The Importance of Response Time When Measuring Flammable Vapors in Process Ovens and Dryers

Continuous Monitoring

NFPA 86[1] requires the use of continuous analyzers to measure the potential flammability of vapor concentrations in any oven or dryer zone exceeding 25% LFL[2]. Sequential sampling systems that multiplex sample streams from several locations into a single analyzer are not allowed - nor are combined or blended streams from multiple locations.

Analyzer Response Time

Analyzer specifications should state the time to reach most of its final measurement in response to a sudden "step" change in concentration. Often, "T90" (time to 90% of the final reading) or "T60" are given. To be useful, the specifications must include both the response of the detector itself and the time needed for effective corrective action.

Sample Transport Time

The time needed for a sample drawn from the process to reach the analyzer is critical. Long sample lines, large diameter tubing, or sample conditioning filters, cause dangerous delays.

Sample Condensation and Drop-Out

Both the analyzer and the sample lines must be warmer than the flashpoint and dew point of all vapors in the sample stream. Condensation of any substance in the sample stream, even those which are not of interest, restrict sample flow and slow the response. Condensation of combustible vapors causes false low readings.

Corrective Action

The analyzer alarm relays should initiate immediate corrective actions. For example, the danger alarm relay should directly activate a safety shutdown, or emergency stop, by an appropriate means.

Determining Response Time

The speed of a flammable vapor monitoring system is the sum of its parts; sample transport, detector response, alarm activation, and corrective action. It can be estimated from the analyzer response time plus, sample transport time (for the length of sample tubing). Preferably, it should be observed by injecting a test gas into the sample probe and measuring the time for the alarm to sound and corrective action to begin. The concentration of test gas should be at least 10% LFL above the Danger (High) alarm point.

Effect on Accuracy

The faster the analyzer system, the more accurate it is. Slow systems have large "dynamic" errors. For the worst type of accident - a sudden increase at +10% LFL per second might occur. If so, a five second time lag will mean that a 50% LFL alarm trips when the actual concentration is 100% LFL.

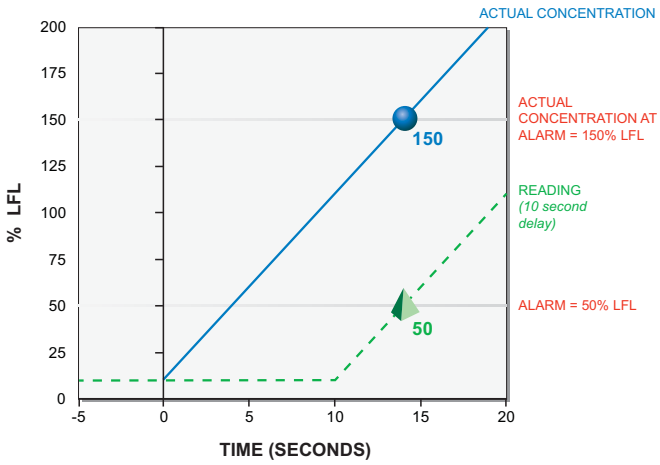

Illustration: The LFL percentage versus the system delay in seconds.

[1] *National Fire Protection Association standard for the safe operation of ovens and furnaces.*

[2] *Lower Flammable Limit; the minimum concentration of solvent vapors in air which can propagate a flame.*