

## SECTION V

### AIR POLLUTION/HAZARDOUS WASTE INSPECTIONS

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## CHAPTER 1

# BASELINE INSPECTION TECHNIQUES FOR AIR POLLUTION SOURCES

### 1.1 OBJECTIVE

To provide information and techniques to support inspection personnel in conducting field inspections which are necessary to promote compliance.

### 1.2 INTRODUCTION

During the period from 1970 to 1975, the majority of sources in the U.S. installed pollution control equipment to satisfy recently promulgated regulations. Most of these systems operated well initially; however, as they aged, operation and maintenance problems began to emerge. The baseline inspection method was developed to provide agency personnel with an aid to diagnosing these emerging problems. The ultimate goal is to be able to identify deteriorating performance before non-compliance occurs and restore collection efficiency to its original level.

In this chapter, information concerning the baseline method, various types of inspections, air pollution control systems, and common air pollution control devices is presented.

### 1.3 PRINCIPLES OF THE BASELINE METHOD

The baseline inspection method embodies four major principles:

1. *Every source and every control device is unique.*

Each control system should be approached initially as if it performs in a manner different from other similar systems on other similar sources. This is important, because substantial differences in performance and vulnerability to problems have been noted in a number of cases where identical

control systems have been installed on identical or similar sources. With the baseline method, a symptom of potential problems is simply a shift in a measured or observed parameter from the value or condition it had when the source was known or assumed to be in compliance. It should be noted that one symptom is rarely used alone. Rather, a combination of symptoms is analyzed to determine if there are potential problems.

2. ***On-site instruments are often unreliable or unavailable.***

If the control device has operation and maintenance problems, it is very likely that the instruments are also not working properly. Also, particularly on smaller systems, a parameter of interest may not be measured. It is important that the inspector be aware of this possible limitation and be prepared to either use less- than-desirable data or to make the needed measurements with portable instruments.

3. ***A counterflow inspection approach ensures that information of most value is obtained first***

In the counterflow approach, the inspection begins at the stack and proceeds toward the source in a direction counter to the gas flow. One of the main advantages of this is that the scope of the inspection can be limited to specific conditions, if any, which are symptoms of operating problems. Thus, process equipment would be inspected only if it had been determined that process changes were the likely cause of control system performance shifts. In many cases, this approach will minimize both the inspector's time and the inconvenience to operator personnel.

4. ***Judgement of the inspector is the most important factor.***

Effective inspection of air pollution control systems goes beyond simply filling out a checklist. Because of the diversity of control system designs and differences in the degree of maintenance, it is important that the inspection procedure not be rigid. Maintaining this flexibility requires the inspector to continually exercise judgement, both in determining how to proceed with the inspection and in interpreting the symptoms observed.

## **1.4 LEVELS OF INSPECTION**

### **Introduction**

It is desirable to conduct detailed engineering-oriented inspections at all sources. This is obviously impractical, however, since large numbers of air pollution sources must be inspected regularly, and Agency manpower and resources are limited. To give control agencies the opportunity to properly allocate limited resources, four levels of inspections have been designed.

The levels of inspection are denoted as I through IV with the intensity of the evaluation increasing numerically. The types of activities normally associated with each level and the experience levels necessary to conduct the different levels vary substantially.

The most complete and time-consuming evaluations are done only when preliminary information indicates that there is or soon will be a significant emission problem.

### **Level I inspections**

The **Level I** inspection is a field surveillance tool intended to provide relatively frequent but very incomplete indications of source performance. No entry to the plant grounds is usually necessary and the inspection is never announced in advance. The inspector makes visible emission observations on all stacks and vents which are visible from the plant boundary and which can be properly observed given prevailing meteorological conditions. Odor conditions are noted both upwind and downwind of the facility. General plant operations are observed to confirm that these conform to permit requirements. Unusual conditions provide the stimulus for an in-plant inspection in the near future. If the visible emission observations and/or other observations will probably result in the issuance of a notice of violation, the information should be transmitted to source management personnel immediately.

### **Level II inspections**

The **Level II** inspection is a limited “walk through” evaluation of the air pollutant source and/or the control device. Entry to the facility is necessary. The inspection can be performed either in a co-current or countercurrent fashion depending on the anticipated types of problems. In either case, the inspection data gathered are limited to that which can be provided by on-site, permanently-mounted instrumentation. An important aspect of this type of inspection is the evaluation of the accuracy of the data from this instrumentation.

When control devices are not in service during the plant inspection, the Level II inspections can include checks on the internal conditions. This is particularly useful for the evaluation of fabric filter performance. The inspection involves observations from access hatches and under no circumstance includes entry into the collector by the inspector.

### **Level III inspections**

The more detailed and complete **Level III** inspection may be conducted when the Level I data and/or the preliminary observations during Level II inspections indicate problems. Where necessary, portable gauges provided by the inspector are used to measure certain operating parameters. The types of instruments generally used include:

- static pressure gauges;
- thermocouples and thermometers;
- oxygen and carbon dioxide monitors;
- pH meters; and
- pitot tubes.

The Level III inspection includes a detailed evaluation of stack effluent characteristics, CEM monitoring data, control device performance parameters, and process operating conditions. Raw material and fuel analyses may be reviewed and samples of the scrubber liquor may be obtained for later evaluation. Failed bags or electrostatic precipitator discharge electrodes may be obtained to confirm that the plant has correctly identified the general type of problem(s). In some cases, the Level III inspection will include an evaluation of the internal portions of an air pollution control device. This is done simply by observing conditions from an access hatch and under no circumstances should include entry of the

inspector into the control device. The internal checks are included only when the unit is locked off line or when one or more compartments can be safely and conveniently isolated for evaluation.

#### **Level IV inspections**

The **Level IV** inspection, identical in scope to the Level III procedures, is done explicitly to gather baseline information for use later in evaluating the performance of the specific sources at a given facility. This type of inspection should be done jointly by a senior inspector and the Agency personnel who will be assigned responsibility for the plant. Such inspections are done in conjunction with stack tests of major sources such as large electrostatic precipitators, scrubbers, and fabric filters. With smaller sources which are rarely tested, the Level IV inspection is done during a period when source personnel believe that the source is in compliance and the control device is working properly.

An important part of the Level IV inspection is the preparation of general process and control device flowcharts. These should be prepared in accordance with published guidelines. As a starting point, the inspector should request the block flow diagrams or drawings for the portions of the plants which are of interest. Specific flowcharts should be prepared so that all of the important information concerning process flow streams, measurement ports, locations of vents and bypass stacks, and locations of all control devices is clearly shown.

## **1.5 LEVEL II SOURCE INSPECTIONS**

### **Introduction**

A Level II inspection involves an on-site evaluation of the control system and relies on plant instrumentation for the values of any inspection parameters.

Since this is the type of inspection most commonly conducted by Agency personnel, additional information is provided in this, and subsequent sections.

### **General information**

- The scope of the Level II inspection should be limited to absolutely essential operating parameters and conditions necessary to evaluate compliance status and/or to evaluate progress toward compliance.
- The Level II inspection should require a maximum of 4 hours on site. Small sources should require less time.
- The inspection form should be identical to the inspection report form. Preparation of the report should require less than 1 hour even for major sources.
- While on site, it should be possible for inspectors to compare inspection data against site-specific baseline data and industry “norms”. The inspection form should help inspectors determine the follow-up information needed to evaluate the adequacy of source operation.
- The inspection procedures and inspection form should include a checklist to help inspectors conduct a complete and consistent inspection. However, the form must allow for flexibility so that inspectors can exercise professional judgement while performing the inspection.

- Evaluation of the accuracy of certain on-site instruments must be completed before data from the instruments is recorded in the inspection notes and report.

### **Safety considerations**

- Nothing should be done which jeopardizes the health and safety of the inspector and/or the plant personnel.
- Under no circumstances should a regulatory agency inspector enter any air pollution control device or any process equipment.

### **Limitations**

- The inspection is intended to evaluate progress toward compliance and to identify abnormal operating conditions which **may** be indicative of excessive emissions. It is **not** intended to provide a definite measure of the pollutant emission rate. This can only be determined by means of the promulgated reference method test.
- Due to the complexity of interrelated performance variables and the lack of on-site inspection time, it is generally impractical for the inspector to positively identify the specific operating problem causing excess emissions. The inspection is inherently limited to the determination of the general type of problem or problems which exist.
- The inspection does not provide a specific list of repairs and/or modifications necessary to achieve compliance with applicable emission regulations.
- The Level II inspection is limited to the observations which can be made by the inspector and any data which can be obtained for plant instruments. These instruments can include permanently mounted gauges on the plant equipment or portable instruments used by plant personnel while the inspector is present.

## **1.6 COMPONENTS OF THE CONTROL SYSTEM**

### **Introduction**

Control of air pollution emissions usually involves a system that employs several components to accomplish its task. The system begins with the collection of contaminants from the area of generation and continues through ductwork and assorted system components until the cleaned gas stream is discharged through a vent or stack to the outdoor air.

### **Components**

An air pollution control system includes the following:

- Contaminant capture (hoods)
- Transport (ductwork)
- Gas stream cleaning (control devices)
- Air moving (fan)

- Instrumentation (controls and monitors)
- Other activities (gas cooling, chemical feeding, waste disposal, etc.)

The components of a control system are usually divided into two groups: (1) the air pollution control device, and (2) its ancillary equipment.

Figure 1-1 illustrates a typical air pollution control system

Contaminated air is captured by a series of hoods located over operations which are the source of contamination. The captured contaminants are conveyed through a branched ductwork system to the control device. Dampers control the flow from each hood. The fan draws the gas flow through the hoods, ductwork and control device and discharges it into a stack and on to the atmosphere.

Please leave this space for figure 1-1

## 1.7 ANCILLARY COMPONENTS

### **Containment capture**

The objective of this system component is to effectively capture (with minimum air flow into the system and minimum pressure loss on entry) the contaminants being released from a source. Optimization of both air flow and pressure loss reduces fan horsepower and operating costs and the size and cost of the control device and its ancillary equipment.

#### ***Level II inspection points***

- *Capture efficiency*: visual evaluation of fugitive losses as indicated by escaping dust or refraction lines.
- *Physical condition*: hood modifications or damage that could affect performance; evidence of corrosion.
- *Fit of "swing-away" joints*: evaluation of gap distance between hood system and duct system on movable hoods.
- *Hood position/cross-drafts*: location of hood relative to point of contaminant generation; effect of air currents on contaminant capture.

### **Transport**

The duct system transports the contaminated gas stream between other components in the control system. The design objective is to select duct and fitting sizes that provide optimum conveying velocities while minimizing friction and turbulence losses.

#### ***Level II inspection points***

- *Physical condition*: indications of corrosion, erosion or physical damage; presence of fugitive

emissions.

- *Position of emergency dampers:* emergency by-pass dampers should be closed and not leaking.
- *Position of balancing dampers:* a change in damper positions will change flow rates; mark dampers with felt pen to document position for later inspections.
- *Condition of balancing dampers:* damper blades can erode and change system balance; remove a few dampers to check their condition.

## **Air moving**

The purpose of the fan is to move the gas stream through the air pollution control system. To do this, the fan must be sized for the proper air flow and must be able to overcome acceleration and entrance losses at the hoods and friction losses in the ductwork, the control device and other system components.

The fan may be positioned upstream or downstream of the control device. A downstream fan position creates a negative pressure at the control device, drawing air in through any cracks or openings and minimizing leakage of contaminants. However, if the openings are excessive, in-leakage may diminish the required capture velocity at the source, allowing emissions to escape. When the fan is located upstream of the control device, a positive pressure is created that permits contaminants to escape through cracks or holes in the casting or connecting ductwork.

### ***Level II inspection points***

- *Physical condition:* indications of corrosion.
- *Vibration:* indications of balance problems due to material build-up or wheel erosion or corrosion; severely vibrating fans are a safety hazard.
- *Belt squeal:* squealing belts under normal operation indicate a loss of air volume.
- *Fan wheel build-up/corrosion:* internal inspection of non-operating fans.
- *Condition of isolation sleeves:* check vibration isolation sleeves for holes.
- *Rotation direction:* check rotation direction with direction marked on fan housing.

## **Instrumentation**

Operating controls are important to the function of the air pollution control system and may directly affect its performance. For example, changing the timing cycle on a fabric filter cleaning system may cause pressure loss to increase, reducing the air flow from the fan and allowing emissions to escape at the source.

### ***Level II inspection points***

- *Physical condition:* indications of excessive wear, obvious signs of failure or disconnected controls.
- *Set-point values:* changes in set-point values for temperature, pH, rapping intensity, air pressure and other controllers may affect system performance.

- *Timer settings:* check for changes in cleaning cycle, chemical delivery cycle and other timer settings.
- *Emission monitors:* evaluate general condition and siting; have operator check zero and span values; review historical data.

### **Other components**

There can be many other components in an air pollution control system, including such items as chemical feed systems and catalyst regeneration units. A component found with all of the dry collection devices is a dust handling system. This component is responsible for removing the collected particles from the control device and conveying them to the final disposal site. Common to such systems are a collection hopper, a dust transfer valve and the piping or conveying equipment.

Many control systems capture gases that are too hot to introduce directly to the control device. In these systems, a component for cooling the gases will be found. This cooling may be accomplished by diluting the hot gases with cooler air, by evaporating water into the hot gas stream or by radiation and convection to the atmosphere.

### ***Level II inspection points***

Solids handling:

- *Physical condition:* indications of hopper corrosion or physical damage; condition of level detectors, heaters, vibrators, insulation, etc.
- *Discharge valve:* check for presence and operating status and indications of air leakage.
- *Solids discharge rate:* rate of solids discharge should be reasonable.

Gas cooling:

- *Physical condition:* indications of corrosion, erosion or physical damage; presence of fugitive emissions.
- *Outlet temperature:* observe plant instruments to determine cooler effectiveness; if controller is used, compare to set-point value.
- *Spray pattern/nozzle condition:* indications of effective atomization on evaporative coolers.
- *Water flow rate:* observe plant flow meters or pressure gauges to evaluate changes in water flow rate on evaporative coolers.

## **1.8 CLASSIFICATION OF AIR POLLUTION CONTROL DEVICES**

Control devices:

- Separate contaminants from a gas stream and then remove them without re-entrainment, either continuously or intermittently, to a disposal system; or
- Change the contaminant from offensive to inoffensive; or
- Both separate and remove, and change contaminants from offensive to inoffensive.

Control devices can be classified according to the contaminants they are typically used to remove:

- Particles only
  - Settling chamber
  - Fabric filter
  - Electrostatic precipitator
  - Cyclone
- Gases only
  - Wet collector
  - Adsorber
  - Incinerator
- Vapors only
  - Condenser
  - Incinerator
- Particles, gases and vapors
  - Wet collector
  - Incinerator

## 1.9 FABRIC FILTERS

### **General information**

Fabric filters remove particles by passing the contaminated gas stream through a woven or felted fabric, usually in a cylindrical configuration. Depending on the direction of gas flow, particles are deposited on either the inside or outside of the cylindrical “bag”. Initially, such forces as impaction, diffusion and electrostatic attraction are primarily responsible for particle capture by the fabric fibers. However, as the dust coats the filter and increases in thickness, direct sieving begins to dominate.

As the thickness of the dust-cake increases, so does the pressure lost in moving the gases across the filter. To keep pressure loss reasonable, it is necessary to periodically clean the fabric. The three most popular cleaning methods are shaking, reversing air flow direction and pulsing with compressed air.

### **Cleaning methods**

#### ***Shaker-cleaning***

A typical **shaker-cleaning collector** is shown in Figure 1-2. The dirty gas stream enters the hopper area and then moves across a tube-sheet to the inside of the filter tubes. The gas stream passes through the filter, depositing the particles on the inside. When it is time to clean the fabric, the collector is isolated from air flow and the bag shaken by moving the supports from which the bags are hung. The dust drops into the hopper where it is removed through a dust discharge valve.

#### ***Reverse-air-cleaning***

The **reverse-air-cleaning collector** (Figure 1-3) is nearly identical in appearance to the shaker, except the bags are hung from rigid supports. Cleaning is accomplished by isolating the collector from the dirty gas flow and introducing clean gas flow in the reverse direction. This

Figure 1-2. Shaker-cleaning fabric filter

Figure 1-3. Reverse-air-cleaning collector

reverse flow dislodges the dust which falls into the hopper. At this point the cleaning air is quite dirty, so it is ducted to an operating unit for cleaning. Thus, a reverse-air collector requires a minimum of two units.

#### ***Pulse-cleaning***

Figure 1-4 shows a typical **pulse-cleaning collector**. Cylindrical bags are suspended from a tube-sheet located near the top of the collector, and the dirty gas flow is directed through the outside of the bags and up through the center to the clean gas discharge. Metal cages are placed inside the bags to prevent collapse. Cleaning is accomplished by directing a pulse of compressed air into the top of the bag and against the dirty gas flow. This pulse momentarily dislodges the dust from the outside of the bag and slowly works it down toward the hopper. Bags are usually cleaned one row at a time without isolating the collector from the dirty gas flow.

### **Level II inspections**

#### ***Inspection activities***

- Method 9 observation of the baghouse discharge.
- Method 9 observation of fugitive emissions from baghouse solids handling operation (if reentrainment is occurring).
- Method 9 observation of fugitive emission from process equipment.
- Counterflow checks of audible air infiltration into fan, baghouse (solids discharge valve, access doors, shell) and ductwork. Also check physical condition and location of hoods.
- Static pressure drop across baghouse using on-site gauge; compare with baseline data.
- Comparison of compressed air pressures at baghouse reservoir with baseline values. Check for

audible leaks of compressed air at fittings.

- Check operation of diaphragm valves, record number of valves which do not appear to be working properly.
- Check inlet gas temperatures using on-site gauge.

Figure 1-4. Pulse cleaning collector

- Observe and describe corrosion of baghouse shell and hoppers.
- Evaluate bag failure records, gas inlet temperature records, pressure drop data, and other maintenance information.

#### ***Performance evaluation***

- Visible emissions greater than 10% from the baghouse indicate poor performance. Inspection should include evaluation of bag problems, including but not limited to abrasion, chemical attack, ember damage, high temperature damage, and improper cleaning. A rip test should be done on failed bags unless quantitative fabric tests have been performed. If conditions appear to be severe, a Level III inspection (primarily clean side checks) is warranted.
- Fugitive emissions from all process sources should be carefully documented. Reasons for poor capture should be investigated, including, but not limited to, air infiltration, poor hood condition or location, fan belt slippage (listen for squeal), fabric blinding and poor cleaning effectiveness. The static pressure drop data and cleaning system performance checks (compressed air pressures, conditions of diaphragm valves and frequency of cleaning) are very important.
- The counterflow check of the entire system for air infiltration is very important since this can generally lead to severe problems.

#### ***Safety considerations***

- The Level II inspection involves some climbing and close contact with the pulse jet baghouse. Check the integrity of all supports and ladders. Climb ladders properly. Avoid contact with hot ducts and roofs. Avoid downward pointing gas discharge points.
- Since the inspector must enter the facility to make a Level II inspection, all normal safety precautions apply.

## **1.10 ELECTROSTATIC PRECIPITATOR'S (ESPs)**

### **General information**

Electrostatic precipitators remove particles from a contaminated gas stream by employing the principle of attraction of opposite charges. The particles are charged in a high voltage electric field created by a corona discharge electrode and are then attracted to a collection plate of opposite charge (see Figure 1-5). When the particles reach the collection plate they slowly lose their charge through conduction, ideally retaining just enough charge to hold the particles to the plate but not so much that it inhibits

further deposition or makes removal difficult. Periodically, the plate is vibrated or rapped and the dust drops into the hopper.

The electric field is powered by direct currents supplied from transformer-rectifier (T-R) sets mounted on the roof. Each T-R set serves one or two fields or electrical sections. Efficiency of collection is usually highest when the voltage is highest. Most industrial ESPs operate with a negative corona because of its stability under high voltage conditions. Peak performance is indicated by the beginning of sparking from electrode to plate.

The plates are generally rapped by hammer mechanisms mounted outside on top of the housing. In some designs the rappers are located inside the housing and cannot be seen by the inspector. Also located on top of the housing will be vibrator units for keeping the discharge electrodes clean.

The electrostatic precipitator looks very much like a fabric filter, i.e., a large box-shaped structure with hoppers beneath it. However, the ESP is distinguished by the rapping mechanisms and transformer-rectifier sets mounted on top of the housing and by inlet/outlet locations that are generally on the ends (see Figure 1-6).

### **Level II inspections**

#### ***Inspection Activities***

- Method 9 observation of the stack discharge.
- Timing, duration and pattern of intermittent puffs.
- Characteristics of any detached, condensing or reactive plumes.
- Physical conditions of transmissometer transmitter and retroreflector.
- Transmissometer zero and span values, status of window lights.
- Transmissometer strip chart data
- Precipitator electrical set data, including plots of the secondary voltages, secondary currents, and spark rates for each chamber starting with the inlet field and proceeding to the outlet field.

Figure 1-5. ESP collection schematic

Figure 1-6. Electrostatic precipitator

- Process operating data.
- Transmissometer strip chart records and electrical set records.

***Performance evaluation***

- An increase of more than 5% opacity in the visible emission since the baseline period or visible emission within 5% opacity of the regulatory limit warrant a Level III inspection.
- If the data indicate the unit is operating in moderate or high resistivity conditions, the power input should be computed and compared against the baseline values.
- The secondary (or primary) voltages should be compared with the baseline values.
- The field-by-field electrical data plots should be compared with baseline plots.
- The transmissometer strip charts should be analyzed for characteristic patterns of operating problems.

***Safety considerations***

- Inspectors should be trained in safety procedures prior to using stack elevators to reach transmissometers mounted on stacks.
- All ladders and platforms should be checked before use. Safe ladder-climbing practices are necessary.
- Poorly ventilated areas around expansion joints, flanges and other areas must be avoided.

## 1.11 CYCLONES/MULTI-CYCLONE COLLECTORS

### **General information**

In a cyclone, the dirty gas stream is directed into a cylindrical shell, either through a tangential entry or through turning vanes. The result is a confined vortex in which centrifugal forces drive the entrained particles toward the outside wall. Particles successfully deposited slide down the wall and into the hopper from which they are removed through a dust discharge valve.

### **Cyclones**

#### ***Single cyclones***

Cyclones can be constructed in either single or multiple configurations. **Single cyclones** are generally

characterized as either high efficiency or high throughput (see Figure 1-7). High efficiency cyclones have a narrow inlet opening in order to attain high inlet velocity, a long body length relative to its diameter and a small outlet diameter/body diameter ratio. High throughput cyclones, which are inherently less efficient, have larger inlet openings, a shorter body length and larger gas exits.

### ***Multi-cyclones***

**Multi-cyclones** have numerous small diameter (typically 15-23 cm (6"-9")) cyclone tubes in parallel inside a single housing (see Figure 1-8). Each cyclone is mounted into a lower "tube-sheet" which separates the in-coming dirty gas stream from the hopper level below. The outlet tube from each cyclone extends up through the in-coming dirty gas stream and into an upper tube-sheet that separates the dirty gas from the cleaned gas.

Cyclone efficiency is very sensitive to particle size, with performance deteriorating rapidly for particles less than about 2-5  $\mu$ m diameter. When particle size distribution and gas flow rate are relatively constant, changes in pressure drop across a cyclone provide a good indicator of changes in collection efficiency.

### **Level II inspections**

#### ***Inspection activities***

- Method 9 observation of the stack for a sufficient period to fully characterize conditions during normal process cycles.
- Method 9 observation of any fugitive emissions from process equipment, material handling operations, and stockpiles.
- Air infiltration sites on collector shell, hopper, solids discharge valve, and inlet ductwork.
- Static pressure drop across collector as indicated by on-site gauge.
- Inlet gas temperature as indicated by on-site gauge.

#### ***Performance evaluation***

- If the visible emissions have increased more than 5% opacity since the baseline period or if the visible emissions are within 5% of the regulatory limit, a Level II or Level III inspection is necessary.

Figure 1-7. Single cyclone collectors

Figure 1-8. Multi-cyclone

- Fugitive emissions from the process area can be at least partially due to air infiltration into the ductwork or collector. The process area and ductwork should be checked in any subsequent Level II or III inspections.
- The static pressure provides an indication of the flow rate and the resistance of gas flow. The static pressure should be checked against baseline static pressure drops for similar process operating rates. If the present value is higher, then pluggage is possible. If the static pressure drop is now lower, erosion of outlet tubes and gasket problems are likely.

***Safety considerations***

- Position selected for the Method 9 observations should be secure from moving vehicles such as cars, trains, and moving machinery.
- There must be secure footing. Stockpiles are not acceptable.
- All climbing and walking safety procedures are very important. Some horizontal structures may not be able to withstand the load of accumulated solids and several people.
- Contact with hot surfaces must be avoided.
- Many multi-cyclone collectors are located in hot areas. Heat stress should be avoided by limiting the time spent in the area (moderate heat conditions) or by not entering the area (high heat areas).
- Poorly ventilated areas must be avoided.

## 1.12 WET SCRUBBERS

### **General information**

Wet collectors remove contaminants from a gas stream by transferring them to some type of scrubbing liquid. For particles larger than about 1  $\mu$ m, the dominant separation mechanism is impaction onto liquid droplets or wetted targets. For sub-micron particles and gases, the dominant mechanism is diffusion to liquid surfaces. Because of incompatible requirements, wet collectors are generally designed to perform as either a particle or a gas collector. Simultaneous collection of both particles and gases is usually possible only when the gas has a very high affinity for the scrubbing liquid.

Contacting the contaminated gas stream with the scrubbing liquid is only the first stage of a wet collector. Because the contact phase usually results in liquid entrained in the gas stream, the second stage is some type of liquid-gas separator. Common entrainment separators include chevron baffles, mesh pads and single-pass cyclones. Contactors producing large droplets may require only a little low-velocity head-space to allow the droplets time to settle back into the unit.

### **Wet collectors**

The almost endless variety of wet collectors makes it difficult to include all types and varieties in one

discussion. To illustrate the range of designs and performance levels, four types of scrubbers will be briefly described: (1) a spray tower, (2) a tray scrubber, (3) a countercurrent packed tower and (4) a venturi scrubber.

### ***Spray tower***

A simple **spray tower** is illustrated in Figure 1-9. The dirty gas stream enters at the bottom of the scrubber and flows upward at velocities between 0.6 and 3.0 meters (2 and 10 feet) per second. The liquid enters at the top of the unit through one or more spray headers, so that all of the gas stream is exposed to the sprayed liquid. A spray tower has only limited particle removal capacity, and is generally selected for applications where the particles are larger than about 5  $\mu$ m. Spray towers can be effective gas absorbers if the contaminant has a moderate affinity for the liquid.

### ***Tray scrubber***

A **tray scrubber** (see Figure 1-10) can also be used for both particle and gas collection. The gas stream again enters at the bottom and passes upward through holes in the trays. The liquid enters at the top and cascades across one tray and then flows down to the next. An overflow weir is used to maintain a liquid level on each tray. Variations in tray design include the placing of assorted “targets” above each hole to enhance the scrubbing action. The tray scrubber is an effective collector of particles larger than about 1  $\mu$ m and can be an effective gas absorber when the contaminant has a moderately low affinity for the liquid.

### ***Packed tower***

**Packed towers** are used primarily for gas absorption because of the large surface area created as the liquid passes over the packing material. The beds can be either vertical or horizontal. The most efficient arrangement is the vertical countercurrent packed tower shown in Figure 1-11. The gas stream again enters at the bottom and passes upward through the packing. The liquid is sprayed from the top and flows downward in a thin film over the surface of the packing. The packed tower is an effective gas absorber when the contaminant has a low affinity for the liquid.

Figure 1-9. Simple spray chamber

Figure 1-10. Tray scrubber

Figure 1-11. Countercurrent packed tower

### ***Venturi scrubber***

A conventional **venturi scrubber** is shown in Figure 1-12. The dirty gas stream enters a converging section and is accelerated toward the throat by approximately a factor of ten. The liquid is injected into the scrubber just beyond the entrance to the throat, where the liquid is shattered into droplets by the high velocity gas stream. Particles are collected primarily by being impacted into the slower moving drops. Following the contactor is usually a single-pass cyclone for entrainment separation. The venturi scrubber is an effective collector of particles down to the sub-micron range, comparable in performance to the fabric filter or ESP, and can be an effective gas absorber when the contaminant has a moderately high affinity for the liquid.

## **Level II inspections**

### ***Inspection activities***

- Method 9 observation of the stack for a period of not less than 6 minutes. Average opacity should be calculated. Cycles in the average opacity should be described.
- Method 9 observation of all bypass stacks and vents. Method 9 observations of any fugitive emissions from process equipment.

- Presence of rainout close to the stack or mud lips at the discharge point.
- Presence of fan vibration.
- The liquor flow rate indicated by on-site gauge.
- Physical condition of shell and ductwork.
- Recirculation pond layout and pump intake position.
- Physical condition of nozzles observed through access hatch.
- Means used to dispose of purged liquor should be noted.

***Performance evaluation***

- A shift in the average opacity may be due to a decrease in the particle size distribution of the inlet gas stream. A co-concurrent inspection of the process operation is often advisable.

Figure 1-12. Conventional venturi scrubber

- Anything which affects the nozzles will reduce performance. The liquor turbidity is related to the vulnerability to nozzle pluggage and erosion.
- Shell and ductwork corrosion is often caused by operation at pH levels which are lower than desirable. The liquor pH should be measured using in-plant instruments if available.
- The performance of a spray tower scrubber is dependent on the liquor flow rate. Any problems which potentially reduce the flow rate should be fully examined.

***Safety considerations***

- All ladders and platforms should be checked before use. Safe climbing and walking practices are important, especially in cold weather.
- Poorly ventilated areas should be avoided.
- Hot duct and pipes should not be touched.
- The inspection should be terminated if a severely vibrating fan is noted in the general vicinity of the scrubber.
- Under no circumstances should the inspector attempt to look inside an operating wet scrubber.
- Visible emissions observations should be made only in secure areas.

### **1.13 CARBON BED ADSORBERS**

## General information

Adsorbers remove gaseous contaminants from an air stream by transferring them to the surface of some high-surface-area solid adsorbent. In air pollution control systems, adsorbers which use activated charcoal as the adsorbent are typically employed to remove volatile organic compounds. Adsorption is most effective when the system temperature is about 24°C (75°F) and the compounds have molecular weights between about 45 and 200.

The most popular cleaning method is to introduce low-pressure steam into the bottom of the bed to raise its temperature and cause the contaminants to desorb from the carbon. The mixed stream of organic vapor and steam coming from the bed is condensed and the solvent recovered by decanting or distillation. Following desorption, the bed is allowed to cool and dry before being put back on line.

A typical multi-bed adsorption system is shown in Figure 1-13. Here, the left two beds are on line and contaminated gas is passing vertically down through each unit. As the system continues to operate, the on-line beds approach saturation with the contaminants and must be taken off line for cleaning to prevent breakthrough of the organic contaminant. This condition is represented in the right hand corner.

## Level II inspections

### *Physical condition*

- Indications of corrosion or physical damage.

### *Adsorption/de-sorption cycle times*

- An increase in the interval between bed cleanings could mean breakthrough is occurring.

### *Steam pressure/*

### *temperature during desorption*

- A decrease in steam pressure/temperature could indicate insufficient steam flow for regeneration.

## 1.14 INCINERATORS

Incinerators remove gaseous contaminants from an air stream by oxidizing them to compounds not considered to be contaminants. The two most common types of incinerators are:

- **Direct-fired or thermal units**, which are refractory-lined chambers with a gas or oil burning apparatus plainly visible (see Figure 1-14).
  - **Catalytic units**, which have the appearance of a duct heater and are more highly instrumented (see Figure 1-15).

Figure 1-13. Activated carbon absorber  
Figures 1-14. Direct-fired incinerator

Figure 1-5. Catalytic incinerator

In both thermal and catalytic units, the principal parameter for indicating efficiency is temperature, the value of which is dictated by the characteristics of the contaminant to be oxidized. In thermal units, the recommended minimum outlet temperature is 704°C (1300°F); most systems operate in the 816-982°C (1500-1800°F) range. Catalytic units are generally designed for a bed inlet temperature of 371-482°C (700-900°F).

#### **Level II inspections**

##### ***Physical condition***

- Indications of corrosion or physical damage; indication of air infiltration.

##### ***Outlet temperature***

- Decreased outlet temperature may mean reduced VOC destruction efficiency.

##### ***Temperature rise***

- Decreased temperature rise across the catalyst bed may mean reduced VOC destruction efficiency.

## **1.15 CONDENSERS**

Condensers remove vaporous contaminants from a gas stream by cooling it and converting the vapor into liquid. In some instances, control of volatile contaminants can be satisfactorily achieved entirely by condensation. However, most applications require additional control methods. In such cases, the use of a condenser reduces the concentration load on downstream control equipment. The two most common types of condensers are:

- **Contact or barometric condensers**, where a direct spray contacts the vapors to cause condensation (see Figure 1-16). The liquid leaving the condenser contains the coolant plus the condensed vapors.
- **Surface condensers**, such as the shell-and-tube heat exchanger (see Figure 1-17). This device consists of a shell into which the vapor stream flows. Inside the shell are numerous small tubes

through which the coolant flows. Vapors contact the cool surface of the tubes, condense and are collected without contamination by the coolant.

Figure 1-16. Contact condenser

Figure 1-17. Surface condenser

## **Level II inspections**

### ***Physical condition***

- Indications of corrosion or physical damage.

### ***Outlet temperature***

- Provides an indirect indication of the liquid flow rate and nozzle condition; increases may indicate nozzle pluggage and lower coolant flow rates; decreases may indicate nozzle erosion and higher flow rates (contact-type only).

### ***Liquid turbidity/ settling rate***

- High settling rate indicates coarse solids that could plug nozzles (contact-type only)

### ***Droplet re-entrainment***

- Droplet rainout or a mud-lip on the stack indicates a significant demister problem.

## **APPENDIX 1-A. SAFETY GUIDELINES**

1. Do not do anything which you feel is dangerous. Do not ask plant personnel to do anything which either you or the plant personnel believe could be unsafe.
2. Interrupt the inspection immediately whenever you feel any of the symptoms of possible exposure to pollutants. These include, but are not limited to: headache, nausea, dizziness, drowsiness, loss of coordination, chest pains, shortness of breath, vomiting, and eye, nose, or throat irritation.
3. Conduct the inspection at a controlled pace. Do not hurry.

4. Avoid areas of possible risk during the inspection if the necessary personal protection equipment is not available.
5. Do not make internal inspections of air pollution or process equipment under any circumstance.
6. Do not wear contact lenses during the inspection unless specifically allowed by both agency and source safety personnel.
7. Avoid areas with potentially high pollutant concentrations which could exceed PEL levels and/or the capabilities of the available respirators. Such areas are common around positive-pressure equipment and areas with many process stacks and vents.
8. Use only intrinsically-safe portable instruments when inspection locations are classified as hazardous.
9. Exercise extreme caution when walking across roofs and elevated platforms. Weak spots are not always apparent. Walk behind plant personnel. Avoid roofs whenever possible.
10. Evaluate means for rapidly leaving elevated roofs or platforms in the event of sudden plume downwash or process fugitive emissions of high-temperature steam or toxic gases.
11. Do not smoke while conducting inspections.
12. Discard or wash contaminated work clothes separately from personal clothing.
13. Know the meaning of all plant warning sirens/codes and know the proper evacuation routes.
14. Avoid areas of dripping and/or splashing chemicals. Flush eyes for at least 15 minutes as soon as possible after contact. Get medical attention.
15. Remove all affected clothing and shower immediately for a period of at least 15 minutes if there is contact with chemicals. Get medical attention.
16. Exit areas around severely vibrating fans immediately. Notify plant personnel immediately of this condition.
17. Conduct plant inspections only in the company of a responsible plant representative.
18. Wear gloves whenever climbing ladders which are possibly hot, covered with small quantities of contaminants, or which have abrasive and/or sharp edges.
19. Do not climb unsafe ladders. Exercise care in climbing. Both hands must be free for holding the ladder. Grasping of the foot rungs rather than the side rails is normally recommended by industrial safety personnel.
20. Avoid all rotating equipment which is improperly shielded.

21. Use grounding and bonding cables when obtaining samples of flammable liquids. Comply with all regulations regarding flammable liquid sampling and shipping.
22. Stand clear when plant personnel are opening any hatches.
23. Ask plant personnel to obtain any samples needed.
24. Wear splash goggles whenever dripping chemicals are possible.
25. Comply with all plant and agency safety requirements.

## **APPENDIX 1-B. RECOMMENDED LIST OF INSPECTION EQUIPMENT**

### **GENERAL EQUIPMENT**

- Camera, film, and flash equipment
- Pocket calculator
- Tape measure
- Clipboard
- Waterproof pens, pencils and markers
- Locking briefcase
- Plain envelopes
- Polyethylene bags
- Wind meter or Admiral Beaufort wind scale
- Ruler (for use as scale in photos)
- Disposable towels or rags
- Flashlight and batteries
- Pocket knife
- Pocket tape recorder
- Level
- Range finder/optical tape measure
- Compass
- Stopwatch
- Square

### **SAFETY EQUIPMENT**

- Safety glasses or goggles
- Face shield
- Coveralls, long-sleeved
- Hard hat
- Rubber-soled, metal toed, non-skid shoes
- Liquid-proof gloves (disposable if possible)
- Long rubber apron

- Plastic shoe covers (disposable)
- Self-contained breathing apparatus
- Respirators and cartridges

#### APPENDIX 1-B. (continued)

#### PAPERWORK

- Proper identification
- Copy of facility's inspection file, permit, and monitoring schedule, including:
  - maps
  - photographs
  - enforcement actions
- Field data sheets
- Checklists
- Notebook
- Notice of inspection (if applicable)
- Chain of custody

#### EXHIBIT 1-C. BASELINE AIR POLLUTION QUIZ

1. True or false? The Baseline Inspection Technique involves detailed internal inspections of the control systems.
  - 1.
2. True or false? Control systems designed by the same manufacturer and operated under similar conditions can be assumed to operate in a similar manner.
  - 2.
3. If a canopy hood has a capture efficiency of 80 percent, the overall efficiency of the air pollution control system must be:
  - a. less than 80 percent.
  - b. no greater than 80 percent.
  - c. unable to be calculated.
  - d. at least 75 percent.
- 3.
4. If the fan is located after the air pollution control device, the static pressure plot should:
  - a. show static pressure steadily becoming less negative with measurements taken closer to the fan.
  - b. remain essentially level.
  - c. reflect sharp changes in pressure depending on the direction of the ductwork.
  - d. become progressively more negative with measurements taken closer to the fan.
- 4.

5. Bags in a reverse air unit are cleaned in the following manner:
  - a. bag by bag.
  - b. row by row.
  - c. compartment by compartment.
- 5.
6. True or false? Both very high and very low gas inlet temperatures can contribute to excess emissions and/or bag failure rates.
- 6.
7. In an ESP, \_\_\_ are used to control the strength of the electric field generated between the discharge and collection electrodes.
  - a. rappers
  - b. transformers-rectifier sets
  - c. capacitors
  - d. adsorbers
- 7.
8. Rappers are:
  - a. commonly used for removing dust from discharge and collection electrodes.
  - b. commonly used for removing dust from collection electrodes only.
  - c. a type of capacitor used to store discharge electrode voltage.
- 8.
9. True or false? Increases in gas velocity result in more reentrainment of particles during rapping.
- 9.
10. Particle collection efficiency in a cyclone depends upon a number of factors including:
  - a. cyclone dimensions.
  - b. inlet gas velocity.
  - c. particle size.
  - d. dust concentration.
  - e. all of the above.
  - f. a, b, and c only.
- 10.
11. Multi-cyclone collectors have a \_\_\_ static pressure drop than large-diameter cyclones.
  - a. higher
  - b. lower
- 11.
12. Wet scrubbers are pollution control devices that use a liquid to remove \_\_\_ from an exhaust gas stream.
  - a. particles
  - b. pollutant gases
  - c. both a & b
  - d. none of the above

- 12.
13. Symptoms of poor thermal incinerator burner performance include:
- a. blue smoke generation.
  - b. higher than normal outlet temperatures.
  - c. lower-than-normal outlet temperatures.
  - d. lower-than-normal VOC outlet concentrations.
- 13.
14. When complete combustion of a gas containing only organic compounds occurs, \_\_\_\_ are the products formed.
- a.  $\text{NO}_x$  and  $\text{SO}_x$
  - b.  $\text{H}_2\text{O}_2$  and  $\text{CO}_2$
  - c.  $\text{NO}_3$  and  $\text{H}_2\text{O}$
  - d.  $\text{CO}_2$  and  $\text{H}_2\text{O}$
- 14.

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## CHAPTER 2

# HAZARDOUS MATERIALS/HAZARDOUS WASTE INSPECTION PROCEDURES

## 2.1 INTRODUCTION

### **Purpose**

The primary purpose of this section is to provide procedural and technical guidance for performing inspections of those facilities which use hazardous materials or generate hazardous wastes. The procedures are general and are not intended to be prescriptive.

### **Inspector responsibilities**

Inspectors should be aware of all Federal, State, local, and international regulations a facility must meet in order to be in compliance. No matter what the reason for the inspection, it must be performed in a manner which is both technically and legally correct. Flaws in either the technical or legal conduct of an inspection may hamper, prevent, or invalidate the use of inspection results for enforcement purposes.

Two overriding criteria must guide the conduct of inspections to insure that inspections optimally fulfill their role in enforcement:

### **1. Technical accuracy and integrity**

Inspections must be technically correct. Any measurements or other data collection and analysis must be thorough, technically proper, and appropriately documented.

## **2. Legal propriety**

Legal requirements concerning the conduct of inspections must be scrupulously followed.

It is important for inspectors to know current enforcement priorities and develop the specific skills necessary to perform the inspections required under those priorities. They also need to be aware of changes in priorities and be flexible so such changes can be accommodated.

In accordance with contemporary program priorities, inspectors are frequently assigned to concentrate on inspections of a particular type of facility or waste management practice. As a result, inspectors will develop specialized skills in inspecting that type of facility or practice through training, research and experience.

It is important, however, that inspectors also maintain a good general knowledge of the overall hazardous material/waste program so that they can respond to new enforcement priorities or changes in assignment which require them to inspect other types of facilities and practices. To maintain knowledge, inspectors should review:

- major new regulations as they are promulgated;
- new and existing guidance on inspecting other types of facilities and practices; and
- new and existing technical guidance that could provide quick background information on other types of facilities and practices.

### **2.2 INSPECTION PREPARATION**

#### **Purpose**

Adequate preparation is critical to the effective performance of hazardous materials/waste inspections. Generally, inspectors will have only a relatively brief period of time on site in which to perform an inspection; therefore, it is important that the inspection be properly scoped and planned in order to use time on site as efficiently as possible and to insure that all aspects of the facility which should be evaluated are inspected.

#### **Objectives**

When preparing for the inspection, inspectors should:

- Determine the scope of objectives of the inspection.
- Coordinate inspection activities with other regulatory or enforcement personnel as necessary.
- Develop a thorough understanding of the technical, regulatory, and enforcement aspects of the facility.

- Develop a plan or strategy for conducting the inspection consistent with inspection objectives.
- Determine health and safety requirements and equipment needs.

Activities the inspector should undertake to achieve these objectives are discussed in the following sections.

## 2.3 HEALTH AND SAFETY REQUIREMENTS

### Planning the inspection

Although routine inspections generally do not involve activities in which inspectors must physically contact hazardous wastes (except inspections involving sampling, in which incidental contact with wastes may occur), there is always the potential for inspectors to be exposed to hazardous wastes or substances during the course of an inspection. Therefore, in planning the inspection, inspectors should:

- Determine the nature of the chemical hazards that may be encountered during the inspection (based on the types of materials handled on site, as identified in the file review).
- Identify and obtain proper safety equipment.
- Become familiar with the proper use of safety equipment (if not already familiar with its use), check equipment for proper function, and perform necessary maintenance on the equipment (if appropriate and within the technical abilities of the inspector).
- Obtain and become familiar with all applicable safety guidance and practices.
- Determine any facility-specific safety requirements by contacting the facility (only in cases where the facility is being notified of the inspection) or by review of previous inspection notebooks.

### Special considerations

In some cases, the inspector will have limited information on the facility, or may be inspecting an uncontrolled site. The inspector should be prepared to encounter the worst conditions in such cases.

**Inspectors should never proceed with inspections involving site conditions for which they are not prepared and do not have the proper safety equipment.**

## 2.4 INSPECTION EQUIPMENT

### Select equipment

The kind of equipment that the inspector takes into the field is dependent on the kind of inspection to be

performed and the type of facility to be inspected. Inspectors should use their knowledge of the facility, understanding of inspection objectives, training, and experience to decide which equipment is necessary for a particular inspection. Inspectors may wish to consult with other inspection personnel or their supervisor in determining equipment requirements. Inspection requirements, the availability of certain equipment, and Regional or State policies and conditions should also be considered when selecting equipment during inspection planning.

Appendix 2-A provides a list of equipment that is commonly used in performing inspections. Inspectors may not need all of the equipment listed for every inspection; however, inspectors may need additional equipment for some inspections. The list is divided into four categories of equipment: general equipment, safety equipment, sampling equipment, and paperwork.

#### **Ensure proper functioning**

The inspector should identify and obtain the equipment necessary to perform the inspection from the appropriate source. The inspector should check inspection equipment to insure that it is in good working order prior to going into the field, and should perform, or have performed by the appropriate agency personnel, any needed maintenance or repairs. The inspector should also insure that he or she is familiar with the use of the equipment; generally, the use and operation of most of the standard inspection equipment listed is apparent.

#### **Consider additional equipment**

Special circumstances may require the use of additional equipment such as fireproof clothing or self-contained breathing apparatus. The inspector should determine whether such additional equipment is necessary in conjunction with his or her supervisor, and, if appropriate, the facility's owner/operator or plant manager.

## **2.5 OPERATIONS, WASTE HANDLING, AND RECORD REVIEW**

### **Initial interview**

The inspector should have the facility representative describe facility operations and waste management practices following the opening discussion. In general, the inspector should be familiar with the facility through previous review of the facility's file. Therefore, the purpose of this discussion will be to:

- Obtain a more detailed understanding of operations.
- Answer any questions the inspector may have on waste generation, waste flow, and waste management activities.
- Identify any changes in operating and/or waste management practices.
- Identify and reconcile any discrepancies between the operations described by the facility representative and those described in the facility file.

During the discussion, the inspector should prepare waste information sheets on each waste managed at

the facility.

### **Record review**

After discussing facility operations and waste handling practices, inspections usually proceed to the record review. The record review provides the inspector with the opportunity to become thoroughly familiar with the facility (e.g., through review of the operating record) and formulate specific questions to be investigated during the visual inspection of the facility. However, the record review does not have to occur before the visual inspection. In some cases, inspection objectives may be best served if the visual inspection occurs before the record review. The visual inspection may be performed first for other reasons as well (e.g., availability of facility personnel or weather conditions).

The regulated community must address administrative requirements for manifests, recordkeeping, and reporting; and hazardous waste facilities must comply with technical requirements mandating plans for waste analysis, training, contingency procedures, groundwater monitoring, and closure.

## **2.6 GENERAL INSPECTION PROCEDURES**

### **Follow inspection plan/strategy**

In general, the visual inspection of the facility should proceed in accordance with an inspection plan or strategy developed by the inspector during inspection planning. This plan should lay out, in the level of detail considered appropriate by the inspector (which may vary according to individual preferences), the operations the inspector intends to inspect and the tentative order in which the inspection will proceed. The inspector may, however, determine that it is appropriate to modify the plan based upon information obtained during the record review or other factors, such as the availability of specific personnel for interviewing or the scheduled operations of waste management units to be inspected. Inspectors should be flexible in changing their planned approach to suit conditions encountered at the facility. Step-by-step procedures for visually inspecting a facility will vary according to the type of facility and the objectives of the inspection.

When planning and performing the visual inspection, it is generally desirable that the inspection proceed in a way which allows the inspector to evaluate and understand the waste flow within the facility and to determine the compliance status of each segment of the facility's waste management system. For example, in a plant which generates hazardous waste, stores waste for off-site disposal, and treats some waste on-site, the inspection could proceed as follows, in brief:

### **Maintain control**

Inspectors should not allow facility representatives to hurry the inspection, direct the route of the inspection, or prevent them from asking pertinent questions of facility personnel. Inspectors should ask relevant questions of both the facility representative guiding them through the facility and of other personnel. Questioning diverse personnel may identify inconsistencies in explanations of procedures or operations that could indicate possible non-complying conditions that should be further investigated, and can also give the inspector an indication of the adequacy of the personnel training program. Answers to questions and observations that are not reported on checklists should be recorded in a field log or notebook.

### **Remain oriented**

Inspectors should be careful to remain oriented during the tour of the facility so that they can accurately

note locations of waste management areas, possible releases, potential sampling locations, etc. At larger facilities, inspectors should carry a map or plot plan in order to note locations and maintain their orientation.

## 2.7 INSPECTION CHECKLISTS

### **Pre-inspection activities**

As previously discussed, the inspector should complete as much of the applicable checklist(s) as possible in the facility office, generally during the record review, prior to visually inspecting the facility (unless the objectives of the inspection or other reasons dictate that the visual inspection occur before the record review). The inspector should leave blank those sections of the checklist(s) which cannot be answered without visual inspection.

### **Inspection activities**

During the visual inspection, the inspector should complete these sections. However, completing these sections is not the sole purpose of the visual inspection, and it is critical that the inspector not limit the visual inspection to only completing the checklist. Inspectors should be aware of, and investigate, all relevant waste generation and management activities throughout the facility, and be alert to what is happening around them as they tour the facility. If inspectors conduct visual inspections in ways which allow them to understand how wastes are generated, transported, and managed at the facility (as previously discussed), they should be able to complete the applicable checklists easily during the inspection.

## 2.8 WASTE SAMPLING

### **Reasons for sampling**

Sampling is generally conducted to verify the identity of a waste or to identify potential releases of hazardous wastes or constituents to the environment.

### **Inspection planning**

If sampling is to be conducted during an inspection, the need to sample will be determined or made known to the inspector during inspection planning. The inspector should refer to sampling manuals during inspection planning to obtain information on preparing sampling plans, taking samples, preserving samples, splitting samples with the owner/operator, and completing chain-of-custody requirements.

### **On-site activities**

In most cases, sampling will not be performed during routine inspections. However, the inspector should be aware of, and identify, potential sampling requirements that may need to be fulfilled in future inspections, particularly in cases where the inspector has identified potentially non-complying conditions or criminal activity during the course of the inspection. In these cases, it is possible that case development inspections will be performed at the facility, and it is helpful when planning these inspections to have the results of previous inspections in which potential sampling locations and needs

have been identified based on observed conditions at the facility.

### **Reasons for future sampling**

There are many possible conditions or activities which may lead the inspector to determine that future sampling will probably be necessary. Examples of some of these conditions include situations in which:

- The owner/operator is handling a potentially hazardous waste as a non-hazardous waste.

(Sampling may be required to verify that the waste is hazardous or non-hazardous.)

- In-plant waste handling practices indicate that mislabeling/misidentification of waste is likely to occur, or that wastes may vary significantly in characteristic over time and be mismanaged as a result.

(Sampling may be required to demonstrate that the facility is mislabeling or misidentifying wastes.)

- There is visible or other observable evidence of possible releases of hazardous wastes from waste management units, satellite storage areas, waste generating areas, etc.

(Sampling media and wastes may be required to demonstrate that a release has occurred or is occurring.)

- Wastes may be being managed improperly, i.e., in an inappropriate treatment or disposal unit.

(Sampling may be required to verify that the correct wastes are being managed in the facility's various waste management units.)

### **Useful information for future inspections**

Whenever such condition/activities are encountered, the inspector should identify the media or wastes to be sampled, the physical locations to sample (e.g., the location of a possible release), the steps within a treatment process to sample, the physical characteristics of the medium to be sampled (e.g., sludge, granular solid), and other relevant information that would be helpful in developing a sampling plan for a future inspection.

## **2.9 DOCUMENTATION**

### **General information**

Documentation refers to all printed and mechanical media produced, copied or taken by the inspector to provide evidence of suspected violations. It is strongly recommended that the inspector record information collected during the inspection in only the following types of records: field notebooks, checklists, photographs, maps, and drawings. Recording information on other loose papers is discouraged; loose papers may be easily misplaced and the information on them discredited during hearings. Proper documentation and document control are crucial to the enforcement system, as the

Government's case in a formal hearing or criminal prosecution often hinges on the evidence gathered by the inspector. Therefore, it is imperative that each inspector keep detailed records of inspections, investigations, photocopies, photographs taken, etc., and thoroughly review all notes before leaving the site.

### **Document control**

The purpose of document control is to assure the accountability of all documents for the specific inspection when that inspection is completed. Accountable documents include items such as logbooks, field data records, correspondence, sample tags, graphs, chain-of-custody records, bench cards, analytical records, and photos. To ensure proper document control, each document should bear a serialized number and should be listed, with the number, in a project document inventory assembled upon completion of the inspection. Water-proof ink should be used to record all data on serialized, accountable documents.

## **2.10 FIELD NOTEBOOK**

In keeping field notes, it is strongly recommended that each inspector maintain a legible daily diary or field notebook containing accurate and inclusive documentation of all inspection activities, conversations, and observations. Field notes should include any comments, as well as a record of actual or potential future sampling points, photograph points, and areas of potential violation. The diary or field notebook should contain only facts and observations because it will form the basis for later written reports and may be used as documentary evidence in civil or criminal hearings. Notebooks used for recording field notes should be bound and have consecutively numbered pages. **A separate notebook should be used for each facility inspected.**

### **APPENDIX 2-A. HAZARDOUS MATERIALS/HAZARDOUS WASTE SAMPLING EQUIPMENT**

- Bucket auger
- Bucket
- Containers
  - jars
  - plastic (for metals)
  - organic sample containers
- Bailers
- Pumps
- Conductivity meter
- Thermometer
- Dissolved oxygen meter
- Steel tape measure
- Sampling safety equipment (in addition to Appendix 1-B items)
  - Tyvek suit

- Rope
  - booties
  - gloves
  - harnesses
- Glass tubes
  - chemical-resistant suit
  - Organic Vapor Analyzer (OVA)
- Ice
- Scoops
  - buckets
- Trowels
  - Alconox
  - brushes
  - grate
  - deionized water
  - solvents for equipment cleaning
  - steam cleaning machine
  - plastic bags
- Tape
  - labeling
  - duct
  - electrical
- Decontamination equipment

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## **APPENDIX 2-B. GENERAL SITE INSPECTION INFORMATION FORM**

A. Site Name

B. Street (or other identifier)

C. City

D. State

E. Site Operator Information

1. Name

2. Telephone Number

3. Street

4. City

5. State

F. Site Description

G. Type of Ownership

1. Federal

2. State

3. Municipal

4. Private

H. Site classification

1. Generator\_\_ 2. Transporter\_\_ 3. Treatment\_\_ 4. Storage\_\_ 5. Disposal

I. Inspector information

1. Principal Inspector                      2. Organization  
3. Title    4. Telephone No.

J. Inspection Participants

- |           |            |
|-----------|------------|
| <u>1.</u> | <u>6.</u>  |
| <u>2.</u> | <u>7.</u>  |
| <u>3.</u> | <u>8.</u>  |
| <u>4.</u> | <u>9.</u>  |
| <u>5.</u> | <u>10.</u> |

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**APPENDIX 2-C. WASTE INFORMATION WORKSHEET**

(To be filled out for each facility waste)

1. Waste Name:  
2. Process generating the waste:

3. Waste classification

Hazardous                                      (Waste code:                                      )  
Non-Hazardous

4. How has the facility made this determination?

Testing  
Process knowledge

5. Are any test results available?

Yes \_\_\_ (if so, look at)  
No

6. Waste generation rate:

7. Disposal procedure:

Current

Past

8. Have manifests been used for off-site shipment?

Yes \_\_\_ (if so, look at)

No

9. Is waste subject to land disposal restrictions? Yes \_\_\_ No

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## **APPENDIX 2-D. CONTAINERS CHECKLIST**

### **A. USE AND MANAGEMENT**

1. Are containers in good condition? Yes \_\_\_ No

### **B. COMPATIBILITY OF WASTE WITH CONTAINER**

1. Is container made of a material that will not react with the waste which it stores? Yes \_\_\_ No

### **C. MANAGEMENT OF CONTAINERS**

1. Is container always closed while holding hazardous waste? Yes \_\_\_ No

2. Is container handled so that it will not be opened, handled, or stored in a manner which may rupture it or cause it to leak? Yes \_\_\_ No

### **D. INSPECTIONS**

1. Does owner/operator inspect containers at least weekly for leaks and deterioration? Yes \_\_\_ No

### **E. CONTAINMENT**

1. Do container storage areas have a containment system? Yes \_\_\_ No

#### **F. IGNITABLE AND REACTIVE WASTE**

1. Are containers holding ignitable and reactive waste located at least 15m (50 ft) from facility property lines? Yes \_\_\_ No

### **APPENDIX 2-D. (cont.)**

#### **G. INCOMPATIBLE WASTE**

1. Are incompatible wastes or materials placed in the same containers? Yes \_\_\_ No
2. Are hazardous wastes placed in washed, clean containers which previously held incompatible waste? Yes \_\_\_ No
3. Are incompatible hazardous wastes separated from each other by a berm, dike, wall, or other device? Yes \_\_\_ No

#### **H. CONTINGENCY PLAN AND EMERGENCY PROCEDURES**

1. Is a contingency plan maintained at the facility? Yes \_\_\_ No

If yes, does contingency plan include:

- a. arrangements with local emergency response organizations? Yes \_\_\_ No
- b. emergency coordinators' name, phone numbers, and addresses? Yes \_\_\_ No
- c. list of all emergency equipment at facility and description of equipment? Yes \_\_\_ No
- d. evacuation plan for facility personnel? Yes \_\_\_ No
2. Is there an emergency coordinator on site or on call at all times? Yes \_\_\_ No

## APPENDIX 2-E. WASTE PILES CHECKLIST

### A. DESIGN AND OPERATING REQUIREMENTS

1. Is the pile containing hazardous waste protected from wind? Yes \_\_\_ No
2. Does waste pile have a liner and leachate collection system? Yes \_\_\_ No
3. Is run-on diverted around active portion? Yes \_\_\_ No
4. Is runoff collected and controlled? Yes \_\_\_ No
5. Are collection and holding facilities emptied after storms? Yes \_\_\_ No

### B. WASTE ANALYSIS

1. Is a representative sample of waste from each incoming shipment analyzed before the waste is added to the pile to determine the compatibility of the wastes? Yes \_\_\_ No
2. Does the analysis include a visual comparison of color or texture? Yes \_\_\_ No

### C. CONTAINMENT

1. Is the leachate or runoff from the pile considered a hazardous waste? Yes \_\_\_ No

If yes, is the pile managed with the following:

- a. an impermeable base compatible with the waste? Yes \_\_\_ No
- b. run-on diversion? Yes \_\_\_ No
- c. leachate and runoff collection? Yes \_\_\_ No

### APPENDIX 2-E (cont.)

- d. periodic emptying of collection and holding facilities? Yes \_\_\_ No

OR

- e. protection from precipitation and run-on by some other means? Yes \_\_\_ No

#### D. MONITORING AND INSPECTION

1. Are liners and covers inspected for damage during construction? Yes \_\_\_ No
2. Are waste piles inspected weekly for deterioration, run-on and runoff controls, wind dispersal control, and proper function of leachate collection system? Yes \_\_\_ No

#### E. IGNITABLE OR REACTIVE WASTES

1. Are ignitable or reactive wastes placed in the pile? Yes \_\_\_ No

If yes,

- a. Does the addition of the waste result in the waste or mixture no longer meeting the definition? Yes \_\_\_ No

(Use narrative explanation sheet to describe procedure)

OR

- b. Is the waste protected from sources of ignition or reaction? Yes \_\_\_ No
1. If yes, use narrative explanation sheet to describe separation and confinement procedures.
2. If no, use narrative explanation sheet to describe sources of ignition or reaction.

#### F. INCOMPATIBLE WASTES

1. Are incompatible waste placed together in the pile? Yes \_\_\_ No
2. Are incompatible waste separated from each other by a dike, berm, or wall? Yes \_\_\_ No
3. Is there evidence of fire, explosion, gaseous emissions, leaching, or other discharge? (Use narrative explanation

sheet.)

Yes \_\_\_ No

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