



# How They Get Away with It: Junk Science in Occupational and Environmental Risk Analysis

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PERSONAL VIEWS WHILE ON ANNUAL LEAVE,  
but coincidentally...

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## How Do They Do It?

### I: Self-Serving Research Design and Interpretation

1. Perform experiments not sensitive enough to detect X; declare victory that “X does not exist”
2. Study too few human subjects to include those of above-average susceptibility
3. Deliberately misattribute quantitative differences as qualitative ones

# Methylene Chloride

- OSHA's final regulation, lowering PEL from 500 ppm to 25 ppm, promulgated January 1997
- > 250,000 workers exposed, primarily in paint stripping, degreasing, foam manufacture, adhesives
- estimated annual cost of compliance: \$1100 per firm; \$400 per exposed worker
- asphyxiation above  $\approx 5,000$  ppm
- central nervous system depression above  $\approx 175$  ppm
- increased carboxyhemoglobin formation above  $\approx 125$  ppm
- *estimated lifetime excess cancer risk at 25 ppm:  $3.6 \times 10^{-3}$*
- of approx. 3,000 samples analyzed by OSHA from 1992-2003:
  - average during 1992-97 was 112 ppm (and 5% > 400 ppm)
  - average during 1997-03 was 89 ppm

## Methylene Chloride Animal Carcinogenicity:

- approx. 50% of mice given 2000 ppm by inhalation developed malignant lung and/or liver tumors
- rats given 2000 ppm by inhalation developed benign mammary tumors; female rats developed malignant lung tumors, but not at significantly elevated rates

## Methylene Chloride Cancer Epidemiology:

- workers at Rock Hill, SC, exposed for decades to approx. 500 ppm: 3-fold risk of liver and bile duct cancer  
95% C.I. = (0.81 – 7.63)
- 1,300 workers at Kodak Park, NY, exposed to avg. of 26 ppm: 1 liver/bile duct cancer (1.5 expected)

“What Were We Thinking?” (courtesy of the Halogenated Solvents Industry Alliance, a trade group of MC manufacturers)

“This research, *which is now complete*, shows that B6C3F1 mice... are uniquely sensitive at high exposure levels to methylene chloride-induced lung and liver cancer, and that other species, including humans, are not at similar risk... As a result of this research program, it appears that there are *no foreseeable conditions in which the carcinogenic effects seen in mice would be expected to occur in man.*”

-- from HSIA letter to OSHA, Oct. 1995 (emphasis added)  
(62 FR 1520)

## Scientific Reaction to HSIA Research: 1

“This experiment [comparing spectra of DNA point mutations caused by MC with those caused by formaldehyde and 1,2-dibromoethane] is extremely weak and not of publication quality. It is unlikely that such a naïve experiment could detect differences in spectra between the different chemicals used... This exhibit contains no useful information for risk assessment.”

--Dr. Douglas Bell, NIEHS (62FR 1521)

## Scientific Reaction to HSIA Research: 2

“I have serious concerns about this [DNA single-strand breaks] assay. It is well known that this assay is extraordinarily difficult to standardize and is sensitive only to very high doses of genotoxic compounds... This data, therefore, is certainly not compelling; persuading any independent scientist of its relevance to humans would be difficult.”

--Prof. Karl Kelsey, Harvard School of Public Health (62FR 1521-22)

## Scientific Reaction to HSIA Research: 3

“This interpretation of mRNA distribution is profoundly in error and contradicts some of the most well established and fundamental principles of molecular biology... Finding mRNA in the nucleus is unsurprising and uninformative about the eventual location of the protein products.”

--Dr. Lorenz Rhomberg, Harvard School of Public Health (62 FR 1526)

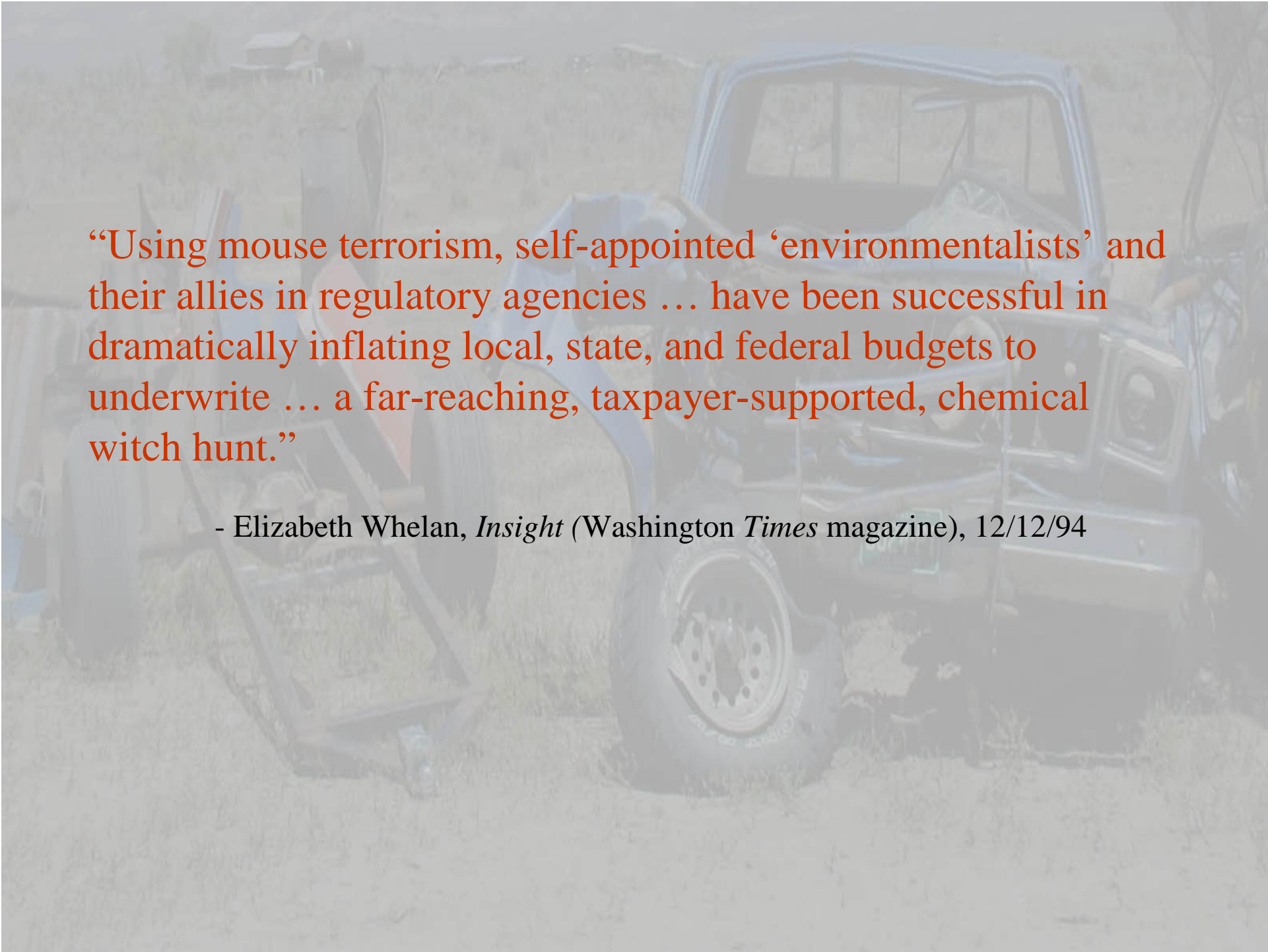
This is what workers and users of MC learn from  
Dow Chemical's current (2004)  
Material Safety Data Sheet:

CANCER INFORMATION: For hazard communication purposes, under OSHA Standard 29 CFR Part 1910.1200, this chemical is listed as a potential carcinogen by IARC and NTP. Methylene chloride has been shown to increase the incidence of malignant tumors in mice and benign tumors in rats. Studies have shown that tumors observed in mice are unique to that species. Other animal studies, as well as several human epidemiology studies, failed to show a tumorigenic response. Methylene chloride is not believed to pose a measurable carcinogenic risk to man when handled as recommended.

## How Do They Do It?

### II: Manipulate Estimates of Costs and Benefits

4. Cherry-pick assumptions you don't agree with, so that a "better" analysis would have to show lower risk
5. Highlight short-term positive trends; ignore subsequent (or simultaneous) negative ones
6. Concoct sham "risk-risk tradeoffs," or suppress information about win/win solutions to real tradeoffs



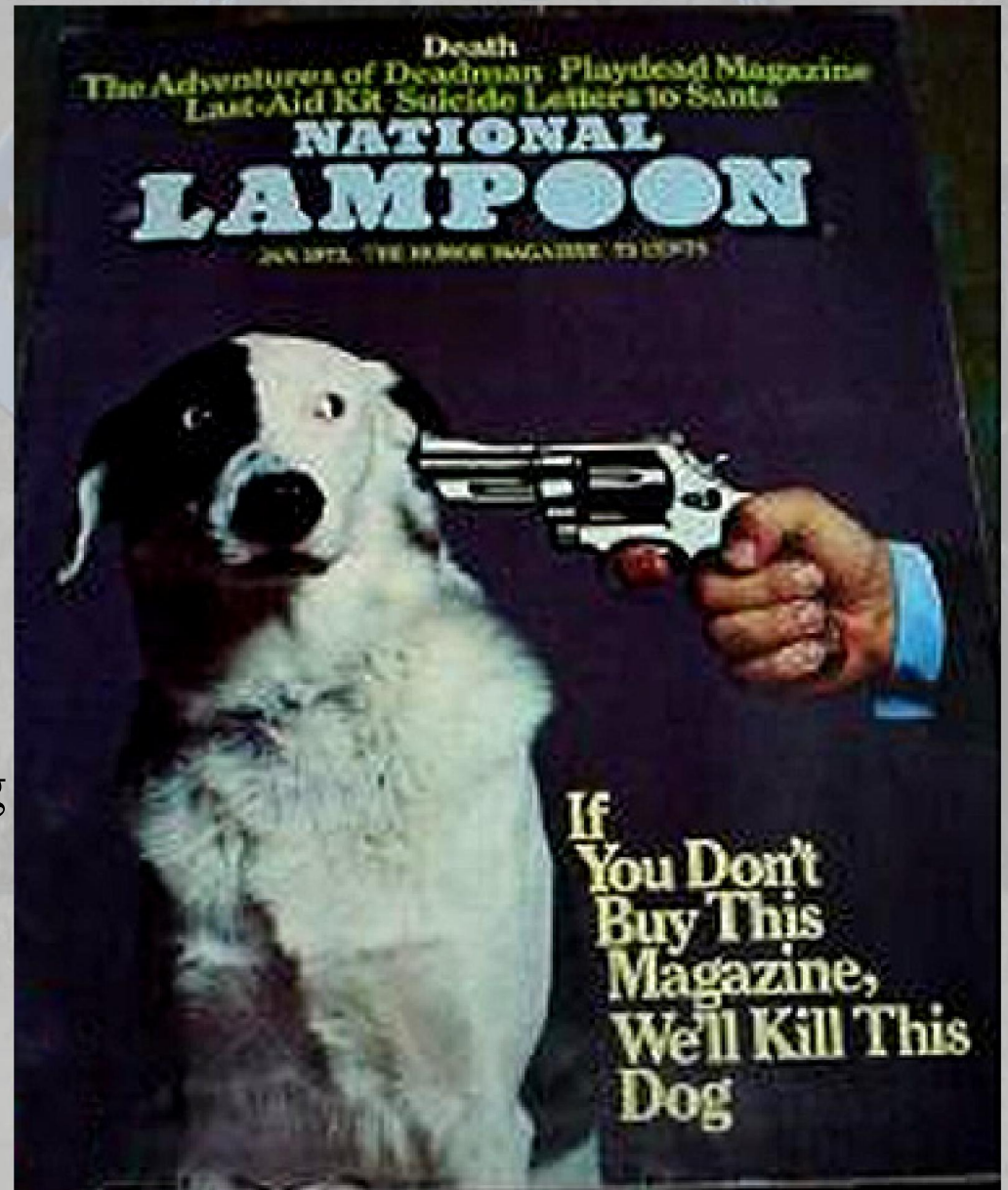
“Using mouse terrorism, self-appointed ‘environmentalists’ and their allies in regulatory agencies ... have been successful in dramatically inflating local, state, and federal budgets to underwrite ... a far-reaching, taxpayer-supported, chemical witch hunt.”

- Elizabeth Whelan, *Insight* (Washington *Times* magazine), 12/12/94

(Jan. 1973)

“If you don’t allow us to spray methylene chloride all over our plants, we’ll switch to a flammable substitute and play with matches”

(46 accidents in U.S. involving acetone between 1990 and 2004— **none** in MC-using applications; overall rate has gone **down** since MC rule)



## How Do They Do It?

### III: Attack “Policies Masquerading as Science” While Imposing Hidden Policy Preferences

7. Force *your* preference for balancing errors of overestimation versus underestimation upon the public, claiming that it alone is “objective” (“policy-neutral”) while all others are “value-laden”



“The cumulative effect of following the upper-bound path, using a long series of conservative assumptions, can be monumental overestimates of health risks.”

“The goal should be clear: Risk assessments should be as close to expected values... as the state of scientific knowledge permits.”

- Albert L. Nichols and Richard J. Zeckhauser, “The Perils of Prudence,”  
**Regulation**, Dec. 1986

# ALL Estimates are “Biased”

Estimate

Corresponding Value Judgment

	(Airplane ex.)	(Unc. in risk)	(Var. in risk)
<b>Mode</b>	Max. probability of arriving just as plane leaves	Max. probability that risk is exactly “acceptable”	Protect “most common person”
<b>Median</b>	50/50 chance of catching or missing flight	50/50 intervention is too risky/ too costly	Protect “typical person”
<b>Mean</b>	X minutes late and X minutes early equally bad	X units “overspending” = X “underspending”	Protect population on average
<b>95<sup>th</sup> %ile</b>	X min. late = 19 times worse than X min. early	X units “underspending” = 19 times worse than converse	Protect persons at increased exposure +/- or susceptibility



## How do they Get Away With It? Ultimately, We Let Them.

“Right now risk assessment is used to answer the following sort of question: “How much of these 41 carcinogens can we give industry the right to dump into public waters without killing an unacceptable number of citizens?” Anyone who helps the state answer such an immoral question is essentially keeping the death camp trains running on time.”

*--Rachel's Environment and Health Weekly  
11/7/96*

“To quiet the bereaved and turn this tragic toll into a form of publicly-sanctioned Russian Roulette, the government and industry are turning to a sham science called risk assessment.”

*--Andre Carothers, E Magazine, May 1991*