

Particulate Matter Emissions, Guarantees and Testing Considerations

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Foreword

This guideline is intended for use by GE personnel, customers and regulatory agencies, for the review of particulate matter (PM) permitting levels and guarantees during the proposal process. The information is provided as an aid in understanding the issues and concerns regarding PM emissions and the challenges involved in their measurement. Although the primary purpose of this document is to aid in discussions with GE customers and regulatory agencies, other internal GE organizations not involved with the subject of air emissions on a regular basis may also have an interest in the information presented.

We hope that you find this document informative and helpful in avoiding undue risk to our customers and to GE.*

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I. Introduction

The determination of expected particulate matter (PM) emission levels from Heavy Duty Gas Turbines (HDGT)—and their subsequent measurement—is an issue of concern for GE’s power plant customers. This is especially true for plants located in areas with low regulatory limits and/or costly regulations on PM emission levels—and the general tightening on PM emission requirements on a global basis.

The following sections discuss the factors that must be considered in estimating and guaranteeing PM levels, the issues involved in the measurement of those levels, and GE’s position on PM guarantee levels.

II. Definition

PM is defined as small airborne particles and/or liquid droplets. It can be made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. PM is many times characterized by the size of the particulate. For example, PM10 are particulates 10 micrometers in diameter or smaller.

III. Level of Emissions

There are two factors contributing to measured HDGT PM emissions. The first is the actual level of emissions exiting the exhaust stack. The second is the accuracy and precision of the measurement of those emissions.

A. Actual PM Emissions

The actual PM emission levels resulting from the operation of HDGTs are minimal. This is especially true of natural gas combustion and other “clean” gaseous fuel. The sources of PM exhaust emissions in

HDGTs are fuel composition, ambient air PM levels, and combustion efficiency. The actual PM exiting the stack may be further influenced by the cleanliness of the equipment (i.e., contamination by dust, dirt and oxidation products) and the presence of control equipment. GE believes that actual HDGT PM emissions are a fraction of measurement results.

B. Measurement of PM Emissions

The regulatory approved methods¹ and test equipment currently required for PM emissions testing were originally developed for the measurement of PM that resulted from burning coal or other fuels that produce comparatively high concentrations of PM. Therefore, the accuracy and precision of these methods were acceptable for that purpose.

Today’s HDGTs are extremely efficient and the natural gas fuels they use must meet stringent content specifications. As a result, they generate minimal concentrations of PM. Average measurement levels are significantly less than a typical modern coal plant. The regulatory approved test methods were not designed for this level of detection. Due to limitations of the equipment used in the field sample collection and the measurement equipment used in laboratories, it is exceptionally difficult using typical testing method approaches to accurately measure low concentrations. Method error and high bias frequently exceed the actual emissions level being measured. This yields measured levels that can be significantly higher and more variable than actual.

IV. GE’s Past Position

Due to the measurement inaccuracy and associated risks, GE has not been able to offer PM emissions guarantees that reflect the

¹ For example, EPA Method 5 for filterable PM and EPA Method 202 for condensable PM.

actual emission levels because they cannot be confirmed using approved testing methods. Consequently, GE's PM emissions estimates and guarantees are based on measured results and accounts for the extremely large standard deviation observed. Power plant owners/operators are frequently required to pay emission-based fees to operate their equipment. Permitting at GE's conservatively high PM guarantee levels has resulted in higher fees and possible resistance from regulators. In some cases where emission fees are high and/or permit limits lower than GE's PM guarantees, the owner may choose to assume the risks associated with permit levels lower than GE's guarantee.

V. GE Improvements and Current Position

In response to this issue, GE has developed add-on improvements to the regulatory approved PM test methods and the processes currently in use. These improvements are explained in detail in the documentation that is supplied to the customer during contract negotiations. The objective of these enhancements is to reduce the inherent error and variability in the current measurement methods and processes—resulting in increased precision and repeatability, and strict control of the process. This will enable GE to offer PM guarantees at lower levels than in the past, with acceptable risk. As a result, our customers may have opportunity to permit equipment at lower PM levels with less risk. GE's add-on method improvements are a non-negotiable requirement to be able to offer the lower PM guarantees and must be in the proposal and final contract.

In order to ensure that improvements are properly applied, GE requires that PM guarantee compliance measurements be included in GE's project scope of responsibility. A GE environmental engineer will manage and control all aspects of the testing, and communicate all pertinent information to the customer.

Due to the complexity of this testing, it is essential that the test firm and individual tester be highly skilled. GE has developed qualification criteria for the test firm, individual tester and laboratory that are described in the documentation provided to the customer during contract negotiations. These criteria are a minimum requirement for eligibility to conduct the testing. In addition to meeting the qualification criteria, all individual testers shall be required to complete a training program developed by GE, which will ensure

their familiarity with the improved processes and test method enhancements. GE will communicate with the Customer to ensure both parties mutually agree on the use of a PM testing firm that meets the specified qualification criteria.

In addition to the above, GE has included more detailed language on PM guarantees in their standard proposal language. This language clarifies the basis for the PM guarantee, and it is essential that it be included in the final contract language. These criteria must be reviewed with the Customer to ensure their understanding and agreement. Any deviation from these criteria may pose additional unnecessary risk to both GE and the Customer.

VI. Conclusions

The improvements and criteria discussed in this document will result in estimated and measured PM levels that more accurately reflect the actual level of PM emissions. The average measurements will still not reflect the actual very low level of PM emissions, but will be lower and closer to actual and will have less variability than in the past.

The increased accuracy and precision will help reduce the risk to the Customer in meeting permitted levels, and to GE in showing compliance to guaranteed levels.

The reduction of the permit and guarantee levels, and margins required to control this risk will help enable the Customer to permit at lower PM levels than in the past and/or reduce the cost of permitting.

GE strongly recommends that the Customer take careful consideration of the requirements for these lower PM guarantees and be fully aware that the testing requirements are definitely not routine. These requirements will incur extra costs and may impact startup/commissioning schedules.

GE's add-on method improvements are a non-negotiable requirement to be able to offer the low PM guarantees and must be included in the proposal and final contract.

* Note: All technical data and other information contained herein is subject to change without notice. This guideline is intended as a summary of issues affecting particulate matter measurement and does not constitute a warranty or guarantee of any kind, whether express or implied.

