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What You Should Know About Stack Testing

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Ambient monitoring and stack testing are key tools for effective management of the environment. Direct measurements provide the basis for quantifying emissions to define the nature and extent of environmental problems. Stack measurements are used as the fundamental basis for evaluating compliance with a wide range of environmental regulations. The 1990 Clean Air Act Amendments (CAAA) has increased the demand for direct measurements of emissions from stationary sources to better understand our environmental challenges and to monitor our progress toward meeting environmental goals.

What is stack testing anyway?

Stack testing represents an analytical procedure to measure air pollutants emitted to the atmosphere or in regulatory terms: measuring the emissions from an emission point. There are different methods to analyze the emissions from a stack. EPA has published numerous technical methods for stack testing. These highly detailed methods coupled with analytical and sampling hardware and specifically trained stack testing specialists can produce quality emission information.

When is a stack test required?

The most common reasons for conducting a stack test include:

- Satisfying regulatory compliance requirements
- Developing site specific or categorical emission factors
- Engineering development, and
- Guarantee verification

The majority of stack tests conducted by industry are consequences of regulatory requirements. Traditional regulatory requirements establish mass emission or concentration limitations or require that minimum control efficiencies be met. The requirement for stack testing is often stated in construction and operating permits, or in specific state or federal rules, and generally involves a one-time test to demonstrate compliance. In addition, new sources which are permitted under Prevention of Significant Deterioration (PSD), Emission Offset Rules or in some cases state Construction Permit rules are required to perform stack tests to demonstrate compliance. Initial Stack tests are generally required after 60 days from achieving maximum production rates but not later than 180 days after initial startup.

The Title V air operating permit program has significantly increased the need for direct emissions measurements. Sources that were unable to determine compliance through engineering evaluations may have elected to stack test to support their Title V certification of compliance. Sources also conducted stack tests to provide a more accurate basis for estimating actual and potential emissions. Title V permits once issued may also require either a one time or periodic testing of larger emission units to verify compliance with applicable emission limitations. In some cases sources will be required to source test as often as every 30 months for large emission units.

Sources frequently conduct source tests to meet non-regulatory objectives. Stack testing is often performed to optimize a process, to evaluate the performance of control equipment, to characterize emissions or study a new process line or equipment. Sometimes an engineering evaluation supported with stack testing information is recommended before a compliance test. This way the operating parameters can be chosen in such a way that the compliance test will generate accurate results under the scenario requested by the regulatory agency. Guarantee testing is typically performed to demonstrate that the process or control equipment is operating within design limits, efficiency limits or regulatory limits. Guarantee testing may be the responsibility of either the vendor or the buyer, depending on the purchasing agreement.

How is stack testing conducted?

The specific methodologies for stack testing for compliance demonstrations are spelled out in detail in 40 CFR 60 Appendix A. A stack test will generally involve the use of several test methods to measure stack gas flows and the concentrations of the specific pollutants required to be tested. Individual tests are generally one hour in length and three replicate tests are generally required, with the final result representing an average of the three tests. Compliance tests are required to be conducted when the production process is at 95% or greater of its rated capacity. The test itself involves the extracting of a representative sample from a properly located sampling port, and analyzing the sample using either a field analytical instrument or sending the sample for analysis to an analytical laboratory.

For engineering evaluations and guarantee testing there is more freedom in choosing the specific test methods and protocols. It may be desirable to perform tests over a wider range of operating conditions. It may also be desirable to use instrumentation capable of providing continuous measurements on-site. The primary advantage of on-site portable instruments is informed decision-making with immediate action based on the analytical result. In addition to a cost advantage, on-site analysis avoids complicated sample handling procedures, removing the potential for sample alteration. Unfortunately, these methods are not as yet widely accepted by regulatory agencies for compliance testing. If well justified, many new methods can be incorporated into existing EPA methods.

How do I go about having a stack test done?

Due to the specialized nature of the sampling equipment and procedures, most stack sampling is conducted by firms, which have developed this specialized expertise. Before selecting a testing contractor, however, several questions should be answered including:

- What is the specific objective for the testing (compliance test, engineering studies, etc.)?
- What Process information will need to be monitored during the test?
- What physical requirements must be met in advance of the source test such as location and installation of a sampling port, provisions for safely conducting the test, etc.?
- What time frame is required to conduct the testing and evaluate the test results?

It may be helpful to seek the assistance of a qualified environmental or engineering consultant to assist you in evaluating these and other related questions. In some instances stack testing may not be required or warranted or the scope of the testing may be able to be limited. For example, if a permit requires testing for several similar emission units, it may be possible to petition the regulatory agency to limit testing to a representative emission unit. Some of the common pitfalls that you will need to avoid include:

- Unclear or ambiguous permit limitations. It is best to resolve any issue with the permitting authority before proceeding to design a testing protocol.
- Inability to operate equipment at 95-100% of rated capacity. The permit may identify a rated capacity, which is well above normal operating conditions.
- Failure to collect relevant process data such as production rate during the test.
- Insufficient lead-time or resources.

Successful stack testing efforts are a combination of good planning and the coordination of various professional disciplines. In addition to the stack-testing expert, the involvement of environmental and engineering expertise, plant environmental staff, production managers, maintenance managers and safety mangers are needed to address the various aspects of a stack-testing project.

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