CHAPTER 1

BASELINE INSPECTION TECHNIQUES

Air pollution source inspection is not easy. Agency inspectors must have the technical skill to quickly and accurately evaluate the compliance status of a wide range of industrial sources that are subject to many complex regulations. They must compile the necessary information in strict accordance with established legal and procedural requirements. The job often demands substantial physical exertion to observe tests in elevated areas and to evaluate equipment operating conditions. Occasionally, the job involves working with adversarial or emotional people who can test the inspector's patience and professionalism.

Source inspections can have a very beneficial impact when performed well. Inspectors have a key role in encouraging compliance without the expense and time commitment involved with litigation. Inspectors can clarify regulatory requirements and improve communication between the source, the agency, and the community. Inspectors can also provide important "feedback" to the agency concerning the adequacy of the promulgated regulations.

Inspections can have a negative impact on the agency's overall compliance program when performed poorly. Superficial inspections can inadvertently convince some source owners or operators that the agency is unable or unwilling to enforce environmental regulations. Conscientious operators who install and maintain environmental controls compete at an economical disadvantage with those who choose to ignore the requirements. Residents close to noncomplying facilities can be subject to both health risks and nuisance problems. Furthermore, the inability to achieve National Ambient Air Quality Standards because of the lack of compliance at certain facilities could result in stringent regulations on all sources in the Air Quality Control Region.

Effective and methodical inspections can be performed well by people with a wide range of educational backgrounds and experience. This section presents some of the basic procedures necessary to compile compliance related data and observations into a form that can be readily evaluated. Introductory material concerning on-site source inspections is also provided.

Responsibilities of Inspectors

Inspectors do not only conduct compliance inspections; they balance a variety of job responsibilities that compete for available time. Many aspects of the agency's overall enforcement program are affected by some role played by the inspector:

- Compliance evaluation
- Testing and sampling
- Agency representation
- Litigation assistance
- Citizen complaint investigation

Due to these responsibilities, the job demands a broad range of skills and an ability to use time wisely.

Compliance Evaluation

One of the primary duties of an agency inspector is to compile technically defensible conclusions regarding the compliance status of the facility being evaluated. These conclusions must be reached in a manner fully consistent with all legal requirements. These requirements include the need to conduct the inspections and ancillary work in a manner that protects all legal rights of the source and its employees and in a manner consistent with agency policies. One of the most important of these policies is the agency's health and safety plan. Inspections must be conducted in accordance with all OSHA requirements and agency and plant health and safety policies. Agency personnel should not make any requests or take any actions that endanger plant personnel or themselves.

Testing and Sampling

Agency personnel are often called on to observe emissions tests to determine compliance with promulgated rules and regulations. These tests must be conducted in strict accordance with applicable reference methods to ensure that the emission rate data represent an accurate and fair measurement of the actual emissions. Agency personnel must understand the many complex testing methods and the types of sampling errors that can affect the results.

Agency Representation

The inspector is a professional representative of the agency. Often, the inspector conducting an on-site inspection is the only employee of the agency whom plant personnel meet. The ability of the inspector to convey the interests of the agency in a calm, firm, and professional manner can have an impact on the extent to which source personnel cooperate.

Litigation Assistance

Agency personnel must prepare enforcement cases and present expert testimony when regulated sources are not making adequate progress toward achieving compliance. The inspection report and the emission test report are often the foundation of the enforcement case. All data and observations from on-site inspections and observed emission tests must be fully documented and properly evaluated. Inspectors might need to provide additional information and assistance to agency attorneys in order to prepare the technical aspects of the

case. Agency personnel might also be requested to present expert testimony concerning the case.

Citizen Compliant Investigation

Citizens expect and deserve prompt attention to their complaints concerning air quality. Agency inspectors responding to complaints, both over the telephone or in person, must document the complaint accurately and determine if a follow-up investigation is warranted. Localized air quality problems leading to complaints are often intermittent and short in duration. This means that the follow-up investigations often have to be performed at inconvenient times. After completing the investigation, it is important to advise the complainant of the results and summarize any actions that will be taken by the sources to minimize future occurrences.

Agency personnel must remain calm and conduct themselves professionally when responding to complaints. Occasionally, the complainants vent their frustration and anger at the agency. Sometimes, the source owners or operators vent their frustration with both the agency and the citizens making the complaints. The agency inspector must encourage all parties involved to remain calm, to communicate with each other, and to comply with all regulations.

Other Responsibilities

The inspector plays a key role in developing good working relationships with the various levels of government often involved in air pollution control work. For example, states have primary responsibility for enforcement, but EPA has the authority to oversee some compliance situations. In some cases, state and local agencies must work together closely on enforcement actions.

On-Site Compliance Inspections

Because of the various responsibilities of the inspector, the on-site inspection can address one or more of the following:

- Evaluation of compliance status with regulatory requirements
- Confirmation that all emission units are included on the permit and that the source is complying with all permit stipulations
- Follow-up evaluation of citizen complaints
- Compilation of information needed for litigation or for formal compliance negotiations
- Collection of information needed for regulation development

Levels of Inspection

Levels of inspection have been developed by EPA to adapt on-site inspections to these different responsibilities. The inspections have been divided into four distinct groups: Levels 1, 2, 3 and 4. The majority of source inspections presently being conducted by regulatory agencies are classified as Level 2. The course focuses almost entirely on Level 2 inspections.

Level 1

Level 1 is defined as a driveby surveillance inspection. It is not necessary to enter the facility. The inspection consists primarily of visible emission observations of stacks and vents visible from public roads, and odor surveys both upwind and downwind of the plant. If conditions warrant further investigation, the inspector submits the information to the appropriate agency personnel to schedule an inspection. Level 1 is not considered an on-site inspection because of its limited scope; however, it is particularly useful for investigating citizen complaints and for determining the best use of limited agency resources.

Level 2

Level 2 inspections are used primarily to gather compliance data and identify violations. They are also used to determine if all the regulated emission units are included on the operating permit. The inspector must enter the plant grounds and do a walkthrough evaluation of emission sources, control devices, and plant records. The initial walkthrough evaluation determines if further investigations are warranted. The inspector must determine the validity of the data collected from plant instrumentation. If emissions problems or other inconsistencies exist, the scope of the inspection is expanded to include one or more follow-up inspection steps.

Level 3

When problems or potential problems are identified by an inspector in either Level 1 or Level 2 inspections, a Level 3 inspection might be performed. A Level 3 inspection has the following characteristics:

- Detailed
- Narrow scope
- Targeted to particular emission units
- Enforcement case development oriented

The inspector might request that plant personnel use portable instruments to measure important operating parameters and to verify that on-site permanent monitors are performing properly. A number of portable instruments are often available to obtain supplemental data:

- Differential pressure gauges
- Thermocouples and thermometers

- Combustion gas analyzers (oxygen and carbon monoxide monitors)
- Hydrogen-ion concentration (pH) meters
- VOC analyzers

Stack effluent characteristics, continuous emissions monitoring (CEM) data, control device operating data, process operating data, ash analyses, and fuel analyses are evaluated for a period of 6 months to more than 2 years prior to the inspection. In some cases, it is also helpful to review air pollution control device maintenance records concerning the rate, spatial distribution, and characteristics of component failure. The entire set of data is reviewed to evaluate the compliance status of the unit and to determine if corrective actions planned by the source operators have a reasonable probability of expeditiously minimizing emission problems.

Level 4

Level 4 is the only type of inspection not used directly for compliance determination or enforcement. The purpose of the Level 4 inspection is primarily to gather data that will be used to facilitate future inspections conducted by less experienced field personnel. Because of the nature of this type of inspection, Level 4 is performed by senior managers and agency personnel with responsibility for a specific plant. Level 4 inspections should include the preparation of general process and control device flowcharts, measurement of operating parameters by plant personnel, and determination of the normal ranges of important operating parameters. Health and safety concerns are addressed to encourage source operators to eliminate the hazards when possible and to help inspectors conducting future Level 2 inspections avoid the hazards. Level 4 should be performed in conjunction with stack tests or at times when the source is believed to be operating in compliance.

Major Elements of Inspection

There are several major steps in the routine Level 2 inspection of stationary sources:

- File review
- Inspection preparation
- Pre-inspection meeting
- Plant inspection
- Post-inspection meeting
- Inspection report preparation

File Review

The file review helps to determine the most appropriate scope and timing of the inspection. As discussed earlier, there is generally insufficient time to evaluate all the individual emission units present in moderate-to-large facilities. During the pre-inspection file review, the issues to be included within the scope of the inspection are selected, and the most appropriate time to conduct the inspection is determined. Also, the types of safety equipment

necessary for the specific areas of the plant to be inspected are determined. An important part of the pre-inspection file review is a check of the operating permit.

Inspection Preparation

During the inspection preparation phase, the equipment needed for the job is packed, and travel plans are optimized to the extent possible to minimize travel costs and travel time.

Pre-Inspection Meeting

The pre-inspection meeting should be conducted with responsible plant officials immediately after entering the facility. The scope of the inspection should be discussed. All records and other information necessary to fully evaluate the facility should be requested so that plant personnel can gather and, if necessary, photocopy all records while the inspector is on-site. As part of the pre-inspection meeting, the agency inspector should explain the general reasons for the inspection and any specific issues that will be addressed. Also, the inspector should be prepared to provide general information concerning the agency's requirements and to provide other information helpful to the source in satisfying agency requests. Legal and administrative issues should be discussed during the pre-inspection meeting so that there are no surprises during the inspection. These issues often include, but are not limited to, confidentiality, use of photographs, and inspector authority.

Plant Inspection

During the plant inspection, the inspector should conduct himself or herself professionally. It is important to always keep in mind that, despite the agency's right to inspect, the inspector is still a visitor at the facility. The inspector must compile all the information necessary to technically evaluate the compliance status of the facility. This often requires numerous questions to obtain data and to clarify operating conditions. The inspector must not be reluctant to ask questions. However, these questions should be directed toward valid technical concerns.

Post-Inspection Meeting

Following the plant inspection, a post-inspection interview should be conducted. This meeting is primarily for the benefit of the inspector to clarify issues raised during the record evaluation and plant inspection. This meeting should not include a presentation of the inspection results to plant personnel. They should be able to reach their own conclusions regarding their compliance status. Furthermore, in most jurisdictions, the agency inspector is not authorized to reach conclusions regarding compliance status of a plant without discussing the data and information with agency supervisors and/or agency attorneys. Accordingly, the post-inspection interview should be restricted to clarifying questions and follow-up requests for more information from the plant.

Inspection Report Preparation

A concise inspection report should be prepared as soon as possible after the on-site inspection. This report should summarize the purpose, scope, and findings of the inspection. All calculations necessary to document the findings should be presented in a clear and complete manner. A consistent report format should be used, to the maximum extent possible, to facilitate supervisory review.

Inspection Analyses

There are three basic approaches to evaluating compliance:

- Direct comparison with promulgated standards
- Comparison of inspected units with similar units
- Evaluation of shifts from baseline operating conditions

Direct Comparisons

Direct comparisons are possible when there is a promulgated regulation or a permit provision that presents requirements in a form and format directly measured by either plant instruments or plant chemical analyses. One of the most common of these regulatory requirements is the sulfur-in-fuel regulation. Many agencies have limited the sulfur content of the coal or oil being burned in industrial boilers. The sulfur content can be accurately measured by ASTM reference method procedures. Other examples of types of regulations that can be directly enforced are listed in Table 1-1. A direct comparison of these analyses with the promulgated limit provides a clear indication of the compliance status.

It is important to note that data used for direct comparison-type analyses can be used as the basis for enforcement actions. When the data are provided by plant continuous emission monitors or other instruments, it is important to obtain information concerning the operator's quality assurance practices and the instrument’s on-line availability. Inadequacies in either of these areas can also be the basis for enforcement actions.

The inspection procedures based on direct comparison analyses use primarily CEMs or plant instrumentation data or sample analyses (e.g., fuel sulfur content, coating VOC content). Information concerning CEMs is provided in APTI Course 474, “Continuous Emission Monitoring.” Information concerning other types of direct comparison inspections is available in APTI Course 444, “Air Pollution Field Enforcement.” Direct comparison inspection analyses are not emphasized in this course because of the availability of these other training materials.

Table 1-1. Examples of Direct Comparison Type Inspection Analyses		
Regulation	**Parameter**	**Type of Instrument or Analysis Used for Direct Comparison**
Municipal Waste Incinerators 40 CFR Part 60, Subpart Ea	Incinerator operating rate	Steam rate gauge
	CO concentration	CO continuous emission monitor
	Control system inlet gas temperature	Thermocouple or equivalent temperature monitor
Fossil Fuel Fired Boilers 40 CFR Part 60, Subparts Da and Db	Sulfur dioxide concentration	Sulfur dioxide continuous emission monitor
	Nitrogen oxides concentration	Nitrogen oxides continuous emission monitor
	Visible emissions	Opacity monitor
Asbestos Removal	Visible emissions	Visible emissions observer
	Adequately wet asbestos-containing material during removal	Observation of work practices

Comparison with Similar Units at Other Plants

An alternative means of evaluating compliance of a specific source is to compare its operating characteristics with those at similar industrial facilities. This can, however, be time consuming and error prone. It takes a substantial investment of time to determine exactly which units are similar, and very often these assumptions are subject to error due to subtle factors that can affect performance. Furthermore, it takes time to compile all the comparative data.

Comparisons with similar units are useful primarily in extreme cases. For example, if a venturi scrubber on an asphalt plant is operating at 8 inches H_2O, and the industrial average is 22 inches H_2O, there is some cause for concern about the low pressure drop at the unit being inspected.

Similar unit comparison type inspection analyses will be used with caution in this course due to the site-to-site variations that can make these analyses irrelevant or in significant error.

Comparisons with similar units can not generally be used as a stand-alone basis for enforcement actions. Emission tests using applicable reference methods are needed to prove the suspected compliance problem.

Baseline Analyses

Many air pollution control regulations cannot be stated in a format compatible with direct comparison type inspection analyses. Air pollution control regulations are often expressed in terms such as pounds of pollutant emitted per hour or pounds of pollutant emitted per ton of product. In these cases, there are no plant instruments that read out directly in the format specified in the regulation. Instead, indirect means are needed to evaluate compliance potential. Shifts from baseline conditions are used to provide an imperfect, but often revealing, indication of the unit performance.

Technical analysis based on shifts from baseline conditions is not a new procedure. It is a fundamental diagnostic technique that has been used successfully for many years in practically all aspects of equipment maintenance. It is even used now in health care. For example, the first physical administered by an occupational physician is called the "baseline" examination. A shift in the medical condition over time for the individual is called a "baseline shift." These types of analyses are also used for monitoring changes in processing equipment performance.

Baseline analyses are especially useful for air pollution control equipment and sources since there are many subtle factors that vary from unit to unit that can strongly influence performance. These factors include, but are not limited to, the following:

- Particle size distributions
- Adequacy of gas distribution
- Liquid surface tension (wet scrubbers)
- Liquid droplet size distribution (wet scrubbers)
- Gas temperature spatial differences
- Gas flow temporal variations
- Particulate composition
- Particulate resistivity (electrostatic precipitators)
- Dust cake cohesiveness (filtration systems and electrostatic precipitators)
- Distribution of cleaning energy (filtration systems and electrostatic precipitators)
- Mist eliminator efficiency
- Venturi throat damper condition (wet scrubbers)
- pH (wet scrubbers)

Most of these variables are not monitored directly by plant instruments and can vary substantially from unit-to-unit, even in the same plant operating under supposedly similar conditions. All these variables can have an influence on pollutant removal performance.

The first principle of baseline analysis is that changes over time are evaluated for individual units. The performance conditions today are compared against the performance levels during the baseline period. For example, a shift in the static pressure drop across a wet scrubber from a baseline level of 30 inches H_2O to the present level of 24 inches H_2O would be a possible symptom of scrubber performance problems and would indicate the need to investigate further. This is more meaningful than trying to determine if a pressure drop of 24 inches H_2O is consistent with other similar scrubbers at different plants or on different process lines in the same plant being inspected. Comparing different units is difficult because there can be subtle differences in the gas streams that have a strong influence on performance. It is rare that units at different plants or even units at the same plant can be directly compared.

The second principle of baseline analysis is that sets of data are evaluated, as opposed to relying on a single measurement A shift in a single parameter is rarely a good basis for a decision concerning compliance status. The instrument that is generating the data could be operating out-of-calibration or entirely in error. Even if the data are correct, the measurement might not be directly relevant to compliance. A number of different parameters need to be evaluated to accurately determine compliance. In the above case of the wet scrubber, a decrease from 30 inches H_2O to 24 inches H_2O may not be sufficient to conclude that there is a compliance problem. However, if this shift in pressure drop is accompanied by the changes listed below, there is more justification for requesting a compliance test or other actions:

- Increased plume opacity from the baseline level of 5% to the present level of 10% to 15%
- Increased outlet gas temperature from the baseline level of 135°F to the present level of 145°F
- Decreased scrubber liquor flow rate from 110 gpm to 60 gpm

All these changes are related to increases in particulate emissions. Accordingly, the inspector would be justified in concluding that the scrubber is not operating as well as it has in the past and that a new compliance test is needed.

The third principle of baseline analysis is that the inspection scope should include component failure information and general observations and should not be limited to operating data alone. In addition to data provided by plant instrumentation, general observations of the facility and interviews with plant personnel are often helpful in evaluating compliance. For example, large holes in the shell of an electrostatic precipitator or fabric filter are clearly a sign of air infiltration related performance problems on a negative pressure system. Severe rainout of solids-laden droplets from the stack of a wet scrubber clearly indicates mist eliminator failure. Perhaps less obvious, but equally important, is a sudden increase in the failure rate of individual components such as fabric filter bags, electrostatic precipitator support insulators, and scrubber nozzles. These conditions all either contribute to or are directly related to pollutant removal problems. Accordingly, these observations and this information should be included in the inspection report because they provide at least part of the basis for the decision regarding compliance status.

The fourth principle of baseline analysis is that inspection data and observations must be organized in a coherent fashion and evaluated during the compliance inspection. The inspection procedures discussed in this course are divided into basic and follow-up categories. The inspection points included in the basic category should be included in all inspections. These inspection parameters are fundamentally important to all types of air pollution control sources and are useful in identifying changes that might accompany increases in pollutant emissions. There are numerous follow-up inspection points for each different type of air pollution control device and source. Only those follow-up inspection points directly relevant to the suspected compliance problems are actually included in the scope of the inspection. It is possible that none of these are performed on a specific inspection, if the basic inspection data indicate that there have been no specific shifts from baseline conditions and that there are no apparent violations of the standards. Based on an evaluation of the basic data, the need for the specific follow-up inspection points can be determined.

By organizing the inspection data, it is also possible to identify data that are probably in error. Certain trends are expected in inspection parameters. For example, static pressure is expected to decrease in the direction of flow, as is the temperature of hot gases. Data that do not follow expected trends are likely in error. It is important to note that incorrectly operating instruments are common in the air pollution control industry due to erosive particles, sticky particles, condensable vapors, and corrosive compounds that are often present inside ductwork and air pollution control systems. Even the most conscientious operator can have a few of the instruments in an air pollution control systems malfunctioning at any one time. One aid to organizing the inspection data is the inspection flowchart. Preparation of inspection flowcharts is discussed in Chapter 7.

The fifth principle of baseline analysis is that inspectors must have the flexibility to exercise professional judgment during the inspection. It is impractical and potentially dangerous to restrict an inspector to a rigid checklist. Completion of the checklist can take the individual to areas in the plant that are unsafe or unhealthy. Furthermore, the rigid checklist might not address the specific follow-up issues that are most relevant to the compliance status of the facility. In these cases, the rigid checklist is even counterproductive. Inspectors must have the flexibility to investigate suspected compliance problems. For these reasons, the inspection procedures discussed in this manual include limited flexibility so that agency personnel can exercise their professional judgment.

The sixth principle of baseline analysis is that baseline analyses or other indirect compliance analyses are not generally used as a stand-alone basis for enforcement actions. Typically, emission tests using applicable reference methods are conducted when the baseline analysis indicates probable compliance problems. However, under the Credible Evidence Rule, it is possible that baseline analyses could be used as evidence in an enforcement action.

Limitations of Inspections

There are practical limits to the scope of an inspection:

- Time constraints that complicate full evaluation of issues
- Health and safety hazards in certain areas of the facility
- Lack of plant instrumentation

The most significant limitation to on-site inspections is time. There is usually not enough time to fully evaluate all the permitted emission units at moderate-to-large industrial facilities. Agency personnel must be skilled in prioritizing the work so that they use their limited on-site time efficiently. Prioritization starts with an effective file review to identify the most likely compliance issues. Agency personnel must be able to adjust the scope of the inspection while on-site to use their time wisely.

Health and safety issues can be a significant limitation. When these issues are recognized, agency personnel should adjust the inspection procedures and even the scope of the inspection as necessary to avoid potential problems. It should be request that the hazards be eliminated or minimized in the future so that such limits will not affect future visits. Agency personnel should, under no circumstances, ignore health and safety concerns involving themselves or plant personnel accompanying them.

Some inspections are limited by the lack of plant instrumentation. When the plant does not have the portable instruments necessary to provide the missing information, the scope of the inspection can be limited.

Review Problems

1. What are the purposes of a Level 2 inspection?

    a. Routine compliance evaluation
    b. Visible emission and/or odor surveillance
    c. Enforcement case development
    d. Complaint investigation
    e. Regulation development

2. What types of compliance analyses are not generally used alone as the basis for an enforcement case?

    a. Baseline analyses
    b. Comparison with similar units
    c. Direct comparisons

3. What is an example of a direct comparison-type compliance evaluation?

    a. Evaluation of wet scrubber pressure drop changes since an emissions test
    b. Evaluation of the plant's wet scrubber pressure drop against the pressure drops of similar units in the same geographical area
    c. Comparison of a boiler's fuel sulfur content against the regulatory limits
    d. Comparison of a boiler's fuel sulfur content against similar units in the same geographical area

4. A source barely passed a USEPA Method 5 particulate emission test. The scrubber pressure drop averaged 26 inches H_2O during this test. Six months later, an inspector notices that the scrubber pressure drop is now 18 inches H_2O. Is this unit out of compliance?

    a. Yes
    b. No
    c. Maybe

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