

**Table 1. Indoor Formaldehyde Concentrations for Different Sampling Times**

Type of sample	No. of Samples	Max. (ppm)	Min. (ppm)	Med. (ppm)	Mean±SE (ppm)	ANOVA	Multiple comparisons by Bonferroni t-test			
							during construction	completed < 1 mo	completed 1~3 mo	completed > 3 mo
during construction	34	1.941	0.025	0.342	0.446 ±0.074					
< 1 mo after construction	12	0.836	0.112	0.314	0.330 ±0.055		<i>t</i> = 2.33*			
1~3 mo after construction	11	0.615	0.041	0.145	0.199 ±0.052	<i>P</i> < 0.05	<i>t</i> = 1.84	<i>t</i> = 1.72		
>3 mo after construction	3	0.147	0.085	0.092	0.109 ±0.019		<i>t</i> = 1.34	<i>t</i> = 1.94	<i>t</i> = 0.88	
Outdoors	7	0.041	0.001	0.025	0.023 ±0.006		<i>t</i> = 2.60*	<i>t</i> = 4.19*	<i>t</i> = 2.69*	<i>t</i> = 5.87*
Indoor background#	4	0.035	0.015	0.023	0.024 ±0.011					

# More than 5 years without remodeling.

\* *p* < 0.05.

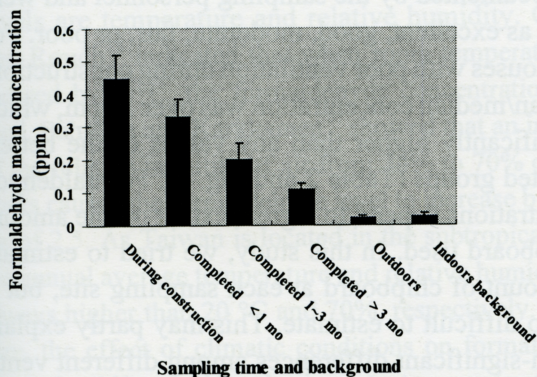


Fig. 1. Indoor formaldehyde mean concentration and standard error versus sampling time and background.

concentrations decreased with time after the construction period. Indoor formaldehyde concentrations ranged from 0.025 to 1.941 ppm, with an average/median value of 0.446/0.34 ppm during the construction period. The exposure of workers was the main concern in this period. Thus, it should be considered as an occupational problem. Judged by the current occupational exposure standards, the permissible exposure limit (PEL) in Taiwan is 1 ppm<sup>14</sup>; the PEL in the US is 0.75 ppm.<sup>8,9</sup> So, 9% and 11.7% of the samples exceeded these two standards, respectively. Obviously, we should be concerned about the formaldehyde exposure of interior construction workers;

and those occupants who remain in the house during the construction period are also susceptible to high concentrations of formaldehyde. One month after completion of the interior decoration, the formaldehyde concentration had decreased to a mean value of 0.330 ppm (median, 0.314 ppm; max., 0.836 ppm); this improvement is partly attributed to the external layers of paint or other substances covering the formaldehyde source. Puhakka and Karkkainen<sup>15</sup> also found that the use of reactive paint to bind formaldehyde clearly reduces the emission of formaldehyde from chipboard. Comparing both periods mentioned above, the difference is significant (*t* = 2.33, *p* < 0.05). Then the formaldehyde concentration continued to fade such that within 1~3 months after construction, the average concentration was 0.199 ppm (median, 0.145 ppm; max., 0.615 ppm); for periods longer than 3 months, the average concentration decreased to 0.109 ppm (median, 0.085 ppm; max. 0.147 ppm). After more than 5 years without remodeling, the mean/median value was 0.024/ 0.023 ppm, which is almost the same as the outdoor concentration, whose mean and median were 0.023 and 0.024 ppm, respectively.

Hanrahan et al.<sup>16</sup> studied indoor formaldehyde exposure concentrations in 135 mobile homes with chipboard and hardwood plywood paneling for structural components. Homes were selected based on the estimated age of the construction components. Homes were studied serially for a 9-month period, with formaldehyde samples obtained on a monthly basis. Formaldehyde concentrations