

**Personal Injury Claim of Chemical Sensitization Caused by the Vapors Released
from a Constructive Adhesive Consumer Product**

(By Dr Gerard A. Macri, Expert Witness)

A New York City pathologist who lived in a Manhattan apartment claimed personal injury from the inhalation of vapors released from a commercially available construction adhesive used in her apartment while she was present. The plaintiff claimed permanent pulmonary distress, asthmatic symptoms, and sensitization to the smell of virtually all other chemicals – including common household chemicals.

She claimed the sensitization was caused by the vapors from the construction adhesive, because she claimed she had never been sensitive to these other chemicals prior to this incident. Now exposure to even minute traces of common household products containing other chemicals (glass cleaners, air fresheners, nail polish, etc.) triggers severe breathing spasms, and other symptoms of pulmonary distress.

The incident involving the construction adhesive occurred on the day when a maintenance man from the property management company/landlord responded to the tenant's request to repair a heat recovery ventilation (HRV) unit by the kitchen window. The HRV is an energy efficient, through-the-wall mini-ventilation system that brings warm fresh air from the outside during the winter to heat a room or a small apartment.

The construction adhesive (called XX-201) used in this case was a 28 fl oz tube containing a mixture of synthetic resins and organic solvents designed to slowly release the volatile organic solvents (VOCs) until the resin cements "set" binding the parts to which it was applied together.

The insurance carrier for the property management company/landlord retained an expert witness in airborne chemical contamination investigations. The first task assumed by the expert was to determine the extent of the VOC contamination in the apartment at that time. Since no air sampling took place during the incident, the only manner in which a reasonable estimate for the amount of VOCs in the air space at that time would be from the information on the product's Material Safety Data Sheet (MSDS), which lists the chemical identity and approximate concentration of each of the product's components. The worker testifies that they only used half of a tube to repair the HRV unit. Based on this data, one-half of a 28 fl oz tube of XX-201 contains approximately 500 gm of resin

and solvents, containing the following VOCs: Heptane, cyclohexane, naphtha, petroleum distillates A, and petroleum distillates B. Petroleum distillates A is a mixture of fractional cuts of low boiling petroleum hydrocarbons varying from C5 to C6 alkanes and petroleum distillates B is a mixture of fractional cuts of medium boiling petroleum hydrocarbons varying from C9 to C16 alkanes and alkenes.

The next task was to determine that if all the VOCs contained in 500 gm of adhesives were volatilized and released into the apartment living space, what would be the concentration of each VOC component in the air space that could be inhaled while the adhesive was being applied?

Several simplifications were necessary to make the arguments understandable (yet factually accurate) by the attorneys, the jury, and the judge presiding the case.

First, the percent concentrations of each VOC given in the MSDS were stated in a range of %s, e.g., cyclohexane = 5-10%. In order to avoid arguments on the actual percentage to use for this exercise, the expert witness chose to use the maximum % values.

Second, the exact manner in which a given mass of solvent is released into an open area from a liquid or semi-solid mixture in grams/hr is based on a complex empirical formula which depends on the solvent's molecular weight and vapor pressure, the room's temperature, and the surface area exposed to the environment. Certainly, while scientifically rigorous, it would be too complicated and technical for presentation and leave a wide range of operating parameters in question since the incident had long passed. Therefore, again for the sake of brevity and simplification and present an indisputable argument for the maximum amount of vapors that could have been released during the incident, the expert tacitly assumed that all the VOCs were released at one time during the time period of application.

The amounts of each VOC released from 500 gm of adhesive are:

Naphtha: $500 \times 5\% = 25 \text{ gm}$

Heptane: $500 \times 5\% = 25 \text{ gm}$

Cyclohexane: $500 \times 10\% = 50 \text{ gm}$

Petroleum distillates A: $500 \times 30\% = 150 \text{ gm}$

Petroleum distillates B: $500 \times 30\% = 150 \text{ gm}$

Now to determine the volume of the air space which the vapors occupied after release. The apartment was a relatively small one-bedroom apartment. Again, for the sake of simplicity, it was assumed that the VOCs would be distributed throughout the entire apartment space more or less evenly.

The apartment floor area was approximately 1620 sq ft. The ceiling height was 8 ft. Therefore, the apartment volume was approximately 13,000 cu ft (or 360 cu meters).

The airborne concentrations of each VOC is obtained by dividing each weight by the apartment volume in cu meters. The concentration of each species in the air space is given in **Table 1** below.

Now, in order to apply a regulatory standard for the maximum allowable concentration of these VOCs in an indoor environment, the expert utilized the values in 29 CFR 1910 OSHA regulations for industry standards for air contaminants. Each air contaminant is assigned a risk-based air concentration to which a worker may be exposed (Permissible Exposure limit = PEL in mg/cu meter) for 8 hr per day, 7 days per week without adverse effects.

These permissible regulatory limits are presented in **Table 1** along with the calculated (estimated) concentrations as described above.

Lastly, almost all VOCs have a distinctive odor and also at different air concentrations at which most persons can typically detect this odor. This air concentration which is the lowest threshold at which the majority of persons tested were able to detect the odor is referred to as the Air Odor Threshold for that VOC. These values are also presented in **Table 1**.

Table 1

VOC	Weight (mg)	Concentration (mg/m ³)	OSHA PEL (TWA) (mg/m ³)	Air Odor Threshold (mg/m ³)
Naphtha	25000	69	400	30
Heptane	25000	69	2000	40
Cyclohexane	50000	138	1000	255
Petroleum distillates A	150000	416	2000	210
Petroleum distillates B	150000	416	2000	210

The data presented above in **Table 1** clearly demonstrated that the subject could not have been exposed to off-gas concentrations of VOCs present in the construction adhesive that were any more harmful than to the average worker during an 8-hour work day under similar conditions.

Furthermore, since the calculated estimates for the VOC concentrations were above or close to the Air Odor Threshold for that VOC, they were most probably detectable by the subject but again not harmful. The Air Odor Threshold is an olfactory response by a normally healthy individual and not a person who is hypersensitive to chemicals in general. It is not applicable to a person who may have a chemical hypersensitivity for multiple chemicals (MCS, Multiple Chemical Sensitivity), which may be caused by low level, long term exposure to chemicals known to cause MCS syndrome. One such chemical is formaldehyde, which is designated by OSHA as a sensitizing agent and is harmful even at the lowest air concentration levels of a few ppm or mg/m³.

Pathologists routinely examine human tissue and other specimens preserved in formalin (a solution of formaldehyde) and therefore are potentially exposed to low level yet harmful concentrations of the sensitizer, which can cause MCS and an adverse reaction to many other unrelated VOCs, which do not affect the unsensitized subject in the same manner.

A certified industrial hygienist (expert) testified that the formaldehyde concentrations to which the plaintiff pathologist was exposed in her normal work environment had most likely caused the MCS syndrome (manifested by pulmonary distress and asthma like symptoms similar to the plaintiff's symptoms). This hypersensitization most likely caused the resulting allergic reaction to the construction adhesive used that day in her apartment.

The court ruled in favor of the defendant.