CleanAir

CASE STUDY

Particle Sizing Techniques for an Evaluation of a Novel Application for Air Pollution Control Equipment

Background

CleanAir was requested by an equipment manufacturer to assist them in evaluating an existing air pollution control device for a novel application. A pilot system was designed and built by the manufacturer that used an aerosol generator on the inlet gas stream to evaluate the collection efficiency of the device over a range of configurations and operating settings.

CleanAir's Approach

The client was interested in data for particles in the E1 size category which is 0.3 to 1.0 microns. CleanAir proposed the use of in-situ University of Washington Mark V cascade impactors because they are well suited to provide approximately 8 size classifications across this size range of particles. The client for this project was knowledgeable regarding particle sizing measurements and endorsed as appropriate CleanAir's proposal to use the impactors to measure the constant inlet and variable outlet particle size distributions during the first test phase.

The second phase of testing evaluated the air pollution control equipment with process configurations that increased the collection efficiency an order of magnitude. Due to the expected low concentration levels during the second phase that would require excessively long test runs to yield measurable results, CleanAir modified the test program to use electronic instrumental particle size measurement techniques to minimize the sampling time without sacrificing data quality. We employed a TSI Inc. Model 3910 Nanoscan SMPS Nanoparticle Sizer and a TSI Inc. Model 3330 Optical Particle Sizer Spectrometer on the inlet and outlet gas streams sampling simultaneously.

Results

During Phase 1, outlet test runs were up to 12 hours long. The impactors were recovered and the stages weighed onsite to provide immediate data to the client. The use of the impactors provided excellent, repeatable, relatable particle size distributions for the various operational settings that provided insight for the client on the equipment's operational characteristics.

For Phase 2, the combined use of the TSI instruments, with their data collection and processing software, enabled us to gather particle size information from 10 nanometers to 10 microns in approximately 28 different size "bins." The use of these instruments also permitted run times to be in the 20 minute range so what would have taken days and weeks to collect took only hours. The generation of massive amounts of data representing numerous operating conditions coupled with expert input regarding the testing matrix evolution by the CleanAir project team, enabled the client to make critical and informed project path forward decisions of both a technological and capital nature.

Summary

CleanAir was able to combine the expertise of its personnel with its inventory of advanced particle sizing distribution equipment to provide the data the client needed for their project and exceeded their expectations.