Introduction

The symposium on which this book was based was the eleventh in a series arranged by Committee E-5 on Fire Standards during the past 25 years. Of the previous ten symposia, four dealt with miscellaneous topics related to fire tests and product performance in fire tests. The other six were devoted to special topics, such as moisture in materials in relation to fire tests, restraint, smoke, ignition, heat release, noncombustibility, design of buildings for fire safety, fire risk assessment, and behavior of polymeric materials in fire.

The Denver symposium differed from the previous symposia in that it looked beyond the problem of testing and product performance. The papers were planned to present a rounded and comprehensive review of the status of fire science and technology.

Some may ask why ASTM should be interested in topics not specifically related to standards and the standards writing process. The answer is that ASTM is a society strongly committed to progress, and progress means searching for solutions not attainable by the application of standard performance tests.

Every test method reflects a level of understanding with respect to the product performance. Experience and the evolution of scientific knowledge are constantly at work to invalidate some existing test methods and to render others superfluous.

In spite of progress, standard fire tests will, for some time to come, yield much of the information needed in fire safety design. It is very important, therefore, that all those involved in the development of test standards be fully aware of the nature and limitations of these standards and be ready to alter or even discard them if science proves them to be inadequate. As fire science probes more deeply into the mechanism of fire phenomena, it comes to light that some of the existing fire test methods were built on precarious foundations. No wonder; they were designed to solve practical problems in an age when those problems were not fully understood.

Unfortunately, altering the test standards is not an easy task. There is usually stiff resistance to any change, partly by the users of the test results and partly by the industry. Having acquired familiarity with the interpretation of the results, the users often find it difficult to adjust to changes reflecting a new level of understanding. And some segments of the industry are also less than enthusiastic. Having tests conducted is a major investment for them in the interests of the marketability of their products, and there is always a chance that the suggested changes in the test standard may lead to a loss of

their market share. To minimize the burden that the changes might bring to the users and manufacturers, it is accepted generally that the updating of old test standards should not be so excessive as to invalidate the majority of available test results. Where major changes are required, the most painless route, it would seem, is to discard the old test procedure and either replace it with another less expensive procedure or allow the use of theoretical methods of performance assessment.

Fire science has come of age during the past 30 years. Although it cannot solve all fire safety problems, it can at least give guidance in the updating of old test standards and in the writing of new performance standards.

Task Group No. 2 of Subcomittee E-5.32 has undertaken the responsibility of scrutinizing all existing fire test standards in the light of available knowledge and making suggestions as to their improvement or replacement. Another task group, Task Group No. 7, has developed nine criteria for good performance tests, to be applied to new test methods. Among them are:

1. A test standard must address a well-defined component of the potential for harm.
2. Those tests that are expensive and time-consuming must be sufficiently fundamental, so that their principal features can be described analytically or by numerical follow-up techniques.
3. The set of prescribed test conditions must, even if in an idealized way, simulate those prevailing in real-world fires with overwhelming frequency. If no single set of test conditions can be regarded as overwhelmingly important, the product must be tested for a range of conditions.

Clearly, it is no longer possible to write performance standards without a thorough understanding of product behavior. Of course, the ultimate goal of fire science is to eliminate the need for performance tests, in other words to make it possible for the fire safety features of buildings to be designed on scientific considerations, supported by test data on basic material properties. The advantage of performance tests to yield early solutions without an insight into product behavior wears off with time as basic research catches up with developments. Inevitably, a stage will be reached when it will be more practical to derive solutions to all but a handful of problems directly from basic knowledge rather than from performance tests. Judging from the progress of fire science during the past 30 years, we have good reason to believe that that stage will be reached not too far in the future. The papers presented at the Denver symposium no doubt will contribute significantly to the preparation of the scientific foundations of fire protection engineering.

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