Manufactured Housing Research Alliance MHRA

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December 23, 2004

Dorothy Shimer
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Re: Comment on Report to the California Legislature, Indoor Air Pollution in California, November 2004 Draft Report for Public Review

Dear Ms. Shimmer:

This comment pertains to the estimates of formaldehyde concentrations in modern manufactured homes discussed in Section 2.3.1.3 of the ARB report, and to the method by which those estimates were calculated as explained in Appendix III, Page III-1.

In our letter of August 19, 2004 commenting on the June draft report, we took issue with the method used to approximate formaldehyde concentrations in new manufactured homes. In that letter, the following two factors were raised as impacting the formaldehyde levels in new homes but not considered by the Sexton study that served as the basis for the ARB estimates (see attached for full text of comments pursuant to the June draft report):

1. There has been a reduction in formaldehyde levels in wood products used in new manufactured homes
2. There have been changes in manufactured homes construction that resulted in an overall reduction in formaldehyde levels

The ARB response referenced the first point; no response was offered to the second. In summary, basing formaldehyde estimates on the Sexton study is not good building science. It does not address the dramatic reduction in the use by home manufacturers of UF-bonded wood products, a change occurring since the Sexton report was completed (wood composite material ceilings and interior wood paneling have virtually vanished in favor or gypsum board).

According to the ARB's response to our comment on the June draft, the calculation is supported by a single study of four homes (Hodgson) conducted in the hot, humid southeast (Florida). This sample size is far too small to provide the basis for projections.

Further the homes in this study were built to a common design and specification by a single manufacturing facility and set up adjacent to the plant. Testing conditions were also atypical. Warm, humid conditions, typical in Florida but not nationally representative, tend to increase the rate of breakdown of UF resins and elevate formaldehyde emissions. The relationship of climate to higher indoor formaldehyde levels is cited in the ARB's report (page 63).

The report implies a far greater confidence in the 37 ppb estimate than is warranted by the combination of a flawed calculation method supported by an anecdotal sample of a few homes produced by a single plant, and conducted under worst case climate conditions. At a minimum, ARB should prominently note the lack of data needed to establish typical levels of formaldehyde in modern manufactured homes and that the ARB estimate is likely to be substantially higher than experienced in most modern manufactured homes.

Thank you for the opportunity to submit this comment. Please contact me with any questions.

Sincerely,
Manufactured Housing Research Alliance

Emanuel Levy
Executive Director

Enclosures: MHRA Comment on CARB June draft report with attachments

Manufactured Housing Research Alliance MHRA

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August 19, 2004

Dorothy Shimer
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Re: Comment on Report to the California Legislature, Indoor Air Pollution in California, June 2004 Draft Report for Public Review

Dear Ms. Shimmer:

This comment pertains to the estimates of formaldehyde concentrations in modern manufactured homes discussed in Section 2.3.1.3 and Figure 2.4 of the Report (Page 52), and to the method by which those estimates were calculated as explained in Appendix III, Page III-1.

It is understood that the method used in the report is an attempt to arrive at a rough approximation of formaldehyde concentrations in contemporary manufactured homes in the absence of contemporary data. However, the application of the method is flawed, resulting in a substantial overestimate of formaldehyde levels. As explained below, a more accurate application of the method utilized in the CARB report would result in a significantly lower estimate of ambient formaldehyde in contemporary manufactured homes.

The CARB report estimates levels of ambient formaldehyde in contemporary manufactured homes by extrapolating from a study conducted in 1985 that measured formaldehyde concentrations in manufactured homes (Sexton, et al., 1985). The extrapolations are based on the reduction in formaldehyde emissions in wood products (specifically particleboard, interior plywood and paneling) measured in a 1983 study (Pickrell, et, al, 1983) as compared to the levels measured in a 1999 study (Kelly, et al., 1999).

The application of this method is flawed in two primary ways:

1. **Reduction in formaldehyde levels in wood products**
   This application of the method assumes that the formaldehyde emission levels from wood product measured by Pickrell in 1983 were typical of the

formaldehyde emission levels from wood products contained in the homes measured by Sexton in 1985. This is an incorrect assumption. While Pickrell measured newly produced materials in 1983, Sexton's measurements were taken from homes produced over a wide range of years – often well before 1983.

By the time Pickrell did his measurements, formaldehyde levels had been dramatically reduced in many wood-based products. For example, the wood products industry had substantially reduced the formaldehyde emissions rates from particleboard by 1982. According to McCredie (1992) (Attachment A), by 1982 average particleboard formaldehyde emissions were approximately 35% of their 1980 levels. By 1985, they were approximately 15% of their 1980 levels.

The Sexton study measured formaldehyde concentrations in numerous existing homes. The homes measured in this study undoubtedly varied in age. According to the US Census Bureau's 1985 American Housing Survey, approximately 75% of "mobile homes and trailers" surveyed that year were acquired prior to 1979 (this was true for the West region as well as the nation as a whole). Additionally, fewer than half of all "mobile homes and trailers" were reported to have been acquired new. Therefore the vast majority of manufactured homes existing in the US (and in the West) in 1985 were constructed prior to 1979. We can conclude from this that the construction (including the formaldehyde content of the materials and the mix of materials in the home) of the vast majority of these homes would have been characteristic of homes constructed prior to the changes in material fabrication implemented by the wood products industry. These changes, as noted earlier, dramatically reduced formaldehyde emissions from these products. Therefore the lion's share of the reduction in formaldehyde emissions from wood products occurred after the majority of the Sexton homes were constructed.

The CARB report concludes that particleboard emissions in relatively new homes are 92% of their 1983 levels (or an 8% reduction). This is consistent with the data in McCredie, however it is incorrect to then apply this percentage reduction to homes that were constructed prior to 1983, when particleboard emissions were much higher. An 85% reduction would be more accurate given the age of the homes measured by Sexton.

2. **Change on construction of manufactured homes**
   The method used in the CARB report assumes that the proportion of particleboard, interior plywood and paneling used in contemporary manufactured homes is similar to that used in the homes measured by Sexton. This is not a correct assumption. According to a survey commissioned by the Manufactured Housing Institute (MHI) (Attachment B), interior paneling had largely been supplanted by non-formaldehyde containing gypsum board by 1993 (96% of all reported homes utilized gypsum wallboard and only 5% utilized hardwood panel walls in some portion of the home). In a similar survey conducted in 1988, approximately 60% of reported homes utilized gypsum wallboard, evidence that

this shift had been underway for some time. To more accurately reflect contemporary homes, the estimate of the contribution to formaldehyde emissions from paneling should be reduced to a maximum of 5% of its former level. The CARB report assumes no reduction (i.e., 100% of the former contribution).

The trend away from UF-bonded materials can also be observed in the construction of manufactured home ceilings. In 1984, the US Department of Housing and Urban Development modified Section 3280.203 of the Manufactured Housing Construction and Safety Standards to include new fire safety provisions; including a requirement for a lower flame spread rating for interior ceilings. The wood-based ceiling panels in use at the time did not comply with this requirement and therefore manufacturers moved away from this material for ceilings. By 1988, according to the MHI survey, nearly 80% of homes used non-formaldehyde containing gypsum board ceilings (Attachment C).

If these two errors are corrected, the CARB method would yield the results shown in Table 1.

Table 1 Revised estimated relative formaldehyde emissions rates

Material	**Revised emissions estimate[1]**	**Revised materials usage[2]**	**Revised aggregate emissions (emissions multiplied by usage)**	**CARB Report estimate[3]**
Particleboard	15%	100%[4]	15%	92%
Interior plywood	15%	100%[5]	15%	15%
Paneling	39%[6]	5%	2%	39%
Unweighted average	**N/A**	**N/A**	**11%[7]**	**49%**

Utilizing the same method as the CARB report, but correcting for the errors in the underlying assumptions, the estimated ambient formaldehyde levels in modern manufactured homes should be approximately 11% of the levels observed in the 1985 Sexton study, not 49% as indicated on page III-1 of the CARB draft report. Applying this to the average of the winter and summer geometric means determined by Sexton, yields an average formaldehyde concentration in modern manufactured homes (i.e. homes constructed in the past 15-20 years) of **8.25 ppb**, compared with 37 ppb in the CARB draft report.

[1] Current formaldehyde emissions as a percentage of emissions typical of materials utilized in the homes measured by Sexton
[2] Current material usage as a percentage of material usage typical of homes measured by Sexton
[3] Current formaldehyde emissions as a percentage of emissions typical of materials in 1983 according to Pickrell and Kelly
[4] Assumes the approximate amount of particleboard is unchanged
[5] Assumes the approximate amount of interior plywood is unchanged
[6] This figure, 39%, is taken from the CARB report, as data on formaldehyde emissions from pre-1983 paneling was not available at the time of this writing, although it is possible that the reduction was greater than stated.
[7] The elimination of wood-based ceiling panels is not accounted for in this figure because the formaldehyde emissions rate from the ceiling material was not included in the CARB average. Inclusion of this material change would further decrease the resulting aggregate emissions level.

Thank you for the opportunity to submit this comment. Please contact me with any questions.

Sincerely,
Manufactured Housing Research Alliance

Emanuel Levy
Executive Director

Enclosures: Attachment A – McCredie Paper
Attachment B – MHI Materials Survey (1993) Summary
Attachment C – MHI Materials Survey (1988) Excerpt

ATTACHMENT A

PROCEEDINGS OF THE TWENTY-SIXTH
WASHINGTON STATE UNIVERSITY

INTERNATIONAL PARTICLEBOARD/COMPOSITE MATERIALS SYMPOSIUM

April 7, 8, 9, 1992

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FORMALDEHYDE EMISSIONS FROM UF PARTICLEBOARD VOLUNTARY STANDARDS VS EPA REGULATION

WILLIAM H. MCCREDIE
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ABSTRACT

Formaldehyde emissions from urea-formaldehyde bonded wood panel products have decreased 75-90% since 1980. In 1984, the U.S. Department of Housing and Urban Development established formaldehyde emission standards for particleboard and plywood used in the construction of manufactured homes. This rule became the model for industry voluntary emission standards and was incorporated into a national consumer standard in 1989.

In 1986, the U.S. Consumer Products Safety Commission voted not to ban the use of urea-formaldehyde bonded particleboard floor underlayment used in conventional homes. Industry was encouraged to convert their voluntary standards to national consensus standards, which, subsequently, was done.

Recently, the U.S. Environmental Protection Agency announced plans to severely limit or ban the use of urea-formaldehyde bonded particleboard, in contrast to the other agencies' actions. Industry has responded with scientific and technical information challenging the reasoning for the proposed limits or ban in the use of urea-formaldehyde resin. There are major uncertainties about formaldehyde cancer risk and irritation caused by formaldehyde emissions. A consensus workshop of independent world health experts is called for, much like a similar consensus work-

shop held in 1984, to address the health issues. Such a consensus workshop should be held before the costly, unwarranted regulations are imposed.

The particleboard industry is working on having a new voluntary standard for flooring in place in 1992. This standard will call for a 0.20 ppm emission limit. Achieving such a limit (as contrasted to the present 0.30 ppm emission limit) will be a major, but achievable challenge. This new level is comparable to the most stringent emission levels found in the world. The plan is to incorporate this voluntary standard into the national consensus standard for particleboard.

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has been conducting a regulatory investigation of formaldehyde emissions from urea-formaldehyde bonded wood panel products since 1984. In August 1991, EPA announced its intent to develop a proposed regulation under Section 6 of the Toxic Substances Control Act (TSCA) that would: (1) ban the use of urea-formaldehyde (UF) resins in particleboard flooring products, and (2) require labels on certain cabinet and furniture products (based on their formaldehyde emission levels). EPA's surprise action apparently was taken to clear this regulatory investigation now in its ninth year; to bring it to a close.

However, EPA's choice of closure action — a ban of UF resins for particleboard flooring products under TSCA — is unwarranted. Substantial progress has been made in reducing formaldehyde emissions from all particleboard grades, a reduction of 75-90% since 1980. At the current low levels of product emissions, there is a significant issue as to whether there is any risk to home occupants, let alone an "unreasonable risk of injury to health," the necessary finding under TSCA to justify a regulation.

Neither is EPA's suggested ban the "least burdensome" regulation sufficient to regulate formaldehyde emissions as required by TSCA. Industry believes that no EPA finding of "unreasonable risk of injury" or regulation of UF particleboard flooring would be legally sustainable, particularly in light of the pronouncements of the Fifth Circuit Court of Appeals last year in overturning the EPA ban of asbestos products in *Corrosion Fittings v. EPA 947 F.2d 1201.*

In January 1992, the particleboard industry proposed to EPA an alternate voluntary standard approach. Industry is proceeding with its part to bring the EPA project to closure by developing a voluntary industry standard for particleboard flooring products with a formaldehyde emission limit of 0.20 ppm as tested in ASTM E1333-90 at a loading of 0.13 ft^2/ft^3. Improved resin formulation and plant process technology, plus the six years of plant experience in controlling emissions to the 0.30 ppm limit, allow this action to now be taken.

Assuming approval of the 0.20 ppm particleboard flooring emission limits, which we expect, industry will seek recognition by the Department of Housing and Urban Development (HUD) for the Manufactured Home Decking grade. For the particleboard Underlayment grade used in conventional homes, industry will seek recognition by the four U.S. model building code organizations. With the support of regulatory agencies, consumer and customer groups, the 0.20 ppm particleboard flooring emission limit could be incorporated into the national consensus product standard — ANSI/A208.1-1989.

A UF particleboard flooring voluntary standard of 0.20 ppm will be a major challenge for the industry, but is achievable. It is comparable to the most stringent emission standards in the world and continues the particleboard industry's achievements in reducing formaldehyde emissions through effective voluntary standards.

BACKGROUND

EPA has been reviewing the potential health effects in humans from low exposure levels of formaldehyde for more than eleven years. EPA decided in 1984, after considering the question for two years, that Section 4(f) of the Toxic Substances Control Act (TSCA) was triggered with respect to formaldehyde exposure of apparel workers and new home occupants. Section

4(f) is a provision of TSCA that authorizes an expedited investigation by EPA when it finds there may be a significant risk of harm from cancer. EPA said the exposure of apparel workers was due to fabrics that were treated for wrinkle resistance with formaldehyde-containing resins. (Note: in 1986, EPA referred the apparel worker portion of its investigation to the Occupational Safety and Health Administration [OSHA]).

For home occupants, EPA said the primary source of exposure was urea-formaldehyde (UF) bonded pressed-wood products (e.g., particleboard, medium density fiberboard [MDF], and hardwood plywood). EPA published its Advanced Notice of Proposed Rulemaking (ANPR), a call for information and public comments, in May 1984. The public, including the affected industries, were given 60 days to prepare and submit information on product emissions and expected exposure levels; technical feasibility, and capital and operating costs for substitute resin bonding systems; and the economic impact on the industry of product substitution or use of alternate higher-cost resin systems. During the next six years, 1985-1990, the pressed-wood industry provided additional information as requested to EPA and arranged for three separate multi-plant tours for EPA staff and their consultants working on the project.

One of the driving forces behind the regulatory interest in formaldehyde up to now has been the potential for cancer risk. This is prompted primarily by experiments in the late 1970s and early 1980s in which rats exposed to very high levels, almost 15 parts of formaldehyde per million parts of air (ppm), developed a rare form of nasal cancer. The EPA and other agencies took this high dose exposure information in rats and extrapolated down to projected risks in humans at very low doses using "linearized multi-stage" mathematical models. These models are controversial in application for a variety of reasons. First, these models produce an unbiased expression of risk — the Maximum Likelihood Estimate (MLE) — which for formaldehyde is extremely low. There is also an ultra-conservative expression of risk, the 95% Upper Confidence Limit or Upper Bound (UB) which can be as much as millions of times higher. The agencies have focused on these UB expressions of risk. Second, the early EPA assessments did not take into account many of the differences between rats and humans and the biological explanations of why the cancer might develop when the cells were bombarded with high level, extremely irritating, "cytotoxic" doses that overcome the body's natural defense mechanisms.

As detailed below, new science on these issues is slowly being incorporated into EPA's risk assessments. However, as the indicated risk of cancer is coming down, the focus of the regulators is switching to purported acute effects such as irritation.

During the 1980s, this very same issue — regulation of formaldehyde emissions from UF pressed-wood products, particularly particleboard flooring products — was reviewed and acted on by two other federal regulatory agencies. In 1984, the Department of Housing and Urban Development (HUD), acting on complaints of odor and irritation, issued a final rule establishing formaldehyde emission standards for particleboard and plywood used in the construction of manufactured homes. The formaldehyde emission limits, testing method, and testing conditions of the HUD standard were strongly supported by industry. This HUD rule became the model for industry voluntary emission standards. The HUD emission standard for particleboard was incorporated into a national consensus standard in 1989 (ANSI/A208.1-1989) and in 1991 was met by over 97% of all particleboard made in the United States. Industry voluntary standards have also been adopted for MDF (NPA 9-87) and hardwood plywood (HP-1 1992). U.S. product emission level testing and certification programs are now considered among the best in the world.

In 1986, the Consumer Products Safety Commission (CPSC) voted on its regulatory review of UF particleboard floor underlayment used in conventional homes. Not only was no product ban imposed, but the Commission denied a petition for a mandatory standard, finding

that the industry voluntary standards, in place since 1984, adequately addressed the concerns. CPSC encouraged industry to convert them to national consensus standards which subsequently has been done for particleboard. Although federal agencies with overlapping jurisdictions can have different views on a subject, the stark contrast in approach on this issue between the practical actions of HUD and CPSC on the one hand and EPA's proposed ban of UF flooring on the other, is difficult to comprehend to say the least.

The net result of the HUD and CPSC actions has been a significant reduction in formaldehyde emissions from all UF pressed-wood products, down 75-90% since 1980. For particleboard, this reduced level has been consistent for the past seven years as shown in Figure 1.

EPA ACTIVITY IN 1991 AND 1992

EPA has two related projects concerning formaldehyde emissions. One is a proposed revision of its assessment of cancer risk and acute (irritation) health effects of formaldehyde. The other is EPA's regulatory investigation of formaldehyde that focuses on UF wood panel products and particularly on UF particleboard used as flooring in new homes, both manufactured (mobile) and conventional.

Health Effects Assessment

EPA, in its 1990 and 1991 drafts — *Formaldehyde Risk Assessment Update* — has lowered the UB cancer unit risk estimate for a lifetime exposure of airborne formaldehyde. The value proposed, 2.4×10^{-7}, for a lifetime exposure of 1.0 $\mu g/m^3$, is 54 times less than the UB unit risk in EPA's 1987 risk assessment (1.3×10^{-5}). This risk reduction is due to EPA's recognition of new scientific research.

A subcommittee of EPA's Scientific Advisory Board (SAB) met in July 1991 to review the draft and to receive public comments. Presentations were made by industry-sponsored independent health experts that supported EPA's use of new scientific research which explains the mechanism of cancer, the differences between species, and why the extremely high doses of the research

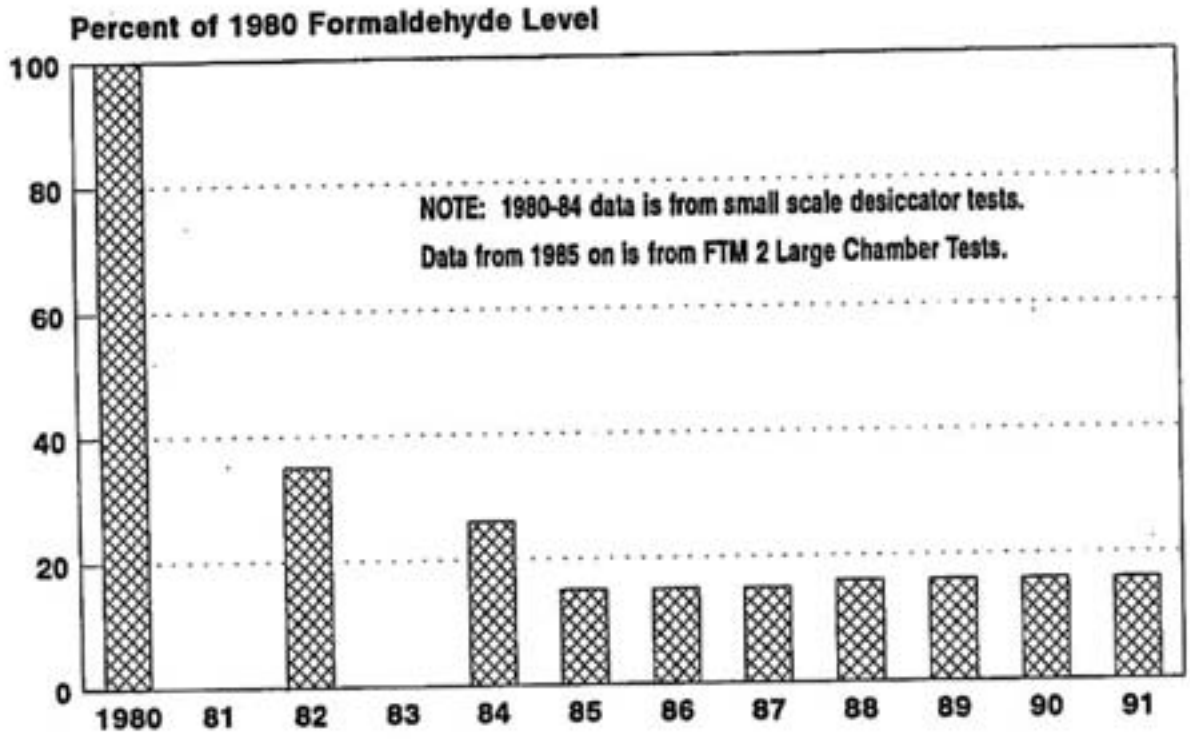

Figure 1. — *Average U.S. particleboard emissions 1980–1991*

studies are not representative of what happens at lower doses. This research includes new information on "monkey DNA-protein-crosslinking" (DPX) and "cell proliferation." At the hearing, the subcommittee members were divided on their support for use of the monkey DPX and the cell proliferation research, although, previously, the committee had strongly supported the monkey DPX information. A report from the SAB subcommittee is expected in April 1992.

EPA, however, still depends on both an ultra-conservative linearized multi-stage model, and the upper 95% confidence limit (UB) expression of risk that significantly overstates real risk. While EPA admits that the real cancer risk for low exposure to formaldehyde may be zero, the message being sent out to other regulatory agencies (such as the California Air Resources Board) and to the public, is one of "unreasonable risk."

In EPA's 1991 risk assessment draft there is a greatly expanded emphasis on irritation effects to people at low formaldehyde exposure levels. The new focus appears to be on exposures above 0.1 ppm. Industry is particularly surprised by EPA's claim that 0.1 ppm causes sensory irritations in normal individuals. People who work in wood panel plants using formaldehyde-containing resins usually cannot even detect the presence of formaldehyde unless it is at much higher levels. Even EPA staffers who visited wood panel plants in the last few years were similarly unaware of any formaldehyde odor/irritation except on rare occasion around the presses when levels were in the 1.0-2.0 ppm levels. Industry believes that in the general population, the threshold for minor sensory discomfort is much, much higher than either the levels being discussed by EPA or the low levels emitted from UF wood panel products.

The major uncertainties about both formaldehyde cancer risk and irritation cry out for another attempt to develop a consensus of science by independent health experts before costly unwarranted regulations are imposed. A consensus workshop in 1984 was instrumental in consolidating the knowledge then available. Industry believes that another meeting of world experts would be very useful, particularly in light of the new research and the controversy surrounding the risk assessment on formaldehyde.

Regulatory Investigation

In early 1991, EPA apparently decided it was time to conclude its eight-year regulatory investigation of formaldehyde. In May, EPA invited industry representatives to a meeting to inform them of this new effort to complete the project and to seek industry views. In June, again at EPA's request, a fifteen person industry team met for a full day with EPA staff and consultants to provide them with current information on the economic and technological aspects of UF resin use in wood panels. On June 19, industry sent a 90-page report to EPA providing specific information on: (1) exposure considerations, (2) cost analysis of resin change, (3) scavenging techniques, (4) special concerns for hardwood plywood, (5) other resin technologies, and (6) competitive products.

Industry, therefore, was shocked to learn on August 2, 1991, from a weekly newsletter on regulatory activities that EPA intended to develop a proposed rule to: (1) ban UF resins in particleboard flooring products, and (2) require labels on certain cabinet and furniture products based on their formaldehyde emission levels. On meeting with EPA staff a few days later, industry found out that the newsletter article was essentially correct. At a briefing of the Assistant Administrator for Toxic Substances on July 2, EPA staff recommended the ban of UF flooring products, the option that was selected. Implicit in any UF ban would be a finding by EPA of an "unreasonable risk of injury to health" due to current estimated exposure levels.

In September, industry representatives held two meetings with Linda Fisher, Assistant Administrator for Pesticides and Toxic Substances, and Mark Greenwood, Director, Office of Toxic Substances (now, Office of Pollution Prevention and Toxics) and other EPA staff members. From these meetings with EPA, came a new possible alternative to the proposed ban, namely, the use of Section 5 of TSCA - the Significant New Use

Rule (SNUR). In a SNUR agreement, industry would agree to a reduction in the formaldehyde emission for UF particleboard flooring that would be enforced by EPA, and further clarifications could be made in exposure estimates.

Industry and EPA teams met three times during November and December 1991 to discuss the SNUR alternative. At the December 17th meeting, industry said it was prepared to discuss a 0.20 ppm emission limit for particleboard flooring products. Industry suggested the new standard would better be accomplished by voluntary action rather than under Section 5 of TSCA.

Industry in early January 1992, submitted to EPA a more specific written proposal to resolve the issue through an effective voluntary standard approach. EPA responded that its primary interest was in an agreement that might use TSCA authorities other than Section 6 to address the issue although it might consider other approaches. EPA also noted that the discussions should be opened to the staff of CPSC. The industry intends to proceed with the new voluntary standard and will also continue discussions with EPA on proper exposure model parameters where we differ, such as on average home temperature and emission decay rates, and EPA's proposal to conduct an elaborate "home study" to verify their exposure models.

INDUSTRY'S CONCERNS

Industry believes that EPA's proposed ban of UF resin use in particleboard flooring is a good example of a bad regulatory proposal that has no practical utility and should be discontinued.

First and foremost, there is no unreasonable risk of injury, no reason to ban the products. At the current low levels of product emissions, there is a significant issue as to whether there is any risk to typical home occupants, let alone an "unreasonable risk of injury to health," the necessary finding under TSCA to justify a regulation.

Second, there is a tremendous stigma attached to a product ban and even the suggestion of a ban. What would consumers with particleboard flooring in their homes be expected to do if EPA banned the product? Should it be removed? Should testing be done of all the homes in America? The stigma would also flow to other UF panel uses.

Third, a UF flooring ban could have a dramatic impact on home values. Remember the experience with Urea Formaldehyde Foam Insulation (UFFI) when CPSC banned it in the early 1980s based on unwarranted, overstated claims of risk? While courts promptly overturned the ban, the damage had been done. Homeowners who had UFFI immediately experienced a precipitous decline in the appraised value of their homes, not because of elevated formaldehyde levels, but just because UFFI had been used in their homes.

Fourth, EPA's proposed ban is not the "least burdensome" regulation sufficient to regulate formaldehyde emissions. This is a requirement under TSCA as the U.S. Fifth Circuit Court of Appeals again stressed last year in *Corrosion Fittings v. EPA.*

For these reasons, industry believes that no EPA finding of "unreasonable risk of injury" or regulation of UF particleboard flooring would be legally sustainable. However, if EPA continues to pursue a ban, the damage to our products and industry and our customers could be significant.

In March, these concerns were submitted by industry to EPA and other interested parties as part of President Bush's Regulatory Moratorium. Under this 90-day review of old and new regulations, EPA is to identify any unnecessary and burdensome regulations which impose needless costs on consumers and impede economic growth.

Viewed in a more technical sense, the expected reduction in the exposure of home occupants to formaldehyde is negligible between UF particleboard flooring at a lower emission standard and PF-bonded flooring panels. The Hardwood Plywood Manufacturers Association has made various exposure estimates using the Versar model developed by EPA. The model inputs used are shown in Table 1.

The product "Loading" estimate is that used by EPA when pressed-wood products are used in substantial amounts. Average temperature for the home model is 73.4°F (23°C) (ASTM E1333-90 test temperature is 77°F [25°C]). Ventilation rate is 0.5 air changes per hour. Emission decay rate is: 1st half-life in one year; then, half-life every 2.92 years. Home background formaldehyde level is 0.03 ppm (i.e., expected level from other emitting sources).

The results of the model runs represent home concentrations of formaldehyde with three different types of underlayment (UL) — the average current UF particleboard, the expected average UF particleboard meeting a new 0.20 ppm industry standard, and a PF oriented strand board (OSB) underlayment are shown in Table 2.

These estimated formaldehyde home levels for the three different underlayments are shown in Figure 2. The purported benefit of a ban of UF particleboard flooring compared with the 0.20 ppm UF voluntary standard would be a reduction in the average first-year concentration of 0.019 ppm, a level that is less than the sensitivity of several good formaldehyde test methods. The difference in the average concentration of the first 10 year period in a new house — *5 parts per billion (ppb)* — must be viewed as a negligible difference with absolutely no related health benefits. To put 5 ppb into perspective, the State of California Air Resources Board estimates the outdoor ambient formaldehyde level to be 4.4 ppb. This is the average for the whole state — both urban and rural areas.

A PRACTICAL SOLUTION

Industry believes that a voluntary standard approach is by far the most practical and efficient way to close out the pressed-wood formaldehyde

Table 1.—Versar model inputs

Panel Product	Initial Emission Level (ppm) (ASTM E1333-90)	Loading Rate (ft^2/ft^3)
Underlayment		
UF Particleboard – 0.30 ppm Std.	0.19	0.109
UF Particleboard – 0.20 ppm Std.	0.12	0.109
PF OSB	0.06	0.109
Other Panels		
UF Particleboard Industrial	0.19	0.021
UF Hardwood Plywood	0.13	0.052
UF MDF	0.21	0.005

Table 2.—Versar model results

		Estimated Home Concentrations	
Underlayment Case	Initial Level (ppm)	Average 1st Year	Average 10-Year
UF Particleboard – 0.30 ppm Std.	0.180	0.130	0.0514
UF Particleboard – 0.30 ppm Std.	0.137	0.099	0.0428
PF OSB	0.110	0.080	0.0379

emission investigation at EPA. A lower emission limit of 0.20 ppm for particleboard flooring products in a voluntary standard would have an enforcement/compliance process that is already established. For Manufactured Home Decking, industry will seek HUD's reference of the lower limit in its Manufactured Home Construction and Safety Standards currently under revision. For Underlayment, industry will seek reference of the lower limit by the four U.S. model building code authorities.

It is time once again for the U.S. particleboard and MDF industries to act by further reducing formaldehyde emissions from their products. Continued regulatory pressures, including EPA's proposed ban of UF particleboard flooring products, whether warranted or not, will cause defamation of UF panel products. Associated with this defamation could be: (1) worsened relations with our customers, consumers, and regulatory agencies, (2) loss of value of homes and other products made with UF pressed-wood products, and (3) increased exposure to liability suits against both panel manufacturers and their customers.

The U.S. particleboard industry has begun the process to have a 0.20 ppm emission limit industry voluntary standard in place by mid-1992 (effective date several months after approval). In great part, the industry is willing to take this action because of the six years of experience plants now have in controlling product emissions to the 0.30 ppm limit. Plant operating and technical personnel together with UF resin suppliers have developed improved technology to obtain lower product emissions. These technical improvements include:

1. Consistent quality, low-emitting UF resin formulations
2. Better understanding of the effect of plant process variables
3. Better process controls
4. Techniques of scavenger use

Plant managers, technical staff, and operators have learned, together, how to employ optimum combinations of these factors to best obtain desired results.

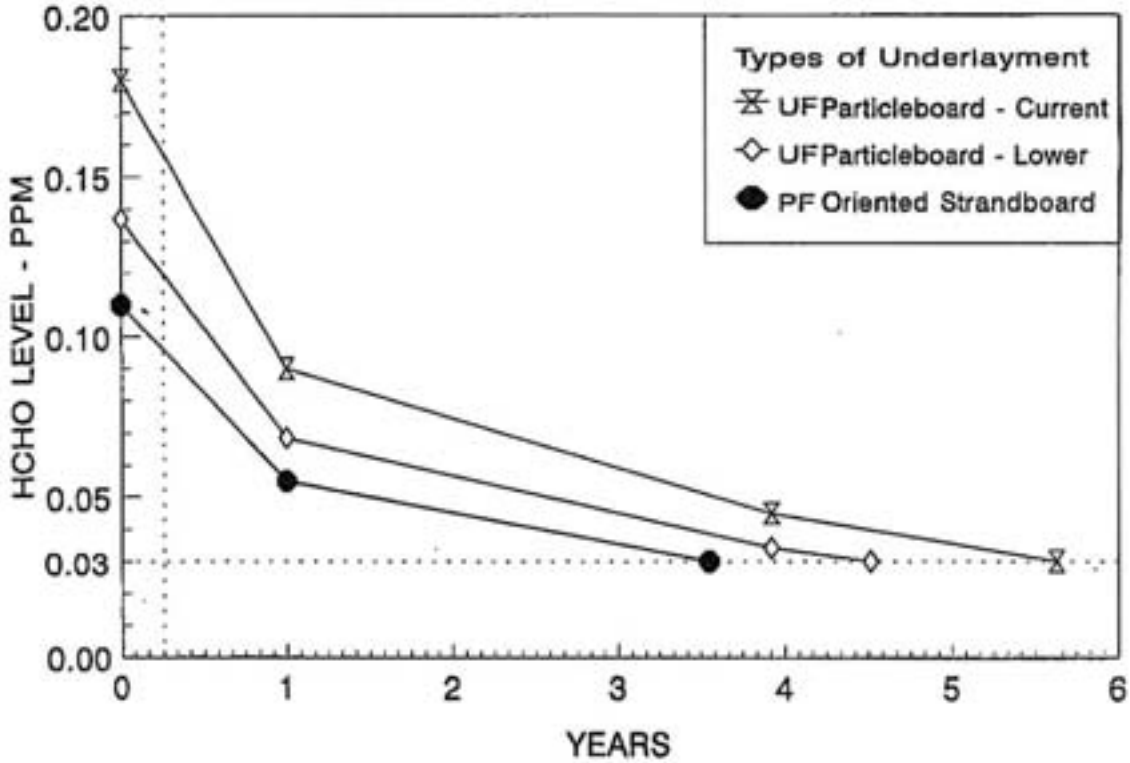

Figure 2. — *Effect of various underlayments on home formaldehyde levels using EPA product loading*

With support from the interested regulatory agencies, consumer, and customer groups, the 0.20 ppm particleboard flooring emission limit could be incorporated into the national consensus product standard for particleboard — ANSI/A208.1-1989. A UF particleboard flooring voluntary standard of 0.20 ppm will be a major challenge for the industry, but is achievable. It is comparable to the most stringent emission standards in the world and continues the particleboard industry's achievements in reducing formaldehyde emissions through effective voluntary standards.

ATTACHMENT B

Manufactured Housing Institute

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FORMALDEHYDE-CONTAINING MATERIALS SURVEY RESULTS ANNOUNCED

The Technical Activities Department conducted a survey of formaldehyde resin use in wood paneling, flooring, cabinets and molding over the past month. Responses accounted for 130,656 homes produced or planned for in 1993, or about 55% of industry's expected production for the year. As such, they are statistically significant.

Type of Material	Total Reported Homes Using	% of All Reported Homes Using
Gypsum Wallboard	124,885	96
Hardwood Panel Walls (UF Resin)	6,903	5.0
UF Particleboard Decking	88,022	67
Oriented Strandboard Decking (PF Resin)	27,108	21
Plywood Decking (PF Resin)	15,702	12
PF Particleboard Decking	573	0.4
Medium Density Fiberboard (UF) Kitchen Cabinet Fronts	88,643	68
Medium Density Fiberboard (UF) Vanity Fronts	91,989	70
Moldings/Cornices:		
Medium Density Fiberboard	15,778	12
Plastic	12,763	10
Wooden	119,827	92

Gyspum wallboard, which does not contain formaldehyde, was used in nearly all homes produced, compared with UF resin-based hardwood paneling which was used in very few homes. UF particleboard decking increased in use from our 1991 survey where 48% of our homes reported being constructed with this decking.

July 16, 1993
Rev. 11-3-93

ATTACHMENT C

COMPARISON OF PRODUCTS USED IN CEILINGS FOR MANUFACTURED HOMES

Figures 5a and 5b show the average percentage of product usage in ceilings for manufactured homes. The predominant product used in ceilings is gypsumboard for both single-section and multisection homes (79.4% and 78.1% of the total square footage for ceiling surface area).

percentage of total square footage for ceiling area only in manufactured homes surveyed

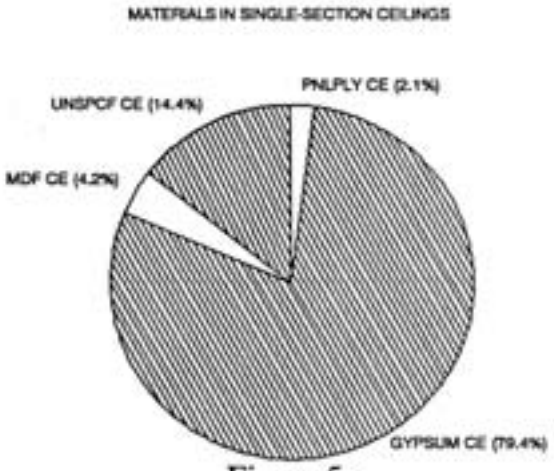

Figure 5a

percentage of total square footage for ceiling area only in manufactured homes surveyed

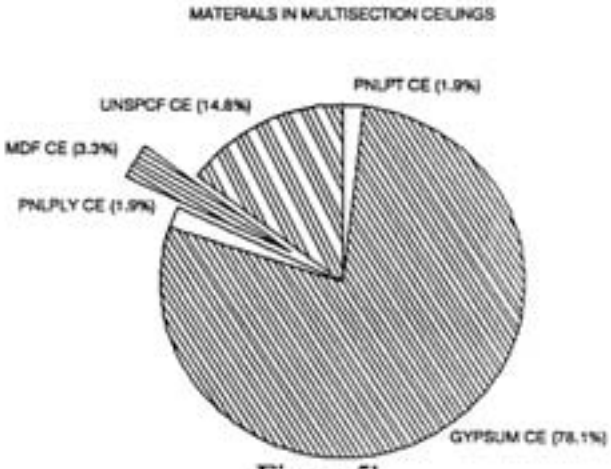

Figure 5b