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Inspection Manual: Federal Equipment Leak Regulations for the Chemical Manufacturing Industry

Volume I: Inspection Manual

EPA Office of Compliance
Chemical, Commercial Services, and Municipal Division

ABSTRACT

The purpose of this manual is to enhance an inspector's ability to conduct more complete and effective inspections at facilities in the chemical industry that are subject to Federal equipment leak regulations. Equipment leak standards are designed to reduce or eliminate emissions of volatile organic compounds (VOCs), volatile hazardous air pollutants (VHAPs), and organic HAPs from the miles of piping and numerous components found in chemical manufacturing processes.

This document is divided into three volumes. The first volume is a manual for inspectors; the second and third volumes describe regulations that apply to the chemical manufacturing and the petroleum refining industries, respectively.

Volume I has five chapters dedicated to helping an inspector:

- C Chapter 1 states the goals, background, approaches to rule enforcement, and organization of the document.
- C Chapter 2 addresses applicability determinations: ensuring the correct rules are being complied with at a facility, determining whether all appropriate components have been identified, and ensuring the components are properly classified by service.
- C Chapter 3 discusses reporting and recordkeeping requirements for NSPS, NESHAP, HON, and RCRA (recordkeeping only), and strategies for reviewing reports and records.
- C Chapter 4 covers on-site inspections: walk-throughs and inspections with the inspector monitoring for leaks. It addresses pre-inspection activities, timing and scope, interviews, leak monitoring evaluations, inspections of the process area and records, and post-inspection reviews and reports.
- C Chapter 5 discusses recommended inspection techniques and procedures.

Volume II tackles the equipment leak regulations applicable to the chemical manufacturing industry.

- C The first three appendices of Volume II summarize the regulations of 40 CFR Part 60 Subpart VV, Part 61 Subparts J and V, Part 63 Subparts H and I, Part 264 Subpart BB, and Part 265 Subpart BB; detail the differences among the regulations; and give the requirements grouped by component.
- C Appendix D describes the regulated equipment.
- C Appendix E contains the "Method 21" approach to leak detection.
- C Appendix F lists chemical manufacturing processes that are subject to HON.
- C Appendix G lists organic HAPs that are subject to HON.
- C Appendix H lists manufacturing processes and associated organic HAP emissions that are subject to HON.

Volume III contains the equipment leak regulations applicable to the petroleum refining industry.

- The three appendices of Volume III summarize the regulations of 40 CFR Part 60 Subparts DDD, GGG, KKK, and QQQ, and Part 63 Subpart CC; detail the differences among the regulations; and give the requirements grouped by component.

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CHAPTER 1

STATEMENT OF GOALS, BACKGROUND, APPROACHES TO RULE ENFORCEMENT, AND ORGANIZATION OF DOCUMENT

1.1 SCOPE OF MANUAL AND STATEMENT OF PURPOSE

The purpose of this manual is to provide guidance to enhance an inspector's ability to conduct more complete and effective inspections at facilities in the chemical industry subject to Federal equipment leak regulations. Inspections are typically conducted not only to determine whether a facility is in compliance with a regulation, but also to evaluate the effectiveness of a facility's implementation of a program.

Equipment leak inspections involve two separate, but equally important activities: evaluation of equipment leak program records and reports and on-site inspections. To effectively conduct these activities, an inspector must be able to:

- Determine which Federal equipment leak regulations are applicable to a chemical industry facility.
- Understand the overall approach of using both equipment standards and leak detection and repair standards to achieve reductions in emissions from equipment leaks.
- Determine if a source is complying with all the requirements of component identification, component marking, equipment design, monitoring, repair, recordkeeping, and reporting.
- Understand the use of alternate standards.
- Understand the volatile organic compounds (VOC) analyzer performance specifications required by U.S. EPA Method 21.
- Understand the basic operating principles of flame ionization analyzers, photoionization analyzers, and catalytic combustion analyzers.

- Evaluate source personnel's calibration procedures and records.

- Evaluate field monitoring procedures used by source personnel to detect leaks from regulated components.

This manual addresses seven Federal equipment leak regulations that affect the chemical industry. These regulations, found in the Code of Federal Regulations (CFR), are:

- 40 CFR Part 60, Subpart VV -- SOCMI Equipment Leaks New Source Performance Standard (NSPS)
- 40 CFR Part 61, Subpart J -- Benzene Equipment Leaks National Emission Standard for Hazardous Air Pollutants (NESHAP)
- 40 CFR Part 61, Subpart V -- NESHAP Equipment Leaks
- 40 CFR Part 63, Subpart H -- Organic Hazardous Air Pollutants (HAP) Equipment Leak NESHAP
- 40 CFR Part 63, Subpart I -- Organic HAP Equipment Leak NESHAP for Certain Processes
- 40 CFR Part 264, Subpart BB -- Air Emission Standards for Equipment Leaks for TSDFs
- 40 CFR Part 265, Subpart BB -- Air Emission Standards for Equipment Leaks for Interim Program TSDFs

Due to the similarity among many of the equipment leak regulations, the guidance in this manual may be of assistance to inspectors responsible for conducting inspections at facilities complying with State or local equipment regulations and at other types of facilities (e.g., petroleum refineries) subject to other Federal equipment leak regulations. The focus of this manual, however, is the seven Federal regulations identified above, which affect facilities in the chemical industry. These regulations are presented in Volume II, Appendices A, B, and C. Regulations that affect the petroleum refinery industry are presented in Volume III.

1.2 BACKGROUND

1.2.1 <u>Introduction: What are equipment leaks and why are they of concern?</u>

Chemical manufacturing processes include miles of piping and numerous components which convey petrochemical feedstocks, water, steam, and intermediate and final products. Emissions from equipment leaks occur in the form of gases or liquids that escape to the atmosphere through many types of connection points (e.g., flanges, threaded fittings, etc.) or through the moving parts of valves, pumps, compressors, pressure relief devices, and certain types of process equipment.

Equipment leaks are primarily defined within the above regulations on the basis of a detection instrument which reads the airborne concentration of volatile organic carbons at a potential leak point on a parts per million (ppm) basis. If the leak exceeds the threshold definition of the applicable regulation, repair of the leaking equipment is required. How the instrument is used (leak monitoring procedure) and performance criteria for the instrument are defined in Method 21 of 40 CFR Part 60, Appendix A (see Volume II, Appendix E). Equipment leaks also may be defined on the basis of visual observation of certain types of equipment. Each regulation includes leak definitions for specific types of equipment (see Volume II, Appendix C).

Equipment leak standards are designed to reduce or eliminate emissions of VOCs, volatile hazardous air pollutants (VHAPs), and organic HAPs. VOCs, along with nitrogen oxides (NO_x) and ultraviolet radiation, contribute to ozone production. Ozone is one of the criteria pollutants for which a national ambient air quality standard (NAAQS) is designated under Section 109 of the Clean Air Act, and nonattainment of the ozone NAAQS is a serious problem in the United States. VHAPs and organic HAPs (collectively referred to as HAPs in this document) are controlled because such air pollutants can pose a health risk for humans, in the form of direct worker exposure or as a contribution to air pollution affecting a broader population.

Equipment leak emissions of VOCs and HAPs from the source categories discussed above constitute a significant source of air pollutants. For example, equipment leak emissions are estimated to be responsible for over 50 percent of the total VOC emissions from refineries or about 10,000 tons per year in California based on the 1990 emissions inventory of the California Air Resources Board. Significant emissions from equipment leaks are also reported by the chemical manufacturing industries to the Toxic Chemical Release Inventory, as required by Section 313 of the Emergency Planning and Community Right-to-Know Act. For example, all manufacturers of chemicals and allied products (Standard Industrial Classification (SIC) Code 2800) reported in 1993 that fugitive emissions accounted for approximately 250,000 tons of air emissions. Fugitive emissions from equipment leaks are a significant subset of total fugitive emissions.

Federal equipment leak standards implemented during the 1980's were estimated to reduce VOC and HAP emissions between 55 and 68 percent from facilities affected by the standards. For example, the EPA estimated the VOC emissions from facilities affected by the synthetic organic chemical manufacturing industry (SOCMI) standards would be reduced from approximately 91,500 tons per year (tpy) to 40,700 tpy--a 56 percent reduction. The emission reduction estimate for benzene sources at chemical manufacturing facilities is 68 percent. The Hazardous Organic NESHAP (HON) standards, as well as some State and local standards, are intended to achieve even greater reductions of VOC and HAP fugitive emissions.

1.2.2 <u>Components</u>

A general set of equipment is covered by all of the equipment leak standards affecting chemical facilities. This includes pumps, compressors, pressure relief devices, open-ended valves or lines, valves, sampling connections, flanges and other connectors. In addition, all of the standards include any devices or systems (i.e., alarms, or dual mechanical seals) required to satisfy performance or equipment standards. The equipment leak standards also identify requirements for closed-vent systems and control devices that may be used to comply with the regulations.

Additional equipment is covered only by specific standards. For example, product accumulator vessels are addressed only by the HON and benzene NESHAP, and agitators are addressed only by the HON. The HON also addresses instrumentation systems.

Leak Detection and Repair (LDAR) programs (see Section 1.2.3.1) affect valves and pumps and other components. Appendix C in Volume II provides a component-by-component summary of the equipment leak regulations. Specific regulated components are discussed in greater detail in Volume II, Appendix D.

1.2.2.1 Pumps

Pumps are used extensively in chemical manufacturing facilities for moving fluids. The most widely used pump is the centrifugal pump. Other types of pumps that also may be used are the positive-displacement, reciprocating and rotary action, and special canned-motor and diaphragm pumps.

Chemicals transferred by pumps can leak at the point of contact between the moving shaft and stationary casing. To isolate the pump's interior from the atmosphere, all pumps, except the seal-less type (canned-motor and diaphragm), require a seal at the point where the shaft penetrates the housing. The most commonly used seals in these pumps are packed and mechanical. However, no seal system is perfect, and many pumps are equipped with a closed-vent system.

1.2.2.2 Compressors

Centrifugal, reciprocating, and rotary compressors are used in chemical manufacturing facilities. The centrifugal compressor uses a rotating element or series of elements containing curved blades to increase the pressure of a gas by centrifugal force. Reciprocating and rotary compressors increase pressure by confining the gas in a cavity and progressively decreasing the volume of the cavity. Reciprocating compressors usually use a piston and cylinder arrangement, while rotary compressors use rotating elements such as lobed impellers or sliding vanes.

As with pumps, seals are required to prevent leakage from compressors. Rotary shaft seals for compressors may be labyrinth, restrictive carbon rings, mechanical contact, or liquid film. All of these seals are leak restriction devices, but none of them completely eliminate leakage. To respond to leakage, many compressors are equipped with ports in the seal area that evacuate collected gases to a control device.

1.2.2.3 Pressure Relief Devices

Engineering codes require the use of pressure-relieving devices or systems in applications where the process pressure may exceed the maximum allowable working pressure of the vessel. The pressure relief valve is the most common type of pressure-relieving device used. Typically, relief valves are spring-loaded and designed to open when the system pressure exceeds a set pressure, allowing the release of vapors or liquids until the system pressure is reduced to its normal operating level. When the normal pressure is re-attained, the valve reseats and a seal is again formed. The seal is a disc on a seat, and a leak through this seal is a potential source of fugitive VOC and HAP emissions. The potential causes of leakage from relief valves are "simmering or popping" (a condition that occurs when the system pressure comes close to the set pressure of the valve); improper reseating of the valve after a relieving operation; and corrosion or degradation of the valve seat.

Rupture discs also may be used to relieve pressure in process units. These discs are made of a material that ruptures when a set pressure is exceeded, thus allowing the system to depressurize. The advantage of a ruptured disc is that the disc seals tightly and does not allow any emissions to escape from the system during normal operations. When the disc ruptures, however, the system will depressurize until atmospheric conditions are obtained, unless the disc is used with a pressure relief valve.

1.2.2.4 Sampling Connections

Process unit operations are checked periodically by routine analysis of feedstocks and products. To obtain representative samples for these analyses, sampling lines first must be purged. If the flushing liquid is not controlled, it could be drained onto the ground or into a process drain where it would evaporate and release emissions to the atmosphere. Closed-loop sampling systems control the purged process fluid by returning it directly to the process line, collecting and recycling the fluid, or transporting the fluid to a control device.

1.2.2.5 Open-ended Lines or Open Valves

Some valves are installed in a system so that they function with the downstream line open to the atmosphere. Open-ended lines, which are used mainly in intermittent service for sampling and venting, include purge, drain, and sampling lines. Some open-ended lines are needed to preserve product purity. Normally, these are installed between multi-use product lines to prevent products from collecting in cross-tie lines during valve seat leakage. A faulty valve seat or incompletely closed valve would result in leakage through the valve, releasing emissions to the atmosphere.

1.2.2.6 Process Valves

One of the most common pieces of equipment affected by these standards is the process valve. Commonly used types are control, globe, gate, plug, ball, relief, and check valves. All except the relief valve (see Section 1.2.2.3) and check valve are activated through a valve stem, which may have either a rotational or linear motion, depending on the design. The valve stem requires a seal to isolate the process fluid inside the valve from the atmosphere. The possibility of a leak through this seal makes it a potential source of fugitive emissions. Since a check valve has no stem or subsequent packing gland, it is not considered a potential source of fugitive emissions and is not subject to the standards.

The stem can be sealed to prevent leakage by using a packing gland or O-ring seals. Valves that require the stem to move in and out with or without rotation must use a packing gland. Conventional packing glands are suited for a wide variety of packing material. The most common are various types of braided asbestos that contain lubricants. Other packing materials include graphite, graphite-impregnated fibers, and tetrafluorethylene polymer. The packing material used depends on the valve application and configuration. These conventional packing glands can be used over a range of operating temperatures, but at high pressures, these glands must be quite tight to obtain a good seal.

Elastomeric O-rings also are used for sealing process valves. These O-rings provide good sealing, but are not suitable if sliding motion occurs through the packing gland. These seals are used rarely in high pressure service, and operating temperatures are limited by the seal material.

Bellows seals are more effective for preventing process fluid leaks than the conventional packing gland or any other gland-seal arrangement. This type of seal incorporates a formed metal bellows that makes a barrier between the disc and body bonnet joint. The bellows is the weak point of this type of system, and service life can be quite variable. Consequently, this type of seal normally is backed up with a conventional packing gland and often is fitted with a leak detector in case of failure.

A diaphragm may be used to isolate the working parts of the valve and the environment from the process liquid. The diaphragm also may be used to control the flow of the process fluid. In this design, a compressor component pushes the diaphragm toward the valve bottom, throttling the flow. The diaphragm and compressor are connected in a manner so that separating them is impossible under normal working conditions. When the diaphragm reaches the valve bottom, it seats firmly against the bottom, forming a leak-proof seal. This configuration is recommended for fluids containing solid particles and for medium-pressure service. Depending on the diaphragm material, this type of valve can be used at temperatures up to 205°C and in severe acid solutions. If the seal fails, however, a valve using a diaphragm seal can become a source of fugitive emissions.

1.2.2.7 Flanges and Other Connectors

Flanges are bolted, gasket-sealed junctions used wherever pipes or other equipment such as vessels, pumps, valves, and heat exchangers may require isolation or removal. Connectors are all other nonwelded fittings that serve a similar purpose to flanges, which also allow bends in pipes (elbows), joining two pipes (couplings), or joining three or four pipes (tees or crosses). Connectors typically are threaded.

Flanges may become fugitive emissions sources when leakage occurs because of improperly chosen gaskets or poorly assembled flanges. The primary cause of flange leakage is thermal stress, which causes deformation of the seal between the flange faces. Threaded connectors may leak if the threads become damaged or corroded or if tightened without sufficient lubrication or torque.

1.2.2.8 Product Accumulator Vessels, Bottoms Receivers, and Separator Vessels

Product accumulator vessels include overhead and bottoms receiver vessels used with fractionation columns and product separator vessels used in series with reactor vessels to separate reaction products. Accumulator vessels can be vented directly to the atmosphere or indirectly through a blowdown drum or vacuum system. When an accumulator vessel contains benzene and other HAPs and vents to the atmosphere, emissions will occur.

1.2.2.9 Agitators

Agitators are used to stir or blend chemicals. Like pumps and compressors, agitators may leak organic chemicals at the point where the shaft penetrates the casing. Consequently, seals are required to minimize fugitive emissions. Four seal arrangements commonly are used with agitators: compression packing (packed seal), mechanical seals, hydraulic seals, and lip seals. Packed seals for agitators are very similar in design and application to packed seals for pumps.

Although mechanical seals are more costly than the other three types of seals, they offer a greatly reduced leakage rate to offset their higher cost. Furthermore, the maintenance frequency of mechanical seals is one-half to one-fourth that of packed seals. At pressures greater than 1,140 kPa (150 psig), the leakage rate and maintenance frequency are so superior that the use of packed seals on agitators is rare. As with packed seals, the mechanical seals for agitators are similar in design and application to the mechanical seals for pumps.

1.2.2.10 Instrumentation Systems

Instrumentation systems consist of smaller pipes and tubing that carry samples of process fluids to be analyzed to determine process operating conditions or to systems for measurement of process conditions.

1.2.2.11 Closed-Vent Systems and Control Devices

A closed-vent system can be used to collect and dispose of gaseous emissions from seal oil degassing vents, pump and compressor seal leakage, relief valve leakage, and relief valve discharges because of over-pressure operation. A closed-vent system consists of piping connectors, flame arrestors, and, if necessary, flow-inducing devices. Closed-vent systems are designed and operated so that all emissions are transported to a control device without leakage to the atmosphere.

Several types of control devices can be used to dispose of VOC and HAP emissions captured in the closed-vent system. Incineration, carbon adsorption, and condensation are three control methods that typically are applied.

1.2.3 Leak Minimization Standards

Equipment leak standards are designed to control emission leaks from regulated equipment through the application of work practices, equipment standards, and operational practices. The work practice most commonly applied to control equipment leaks is the LDAR program. Equipment practices include the use of specific types of components, equipment design standards or specifications, and operational standards for certain types of equipment. Equipment practices are evaluated using performance standards that provide a basis for monitoring or substantiating the effectiveness of such control practices.

1.2.3.1 Leak Detection and Repair

LDAR programs consist of two phases: (1) monitoring potential fugitive emission sources within a process unit to detect leaks, and (2) repair or replacement of the leaking component.

The level of emission reduction achieved by a LDAR program is affected by several factors. The three main factors are monitoring interval, leak definition, and repair interval:

- Monitoring interval--The monitoring interval is the frequency at which individual component monitoring is conducted. For example, valves are generally required to be monitored once a month using a leak detection instrument, but the monitoring interval may be extended to once every quarter for each valve that has not leaked for two successive months. The LDAR programs also specify weekly visual inspections of pumps and compressors for indications of liquids dripping from the seals.

- Leak definition--The leak definition is the VOC (or HAP) concentration observed during monitoring with a leak detection instrument that exceeds the threshold standard for the applicable regulation. Leaks may also be defined on the basis of visual inspections. In other cases, monitoring is required if certain indications of leaks are observed.

- Repair interval--The repair interval is defined as the length of time allowed between detection of a leak and repair of the leak. When a leak is detected, the affected component is required to be repaired as soon as practicable, but not later than 15 calendar days after the leak is detected, unless the conditions described under "Delay of Repair" (later in this section) are met.

For each component, the first attempt at repair is to be made no later than five calendar days after each leak is detected. First attempts at repair include, but are not limited to, the following best practices, where practicable and appropriate:

- Tightening of bonnet bolts

- Replacement of bonnet bolts

- Tightening of packing gland nuts

- Injection of lubricant into lubricated packing

Other factors that can improve the efficiency of an LDAR program that are not addressed by the standards include training programs for equipment monitoring personnel and tracking systems that address the cost efficiency of alternative equipment (e.g., competing brands of valves in a specific application).

1.2.3.2 Equipment, Design, Operational, and Performance Standards

Equipment standards refer to the use of specific types of components. Design standards include requirements for dual mechanical seals, closed purge and vent systems, caps, blind flanges, second valves, and control equipment specifications associated with flares and enclosed combustion devices.

Certain equipment operations, e.g., the proper sequence for closing double blocks and bleed valves or the requirement to maintain a pilot flame in flares, are regulated through implementing operational standards.

Performance standards refer to no detectable emissions and percent reduction efficiency for control devices. Annual monitoring is used for components subject to the "no detectable emissions" requirement, which requires emissions of less than 500 ppmv above background levels. No detectable emissions components include pumps, compressors, valves (specifically designated for no detectable emissions), pressure relief devices in gas/vapor service, and closed-vent systems for both NSPSs and NESHAPs.

1.2.4 Federal Equipment Leak Regulations

Federal equipment leak regulations affecting chemical manufacturing facilities consist of standards promulgated under the NSPS, NESHAP, and the Resource Conservation and Recovery Act (RCRA). NSPSs are implemented under Section 111 of the Clean Air Act and apply to newly constructed stationary sources--those sources constructed after the date that an NSPS is proposed in the *Federal Register*. NSPSs become effective upon promulgation. In addition, existing stationary sources (sources existing prior to the NSPS proposal date) can become subject to an NSPS if they are modified or reconstructed after the NSPS proposal date. A degree of national uniformity to air pollution standards is established through NSPSs. Such uniformity tends to preclude situations in which certain States could attract new industries as a result of relaxed standards, relative to other States.

NESHAPs, which are implemented under Section 112 of the Clean Air Act, apply to both new and existing stationary sources. NESHAPs are intended to control hazardous pollutants such as carcinogens or other serious disease-causing agents. Formerly, they were developed and implemented for individual pollutants, but this proved to be an extremely cumbersome and slow-moving process. By 1990, NESHAPs had been established for only eight pollutants. Of these, equipment leak regulations were applied only to benzene and vinyl chloride. The Clean Air Act Amendments of 1990 (CAAA) have changed the approach for controlling hazardous air pollutants. In the CAAA, 189 chemicals are identified as air toxics that will be controlled on a source category basis. A subset of the listed chemicals will be regulated under the HON.

As a class, organic air emissions at hazardous waste treatment, storage, and disposal facilities (TSDFs) are regulated under Subtitle C of RCRA. Final standards are established in the rule to limit leaks from equipment (e.g., pumps and valves) that contains or contacts hazardous waste streams with 10 percent or more total organics. The final standards incorporate, or closely follow, many of the provisions of the equipment leak NSPS and the benzene NESHAP. These standards are promulgated under authority of Section 3004 of the Hazardous and Solid Waste Amendments to RCRA and are incorporated into Parts 264 and 265 (Subpart BB), Air Emission Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (U.S. EPA, 1990b).

1.2.4.1 Federally Regulated Source Categories - NSPS

The NSPS equipment leak standards for the SOCMI are in Subpart VV of 40 CFR Part 60, and sections (§) of this standard are found in §60.480 through §60.489. The proposal and applicability date for Subpart VV is January 5, 1981. The rule was promulgated on October 18, 1983.

1.2.4.2 Sources Subject to NESHAP Regulations

NESHAPs have been established for equipment leaks of two designated VHAPs--benzene and vinyl chloride. Only the benzene NESHAP is applicable to chemical manufacturing facilities.

The NESHAPs are found in 40 CFR Part 61. Part 61 contains the national emission standards for hazardous air pollutants, including the following subparts:

- Subpart J specifies the national emission standard for equipment leaks of benzene and basically incorporates Subpart V as its standards. Subpart J is found in §61.110 through §61.112. Subpart J was promulgated on June 6, 1984.

- Subpart V contains the national emission standard for VHAP equipment leaks. This subpart contains generic provisions and standards that are incorporated by reference in 40 CFR 61, Subpart J. Subpart V is found in §61.240 through §61.247. Subpart V was promulgated on June 6, 1984.

1.2.4.3 Hazardous Organic National Emission Standard (HON)

The HON for equipment leaks at organic chemical plants is found at 40 CFR Part 63, Subpart H, in §63.160 through §63.182. These standards apply to equipment in organic hazardous air pollutant service for 300 or more hours per year. The chemical manufacturing processes and organic HAPs subject to the rule are published in Tables 1 and 2 of Subpart F to 40 CFR Part 63 (see Volume II, Appendices F and G).

Subpart H standards also apply to some additional processes that produce certain butadienes, chlorine, or styrene-based products. These processes are addressed in Subpart I of 40 CFR 63 (see Volume II, Appendix H) at §63.190 through §63.193. The HON was promulgated on April 22, 1994.

A number of the manufacturing processes listed under the HON also contain equipment subject to NSPS or NESHAP equipment leak standards. Wherever such overlapping rules apply, the HON takes precedence.

1.2.4.4 Hazardous Waste Facility Emission Standards

Organic air emissions at hazardous waste TSDFs are found at Parts 264 and 265 (Subpart BB), Air Emission Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities and Air Emissions Standards for Owners and Operators of Interim Status Hazardous Waste Treatment, Storage and Disposal Facilities, respectively. The regulations may be found at §264.1050 through §264.1065 and §265.1050 through §265.1064. The rules were both promulgated on June 21, 1990.

1.3 APPROACHES TO RULE ENFORCEMENT

Reports, recordkeeping requirements, and inspections form the basis of assessing compliance with the Federal equipment leak standards. Inspections require the evaluation of records and reports as well as the performance of on-site inspections, including leak detection. Both activities are necessary to the accomplishment of effective regulatory oversight.

1.3.1 Review of Reports and Recordkeeping

The review of records and reports can encompass two separate functions: (1) determination that the records and reports are in compliance with the applicable standards, and (2) use of records and reports in the performance of on-site inspections. One of the goals of this manual is to assist inspectors in evaluating the often complicated and voluminous records that are an essential part of the equipment leak programs. The records and reports required by the Federal equipment leak standards are essential elements for the demonstration of compliance by the regulated facility. It should be noted that these regulations are complicated and are not uniform from one category to another. It is imperative therefore, that the inspector be thoroughly knowledgeable of the source specific regulations before conducting an inspection. This will aid the inspector in recognizing what types of information are important for the compliance determination as well as providing a means of preparation for site visits and inspections.

1.3.2 <u>On-Site Inspections</u>

On-site inspections can encompass the direct monitoring of regulated equipment and measurement of equipment leaks as well as observational techniques addressing plant procedures, equipment usage, and evaluation of monitoring and testing performed by the plant. One goal of this manual is to provide guidance in the development and implementation of direct monitoring inspections. Another goal is to enable the inspector, through observational techniques, to determine if plant personnel are in full compliance with EPA Method 21 field monitoring techniques and if they are adequately identifying regulated and/or leaking equipment. Inspectors must, therefore, be thoroughly familiar with VOC detector operating principles, calibration procedures, operating problems, and leak screening techniques in order to perform both types of inspections.

1.4 ORGANIZATION OF DOCUMENT

<u>Chapter 2 - Applicability</u>

The focus of this chapter is to address applicability determinations needed to ensure the correct rule(s) is (are) being complied with, all appropriate components are included in the program, and all such components are correctly identified as to which service they are in.

<u>Chapter 3 - Compliance/Inspection Through Reports and Recordkeeping</u>

This chapter addresses the review of reports and recordkeeping for compliance with the Federal equipment leak regulations.

Chapter 4 - Compliance/Inspection Through Walk-Through Monitoring

This chapter addresses the compliance and inspection issues that can be addressed by conducting an actual walk-through of the facility including on-site review of records and the use of a monitor during the walk-through.

Chapter 5 - Recommended Inspection Techniques and Procedures

This chapter provides a summary of the pros and cons of both enforcement strategies. Actual programs should seek a balance between the two. The best procedure will vary based on resources available to the inspector and the air quality priorities of the regions.

CHAPTER 2

APPLICABILITY

This chapter addresses three critical applicability determinations. The first determination is to ensure the correct rules are being complied with at any given facility. Second, once the correct rule is determined for each process area within a facility, determine whether all appropriate components have been identified. The third critical determination is to ensure that these components are properly classified as to what type of service they are in.

These three determinations are discussed in the following sections of this chapter. For each determination, a discussion of each regulation is presented, followed by a discussion of procedures that can be used in making these critical determinations.

2.1 WHICH REGULATION?

2.1.1 Specific Regulations

At many chemical manufacturing facilities, more than one Federal equipment leak rule may be applicable to different pieces of equipment or process areas within the facility. However, each rule has a precedence ranking relative to the other rules such that only one rule should be applicable to any specific piece of equipment or process area.

The HON standard (40 CFR 63, Subpart H and I) is the best place to begin for the determination of rule precedence. The rule takes precedence over any equipment also subject to NSPS or NESHAP standards, including some equipment previously subject to benzene regulations. If a process is not subject to 40 CFR 63, it should be reviewed for benzene applicability (40 CFR 61, Subparts J and V). The NESHAPs take precedence over any applicable NSPS [§61.110(d) or §61.240(c)].

Several terms important to determination of rule applicability can be confusing because they have different meanings under some of the rules (e.g., affected facility) or can be used in different contexts (in service). Those terms important to the following discussions are reviewed here to help clarify how the standards are applied.

Affected Facility. An affected facility is an emission source or group of emission sources to which a standard applies. Part 60, Subpart VV defines affected facility as the “group of all equipment within a process unit." All of the other rules addressed by this manual define each individual piece of equipment (e.g., pump, compressor) as the affected facility.

Process Unit. All of the standards (except RCRA Subpart BB) contain the following generic definition: "a process unit can operate independently if supplied with sufficient storage facilities for the product." Each standard also contains specific qualifiers (see Table 2.1). The RCRA definition of a hazardous waste management unit refers to the area in which a hazardous waste is stored or in which constituent wastes are mixed.

Table 2.1. Process Unit Definitions--Specific Qualifiers

Standard	Specific Process Unit Definition
40 CFR Part 60	Components assembled to produce, as intermediate or final products, one or more of the chemicals listed in §60.489 of Subpart VV.
40 CFR Part 61	Equipment assembled to produce VHAP or its derivatives as intermediates or final products, or equipment assembled to use a VHAP in the production of a product.
40 CFR Part 63	Equipment assembled and connected by pipes or ducts to process raw materials and to manufacture an intended product.
40 CFR Part 265	A contiguous area of land on or in which hazardous waste is placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area. Example: A tank and its associated piping and underlying containment system.

The EPA clarifies the definition of process unit for the SOCMI standards, as follows: The definition was drafted by EPA to provide a practical way to determine which equipment is included in an affected facility. There are no specific physical boundaries or size criteria. The definition instead depends upon several operational factors, including chemical produced and the configuration of the processing equipment. Such configurations may be different for different producers of the same chemical; therefore, the definition may be fairly site specific. In practice, however, the definition will implement the selection of a process unit basis as the "source" covered by the standards.

Service. Service refers to two district concepts. "In . . . service" addresses the specific conditions by which rule applicability is determined. These terms (in organic HAP service, in volatile organic compound (VOC) service, etc.) are discussed in this section. "Type of service" refers to the physical condition of the process material: gas/vapor, light liquid, or heavy liquid. Type of service is discussed in a later section of this chapter.

2.1.1.1 40 CFR Part 63

Within the chemical industry, the HON applies to major sources which manufacture as a primary product one or more of a designated list of chemicals and which make or use as a reactant or manufacture as a product, co-product, or byproduct any of a designated list of organic HAPs. The applicable chemicals and HAPs are published as Table 1 and Table 2 of 40 CFR 63, Subpart F.

In addition to the chemical manufacturing processes referred to above, the HON also applies to a number of processes that produce certain butadiene-, chlorine-, or styrene-based products. These processes are identified in 40 CFR 63, Subpart I, and are required to comply with the provisions of Subpart H.

For those facilities subject to the HON, the standards apply to equipment in organic hazardous air pollutant service for 300 or more hours per year. "In organic HAP service" means that the equipment contains or contacts a fluid that is five percent or greater by weight of total organic HAP. Within the rule, specific standards apply to equipment in different types of service: gas/vapor, light liquid, and heavy liquid.

The HON also stipulates that each piece of equipment within a process unit that can reasonably be expected to contain equipment in organic HAP service is presumed to be in organic HAP service unless an owner or operator demonstrates that the piece of equipment is not in organic HAP service. For a piece of equipment to be considered not in organic HAP service, it must be determined that the percent organic HAP content can be reasonably expected not to exceed five percent by weight on an annual average basis. For purposes of determining the percent organic HAP content of the process fluid that is contained in or contacts equipment, Method 18 of 40 CFR Part 60, Appendix A is to be used.

The HON is applicable to both new and existing facilities, regardless of their date of construction. For the purpose of establishing compliance deadlines, those processes subject to Subpart H are divided into five distinct groups. The compliance dates (as of April 10, 1995) for the process groups at existing sources are as follows:

Group I:	October 24, 1994
Group II:	January 23, 1995
Group III:	April 24, 1995
Group IV:	July 24, 1995
Group V:	October 23, 1995

The group designation for each process unit is indicated in Table 1 of Subpart F. However, the owner/operator of a plant has the option to comply at an earlier date than required by the schedule.

New sources that commence construction or reconstruction after December 31, 1992, should be in compliance with Subpart H upon initial startup or April 22, 1994, whichever is later.

Existing sources identified in Subpart I were required to comply with the standard no later than October 24, 1994. New sources are required to comply upon initial start-up.

Finally, any equipment that is in vacuum service and equipment that is in organic HAP service less than 300 hours per year are excluded from the requirements of the HON standard. No other specific exemptions are identified in the rule. Equipment in VHAP service less than 300 hours per year as well as exempt equipment in vacuum service must be identified in plant records.

2.1.1.2 <u>40 CFR Part 61</u>

The benzene equipment leak standards apply to components that are intended to operate in benzene service. This is defined as "a piece of equipment which either contains or contacts a fluid (liquid or gas) that is at least 10 percent benzene by weight." Generic provisions and standards for equipment in VHAP service are at 40 CFR 61 Subpart V, and the benzene standards are at 40 CFR 61 Subpart J.

As with the HON, the benzene equipment leak standards apply to both new and existing sources, and no applicability date separates new from existing sources. Each piece of equipment within a process unit that can conceivably contain equipment in VHAP service is presumed to be VHAP service unless an owner or operator demonstrates that the piece of equipment is not in VHAP service. A piece of equipment is considered to be not in VHAP service if the percent VHAP content can be reasonably expected never to exceed 10 percent by weight. Such determinations can be made through the use of engineering judgement or by following procedures that conform to ASTM Method D-2267.

These standards do not apply to sources located in coke by-product plants. Any equipment in benzene service located at a plant site designed to produce or use less than 1,000 mg of benzene per year is exempt from the benzene NESHAP. This cutoff is intended to exempt most research and development facilities and other small-scale operations. Also exempt is any process unit that has no equipment in benzene service and any equipment that is in vacuum service. All exempt equipment and equipment not in VHAP service must be identified in plant records.

2.1.1.3 <u>40 CFR Part 60</u>

SOCMI is a broad source category that covers plants that produce many types of organic chemicals. Examples of organic chemicals produced in the SOCMI segment include acetone, methyl methacrylate, toluene, and glycine. The complete list of organic chemicals covered by SOCMI equipment leak standards is found in §60.489 of 40 CFR Part 60. 40 CFR 60 Subpart VV applies to the industries that produce as intermediates, byproducts, or final products, one or more of the chemicals listed in §60.489 of the standard. The standards apply to any affected facility that commenced construction or modification after January 5, 1981.

Subpart VV applies to any piece of equipment which contains or contacts a process fluid that is at least 10 percent VOC by weight.

Any affected facility that has the design capacity to produce less than 1,000 megagrams (Mg) (1,100 tons) per year is exempt from the SOCMI rules. An affected facility that produces heavy liquid chemicals only from heavy liquid feed or raw materials is also exempt. Exemptions also apply to: any affected facility that produces beverage alcohol, any affected facility that has no equipment in VOC service, and all equipment in vacuum service.

2.1.1.4 40 CFR Part 264 and 265

40 CFR Part 264, Subpart BB applies to owners and operators of facilities that treat, store, or dispose of hazardous wastes (TSDFs). Part 265, Subpart BB applies to owners and operators of interim status TSDFs. These subparts apply to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 per cent by weight that are managed in: (1) units that are subject to the permitting requirements of 40 CFR Part 270, or (2) hazardous waste recycling units that are located on hazardous waste management facilities otherwise subject to the permitting requirements of Part 270. A facility may be an operational chemical manufacturer, but any organic waste streams it generates may render it subject to 264/265 BB (i.e., it does not need to be a commercial treatment, storage, or disposal facility).

Any equipment that is in vacuum service is excluded from the requirements of this standard. However, equipment in vacuum service must be identified in plant records. These regulations do not affect conditionally-exempt or small-quantity generators, and they do not affect satellite accumulation areas.

2.1.2 Procedures to Determine if Appropriate Rule is Being Applied

Determination of rule applicability is ultimately the responsibility of the regulated facility. Normally, any questions regarding applicability are reviewed and resolved through the State permitting process. Thus, an inspector can determine which rules are being applied to a facility by consulting that facility's air permits. However, permits are not always correct, and total reliance on the permit is not recommended. A thorough knowledge and understanding of the various process areas within a facility, and the relationship of such processes to potentially applicable rules, will contribute to an inspector's effectiveness.

At any given facility, there will be an ongoing activity of equipment replacement or retirement and additions or modifications to the various processes. Good process knowledge will help the inspector to keep track of such changes, understand how the current rule applies to new equipment, and identify any oversights by the facility in the identification of such equipment. Additionally, the inspector may identify situations such as changes to process constituents or formula, or major modifications, which necessitate a review of rule applicability. With experience, the inspector may be able to identify entire processes or facilities which an owner/operator has failed to recognize as potentially subject to a rule.

2.2 WHICH COMPONENTS?

2.2.1 Specific Components

Each of the Federal equipment leak regulations specifies a list of components covered by each regulation. Specific components common to all of the regulations include: valves, connectors, pumps, compressors, pressure relief devices, sampling connection systems, open-ended valves or lines, and closed vent systems and control devices. The benzene NESHAP also applies to product accumulator vessels, whereas the HON also applies to agitators, surge control vessels, bottoms receivers, and instrumentation systems.

2.2.2 Guidance to Determine if Equipment Has Been Identified Properly

Production facilities subject to one or more of the equipment leak standards are typically large plants with a very large number of components. In order to comply with the various standards, an owner or operator needs to be able to locate and identify those components subject to the standards and to reference any relevant information applicable to each individual component. Some types of information are required by some of the rules; other information is simply useful or prudent from the owner/operator's perspective. An inspector should develop a detailed understanding of a facility's component identification system, as well as information about the components themselves.

The most basic element of any component identification system is the assignment of a unique identification (ID) number to each component. The ID number is used to comply with various recordkeeping and reporting requirements. For example, the ID number of each component that is found to be leaking is recorded in a log. In addition, a list of the ID numbers of all equipment subject to the standards are to be recorded in a log. Lists of identification numbers are also required for equipment in vacuum service, and other equipment in any special status identified by the regulations.

Following establishment of an ID system, being able to establish the exact location of each component is the next basic element. Most ID systems are designed to facilitate location by incorporating the individual process unit (or other geographically convenient criteria) into the number system. For the NSPS equipment leak standards, components are only subject to the standards if they are located in an affected facility. Therefore, it is important to identify the location of each component with regard to the process unit it is in and whether that process unit is an affected facility.

Another item of concern to the inspector is the relationship between the plant's inventory of equipment subject to the standards and the equipment which is actually in service. When individual pieces of equipment or subsections of a process area are taken out of service, such equipment should be routinely retired or identified as out-of-service on the inventory. Likewise, new or replacement equipment should be added to the inventory. If an inspector can identify equipment that has not been properly added or deleted from the inventory, then the facility may not be in full compliance with the applicable rule.

2.3 WHICH SERVICE?

2.3.1 Service Definition

The specific standards applied to equipment subject to these rules depends on the type of service the equipment is in. Most rules identify three types of conditions: gas/vapor service, light liquid service, and heavy liquid service. Part 61 does not define "light" or "heavy" liquid, just "liquid service." Definitions of the three types of service are the same, although several rules provide for alternative means of measurement or demonstration.

"In gas/vapor service" means that the piece of equipment contains or contacts process fluid that is in the gaseous state at operating conditions. All of the standards use this definition except the HON, which refers to "equipment in organic hazardous air pollutant service (which) contains a gas or vapor at operating conditions."

Equipment is "in light liquid service" if all of the following conditions are met:

- The vapor pressure of one or more components is >0.3 kPa (0.04 psi) at 20ºC.
- The total concentration of the pure components, with a vapor pressure >0.3 kPa (0.04 psi) at 20ºC, is $20 percent by weight.
- The fluid is a liquid at operating conditions.

40 CFR Part 61, Subpart V defines "in liquid service" rather than differentiating between "in light liquid service" and "in heavy liquid service." In liquid service means that a piece of equipment is not in gas/vapor service. The HON also uses this definition of "in liquid service."

A summary of components and type of service designations covered by the Federal equipment leak regulations is presented in Table 2.2.

2.3.2 Guidance to Determine if Correct Service is Identified

As is the case with rule applicability, determination of type of service is the responsibility of the regulated facility. The regulations require that documentation of type of service determination be maintained by the facility. If an inspector questions a facility's classification, a review of the records which address how the type of service classification was made would be the first step.

An inspector may also be able to review process and material balance data to determine if type of service classifications are appropriate. As a final course of action, an inspection may collect a sample of the process material in question and apply the analysis specified by the applicable rule.

TABLE 2.2
SUMMARY OF EQUIPMENT LEAK COMPONENTS COVERED

COMPONENT	40 CFR Part 60, Subpart VV	40 CFR Part 61, Subparts J and V	40 CFR Part 63, Subparts H and I	40 CFR Part 264, Subpart BB 40 CFR Part 265, Subpart BB
Valves, gas/vapor service	60.482-7	in VHAP service 61.242-7	63.168	264.1057 265.1057
Valves, light liquid service	60.482-7		63.168	264.1057 265.1057
Valves, heavy liquid service	60.482-8		63.169	264.1058 265.1058
Pumps, light liquid service	60.482-2	in VHAP service 61.242-2	63.163	264.1052 265.1052
Pumps, heavy liquid service	60.482-8		63.169	264.1058 265.1058
Pressure relief devices, gas/vapor service	60.482-4	61.242-4	63.165	264.1054 265.1054
Pressure relief devices, light liquid service	60.482-8	in liquid service 61.242-8	in liquid service 63.169	264.1058 265.1058
Pressure relief devices, heavy liquid service	60.482-8			264.1058 265.1058
Compressors	60.482-3	61.242-3	63.164	264.1058 265.1053
Sampling connection systems	60.482-5	61.242-5	63.166	264.1055 265.1055
Open-ended valves or lines	60.482-6	61.242-6	63.167	264.1056 265.1056
Flanges and other connectors (all services)	60.482-8	61.242-8	NA	264.1058 265.1058
Connectors in gas/vapor service	NA	NA	63.174	NA
Connectors in light liquid service	NA	NA	63.174	NA
Connectors in heavy liquid service	NA	NA	63.169	NA
Closed-vent systems and devices	60.482-10	61.242-11	63.172	264.1060 265.1060
Agitators in gas/vapor service	NA	NA	63.173	NA

TABLE 2.2
SUMMARY OF EQUIPMENT LEAK COMPONENTS COVERED

COMPONENT	40 CFR Part 60, Subpart VV	40 CFR Part 61, Subparts J and V	40 CFR Part 63, Subparts H and I	40 CFR Part 264, Subpart BB 40 CFR Part 265, Subpart BB
Agitators in light liquid service	NA	NA	63.173	NA
Agitators in heavy liquid service	NA	NA	63.169	NA
Instrumentation systems	NA	NA	63.169	NA
Product accumulator vessels	NA	61.242-9	NA	NA
Surge control vessels	NA	NA	63.170	NA
Bottoms receivers	NA	NA	63.170	NA

NA - not applicable

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CHAPTER 3

COMPLIANCE/INSPECTION THROUGH REPORTS AND RECORDKEEPING

It is extremely important that an inspector be thoroughly familiar with the reporting and recordkeeping requirements of the regulations. With the exception of RCRA, all of the equipment leak standards addressed by this manual stipulate that compliance with the applicable standards will be determined by review of required records, by review of performance test results, and by inspections. The NSPS and HON also reference reports as a basis for compliance demonstration. Parts 264 and 265 both specify recordkeeping requirements, and Part 264 requires reports if leak repairs are not completed on schedule or if control devices deviate from their operational standards for more than 24 hours. Review of reports and records is also a critical component in the conduct of effective on-site inspections.

This chapter first addresses the content of required reports for the NSPS, NESHAP and HON and discusses their review for the purposes of compliance determination. Recordkeeping requirements of the NSPS, NESHAP, HON, and RCRA regulations are then addressed, with a concluding discussion of recordkeeping compliance reviews. The chapter concludes with additional discussion of strategies an inspector can use to supplement the review of records and reports. Chapter 4 addresses the role of records and reports as a resource for on-site inspections.

3.1 REPORTS

3.1.1 <u>40 CFR Part 60, Subpart VV</u>

Facilities subject to Subpart VV are required to submit reports both under the general provisions, which are applicable to all NSPSs unless the specific subpart says otherwise, and under Subpart VV. The following paragraphs identify the various reports required and the information each is to contain. Failure to submit the required reports on time and with the required information may be grounds for non-compliance.

The NSPS General Provisions (40 CFR Part 60, Subpart A, §60.7) mandate that any owner or operator subject to a NSPS must provide written notification of the date of construction or reconstruction within 30 days after work begins. In addition to the construction or reconstruction notification, the general provisions require the following:

- A notification of the anticipated date of initial startup of an affected facility postmarked between 30 and 60 days before the startup date.

- A notification of the actual date of initial startup of an effective facility within 15 days after startup.

- A notification of any physical or operational change to an existing facility that may increase the emission rate of any pollutant to which a standard applies, unless that change is specifically exempted. This notice shall be postmarked 60 days, or as soon as practicable, before the change.

3.1.1.1 Initial Reports

Under Subpart VV facilities are required to submit semiannual reports beginning six months after the initial startup date and every six months thereafter. The initial report must include an identification of the process unit, the number of valves in gas/vapor service or light liquid service, the number of pumps in light liquid service, and the number of compressors. Valves, pumps, and compressors that are designated as having no detectable emissions should not be included in the totals listed in the initial report.

3.1.1.2 Semiannual Reports

Semiannual reports are required beginning six months after the initial report and each six months thereafter. These reports contain information on the results of LDAR programs. The information required in these reports begins with the process unit identification, which should correspond with the identification in the initial report. The semiannual report must document, on a monthly basis, the total number of detected leaks and the number of this total that were not repaired in the required 15-day period. In each instance where a repair is delayed, the report is to explain the delay. If the reason for the delay is that it could not be repaired until a process unit shutdown, then the report is to indicate why a process unit shutdown was technically infeasible during the reporting period. The report shall then show the dates during the reporting period when process unit shutdowns occurred. In addition, any revisions to items reported in the initial report are to be described and discussed. The format of reports is not specified in the regulations, and a number of variations are acceptable.

3.1.1.3 Other Reporting Requirements

Other reporting requirements contained in the NSPS regulations include two alternative standards for valves: the allowable percentage of valves leaking, and the skip-period LDAR program. If an owner or operator elects to comply with either of these alternative standards, a notification must be provided 90 days before implementing the provisions.

40 CFR Part 60 also requires the owner or operator to submit a written report of the results of any performance test to EPA. Performance tests are required for no detectable emissions equipment and valves complying with an alternative standard. They also may be required for closed-vent systems, control devices, and equivalent means of emission limitation. Information must be made available to EPA as necessary to determine the operating conditions during the performance tests. In addition, Subpart VV requires that the owner or operator notify the Administrator of the schedule for the initial performance tests at least 30 days before conducting them.

3.1.2 40 CFR Part 61

40 CFR Part 61, Subparts J and V require submission of an initial statement and semiannual reports.

3.1.2.1 Initial Reports

The initial report must contain two portions: a written assertion stating that the company will implement the standards and the testing, recordkeeping, and reporting requirements contained in the applicable NESHAP; and information on the equipment subject to the regulation, including equipment identification (ID) numbers, process unit IDs for each source, and a description of the type of equipment (e.g., a pump or a pipeline valve). Also, the percent by weight of VHAPs in the fluid being handled by the equipment and the state of the fluid (i.e., gas/vapor or liquid) must be included. Finally, the initial report must contain a description of the chosen method of compliance and a schedule for subsequent semiannual reports. The source must abide by this schedule unless it is amended in subsequent semiannual reports.

All facilities in existence on the effective date of any NESHAP were required to submit an initial report. Therefore, all existing facilities subject to the above-referenced standards should have already submitted an initial report. All new plants are required to submit an initial report with the application for approval of construction, as required by the general provisions of Part 61 (NESHAP).

3.1.2.2 Semiannual Reports

Six months after the initial report, and every six months thereafter, the facility must submit a semiannual report. These semiannual reports are for NESHAP compliance and are similar to the required NSPS semiannual reports. They must provide process unit IDs for regulated equipment and, on a monthly basis for each process unit, the number of valves, compressors, and pumps that were detected leaking. Of those valves, compressors, and pumps that were detected leaking, the number that were not repaired within 15 days is to be reported, along with an explanation of why a repair was delayed. If the reason for the delay was that a process unit shutdown is needed before repair, then an explanation must be given why a process unit shutdown was infeasible.

The report also must include the dates of all process unit shutdowns during the six-month reporting period and a discussion of any revisions to the initial report or subsequent revisions to the initial report. The regulations do not specify the format of the reports; they only specify minimum content requirements. Each facility develops and uses its own format.

These standards allow the designation of equipment subject to a no detectable emissions limit rather than an LDAR standard, an alternative standard based on the allowable percentage of valves leaking, and an alternative skip-period LDAR program. All three of these as well as closed-vent systems and control devices require performance tests. If a performance test was conducted within the six-month reporting period, then the results of the test also must be included in the semiannual report.

3.1.2.3 Other Reporting Requirements

An owner or operator of a facility electing to comply with either of the alternative standards for valves (i.e., the allowable percentage of valves leaking or the skip-period LDAR program), must provide notification 90 days before implementation of either of these programs.

Certain circumstances described in the regulations do not require an application for approval of construction/modification. These circumstances are: (1) a new source complies with the standards, (2) a new source is not part of the construction of a process unit, or (3) all information required in the initial report is contained in the next semiannual report.

3.1.3 40 CFR Part 63, Subparts H and I

Existing facilities subject to the HON standards are required to submit an initial notification that describes the source and the chemical manufacturing processes subject to the standards. New sources (if the start-up date is 90 days or more after the promulgation date) are required to submit an application for approval of construction or reconstruction in lieu of the initial notification. All sources are required to submit a Notification of Compliance Status within 90 days of the applicable compliance date. This notification describes how the source will maintain compliance with the standard. Finally, periodic reports are to be submitted semiannually beginning six months after the Notification of Compliance Status. Reports can be submitted on electronic media where acceptable to the regulating agency and the owner/operator of the source.

3.1.3.1 Initial Notification

The initial notification required of existing sources is due within 120 days of the date of promulgation of the applicable standard (April 22, 1994, for Subparts H and I). It is to include the name and address of the owner or operator, the address (physical location) of the affected source, identification of the chemical manufacturing processes subject to the subpart, and a statement of whether the source can achieve compliance by the applicable compliance date. The application for approval of construction or reconstruction submitted by new sources is to contain the same information as required for the initial notification.

3.1.3.2 Notification of Compliance Status

The Notification of Compliance Status is due within 90 days of the applicable compliance date (Subpart H has five dates, see Chapter 1) for existing sources. New sources, which are required to comply with Phase II of the HON upon initial startup, would include the equivalent compliance status information in their application. The Notification of Compliance Status requires the following information for each process unit subject to the standards:

- Process unit identification

- Number of each equipment type (e.g., valves, pumps) excluding equipment in vacuum service

- Method of compliance with the standard (e.g., "monthly LDAR" or "equipped with dual mechanical seals")

- A planned schedule for each phase of the requirements applicable to pumps in light liquid service and valves in gas/vapor or light liquid service.

If a source elects to use pressure testing of batch product process equipment to demonstrate compliance, the notification report is to include the batch products or product codes subject to this option and the planned schedule for pressure testing of the equipment when it is configured for such production. The notification shall identify each enclosed-vented process unit and describe the negative pressure system and control device used.

3.1.3.3 Periodic Report

The periodic reports are to be submitted semiannually and are to convey the following information for each process unit for each monitoring period during the six-month period reported:

- The number (by type) of valves, pumps, compressors, agitators, connectors, and screwed connectors that were detected leaking and the number for which leaks were not repaired as required in the standard.

- The total number (by type) of valves, pumps, connectors, and screwed connectors monitored and the percent of the total found leaking.

- The number of unrepaired valves and the number of unrepaired connectors that are determined non-reparable.

- The facts that explain any delay of repairs and, where appropriate, why a process unit shutdown was technically infeasible.

- The results of all monitoring of pressure relief devices, closed-vent systems, and any compressors designated to operate at less than 500 ppm.

- If applicable, implementation of a monthly monitoring program for valves, a quality improvement program for valves or pumps, or a change in connector monitoring alternatives.

If the source has elected to use pressure testing to demonstrate compliance for batch process equipment, the report shall also include:

- Batch product process equipment train identification.

- The number of pressure tests conducted and the number of tests where the equipment train failed the test.

- The facts that explain any delay of repairs.

- The results of all monitoring to determine compliance with standards for closed-vent systems and control devices.

3.1.4 40 CFR Parts 264 and 265, Subpart BB

TSDF facilities to which Part 264 applies are not required to submit an initial report and are required to submit a semiannual report only under certain conditions. These conditions refer to failure to repair leaking equipment on schedule or failure to correct a control device which exceeds or operates outside of design specifications. If a report is required, it shall identify the facility and provide the dates of hazardous waste management unit shutdowns that occurred during the preceding semiannual reporting period. For each month during the semiannual reporting period, the TSDF is required to report: (1) the ID number of each valve, pump, or compressor for which a leak was not repaired or required, and 2) the date, duration and cause of any control device exceedance, and any corrective measures taken.

40 CFR Part 265, Subpart BB contains no reporting requirements.

3.1.5 <u>Reviewing Reports</u>

Although reports are the primary mechanism by which a facility documents compliance with the equipment leak rules, they are of limited value to the inspector as a means of identifying specific violations or of substantiating noncompliance. From a regulatory point of view, review of reports can only substantiate noncompliance on the basis of:

- Failure to submit a report
- Late submittals
- Missing or incomplete report content
- Self-reported violations

For purposes of determining compliance, the primary focus of an inspector's review of reports should be on the issue of report completeness. Other issues (accuracy, equipment classification, monitoring performance, etc.) require some further interaction with the review of records and/or on-site inspections.

During the first year or two of developing an equipment leak program at a regulated facility, it is possible that a facility may overlook or be unaware of some reporting requirements. Equipment subject to partial exemptions or non-routine reporting schedules may be the most likely to be overlooked. However, once a facility has submitted a report that the Agency accepts as complete, the facility is unlikely to regress from this established standard. Subsequent violations of reporting requirements are most likely to be associated with changes in the process, e.g., failure to add/delete equipment as a result of maintenance or process modifications.

A report may contain "self-reported" violations such as failure to attempt equipment repair within schedule or during process shutdown. An inspector should, of course, review each report carefully and note such "self-reported" violations for follow-up. In many cases, these events prove to be recordkeeping or reporting errors rather than true violations. For example, transcription errors may occur between records and reports (e.g., a valve is monitored as leaking at 1,500 ppm but is transcribed to a report at 15,000 ppm), or a maintenance crew may forget to submit repair invoices. By routinely following up on such questions, an inspector will help the facility to recognize inadequacies in its equipment leak compliance program and such reporting errors should decline.

Many facilities employ sophisticated monitoring systems and databases to minimize both the labor hours and opportunities for clerical errors associated with large scale monitoring systems. Monitoring equipment can be equipped with a data logger containing the sequential ID numbers for all equipment within a process area. At each monitoring point, the data logger automatically records the highest instrument reading obtained at that point. This data can then be downloaded to a database that contains: (1) all the relevant information for each piece of equipment, and (2) a report generator which automatically prepares the appropriate report for each process area.

Sophisticated systems can also generate erroneous reports, as a result of lack of foresight in their preparation or due to a lack of human attention to the system. As an example, some data logging systems employ a default value of zero or carry forward the reading from the previous monitoring. As a result, these systems may report a numerical reading for a piece of equipment, even if that equipment was not monitored. Conversely, these systems may not be able to record readings from new equipment until the equipment data has been entered into the database.

Ultimately, the best strategy for effective review of reports by an inspector is developed familiarity. This includes familiarity with the recordkeeping and reporting requirements of the rules, and familiarity with how the regulated facility is performing its monitoring, data management, leak repair, and reporting programs. By developing such detailed knowledge about a specific facility, an inspector will be better prepared to interpret and understand that facility's reports. This developed familiarity requires an ongoing balance of effort which includes on-site inspection and review of records.

3.2 RECORDKEEPING

3.2.1 Part 60 Subpart VV and Part 61 Subpart V & J

All of the equipment leak regulations require the maintenance of extensive, detailed records that can be readily accessed at the plant site. Specific records that are required include:

- A list of ID numbers for all equipment subject to the requirements (except for welded fittings or connectors under some rules).

- A list of equipment ID numbers for equipment designated for "no detectable emissions" or complying with the less than 500 ppm above background standard. The no detectable emissions designation must be signed by the owner or operator and requires an annual compliance test and a record of the date of the compliance test, the background level measured, and the maximum instrument reading measured at the equipment.

- A list of equipment ID numbers for pressure relief devices required to comply with the standards for pressure relief devices in gas/vapor service.

- A list of ID numbers for equipment in vacuum service.

If a closed-vent system and a control device are used to control fugitive emissions, the records for this equipment must include:

- Detailed schematics, design specifications, and piping and instrumentation diagrams.

- Dates and descriptions of any changes in the design specifications.

- A description of the parameter(s) monitored to ensure that a control device is operated and maintained in conformance with the design, and an explanation of why that parameter was selected for monitoring.

- Periods when the closed-vent systems and control devices are not operated as designed, including periods when a flare pilot light does not have a flame.

- Dates of start-ups and shutdowns of the closed-vent systems and control devices.

A dual mechanical seal system that includes a barrier fluid system is an alternative for reducing emissions from pumps and compressors. If a dual mechanical seal system with a barrier fluid system is used, the following information must be recorded: (1) the design criteria that indicates failure of the seal system, the barrier fluid system, or both; (2) an explanation of the choice of this design criteria; and (3) documentation of any changes to the criteria and the reasons for the changes.

The records also must contain a list of ID numbers for valves that are designated as "unsafe to monitor," an explanation for this designation, and the plan for monitoring each valve. The same records are required for valves designated as "difficult to monitor." For valves complying with the skip-period provisions, a schedule of monitoring and a record of the percent of valves found leaking during each monitoring period must be kept on file.

Certain criteria allow a facility to be exempted from the requirements (see Chapter 2). If a facility claims an exemption, then it must maintain a log that contains information, data, and analyses to support its exemption declaration. For example, 40 CFR 63 Subparts V & J stipulate that the following information shall be recorded: (1) an analysis demonstrating the design capacity of the process unit, and (2) an analysis demonstrating that equipment is not in VHAP service.

For each compliance monitoring test conducted, a record of results must be retained. This includes the monthly leak monitoring for pumps and valves, as well as the annual no detectable emissions monitoring for pumps, compressors, valves, and closed-vent systems. Any monitoring for alternative standards also must be documented.

Other non-periodic circumstances require compliance monitoring. A pressure relief device must be monitored within five calendar days after a pressure release to confirm that no emissions are detectable. If a pump or valve in heavy liquid service, flange, or other connector is suspected of leaking, this equipment must be monitored within five days. If a leak is detected and repair is attempted, the component must be monitored to determine if the repair attempt was successful. Records must be kept of the findings of all such monitoring tests. If a leak is detected, the equipment must be identified as a leaking component by attaching an ID tag to the leaking equipment. The tag must be weatherproof and readily visible. A tag may be removed after the equipment has been repaired and retested successfully. The tag may be removed from a valve, however, only after it has been repaired and monitored for two successive months with no detected leak.

When leaks are detected, records on each leak must be kept and maintained for two years. For each detected leak, the equipment ID number, the instrument and operator ID numbers, and the date the leak was detected must be recorded. The date of each repair attempt and an explanation of each method applied should be recorded. If the leak is corrected, then the date of successful repair should be entered in the log. If the repair is unsuccessful, the operator should record that the maximum instrument reading of the monitoring after the respective repair was above the applicable leak limit.

If a leak is not repaired within 15 calendar days of being detected, "repair delayed" should be entered in the log, and the reason for the delay should be discussed. If the reason for the delay is that the repair could not be attempted until a process shutdown, then the person who made the decision to delay repair must sign the log. If process unit shutdowns occurred while the leak remained unrepaired, the dates of these shutdowns also must be recorded. Finally, the expected date of successful repair of the leak should be entered for these delinquent leaks.

3.2.2 Recordkeeping for the HON

The HON incorporates virtually all of the recordkeeping requirements of the NSPS and NESHAP standards, with significant additions and extensions. For example, all equipment ID numbers are required to identify the process area in which the equipment is located. Additional equipment addressed by the HON includes agitators, product accumulator vessels, and bottoms receivers equipped with closed-vent and control systems, pressure release devices equipped with upstream rupture disks, instrumentation systems, batch process equipment, enclosed-unit processes, and equipment in HAP service less than 300 hours per year. Substantial new recordkeeping requirements are associated with equipment in a quality improvement program (QIP).

Connectors need not be identified individually, but the number of connectors in each process area are to be recorded. Screwed connectors are to be individually identified. Additionally, each connector which has been disturbed since the last monitoring is to be identified and the date and result of follow-up monitoring recorded.

The HON records require a monitoring schedule by process area for valves and connectors. Both valves and connectors that are designated as difficult to monitor, unsafe to monitor, or unsafe to repair are to be identified in the records. The records must also ID valves and connectors which have been removed from service and claimed for emission reduction credits.

Tagging of individual components within each process area is not required by the HON, so long as other identification requirements are met. Tagging and reporting requirements for leaking equipment are the same as the NESHAP regulations. For equipment which cannot be repaired within the applicable deadline, the HON allows written procedures for determining that such equipment qualifies for delay of repair status to be included in the records.

Visual inspections required by the HON are to be recorded. These are to include documentation that the inspection was conducted, the date of the inspection, and detailed records for leaking equipment identified in these inspections.

When a facility elects to periodically pressure test a batch process, each regulated product and the time in service for each product are to be recorded. Pressure test records are to include the date of each test and any visual observation of leaks. When equipment fails a pressure test, records are to be kept of each leak repair attempt, the date of each repair, the repair methods employed, and the reasons for any delay of repair.

Enclosed-vent process units and the HAPs they handle are required to be identified in the records. Enclosed-vent process units are enclosed in such a manner that all emissions from equipment leaks are vented through a closed vent system to a control device. The records are to include a schematic of the process unit, enclosure, and closed vent system and a description of the system used to create the negative pressure in the enclosure.

A QIP generally consists of information gathering, determining superior technologies, and replacing existing equipment with the superior technologies until the required base performance levels are achieved. The recordkeeping requirements basically stipulate dates and documentation of QIP activities. The Demonstration of Further Progress QIP for valves requires additional recordkeeping for monitoring and repair activities. The Technology Review and Improvement QIP for valves or pumps extends recordkeeping requirements to include: equipment construction and use data, process stream data, inspection of leaking valves removed from service or of pumps that leak frequently, and analysis of equipment performance based on these records.

3.2.3 RCRA Recordkeeping Requirements

The RCRA equipment leak standards stipulate that records be maintained in the facility operating record or in a log maintained in the facility operating record. The following information is to be maintained for each piece of equipment to which Subpart BB applies:

- Equipment ID number and hazardous waste management unit identification.

- Approximate location within the facility.

- Type of equipment (e.g. pump or pipeline valve).

- Percent-by-weight total organics in the hazardous waste stream at the equipment.

- Physical state of hazardous waste at the equipment (e.g., gas/vapor or liquid).

- Method of compliance with the standard.

- A list of ID numbers for all subject equipment.

- A list of ID numbers for equipment designated for "no detectible emissions," with signature of the owner or operator.

- A list of ID numbers for pressure relief devices subject to the standard.

- For each compliance test required by the standards, the date, the background level, and the maximum instrument reading measured at the equipment.

For each leak detected in the compliance tests, the following information is to be recorded in a log and maintained for three years:

- The instrument, operator, and equipment ID numbers.

- The date evidence of a potential leak was found.

- The date the leak was detected and the dates of each repair attempt.

- Repair methods applied in each attempted repair.

- "Above 10,000" if the instrument reading following a repair attempt exceeds 10,000 ppm.

- "Repair delayed" and the reason if a leak is not repaired within 15 days of discovery.

- Delay of repair documentation for applicable valves.

- Owner or operator signature when repairs cannot be effected without a unit shutdown.

- The expected date of repair for leaks not repaired within 15 days.

- The date of successful repair.

The records are to include design documentation and monitoring, operating, and inspection information for each closed vent system and control device. In addition, a performance test plan and documentation of performance test results are required when test data is used to demonstrate control device performance. Control devices not otherwise identified in the regulations are also required to record monitoring and inspection information indicating proper operation and maintenance of the control device.

A list of valves designated as unsafe to monitor and a list of valves designated as difficult to monitor are to be maintained. Each list is to include an explanation of the designation and a plan for monitoring each valve. Recorded information for other valves must include (1) a schedule of monitoring and (2) the percent of valves found leaking during each monitoring period.

The following information is to be maintained in a log for determination of applicable exemptions: (1) analysis determining the design capacity of the hazardous waste management unit, (2) a statement listing the hazardous waste influent/effluent to each unit and an analysis determining whether these hazardous wastes are heavy liquids, and (3) up-to-date analysis, supporting information, and data used to determine applicability of the standards.

3.2.4 Reviewing Records

When reviewing equipment leak records, it is important to keep in mind the primary purpose of the records, which is verification of the information in the reports and documentation of other elements of program performance such as performance of monitoring, adherence to repair schedules, documentation of visual inspections, etc. Review of records should be guided by the inspector's prior review of the reports and should focus on using the records to (1) confirm the accuracy and content of the reports and (2) determine that recordkeeping requirements of the applicable standard are complied with.

Specifically, records should be investigated to confirm that all components are indicated as being monitored as reported and to confirm the number of reported leaks. Additionally, such information should be compared with the inventories of total components by type of service as recorded in the initial report for each facility. There will normally be some fluctuation in the total number of components inspected during each monitoring period due to a variety of factors such as leak/repair status and equipment retired from or added to a process. A detailed review of the records may be necessary to resolve all of the apparent anomalies in process areas with a large number of components or where substantial modifications are underway. Failure to record and report such changes may result in a violation of the standards.

Records should also be reviewed to confirm the performance of repairs and follow-up monitoring on all reported leaks. For example, if a valve was reported leaking, check if the records confirm the following: (1) a first attempt to repair within five days, (2) completion of repair within 15 days, and (3) monthly monitoring for two months before return to quarterly monitoring. If the valve was not repaired but was scheduled for repair at the next shutdown, was this an appropriate classification (i.e. is the explanation/documentation of the classification reasonable and signed by the proper official)? The complete list of components scheduled for repair at the next shutdown should be reviewed to determine the appropriateness of this classification.

As is the case with reports, only a limited number of specific violations can be identified and confirmed solely through a review of records. Establishing such a violation is primarily a process of identifying something which is missing. Facilities are in direct noncompliance under the following situations:

- Failure to record leaks and dates of repairs,
- Failure to record the reason for delaying repair of leaks past an allotted time frame,
- Failure to develop a schedule to observe visual emissions from flares,
- Failure to perform emission testing for control devices (except in the case of flares), and
- Failure to record periods when the control device is not operating.

Finally, each facility will develop and implement its own form of recordkeeping. The variety and inconsistency of recordkeeping formats from one facility to another is a problem which an inspector has little opportunity to influence or correct. For example, the availability and utility of work orders to support recordkeeping or to confirm/resolve errors and oversights will vary from facility to facility. To be effective, an inspector needs to develop a degree of familiarity with the data collection and management system of each facility in his or her area of responsibility.

3.3 STRATEGIES FOR REVIEWING REPORTS AND RECORDS

As has been previously discussed, the report and recordkeeping requirements of the equipment leak regulation do not provide enough information for an inspector to make a complete determination of compliance. The report and recordkeeping review activities provide the basis for determining whether a facility is in compliance with the report and recordkeeping requirements and provide the informational basis for more in depth inspection activities. Strategies available to the inspector to improve the effectiveness of both functions include (1) requesting additional information and 2) coordinating the review process with on-site inspections to reinforce the determination of compliance.

An inspector can generally request that a facility provide any records specified by the equipment leak regulations in the form of a supplementary report. A thorough understanding of the records required by the standards and the data management systems of the individual facilities will enable an inspector to request additional information in a format that is reasonable for the facility to comply with and useful to the inspector's objectives. Other information not specifically referenced in the regulations may also be available to the inspector. Process flow diagrams and/or schematics of individual process areas can be particularly useful as a means of orienting oneself prior to a site visit, reviewing the appropriateness of various equipment designations (e.g., type of service, dangerous to monitor), and for cross-referencing data from various records sources. Work repair orders and/or repair invoices are another source of potentially useful information, especially when it is necessary to reconcile apparent gaps or oversights in the records.

Required reports and supplementary information provided by the facility are useful means of preparing for on-site inspections. In addition, information collected on-site or requested during a site visit can be used for follow-up review and evaluation of compliance status. Collecting or requesting information for review after completion of a site visit allows the inspector to make more efficient use of available time while on-site. Such information can be used to supplement and/or document inspection field notes and observations. Additionally, such information can be compared with the initial review of semiannual reports to resolve any lingering questions.

CHAPTER 4

COMPLIANCE/ASSESSMENT THROUGH ON-SITE INSPECTIONS

On-site inspections are a critical component in evaluating compliance with the leak detection rules and evaluating the effectiveness of facility LDAR monitoring activities. Due to the complexity of the standards and the large numbers of emission points at a typical facility, it is imperative that an inspection be conducted in a systematic fashion. An inspector may choose to use a portable VOC analyzer to conduct direct leak checks of regulated equipment, but it is also possible to conduct a compliance inspection without the use of such equipment. The first portion of this chapter addresses the conduct of a walk-through inspection without an analyzer; the second portion addresses the conduct of inspections with the direct monitoring of regulated equipment.

Equipment leak inspections encompass a broad range of potential activities. The specific content and organization of inspections will vary according to the priorities or objectives of the inspector and/or policies of the agency. For example, it may be necessary to devote an entire inspection to on-site interviews and examination of records addressing the appropriate classification of equipment. Short, follow-up inspections may be combined with other on-site activities. This chapter uses a simplified inspection format to illustrate the important elements of organizing and conducting inspections.

4.1 WALK-THROUGH INSPECTIONS

A complete equipment leak inspection program includes pre-inspection activities, on-site activities, and post-inspection review and reports. The pre-inspection activities help the inspector become familiar with the facility, contributes to the selection of specific process areas or components to be inspected, and may determine the actual timing of the inspection. On-site activities include review of records, interviews with plant personnel, inspection of regulated equipment, and observation of monitoring procedures. Post-inspection activities include additional review of records and other information, preparation of the inspection report, and establishing the foundation for subsequent inspections.

4.1.1 Pre-Inspection Activities

The purpose of pre-inspection activities is for the inspector to develop a general understanding of the plant under investigation, the processes employed, and products produced. Additionally, the inspector should be familiar with the applicable regulations and understand what types of information are required to determine compliance prior to the on-site inspection. Good preparation helps to select those units suspected or detected as being compliance problems, determine the appropriate timing of the inspection, and improve an inspector's efficiency while on-site. **Caution: While it is meaningful to gain an impression of the overall situation through these pre-inspection activities, it is equally important than an inspector not prejudge a facility based only on the preliminary information. Compliance determination should be finalized only after the on-site inspection and follow-up activities are completed.**

It is important that the inspector keep detailed records for each inspection. An inspection notebook should be started during the pre-inspection time period so that all information is contained in a central location for the entire inspection. Since the notebook may be used to form the premise of the inspector's report and as evidence in legal proceedings, it is critical that the inspector substantiate the facts with tangible evidence such as pertinent observations, photographs, copies of documents, descriptions of procedures, unusual conditions, problems and statements from facility personnel.

4.1.1.1 Report Reviews and Other Information Sources

Sources subject to the various equipment leak standards are required to submit a preliminary notification and/or initial report which provides general facility information, process unit information, and the inventory of all subject equipment with details of individual components. These initial documents should be evaluated for completeness, as discussed in the preceding chapter. If any aspect of the initial documents are incomplete, the inspector should record this in the inspection notebook.

Each of the regulations also require the submission of semiannual or periodic reports. The inspector should evaluate the most recent of these reports for completeness and compliance with the requirements. Additionally, these reports should be compared with each other and with the initial reports to determine the consistency of information. Any inconsistencies or omissions of required information should be recorded in the inspection notebook.

Following the review and evaluation of these reports, the inspector should review previous inspection reports and related documentation such as field notes, post-inspection correspondence, and violation notices. These will identify previous deficiencies and related issues, may record the estimated schedule of additions or reconstructions the facility is planning to implement, and may record specific actions the facility has committed to with respect to improving its compliance with the equipment leak regulations.

The omissions, inconsistencies, unclear information, or question areas identified by the above review should be noted in the inspection notebook. A complete and well organized list of questions should be developed from these notations so that plant personnel can be questioned or plant records checked during the inspection. Inconsistencies by themselves are not uncommon and do not necessarily indicate violations. They may indicate poor implementation of recordkeeping and reporting which can be corrected at the facility without the issuance of formal citations.

In the case of new regulations (e.g., the HON in 1995/96) or new plant construction, the only source of information specific to the equipment leak programs may be the initial report. In such cases, the inspector should examine agency files to determine if other process areas at the facility have been previously regulated under other equipment leak rules. If so, these reports may provide some background about the facility's familiarity and performance with respect to equipment leak regulations. Agency files should also be examined to obtain other compliance information, correspondence, complaints, etc. regarding the facility. Other types of permits and reports, such as those for other air regulations, wastewater, hazardous waste, or toxic substance permits, should also be reviewed. A good example is TRI reports, submitted pursuant to EPCRA requirements. Information contained in the initial equipment leak reports should be compared with these other sources of information to assess the consistency between the details reported.

Other inspectors who are currently or formerly assigned to the facility in question should be interviewed for their experience and insight. For example, RCRA and air inspectors should perform cross-media reviews of each other’s inspection reports.

Finally, up-to-date schematics or flow charts of regulated process areas at the facility should be obtained to facilitate understanding of the physical site layout. A major problem that confronts the inspector is determining if equipment exists in the facility that is subject to the standard, but is not listed in the in-plant records and therefore is not being monitored and/or does not meet the equipment specifications. This may be the most difficult part of an inspection. One method of addressing this problem is to request a process unit material balance with a corresponding simplified flow diagram. This information could then be reviewed in detail to determine if there appears to be equipment which should be listed and is not. If such areas exist, then the on-site inspection or follow-up inspection should address this issue.

4.1.1.2 Inspection Timing and Scope

An additional consideration during pre-inspection preparations should be the nature of the inspection itself. Does the purpose of the inspection require an unannounced visit or is some degree of notification acceptable? While it is desirable to maintain some degree of flexibility as to the specific plant areas and records you will examine while on-site, it is also necessary to allow key plant personnel an opportunity to rearrange their activities to accommodate the inspection. The inspection involves the review of many records and interviews with key company officials. Additionally, plant personnel should be available to accompany the inspector during the facility walk-through and to answer the inspector's questions.

If you plan to examine leak monitoring activities of plant personnel or their outside contractors, obtain their current monitoring schedule. You need to ensure that routine monitoring activities will be conducted during your visit, and you may want to select an inspection date which coincides with monitoring of specific process areas.

Another aspect of inspection preparation involves making an assessment of what can be accomplished within the time available to conduct the inspection. To make the best use of limited time and resources, it is often useful to structure the inspection on the basis of what can be accomplished within one full day.

For the inspection program discussed in this section, an initial interview with plant officials and the site walk-through can be accomplished during the morning, with the afternoon devoted to review of records and a final interview addressing any questions or observations resulting from the inspection. It may be necessary to review some of the records prior to conducting the site walk-through, especially if the records are needed to identify specific equipment to be inspected. In general, the site walk-through should be completed before reviewing the records in detail to assure that enough time is available for the walk-through. If the record review cannot be completed on-site, copies can generally be taken back to the office.

It is useful to become familiar with the normal workday schedule at each plant and to schedule your inspection accordingly. For example, the equipment leak monitoring personnel may work an early shift (e.g., 6 am to 3 pm) so that maintenance personnel can conduct same-day equipment repairs on a later shift. At a small facility which employs a contract monitoring service, monitoring personnel may only be available one or two days per week or during alternating weeks. It is generally difficult to obtain useful observations or interviews if you schedule a process area walk-through during the lunch break. More importantly, if you are flexible in the scheduling of inspection activities, plant personnel may be more relaxed and responsive to your inquiries.

4.1.1.3 Health and Safety Planning

A critical aspect of pre-inspection planning includes efforts to ensure that personnel safety measures are in place. Contaminants of concern identified during the preliminary review of the facility should be reviewed for exposure impacts, via dermal or inhalation pathways, to ensure appropriate personnel safety gear is donned for the inspection. Further, if potential risks exist, the inspector should wear a modified level C and be able to don a respirator if monitoring equipment indicates levels in the breathing zone exceed acceptable levels. Finally, when you schedule an inspection, review with company officials what safety equipment is needed and what, if any, safety equipment the company will provide.

4.1.2 On-Site Inspection

When you arrive at the facility, notice if there are any strong odors or visible emissions. If there is a visible emission or strong odor, make sure it is thoroughly documented before entering the facility. Try to find out the cause of the visible emissions or odor after you have introduced yourself.

4.1.2.1 Initial Interview

Once the inspector has identified himself or herself and has been granted entry to the facility, the initial interview should be conducted. The objective of the interview is to inform the facility officials of the purpose of the inspection, the authority under which it will be conducted, the procedures to be followed, and your agenda for the day of the inspection.

Discussion of the agenda should include an explanation of how you plan to perform the inspection and should address any adjustments to your schedule necessitated by plant operating schedules and conditions. With regard to leak monitoring activities, it is probably best to observe calibration and monitoring procedures as they are scheduled for that day, rather than to observe a possibly rehearsed demonstration of these activities. Final specification of the records you wish to inspect should be made at this time, along with agreement as to when they will be available and where you can review them.

An important component of the inspection involves the evaluation of how well company officials understand the applicable regulations and how effectively they are acting to achieve compliance. The inspector should have key plant officials explain the compliance program of the facility: including a general discussion of problems/solutions, plant quality assurance procedures, and compliance program goals of the plant. With regard to the inspection agenda for the day, the inspector should verify that the sources are subject to the standard and should ask for a description of the process areas, principal products, and location of major emission points.

Before proceeding into the process areas, the inspector should review plant safety procedures and confirm that all appropriate safety equipment is available. Finally, plant officials should be advised of their right to request confidential treatment of trade secret information. Company officials may review the inspection notes at the end of the inspection and mark trade information confidential.

4.1.2.2 Leak Monitoring Activities

A key element of the facility inspection involves evaluation of the leak monitoring program. This activity may include: interviewing monitoring personnel, observing the calibration of leak detection equipment, and observing facility personnel perform leak detection monitoring and spot checking of equipment sources for leaks.

Some facilities conduct monitoring with their own personnel, while others employ an outside contractor to perform the leak monitoring. If in-house personnel conduct the monitoring, an inspector may want to review the training and resources provided to the employees. If an outside contractor is employed, the inspector should determine if the facility employs any oversight or quality assurance procedures to evaluate the performance of the contractor. Other pertinent items include: how monitoring personnel report leaks, how repairs are scheduled, and how follow-up monitoring is scheduled for repaired equipment.

The competency of the personnel who conduct the monitoring may be evaluated both through observation and direct interviewing. The inspector should discuss the plant procedures and schedules for monitoring, the recording of monitoring results, general information regarding the analyzers in use, requirements of Method 21, and any other areas the inspector determines to be of importance. These could include training received, task supervision, and ancillary duties performed by the leak monitoring personnel.

The leak detection equipment used to document facility compliance must be calibrated on a routine basis. The inspector should observe calibration procedures performed by the facility or contractor personnel who normally perform the routine monitoring. The calibration precision tests, response time, and response factor tests reveal whether the instruments are operating properly for the specific applications. The inspector should witness the calibration procedures and should note any deviations from the Method 21 procedures.

A number of other factors can be important such as: probe cleanliness, probe leakages, gas flow rates, improper warmup period, incorrect zero, or meter adjustment. If the meter readout cannot be adjusted to the proper value, a malfunction of the analyzer is indicated and corrective actions are necessary before using the analyzer. The inspector should verify that the correct calibration gases are used and that the gases are within the proper range. The inspector should record the instrument response time, response factors, and calibration precision tests.

After the calibration procedure is complete, the inspector should observe the plant personnel's or private contractor's technique in performing actual leak detection measurements. The plant personnel should be able to correctly monitor fugitive emissions from all the equipment types at the plant site. Additionally, the plant personnel should be able to correctly determine background concentrations. Any deviations from Method 21 procedures should be noted. Techniques for correctly monitoring certain equipment items are described in the following paragraphs. See Appendix E in Volume II for a more detailed discussion of monitoring techniques.

Fugitive leaks from valves occur primarily from the valve stem packing gland. The normal procedure is to circumscribe the valve stem with the probe held at the stem-packing interface. Maintaining such a close proximity to the stem is necessary in order to obtain accurate measurement because of the relatively poor capture effectiveness of the probe design. The presence of strong cross-draft wind further reduces the probe capture capability. For these reasons the proper placement of the probe is critical. It should be noted, however, that this monitoring requirement dictates that the inspector position himself or herself in the immediate vicinity of the leak because most probes are relatively short in length. **Caution: If the inspector detects unsafe conditions, he or she should stop observation and inform plant personnel. All involved parties should follow their organization's safety procedures.**

Certain monitoring procedures can be employed to minimize the risk of such exposure. Whenever feasible, equipment to be monitored should be approached from downwind. Concentrations of equipment in a sheltered area should be approached relatively slowly from a more open area. In both cases, use your sense of smell and visual observation of the instrument background reading as an early means of detecting elevated concentrations.

Fugitive emissions from pumps occur from the pump shaft seal used to isolate the process fluid from the atmosphere. Monitoring must be performed within one centimeter of the seal and the rotating shaft. **Caution: A rigid probe tip should not be used near the rotating shaft because it could break if the monitoring personnel were not able to hold the probe absolutely steady during the measurement.** A flexible tip is usually added to the end of the rigid probe when sampling pumps. If the housing configuration prevents a complete traverse of the shaft periphery, sample all accessible portions. Additional points on the pump or compressor housing where leaks could occur include flanges and other connections, and these should be sampled. Also, look for liquid leaks from the stuffing boxes of pumps.

Care must be exercised when monitoring sources, such as valves and pumps, that handle heavy liquid streams at high temperatures. Relatively nonvolatile organic compounds can condense in the probe and detector. Both the instrument response to the emissions and the instrument return to zero may be slowed due to the condensation of these compounds.

Fugitive leaks from flanges or other connectors typically occur at the flange or connector sealing interface. For all connections, the probe should be positioned at the outer edge of the flange-gasket interface, and monitoring should be conducted over the entire circumference of the flange.

In most cases, the configuration of pressure relief devices prevents sampling at the sealing interface. However, for those pressure relief devices equipped with an enclosed discharge pipe, extension, or horn, the sample probe inlet should be placed at the approximate center of the exhaust area relative to the atmosphere. Also, sample at any "weep hole" at the bottom of such devices.

Certain fugitive leak sources are subject to a "no detectable emission" regulation, i.e., the difference between the background organic vapor concentration and the concentration measured at the source should not be greater than 500 ppmv. The background concentration is determined by placing the probe one to two meters upwind of the source. If other equipment interferes with the background measurement, the upwind monitoring location can be as close as 25 centimeters.

Leak monitoring personnel should record the highest instrument reading obtained at each piece of equipment. For fugitive VOC sources that have a highly variable leak rate, the maximum sustained concentration or maximum repeated concentration observed should be recorded.

During observation of the leak monitoring, the inspector should note how well the monitoring personnel keep track of their monitoring equipment. While monitoring is underway, the probe tip should be routinely checked and cleaned out as necessary. Instrument background readings and return to zero rates should be monitored periodically. Also, note whether monitoring personnel are equipped with and using appropriate tags to mark leaking equipment.

Finally, note the number of equipment components and the number of leaks detected by the monitoring personnel. These can be used to calculate rough estimates of leak monitoring rates (i.e., valves per hour or total components per hour) and component leak rates (e.g., eight leaking valves out of 150 tested equals six percent leak rate). These rates can be compared to leak monitoring rates and component leak rates calculated from the records for the same or similar process areas. A large and consistently repeated difference between reported rates and observed rates may indicate that monitoring personnel are changing their procedures in some consistent fashion while being observed by the inspector.

In addition to observing the performance of routine monitoring, the inspector may wish to have the monitoring personnel spot-check a representative sample of equipment for leaks. This should be done by observing personnel perform leak detection monitoring on each type of equipment subject to the standard. The spot-checks should include:

- recently leaking devices;
- "no detectable emission" devices;
- exempt devices (verify compliance).

Finally, if a facility is using closed vent systems and control devices, ensure compliance with minimum temperature, residence time, efficiency and no detectable emissions requirements. If flares are being used, inspect for no visible emissions as determined by Reference Method 22.

4.1.2.3 Process Area Inspection

In addition to observing the leak monitoring program, an inspector should devote some time to observation of the process area itself and interviewing process personnel regarding their roles in the equipment leak program. By doing so, an inspector can determine compliance with observable requirements such as equipment tagging and gain a better understanding of the program implementation.

The degree to which process area personnel will be aware of and involved in the equipment leak program will vary from facility to facility. At a minimum, there should be a designated individual (process area chief or shift foreman) responsible for (1) documentation of visual inspections, (2) maintenance of on-site logs, and (3) coordination between leak monitoring and equipment maintenance. Other areas in which process personnel may be involved include (1) performance of first attempt at repair, (2) oversight or quality review of leak monitoring personnel, and (3) on-site responsibility for equipment markers and removable equipment (e.g., end caps or plugs).

Perhaps one of the most important areas to discuss with process personnel is the issue of coordination between leak monitoring and equipment maintenance personnel. Lack of communication between these groups is a significant source of errors and compliance problems. How well the facility understands these problems and the types of procedures undertaken to correct or prevent such oversights can reveal a lot about the development and effectiveness of a facility's equipment leak program.

Observation of the process area should include verification of component tagging, observation of end caps or plugs on open ended lines, inspection of sampling connection systems and equipment in vacuum service, and evaluation of the operation of various control devices.

Errors and oversights with respect to component tagging requirements are a common problem which can be directly observed by the inspector. All equipment that is scheduled for repair or to be monitored following repair must be clearly labeled. An inspector can use records and reports to develop a list of components that should be tagged and can then directly inspect those components to confirm the tags are being applied and maintained. For equipment that will not be repaired until the next process turnaround, the inspector can review the process equipment where the component is located to confirm that such repairs cannot be accomplished without a process shutdown.

Open-ended lines are frequently out of compliance (e.g., no plug or end cap) and can be directly cited as a violation as a result of on-site inspections. Plant personnel may lose or misplace end caps or plugs when such lines are opened, then simply forget about them. An area-wide maintenance activity may result in numerous lines with missing caps.

Sampling connection systems should be examined to confirm that the vent properly returns process fluids to the process. Similarly, equipment in vacuum service should be examined to confirm that equipment to create such a vacuum is in place, operating, and venting to a control device.

Each dual mechanical seal with barrier fluid system is required to be equipped with a sensor that monitors the chosen criteria to detect a system failure. This sensor must be checked daily or be equipped with an audible alarm. The inspector should verify that the sensor has an alarm which is working properly or that the sensors are being monitored daily.

If a control device is being used to control equipment leak emissions, the inspector needs to observe several items. The first is the identification of the control device and the manner in which the owner or operator is monitoring its operation. Following are several questions that should be answered during the inspection:

- Why type of control device is used?
- What is the claimed control device efficiency?
- Is the efficiency measured (tested) or calculated? Obtain a copy of any of these test results or calculations.

- For incineration devices, what is the combustion temperature (from the field or control room)?

- For each type of control device in use, what are the critical parameters that demonstrate compliance (e.g., adsorber pressure drop/regeneration cycle time, scrubbing fluid flow rate/pressure drop, final temperature leaving condenser)?

- For flares, during normal operation what is the net heating value and exit velocity of the flare gas? Is the velocity and net heating value of the flare gas measured (tested) or calculated? Obtain copies of these test results and/or calculations. Check the flame indicating device (probably a thermocouple readout) in the field or control room for proper operation. Observe the flare for visible emissions.

The inspector should evaluate the parameters chosen and the rationale for this selection to determine if these parameters are appropriate to monitor proper operation for the type of control device. This evaluation may need to be done off-site if the inspector is not readily familiar with a particular type of control device.

4.1.2.4 Inspection of Records

Recordkeeping requirements and strategies for the review of records have been addressed in Chapter 3. The primary objective of the record inspections is to minimize fugitive emissions through requiring adherence to the recordkeeping requirements of the regulation. Records that are required to be kept by the facility (and not reported) should be reviewed by the inspector during the on-site inspection. The inspector should determine what information needs to be obtained to document compliance. In particular, the inspector should identify missing information, incomplete data or reports and inconsistencies in the available background material, and specifically seek to extract this information from on-site facility reports for the purpose of making a compliance determination. Likewise, if noncompliance is suspected, the inspector should concentrate efforts on obtaining necessary documentation for verifications.

The first step in the records review should be to determine if the records are complete according to the regulations. After determining the completeness of the records, a check for consistency and validity should follow. An inspector should take along a few of the most recent semiannual reports so that comparisons can be drawn between the information contained in these reports and the information in the on-site records, especially if during the pre-inspection review the inspector identifies any inconsistencies. Alternatively, the inspector may copy the appropriate records and perform this comparison off-site. If any equipment is complying by an option of the regulations that requires annual testing, then it is advisable to bring semiannual reports which contain test results to check for consistency with the complete test reports. The records for leaking pumps, compressors, and valves should be compared with the numbers in the last several semiannual reports. Any inconsistencies between the reports and records should be noted.

The inspector should then review the monitoring data to ascertain if the control device is being operated according to its design. The records must also contain design specifications, instrumentation diagrams, etc. so that this comparison can be drawn. The records are to contain a log of periods when the closed-vent systems and control devices are not operated in accordance with the design specifications. The duration and frequency of noncompliance episodes should be noted. The inspector should compare his findings regarding such periods (based on a review of the monitoring data) with the instances recorded in the log. Any inconsistencies should be noted in the inspection notebook.

The test data pertaining to no detectable emissions equipment or valves complying with percentage of valves leaking provision that was reported should be compared with the test information contained in the records. Again, any inconsistencies should be noted. A test for a process unit complying with the percent leakage that indicates greater than two percent leakers is a violation. Any instance where such a test was conducted and not reported should be noted and evaluated as a possible inconsistency or a violation.

4.1.3 <u>Post-Inspection Review and Reports</u>

4.1.3.1 <u>Post-Inspection Review</u>

The post-inspection process should begin by reviewing the applicability determination to ensure that all questions about the facility as a whole and all individual process units have been fully answered. The equipment listings should also be reviewed.

There are two fundamental questions that an inspector should consider during this post-inspection data sorting.

- Is the recordkeeping system adequate to track monitoring, leaks, and repairs?
- Are the monitoring staff, equipment, and procedures adequate?

The answers to these questions and rationale for these answers should be contained in the inspection report. If the response to either of these is no, suggestions should be made to proper plant personnel to address correction of the existing problems.

4.1.3.2 <u>Post-Inspection Reports</u>

Upon completion of the walk-through inspection, the inspector should begin preparing the inspection report while all the events of the inspection are still fresh in his or her mind. The inspector should prepare the report before conducting another leak detection inspection. When two or more inspections are done at one time, it becomes difficult to mentally separate one from another. The facility data contained in the initial report, the semiannual reports, as well as results of the facility record review and the inspection, constitute the information available to the inspector to evaluate compliance with the regulations. Additional information, elaboration or clarification may come from the inspector's field notebook. If the inspector feels that it is needed, letters may be issued or phone calls made requesting additional information. The instance may occur where a return visit to the plant is necessary. These follow-up type inspections should be abbreviated in nature and focus on the unanswered questions or problem areas.

The next phase of the post-inspection process is to write the inspection report. The report organizes and correlates all evidence gathered during the inspection into a concise and useable format. The report serves to record the procedures used in gathering data and gives factual observations and evaluations drawn in determining facility compliance. The inspector's report will also serve as part of the evidence for any enforcement proceeding or compliance-related follow-up activities.

The inspection results should be organized in a comprehensive, objective and accurate report. The recommended report elements are listed below:

- Introduction
- Compliance Status for Regulated Equipment
- Evaluation of Observed Program
- Data
- Summary

4.1.4 Preparation for Subsequent Inspections

After completing the report, the inspector should prepare for the next inspection while the facility's processes are still fresh in his or her mind. This can be accomplished by preparing a list of items to be checked and information to be reviewed or gathered during the next inspection.

There are several suggestions to be considered for subsequent inspections at a facility. The pre-inspection preparation should basically be the same for each inspection. The inspector should review all the information contained in the facility's file including the initial and semiannual reports. The semiannual reports that have been submitted since the last inspection should be reviewed most carefully. The past inspection reports should also be reviewed. If any items were noted in these reports which required action by the facility, then the semiannual reports should be examined with these specific areas in mind. There also are items to consider regarding the on-site inspection. Due to the large number of records that are required, it may be impossible to review all records on each visit. If this is the case, it is a good idea to spot-check a different portion of the records during each inspection. It is also suggested that the inspector check a different area of the plant by general walk-through and equipment spot-checks in an effort to eventually cover the entire affected facility.

4.2 DIRECT MONITORING OF COMPONENTS

The use of monitoring equipment by an inspector introduces an added level of complexity to the inspection process and may produce unsatisfactory results if the direct monitoring is not carefully planned. On the other hand, some detailed inspection data suggest that actual leak rates are often much higher than what is reported by the facilities, and some local agencies are convinced that a comprehensive direct monitoring strategy is necessary for effective enforcement of the equipment leak rules. However, the use of direct monitoring by inspectors does not necessarily guarantee an effective regulatory program in and of itself.

In recent years, the National Enforcement Inspection Center (NEIC) of U.S. EPA has conducted a number of comprehensive sampling inspections of facilities subject to 40 CFR 60, Subpart GGG, NSPS for petroleum refineries. These inspections included some facilities at which direct monitoring had been included as part of the local agency's inspection procedures. A typical NEIC inspection involved two or three inspectors conducting direct monitoring of eight or ten process areas. Plant personnel or their contractors accompanied the inspectors and conducted their own monitoring, employing the same methodology used by the EPA inspectors (Method 21). In all cases, the NEIC inspections measured leak rates at a majority of process areas that were substantially higher than leak rates currently being reported by the facilities. A typical inspection of ten process areas would find seven or more process areas with leak rates of three to five times the reported rates. In all cases but one, leak rates found by the plant personnel accompanying the inspection agreed with the findings of the inspectors.

These inspections suggest that the primary problem is the monitoring methodology employed by the facilities or their contractors. Although ostensibly following Method 21 procedures, the monitoring personnel appear to be performing cursory examinations in an attempt to complete as many inspections as possible within an allotted period of time, resulting in a chronic under-reporting of leak rates.

These inspections also illustrate some of the difficulties associated with evaluating compliance with the equipment leak rules. If a facility is conducting the required monitoring, performing repairs on schedule, and complying with all of the recordkeeping and reporting requirements, it can be extremely difficult to demonstrate that the facility is not achieving the emission reductions expected from the reported level of performance. The inspector can only periodically observe performance of the monitoring personnel and can at best only develop circumstantial evidence of inconsistencies between routine and observed monitoring practices.

The use of direct monitoring within the context of an agency inspection program needs to address this issue of verifying that the monitoring and testing procedures utilized by the plant are in full compliance with the Method 21 sampling methodology. To accomplish this, an inspector could monitor a representative sample of equipment within a process area and compare the results with the history of leak checks for that process area conducted by the plant. A large discrepancy between the inspector's findings and the plant's records would indicate that the monitoring procedures of the plant need to be improved.

Another means of evaluating the monitoring procedures of plant personnel is to have them monitor all of the components in a specific area of a process unit, while the inspector follows and monitors the identical equipment. Alternatively, the inspector could accompany the plant personnel and monitor each piece of equipment concurrently, so that both operators obtain the same reading. In the first case, discrepancies in the results of the two evaluations would indicate a need for improved monitoring technique, while the second scenario allows the plant personnel to directly perform the monitoring method as practiced and approved by the Agency.

4.2.1 <u>Process Area Inspection</u>

Evaluating the monitoring technique of plant personnel is useful on an occasional basis, but conducting inspections of a representative sample of equipment within a process area is probably preferable as a long-term inspection practice. It directly addresses the performance of regulated equipment at a facility and can be more consistently replicated as an inspection procedure. Plant personnel would also have the opportunity to accompany the inspector with their own monitoring equipment without interfering with the inspection procedure.

Determining what constitutes a representative sample of equipment within a process area is an issue of both numbers and accessibility. Equipment that is not classified as difficult or unsafe to monitor, but which requires some exertion to reach (e.g., climbing towers) should be systematically included in the inspector's sampling pattern. Equipment such as pumps and compressors, which are normally present in small numbers within a process area, can all be sampled. Valves, normally present in very large numbers within a process area, need to be systematically sampled. Other equipment, including connectors, pressure relief devices, and equipment subject to no detectable emission limits, can be spot-checked during the inspection.

As a general rule of thumb, 200 to 300 valves can be inspected within a half day of direct monitoring and are usually a sufficient number to constitute a representative sample. Very large process areas (i.e., more than 1,000 valves) may require a larger sample. A purely random sampling of valves is often infeasible and is usually not necessary so long as other steps are taken to maintain representativeness. For example, if a process area has four reactor columns which require climbing to access equipment, select one or two columns and monitor all valves on those selected.

Usually, one or two cohesive subsets of a large process area can be identified and sampled as a representative sample of that area. Often, the facility will have an established "start-to-finish" route to be used by its own monitoring personnel or subcontractors. Using a process flow diagram, it may be possible to divide the route into three or four sections and then select any one section as the representative sample for that area. Any equipment type such as pumps, reactor columns, surge control vessels, etc. that are concentrated in a specific area should be added to the inspection. Depending on the number involved, all or a portion of these units (as well as valves and other connectors associated with the units) can be sampled.

To be most effective, direct monitoring needs to be repeated. An ideal practice might be to test each process area at a regulated facility once per year. The specific process area to be tested on any given day would be unannounced. If annual testing of all process areas cannot be achieved, the selection of process areas to be tested should be guided by the inspector's on-site observations and evaluation of the facility's records and reports. Additionally, certain process areas can be expected to leak more often than others and should therefore be inspected more frequently. These areas include those processes containing more volatile materials and processes operating at elevated temperatures or pressures.

4.2.2 Inspection Preparation

Preparing for and conducting an inspection that includes direct monitoring of a process area is very similar to the procedures for a walk-through inspection described earlier in this section. The principal difference is that performance of the monitoring by the inspector replaces the observation of monitoring by facility personnel. Other inspection activities, including preview of reports, on-site observations of regulated equipment, interviews with plant personnel, and on-site inspection of records remain virtually unchanged. Direct monitoring activities may increase an inspector's risk of exposure and the adequacy of safety planning steps should be reviewed.

Several steps need to be added to the preparation stage to ensure a successful inspection. These include equipment maintenance, supplementary supplies, and planning the monitoring approach.

Prior to each inspection, the monitoring instruments and supporting equipment should be inspected to confirm that everything is in good working order and will be available on the dates needed.

The next step in the pre-check procedure is to confirm that the sampling instrument is properly calibrated. This includes checking that the monthly calibration precision test has been conducted and scheduling a daily calibration test for the inspection date. If a calibration test is to be performed in the field, confirm that disposable cylinders of certified gas mixtures in the appropriate concentrations will be available.

Finally, check the condition of the analyzer backpack. All analyzers should be outfitted so that the instrument can be carried on the inspector's back. Additionally, the pack straps should be equipped with clips for the hand-held probe and the inspector's clipboard. This allows both hands to be free for climbing ladders. Use of a backpack will greatly reduce fatigue, and the probe can also be clipped to a strap when the inspector is writing in the clipboard.

Selection of the specific process area or areas to be tested should be accomplished during the inspection preparation. This may be done as a result of a preliminary review of reports and records, notes from previous inspections, or an annual schedule. Process area schematics, leak monitoring and repair records, and information about process materials (type of service, heated or pressurized processes, volatility of process materials) can be used to make such determinations. These materials should be requested in advance from the facility. When the inspection is scheduled with the facility, the inspector should request that the most recent records for four or five process areas (including the one to be directly monitored) be available at the beginning of the inspection. This will allow the inspector to review the most up-to-date information on the process area immediately before the inspection.

4.2.3 On-Site Inspection Procedures

During the pre-inspection meeting, identify the specific process area(s) you plan to inspect and monitor and review the most recent records from those processes. Also, request to see a copy of the permit and check to see if the permit is current and valid. Compare your agency's current equipment list with the source's equipment list. Check existing permit conditions and ask if any changes have been made to the operation which are not reflected in the permit.

Immediately prior to entering the process area, warm up your analyzer instrument, check that all components are operating properly, and perform a span check with the appropriate calibration gas. Upon entering the process area, ask the production personnel if there are any leaking components and when they were found leaking and tagged. Compare any reported leakers with the most recent records for that area. While conducting the monitoring inspection, observe tags on leaking components to ensure that they are properly dated and that the allowed time period for repair has not expired.

While conducting the monitoring inspection, use your senses of sight, smell, and hearing to survey an area for leaks and to help you zero in on leaking components. As you enter an area and proceed from component to component, note any suspect odors and watch for any increases in background concentrations on your analyzer gauge. Look for any distortion emanating from the equipment similar to the distortion seen from infrared radiation near the ground or on a roof on a hot day. Also, look for such distortions in the shadow of the equipment. If background noises are not excessive, you may also detect leaks by hearing them. Investigate the source of any unexplained hissing sounds. **Caution: Your risk of an exposure that exceeds acceptable levels can increase significantly as you zero in on leaking components. Be certain that all appropriate safety gear is donned before proceeding with your investigation.**

Always look for liquid leaks from components in the form of drips or spray mist. Investigate any stains which may be the result of recent evaporation of such leakage. If process or sealing fluids are present at valve stems, pump shafts, or connection points, look for bubbles which may indicate a leak.

When using the analyzer to check each piece of equipment for a leak, move the probe slowly along the interface where a leak may be likely, holding the probe tip as close to the interface as possible. Look for blips in the meter reading, which may indicate that you recently passed over a leak. Remember that there is a response time lag (usually less than five or ten seconds) between the time a VOC is sucked into the probe and the time that a meter indication is observed. When a blip is observed, slowly retrace your sampling route until you find the point at the interface where the leak is highest.

The leak rate is measured by finding the highest concentration of the leak. At the interface where the leak is highest, vary the angle of the probe to maximize the concentration. If possible, block any wind or draft from the area you are checking. Read and record the maximum concentration that you can maintain for several seconds, not just the peak of a spike. If the leak is intermittent or pulsing, note the maximum concentrations across several cycles and record the maximum of these readings. In the case of gross leaks (e.g., 50,000 ppp or more), attempting to read the maximum concentration following this procedure may lead to flame-out or saturation of the analyzer. Addition of dilution air to the probe intake may be necessary to obtain an accurate reading. Alternatively, the inspector may record the highest reading obtainable without risking damage to the analyzer and note any supplementary information (odors, etc.) associated with the leak.

Within the portion of a process area selected for direct monitoring, certain components are more likely to leak than others, and these components should be carefully examined. Flow control valves, which are operated more frequently than other valves, are correspondingly more likely to leak. There are often valves and connectors located near pumps and compressors that are subjected to vibrations and pressure surges. A pump that is not running is more likely to leak at the shaft seal than one which is operating. Gauges and meters that have been repositioned by plant personnel are more likely to leak as a result of such movement. Finally, any equipment that has been worked on or recently installed is more likely to leak. Visual cues (tool marks, new looking or cleaner components) as well as the facility's monitoring and repair records will help you identify such components.

It may not be necessary to record every component you examine, especially if you can use a process diagram to document the areas inspected. Ask the plant personnel who accompany you during the inspection to keep a running tally of the number and type of each component inspected. When a leak is detected, record the leak rate and the ID for the leaking component. Plant personnel should tag each leaking component. If plant personnel make an initial attempt to repair the component, try to reinspect these components to confirm the results of the initial repair attempt. It may be possible to do this after monitoring of the selected area is completed or at the end of the day. If personnel initiate repair attempts while you are conducting the monitoring inspection, do not slow down your own inspection schedule by waiting to monitor repairs. Come back after completing your monitoring schedule.

Detailed inspection procedures for valves, pumps, compressors, pressure relief devices, connectors, and other equipment have been discussed earlier in this chapter. While conducting the inspections, remember to look for grease or other materials that could plug the probe and continually check the probe tip for any obstructions. Also, use caution when inspecting any moving equipment. Do not touch the surface of any rotating or reciprocating shaft with the probe tip of your analyzer. Use a short piece of plastic or tygon tubing at the probe tip as an extra means of protection.

4.2.4 Post-Inspection Interview

Include a discussion of the findings from your monitoring inspection in the post-inspection interview with plant personnel. Address any areas where the monitoring results may result in a notice of violation, such as leaks from equipment designated for no detectable emissions. If the monitoring results indicate a significant discrepancy with leak rates reported by the facility, discuss this issue and elicit comments from the plant personnel regarding specific actions to be taken to address the problem.

CHAPTER 5

RECOMMENDED INSPECTION TECHNIQUES AND PROCEDURES

5.1 INSPECTION PROGRAM DEVELOPMENT

Chapter four briefly referred to the fact that the emphasis of equipment leak inspections will vary in response to a variety of factors. One important factor is the state of LDAR program development at a new facility or at a facility newly subject to a new rule. Initial inspections at such facilities would focus on applicability, appropriate classification of equipment, and documentation of exemptions. Later inspections would focus more heavily on inspection of monitoring practices, recordkeeping, and repair procedures, and addressing the correction of identified deficiencies. Assuming the LDAR program at the regulated facility matures and stabilizes, on-going inspections may evolve into a more-or-less routine pattern of compliance oversight.

However, even within the context of inspections at a facility with an established LDAR program, the emphasis of individual inspections will vary. There may be one or two annual inspections that address the facility as a whole in addition to periodic inspections that look more closely at individual process areas. Intermittent events, such as start-up following a process shutdown or the employment of new monitoring personnel at the facility, may become the primary emphasis of individual inspections. Finally, the experience level of the inspector may be a factor in the selection of inspection emphasis.

Implementation of the HON equipment leak provisions provides a convenient means of illustrating such an evolution of inspection emphasis. As the rule was implemented, many chemical facilities found themselves subject to equipment leak regulations for the first time. For those facilities already subject to NSPS or NESHAP regulations, the HON was likely to introduce an expansion of the number of regulated process areas as well as more extensive recordkeeping requirements and more stringent leak standards. Such facilities may have found that current monitoring and recordkeeping practices were inadequate, or even inappropriate, for the demands of the regulations and the needs of the facility. Those changes may have resulted in an expanded level of inspection activity for the regulatory agency as well as a need to adjust the inspection emphasis in step with development of the LDAR programs at the regulated facilities.

At the outset of implementation of new LDAR requirements for a facility, the first few inspections would focus primarily on applicability issues while developing familiarity with the plant's initial approaches to monitoring, recordkeeping, and equipment repair. Finding and reconciling any misclassification or oversight with respect to regulatory applicability during the initial phase could avoid more serious complications at a later stage. An inspector addressing this issue could consult with personnel in the agency who have developed the facility's permits, study process flows and material balances of the facility, and review the documentation and justification for those processes which have been classified as qualifying for various exemptions. At this time, the inspector should also look at equipment classified as "difficult to monitor" or "unsafe to monitor" to confirm that such equipment meets the applicable requirements.

Once the issue of applicability has been adequately resolved, the inspector can begin to concentrate on direct observation of the facility's monitoring program and conduct visual inspections of individual process areas. While observing monitoring activities, the inspector may devote one or two site visits to conducting side-by-side monitoring with the facility's personnel. This would afford an opportunity to identify and address any problems with monitoring techniques at the facility. In the case of process area site visits, the inspector can interview operating personnel so as to gain insight into how well they understand their role in developing compliance with the equipment leak regulations. The inspector should also address issues such as proper tagging of leaking equipment, performance of repairs within the allotted time, follow-up monitoring of repaired equipment, visual inspections, and recordkeeping practices to document these activities. The inspector should also become familiar with closed-vent control devices at the facility and the equipment served by such devices.

After several rounds of monitoring have been completed and the first one or two periodic reports submitted, the inspector can relate his or her developed familiarity with the facility to the information in these records and reports. The inspector will be able to identify those process areas and equipment types that are exhibiting higher than average leak rates and may even be able to identify specific pieces of equipment as "chronic leakers."

The next phase of inspection activities, beginning perhaps midway through the second year of regulations, would begin to incorporate direct monitoring of representative portions of selected process areas. Once again, developed familiarity with the facility will aid the inspector in selection of appropriate areas to be monitored. Direct monitoring inspections can become an important part of inspection procedures over the next several years, along with periodic observational inspections or walk-throughs of larger portions of the facility.

Maintaining consistent documentation in the form of inspection reports and associated notes will help to develop a consistent background file on the facility. This can be especially important as experienced inspectors are replaced by new personnel. Ideally, one or two inspectors should be continuously assigned to the same facility or group of facilities and should be responsible for the full range of air related permits and emission control programs at those facilities. This will help to reinforce a fuller understanding of the facilities and will also broaden the range of regulatory expertise among the individual inspectors. Additionally, if possible, a new inspector should accompany a more experienced individual on several inspections for training. Finally, whenever feasible, experienced inspectors should accompany each other on inspections of their respective facilities. This will help to expand the inspector's perspective by exposing them to equipment leak programs at other facilities and will also help to reinforce consistent monitoring and inspection techniques among the inspection staff.

A final, optional phase of inspection activities would be to conduct comprehensive monitoring inspections of individual facilities. This would involve two or three inspectors visiting a facility for several days to conduct complete monitoring of selected process areas and/or representative portions of larger process areas. Such inspections could be patterned after the in-depth inspections of the NEIC. Facility personnel would accompany the inspectors and conduct side-by-side monitoring of selected process areas. These comprehensive monitoring inspections could accomplish three purposes: (1) evaluate and compare the extent to which the facilities are accomplishing the emission reduction objectives of the regulations, (2) evaluate the effectiveness of the agency's inspection program, and (3) provide a basis for documenting noncompliance in the form of under-reporting of leak rates at individual facilities. As a long-term program, comprehensive monitoring inspections could be performed on all facilities or a subset of facilities within an agency's jurisdiction on a cycle of once every four or five years. Additionally, comprehensive inspections could be performed at individual facilities whenever such action is necessary.

5.2 WORKING WITH REGULATED FACILITIES

Over the long term, a successful inspection and regulatory enforcement program for the equipment leak regulations is more likely to succeed if the inspector can develop a cooperative working relationship with the regulated facilities. Such a relationship will make it easier for the inspector to obtain information about the facility in the form of reformatted or supplemental reports and other information not specifically identified by the recordkeeping requirements. The inspector may also find it easier to elicit verbal information about planned changes or developments within the facility which can be useful to the planning effort for future inspections. In exchange, the inspector may be able to assist the regulated facility by providing information or assistance helpful to the facility's development of a successful equipment leak program. Such a relationship can therefore improve the probability that enforcement of the equipment leak regulations will contribute to effective and long-term reductions of this class of emissions.

The issue of component monitoring technique is a particularly important area in which the inspector can potentially contribute assistance. Facility personnel or contractors responsible for monitoring may feel inclined to complete the monitoring of as many components as possible within a limited amount of time. This emphasis on speed and efficiency may result in a decline in monitoring technique, with personnel moving their analyzers too quickly over the equipment or not holding the probe tip close enough to those points where leaks are likely to occur. As previously discussed, the inspector can review and critique the monitoring technique of plant personnel or engage in side-by-side monitoring with the personnel. This creates an opportunity for the inspector to demonstrate correct monitoring techniques and can improve the probability that reported leak rates accurately reflect conditions at the facility.

Collaboration in the area of monitoring technique can be taken one step further by making agency training available to monitoring personnel from the regulated facilities. Shared training further reinforces the objective of getting the facilities to practice appropriate monitoring techniques and may also contribute to cost savings for both the agency and the facilities with respect to training costs. For example, the South Coast Air Quality Management District (SCAQMD) has found shared training to be a successful approach. The SCAQMD is planning to expand their program to include certification of facility monitoring personnel.

As an inspector develops experience with equipment leak programs and learns more about how other facilities are developing their programs, the inspector may be able to offer additional assistance or advice in a number of areas. An inspector can develop such experience from accompanying other inspectors to other facilities, and through long-term observation of different approaches within facilities assigned to the inspector. If one or two facilities within an agency's jurisdiction are achieving exceptional success with their leak minimization programs, an inspector can inform other facilities of such accomplishments and encourage information sharing between the facilities. An inspector may also be aware of additional potential resources, such as trade associations, that may be a source of help to a facility.

Some of the approaches used by successful facilities include in-plant oversight of monitoring procedures, use of internal leak standards, innovative component tracking systems, use of advanced repair systems and materials, and installation of new equipment with improved leak minimization performance.

In-plant oversight of monitoring involves the application of quality assurance techniques to the equipment monitoring and leak reporting activities. Some facilities that employ subcontractors have found it advantageous to obtain analyzer instruments and train one or two plant personnel to provide oversight and backup to the contract monitoring service. By developing an in-house monitoring capability, the facility is better able to identify and correct any deficiencies in the contractor's performance. As a backup resource, the in-house personnel are most valuable as a means of assuring appropriate follow-up monitoring and reporting of repaired equipment.

Although most contract monitoring services provide a database and recordkeeping system as part of their package, some facilities prefer to develop an internal system. This allows for faster acquisition of reports, enables report formats to be modified, addresses some issues of confidentiality, and creates the opportunity to incorporate the monitoring and recordkeeping systems in the development of additional program elements.

Facilities that perform their own monitoring cite a number of factors which reinforce their commitment to this approach. Having plant-wide in-house monitoring capabilities permits the establishment and maintenance of higher performance standards and allows for greater flexibility in the utilization of monitoring resources. This flexibility can be applied to leak testing equipment during process repair and maintenance activities, during startup after a process shutdown, and for spot-checking suspect equipment without waiting for the routine monitoring schedule.

Internal plant standards refer to a potentially broad range of activities designed to ensure compliance by doing more than the minimum requirements of the regulations. Some plants will repair equipment before applicable leak rate definitions are exceeded (e.g., conduct an initial repair procedure on any equipment leaking at 5,000 ppm or more when the leak definition is 10,000 ppm) Other strategies include supplemental monitoring as described previously, replacement of equipment which continues to leak after two or more attempts at repair, and repair of equipment which could be classified as non-repairable. In a related approach, many facilities have incorporated environmental compliance, waste minimization, pollution prevention, and similar goals within the context of total quality management programs or other production quality initiatives.

Component tracking addresses the utilization of repetitive monitoring data to evaluate the long-term performance of equipment. This can include the identification of equipment which leaks chronically or performance comparisons of alternative components within a process area. The increased sophistication and flexibility of internalized databases and recordkeeping systems lends support to the utilization of component tracking strategies.

Equipment leak regulations have been in effect at some facilities for a number of years. Efforts to minimize equipment leaks have contributed to advances in repair techniques and materials and to development of new equipment with improved leak minimization performance. Improved repair techniques have greatly expanded the number and types of equipment which can be repaired in place, without a process shutdown. Improved component materials such as specialty gaskets can improve the performance and extend the life of existing equipment. Finally, the design of new processes or reconstruction of existing process areas can incorporate leak minimization efforts by reducing the number of valves, flanges, and other connectors within the process system.

The leak standards and other specified control strategies within the HON are a reflection of the achievable standards resulting from the improved equipment, repair techniques, and information management strategies summarized above. Additionally, the QIP provisions of the HON are based on leak minimization programs that have worked for other facilities in the past. Although not formally required until Phase III, an inspector might suggest that facilities implement QIP plans or an in-house equivalent early on as a means of improving their opportunities to meet compliance with the standard.

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