

The Results in Layman's Terms

Due to the technical language in the scientific report which was produced, an officer of MasterGuard Corporation, wrote the Principal Investigator who conducted the tests requesting an explanation of the findings in layman's terms. The following is the response from the lead investigator, Larry Grosse, Phd.

From letter on file dated August 13, 1997.

"With reference to your recent inquiry concerning the publication of data from the scientific residential fire detector research project conducted at Texas A&M University, the findings of this major research effort have been published in a refereed article titled, "Risk Analysis of Residential Fire Detector Performance". The article was published in the Journal of Applied Fire Science, Volume 6, Number 2, June 1997. The journal is a refereed publication of international scope presenting current thought and research leading to practical solutions in fire protection. The research activities I previously referenced were conducted during a two year span while I served as the Department Head and Professor in the Department of Construction Science, Texas A&M University. The research project was completed in 1994 and the data of this research was consolidated with data collected by the Consumer Products Safety Commission (CPSC) for the National Smoke Detector Project and other research as referenced.

The process of utilizing data from various studies, integrated into one risk analysis, provides an evaluation tool to determine the probability of success or failure of a fire detector to alarm with normal installation and maintenance in a residential structure. This process permits the incorporation of actual influences such as lack of cleaning, age of detector, power disconnected because of nuisance alarm and contact corrosion to be considered with the demonstrated real-scale performance of the fire detectors in controlled fire test. The outcome of this consolidation of data resulted in the development of a realistic risk analysis for the performance of fire detectors for various fire scenarios.

The development of the risk analysis offered a clear insight into why there continues to be a high residential death rate in spite of an increase in the residences reported to have smoke detectors installed. The current thought process demonstrated by fire officials in the position to make recommendations, has been to just install a smoke detector in the home without consideration as to the type of potential fire ignition that most frequently occurs or to the quality of the fire detector. A review of the risk analysis provides a clear example of the probability of a detector failure if there is no consideration as to the risk involved with the use of the various types of fire detectors. As illustrated in the article, the various types of fire detectors provide different levels of risk which supports the need for a change in the current thought process of many fire officials. Certain types of fire detectors are more reliable for the different types of fires, therefore, recommendations as to the type and location of the fire detector should include the type of fire ignition that would most likely occur and the most reliable detector that can be installed in that location. For example, during a smoldering ignition fire, the photoelectric smoke detector offered the most reliable method of detecting the fire while the room of origin was still in a tenable condition. The probability of the failure of the photoelectric detector to detect a smoldering ignition fire is 4.06% while the ionization detector provided a 55.8% probability of a failure in a similar type of fire. This high probability of a failure of the ionization detector can be contributed to a number of factors such as performance under normal conditions and an inability to consistently detect smoldering smoke particles. This is a very important consideration since most of the fires that occur in residences start out as smoldering ignition fires.

During a flame ignition fire, the probability of a failure for the fusible link detector to detect a fire is 1×10^{-6} %. This means that the chance of a fatality is basically one in a million or a high probability that the unit will not fail during flaming or high heat conditions. For the same type of

fire, the photoelectric smoke detector had a 3.99% probability of a failure to detect the fire while the ionization smoke detector probability of failure to detect the fire is 19.8%. It is important to point out that the mechanical function of a fusible link fire detector offers long-term reliable fire detection. In our scientific research we found that a 117o F heat detector will activate while the room of origin is still tenable for safe egress. While the ionization process responds effectively to a flame ignition fire, a number of factors under normal use conditions tends to increase the probability of failure.

This past year, I accepted the position of Department Head and Professor for the Department of Manufacturing Technology and Construction Management at Colorado State University. Prior to my relocation to Colorado State University, I served as the Principal Investigator for this research project while tenured at Texas A&M University. During this time, I spent several years researching and testing all types of smoke detectors during our full-scale fires. Our research supported several earlier research studies on fire detectors. As you can see, of the two types of smoke detectors, the photoelectric smoke detector has the lowest probability of failure for both smoldering and flame ignition scenarios.

The previous statements should not be considered an endorsement for any brand of smoke detector, instead, the information has been offered to assist you with factual information concerning the performance profile of the two different types of smoke detectors. As a general rule, the opinion that there is no difference in smoke detectors currently available to the public has been shared by many fire officials and other regulatory agencies. After many years of being involved in scientific research on smoke detectors, I feel qualified to say that all smoke detectors are not equal in their performance.

Respectfully yours,

Larry Grosse, Ph.D.
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