Control Instruments® Corporation

Application Note

Understanding NFPA 86 Safety Ventilation & Continuous LFL Monitoring

Copies of NFPA 86, the Standards for Ovens and Furnaces, may be obtained from the National Fire Protection Association.

Call toll free to order:
1-800-344-3555

Introduction to NFPA 86

The National Fire Protection Association (NFPA) establishes fire safety standards, including standards for the safe operation of processes. NFPA 86, the Standard for Ovens and Furnaces, addresses the safe operation of Class A, Class B ,Class C and Class D ovens, dryers, and furnaces, thermal oxidizers, and any other heated enclosure used for processing of materials and related equipment.

NFPA 86 is the minimum standard required by law

OSHA makes reference to NFPA 86 under paragraph 1910.107, the law related to coating processes utilizing flammable or combustible liquids. NFPA 86 is therefore the minimum standard required by law, and should be applied in all processes falling under OSHA regulations.

In addition, Factory Mutual applies NFPA 86 when auditing insured facilities for compliance to acceptable safety standards.

Solvent Vapor Monitoring

This technical note focuses on the NFPA 86 requirements for solvent vapor monitoring in continuous process ovens in which flammable liquids (solvents and other compounds) are being vaporized. The number of industries and types of products falling into this category is very large, including paper, film and foil converting, printing, coating and laminating operations. In these processes, solvents are used to apply a coating or finish to substrate or raw material. The "wet" material is then run through an oven or dryer, where the solvents are vaporized, leaving behind finished product.

Safety ventilation is required to stay below 25% LFL

To prevent solvent vapor buildup, NFPA 86 requires continuous ventilation of the oven. This requirement is true for all continuous process ovens, including multiple zone ovens, as well as batch process ovens.

NFPA states the safety ventilation rate of continuous process ovens shall be designed, maintained, and operated to prevent the vapor concentration in the oven exhaust from exceeding 25 percent of the LFL.[1] Similar language is found regarding batch process ovens.

Using safety ventilation alone can result in higher operating costs

It is important to note that the safety ventilation rate required to keep the solvent vapor concentration from exceeding 25% LFL is calculated based on the oven's *maximum* solvent load. If the process typically runs below its maximum solvent load, then excess ventilation air is being run through the oven. This excess ventilation results in higher operating costs not only for heated air: it will also increase the cost of handling the exhaust air stream (which must be run through a VOC reduction system).

Safety ventilation alone provides only a limited margin of safety

The ventilation-only method results in higher operating costs, yet provides only a limited margin of safety. The methods for calculating expected vapor concentration cannot take into account failures within the process itself, and there is no ability to shut down the process should such a failure occur.

[1] NFPA 86:2011 section 11.6.8.1

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For example, an improperly welded damper can close too far, or the web can break and block the exhaust duct; solvent vapor will build up without warning, presenting a serious explosion hazard.

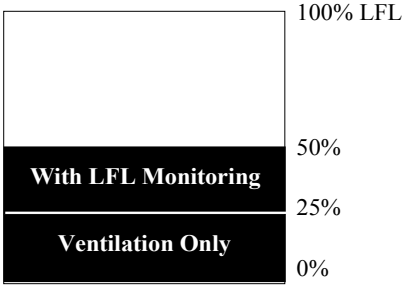
Continuous solvent vapor monitoring allows operation above 25% LFL

NFPA also states the safety ventilation rate shall be permitted to operate at a safety ventilation rate lower than that specified where a continuous solvent vapor concentration indicator and controller is provided in accordance with 11.6.10. For such installations, the continuous indicator and controller shall be arranged to alarm and shut down the oven heating systems or operate additional exhaust fans at a predetermined vapor concentration that shall not exceed 50 percent of the LFL.[2] Similar language is found regarding batch process ovens

In other words, when a continuous LFL monitor is installed, the oven can operate above 25%LFL but must shut down before exceeding 50%LFL.

LFL monitoring improves safety

There is enormous benefit in knowing the actual concentration of solvent vapor present in the oven zone. Rather than relying on calculations, the vapor monitor provides real-time, actual conditions.



When continuous LFL monitors are installed, the solvent vapor concentration in the oven can exceed 25% LFL. This allows operators to increase overall safety and productivity while reducing operating costs.

Should the concentration rise due to a failure in the process, the operator is notified immediately and the monitoring system can shut down the process before an explosive concentration is achieved.

LFL monitoring reduces operating costs while enhancing productivity

When vapor concentrations can rise above 25% LFL, the amount of heated air needed to ventilate the oven can be reduced, resulting in lower operating energy costs. Or the ventilation rate can be maintained but the throughput can be increased, improving productivity.

In addition, the lower ventilation rate means that there is a lower amount of exhaust air that must be handled by the VOC reduction system. In some cases, the VOC reduction system may be smaller in size or may require less fuel to operate (because the higher vapor concentration in the process exhaust can be used as fuel).

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For more information regarding NFPA 86 and solvent vapor monitoring, please refer to these additional application notes:

How to Select a Continuous Solvent Vapor Monitor to meet NFPA 86 requirements.

Using Flammability Analyzers to Protect Thermal Oxidizers.

Reducing Fuel Costs in Process Ovens and Dryers which use Solvents.

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[2] NFPA 86: 2011, section 11.6.8.1