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Impact of UL 268 and UL 217 Fire and Nuisance Tests

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CONTENTS

Foreword

This document will explain the context that led to the development of the new requirements, details about the new tests, and the consequences of the new products for designers, installers, end-users, and authorities having jurisdiction.

This document was developed by the Building Systems—Fire, Life Safety, Security and Emergency Communications Section.

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1 Scope

The addition of new polyurethane foam fire tests and a cooking nuisance smoke test were the largest changes ever to UL 217 and UL 268. These new tests required that all smoke alarms and detectors be redesigned to operate completely differently, that is, detect fires more quickly and reject cooking nuisances. This document will explain the context that led to the development of the new requirements, details about the new tests, and the consequences of the new products for designers, installers, end-users, and authorities having jurisdiction.

2 History of Smoke Detection Standard Requirements

One of the key moments for the development of modern smoke detector requirements was the so-called Dunes Studies that took place in 1975. The research was conducted by Underwriters Laboratories and the Illinois Institute of Technology for the National Bureau of Standards (now called the National Institute of Standards and Technology (NIST)). The testing was conducted on what is now the Indiana Dunes National Park, which is located along the southern tip of Lake Michigan. The testing involved setting fires in actual homes that were slated for demolition as part of the development of the park. Controlled fires were set in the homes, and detailed data was collected in order to establish detector activation criteria based on measured tenability criteria such as temperature and obscuration (visibility). These tests directly affected smoke detector requirements in UL and NFPA standards. The tests are known as NBS GCR 75-51 and NBS GCR 77-82 and can be located on the NIST website.

In terms of performance requirements, UL standards remained relatively static for several years. However, there were minor fire test changes in order to eliminate gasoline (in favor of heptane), eliminate the polystyrene (packing peanuts) test, and modify smoldering smoke limits for increased nuisance immunity. By the early 2000s, concern was growing in the fire protection community that detectors set to limits established by testing in the 1970s were no longer adequate for the 21st century.

A research study was begun that sought to update the research that was done in the original Dunes test. This new testing was conducted by NIST and was completed in 2004. The report was called, Performance of Home Smoke Alarms—Analysis of the Response of Several Available Technologies in Residential Fire Settings (NIST TN 1455). The testing was done in an actual home in much the same way as the original Dunes testing with some updated fire scenarios. The key finding in the research was that while both photoelectric and ionization detection technologies provided adequate escape time, the amount of time had decreased since the 1970s. This decrease in escape time from 17 minutes to 3 minutes, in some cases, was attributed to the increased use of synthetic materials in furnishings.

The decrease in escape time was alarming to the fire protection community, and it was decided that more data was needed in order to potentially update fire detection standards. To fill this knowledge gap, the Fire Protection Research Foundation commissioned a research project that was funded by an array of companies and institutions in the industry. Underwriters Laboratories was selected as the contractor for the project, called the Smoke Characterization Project. The project consisted of the careful characterization of dozens of different types of materials. The parameters measured included particle size and color, detector response, and gas effluent composition, among others. The conclusion of this work was that additional test-fires should be added to the UL smoke alarm and smoke detector standards that would expand the range of smoke types that detectors are required to react to. Specifically, it was recommended that polyurethane foam should be added as a fuel type.

Upon the conclusion of the Smoke Characterization project, a task group was formed to provide recommendations on new tests that could be added to the smoke alarm and smoke detector standards to enable products to be more responsive to modern furnishings and building materials. The task group was led by UL and quickly focused its efforts on the development of a smoldering polyurethane foam fire and a flaming polyurethane foam fire as these tests would create smoke of a type outside that of the existing fire tests. The development of these new fire tests proved to be a massive undertaking. Even deciding upon the type of polyurethane foam that is most typical of furnishings was challenging. After the selection