

FIRE-EMULATOR DETECTOR-EVALUATOR

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The performance of a fire detection system is determined as much by its ability to recognize correctly the non-fire state as to sense the presence of a real fire. Common fire detectors respond to particulate matter in the form of smoke from a flaming or smoldering source by scattering light, absorbing light, or decreasing the level of ionization. Atmospheric aerosols from non-fire sources also can cause an ionization or photoelectric detector to respond. While different manufacturers have developed means to compensate for background particulate levels, standard methods to assess how well a particular detector discriminates background from fire-generated aerosols do not exist.

The purpose of the FE/DE is to produce an environment representative of what would be present immediately adjacent to an installed detector. By carefully controlling the velocity, temperature, smoke, and gas concentrations, the sensitivity and time response of the detector can be evaluated just as if it were placed within a standard room along with the desired test fire. The advantage of the FE/DE is that by adjusting the flow parameters, the impact of placing the detector or the fire arbitrarily within the room, or of locating the detector behind a beam or recessed in the ceiling, can be determined. The link between the set environmental conditions and the actual installation is the model of mass, momentum and energy transport from the fire source to the detector location.

The FE/DE consists of an open wind tunnel with a 0.3 m by 0.6 m cross-section. Time-programmed velocities between 0.03 m/s and 1.5 m/s, temperatures up to 70 °C, smoke obscuration levels up to 20 %/m, and desired concentrations of gaseous CO₂, CO, H₂O and CH₄ can be selected and maintained by computer control.

A (black) smoke generator was evaluated in the FE/DE; it is based on a propene diffusion flame that produces soot. Smoke from flaming fires have similar optical properties expected in building fires. Measurements of detector response to changes in smoke concentration and flow velocity were made with two types of smoke detectors; additional detectors from other manufactures are being evaluated.