FIRE AND WOOD[1]

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ABSTRACT

Restrictive measures are increasingly being imposed on traditional markets for wood in the name of fire safety through actions of such federal agencies as FTC, FHA, and HUD, as well as state and local legislation and building codes. Although many of our traditional markets are threatened, a positive reaction to the public concern over the fire hazard of materials can open new markets for wood products. The forest products industries must develop new fire-rated products and fire-safe systems for use in constructing and furnishing all types of buildings. Our goal is to see that wood is used properly for fire safety. We must: learn more about fire and wood, work to reduce hazards in buildings and furnishings, participate actively in the efforts of trade and building code bodies, and establish programs to correct deficiencies in fire properties of wood-based materials.

Additional keywords: Fire hazard, fire performance, fire ratings, fire resistance, fire retardants, fire tests, building codes, building design, markets, combustion, applied research, research and development.

". . . a mood for fire safety is gathering irresistible momentum that sooner or later cannot be ignored." This quotation from a recent issue of *Fire Research*, a Stanford Research Institute publication, is a fair appraisal of the situation that now prevails in the United States. I would like to discuss with you today the sense of urgency that I feel when I observe the restrictive measures being imposed on traditional wood markets in the name of fire safety.

THE GROWING CLIMATE OF RESTRICTION

Indeed, there is today great momentum to apply restrictions on the use of materials in building construction and furnishings. Recent developments that have contributed to this momentum include:

1. *America Burning*, the 1973 report of the National Commission on Fire Prevention and Control. In this report it is stated that "material producers owe to various publics—building designers, code officials, fire service personnel, and consumers—an expanded and more candid effort to explain the fire characteristics of the materials they sell." "Industry should accept its responsibilities in the absence of coercion." They recommend that "associations of material and product manufacturers encourage their member companies to sponsor research directed toward improving the fire safety of the built environment."

   The Commission offers a convincing case for the need to reduce the nation's annual toll of fire deaths and injuries, and recommends ways to achieve this reduction. If you have not yet seen this publication, I suggest that you obtain a copy, for $2.35, from the Superintendent of Documents, in Washington, D.C.

2. *The Federal Fire Prevention and Control Act of 1974.* This legislation was based on the recommendations of the Commission on Fire Prevention and Control to the federal government on a program of national fire loss reduction. Among other important first steps, the Act establishes a new National Center for Fire Research at the National Bureau of Standards, with a budget for 1975 of $3.5 million. This Center "shall have the mission of performing and supporting research on all aspects of fire . . . ." But, before the

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problems of fire safety can be solved, they must be identified. The Act provides for this also with a "National Fire Data Center for the selection, analysis, publication, and dissemination of information related to the prevention, occurrence, control and results of fires of all types." This item is of great importance because it provides the means whereby we can finally determine what the problem really is, what causes the 12,000 fire fatalities in the United States every year, where the fires originate, and what causes them to spread. And then, other authority under the Act can be used to take remedial action.

3. *Federal Trade Commission action on the fire hazards of plastics.* In May 1973, the FTC filed a complaint against a number of companies in the plastics industry. This has resulted in a consent order which, among other things, obligates the respondent companies to finance a $5 million research program into the combustibility properties of plastic products. This is in addition to the millions of R&D dollars already being spent annually by this industry on fire-related matters. Similar action against other suppliers of construction materials and furnishings is possible in the future, based on alleged fire hazard of the products.

4. *Limitations on flamespread in mobile homes.* This is still another indication of the momentum building for tighter restrictions. There have been proposals recently by FHA that a maximum flamespread limit of 150 by ASTM E-84 be adopted for the interiors of mobile homes. Other jurisdictions have proposed limits of 75 or less. Current and traditional limits for interior finish have been set at 200. Adoption of these lower figures could work hardships on the producers of traditional paneling materials and the consuming public, while not necessarily providing greater life safety in fires.

5. *Smoke density limits.* HUD has suggested a limit for building products of 450 Maximum Optical Smoke Density (Dm), as determined by the Smoke Density Chamber. This figure is arrived at by averaging the DM for flaming and the Dm for smoldering conditions. Many wood products cannot meet this figure.

   Although there is serious doubt that this test method is adequate for specifying materials for use in building construction, nevertheless limiting Smoke Density Chamber figures are being cited now in some specifications.

As you can see from these five examples, the rapidly increasing public concern over the fire hazard of materials and structures can pose a threat to many of the traditional markets for wood and wood products. Or, it can be an opportunity to move into new markets that have been traditionally denied to us, if we react to it positively.

THE RESPONSE BY INDUSTRY

What does this mean to us, the technological arm of the forest products industry? It means that we must all have this sense of urgency about developing new fire-rated products and fire-safe systems for use in constructing and furnishing buildings of all types. Wood can be, and in most cases is, a safe and economical building material; but unless the industry takes concerted action in the very near future, we may be overwhelmed by reaction to the fire problem.

We must strive to understand the problem, develop suitable solutions to the problem, and then make our position clear to code authorities, fire protection experts, and the consuming public.

What are we doing about the situation now?

I said earlier that the first task is to understand the problem, and that this can be done through an analysis of fire data. To this end, a group of forest products companies is sponsoring a Research Associate at the National Bureau of Standards. One of his goals is to follow the progress

of the National Fire Data System and to contribute to it. When operational, this system should tell us what the problem really is and where the hazards really lie in fires of all types. Only when this is known can the nation, including our industry, know where the priorities should be placed most to effectively reduce the annual toll from fire. Already several smaller studies, including one sponsored by Weyerhaeuser in 1969, have indicated that the biggest threat is not from structures, but from contents.

Our Research Associate is also working on the rate-of-heat-release of building materials. In this important study, we are trying to introduce a more realistic rate of release to supplement the often misleading potential heat concept. After all, the life hazard in most fires is related to the rate at which heat and smoke are released rather than to the total content theoretically available from combustible materials.

On the subject of smoke and toxic gases in a fire, the industry is sponsoring a Graduate Research Fellow at the University of Utah to investigate products of combustion from the burning of wood. The Flammability Research Center at The University of Utah is one of the foremost organizations in the nation for this type of work. Since smoke and toxic gases cause the majority of fire deaths, and since very little is known about these properties of wood, this work is regarded as being very important. By way of comparison, the plastics industry is sponsoring six graduate students at the University of Utah in this same type of study.

The Forest Products Industry is also active in the affairs of The American Society of Testing and Materials' Committee E-5 and Committee E-39 and the National Fire Protection Association. These groups write the consensus standards by which products are tested and rated for fire safety. Our work on their committees and subcommittees is essential if a balanced view of the problems of fire testing is to be obtained. At present, however, only a relatively small number of forest products interests are represented in the work of these groups.

In addition, it is important to note that the industry does have knowledgeable people working on fire problems in the area of model codes and state and federal legislation.

FIRE TECHNOLOGY AT WEYERHAEUSER

I would also like to give you some idea of the activities of Weyerhaeuser Company in the field of fire technology. The company is participating in all of the activities that I mentioned above and, in addition, we have a large-scale fire test facility and a program for developing fire-rated products. At our Longview, Washington, laboratories we have an ASTM E-84 25-foot tunnel, an 8-foot tunnel, a 2-foot tunnel, an E-152, E-119 door and wall furnace, a small scale door and wall furnace, an E-108 roofing test apparatus, an Ohio State rate-of-heat-release apparatus, a National Bureau of Standards' Smoke Density Chamber, and an E-162 Radiant Panel.

We have been working for many years to develop fire-rated and fire-safe products at Weyerhaeuser. An example of this can be seen in our very complete line of fire doors. This also serves as an example of the opportunities that can be realized through R&D effort in this area.

We are currently participating in the round-robin testing of the NBS Smoke Density Chamber and the Ohio State rate-of-heat-release apparatus. This enables us to learn about these new techniques and to influence their development so that a more useful, realistic tool is eventually evolved.

RECOMMENDATIONS

What further steps do we need to take in our industry? First of all, we must become aware of the situation and learn more about this very complex subject. We need to realize that there is a threat and an opportunity!

Then we must work through established organizations such as the National Fire Protection Association, ASTM, the forest products associations, and model code bodies to see that reasonable and effective standards are adopted and used to control

the hazards of fire in buildings and furnishings.

We must increase the effort on rate-of-heat-release testing. We need participation by other wood products laboratories in this essential work to see that a realistic test is developed and adopted. It must be one which is large-scale enough to predict response in "real" fires and yet not so large as to be impractical. We need your help and your inputs in this endeavor.

A much higher level of activity is required in the area of smoke and toxicity of products of combustion. Most fire deaths result from obscuration, disorientation, and panic due to smoke plus the toxicity of the fire gases. Not as much has been accomplished in this area as in the area of flamespread, for example, because of the complexity of the subject. Now, however, projects are being undertaken on a large scale, principally by government and university laboratories. This work requires skills often not possessed by the staffs of our industry laboratories, such as pathologists. Therefore, we must continue and expand the work being done at the University of Utah, Johns Hopkins, Southwest Research Institute and elsewhere.

We should be involved in the development of detection and suppression devices for the home as well as for commercial buildings. *All* buildings do and will contain combustibles of one kind or another. The many tragic fires in "fireproof" buildings testify to the fact that fires will occur in spite of the most severe restrictions on building materials. Therefore, a system of detection and suppression of hostile fires is required. In the last few years, reliable, inexpensive smoke detectors have become available to protect homes as well as commercial establishments. Some progress has been made in the development of suppression systems, such as sprinkler systems using plastic or copper piping, but more work needs to be done in this area to lower costs and improve performance. Once in place, such a system would permit the safe and economical use of materials which otherwise might be prohibited.

Our role in this area should be to see that the systems developed are suitable for use with wood and to provide enthusiastic support for their application as they are developed.

Most often, untreated wood products can be safely used if systems and products are properly designed. It must be our goal to see that wood is used properly for fire safety. However, new fire-retardant systems for wood must also be developed that are economical and process-compatible and that have acceptable product properties such as nonleachability and corrosion resistance. The traditional fire retardant treatments have incorporated inorganic salts in a pressure-vacuum system. The process tends to be expensive, frequently downgrades the wood, and results in a product with some undesirable properties, such as hygroscopicity and corrosion of hardware and fasteners. A better system is needed to reduce flamespread and control the evolution of smoke and toxic gases from wood exposed to fire. Some help in this area must come from suppliers to the wood industry, such as the chemical companies. But unless and until we can tell them what we need, they will be unable to aid us.

This work must apply to *all* wood products including structural members, finishing materials and furnishings.

IN SUMMARY

To summarize, I believe that it behooves you to:

1. *Investigate and learn more about the subject of fire and wood.* This calls for a considerable amount of reading and attendance at seminars and meetings concerned with hostile fires. It requires a knowledge of some of the fire characteristics of wood-based products in general. What do you know about this subject of fire and wood?
2. *Participate actively in the work to understand the hazards of fire in buildings and furnishings.* We need additional people in our industry to run

the various tests and to participate in the work of other agencies in the role of advisors and consultants. For example, there is a pressing need now for someone in our industry to be conducting burn-out tests. This would seem to be a likely role for universities or trade associations to undertake. Is anyone in your organization participating in this important work?

3. *Take an active part in the efforts of such bodies as The National Fire Protection Association, ASTM, the forest products industry associations and the model codes.* I cannot emphasize this too strongly. We need participation by other members of our industry in developing new test methods, for example, and in improving those methods already on the books. Are you or your associates attending these meetings?

4. *Analyze the products with which you are familiar for deficiencies in the area of fire safety.* We each have an obligation, to society and to our organizations, to investigate the fire properties of those products with which we are most familiar. Do you know how your product will perform in the standard fire tests?

5. *Set up programs to correct these deficiencies and exploit advantages.* Once we know the limitations of the various materials, we can seek to improve their limiting properties and to exploit those areas where we have inherent advantages. Are you working to improve the fire properties of your products?

6. *Vigorously carry out these programs.* This includes fighting for appropriations for the programs that you recommend and pushing the work in competition with other projects that may seem more glamorous. And above all it means that you must indulge in a little sales and missionary effort to see that others appreciate the importance of these projects. Could your organization use a little motivation along these lines?

Whether this emphasis on fire safety is a threat or an opportunity is up to you. If we meet the challenge and satisfy the requirements of fire safety, we can look forward to taking over new markets and recapturing old ones lost over the years. If, on the other hand, we fail to meet these requirements, we stand to lose many of the traditional markets for wood to plastics, steel, aluminum and concrete.

DISCUSSION

Tom Batey: Ray, can you say anything about the status of the rate-of-heat-release work going on at NBS and Ohio State?

McNeil: They are interconnected. The work at NBS is being sponsored by our industry. Dave Chamberlain, the Research Associate, is in the process right now of sending samples out to Stanford Research Institute, Ohio State University, and Factory Mutual to determine correlation with the calorimeter at the Bureau of Standards. He is also going to endeavor to scale up the size of the samples. One difficulty with rate-of-heat-release testing is that small samples are often required and that is a current difficulty with the Ohio State apparatus. They are down to a 4″ × 6″ sample size and results do not necessarily correspond to performance in real fire situations. We would have to be testing things like a section of a wall that includes the studs and sheathing and not just a 4″ × 6″ section of one of the components. This is not possible with the OSU equipment. So one of the tasks that Dave Chamberlain has is to run samples on larger size furnaces and try to correlate the results with those from smaller calorimeters. We do not yet have a test that is satisfactory for comparing materials.

Then there is the question of the horizontal versus the vertical mode of testing.

Some plastic materials cannot be run in the vertical mode because of a tendency to melt, drip, and run when heated. But my contention is that you cannot compare results if one sample is burned in a horizontal mode and another in the vertical mode. In summary, both test methods are in a developmental stage right now and considerable work remains before either can be promulgated as a test standard.

Tom Maloney: Are other materials such as plastics and the contents of the building evaluated by the same test?

McNeil: Contents are generally not evaluated by the same tests as are used for building materials, but there is a move in this direction. Most building materials are evaluated by the same standard tests, be they plastic, wood, gypsum board, or whatever.

However, contents are not controlled to the same degree that parts of a building are controlled. This is one of the problems. Since most fires start in contents and most of the hazards exist in contents, I believe that they should be controlled even more rigorously than building materials. Obviously, that chair with the foam cushion is more of a hazard than the wood studs that won't become involved in a fire for perhaps 20 or 30 minutes. The cushion can be ignited right away and can result in death long before the stud ever becomes involved. Yet, the performance of the stud is measured and spelled out in codes, while the cushion is largely unregulated. This is one of the areas where we should become more active to see that the emphasis is placed properly.

John Howe: What's new in fire retardants?

McNeil: Not much, really, if you're speaking about fire retardants for wood. We still have the inorganic salts—the phosphates, the borates, antimony oxide. The only new developments are in the organics, which have been developed primarily for textile treatments and for plastics.

The problem with these is, first of all, that they are very expensive. Second, they're not designed for use with wood products; and third, they're formulated to pass a different type of test than that to which building products are exposed. We need better communication with the chemical companies that are developing these products. Right now, if they had something good that was applicable to wood products, many of them wouldn't know it. They need to know more about our requirements. They often don't understand the end uses or the tests that are normally used to evaluate building products. We must establish a communication bridge with these people so that we can tell them what we need and work on the project with them.

Harold Gatslick: Can you tell me why the University of Utah was chosen to work on fire research on wood?

McNeil: The University of Utah was chosen for a number of reasons. One, because they are one of the most outstanding organizations working on this phase of fire hazards today and they are recognized as such. They're receiving large federal grants as a result of this recognition. Another reason was that they are proceeding to test wood anyway. Their rationale is as follows. The codes state ". . . . shall be more hazardous than wood" or ". . . . shall not be more toxic than the smoke from burning wood." So, before they can evaluate other materials, such as plastics, they must know something about burning wood.

Some of the data from their early work has been frightening. It shows high mortality rates for rats exposed to wood smoke; in some cases the results are worse than for plastics smoke.

We felt that we should become active in their work so that we could interject some of our thoughts because much of their financing and all of their industrial inputs are now coming from the plastics industry. I sense that you have another point.

H. Gatslick: The point being that I was wondering where the wood technologists or the construction engineers related to wood were that could assist in this research at that particular University.

McNeil: That's a good point. They don't have any. We are trying to get this sort of input and advice into the University of Utah Flammability Research Center because they

are now proceeding without the benefit of this input. This is something that alarms me very much. Through this graduate student program, we hope to be able to help their work along in the investigation of the products of combustion of wood. Prof. Einhorn has told me that they would welcome a candidate with a wood technology background, and I would be pleased to hear from any of you who know of anyone who might be interested. I've tried to find someone from our industry, but so far I've drawn a blank.

John Hill: For years heavy timber construction has enjoyed an advantage or a preferred position because of the sort of accepted opinion that it has one-hour endurance and that you must make field construction equal to that, etc. Do you see in the future a regulation requiring us to prove that we have that one-hour resistance in heavy timber construction?

McNeil: Very definitely. Everything will have to be proved. The grandfather clause is on the way out. We have enjoyed ratings on many wood products of 200 flamespread without testing because this was generally conceded to be true. But now a certification is required that each product does meet this limit. And the one-hour rating is not sacrosanct either; proof will be required, and I'm sure that it can be obtained for heavy timber construction.

J. Hill: For years we've had information about the rate of char of heavy timber construction but as far as I know this has never been incorporated by engineers in design of buildings to ensure that wood buildings have superior fire resistance by not only worrying about the design itself but using this characteristic to provide resistances up to certain levels. Do you see that there's any possibility that we could use that sort of approach?

McNeil: Some work has been done along this line and fire resistance of wood construction has been calculated by using an average char rate and figuring backwards. So it is possible to use this type of background data for interpolation and arrive at estimates of fire endurance. However, there will always be someone around who will contest the results and will say "Prove it. Run a test."

George Marra: Many of you know of Tom Maloney's particleboard symposiums at Washington State University. Last April we had a man on the control board who made a very surprising statement to that group to the effect that we should forget about the combustibility of wood; it's not important to marketing. He said we should concentrate instead on detection, suppression, and design from the standpoint of exits. The statement he made was "forget about the combustion." Do you agree with that?

McNeil: I don't see how you can because you are not going to be allowed to forget about it. The competition is not going to allow it. The code people are not going to allow it. Wood is a combustible material and the codes are stating "shall be noncombustible." If you don't meet their definition of noncombustibility or low combustibility, you are not allowed in. This will be important in marketing when we are shut out of whole sections of an industry, as we may be in mobile homes, for example. This is the main reason that we are interested in the rate-of-heat-release concept instead of potential heat. By the potential heat method, wood is "combustible" and always will be. Using rate-of-heat-release we may be able to establish limits for rates of burning that are considered safe for certain areas and uses. You might have 5 or 6 classes or rates-of-heat-release, with a suitable class being specified for each type of occupancy. From everything that I can see, the combustibility of wood and other building products is definitely becoming an issue and can be ignored only at the peril of losing whole markets for wood.

Fred Brown: How would you relate Dr. Einhorn's findings on interaction between phosphorus and trimethylol-propane initiated polyols to toxicity of combustion products in the wood industry?

McNeil: I don't know. That is the reason that we want to get closer to the work of the University of Utah to get a better understanding of the impact of their activities on

the use of wood products. Would you care to elaborate on his findings?

F. Brown: As I understand Dr. Einhorn's work, one of his experiments involved exposure of animals to the combustion products of a rigid urethane foam containing both trimethylol-propane-initiated polyol and a phosphorus-based fire retardant. The combustion products resulted in rapid death of test animals. Subsequent studies confirmed the finding and the U.S. Consumer Product Safety Commission has published a warning of the hazard involved and identified the toxic pyrolysis by-product as a 4-alkyl bicyclic phosphorus ester.

McNeil: And we also don't know what happens when we burn wood containing these fire retardants. You may have the same sort of synergism that you got with urethane. Again, this is a reason for supporting the work at the University of Utah.

F. Brown: This apparent interaction between trimethylol-propane-initiated polyol and phosphorus exemplifies the necessity of testing our products in their final form.

McNeil: Right, and then you run into the problem of what temperature you employ because the temperature that Professor Einhorn used in his experiment *might* be one which we rarely encounter in an actual fire. So you have to burn it at various temperatures, in various oxygen contents, etc. This is an extremely complex situation.

Bill Groah: We're very concerned about this problem. Twenty-five percent of our resources over the last ten years have been used on what we call the fire problem. The problem is that there are just too few people in this industry who are concerned about this and view it as a threat. Let me give you an example. About ten years ago, there was an excellent market in this country for red oak flooring. The Federal Housing Administration put into their minimum standards property allowance that, in new homes, a carpet placed over some material would be acceptable as part of a building and would therefore qualify for a mortgage. I don't know whether you fellows have looked at the trend in red oak flooring in the last ten years, but if you do you'll find precisely what happened.

We have seen the first proposed draft of the Federal Mobile Homes Standard. This standard will become effective next February. A statute will have to be promulgated and out to the public this August. The first proposal was that interior finish flame spread is two hundred, except in the hallways of mobile homes, where the flame spread would be twenty-five. The hallway in the mobile home is located right in the center of the mobile home. In over-the-road transport, it is the most critical structural area. Plywood has been used in interior finish as an important structural element in terms of transporting material. Mobile home industry has learned a lot and will continue to learn—it's going to cost money—but they can learn to strap and produce mobile homes in such a way that they can utilize gypsum board. Once gypsum board gets into the hallway of mobile homes, it will be a very easy matter for it to be used in the rest of the mobile homes.

The plastics industry acknowledges that they spend forty million dollars a year on certain fire problems. They're concerned about this very combustible product. They're concerned about it and they are responding to it.

McNeil: I'm not proposing that we do anything radical, gentlemen, I'm proposing that we react to something that is more than a threat, it's right here with us. It's no longer something on the horizon. Look what happened when it was decided that the flamespread of floor coverings in Federal buildings should be 75 or less. Red oak flooring, by definition, is 100. No more red oak flooring is being used in federal buildings—hospitals, veterans buildings, anything.

Helmuth Resch: I recall the long discussions that the technical committee of National Forest Products Association had before funding the research associate at the National Bureau of Standards. A number of years have passed. Looking back at this association, can you tell us a little bit about the feedback you get from this work at the NBS?

McNeil: The purpose of having a representative at the National Bureau of Stan-

dards is at least threefold. The primary purpose is to establish a communication link with NBS so that we have communication between the forest products industry and those people in government working on fire—so we know what they're doing and they have our inputs. Second, he is working on the rate-of-heat-release problem. And, third, he is working on a fire data system, which I indicated earlier is necessary to understand what the problem is in the first place, to define those areas that are hazardous so that we may do something about them. If someone at the bureau needs to know something about wood, they now can find out authoritatively and we now can learn of their progress and their plans. So, in the first area, the program has been successful. In the second area, we have learned a great deal about the various rate-of-heat-release systems being developed and are contributing to their evolution. It looks as though we will be able to make progress in the third area, the fire data system, in the near future.

Bob Hoyle: It seems to me we ought to have a professor at the University of Utah, somebody who is a graduate rather than a student who's learning.

McNeil: I agree with you. We ought to be doing more at the Bureau of Standards too. We ought to be doing more at the University of Utah. We ought to be doing something at John Hopkins. We ought to, and this is what the plastics industry is, indeed, doing. That's why I'm here today, sir. I'm here today to convince you people that we ought to be doing things like this.

B. Hoyle: I realize you're challenging us. It makes me think back over the years as an employee of the forest products industry that I've been told to keep as far away from fire testing as I could.

McNeil: This is a common philosophy. But it doesn't work. It's also known as burying your head in sand. It leaves another part of your anatomy exposed! I feel fortunate that I've gotten the support that I have from Weyerhaeuser in going as far as we have in fire testing and fire technology. You will notice that I have a couple of lines in my talk about a little missionary effort and a little sales job on your own organizations. I think it behooves every one of us to go out and do that.

Poo Chow: You mentioned you have a 2-foot tunnel test apparatus at the Weyerhaeuser lab. Can you relate test results obtained by the 2-foot tunnel test to the 25-foot tunnel?

MeNeil: The main purpose of the 2-foot tunnel is as a screening tool for the 25-foot tunnel. You can develop a correlation curve for each class of product. You may have a correlation curve for particleboard and another correlation curve for softwood plywood. You would not necessarily use the same correlation curve for both. We use it successfully as a screening tool for the 25-foot tunnel.

Ed Young: To get back to your problems in getting the money to finance somebody, it seems to me that would be a natural for the National Forest Products Association.

McNeil: They're supporting it with six thousand dollars. I got this as an association effort, which was my purpose. My objective was to get the wood products industry behind this effort.

Question: A field like this would be a legitimate area for the U.S. Forest Products Laboratory on a contractual basis to put the kind of man you need out there at the University of Utah. Have you ever approached the Lab?

McNeil: The Lab is aware of our situation. They have been involved in these discussions. They have not come forward with anybody thus far.

Comment: The effort needs to be directed toward convincing the public and designers of buildings that there are other factors involved.

McNeil: Surely, it's a continuing effort. The NFPA works on this continually. It's important. We have people working with the codes all the time trying to forestall this kind of poor code, but you can't wait forever. You can insist for just so long that "Wood is good."

Comment: I'm not talking about "Wood is good." I'm talking about the design of buildings via safety—putting emphasis on that.

McNeil: I firmly agree with you. We should design buildings with adequate exits, smoke warning devices, etc., and then we would not have to worry so much about the combustibility of the studs, the floor joists, or the interior paneling. We must work on the whole structure at once. Weyerhaeuser some years ago sponsored a program on fire data collection and analysis at the Southwest Research Institute. One of the reasons was to determine what would be the best way to design a building for fire safety. Since fires usually start in the contents, it doesn't matter whether you use combustible or noncombustible components in the walls if you have adequate smoke detection and egress possibilities. You will save the occupants.