.9	73.2	78.9	84.8	91.4	100
36	4.1	8.2	12.3	16.7	20.8	25.1	29.4	33.9	38.3	42.9	47.6	52.4	57.2	62.2	67.4	72.8	78.5	84.5	91.1	99.9
37	4	8.1	12.2	16.5	20.5	24.8	29.1	33.5	38	42.5	47.2	51.9	56.8	61.8	66.9	72.3	78	84.1	90.9	99.9
38	4	8	12	16.3	20.3	24.5	28.8	33.1	37.6	42.1	46.7	51.4	56.3	61.3	66.5	71.9	77.6	83.7	90.6	99.9
39	3.9	7.9	11.9	16.1	20	24.2	28.5	32.8	37.2	41.6	46.2	50.9	55.8	60.8	66	71.4	77.1	83.3	90.3	99.9
40	3.9	7.8	11.7	15.9	19.8	23.9	28.1	32.4	36.7	41.2	45.8	50.4	55.3	60.2	65.4	70.9	76.6	82.9	89.9	99.9
41	3.8	7.6	11.5	15.7	19.5	23.6	27.8	32	36.3	40.7	45.3	49.9	54.7	59.7	64.9	70.3	76.1	82.4	89.6	99.9
42	3.7	7.5	11.4	15.5	19.2	23.3	27.4	31.6	35.9	40.3	44.8	49.4	54.2	59.1	64.3	69.8	75.6	81.9	89.2	99.9
43	3.7	7.4	11.2	15.3	19	23	27	31.2	35.4	39.8	44.2	48.8	53.6	58.5	63.7	69.2	75	81.4	88.8	99.9
44	3.6	7.3	11	15.1	18.7	22.6	26.6	30.8	35	39.3	43.7	48.3	53	57.9	63.1	68.6	74.5	80.9	88.4	99.9
45	3.6	7.2	10.9	14.8	18.4	22.3	26.3	30.3	34.5	38.7	43.1	47.7	52.4	57.3	62.5	68	73.9	80.4	88	99.9
46	3.5	7.1	10.7	14.6	18.1	21.9	25.9	29.9	34	38.2	42.6	47.1	51.8	56.7	61.8	67.3	73.2	79.8	87.5	99.8
47	3.4	6.9	10.5	14.4	17.8	21.6	25.5	29.4	33.5	37.7	42	46.5	51.1	56	61.1	66.6	72.6	79.2	87	99.8
48	3.4	6.8	10.3	14.1	17.5	21.2	25	29	33	37.1	41.4	45.8	50.5	55.3	60.5	65.9	71.9	78.6	86.5	99.8
49	3.3	6.7	10.1	13.9	17.2	20.9	24.6	28.5	32.4	36.5	40.8	45.2	49.8	54.6	59.7	65.2	71.2	77.9	86	99.8
50	3.2	6.5	9.9	13.6	16.9	20.5	24.2	28	31.9	36	40.1	44.5	49.1	53.9	59	64.5	70.5	77.2	85.4	99.7
51	3.2	6.4	9.7	13.4	16.6	20.1	23.7	27.5	31.4	35.4	39.5	43.8	48.3	53.1	58.2	63.7	69.7	76.5	84.8	99.7
52	3.1	6.3	9.5	13.1	16.2	19.7	23.3	27	30.8	34.7	38.8	43.1	47.6	52.3	57.4	62.9	68.9	75.8	84.2	99.7
53	3	6.1	9.3	12.8	15.9	19.3	22.8	26.5	30.2	34.1	38.2	42.4	46.8	51.5	56.6	62	68.1	75	83.5	99.6
54	3	6	9.1	12.6	15.6	18.9	22.4	25.9	29.6	33.5	37.5	41.6	46	50.7	55.7	61.2	67.2	74.2	82.8	99.6
55	2.9	5.9	8.9	12.3	15.2	18.5	21.9	25.4	29	32.8	36.7	40.9	45.2	49.9	54.8	60.3	66.3	73.3	82.1	99.5
56	2.8	5.7	8.7	12	14.9	18.1	21.4	24.8	28.4	32.1	36	40.1	44.4	49	53.9	59.3	65.4	72.4	81.3	99.4
57	2.8	5.6	8.5	11.7	14.5	17.7	20.9	24.3	27.8	31.4	35.3	39.3	43.5	48.1	53	58.4	64.4	71.5	80.4	99.3
58	2.7	5.4	8.3	11.4	14.1	17.2	20.4	23.7	27.2	30.7	34.5	38.5	42.7	47.2	52	57.4	63.4	70.5	79.6	99.2
59	2.6	5.3	8	11.2	13.8	16.8	19.9	23.1	26.5	30	33.7	37.6	41.8	46.2	51	56.3	62.4	69.5	78.6	99.1
60	2.5	5.1	7.8	10.9	13.4	16.3	19.4	22.5	25.8	29.3	32.9	36.8	40.8	45.2	50	55.3	61.3	68.4	77.6	99
CORRECTED OPACITY (%)																				

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.