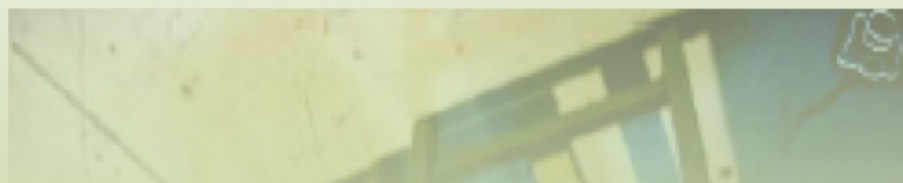


kid-safe furniture

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Painted pressed wood furniture for use in kindergarten must be regulated to minimize harm to young children.

Table of Contents

1. Background&Introduction

2. What are the pollution and pollutants levels of current pressed wood furniture in indoor environment?

- *Table 1 Formaldehyde Effects levels*

- *Indoor formaldehyde levels are dependent on four factors*

- *table 2 and 3*

3. Difference between young children and adult on pollution tolerance and sensitivities?

- *different in terms of exposures*

- *U.S EPA, Toxicity and Exposure Assessment for Children's Health [TEACH].*

- *table 4 and 5*

4. Summary on potential harm

- *Formaldehyde - Volatile Organic Compounds [VOCs]*

- *table 6,7,8 and 9*

5. Search strategies

- *Google searches online*

- *References*

Background&Introduction: In modern city life, the quality of air in the indoor environment has a significant impact on human health and comfort. After all, where most people spend most of their time. Poor indoor air quality can lead ill health. Good indoor air quality safeguards the health of the building occupants and contributes to their comfort and well-being. In homes, the most significant sources is formaldehyde, it's a Volatile Organic Compound and toxic chemical ingredient from pressed wood products made using adhesives that contain urea-formaldehyde resins.

Include:particleboard;hardwood plywood paneling;and medium density fiberboard.Medium density fiberboard contains a higher resin-to-wood ratio than any other urea-formaldehyde pressed wood product and is generally recognized as being the highest formaldehyde-emitting pressed wood product.

What are the pollution and pollutants levels of current pressed wood furniture in indoor environment?

Formaldehyde is a colorless gas with a pungent smelling, cause effects see [Table 1]. Emissions of formaldehyde are highest in the first few months when products are new. Later,formaldehyde is released more slowly, but the release continues for a long period of time, often over a number of years.

Table 1 Formaldehyde Effects levels

<p>Formaldehyde -hyde Aldehyde -s</p>	<p>Common indoor sources: Pressed wood products with adhesives using urea-formaldehyde resins.Such as: particleboard used in cabinetry and furniture, hardwood plywood paneling, fiber board, combustion sources, tobacco smoke,textiles and glues.</p>	<p>Health Effects: Water eyes, burning sensations in the eyes, nose, throat, nausea and difficulty breathing at elevated exposure levels. Wheezing, coughing, fatigue, skin rash, and severe allergic reactions. High levels can trigger asthma.</p>
<p>Volatile Organic Compound -s [VOC]</p>	<p>VOCs are emitted as gases from solids or liquids and include a variety of chemicals. Found in many household products such as paints, cosmetics, hobby products, varnishes, cleaning and disinfectant sprays.</p>	<p>Some chemicals can have short or long term health effects: eye, nose and throat irritant, nausea, loss of coordination, headaches, damage to liver, kidney, and central nervous system. Visual disorders, memory impairment, respiratory tract irritation and some are suspected or known to cause cancer.</p>

Indoor formaldehyde levels are dependent on four factors:

- ① *The volume of the home;*
- ② *Its ventilation rate [the amount of outdoor air entering or leaving the indoor area];*
- ③ *The formaldehyde emissions of each product within the home;*
- ④ *Temperature and humidity.*

- Home with a low volume, poor ventilation and a larger number of formaldehyde-emitting products will tend to have high levels of indoor air pollution.

- As the temperature rises, more formaldehyde is emitted from the product. The reverse is also true; less formaldehyde is emitted at lower temperature. In a residence change with the season and from day-to-day and day-to-night. Levels may be high on a hot and humid day and low on a cool, dry day.

- Humidity also affects the release of formaldehyde from the product. As humidity rises more formaldehyde is released.

Understanding these factors is important when you consider measuring the levels of formaldehyde. To be effective, any such coating must cover all pressed wood furniture's surfaces and edges and remain intact.

The World Health Organization guideline for indoor air formaldehyde concentration is 0.08 ppm (0.1mg/m³).

Formaldehyde is normally present at low levels, usually less than 0.03 ppm in both outdoor and indoor air. Average concentrations in older houses with UFFI are generally well below 0.1 ppm. In homes with significant amounts of new pressed wood furniture, levels can be greater than 0.3 ppm. Highest average concentrations are reported for mobile homes. The high concentrations of formaldehyde in mobile homes are primarily caused by the large quantity of the decking, decorative hardwood plywood wall covering, particleboard shelving, and cabinetry made from a variety of pressed wood furniture. With few exceptions, average formaldehyde levels in UFFI houses are typically in the range of 0.5-0.06 ppm.

See table 2 and 3

Table 2 Formaldehyde Levels in Residential Environments

Study	Number	Concentration (ppm)		
		Range	Mean	Median
Mobile Homes				
Minnesota ¹³⁰	397	0.02-3.69	0.42	—
Texas ¹³¹	159	<0.02-0.78	0.15	—
Wisconsin				
Complaint ¹³²	65	<0.10-3.68	—	0.47
Noncomplaint ¹³³	137	<0.10-2.84	0.46	0.39
California ¹³⁴	663		0.09	0.07
UFFI Homes				
Ontario ¹³⁵	450		0.045	—
New York State ¹³⁶	1954	0.00-0.49	0.06	—
New Hampshire ¹³⁷	71	0.01-0.17	0.06	0.05
Conventional Homes				
Ontario ¹³⁸	225		0.03	—
CPSC ¹³⁸	41	0.01-0.08	0.03	—
Indiana ¹³⁹				
PB subflooring	30	0.01-0.46	0.11	0.09
Non-PB subflooring	58	0.00-0.14	0.06	0.06
Minnesota ¹³⁰	489	0.01-5.52	0.14	—
California ¹³⁴	51	0.01-0.09	0.04	—

Table 3 Formaldehyde Effects levels

Formaldehyde Effects	
Concentration (ppm)	Effects
0 - 0.5	None
0.01 - 0.20	Eye Irritant
0.05 - 1.0	Odor
0.10 - 0.25	Upper Airway Irritant
5.0 - 30	Pulmonary Effects
50 - 100	Edema, Pneumonia
>100	Death

Note: This table is an accumulation of results from several studies which produced varying results.

Difference between young children and adult on pollution tolerance and sensitivities?

Children are not simply little adults. Children are different from adults in terms of sensitivity because they are growing and their internal organs are developing and maturing; Also different in terms of exposures because they have distinctly different behavioral and eating patterns.

- 1st children's metabolic pathways, especially in the first months after birth, are immature compared to those of adults. In some instances, children are actually better able than adults to cope with environmental toxicants;

- 2nd children are growing and developing, and their delicate developmental processes are easily disrupted.

Their immune system is immature. Many organ systems in infants and children undergo extensive growth and development throughout the prenatal period and the first months and years of extrauterine life;

- 3rd children have more future years of life than most adults, they have more time in which to develop chronic disease that may be initiated by early exposures. Exposures sustained early in life, including prenatal exposures, appear more likely to lead to disease than similar exposures encountered later. Also, deficits sustained early may persist lifelong;

- 4th children breathe faster and eat and drink more in proportion to their body weight which means they are exposed to proportionally more chemicals;

- 5th children's behavioral predisposes them to chemical exposure as they tend to put things in their mouths and spend more time in close contact with potentially contaminated surfaces such as carpets and dirt because they crawl and play on the floor;

- 6th children often don't realise they have come into contact with hazardous chemicals and don't take the necessary steps to wash remove themselves from it.

U.S EPA, Toxicity and Exposure Assessment for Children's Health [TEACH].

- The **TEACH Database** contains summaries of research articles from peer-reviewed journals that pertain to early-life and childhood exposure and health effects.

- The **TEACH Chemical summaries** highlight information from the TEACH Database and other U.S Federal resources in a standardized format. [*Table 4 & 5*]

Chemicals of Concern Listed in TEACH Database

2,4-Dichlorophenoxyacetic Acid	Dichlorvos	Nitrates and Nitrites
Arsenic	Formaldehyde	Permethrin and Resmethrin (Pyrethroids)
Atrazine	Manganese	Phthalates
Benzene	Mercury (Elemental)	Polychlorinated Biphenyls (PCBs)
Benzo(a)pyrene (BaP)	Mercury (Inorganic)	Trichloroethylene (TCE)
DEET	Mercury (Methylmercury and Ethylmercury)	Vinyl Chloride

The TEACH Database

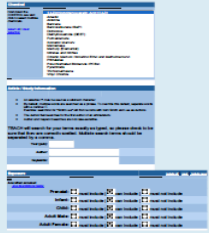
The primary purpose of the TEACH Database is to summarize children's health-related articles from the recent scientific literature, and organize that information for a range of users. Studies included in the TEACH Database are generally restricted to developmental studies (from gametes to adolescence) from the peer-reviewed literature. The TEACH Database does not critically review or evaluate studies for scientific quality. The TEACH Database contains almost 2,000 summaries of articles published from January 1972 through December 2004 and is updated annually.

TEACH Database Query Parameters

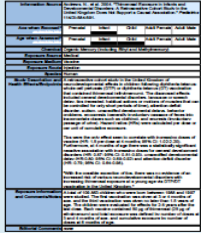
The TEACH Database offers the ability to search using the following parameters:

- one or more of the chemicals;
- first author;
- date of publication;
- keywords;
- exposure and assessment criteria.

Query Parameters
(partial list of parameters)



Query Results



The TEACH Chemical Summaries

Each TEACH Chemical Summary focuses on one TEACH chemical of concern. TEACH Chemical Summaries provide a compilation of information from U.S. EPA publications/Web sites, ATSDR publications/Web sites, and articles included in the TEACH Database. Additional Chemical Summaries will be posted in the upcoming months, with at least four more summaries to be posted by summer 2006.

Information in the Chemical Summaries

Introduction: overview of exposure and health effects for the chemical

Exposure: relative potential for exposure from several media

Toxicity Summary: summary of known health effects

Exposure and Toxicity Studies from the TEACH Database: summary of developmental studies listed in the Database

Considerations for Decision-Makers: information pertaining to risks


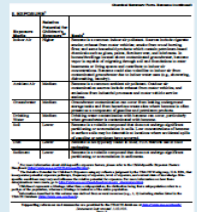
Toxicity Reference Values: list of current toxicity and reference values

Regulatory Information: current U.S. regulatory resources

Background on Chemical: chemical properties, and production/use details

References: references cited for all sections of the Chemical Summary

TEACH Chemical Summaries are 9-14 pages in length. Shown below are two sample pages from the Benzene Chemical Summary.

The Chemical Summaries include sections on special concerns for children, considerations for decision-making, exposure, toxicity, regulatory issues, and background on the chemical. Moreover, the tolerance and sensitivities for standard pollution level for the young children and adult have different and the threshold pollution level of the children under six years old has lower than the threshold pollution level of the adult. The children under six years old and adult has different reaction for the different time of exposure for the pollution level of current pressed wood furniture in the indoor environment.

Summary on potential harm

Table 6 Problem indicators indoor

Description	Problem
Solvent smell	VOCs
Chemical smell	Formaldehyde, pesticides, other chemicals

Volatile Organic Compounds [VOCs] are chemical compounds that contain one or more carbon atoms and tend to evaporate at room temperature and normal atmospheric pressure. They could create an indoor air quality problem if they temporarily or permanently exceed normal levels. [Table 7] Formaldehyde is a VOC and a chemical ingredient from pressed wood furniture and paints used indoors.

Table 7 Indoor VOCs and Sources

Pollutant	Indoor Sources
Formaldehyde	Germicide, pressed-wood products, urea-formaldehyde foam insulation (UFFI), hardwood plywood, adhesives, particle-board, laminates, paints, plastics, carpeting, upholstered furniture coverings, gypsum board, joint compounds, ceiling tiles and panels, non-latex caulking compounds, acid-cured wood coatings, wood panelling, plastic/melamine panelling, vinyl floor tiles, parquet flooring

Table 8 HongKong Classification of Emission Rates

Parameter	Excellent Class	Good Class
Total Volatile Organic Compounds (TVOC)	< 200 $\mu\text{g}/\text{m}^2 \text{h}$	< 400 $\mu\text{g}/\text{m}^2 \text{h}$
Formaldehyde (HCHO)	< 50 $\mu\text{g}/\text{m}^2 \text{h}$	< 125 $\mu\text{g}/\text{m}^2 \text{h}$
Ozone (O_3) - for centrally located machines	< 10 $\mu\text{g}/\text{h m}^3$	< 10 $\mu\text{g}/\text{h m}^3$
Ozone (O_3) - for personal-used machines	< 100 $\mu\text{g}/\text{h m}^3$	< 100 $\mu\text{g}/\text{h m}^3$

Table 9 Formaldehyde Emissions a Variety Products

	Range of Formaldehyde Emission Rates $\mu\text{g}/\text{m}^2/\text{day}$
Medium-density fiberboard ¹²⁶	17,600–55,000
Hardwood plywood paneling ¹²⁷	1,500–34,000
Particleboard ^{127,128}	2,000–25,000
Urea-formaldehyde foam insulation ¹²⁸	1,200–19,200
Softwood plywood ¹²⁸	240–720
Paper products ¹²⁷	260–680
Fiberglass products ¹²⁷	400–470
Clothing ¹²⁷	35–570
Resilient flooring ¹²⁷	< 240
Carpeting ¹²⁷	NP ^a –65
Upholstery fabric ¹²⁷	NP–7

^aNP = none present.

Formaldehyde is just one of several gases present indoors that may cause illnesses. Many of these gases, as well as colds and flu, cause similar symptoms.

Persons have developed allergic reactions [allergic skin disease and hives] to formaldehyde through skin contact with solutions of formaldehyde or durable-press clothing containing formaldehyde. Others have developed asthmatic reactions and skin rashes from exposure to formaldehyde.

Potential media of permethrin and resmethrin exposure of infants and children include lice shampoos, air in urban areas, soil in agricultural areas, house dust, treated turf and carpeting, and diet.

- Children are at risk of exposure to pyrethroids in the home. Infants and toddlers were estimated to have higher rates of dermal exposure to resmethrin than adults through contact with resmethrin-contaminated house dust on household surfaces. A study in Minnesota revealed that 24% of families surveyed stored permethrin in the house, and 15% of families used permethrin at home. Another study in

Minnesota detected permethrin most frequently in personal air samples, but infrequently in drinking water.

- Pyrethroid metabolites have been detected in urine of adults and children. A cohort study of 386 pregnant women in New York City were evaluated for indoor pesticide exposure, and detected a pyrethroid metabolite, phenoxy benzoic acid [PBA], in their urine. Pyrethroid metabolites have also been detected in urine of children in Germany.

- Measuring infant growth parameters at birth, one study found no significant associations between pyrethroid metabolite concentrations in maternal urine, and their infant's size at birth [head circumference, birth weight]. Another study found no significant differences in several measurements of birth outcome [birth weight, number of miscarriages] in children born to women who used permethrin for head lice treatment during pregnancy, as compared to women who did not.

- Permethrin exposure may impact the immune system in children. The presence of anti-nuclear antibodies in blood, a marker of potential or existing autoimmune disease, in children and adults was associated with estimated exposure [personal questionnaire] to permethrin. The incidence of anti-nuclear antibodies between age groups was similar in this study. Also, case reports indicated that children exposed to permethrin developed immune-mediated respiratory and dermal irritation.

Additional formaldehyde is an irritant which can elicit adverse respiratory responses in children and adults.

- Adult epidemiological studies have found formaldehyde to be significantly associated with cancer of the respiratory tract, including nasopharyngeal [nose/throat] cancer. The World Health Organization [WHO] International Agency for Research on Cancer [IARC] reported "strong but not sufficient evidence for a causal association between leukemia and occupational exposure to formaldehyde". Formaldehyde exposure has also been associated with inflammation and toxicity of the gastrointestinal tract in adults.

- In children, inhalation exposure to formaldehyde were associated with irritation of the respiratory tract, asthma, and irritation of eyes. Dermal exposure via patch tests have resulted in skin irritation [positive patch test result], possibly mediated by an allergic response. One study in rats reported that formaldehyde was found to be teratogenic for fetuses from inhalation-exposed, iron-deficient pregnant mothers.

Search strategies:

Google searches online:

- The WHO IARC classified formaldehyde as carcinogenic to humans <http://monographs.iarc.fr/ENG/Monographs/vol88/volume88.pdf>

- U.S. Environmental Protection Agency[EPA], Toxicity and Exposure Assessment for Children's Health. database at: <http://www.epa.gov/teach/>. Last revised 9/20/2007: includes research articles and other information through 2006.

 - <http://www.epa.gov/iaq/formalde.html>

 - <http://www.surgeongeneral.gov/library/secondhandsmoke/>

 - <http://www.atsdr.cdc.gov/toxprofiles/tp111.pdf>

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