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# SYMPOSIUM OVERVIEW

The Symposium had as its objective to communicate the status and future of fire protection engineering as it specifically relates to wood use in construction. The speakers and moderators did an excellent job in conveying their views not only on regulation of wood products and construction, but also on recent developments in product behavior assessment and fire design.

## REGULATION CONCERNS

Though the impact of fire protection concerns for wood products used in construction will continue to be of major importance in the future, trends in technology development and regulatory moves allow one to rank factors of fire performance (McNeil, Weyerhaeuser). In priority order these are: 1) flame spread of interior finishes, 2) fire resistance or endurance, 3) toxicity, 4) rate of heat release, 5) ignitability, and 6) smoke development.

Regulatory trends indicate that building defenses in fire will diminish in importance and more emphasis will be placed on warning and suppression of fire (Bihr, ICBO). A special challenge will be to provide state-of-art fire safety in existing constructions. In this changing regulatory area, wood products will provide the "baseline" upon which to compare fire performance attributes of other materials (Westfall, NFPA; and McNeil, Weyerhaeuser). Critical to this will be the development of performance data for wood products and assemblies, and establishing a reliable data base on the cause and involvement of wood products in actual fires.

A low cost and reliable fire suppression system is seen as a distinct need (Westfall, NFPA). The National Fire Protection and Control Administration is searching for such a system for residential housing.

The Consumer Product Safety Commission (CPSC) is currently concerned with flammability standards for clothing and mattresses, but will likely enter the regulation of other products in the near future (Rabush, CPSC).

"Mill" construction, upon its introduction at the turn of the century, was an effective means to reduce property loss and led to sprinkler-protected buildings (Boyd, Factory Mutual Research). Renewed emphasis incorporates a balancing of the cost to provide fire protection with benefit to life safety as a guide for evaluating impact of code changes (Penoyar, Dept. of Commerce).

The need for improving fire test methods is called for (McNeil), as past standard test methods were shown to have a dramatic effect on generating rational codes (Thompson, Consultant). An example of such change was the move away from using potential total heat and towards using the rate of heat release consideration of materials involvement in fire growth situations.

## FIRE GROWTH CAUSES, COSTS, AND CONTRIBUTIONS

Half of the 12,000 fire deaths annually involve the loss of firemen's lives. Though fire deaths per million population continue to decline, the annual fire death total remains constant (Yuill, Consultant).

A frequently cited scenario of events associated with residential fires resulting in death and involving wood products is "fire at night . . . due to electrical equipment arcing . . . involving wood or paper products . . . and spreading in structural wood components" (Henry Tovey, National Fire Protection Control Administration).

Critical to fire intensity or severity is the amount of combustibles available in buildings or residences to support fire (Dan Gross, NBS). Current survey results of residences indicate that a home basement recreation room contains about 5.5 pounds per square foot (range from 1 to 11 lb/ft$^2$) of wood equivalent combustibles. Of this load, 20 percent is combustible interior surface finish materials. (A 0- to 10-lb/ft$^2$ fire load corresponds to a 0- to 1-h standard fire in fire endurance testing.)

Fire-retardant-treated wood has been shown to have benefits to inhibition of fire growth (B. H. Shunk, Koppers Company). The public, however, is largely unaware of fire-retardant-treated wood product availability or use. More technology transfer effort needs to be applied in using improved technologies for fire-safe materials and design. The influence of interior finish materials on fire performance of large-scale structures is under evaluation (William J. Groah, Hardwood Plywood Manufacturers Association). Conclusions from three dwelling-type fire tests indicate that combustible furnishings, and not the finish, control fire conditions.

The ability to treat fire initiation, growth, and suppression by isolating factors in fire development (e.g., flame spread, ignition, etc.) has led the National Bureau of Standards to investigate the step-wise total growth to fire employing a "systems" modeling approach (Harold E. Nelson, NBS). Critical to its use is the need for definition of rate constants that control fire development in each step.

## CONTROL PROCEDURES

A review of the effectiveness of wood assemblies or members to act as a fire barrier or prevent collapse during fire indicates that abundant tests have been conducted on wall and floor systems (Erwin L. Schaffer, Forest Products Laboratory). Empirical models are available only for predicting fire endurance times of unprotected wood joist floors. An extensive series of fire tests of heavy timber columns has been conducted in Britain for which an empirical model is available to predict fire endurance. Column and beam fire endurance models based upon material thermal and strength properties are being adopted in some foreign countries.

Building design to minimize fire hazard guided by regulations or codes should be flexible enough to allow innovative fire protection designs to be incorporated (Tibor Z. Harmathy, Canadian National Research Council). An example of innovative design given is the isolation of fire on one floor of a building by dropping noncombustible curtains to compartmentalize the fire and essentially allow it to burn out within.

Of critical importance to life safety is the need to assess the hazard of products of combustion. Animals exposed to combustion products are recognized as the only means available in the United States to relate to human effects. Special care is being taken to isolate toxicological influence from effects of both heat and oxygen loss.

## CONCLUSIONS

The focus of fire-safe design will emphasize life safety first and property loss second. Adequate hazard analysis techniques employing a "systems" approach require development and application. Benefit cost evaluations will be essential.

Data base needs are many. Actual fire survey information on factors contributing to loss of life and property is a key initial gap to be filled. Basic data on reactions of wood products to heat and fire are important to analysis and comparative purposes.

Analytic procedures in safety evaluations should be capable of handling variability in fire severity, construction configurations, materials, and occupancy factors.

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