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ENFORCEMENT WORKSHOP ON
PLANT INSPECTION AND EVALUATION

COUNTERFLOW INSPECTION PROCEDURES FOR PERFORMANCE BASELINE ASSESSMENT AND ROUTINE EVALUATION

by

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SECTION 1

COUNTERFLOW INSPECTION PROCEDURES FOR PERFORMANCE BASELINE ASSESSMENT AND ROUTINE EVALUATION

The Counterflow Inspection Procedure has been developed by PEDCo Environmental to aid both the source operators and regulatory agency inspectors to routinely evaluate air pollution control equipment performance. The fundamental principal of the Counterflow Techniques is simply that performance diaggnosis is done by comparison of observed operating conditions with a site-specific baseline operating condition. It is recognized that field measurements are sometimes subject to error or impossible; therefore, diagnosis is based on sets of trends rather than just one parameter. Even when some of the basic data is missing, it is still possible to reach meaningful and accurate conclusions.

The purpose of the Counterflow Technique is to rapidly identify significant changes in performance and the possible reasons for the changes. It does not, necessarily, provide definite evidence of noncompliance nor does it, necessarily provide a specific list of repairs required.

Persons utilizing the Counterflow Inspection Technique should have a technical background--preferably engineering experience. As with any work involving equipment, care should be exercised. Section 6 provides some minimum guidelines and should be read and reread regularly. Formal safety training is highly recommended for this activity and any field work involving air pollution control equipment.

No single technique can satisfy all source characteristics and inspection circumstances. Inspectors and source operators should modify these procedures whenever necessary.

1.1 BASELINE ASSESSMENT

Baseline determinations are preferably done soon after the unit is installed and the shakedown period has been successfully completed. For existing units, an adequate baseline can be developed during a properly conducted stack test. The purpose of the baseline assessment is to provide a site-specific comparison of equipment performance.

The inspection procedures (and forms) presented in this report should be used for both the baseline assessment and the routine evaluation. There are several additional items, however, that should be accomplished, namely:

1. Request a set of general arrangement drawings of the control equipment, ventilation system layout, and waste handling system;

2. Evaluate the stack test location and procedures to ensure the emissions data will be accurate and complete;

3. Carefully describe all internal conditions (if such inspections can be conducted safely). Photographs are extremely valuable and should be taken if it is safe to do so and if plant personnel permits;

4. The sounds of operating components, such as rappers and solenoids, should be noted so that the inspector will be able distinguish developing problems;

5. Obtain a complete set of process operating conditions, fan characteristics, and raw material characteristics; and

6. Obtain Method 9 opacity readings.

Using the opacity observation and the stack test results, the inspector should evaluate how close the source is operating to the applicable regulations. If the margin is small, the variability is normal; performance may be enough to result in frequent violations. If the source is initially well-below the standard, major changes in operation or severe deterioration of control equipment is needed to result in noncompliance. The inspector must <u>always</u> be congnizant of the compliance margin. The Counterflow Inspection Procedures are used to evaluate the significance of the changes since the baseline assessment.

SECTION 2

COUNTERFLOW INSPECTION CONCEPTS

Proceeding counter to the gas flow (backward through the system) should minimize inspection time and reporting requirements and maximize the amount of useful information obtained. More specifically, the information on effluents and control equipment gained early in the inspection is not only the easiest to obtain, it can be used later either to narrow the scope of the inspection or to terminate the inspection without completing the most time-consuming part of the evaluation--namely, the process equipment.

As shown in the list below, the steps start at the stack, proceed backward through the system, and end with the process equipment. For regulatory agency personnel, there are some additional preinspection and post-inspection steps required.

Counterflow Inspection Procedure

- Observe the stack effluent
- Check the continuous monitor(s)
- Measure the fan parameters and evaluate physical condition
- Analyze the control equipment performance and physical conditions
- Check the ventilation system performance and physical condition
- Evaluate process operating conditions
- Check raw materials and/or fuels

Pre-inspection Steps (regulatory agency personnel only)

- Review the source files
- Schedule the inspection
- Check the inspection equipment
- Observe the plant surroundings

Request entry to the plant
Interview plant official(s)

Post-inspection Steps (regulatory agency personnel only)

Interview plant official(s)
Update source files
Prepare report

SECTION 3

PRE-INSPECTION

3.1 FILE REVIEW

A logical starting point for Agency inspectors is to review the files concerning the specific plant. The following items should be checked. Copies of items 1 and 2 should be obtained for the project files.

1. Pending compliance schedules,
2. Construction and/or operating permits pertaining to source processes,
3. Past conditions of noncompliance,
4. Frequency of malfunctions reports, and
5. History of abnormal operations.

The inspector should also obtain a copy of appropriate plant layout drawings for use in preparing the audit inspection report. If possible, the files should be reviewed before entry to the plant so that important characteristics will be more easily remembered.

The inspector should prepare a concise file containing basic plant information, process descriptions, flowsheets, and acceptable operating conditions (Appendix A). It should contain the following to facilitate inspections and/or preparations:

1. A chronology of control actions, inspections, and complaints concerning each major source in the plant;

2. A flowsheet identifying sources, control devices, monitors, and other information of interest;

3. The most recent permits for each major source, and

4. Previous inspection checklists.

Volume IV presents a recommended flow charting technique. In plants with complex control systems, it may be beneficial to review the technical literature and/or the complete agency file.

Based on reviews of agency and personnel files, the inspector should select a time when processes will probably be operating at representative conditions. The scheduling of time to visit plants with batch operations or other irregular operating schedules (e.g., seasonal) is especially important.

3.2 INSPECTION ANNOUNCEMENT

Written instructions from the Agency supervisory personnel should be obtained concerning the advance announcement of inspections. If it is desirable to announce the inspection in advance, leads of 1 day to 1 week are generally adequate to ensure that the necessary plant personnel will be available. The person contacted should have the authority to release data and samples and to arrange for access to specific processes.

3.3 INSPECTION EQUIPMENT

Necessary tools and safety gear should be carried in a portable case from source to source:

Carry at all Times

Hardhat
Safety glasses or goggles
Gloves
Coveralls
Safety shoes (steel tipped)
Ear protectors

Tape measure
Flashlight
Manometer or differential pressure gauges
Stopwatch
pH paper
Brass rods
Duct tape
Pry bar
Pocket guide of industrial hazards

Other equipment can be left in a central location until needed.

<u>Carry When Needed</u>

Pipe wrench
Respirator with appropriate cartridge
Velometer
Pump and filter system
Bucket
Combustion gas analyzer
Thermometers or thermocouples
Multimeter
Sample bottles
Strobe
Inductance ammeter
Tachometer
Oxygen and combustibles meter
Self-contained breathing equipment
Pipe wrench
Rope

Particularly important is the safety equipment--including the hard hat, the safety glasses, and the ear protectors. Remember, it is the inspector's responsibility to have safety equipment before entering the plant. Access to certain industrial facilities can be rightfully restricted or refused by plant representatives if designated equipment is not worn.

3.4 PLANT SURROUNDINGS

Observations of areas surrounding the plant may reveal a variety of signs of operational practices and pollutant emissions which can aid in the preentry evaluation, including:

1. Obvious vegetation damage near the plant,
2. Odors downwind of the plant,

3. Deposits on cars parked closeby,
4. Other signs of "dusting" downwind of the plant,
5. Fugitive emissions near plant boundaries,
6. Conditions around the product and/or waste storage piles, and
7. Conditions near lagoons and sludge ponds.

Some of the signs may mean that fugitive emission sources should be added to the inspection agenda. If odors are a problem, the weather conditions should be noted for later inclusion in the inspection report. Once inside the plant, olfactory fatigue may (under certain circumstances) reduce the inspector's ability to detect odors.

3.5 PLANT ENTRY

Upon arrival at the plant offices, the inspector should contact a responsible official to gain access to specific areas. If requested, the inspector should display an employee identification card which includes a photograph, and a physical description including, but not necessarily limited to, height, color of eyes, and color of hair. Visitor release forms generally can be signed as long as they in no way restrict the scope of the inspection.

If entry is refused for part or all of a facility within the scope of the inspection, obtain 1) reason(s) for refusal of entry, 2) plant official's name and title, and 3) time and date entry was requested. Notify supervisory personnel by telephone immediately. Under no circumstances should field inspectors attempt to summarize the potential legal consequences of refusal of entry.

3.6 PRE-INSPECTION INTERVIEW

The inspector should plan the initial interview with the plant manager or other responsible officials prior to the in-plant inspection. Some of the points for discussion are:

1. The purpose of the inspection,
2. The type of measurements to be made,
3. The samples (if any) to be acquired,
4. The systems to be evaluated,
5. Changes in plant management that need to be noted in the main file,
6. Process flowsheets needed to confirm that operational conditions in the file still pertain, and
7. Operating records required by Standards of Performance for New Sources (NSPS) and/or for determinations of operating conditions specified in permits.

Applicable regulatory requirements should be reviewed carefully, and their apecific applications to the source in question should be discussed with appropriate engineering and/or legal staff.

Other issues the inspector should be prepared to discuss include:

1. Authority for the inspection,
2. Agency organization,
3. Scope, timing, and organization of the inspection (preferred inspection agenda), and
4. Treatment of confidential data.

The inspector should ask plant officials about the operational status of all processes and pollution control equipment within the scope of the inspection and about the types and frequencies of any malfunctions. If equipment is not at or near normal conditions, the reasons for deviation should be noted, and the times when units can be expected to achieve representative operations should be recorded for use in scheduling follow-up inspections, if necessary.

SECTION 4

COUNTERFLOW INSPECTION

The inspector starts the inspection at the gas exhaust point (or endpoint) of the process and proceeds through the process flow to the point where raw materials are input. Each step shown on the flowsheet of Figure 1 should be based on data from previous steps to derive increasingly precise analyses. Examples of data received at each step are listed in column 2 of Table 1; the evaluations in column 3 gradually focus on air pollution control effectiveness as the inspection continues, due to the expanding data base in column 4. By the time the in-plant inspection has ended, a series of ten or fifteen distinct observations should provide a consistent and logical assessment of performance conditions.

4.1 STEP 1: OBSERVE THE STACK EFFLUENT

The opacity readings[a] of emission points should be observed using Method 9 procedures. PEDCo recognizes that an agency can, in many cases, develop a legally and technically sound case solely on the basis of visible emission observations. In some cases, however, it is possible that the value of opacity information will be primarily for diagnosing changes in system performance. The following paragraphs describe how the Counterflow Technique includes this diagnostic requirement.

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[a] Only staff with currently valid Visible Emission Certificates should make these observations. It should be recognized that an agency may choose to initiate enforcement actions directly on the basis of these observations.

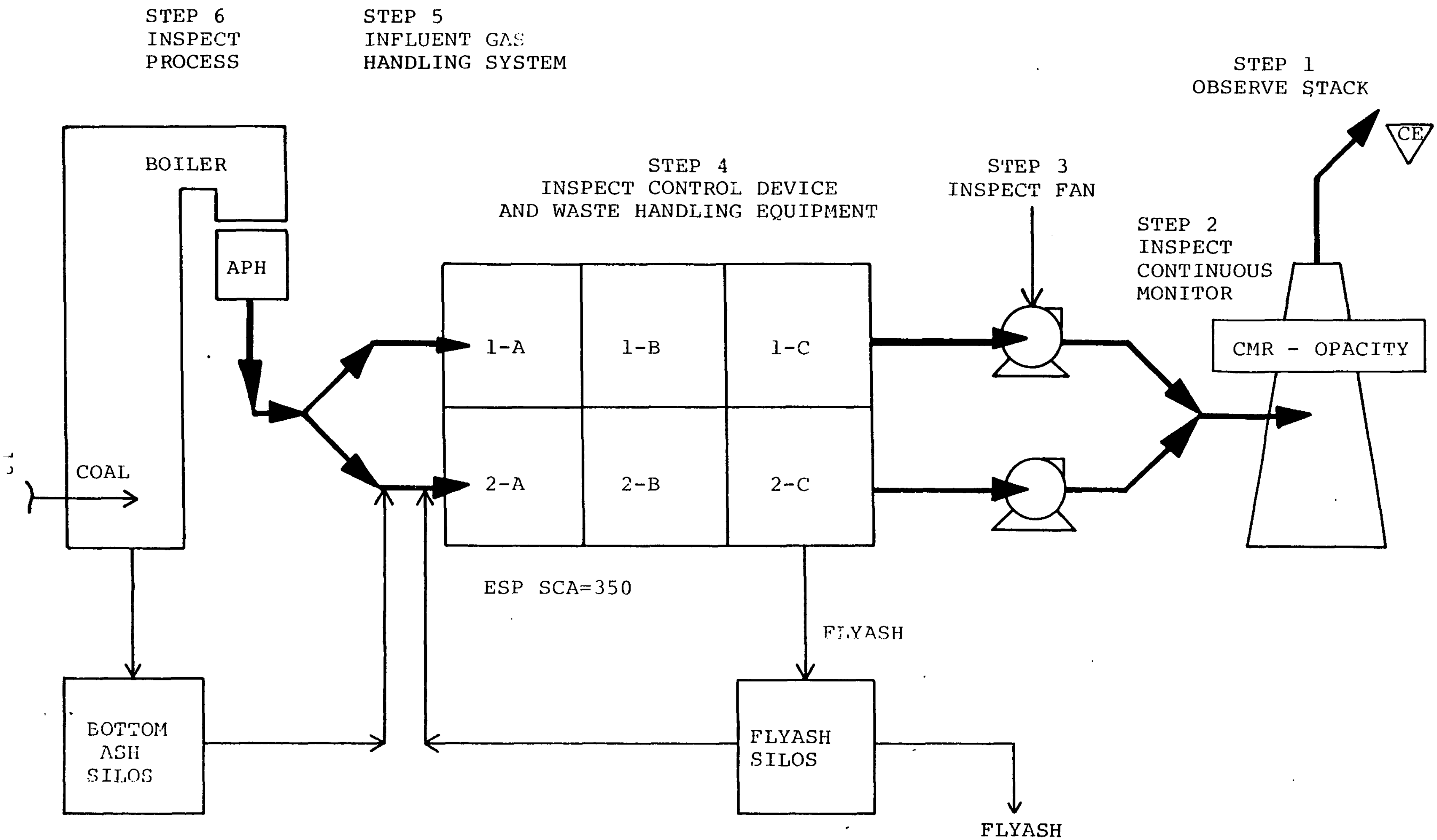


Figure 1. Steps in Counterflow Inspection Technique for coal-fired utility boilers controlled by a "cold side" electrostatic precipitator.

TABLE 1. COUNTERFLOW TECHNIQUE, UTILIZATION OF DATA

Step	Data obtained	Preliminary evaluation	Support data and steps obtained
1. Stack effluent	Change in opacity reading Presence of detached plume Presence and timing of puffs Colors of emissions	None	None
2. Continuous monitors	Change in opacity reading SO_2 and NO_x concentrations Temperature of gas stream Intermittent emission spikes Representativeness of inspection period (review of records)	Have emissions increased to the point of possible noncompliance? Has size distribution of particles changed? Are there intermittent emission problems?	Opacity - step 1 Opacity - step 1 Color - step 1 Puffs - step 1
3. Induced draft fan	Fan static pressure Fan R.P.M. Fan motor current Gas temperature Fan wheel vibration Fan housing condition Fan damper position	Has system pressure drop changed? Has control system been bypassed? Is effluent diluted? Has gas flow rate changed? Is demister operating satisfactorily? Has operation changed fan R.P.M.?	None
Inspection stop point		Is further inspection necessary?	Opacity - step 1 Opacity - step 2 Gas temp - step 2 or 3 Fan static pressure - step 3 Fan motor current - step 3 Fan R.P.M. - step 3
4. Air pollution control device external inspection	Static pressure drop Cleaning system operation Hopper condition Liquid flow rate Liquid temperature Liquid pH Electrical parameters Rapper operation Solids/liquids discharge rate	Has gas flow rate increased or decreased substantially? Has mass loading increased? Has particle size distribution changed? Are operating and maintenance practices adequate?	Opacity - steps 1 and 2 Gas temperature - step 2 or 3 System pressure drop - step 3 Fan motor current - step 3 Opacity - steps 1 and 2 System pressure drop - step 3 Opacity - steps 1 and 2 Color of plume - step 1

(continued)

TABLE 1. (continued)

Step	Data obtained	Preliminary evaluation	Support data and steps obtained
Inspection stop point		Is further inspection necessary?	Results of previous analyses, plus comparison of control device actual and baseline parameters (diagnostic score)
5. Ventilation system ductwork (effluent delivery)	Hood capture velocities Static pressures along ductwork Gas temperatures Condition of cleanout traps Integrity of ductwork	Have gas flow rates changed? Are gas streams being diluted? Are all sources being operated?	Fan current - step 3 Fan static pressure - step 3 Control equipment static pressure drop - step 4 Gas temp - steps 2 and 3
6. Process equipment	Production data Process monitors Raw material information and samples	Has production rate increased? Have operating conditions changed? Have raw material characteristics changed? Has particle size distribution of effluent changed? Can an internal inspection of control equipment be conducted safely?	Gas flow rate - step 5 Static pressure data - steps 4 and 5 Solids discharge rates - step 4 Opacity - steps 1 and 2 Fan motor current - step 3 Fan static pressures - step 3 Opacity - steps 1 and 2
Inspection stop point		Is an internal inspection of air pollution control devices necessary and feasible?	Process operating conditions - step 2 Control device conditions - step 4
7. Air pollution control device (external inspection)	Clean side deposits Alignment of electrodes - ESP Insulator conditions Fabric condition Gas distribution plate/vane conditions Air inleakage through welds and holes Hopper conditions		Confirm preliminary evaluations - steps 1 through 6

In most cases, there is a relationship between the opacity observed during the inspection and the mass emissions penetrating the control device. Regardless of the mathematical form of this relationship, as the opacity increases, the mass emissions generally increase. In Figure 2a, Case 1 represents the most sensitive relationship--a small increase in opacity indicates a large increase in mass emissions; however, errors inherent in a small opacity increase can make any conclusions meaningless in this case. Case 2 presents "contrary" problems--above a certain upper opacity level, there is no change in mass emission rates; thus, at this level, opacity has no diagnostic value. The ideal case is the linear relationship of Case 3; fortuitously, this is generally the prevailing relationship in most industries.

Despite the best efforts of regulatory development personnel, the mass emission regulations and opacity regulations may not always agree. Linear relationships illustrate these possible disagreements in Figure 2b. Case 4 represents the intended situation; that is, <u>any</u> violation of an opacity regulation also involves a violation of the mass emission regulation. In Case 5 there is a substantial opacity violation without a violation of the mass standard. In other cases (represented by line segment 6), a violation of mass emission standards might not be suspected due to decreased sensitivity to opacity. The point is: in certain cases the absolute magnitude of the observed opacity is most useful when the opacity-mass relationship is known.

In the diagnostic phase of the Counterflow approach, the procedure uses (whenever possible) a <u>change</u> in opacity (observed versus historical) rather than an absolute magnitude of observed opacity. Regardless of the opacity-mass relationship, (or the mathematical form) a change in opacity does indicate a change in mass emissions. This information supported by a set of facts herein provides the conclusions sought in a plant inspection using the counterflow procedure.

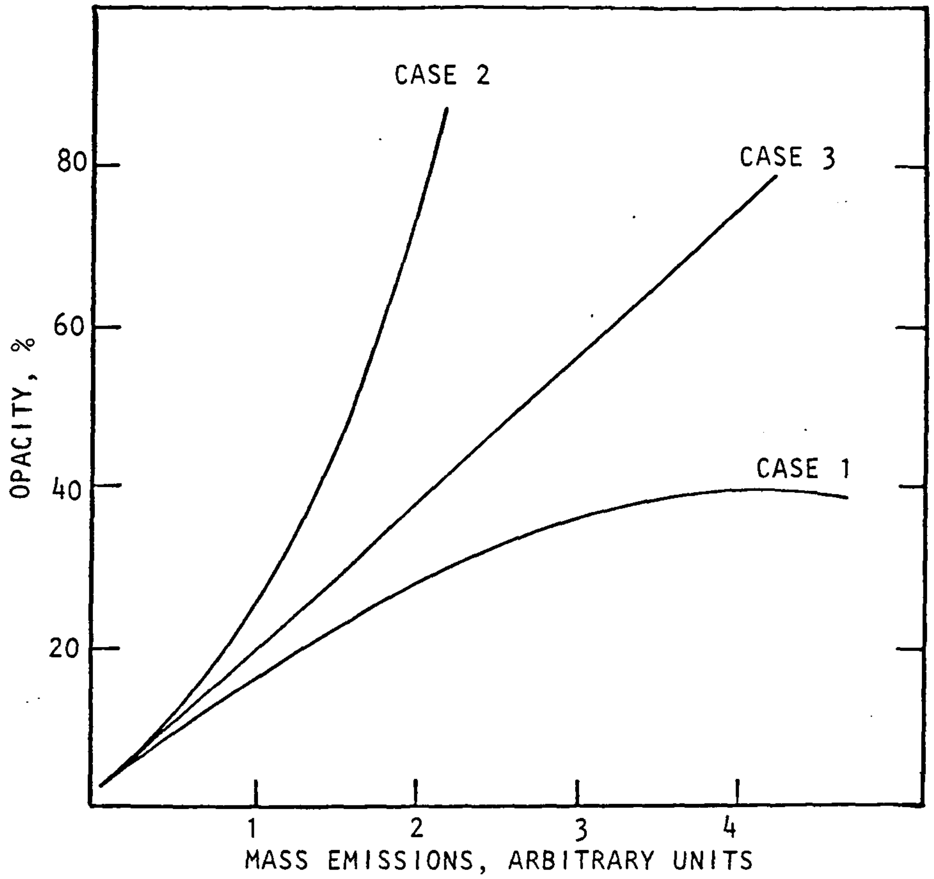


Figure 2a. Opacity-mass relationships.

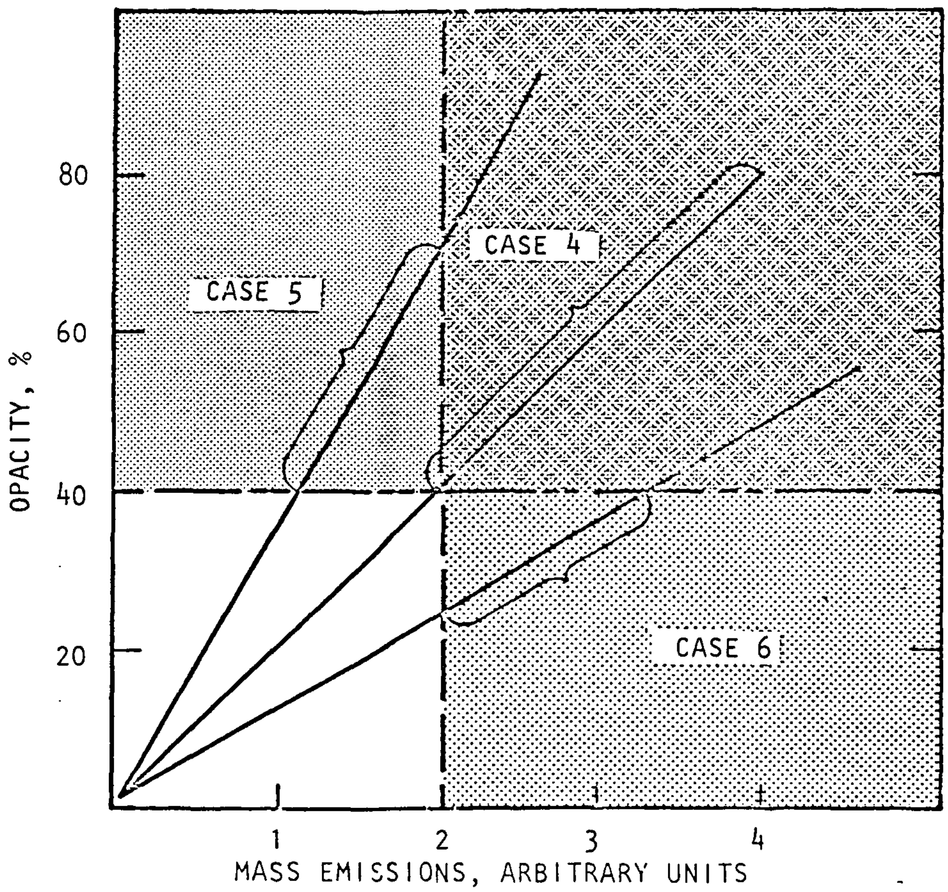


Figure 2b. Opacity and mass emission violations.

The color of the effluent is another plume characteristic which should be observed. For fossil fuel combustion sources, the color is an indirect indication of operating conditions. The following list (Table 2) was compiled by EPA's Control Programs Development Divisions:

TABLE 2. PLUME CHARACTERISTICS AND COMBUSTION PARAMETERS

Plume color	Possible operating parameters to investigate
White	Excess combustion air; loss of burner flame in oil-fired furnace
Gray	Inadequate air supply or distribution
Black	Lack of air; clogged or dirty burners or insufficient atomizing pressure, improper oil preheat; improper size of coal
Reddish brown	Excess furnace temperatures or excess air; burner configuration
Bluish white	High sulfur content in fuel

For other types of sources, the color may not be as variable or may not have a distinct meaning with respect to the process or the control equipment. Nevertheless, a change in the color indicates a change in the system. For example:

1. Increased quantities of bluish particulates generally indicate increased generation of very small particles (0.1 to 2 microns) which are difficult to collect in most control devices.

2. A detached plume indicates fairly conclusively that particulates are forming as the vapors are released to the cold ambient air; detached plumes often cause serious corrosion problems, since any cold surface in the system is susceptible to acid-mist condensation.

3. The frequency and duration of "puffs" from the stack are often caused by rapping reentrainment problems in electrostatic precipitators (ESP's) or by fabric leaking/cleaning problems in baghouses. Cyclic process conditions can also lead to puffs.

4.2 STEP 2: CHECK THE CONTINUOUS MONITORS

After observation of the stack effluent, the next logical step is to check the continuous monitors downstream from the control equipment.

1. The operation of the purge air blowers should be confirmed and the alignment of the source and retro-reflection should be checked.

2. The actual path length should be compared with the value used in the instrument calibration.

3. In almost all cases, the zero and full-scale settings can be checked and confirmed without taking the instrument offline.

4. The status of the window inductor light should be checked.

5. Also, the appearance of the instrument recording trace and the changes in recorded values may indicate reliability or unreliability of continuous monitor data.

Process operating personnel should be able to supply data on the technique and the frequency of calibrations.

The continuous opacity monitor (commonly called a transmissometer) indicates intermittent emission spikes caused by rapping reentrainment (ESP's); pulse flexing of bag seams (fabric filters); and other problems. A brief scan of the last 24 hours of chart paper may help to identify these problems and to describe system performance.

The transmissometer data should be used to confirm and clarify the opacity observations in step 1. Instrument problems should be suspected when there are substantial differences between the opacity recorded in step 1 and that indicated on the monitor. If the instrument response time and the recorder chart speed have been set properly, it will be possible to check for trends in the opacity levels.

1. A cyclic pattern suggests variation in process operating conditions; and

2. A continually deteriorating pattern suggests a developing control device problem which is likely to demand the attentions of the operator and the inspector; the deterioration can also suggest a gradual drift of the instrument or accumulation of dirt on the optical surfaces.

Failure to properly operate and/or maintain an opacity monitor can constitute a violation of regulations.

In step 2, the inspector should have:

1. Confirmed the visible emissions status with respect to opacity regulations,

2. Confirmed the installation and operating status with respect to continuous monitor regulations, and

3. Developed a preliminary idea of the process and the control device operating conditions.

As yet, there would not be enough information to evaluate mass emissions in cases where a reliable opacity-mass emission correlation has not been identified.

4.3 STEP 3: MEASURE THE FAN OPERATING PARAMETERS

Three operating parameters of the induced draft fan are useful in interpreting control system operations:

1. Increase in total static pressure across the fan,
2. Electrical current drawn by the fan motor, and
3. Revolutions per minute (R.P.M.'s) of the fan wheel.

Evaluated together these parameters indicate the gas flow rate and the total system pressure drop. These changes are important in diagnosing control system operating conditions.

If the fan parameters are not monitored at the plant, the inspector should use an inductance ammeter, a manometer (or magnehelic gauge), and a tachometer (or a strobe in cases where the tachometer cannot be used). The inspector should request that static pressure taps be made in the ductwork leading to and from the induced draft fan. The inspector should not drill or cut these holes unless the plant manager approves. Once taps are available, the static pressures at the fan inlet and outlet should be measured using the set of magnehelic gauges.

The fan data can be used to estimate the gas flow at the time of the inspection. After correction of all readings to standard conditions, refer to the appropriate set of characteristic curves to determine SCFM. Please remember that this is only an estimate and is subject to errors due to variability in fan performance, site-specific gas flow factors, and physical condition of the wheel. The remainder of this section concerns means to utilize fan data to diagnose changes since the previous Counterflow Inspection. (Note: in most cases the baseline data will not be available since fan parameters are not measured in conventional inspections).

The type of fan used by most industrial sources with particulate-laden effluents is the radial blade centrifugal fan. Its operating parameters are illustrated in Figure 3; this curve applies to a New York Blower Company size 332 general induced draft fan with an LS wheel operating at 1460 R.P.M.'s at standard conditions. As indicated, the static pressure losses in the control equipment and ductwork (curve A) increase proportionally with the square of the flow rate. The fan, however, develops less static pressure at higher flow rates, and thus it has a strong negative slope (curve B). The intersection of the system line and the fan pressure drop curves define the operating point of the system. At this point, the gas flow rate is 8,400 SCFM, and the brake horsepower (curve C) is approximately 24.5. Figure 3 should be used as baseline data in considering:

1. The potential effects of gas temperature,
2. The changes in system static pressure drop, and
3. The changes in fan speed.

Changes in the rotation speed of the fan wheel is possible in many belt-driven units as shown by the curves in Figure 4. In Case 1, an R.P.M. increase leads to a greater gas flow rate and

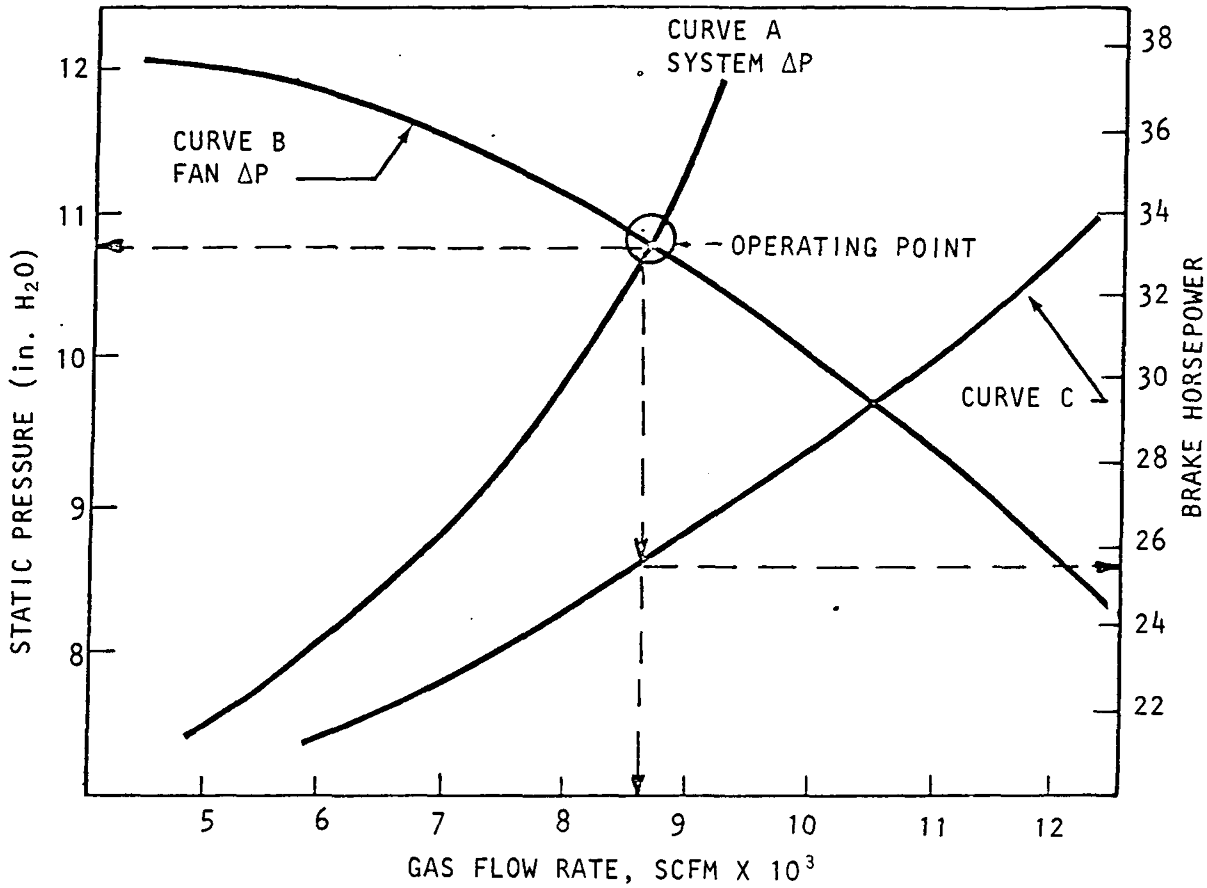


Figure 3. Operating characteristics of radial blade centrifugal fan (New York blower size 332 with LS wheel @ 1460

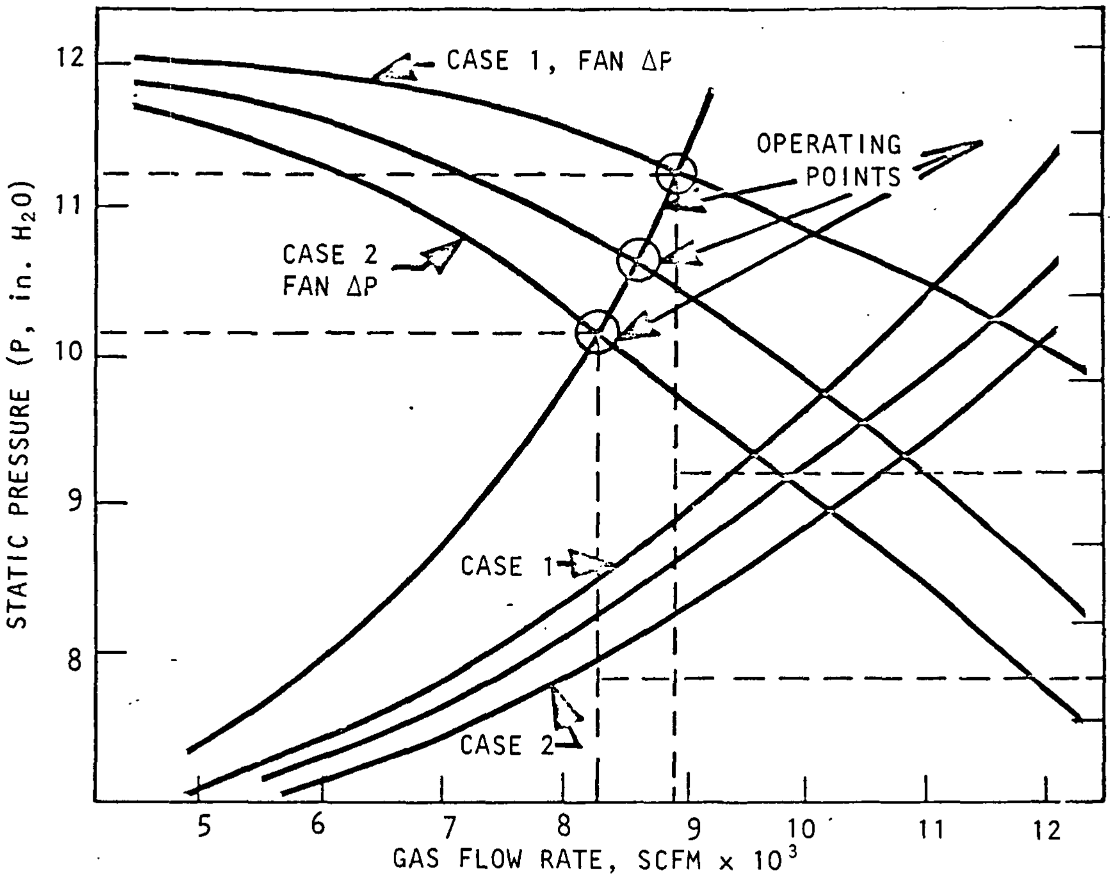


Figure 4. Fan characteristic curves, effect of R.P.M. change.

higher static pressure. Increasing the R.P.M. is the course of action at plants where process gas flow is insufficient; however, this can dangerously increase tip speed, and it can adversely affect fabric filters or ESP's. The opposite situation is illustrated in Case 2. An R.P.M. decrease (perhaps to save energy cost) can decrease the flow substantially; this can reduce the collection efficiency of cyclones and wet scrubbers since these depend on impaction for particle collection and since impaction efficiency is directly dependent on gas velocity. Increases in the fan wheel R.P.M. can occur because of intentional actions of the operator. (Belt shippage can reduce R.P.M. without operator's knowledge).

Other changes in fan operation can occur with or without the operator's knowledge. For example, the fan motor current decreases when the static pressure drop increases; Case 3 in Figure 5 represents total system pressure drop increases. Accompanying this Case 3 change should be an increase in the fan motor current as indicated in Figure 5. As indicated in Table 3, this change can be due to a variety of process and control device operating factors. Pressure drop decreases can be caused by (partial list):

1. Decreased effluent gas flow rate, and/or
2. Operating conditions such as control device short-circuiting (open access doors, gaps in ductwork, open by-pass dampers), and
3. Decreased scrubber liquor flow.

The cause of the change can be further analyzed by considering the measured gas temperature at the fan inlet. A low temperature suggests either an open access hatch or a serious leak in the ductwork.

System diagnoses are based on <u>changes</u> in the three fan operating parameters. All three (total static pressure, motor current, and wheel R.P.M.) must be measured since all three are analyzed as a set. (The Counterflow Procedure does <u>not</u> require

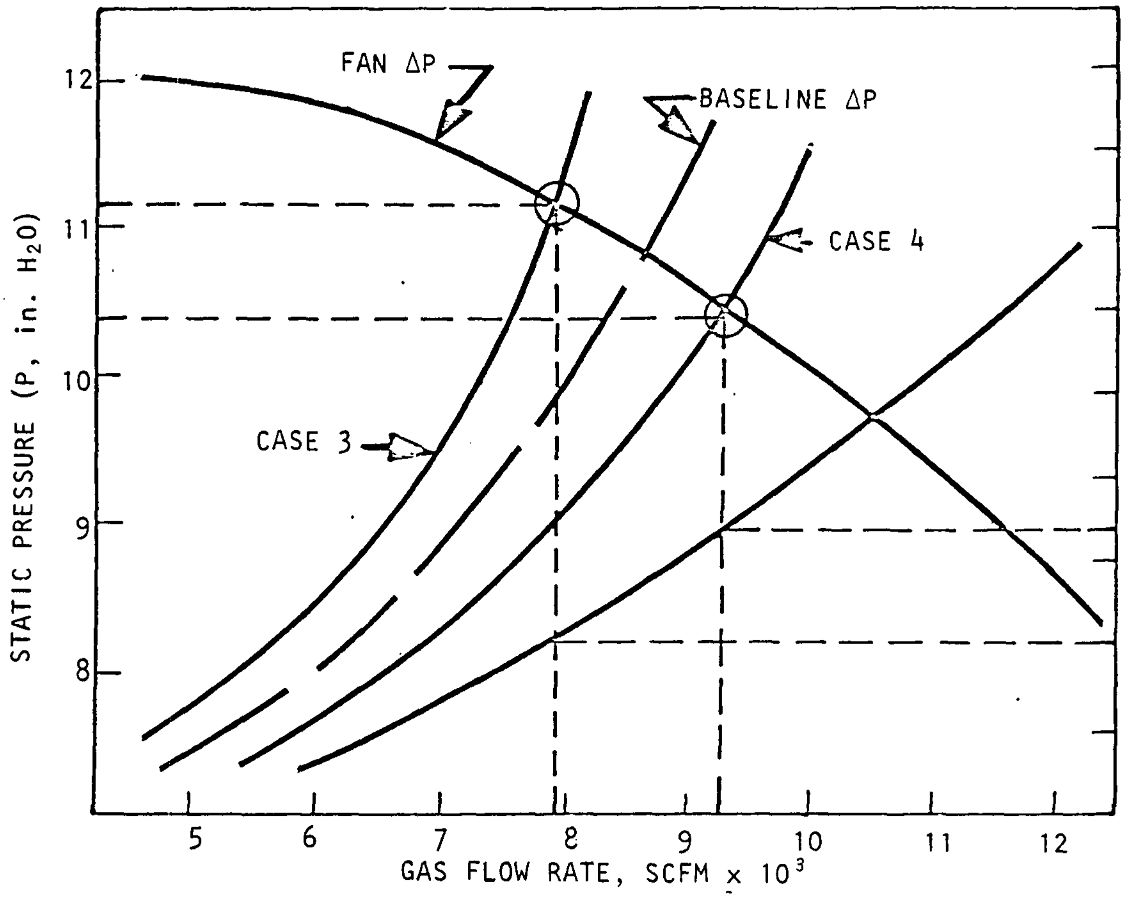


Figure 5. Fan characteristic curves--effect of system pressure drop change.

knowledge of fan characteristic curves.) With these, the inspector should be able to determine if abnormal conditions exist and which of the four cases is applicable.

In addition to analyzing the operation of the fan, the inspector should observe the physical condition of the fan. If it is possible to physically inspect the fan (be sure it is locked off), note the presence of:

1. Blade abrasion,
2. Deposit buildups, and
3. Corrosion of the wheel and fan housing.

The first two problems indicate excess emissions of large particles (10μ) and demister malfunction. The third problem could be due to both the overloading of the demister and excess emissions of corrosive gases. The induced draft fan operating parameters indicate a number of important changes in control device operating conditions (Table 3). The measured parameters were corrected for the gas temperature at the fan inlet by using the factors in Table 4.

At the end of step 3, the inspector should decide whether or not further on-site efforts are necessary to determine compliance with mass emission standards. If the fan operating parameters (static pressure, motor current, and R.P.M.'s) are $\pm 10\%$ and if the gas temperature at the fan inlet is $\pm 20^{\circ}F$, it is unlikely that mass emissions have changed significantly. In some cases, the field inspection can be terminated with step 3. Generally, it is necessary to inspect the control equipment (step 4) to confirm the evaluations of steps 1, 2, and 3.

4.4 STEP 4: ANALYZE CONTROL DEVICE PERFORMANCE

Based on the previous three steps in the Counterflow Procedure, the inspector should have a preliminary estimate of the following:

1. Present gas flow rate through the control system and changes since last Counterflow Inspection,

TABLE 3. INTERPRETATION OF FAN OPERATING CONDITIONS (RADIAL BLADE TYPE ONLY)

Case	Fan parameters			Possible causes
	Calculated ΔP_{sp} at $70^{o}F$	Calculated Amps at $70^{o}F$	Fan wheel R.P.M.	
1	Decreased	Decreased	Decreased	Operator decreased R.P.M.
2	Increased	Increased	Increased	Operator increased R.P.M.
3	Increased	Decreased	Unchanged	a) Filter blinding b) Filter cleaning problem c) Hopper overflow d) Scrubber bed pluggage e) Decreased gas flow f) Damper partially closed
4	Decreased	Increased	Unchanged	a) Baghouse leaks b) Shortcircuiting c) Decrease in liquor flow d) Increase in gas flow e) Damper partially open

TABLE 4. FAN DATA, TEMPERATURE CORRECTION[a]

Temp ^{o}F	Factor	Temp ^{o}F	Factor
20	0.91	320	1.47
40	0.94	340	1.51
60	0.98	360	1.55
80	1.92	380	1.59
100	1.06	400	1.62
120	1.09	420	1.66
140	1.13	440	1.70
160	1.17	460	1.74
180	1.21	480	1.77
200	1.25	500	1.81
220	1.28	520	1.85
240	1.32	540	1.89
260	1.36	560	1.92
280	1.40	580	1.96
300	1.43	600	2.00

[a]Adapted from "Basic Energy/Environment Analysis", NAPA information series 67, by C. Heath, August 1978.

2. Present total system static pressure drop and changes since last Counterflow Inspection,

3. Changes in particulate emission levels since last stack test or Counterflow Inspection,

4. Present temperature of the effluent, and

5. Presence of cyclic or intermittent emissions.

Results of these five observations should provoke specific questions to guide the inspection of the control system.

When inspecting the control device and its auxiliary equipment, the inspector should proceed in a logical sequence to obtain the information needed for evaluating the performance. Detailed checklists (Appendix B) have been prepared for wet scrubbers, fabric filters, and ESP's. The general approach to all three is to use checklists as the inspector proceeds from the control room (if applicable) to the control device. These checklists are arranged to facilitate the inspection. The checklists include preliminary diagnostic sections (Tables 5-7) which are arranged according to commonly encountered problems.

For example, the ESP diagnostic sheet includes, but is not limited to:

1. Particle resistivity changes,
2. Insulator failures,
3. Broken discharge wires, and
4. Nonuniform gas distributions.

Under the each problem category is a list of readily observed symptoms and the relative importance of each as indicated by a rating factor. If the sum of the factors under any category is >10, there is a reasonable probability that a problem does exist; if so, further inspection and/or testing is needed and should be recommended in the inspection report.

In most plants, it will be impractical to observe every item listed in Figures 6-8 or to observe every symptom listed

TABLE 5. FABRIC FILTERS COUNTERFLOW INSPECTION DIAGNOSTIC SECTION

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
A. Bag Tears or Pinholes						
1. Filter house pressure drop low (<80% avg.)			E		3	If sum (Σ) of ratings is ≥ 10, perform internal inspection. Check for deposits on filter house clean side. Check inaccessible bags. Use fluorescent dye technique. Check integrity of fabric by attempting to extend rips.
2. Opacity high			E		5	
3. Bag age high (typical avg.)			E		5	
4. Some bags inaccessible	N/A	N/A	I		2	
5. Design A/C high (>120% avg.)			E		4	
6. Actual A/C high (>120% avg.)			E		4	
7. Wear plate eroded	N/A	N/A	I		3	
8. Frequent high excursions			E or I		4	
					Σ =	
B. Bag Blinding						
1. Filter house pressure drop high (>150% avg.)			E		7	If sum (Σ) of ratings is ≥10, perform internal inspection. Check dirty side of bags for coatings (this may be difficult to identify in some cases). Check records for steady rise in filter house pressure drop. Reschedule inspection in near future.
2. Opacity low			E		2	
3. Cleaning frequency high (cycles/day)			E		5	
4. Gas temp low (≤20°F avg.)			E		4	
5. Moisture in gas stream	N/A	N/A	E		4	
6. Particulate sticky	N/A	N/A	E		4	
7. Air in-leakage (hoppers/access doors)	N/A	N/A	I		2	
8. Unit not insulated	N/A	N/A	E		2	
					Σ =	
C. Bag Bleeding						
1. Opacity high			E		5	If sum (Σ) of ratings is ≥10, attempt to confirm uses of fluorescent dye and black light.
2. Pressure drop gradually increasing			E		2	
3. Cleaning frequency high			E		5	
					Σ =	

(Continued)

*Location: E is external, and I is internal.

TABLE 5 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
D. Cleaning System						
1. Filter house pressure drop high	______	______	E	____	5	If sum (Σ) of ratings is ≥10, perform internal inspection and check deposits on dirty side of bags. Check bag tension. Reschedule inspection in near future.
2. Pulse-jet air header pressure low	___ ___	______	E	____	5	
3. Solenoids inoperative	N/A	N/A	E or I	____	10	
4. Reverse air fan inoperative	N/A	N/A	E or I	____	10	
5. Shaker motor inoperative	N/A	N/A	E or I	____	10	
6. Bag length long	______	______	E	____	2	
7. Equipment inaccessible	N/A	N/A	I	____	2	
8. High intensity cleaning required	______	______	E	____	2	
					Σ =	
E. Hopper						
1. Filter house pressure drop high	______	______	E	____	5	If sum (Σ) of ratings is ≥10, perform internal inspection of hoppers.
2. Solids-removal run intermittent	N/A	N/A	E	____	3	
3. Indicator level existent and/or inoperative	N/A	N/A	E	____	2	
4. Heaters nonexistent and/or inoperative	N/A	N/A	E	____	2	
5. Vibrators nonexistent and/or inoperative	N/A	N/A	E	____	2	
6. Hopper valves corroded	N/A	N/A	I	____	3	
7. Hopper slope <60°	N/A	N/A	E	____	2	
8. Hoppers not insulated	N/A	N/A	E	____	2	
9. Winter	N/A	N/A	E	____	2	
10. Hammer markings on hopper walls	N/A	N/A	E	____	2	
11. Conveyor inoperative	N/A	N/A	E	____	10	
					Σ =	

*Location: E is external, and I is internal.

TABLE 6. SCRUBBERS COUNTERFLOW INSPECTION DIAGNOSTIC SECTION

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
A. No Liquor Flow						
1. Pumps are inoperative	N/A	Yes, No	E		10	If sum (Σ) of ratings ≥10, request immediate correction action, and/or stack test.
2. Inlet and outlet gas temps same	N/A	N/A	E		10	
3. Opacity high			E		5	
4. Scrubber pressure drop low			E		5	
5. Nozzles plugged	N/A	Yes, No	I		7	
					Σ =	
B. Low Liquor Flow						
1. Nozzle operating pressure (<80% avg.)			E		3	If sum (Σ) of ratings is ≥10, attempt to measure exit water flow rate to confirm conclusions. Request stack test.
2. Gas temp high (10% above avg.)			E		3	
3. Opacity high			E		5	
4. Recirculation liquor pH low (<5)			E		3	
5. Flow rate monitor value low (<80% avg.)			E		7	
6. Scrubber pressure drop low (<80% avg.)			E		3	
7. Exit water temp high (>20% above avg.)			E		3	
					Σ =	
C. Gas Flow Rate High						
1. Opacity high			E		5	If sum (Σ) of ratings is ≥ 10, check process equipment and production rate.
2. Outlet gas stream temp high (>20°F above avg.)			E		5	
3. Exit water temp high (>20°F above avg.)			E		5	
					Σ =	

*Location: E is external, and I is internal.

(Continued)

TABLE 6 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
D. Gas Flow Rate High						
1. Opacity high	______	______	E	______	5	If sum (Σ) of ratings is ≥10, check process equipment and production rate. Request stack test if problem is serious.
2. Temp of outlet gas low (>20°F below avg.)	______	______	E	______	5	
3. Temp of exit liquor low (>20°F below avg.)	______	______	E	______	5	
4. Scrubber pressure drop low (<80% avg.)	______	______	E	______	5	
				Σ =		
E. Bed Plugging						
1. Scrubber pressure drop high (>40% above avg.)	______	______	E	______	5	If sum (Σ) of ratings is ≥10, check for bypassing of effluent around scrubber. Request immediate corrective action.
2. Liquor turbidity high	N/A	N/A	E	______	5	
3. Liquor pH high (>8)	______	______	E	______	5	
				Σ =		
F. Nozzle Erosion						
1. Nozzle operating pressure drop low (<80% avg.)	______	______	E	______	5	If sum (Σ) of ratings is ≥10, recommend nozzle replacement.
2. Opacity high	______	______	E	______	3	
3. Liquor turbidity high	N/A	N/A	E	______	3	
4. Corrosive liquor	N/A	N/A	E	______	3	
5. Nozzles unchanged in 6 months	N/A	N/A	E	______	3	
6. Nozzles operable	N/A	N/A	I	______	10	
				Σ =		

*Location: E is external, and I is internal.

(Continued)

TABLE 6 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
G. <u>Demister</u>						
1. No water flow to demister			I		5	If sum (Σ) of ratings is ≥10,
2. Gas velocity high (>10 ft. per second)			E		10	check for changes in productio rate. Reschedule inspection
3. Fan vibrating			E		5	in near future in anticipation
					Σ =	of fan unbalance problem.
H. <u>Venturi Throat Adjustment</u>						
1. Scrubber pressure drop low (<80% avg.)			E		4	If sum (Σ) of ratings is ≥10, request corrective action
2. Visible evidence of changes	N/A	N/A	E		4	immediately or request stack
3. Opacity high			E		4	test.
					Σ =	
I. <u>Impingement Plate or Tray Collapse</u>						
1. Pressure drop low (<80% avg.)			E		4	If sum (Σ) of ratings is ≥10,
2. Opacity high			E		4	attempt internal inspection.
3. Build-up of liquor in sump	N/A	N/A	I		4	
					Σ =	
J. <u>In-leakage of Air</u>						
1. Temp of gas stream low			E		5	If sum (Σ) of ratings is ≥10,
2. Obvious shell corrosion	N/A	N/A	I		5	attempt internal inspection.
					Σ =	

*Location: E is external, and I is internal.

TABLE 7. ELECTROSTATIC PRECIPITATORS COUNTERFLOW INSPECTION DIAGNOSTIC SECTION

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
I. ELECTRICAL						
A. Particle Resistivity						
1. Peak voltage low (down 5-10 kv)			E		5	If sum (Σ) of ratings is ≥10, request in-situ resistivity tes and check sulfur content of fuel, moisture content of gas, and temperature of gas.
2. Rapping intensity increased			E		5	
3. Temp changed (±50°F)			E		3	
4. Spark rate increased (±50 sparks/min)			E		5	
5. Opacity high			E		6	
6. Coal sulfur content low (<1.0%)			E		6	
				Σ =		
B. Transformer-Rectifier Set Problems						
1. No secondary current	N/A	N/A	E		10	If sum (Σ) of ratings is ≥10, request repair.
2. No penthouse purge	N/A	N/A	E		2	
3. Voltage zero, current high	N/A	N/A	E		10	
4. Opacity high			E		6	
				Σ =		
C. Insulator Failure						
1. Peak voltage low			E		5	If sum (Σ) of ratings is ≥10, request repair.
2. Penthouse purge (not used)	N/A	N/A	E		5	
3. Penthouse temp high (+20°F)			E		3	
4. Opacity high			E		6	
5. Cracks visible	N/A	N/A	I		10	
				Σ =		

(Continued)

*Location: E is external, and I is internal.

TABLE 7 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
D. Broken Discharge Wires						
1. Deposits on wires	N/A	N/A	I		5	If sum (Σ) of ratings is ≥10, request repair.
2. Violent meter fluctuating	N/A	N/A	E		10	
3. Hopper level indicator not used	N/A	N/A	E		2	
4. Spark rate high (±50 sparks/min)			E		5	
5. Opacity high			E		3	
6. Broken discharge wires	N/A	N/A	I		10	
				Σ =		
II. GAS FLOW						
A. Excessive Velocity						
1. Flow rate high			E		5	If sum (Σ) of ratings is ≥10, check production and/or generator rate.
2. Voltages high, currents low			E		5	
3. Opacity high			E		5	
				Σ =		
B. Nonuniform Distribution						
1. Flow rate increased			E		2	If sum (Σ) of ratings is ≥10, request velocity traverse.
2. Secondary currents nonparallel	N/A	N/A	E		5	
3. Hopper levels differences on parallel branches			I		5	
4. Rappers on distribution plates not used	N/A	N/A	E or I		3	
				Σ =		

*Location: E is external, and I is internal.

(Continued)

TABLE 7 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
III. MECHANICAL						
A. Rapper Problems						
1. Puffs visible	N/A	N/A	E		5	If sum (Σ) of ratings is ≥10, request internal inspection by plant personnel. Request intensity measurement, if appropriat
2. Peak voltage changed, secondary current constant			E		5	
3. Spark rate changed			E		3	
4. Low sulfur coal used			E		3	
5. Dust sticky	N/A	N/A	E		3	
				Σ =		
B. Hopper Solids Removals						
1. Broken discharge wires	N/A	N/A	I		5	If sum (Σ) of ratings is ≥10, request internal inspection and/or changes in operational practices.
2. Mass loading probably increased	N/A	N/A	E		5	
3. Nonuniform gas distribution	N/A	N/A	E		3	
4. Hoppers not emptied continuously	N/A	N/A	E		5	
5. Level indicators not used	N/A	N/A	E		3	
6. Heaters not used	N/A	N/A	E		2	
7. Vibrators not used	N/A	N/A	E		2	
8. Hoppers not insulated	N/A	N/A	E		2	
9. Corrosion around outlet valves	N/A	N/A	I		3	
10. Hopper slope <60°	N/A	N/A	E		3	
11. Hoppers full or bridged	N/A	N/A	I		10	
				Σ =		

*Location: E is external, and I is internal.

(Continued)

TABLE 7 (Continued)

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
III. MECHANICAL (continued)						
C. Collection Plate Warp and Malalignment						
1. Change in air load	N/A	N/A	E	____	5	If sum (Σ) of ratings is ≥10, request alignment check.
2. Repeated hopper overflow	N/A	N/A	E or I	____	3	
3. Air in-leakage	N/A	N/A	E	____	3	
4. Malalignment visible	N/A	N/A	I	____	10	
				Σ =	____	
IV. EFFLUENT CHARACTERISTICS						
A. Mass Loading Increases						
1. Opacity high	____	____	E	____	6	If sum (Σ) of ratings is ≥10, check production and/or generator rate.
2. Inlet section, secondary currents low	____	____	E	____	5	
3. Hopper unloading frequency increases	____	____	E	____	2	
				Σ =	____	

*Location: E is external, and I is internal.

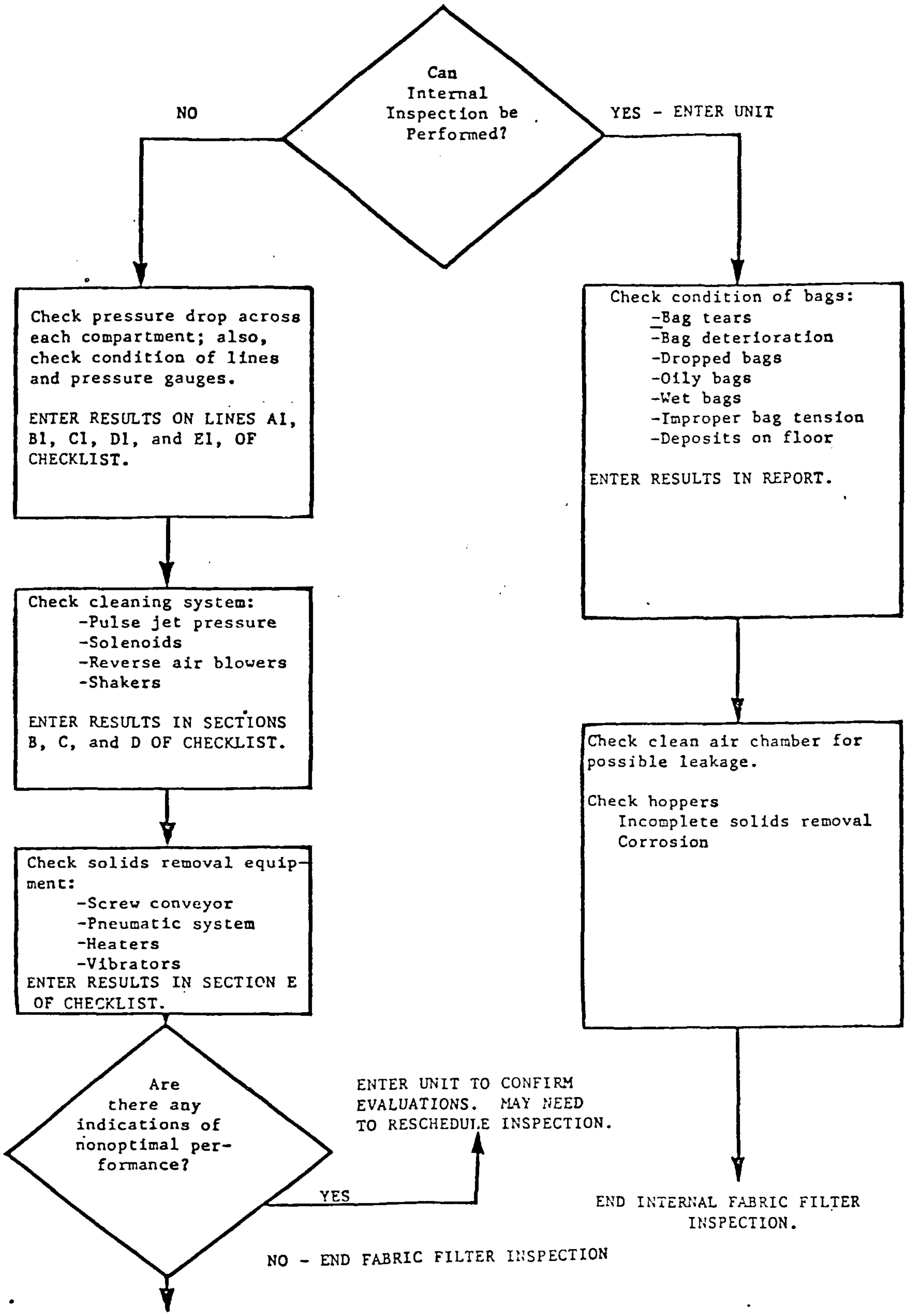


Figure 6. Fabric filter inspection flowsheet.

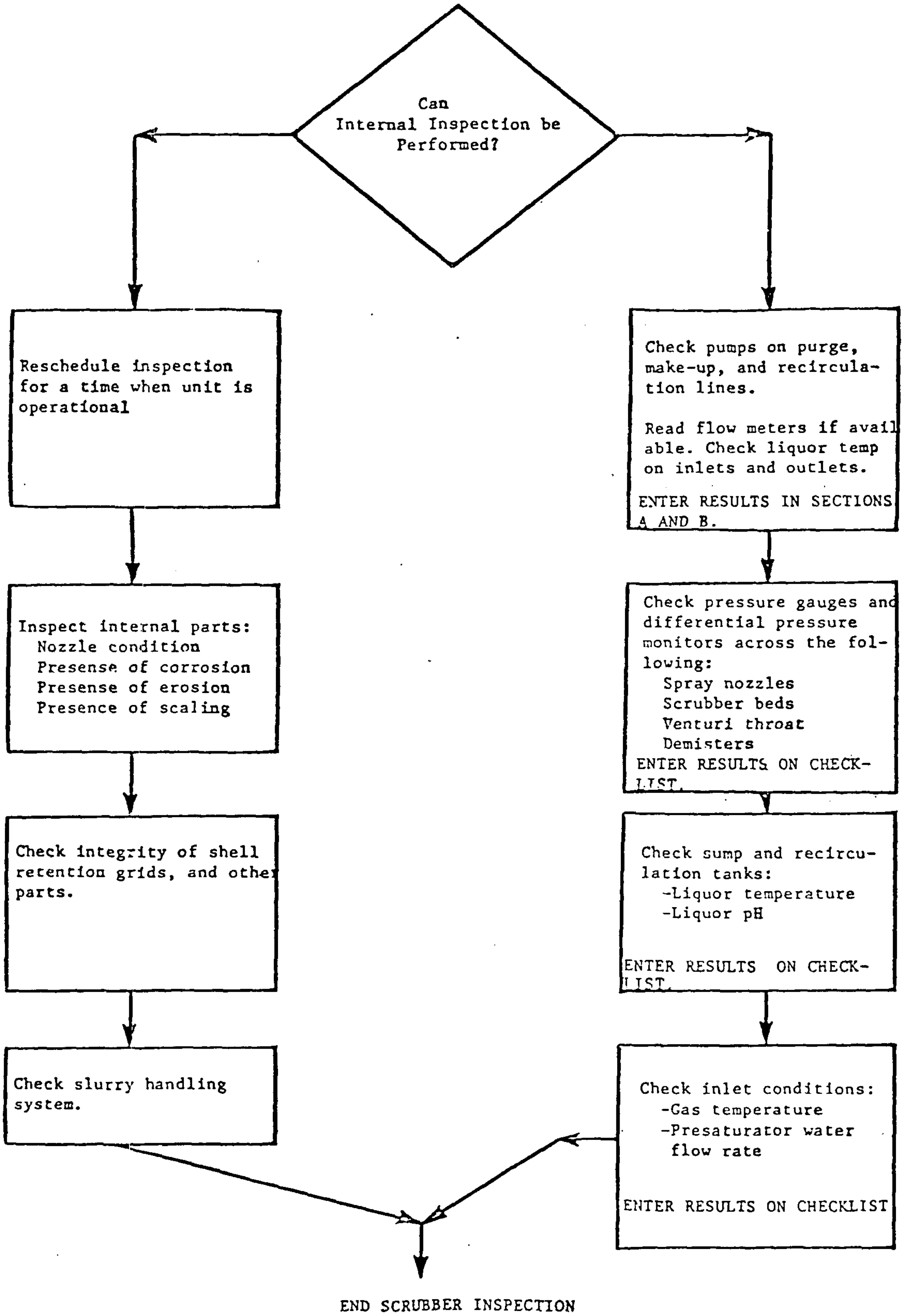


Figure 7. Scrubber inspection flowsheet.

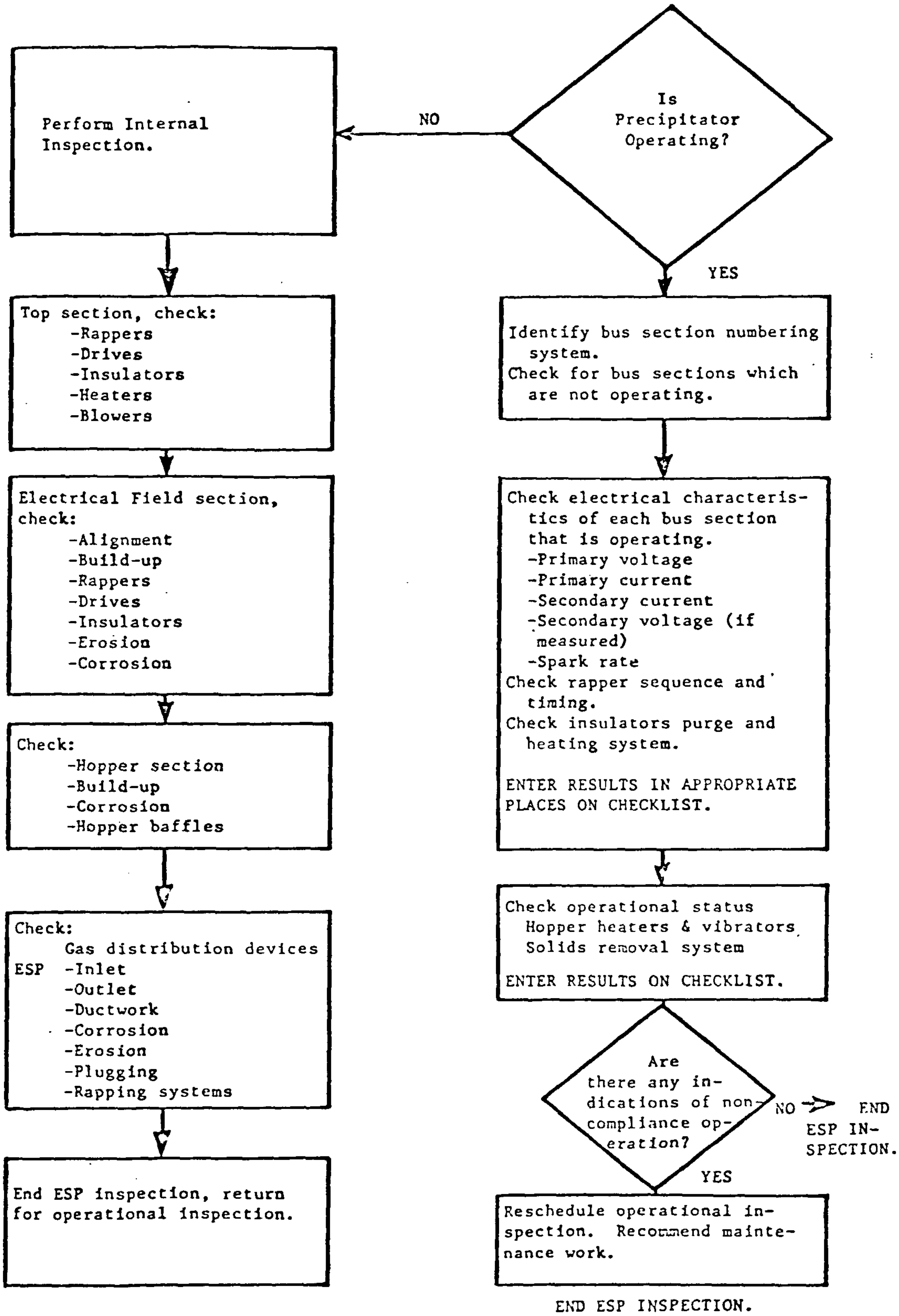


Figure 8. Electrostatic precipitator inspection flowsheet.

in Tables 5-7. This is why the diagnostic sheets are designed to reflect combinations of observations. In the extreme situation where there are essentially no equipment monitors and where access to components is restricted, the difficulty and limitations involved in performance evaluation should be noted in the inspection report.

During each stage of the control device evaluation, the inspector should compare the observed operating conditions with the baseline values obtained from compliance stack tests or from manufacturer's specifications. Deviations from site-specific baseline values are the best indicators of abnormal performances.

The following discussions of control devices do not extend to standard design methodology and operating procedures. It is assumed that the field inspector is familiar with most control devices and has performed in-plant inspections in the past.

4.4.1 Fabric Filters

Five major categories of fabric filter operating problems are listed in the left column of Table 5. Only one of these--Bag Tears/Pinholes--causes immediate excess emissions. The others strain the fabric to the point that extensive repair and/or replacement is eventually necessary.

There are two basic approaches to the inspection of fabric filters. With the most common one, the unit is not shutdown during the inspection. The field inspector should decide if the observed performance symptoms call for a follow-up internal inspection and if a stack test should be recommended. With the second approach, the system can be shutdown (or compartments isolated one-by-one) long enough to perform the internal inspection. If the opacity observed in step 1 and/or step 2 is high and if the internals are accessible, we highly recommend proceeding along the right-hand path of Figure 6. Internal checks are the only truely reliable means for identifying fabric filter problems. Only if access to the unit is impossible do we suggest the use of the indirect approach illustrated on the left of Figure 6; in this case, the inspector evaluates whether a return trip (when the unit is down) is justified.

Some of the symptoms on the diagnostic checklists are design factors. Fabric filter design is very significant with respect to long-term performance. Design deficiencies at any source should be checked routinely during each inspection.

4.4.2 Wet Scrubbers

To evaluate the performance of a wet scrubber, the PEDCo inspector should first confirm that the recirculation pump is operating. If there is no water/liquid circulating through the system, the inspector should recommend a follow-up inspection when the scrubber will be operational. If there is circulation, the inspector should proceed along the flow of water through the system (water flow is generally counter to gas flow).

Next, the inspector should confirm that the pumps are on, and if so, should read the flow meter (if any). In the line going to the spray nozzles, low pressure indicates erosion of the nozzles and likely increases in the water spray droplet size. If the line pressure does not change when the flow is temporarily shut off (the inspector must not adjust valves), the nozzles are plugged. Static pressure drop across each stage should be recorded, if possible, to help in problem diagnosis.

To complete the check of the water system, the inspector should measure the temperature and the pH of the sump liquor. It is advisable to take a liquor sample; however, the expense should not be incurred unless there are reasons to suspect operational and/or corrosion problems (chain-of-custody procedures must be followed). During the inspection, the integrities of the scrubber shell and the component parts should be rountinely checked.

4.4.3 Electrostatic Precipitators

There are four problems which can affect the performance of an ESP:

1. Electrical,
2. Gas flow,
3. Mechanical, and
4. Effluent.

In each problem category, there are three to five symptoms which occur with reasonable frequency, but the observed symptoms do not often indicate a particular problem. Due to the complexity caused by the interfacing of these problems, it is important that the inspector use a combination of symptoms in identifying operational difficulties.

The checklist (Table 7) and the flowsheet (Figure 8) are logical approaches to the evaluation of an ESP. Unlike the comparable charts for fabric filters and wet scrubbers, those for an ESP include a preliminary flowcharting step for use if a diagram is not available, so that the electrical data can be simplified and understood.

The inspector should begin in the main control room (or the substation) where much of the electrical data can be obtained. Performance evaluation should include, but not necessarily be limited to:

1. Power density calculations,
2. Evaluation of parallel field secondary currents,
3. Evaluation of inlet field secondary currents,
4. Spark rate,
5. Hopper heater/vibrator operational status,
6. Penthouse purge fan operational status,
7. Hopper unloading frequency,
8. Rapper operational status, and
9. Rapper frequency in various locations.

We recommend that internal ESP inspections be done only when the inspector is accompanied by a company representative. Furthermore, the inspector should always wear a respirator, hard-hat, and gloves; should fully understand the lockout procedures used at the plant, and should strictly adhere to safety procedures due to the many potential hazards. A precipitator is essentially a giant capacitor.

Inside the unit, it is possible to identify many operating problems which are hard to diagnose otherwise. Particular attention should be given to:

1. Dust accumulation on turning vanes and distribution plates which can indicate and/or cause poor gas distribution and low particulate control efficiency;

2. Obvious corrosion which suggests in-leakage of air or operating below the acid dewpoint;

3. A full hopper which causes misalignment of the collection plates, which in turn can reduce collection efficiency;

4. Removal of a large number of discharge wires in a bus section which can indicate alignment problems and/or design deficiences; and

5. Inadequate rapping of collection plates, and/or discharge wire.

Broken discharge wires can generally be located by checking for bottle weights hanging below the normal level.

At the end of step 4, the inspector decides whether or not the ventilation system and the process, itself, need to be inspected. If the operation and maintenance of the control system appear to be adequate and if there are no indications of changes in effluent characteristics (e.g., increased gas flow rates, smaller particle size distribution, higher temperature), the inspection should be terminated. Otherwise, the ventilation system (if applicable) and the process operations should be visited.

4.5 STEP 5: CHECK THE VENTILATION SYSTEM

To inspect the ventilation system, the inspector checks the capture velocities of hoods to the extent possible using the velometer. Factors which could cause inadequate capture efficiency include the following problems (partial list):

1. Inadequate hood design and location,
2. Thermal drafts,
3. Cross-drafts in the vicinity of the hood, and
4. Leaking of air into hoods and/or ducts within the system.

If the ductwork is accessible, the static pressures at various points should be inspected; furthermore, the physical conditions of ducts should be observed to locate leaks. Improper hood locations can account for drops in pollutant mass loading or for changes in particle size distributions. Releases of emissions to roof monitors or as fugitive material should be checked, especially for movable hoods.

4.6 STEP 6: EVALUATE PROCESS OPERATING CONDITIONS

The purpose of the process inspection is to answer questions and to confirm conclusions reached in earlier steps. However, if the source is subject to special state/local regulations or to New Source Performance Standards or to National Emission Standards for Hazardous Air Pollutants, compliance with recordkeeping and monitoring requirements should be checked first, using a DSSE-published series of documents which includes checklists and associated information.

The inspector can seek answers to questions which were derived from steps 1 through 5. The inspector addresses problems which could be individually or collectively responsible for nonoptimal performance, including, but not limited to:

1. Has the production rate increased (higher mass loading and/or gas flow rate)?

2. Have the raw materials and/or fuels changed to the extent that effluent characteristics are different?

3. Has the process equipment deteriorated to the extent that emissions are affected?

4. Have changes in operating conditions resulted in more difficult collection problems (particle size decreases)?

The process inspector should begin at the control centers where process monitors are located to look for signs of changes in operating conditions and to observe current operating/maintenance practices. At these centers, process operating data are available; a process flowsheet is generally posted on the control panel; plant operators are generally nearby; and the subdued noise level is conducive to technical discussions.

While in the control room, the inspector should seek out the process monitors and/or records most pertinent to the compliance questions. Example "inspection points" for six source types are in Table 2; several generalizations can be drawn from this table.

1. In most cases, the inspector can confirm increased production rate by using data available in the control room;

2. The inspector can confirm raw material changes by inspecting records kept either in the control room or in the administrative offices;

3. The inspector cannot easily confirm process operational changes;

4. For batch operations, it is necessary to observe the equipment since little useful information is available in the control room; and

5. For other processes, it is possible to identify changes in operating conditions, but the significance of the changes is hard to determine.

Follow-up questions remaining after the inspection of records and monitors in the control room can be quite time consuming due to the cyclic processes and to distances between inspection points at large plants. The follow-up can be guided by the items listed in Table 8, but the inspector is encouraged to develop more extensive lists for specific plants. The presence of fugitive emissions should be noted.

TABLE 8. EXAMPLE INSPECTION POINTS, COUNTERFLOW INSPECTION PROCEDURES

Type of Industry/Source	Inspection in the Office and/or Control Room	Inspection of Specific Equipment
1. Confirm the Rates of Production and/or Generation		
Sulfuric acid	Check acid production records, and observe acid flow rate indicator.	N/A
Asphalt	N/A	Observe number of batches shipped per hour of plant operation.
Utility or industrial boiler	Check megawatt generation and steam production rates.	N/A
Cement	Check raw material feed rate records.	N/A
Refinery	Check throughput records on catalytic cracker.	N/A
2. Confirm Raw Material Changes		
Asphalt	N/A	Perform lab tests to determine coal gradation and surface moisture percentage.
Utility or industrial boiler	Check daily records of analyses: % ash, %S, Btu content, ash fusion temp.	Take sample for later analyses.
Sulfuric acid	Check records of feed content; high levels contribute acid mist.	N/A
Refinery	Check production inventory records.	N/A

TABLE 8 (Continued)

Type of Industry/Source	Inspection in the Office and/or Control Room	Inspection of Specific Equipment
3. Confirm Process Operational Changes		
Sulfuric acid	Check catalyst bed temp and air flow rate to catalyst bed if SO_2 monitor values are high. Check acid concentration temp and flow to absorbers.	N/A
Secondary brass and bronze	Check records for percentage of zinc in alloy and for pouring temp.	Check for grease and oil on scrap and for operational practices such as maintenance integrity of slag load. Check hood caption velocity in furnace area. Determine if zinc is added before furnace temp is maximum.
Utility or industrial boiler	Check air preheater exit temperatures.	N/A
4. Confirm Process Equipment Deterioration		
Sulfuric acid	Observe SO_2 concentration monitors; check for inactive or poisoned catalyst if SO_2 is high.	Check pressure drop across mist eliminator. If low, check for shortcircuiting; if high, check for plugging.
Secondary brass and bronze	N/A	Check hoods and ductwork for physical damage and caption velocity.
Utility or industrial boiler	Check excess air level by means of O_2 readings.	Check to see if stoker boiler draft above fuel beds has >0.10" negative pressure.
Refinery	N/A	Observe flow rate.

SECTION 5

POST-INSPECTION

5.1 PLANT INTERVIEW

Having evaluated the exhaust system, monitoring equipment, control systems, and possibly the process itself, the inspector should meet with a responsible plant official to:

1. Ask follow-up questions as necessary,
2. Review inspection notes so that there is general agreement on the technical facts, and
3. Discuss need for followup inspection or additional records.

5.2 FILE UPDATE AND REPORT PREPARATION

All appropriate file entries should be changed as necessary. The conclusions of the inspector, based on observations and calculations, should be clearly stated in a concise paragraph in the inspection report which should also include two sheets--the control device diagnostic checklist and a coverpage (Table 9)--with the following information:

-Any change in responsible plant personnel,

-Requested permit changes or reported process modifications,

-Results of Counterflow evaluation,

-Action requested,

-Inspector's signature, and

-Date of inspection.

A copy of both sheets should be kept in the inspector's source file and in the agency's central file.

SECTION 6

SAFETY CONSIDERATIONS

The field inspector should take any precautions necessary to absolutely ensure that the inspection is conducted safely. All applicable OSHA regulations should be satisfied. If there is any question whether all or part of the inspection can be done safely, that part should be delayed until the issue is adequately resolved.

There are several principles which should be obeyed during a field inspection, namely:

1. Prior to the inspection, the files should be reviewed to assess possible hazards. Consult references, such as the Pocket Guide of Industrial Hazards and Occupational Diseases, a Guide to Their Recognition;

2. The inspection should bring all necessary safety equipment (in good working order);

3. Safety equipment should be worn whenever necessary regardless of the practices of plant personnel;

4. The inspector should proceed with the inspection at a controlled pace so there is time to fully assess possible hazards and so foolish accidents do not occur;

5. Inspectors should not work alone. If plant personnel are not available or willing to accompany the inspector, then the inspector should wait until additional help is available from the agency or the company;

6. Prior to any confined space entry, the inspector should read Appendix C, and follow the recommendations completely;

7. Physical examinations should be completed annually;

8. Accidents should be reported to supervisory personnel immediately, regardless of the suspected severity of the injury;

9. Lock-out procedures should be followed completely;

10. Entry to electrostatic precipitators should not be done until grounding hooks have been used in all areas to be inspected;

11. Hoppers full of material should never be opened or entered by the inspector; and

12. Fans vibrating severely should be avoided and plant personnel should be notified immediately.

A field inspector cannot afford to under-estimate potential hazards. The inspector is inherently exposed on a regular basis to a wide variety of hazards and does not have the opportunity to acquaint himself or herself with the details of each plant. For these reasons, it is particularly important that the inspector adhere to the basic principles outlined above. It should also be realized that these are simply a starting point and other precautions will be needed in most circumstances.

TABLE 9. CONTROL DEVICE DIAGNOSTIC CHECKLIST AND COVERPAGE

INSPECTION REPORT

REPORT NUMBER ____________________

PLANT NAME ____________________

PLANT I.D. ____________________

SPECIAL ACTION RECOMMENDED (Yes) (No)

I. GENERAL INFORMATION

A. Sources Inspected ____________________ Production Status ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

B. Reasons for Inspection (Check Appropriate Items)

Routine Inspection ____________ Compliance Progress ____________
Complaint Investigation ____________ Permit Review/Renewal ____________
Stack Testing Observed ____________ Tax Certification ____________
Special Studies ____________ Emergency Episode ____________
Other ____________ Equipment Malfunction ____________

C. Plant Representative Contacted (Name and Title) ____________________

____

D. Inspection Procedures and Conditions

Prior Notice (Check One) Yes ____ No ____

Time/Date ____________ Duration On-Site ____________ ____________

Type Inspection (Check One) Counterflow ________ Follow-Up ____________

Other ____________________

Weather ____________________ Wind Direction ____________

II. PRE-INSPECTION INTERVIEW

A. Production Status: Normal ____________ Abnormal ____________
B. Control Equipment: Normal ____________ Abnormal ____________
C. Permit/Compliance Schedule Changes Needed: Yes ________ No ________
D. Comments ____

____

____

(continued)

TABLE 9. (continued)

Report Number ____________________

III. INSPECTION RESULTS

A. General Conclusions

All Sources in Compliance with:

Mass Emission Regulations:	Yes ____	No ____	N/A ____
Visible Emission Regulations:	Yes ____	No ____	N/A ____
Fuel Quality Regulations:	Yes ____	No ____	N/A ____
Continuous Monitoring Regulations:	Yes ____	No ____	N/A ____
Sampling/Testing Requirements:	Yes ____	No ____	N/A ____
Recordkeeping Requirements:	Yes ____	No ____	N/A ____
Permit Stipulations:	Yes ____	No ____	N/A ____
Special Orders:	Yes ____	No ____	N/A ____

O&M Practices:	Good ____	Average ____	Poor ____
Housekeeping:	Good ____	Average ____	Poor ____

B. Specific Conclusions

Compliance Questionable Due To:

Changes in Raw Materials and/or Fuels ____________________
Production Rates Increases ____________________
Operational Changes in Process ____________________
Deterioration of Process Equipment ____________________

Operational Problems in Control Equipment (Check Appropriate Items Below)

Electrostatic Precipitators	Fabric Filters	Wet Scrubbers
Resistivity ____	Tears/Pinholes ____	Low Liquor Flow ____
TR Sets ____	Blinding ____	Gas Flow Rate Low ____
Insulators ____	Bleeding ____	Bed Plugging ____
Discharge Wires ____	Cleaning System ____	Nozzle Erosion ____
High Velocity ____	Hopper Overflow ____	Demisters ____
Gas Distribution ____	Corrosion ____	Throat Adjustment ____
Rappers ____		Tray Collapse ____
Solids Handling ____		Corrosion ____
Plate Warpage ____		
Mass Overload ____		
Other ____		

C. Samples Taken (Describe) ____________________

____

____

D. Comments/Recommended Action ____________________

____

____

Inspector ____________ Date ________

Reviewer ____________ Date ________

APPENDIX A

(See Working File Handout)

APPENDIX B

(Sample Inspection Data Sheets)

PEDCo ENVIRONMENTAL

INSPECTION DATA SHEET

A. INSPECTION INFORMATION

1. IDENTIFICATION

Company______________________________

Plant Name______________________________

Plant I.D. Number______________________________

Address______________________________

____

____

Control Device/System Number______________________________

Process Served______________________________

2. PROCEDURES AND CONDITIONS

Prior Notice: Yes______ No______

Time(s) On-Site______________________________

____

Type Inspection______________________________

____

Inspectors______________________________

____

____

Plant Representatives______________________________

____

____

Information Claimed Confidential: Yes______ No______

B. Visible Emissions Observations

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No.______ of ______

1. STACK CHARACTERISTICS

Location______________________________

Height______________________________

Temperature______________________________

Exit Dimensions______________________________

Orientation______________________________

Other Information______________________________

2. STACK EFFLUENT

Detached Plume: No______ Yes______ Distance______________

Color______________________________

Puffing: Yes______________ No______________

Opacity

Time	Average Opacity	Observation Point	Sheet No.

3. FUGITIVE EMISSIONS

Control Device: Yes______ No______

Solids Removal System: Yes______ No______

Process: Yes______ No______

Continuous______________ Intermittent______________

Adjacent Deposits: Yes______ No______

C. Fan Data

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No. ______ of ______

1. FAN MOTOR

Manufacturer____
Model No.______________________ Type________________________
Rated Horsepower____
Volts__________________________ Maximum Amps__________________
Maximum R.P.M.__________________ Service factor_______________
Operating Current: Panel____________ Other__________________

2. DRIVE

Direct__________________ Belt_______________ Other______________
Sheath Reduction____
Audible Belt Slippage: Yes_______________ No_________________

3. FAN

Manufacturer____
Model No.______________________ Type________________________
Fan Vibration____
Gas Temperature at inlet, $^{\circ}F$______________________________
Fan R.P.M.____
____
Fan Static Pressures: Inlet_____________ Outlet______________
Differential Static Pressures: Measured_______ Panel__________
Fan Housing Condition______________________________________
Dampers____
Fan Exit____

D. Electrostatic Precipitator Data

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No. ______ of ______

1. DESCRIPTIVE INFORMATION

Type____

Manufacturer____

Model Number____

Plant Inventory Number____________________________________

Date Installed____

Number of Chambers____

Number of Fields in Series________________________________

Specific Collection Area (Ft^2/1000 Ft^3)______________________

Design Superficial Viscosity (Ft/Sec)_______________________

Pulse Energization (Yes/No)_________________________________

2. LOCATION

Building/Area____

Elevation____

3. LAYOUT (SKETCH FIELD LAYOUT AND NUMBER FIELDS, SHOW FANS)

E. Electrostatic Precipitator
External Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

1. HOPPER LAYOUT (SKETCH TOP VIEW AND NUMBER; SHOW SOLIDS HANDLING SYSTEM)

2. HOPPER DESCRIPTION

Vibrators: Yes__________________ No__________________________

Heaters: Yes__________________ No__________________________

Insulation: Yes__________________ No__________________________

Level Indicators: Yes___________ No_________ Type______________

Physical Condition (Characterize)______________________________

____

Transport Equipment: Screws______ Pneumatic_______ Other_______

Transport Equipment Operating: Yes__________ No_______________

Characterize Discharge____

____

____

____

____

E. Electrostatic Precipitator
External Inspection

Inspection No.________________

Equipment No._________________

Confidential: Yes____ No_____

Page No.______ of ______

3. HOPPER VALVES

Type: Screw______________________ Other___________________________

Speed/Cycle Times____

____

Blade Type____

4. RAPPER LAYOUT (SKETCH TOP VIEW, SHOW DISCHARGE WIRE UNITS AS D, COLLECTION PLATE UNITS AS C AND DISTRIBUTION PLATE UNITS AS X).

E. Electrostatic Precipitator
External Inspection

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No.______ of ______

5. RAPPER PERFORMANCE (Continued)

COLLECTION PLATE RAPPERS

No.	Time Interval (Minutes)	Duration (Seconds)	Comments
C_1			
C_2			
C_3			
C_4			
C_5			
C_6			
C_7			
C_8			
C_9			
C_{10}			
C_{11}			
C_{12}			
C_{13}			
C_{14}			
C_{15}			
C_{16}			
C_{17}			
C_{18}			
C_{19}			
C_{20}			

E. Electrostatic Precipitator
External Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

5. RAPPER PERFORMANCE

DISCHARGE WIRE RAPPERS

No.	Time Interval (Minutes)	Duration (Seconds)	Comments
D_1			
D_2			
D_3			
D_4			
D_5			
D_6			
D_7			
D_8			
D_9			
D_{10}			
D_{11}			
D_{12}			
D_{13}			
D_{14}			
D_{15}			
D_{16}			
D_{17}			
D_{18}			
D_{19}			
D_{20}			

E. Electrostatic Precipitator
External Inspection

Inspection No.____________

Equipment No.____________

Confidential: Yes____ No____

Page No.______ of ______

5. RAPPER PERFORMANCE (Continued)

DISTRIBUTION PLATE RAPPERS

No.	Time Interval (Minutes)	Duration (Seconds)	Comments
X_1			
X_2			
X_3			
X_4			
X_5			
X_6			

6. RAPPER DESCRIPTION

DISCHARGE WIRES

Type ____________

Number ____________

Manufacturer ____________

Air Pressure ____________

COLLECTION PLATES

Type ____________

Number ____________

Manufacturer ____________

Air Pressure ____________

DISTRIBUTION PLATES

Type ____________

Number ____________

Manufacturer ____________

Air Pressure ____________

E. Electrostatic Precipitator
External Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

7. TRANSFORMER - RECTIFIER SET LAYOUT (SKETCH TOP VIEW SHOWING T-R SETS ON CHAMBERS AND FIELDS)

8. TRANSFORMER - RECTIFIER SET DESCRIPTION

Power Control: Yes______ No______

Mode Voltage____________ Current___________ Spark Rate___________

No.	Plant No.	Manufacturer	Model No.	Milliamp Rating	Type
T-R_1					
T-R_2					
T-R_3					
T-R_4					
T-R_5					
T-R_6					
T-R_7					
T-R_8					
T-R_9					
T-R_{10}					

E. Electrostatic Precipitator
External Inspection

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No. ______ of ______

9. TRANSFORMER - RECTIFIER SET CONDITIONS

No.	Primary current (amperes)	Primary voltage (volts)	Secondary current (milliamps)	Secondary voltage (kilovolts)	Spark rate #/min	Control mode M-manual A-automatic
T-R-1a						
T-R-1b						
T-R-2a						
T-R-2b						
T-R-3a						
T-R-3b						
T-R-4a						
T-R-4b						
T-R-5a						
T-R-5b						
T-R-6a						
T-R-6b						
T-R-7a						
T-R-7b						
T-R-8a						
T-R-8b						
T-R-9a						
T-R-9b						
T-R-10a						
T-R-10b						

E. Electrostatic Precipitator
External Inspection

Inspection No.____________

Equipment No.____________

Confidential: Yes____ No____

Page No.______ of ______

10. OPERATING INFORMATION

Gas Inlet Temperature, °F____________________________

Hopper Heater Operational Indicator Lights (Identify units not on)

____

Penthouse Heater/Blower Operational Indicator Lights (Identify units not on)____

____

Comments____

____

____

____

11. OPACITY MONITORS

Opacity - Minimum, % ________________

Average, % ________________

Maximum, % ________________

Spikes (Characterize Frequency, Duration, Intensity)__________

____

____

____

Calibration Spikes (Characterize Levels, Frequency)__________

____

____

Comments____

____

____

F. Electrostatic Precipitator
Interal Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

1. PURPOSE

   Reason(s) Necessary____

   ____

   ____

   SAFETY EVALUATION

   Lockout Procedure Followed__________________________________

   Plant Employee Performing Lockout___________________________

   Grounding Straps Available: Yes____________ No______________

   Time Period De-energized (Hours)____________________________

   Purge Completed: Yes________________ No______________________

   O_2, %____

   Combustibles, %____

   Noise____

   Other____

   Inspection Not Conducted Due to Potential Hazards (Characterize)

   ____

   ____

2. AREAS INSPECTED (SKETCH TOP VIEW AND INDICATE ENTRY POINTS)

F. Electrostatic Precipitator
Internal Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page ______ of ______

3. HATCH CONDITIONS

Gaskets____

Corrosion____

4. PENTHOUSE CONDITIONS

Purge Air____

Heater(s)____

Insulators____

Alignment of Collection Plates__________________________________

Comments____

F. Electrostatic Precipitator
Internal Inspection

Inspection No.____________

Equipment No.____________

Confidential: Yes____ No____

Page No.______ of ______

5. ELECTRODE CONDITIONS

DISCHARGE WIRES

Type____

Diameter____

Material____

Spacing and Length____

Conditions____

____

____

____

COLLECTION PLATES

Type____

Material____

Spacing and Length____

Conditions____

____

____

____

Alignment____

____

____

____

____

F. Electrostatic Precipitator
Internal Inspection

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

6. INTERNAL SUPPORTS

Describe____
____
____
____

Conditions______________________________________
____
____
____

7. GAS DISTRIBUTION EQUIPMENT

Type____
Condition_______________________________________
____
____
____

8. HOPPERS

Baffle Condition________________________________
____
____

Hopper Condition________________________________
____
____

G. Continuous Monitor Evaluation

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

1. DESCRIPTIVE DATA

Manufacturer______________________________

Model______________________________

Type______________________________

Date Installed______________________________

Single or Multiple Breeching (Describe Sources)______________

____

____

NSPS Applicable: Yes______________ No______________

2. TRANSMISSOMETER

LAYOUT (SHOW LOCATION RELATIVE TO FLOW RESTRICTIONS)

G. Continuous Monitor Evaluation

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

2. TRANSMISSOMETER (Continued)

Approximate Path Length, (Feet)______________________________

Mounting (Characterize)______________________________

____

Vibration (Characterize)______________________________

____

Housing (Characterize)______________________________

____

Purge Air (Condition of Blowers and Hoses)______________

____

____

Filters (Characterize Type and Describe Condition)__________

____

Alignment (Window Check)______________________________

____

3. CONSOLES

Breeching/Stack Correlation______________________________

____

Zero/Span______________________________

____

Comments______________________________

____

____

____

H. Electrostatic Precipitator Evaluation

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No.______ of ______

1. FILES/ADMINISTRATIVE

Specification Sheets Available: Yes____________ No____________

Prints Available (Characterize)____________________________

Supervisor of Unit____________________________________

O and M Personnel (Describe Staff and Organization)____________

2. RECORDKEEPING

Type Records____

Operating Records (List Parameters)__________________________

Diagnostic Records (Characterize)____________________________

3. PROCEDURES

Spare Parts Inventory (Characterize)________________________

O&M Plan (Characterize)____________________________________

Troubleshooting (Characterize)______________________________

I. Samples

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No.______ of ______

1. Solids

Sample No.________________________________
Location Obtained__________________________
Date/Time Obtained_________________________
Results___________________________________

2. Other Samples

Sample No.________________________________
Location Obtained__________________________
Date/Time Obtained_________________________
Permeability______________________________
Tensile Strength__________________________
Count_____________________________________
Weight/$Yard^2$______________________________

3. Other_____________________________________

J. Electrostatic Precipitator Evaluation

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No.______ of ______

1. POWER INPUT

Collection Plate Area/Field

Inlet____

Other____

Discharge Wire Length/Field

Inlet____

Other____

Field	Secondary Currents (Milliamps)	Power Input (Watts)	Current Densities (Milliamps/Ft)	Current Densities Watts/Ft²
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

K. Process

Inspection No.____________
Equipment No.____________
Confidential: Yes____ No____
Page No.______ of ______

1. PROCESS TYPE

Characterize Source____

Operating Schedule____

2. OPERATION

Product Type During Inspection____________________________

Production Data During Inspection__________________________

Raw Materials During Inspection___________________________

Fuels During Inspection__________________________________

L. Summary

Inspection No.________
Equipment No.________
Confidential: Yes____ No____
Page ______ of ______

1. POWER INPUT____
____
____

2. MECHANICAL____
____
____

3. SOLIDS REMOVAL____
____
____

4. EFFLUENT QUANTITY/CHARACTERISTICS________________________
____
____

5. OTHER____
____
____

6. SHEETS

A.________ B.________ C.________
D.________ E.________ F.________
G.________ H.________ I.________
J.________ K.________

Preparer: Name________________ Signature________________
Date________________

Reviewer: Name________________ Signature________________
Date________________

Copy Received: Initials____________ Date________________

PEDCo ENVIRONMENTAL

INSPECTION DATA SHEET

A. INSPECTION INFORMATION

1. IDENTIFICATION

Company______________________________

Plant Name______________________________

Plant I.D. Number______________________________

Address______________________________

____

____

Control Device/System Number______________________________

Process Served______________________________

2. PROCEDURES AND CONDITIONS

Prior Notice: Yes______ No______

Time(s) On-Site______________________________

____

Type Inspection______________________________

____

Inspectors______________________________

____

____

Plant Representatives______________________________

____

____

Information Claimed Confidential: Yes______ No______

B. Visible Emissions Observations

Inspection No.______________

Equipment No.______________

Confidential: Yes____ No____

Page No.______ of ______

1. STACK CHARACTERISTICS

Location____

Height____

Temperature____

Exit Dimensions____

Orientation____

Other Information____

2. STACK EFFLUENT

Detached Plume: No______ Yes______ Distance____________________

Color____

Puffing: Yes____________________ No____________________________

Opacity

Time	Average Opacity	Observation Point	Sheet No.

3. FUGITIVE EMISSIONS

Control Device: Yes______ No______

Solids Removal System: Yes______ No______

Process: Yes______ No______

Continuous______________________ Intermittent____________________

Adjacent Deposits: Yes______ No______

C. Fan Data

Inspection No.______________
Equipment No.______________
Confidential: Yes____ No____
Page No. ______ of ______

1. FAN MOTOR

Manufacturer____

Model No.________________________ Type__________________________

Rated Horsepower____

Volts____________________________ Maximum Amps__________________

Maximum R.P.M. ____________________ Service factor_________________

Operating Current: Panel_____________ Other_____________________

2. DRIVE

Direct___________________Belt________________Other______________

Sheath Reduction____

Audible Belt Slippage: Yes________________ No__________________

3. FAN

Manufacturer____

Model No.________________________ Type__________________________

Fan Vibration____

Gas Temperature at inlet, °F____________________________________

Fan R.P.M.____

____

Fan Static Pressures: Inlet______________ Outlet______________

Differential Static Pressures: Measured_______ Panel___________

Fan Housing Condition____

Dampers____

Fan Exit____

D. Fabric Filter Data

Inspection No. ______________
Equipment No. ______________
Confidential: Yes ____ No ___
Page No. _______ of _______

1. DESCRIPTIVE INFORMATION

Fabric Filter Type ______________________________
Manufacturer ______________________________
Model No. ______________________________
Plant Inventory No. ______________________________
Date Installed ______________________________

2. LOCATION

Building/Area ______________________________
Inside ______________ Outside ______________

3. LAYOUT (SKETCH FABRIC FILTER, FAN, INLET, SOLIDS REMOVAL, ETC.).

E. Fabric Filter External Inspection

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. ______ of ______

1. SOLIDS REMOVAL

Valve Type: Rotary __________ Flapper __________ Other ________

Valve Speed/Frequency ____

Transport Equipment: Screws ____________ Other _________________

Transport Equipment Operating: Yes __________ No _______________

Transport Equipment Discharging Solids: Yes ________ No ________

Characterize Discharge _______________________________________

____

____

Hopper Vibrators: Yes _________________ No _____________________

Hopper Insulation: Yes _________________ No ____________________

Hopper Level Indicators ______________________________________

____

Hopper Condition ____

____

____

Disposal Method ____

____

____

2. SHELL CONDITIONS

Insulated: Yes ___________________________ No ________________

Possible Weld/Seam Gaps, Characterize ________________________

____

____

____

____

E. Fabric Filter External Inspection

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

3. OPERATING CONDITIONS

Static Pressure on Clean Side, ______________________ in. H_2O

Static Pressure on Dirty Side, ______________________ in. H_2O

On-site Monitor, Differential Static Pressure ____________ in. H_2O

Tap Conditions ______________________________

Gas Inlet Temperature ______________________ ^oF

4. CLEANING SYSTEMS

Type ______________________________

Frequency ______________________________

____

____

Air Pressure, ______________________________ PSIG

Drier: Yes ________________ No ____________

Evidence of Water and/or Oil Problems ______________

____

____

Solenoids Inoperative ______________________

5. PRECLEANERS

Type ______________________________

Static Pressures: Inlet ____________ Outlet ____________ in. H_2O

Gas Inlet Temperature ______________________ ^oF

F. Fabric Filter Internal Inspection

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

1. PURPOSE

Reason(s) Necessary

Inventory Check ______________________________

Comprehensive Inspection ______________________________

Other ______________________________

Safety Evaluation (Describe if applicable)

Respirator Necessary ______________________________

Temperature ______________________________ °F

O_2 ______________________________ %

Combustibles ______________________________ %

Electrical Grounding ______________________________

Mechanical Hazards ______________________________

Noise ______________________________

Other ______________________________

Inspection Conducted: Yes ______________ No ______________

Inspection Not Performed Due to Safety ______________

2. BAG LAYOUT (ATTACH DRAWING)

No. of bags ______________________________

Length ______________________________ ft

Diameter ______________________________ in.

Material (Characterize) ______________________________

____

Attachment(s) ______________________________

____

____

F. Fabric Filter Internal Inspection

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

3. HATCH CONDITIONS

Gaskets ____

____

Corrosion ____

____

Bolts/Ears ____

____

Ease of Access ____

____

4. LEAK JETS

Location ____

____

____

Number ____

5. BAG CONDITIONS

____

____

____

____

____

____

____

F. Fabric Filter Internal Inspection

Inspection No. ____________

Equipment No. ____________

Confidential: Yes ____ No ___

Page No. _______ of _______

6. HOPPERS AND BLAST PLATES

____

____

____

____

____

7. CLEANING APPARATUS

____

____

____

____

____

G Samples

Inspection No. ______________
Equipment No. ______________
Confidential: Yes ____ No ___
Page No. _______ of _______

1. SOLIDS DEPOSITS

Sample No. ______________________________
Location Obtained ______________________________
Date/Time Obtained ______________________________
Results ______________________________

____
____
____
____

2. FABRIC SAMPLES

Sample No. ______________________________
Location Obtained ______________________________
Date/Time Obtained ______________________________
Permeability ______________________________
Tensile Strength ______________________________
Count ______________________________
Weight/Yard^2 ______________________________

3. OTHER

____
____
____
____
____
____
____

H Ventilation System

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

1. DUCTS (SHOW STATIC PRESSURES ON LAYOUT.)

2. HOOD

Configuration

Average Capture Velocity ________________________________ ft/min

Thermal Drafts (Characterize) ________________________________

____

____

Cross Currents (Characterize) ________________________________

____

____

Estimated Effectiveness ________________________________ %

| Process

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

1. PROCESS TYPE

Characterize Source ____________________________________

____

____

____

Operating Schedule ______________________________________

____

____

____

2. OPERATION

Product Type During Inspection __________________________

____

____

Production Rate During Inspection _______________________

____

____

Raw Materials During Inspection _________________________

____

____

Fuels During Inspection _________________________________

____

____

____

Inspection No. ______
Equipment No. ______
Confidential: Yes ___ No ___
Page No. ___ of ___

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
D. Cleaning System						
1. Filter house pressure drop high			E		5	If sum (Σ) of ratings is ≥10, perform internal inspection and check deposits on dirty side of bags. Check bag tension. Reschedule inspection in near future.
2. Pulse-jet air header pressure low			E		5	
3. Solenoids inoperative	N/A	N/A	E or I		10	
4. Reverse air fan inoperative	N/A	N/A	E or I		10	
5. Shaker motor inoperative	N/A	N/A	E or I		10	
6. Bag length long			E		2	
7. Equipment inaccessible	N/A	N/A	I		2	
8. High intensity cleaning required			E		2	
				Σ =		
E. Hopper						
1. Filter house pressure drop high			E		5	If sum (Σ) of ratings is ≥10, perform internal inspection of hoppers.
2. Solids-removal run intermittent	N/A	N/A	E		3	
3. Indicator level existent and/or inoperative	N/A	N/A	E		2	
4. Heaters nonexistent and/or inoperative	N/A	N/A	E		2	
5. Vibrators nonexistent and/or inoperative	N/A	N/A	E		2	
6. Hopper valves corroded	N/A	N/A	I		3	
7. Hopper slope <60°	N/A	N/A	E		2	
8. Hoppers not insulated	N/A	N/A	E		2	
9. Winter	N/A	N/A	E		2	
10. Hammer markings on hopper walls	N/A	N/A	E		2	
11. Conveyor inoperative	N/A	N/A	E		10	
				Σ =		

*Location: E is external, and I is internal.

Inspection No. ________
Equipment No. ________
Confidential: Yes ___ No ___
Page No. ___ of ___

Possible Operating Problems	Average Baseline (Specify Value)	Observed (Specify Value)	Location*	Abnormal (Check)	Rating (1-10)	Recommended Action
A. <u>Bag Tears or Pinholes</u>						
1. Filter house pressure drop low (<80% avg.)			E		3	If sum (Σ) of ratings is ≥ 10, perform internal inspection. Check for deposits on filter house clean side. Check inaccessible bags. Use fluorescent dye technique. Check integrity of fabric by attempting to extend rips.
2. Opacity high			E		5	
3. Bag age high (typical avg.)			E		5	
4. Some bags inaccessible	N/A	N/A	I		2	
5. Design A/C high (>120% avg.)			E		4	
6. Actual A/C high (>120% avg.)			E		4	
7. Wear plate eroded	N/A	N/A	I		3	
8. Frequent high excursions			E or I		4	
				Σ =		
B. <u>Bag Blinding</u>						
1. Filter house pressure drop high (>150% avg.)			E		7	If sum (Σ) of ratings is ≥10, perform internal inspection. Check dirty side of bags for coatings (this may be difficult to identify in some cases). Check records for steady rise in filter house pressure drop. Reschedule inspection in near future.
2. Opacity low			E		2	
3. Cleaning frequency high (cycles/day)			E		5	
4. Gas temp low (≤20°F avg.)			E		4	
5. Moisture in gas stream	N/A	N/A	E		4	
6. Particulate sticky	N/A	N/A	E		4	
7. Air in-leakage (hoppers/access doors)	N/A	N/A	I		2	
8. Unit not insulated	N/A	N/A	E		2	
				Σ =		
C. <u>Bag Bleeding</u>						
1. Opacity high			E		5	If sum (Σ) of ratings is ≥10, attempt to confirm uses of fluorescent dye and black light.
2. Pressure drop gradually increasing			E		2	
3. Cleaning frequency high			E		5	
				Σ =		

*Location: E is external, and I is internal.

K Summary

Inspection No. ____________

Equipment No. ____________

Confidential: Yes ____ No ___

Page No. _______ of _______

1. CONTROL SYSTEM PERFORMANCE

System Air Flow Based on Fan Data ______________________ ACFM

System Air Flow Based on Pitot Traverse ______________________

System Air Flow Based on Process ______________________

Actual Air to Cloth Ratio ______________________

Design Air to Cloth Ratio ______________________

Fabric Compatibility with Environment ______________________

____

2. ADDITIONAL COMMENTS

____

____

____

____

____

3. SHEETS INCLUDED

A. _______ B. _______ C. _______ D. _______ E. _______ F. _______

G. _______ H. _______ I. _______ J. _______ K. _______

Preparer: Name ______________________ Signature ______________________

Date ______________________

Reviewer: Name ______________________ Signature ______________________

Date ______________________

Copies Received _______ Initials _______ Date ______________________

Fabric Filter Supplemental Information

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

Fabric Filter Supplemental Information

Inspection No. ______________

Equipment No. ______________

Confidential: Yes ____ No ___

Page No. _______ of _______

PEDCo ENVIRONMENTAL

WET SCRUBBER INSPECTION DATA SHEET

LOCATION ____________ DATA SHEET NO. ____________

DESIGNATION ____________ DATE ____________

CLIENT ____________ INSPECTOR(S) ____________

PN ____________ INSPECTION NO. ____________

CLAIMED CONFIDENTIAL Yes _____ No _____

A. DESCRIPTIVE INFORMATION

Wet Scrubber Type ____________

Manufacturer ____________

Model Number ____________

Date Installed ____________

Process/Source Controlled ____________

Particulate Characteristics ____________

B. COMPONENT INFORMATION (Describe if applicable)

1. Gas Pretreatment:

Presaturator ____________

Cyclones ____________

Settling Chamber ____________

Other ____________

2. Demister:

Cyclone ____________

Chevron ____________

Fiberous Mat ____________

Other ____________

3. Pumps:

Number ____________

Recirculation Pump Manufacturer ____________

Recirculation Pump Rated Horsepower ____________

Recirculation Pump Type ____________

Inspection No. __________
Data Sheet No. __________
Preparer ______________
Confidential: Yes__ No__

B. COMPONENT INFORMATION (continued)

4. Fan/Motor (Specify)

Fan Manufacturer ____________________

Blade Type: Radial ____ Backward ___ Forward ____

Drive: Direct ______________ Belt ______________

Damper Position ____________________

Motor Manufacturer ____________________

Model No. ____________________

Rated Horsepower ____________________

Location: Forced Draft ______ Induced Draft ______

5. Instrumentation (Check if Applicable)

Differential Pressures:	Throat	______________
	Separator	____________
	Demister	_____________
Temperatures:	Gas Outlet	___________
	Gas Inlet	____________
	Liquor Inlet	__________
	Liquor Outlet	________
pH:	Recirculation	________
	Exit Liquor	__________
	Fan Motor Current	____
	Other	______________
	Nozzle Pressure	______
Flow Rates:	Recirculation	________
	Makeup	______________
	Purge	_______________
Motor Current:	Fan	________________
	Pump	_______________

Inspection No. __________
Data Sheet No. __________
Preparer ________________
Confidential: Yes__ No__

B. <u>COMPONENT INFORMATION</u> (continued)

6. Materials of Construction (Specify type and gauge)

   Presaturator ______________________________________
   Throat ____
   Scrubber Shell ____________________________________
   Trays/Bed Supports ________________________________
   Demister ____
   Fan Housing _______________________________________

Inspection No. ____________

Data Sheet No. ____________

Preparer __________________

Confidential: Yes__ No__

C. DIAGRAM

1. Sketch wet scrubber system. (Show all major components and processes controlled.)

2. Sketch wet scrubber layout (each square 1' x 1')

Inspection No. __________
Data Sheet No. __________
Preparer ______________
Confidential: Yes__ No__

F. <u>SAMPLE ANALYSIS</u>

Scrubber Liquor Effluent

Sample No. ____________________

Location Obtained ____________________

Date/Time Obtained ____________________

Results:

Suspended Solids ____________________ ppm

Dissolved Solids ____________________ ppm

pH ____________________

Chloride ____________________ ppm

Scrubber Recirculation

Sample No. ____________________

Location Obtained ____________________

Date/Time Obtained ____________________

Results:

Suspended Solids ____________________ ppm

Dissolved Solids ____________________ ppm

pH ____________________

Chloride ____________________ ppm

Other

____

____

____

____

____

____

Inspection No. ________
Data Sheet No. ________
Preparer ________
Confidential: Yes__ No__

G. CONTROL SYSTEM PERFORMANCE

Gaseous Flow ________ ACFM
(implied from fan operation)

Gaseous Flow ________ ACFM
(calculated from pitot traverse)

Gaseous Flow ________ ACFM
(implied from process operation)

Liquor Flow ________ gpm

L/G Ratio ________

Bypass (% of total gas flow) ________ %

Throat Velocity ________ FPS

Superficial Velocity (design) ________ FPM

(effective) ________ FPM

Visible Emissions (residual) ________ %

H. ADDITIONAL COMMENTS

____
____
____
____
____
____

Sheets Included: A ___ B ___ C ___
D ___ E ___ F ___
G ___ H ___

Inspector's Signature ________
Date Prepared ________
Reviewer's Signature ________
Date Reviewed ________
Date Filed ________

PEDCo ENVIRONMENTAL

MECHANICAL COLLECTOR INSPECTION DATA SHEET

LOCATION ________________ DATA SHEET NO. ____________

DESIGNATION ______________ INSPECTION NO. ____________

CLIENT ________________ INSPECTOR(S) ____________

PN ________________ DATE ____________

CLAIMED
CONFIDENTIAL Yes _____ No _____

A. DESCRIPTIVE INFORMATION

Mechanical Collector Type

Cyclone __________ Settling Chamber __________

Cyclone Bank _____ Double Vortex Cyclone _____

Multiclone _______ Other (describe) __________

____

Manufacturer ______________________________

Model Number ______________________________

Date Installed ______________________________

Process/Source Controlled ______________________

Particulate Characteristics ____________________

____

B. COMPONENT INFORMATION

1. Cyclone

Diameter of Body ______________________ ft.

Cone Angle __________________________ degrees

Material of Construction __________________

Gauge of Metal ______________________

Number of Cyclones ____________________

2. Hoppers

Number ______________________________

Slope ______________________________

Insulation: Yes ____________ No ____________

Heating: Yes ____________ No ____________

Vibrators: Yes ____________ No ____________

Inspection No. __________

Data Sheet No. __________

Preparer ______________

Confidential: Yes__ No__

B. COMPONENT INFORMATION (continued)

3. Solids Removal (Check applicable items and provide dimensions)

   Rotary Valves ______________________________

   Flapper Valves ______________________________

   Screw Conveyors ______________________________

   Pneumatic Conveyors ______________________________

   Free Fall ______________________________

4. Fan/Motor

   Fan Manufacturer ______________________________

   Model Number ______________________________

   Blade Type: Radial ____ Backward ____ Forward ___

   Drive: Direct _________________ Belt ____________

   Motor Manufacturer ______________________________

   Model Number ______________________________

   Rated Horsepower ______________________________

   RPM ______________________________

   Location: Forced Draft ______ Induced Draft _____

C. SYSTEM LAYOUT

Inspection No. __________
Data Sheet No. __________
Preparer ______________
Confidential: Yes__ No__

D. EXTERNAL INSPECTION

Fan Inlet Static Pressure ______________________ in. of H_2O
Fan Outlet Static Pressure ______________________ in. of H_2O
Fan Motor Current ______________________ amperes
Fan Rotational Speed ______________________ rpm
Fan Damper Position ______________________
Gas Temperature at Fan Inlet ______________________ ^oF
Fan Vibration (low, moderate, severe) ____________
Static Pressure at Collector Outlet ____________ in. of H_2O
Static Pressure at Collector Inlet ____________ in. of H_2O
On-site Differential Pressure Gauge Reading _____ in. of H_2O
Gas Temperature at Collector Inlet ____________ ^oF
Rotary Valve Rotational Speed ______________________ rpm
Flapper Gate Frequency ______________________ (#/hr)
Hopper Conditions (Check if applicable)

Cold ________
Dented ______
Warped ______
Corroded ____

Inspection No. ________
Data Sheet No. ________
Preparer ____________
Confidential: Yes__ No__

E. INTERNAL INSPECTION

Hoppers (plugged or corroded) ____________________

____

____

Hopper Baffles Nonexistent (Characterize potential abrasion) ____

____

____

____

Inlet Vanes Plugged/Eroded (Characterize severity) ____

____

____

Cones Plugged (location, number) __________________

____

____

____

Flow Disturbances (Characterize severity) __________

____

____

____

____

Outlet Tube Erosion (Characterize potential bypassing)

____

____

____

Corrosion (Characterize) ______________________

____

____

____

Scaling (Characterize) ________________________

____

____

____

Inspection No. ________
Data Sheet No. ________
Preparer ____________
Confidential: Yes__ No__

F. CONTROL SYSTEM PERFORMANCE

Air Flow Rate (implied from fan operation) __________ ACFM
Air Flow Rate (calculated from pitot tube) __________ ACFM
Air Flow Rate (implied from process operation) ________ ACFM
Inlet Velocity ______________________________ FPS
Opacity ____________________________________ %

G. ADDITIONAL COMMENTS

____
____
____
____
____
____

Sheets Included: A___ B__ C___ D__
E___ F__ G___

Inspector's Signature ____________
Date Prepared ________________
Reviewer's Signature ____________
Date Reviewed ________________
Date Filed __________________

SOURCE NAME

SOURCE ID NUMBER

OBSERVATION DATE / /

ADDRESS

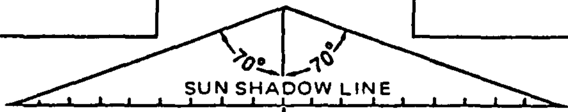
OBSERVER'S NAME (PRINT)

ORGANIZATION

STATE | ZIP | PHONE

CERTIFIED BY

DATE / /



PROCESS

OPERATING MODE

CONTROL EQUIPMENT

OPERATING MODE

DESCRIBE EMISSION POINT

EMISSION POINT HEIGHT ABOVE GROUND LEVEL

EMISSION POINT HEIGHT RELATIVE TO OBSERVER

DISTANCE TO EMISSION POINT

DIRECTION TO EMISSION POINT

DESCRIBE EMISSIONS

COLOR OF EMISSIONS

CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER VAPOR PRESENT NO ☐ YES ☐

IF YES, IS PLUME ATTACHED ☐ DETACHED ☐

AT WHAT POINT WAS OPACITY DETERMINED

DESCRIBE BACKGROUND

COLOR OF BACKGROUND

SKY CONDITIONS

WIND SPEED

WIND DIRECTION

AMBIENT TEMPERATURE

RELATIVE HUMIDITY

COMMENTS

START TIME					STOP TIME			
	0	15	30	45		0	15	30	45
1					31				
2					32				
3					33				
4					34				
5					35				
6					36				
7					37				
8					38				
9					39				
10					40				
11					41				
12					42				
13					43				
14					44				
15					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				
30					60				

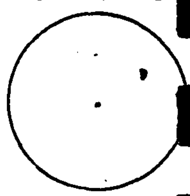
AVERAGE OPACITY

NUMBER OF READINGS ABOVE ______% WERE______

RANGE OF OPACITY READINGS FROM______TO______

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



X EMISSION PT.

OBSERVER'S SIGNATURE

DATE / /

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS.

SIGNATURE

VERIFIED BY

TITLE

DATE / /