

CHINESE DRYWALL

TOXICITY, RISK & CAUSATION



*Consultants
in
Toxicology*

Chinese Drywall

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TOXICITY

RISK ASSESSMENT

CAUSATION

TOXICITY

The effect of an agent on an organism

- **Carbonyl sulfide - volatile, central nervous system toxin**
- **Carbon disulfide - volatile, central nervous system toxin**
- **Strontium sulfide, iron sulfide - not volatile**
- **Other components - methyl mercaptan, hydrogen sulfide, sulfur dioxide**

PROBABLE ROUTES OF EXPOSURE

- **INHALATION**
- **DERMAL**
- **ORAL**

SIGNS AND SYMPTOMS REPORTED

For Short-Term Exposures to CS₂ and COS

Eye irritation

Chest pain

Sore throat

Shortness of Breath

Stuffy nose

Cough

Headache

Nausea

SIGNS AND SYMPTOMS REPORTED

For Long-Term Exposures to CS₂ and COS

Fatigue

Insomnia

Poor memory

Irritability

Sneezing

Dizziness

Loss of appetite

SIGNS AND SYMPTOMS REPORTED

By Homeowners

Congestion

Dizziness

Runny Nose

Fatigue

Coughing

Headaches

Eye Irritation

Nausea

Sneezing

Shortness of Breath

Sore Throat

SIGNS AND SYMPTOMS REPORTED

By Homeowners

Acne

Asthma Attacks

Ear Infections

Hair Loss

GI Problems

Joint/Muscle Pain

Hives

Phlegm

Nosebleeds

Urinary Tract Infections

Sinus Problems

Rashes

Trouble Breathing

Tight Chest

SIGNS AND SYMPTOMS IN WORKERS EXPOSED TO CARBON DISULFIDE

- **Vascular atherosclerotic changes**
- **Increased mortality due to coronary heart disease**
- **Increased mortality due to circulatory disease**
- **Increased incidence of angina and high blood pressure**
- **GI problems, impaired appetite, nausea, vomiting**
- **Possible hematological and cholesterol effects**
- **Peripheral and central nervous system effects**

DRYWALL ANALYSIS – U.S. EPA FINDINGS

- **Propionic acid, 2-methyl-,2,2-dimethyl-1-1-(2-hydroxy-1-methylethyl)propyl ester at 58 ppm and 92 ppm**
- **Propionic acid, 2-methyl-, 3-hydroxy-2,4,4-trimethylpentyl ester at 50 ppm and 84 ppm**
- **Strontium 2,570 ppm and 2,670 ppm**

RISK ASSESSMENT

- **The dose makes the poison**
- **No dose, no health effect**
- **Minimum dose, possible health effects**
- **High dose, well defined health effects**
- **Acute versus chronic exposure**
- **NOAEL, LOAEL, MRL, RfD, TLV, PEL, TWA, STEL, LD₅₀ etc.**

RISK ASSESSMENT

- **Carbonyl sulfide and carbon disulfide are neurotoxins**
- **At the right dose, they will kill you quickly**
- **Exposure differs from dose**
- **Must define exposure before we can estimate dose**
- **In this case, exposure and dose have not been quantified**
- **In this case, little is known about the potential of very low doses to produce health effects**

HOW TO DEFINE EXPOSURE AND DOSE

- **Bulk sampling - cannot relate this to exposure or dose**
- **Copper corrosion test - cannot relate to exposure or dose**
- **Long-term air sampling under controlled conditions coupled with exposure scenario**
- **Control temperature, humidity, air movement in several contaminated homes**
- **Sample over long periods - 24-48 hours or longer**
- **Use sensitive and reproducible analytical techniques**

CAUSATION - THE HILL CRITERIA

- 1. Strength of Association**
- 2. Consistency of Association**
- 3. Specificity of Association**
- 4. Temporality**
- 5. Biological Gradient**
- 6. Plausibility & Coherence**
- 7. Experimental**
- 8. Analogy**

STRENGTH OF ASSOCIATION

The essence of this criteria involves an assessment of the extent to which a particular disease coincides with a particular exposure. The incidence of the disease does not have to be high in order to establish a strong association. In the case of a rare disease, the finding of even a few cases within a small population who have been treated with a particular drug would be of great significance.

- In this case we have a strong association between volatile components of drywall and neurotoxicity and other signs and symptoms exhibited by plaintiffs but we do not have any controlled studies
- No epidemiology studies relating long-term low level exposure to COS or CS₂ to symptoms exhibited by plaintiffs
- There is clearly an association but a causative link is doubtful based on this criteria

CONSISTENCY OF ASSOCIATION

Hill asks the question, “Has it been repeatedly observed by different persons, in different circumstance and times?”. In other words, have similar findings been observed by different observers.

It would appear that this criteria can be met for many of the symptoms being exhibited by the plaintiffs who have been exposed in their homes.

SPECIFICITY OF ASSOCIATION

The specificity of an association describes the precision with which the occurrence of one variable will predict the occurrence of another. This criterion overlaps the strength of association to some extent but focuses more on the direct link between a specific disease and a specific cause for that disease. When dealing with human populations, this specificity is rare.

In the case under consideration herein, many of the symptoms exhibited by plaintiffs are fairly non-specific and could be caused by a number of factors unrelated to their exposure to drywall effluent.

TEMPORALITY

Hill asks “Which is the cart and which is the horse?” If a disease state exists prior to exposure to a medication, the exposure may exacerbate the disease but may not have caused the disease. The appearance of a diseased state must follow treatment with the medication being addressed.

This criteria can clearly be met with those experiencing symptoms which did not pre-exist their residing in their contaminated homes.

BIOLOGICAL GRADIENT

Dose-response is the foundation of good toxicological studies. The higher the dose or the longer the treatment, the more severe the response or the more prevalent the response. Dose cannot only be expressed as a single dose producing an acute response, but also by specifying the daily dose and exposure period. The latter is more appropriate in this situation.

There are ample animal studies and even some human studies that report the dose-response relationship with these compounds but these studies have been carried out at exposure levels much higher than those anticipated here.

PLAUSIBILITY AND COHERENCE

I will consider these criteria together since they impinge on the same theme voiced by Hill with regard to coherence “. . . the cause and effect interpretation of our data should not seriously conflict with generally known facts of the natural history or biology of the disease”. In addition, hypotheses based on sound scientific principles should be presented to explain the phenomena under consideration to demonstrate the plausibility of the causal conclusions being reached. It is desirable to provide experimental evidence to support the hypothesis, but this is not always available.

In general it is well known that the class of compounds under consideration here are neurotoxic and have reportedly produced many of the symptoms experienced by some of the plaintiffs. Mechanisms to explain these effects have also been postulated and no scientific principles have been violated here.

EXPERIMENT

Although human clinical trials are relied upon to establish the efficacy of drugs, and epidemiology studies are used in establishing causation, animal experimentation is extremely useful in demonstrating concepts used to explain some of the human findings. In addition, studies of the effects of chemicals on cellular processes have also proven useful in being able to understand the mechanisms involved in the toxicological processes being studied.

There is ample experimental data showing the neurological effects of carbonyl sulfide and carbon disulfide on animal models. This criteria can be met.

ANALOGY

Are there other drugs, chemicals or conditions that simulate the causal relationship which is under scrutiny? Are there other similar situations that parallel the events relating to the causal connection addressed herein?

While there are studies showing similar toxicological patterns of other sulfur compounds such as mercaptans, but there is not data on situations that parallel that which is under consideration here, that is, chronic low level exposure.

ISSUES

- **Consistency of symptoms with exposure to off-gases**
- **Most symptoms are subjective not objective**
- **No quantification of the toxicants within plaintiff's households**
- **No epidemiological studies have been carried out**
- **Consequences of long term exposure to these off-gases at low concentrations - unknown**



THE END

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