4-203

FINAL REPORT

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Occupational Safety and Health Administration

United States Department of Labor

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EXECUTIVE SUMMARY

The OSHA Hazard Communication standard (HazCom) utilizes material safety data sheets (MSDS) as the principal written vehicle for communicating product toxicity information to workers. Therefore, the effectiveness of the standard in protecting workers depends, in good part, on how well material safety data sheets are prepared. This study analyzes the content of a group of approximately 200 material safety data sheets for products used in auto repair and body shops. The sheets were collected by letter-requests to product marketers, with the first letter sent in October 1987, shortly after the Hazard Communication standard's scope was expanded to cover non-manufacturing workers.

The products in the study group were marketed by a total of 86 companies, with great variation in size and type of business. The marketer group included major chemical companies such as du Pont, Borden and Ashland, the major automobile manufacturers (General Motors, Ford, Chrysler, American Motors, Mack Truck), small local distributors of auto aftermarket products such as water-based cleaners and relabeled solvents and major national marketers of auto aftermarket products.

By late July 1988, material safety data sheets had been received from 55 companies. In general, large national companies were quicker to reply to requests for material safety data sheets than small local companies, but response from both groups was, ultimately, very good. A major difference between this study and a similar survey carried out in 1980 was that small companies did send material safety data sheets. Also, of 196 material safety data sheets received by late August 1988, 139 had product composition completely disclosed, a significant increase in total constituent disclosure since 1980.

However, the material safety data sheets received were, in general, incomplete or inadequate, especially as regards information on chronic toxicity. A large proportion of the sheets were in violation of one or more of the requirements of the Hazard Communication standard.

Here are a few examples of inadequate toxicity data.

---Methylene chloride, a widely-used solvent, breaks down to carbon monoxide in the body, and can pose acute health hazard, especially to people with cardiovascular disorders or people who smoke, work in hot environments or are otherwise subjected to cardiovascular stresses. Nine of 16 companies in our sample marketing products containing methylene chloride mentioned carbon monoxide production or production of carboxyhemoglobin. Five of the 9 companies mentioned both carbon monoxide and susceptible groups. Data on methylene chloride's conversion to carbon monoxide and resulting potential toxicity were widely available long before the Hazard Communication standard was promulgated.

---Methylene chloride causes cancer in animals. Animal test data were published in a National Toxicology Program (NTP) technical report in January 1986, and the International Agency for Research on Cancer (IARC) listed the chemical as an animal carcinogen in a 1986 monograph. Six of 16 companies sending in material safety data sheets for products containing methylene

chloride reported that methylene chloride caused cancer in animals. Three additional companies reported that the chemical caused tumors in animals but did not use the word "cancer". Twelve of the 16 companies prepared their material safety data sheets in 1986 or 1987.

---n-Hexane causes nerve damage. This chemical's neurotoxic effects were well-documented in people long before the Hazard Communication standard was promulgated. Eight companies submitted material safety data sheets for products whose ingredients included hexane, but only two of the eight companies mentioned that n-hexane causes peripheral neuropathy (one company) or neurotoxicity (one company).

Companies, large and small, failed to comply with Hazard Communication standard requirements.

---The Hazard Communication standard requires that carcinogens be listed if they are present in products at concentrations of 0.1% or above. Certain chlorinated hydrocarbons such as 1,1,1-trichloroethane and tetrachloroethylene are often sold stabilized with carcinogenic chemicals such as 1,4-dioxane. By our calculations based on percentage composition, products containing 1,1,1-trichloroethane or tetrachloroethylene in our study group should have listed stabilizers if carcinogenic stabilizers had been used. Only 2 of 17 companies whose products contained 1,1,1-trichloroethane and/or tetrachloroethylene listed stabilizers. Both of these companies listed 1,4-dioxane, and both identified the chemical as an animal carcinogen.

---The Hazard Communication standard requires that material safety data sheets indicate whether chemicals are listed as carcinogens by NTP, IARC and OSHA. Twenty-seven of 55 companies sending in material safety data sheets provided no information on listing by IARC, NTP or OSHA.

---The Hazard Communication standard requires that material safety data sheets include ACGIH TLVs, OSHA PELs and other exposure limits used by product marketers. Of 55 companies submitting material safety data sheets, 24 listed both PELs and TLVs. Twenty-five companies listed TLVs but no PELs, 3 listed PELs but no TLVs, and 4 companies didn't list any exposure limits.

These are a few examples of data collected from our survey of material safety data sheets. Since problems were found in sheets from large as well as small companies, and problems were pervasive throughout the group of sheets in our relatively small study, a larger study would be in order. It is also clear that active enforcement by OSHA of the Hazard Communication standard and, it would appear, amendment of the standard, are necessary to increase the usefulness of material safety data sheets.

Introduction

The OSHA Hazard Communication standard (HazCom) is a right-to-know rule, which works by providing toxicity information to workers through material safety data sheets (MSDS) and training given by employers, as well as labels on containers of products used in the workplace. This paper reports on some of the results of a study of a group of approximately 200 MSDS for products used in auto repair and body shops. The results of this study suggest that increased enforcement of the HazCom standard is necessary to bring MSDS into compliance with the standard, and that changes in the HazCom standard are needed to improve the toxicity information workers obtain. Our results also show that MSDS can provide at least some useful information on toxicity for workers, and are worth improving.

Background of study

In 1980, Local 259, United Auto Workers (UAW) asked the Environmental Cancer Information Center, Mt. Sinai School of Medicine, New York City, for a health study of chemical products used in auto repair and body shops. (At that time, Dr. Myra Karstadt was Director of the Environmental Cancer Information Center and Assistant Professor of Community Medicine (Environmental Medicine), Mt. Sinai School of Medicine.) The Local represents workers in these shops in the New York metropolitan area, and had long been concerned about health hazards in the workplace. Very little was known about chemical exposures in repair and body shops, so a decision was made to first find out what chemicals were in the products being used in the shops. To maximize limited resources, we decided to obtain this information by asking product marketers for composition data.

In summer 1980, we did a survey in cooperation with Local 259, to identify products used in the 184 repair and body shops (180 repair with 56 body and 4 independent body shopw). Letters were sent to the marketers of the products, asking for composition information. The great majority of the companies that responded to our request for product composition data sent us MSDS. This request for composition information was repeated in 1984.

At the time the original request for product composition data was made, the New York State worker right to know law had been passed, but had not yet become effective. The Hazard Communication standard was promulgated as a final rule in November 1983, and became fully effective for manufacturing SICs as of November 1985. In August 1987, the Hazard Communication standard was expanded to cover non-manufacturing SICs. The expanded coverage became effective as of September 1987.

In October 1987, we sent a letter to product marketers asking specifically for MSDS. Thus, the workers in auto repair and body shops would have been covered by the Hzard Communication standard at the time we requested material safety data sheets from product marketers.

This paper reports some of the results of our 1987 information request.

Results and discussion

1. Response to request for MSDS

In October 1987, we sent a letter to marketers of the auto aftermarket products in our sample group. We wrote to 86 marketers of 219 products. We wrote again in December 1987 and July and August 1988 to companies that had not responded to earlier letters.

In our October 1987 letter, we requested MSDS, noting that we were continuing our earlier study of products used in auto repair and body shops. We enclosed copies of our 1980 and 1984 letters requesting product composition data. Our December 21 letter was a follow-up to the October 1 letter and contained no new information.

Our July 1988 letter included further information on our study and on our plans to use information collected from the study for "worker training and other health protection activities".

Our August 10 letters stated that the "project is being carried out at the request of and in cooperation with Local 259, UAW". The letter also stated that a complaint would be filed with OSHA if we did not receive the MSDS we requested.

Copies of our letters are attached.

By late July 1988, we had received MSDS from 55 marketers of 196 products, and had heard from an additional 5 companies who needed more information to reply or didn't make or sell the product about which we had inquired. (Table 1). In addition, letters to 14 companies were returned as "undeliverable"; we located 2 of these companies by July 1988. As it turned out, three of our original 86 companies were really only one company (Consolidated Foods - PlastiKote- Alco Standard) so by July we had MSDS from 65% of our actually 84 company original sample---over 75% MSDS receipt from the 72 extant companies. (We had over 90% follow-up on our full company sample.) Subsequent calculations and tables are based on the late July data.

(By late September 1988, we had received replies from all but two of the companies to which we sent letters in October 1987. We received MSDS from 60 marketers of approximately 205 products.)

As can be seen from the data in Figure 1, we received MSDS from the majority of companies (30/55) by the end of the third week after we mailed our requests for MSDS. Eleven of the company MSDS replies- 20% of the final total- were received on the 11th day after our mailing date.

A test of effectiveness of the HazCom standard would be: do companies actually send MSDS when requested? Our results suggest most do.

Are big companies more likely to send sheets than small companies? We tried to determine this by tracking the states where our MSDS replies came from. The auto aftermarket includes firms from the local area, largely small distributors of solvents and water-based cleaning products, as well as major national firms including primary chemical companies, the auto makers, and national auto aftermarket companies.

Table 2 shows that we received low response in terms of MSDS received from firms in New York and New Jersey. Ohio, the state with the single largest number of companies in our survey, largely aftermarket companies and one major

chemical company, had a perfect reply record.

Overall, companies did reply to our request, with big and national companies doing better than small local companies. And we had better results overall than in 1980, as shown in Table 3.

Our results suggest that it would be advisable to amend HazCom to provide for health care professionals and workers having the right to request MSDS directly from product marketers. This is especially inportant for those situations in which, as is common in US companies, a worker in a non-union worksite, especially in small business, may fear economic reprisal if he expresses concern about chemical exposures or asks to look at or copy MSDS.

2. Disclosure of product composition

Knowledge of full product composition is necessary to assess the potential hazard of a product. We therefore checked percentage composition of the MSDS we received. Table 4 shows that 139/196 products had 100% disclosure. Water-based cleaners usually listed their few percent of active ingredients, the remainder of the product being water.

The 1987 100% disclosure results were much better than those in 1980. when only 20% of product compositions were 100% disclosed(Table 5).

The HazCom standard requires that if the identity of a hazardous substance is not disclosed, trade secret, confidential or proprietary claims must be noted on the MSDS. Thirteen companies made trade secret claims for at least 1 component of a total of 24 products. This means that 21 products in our product sample have their contents incompletely disclosed and lack trade secret claims.

A greater number of trade secret claims were made for identity of "non-hazardous" substances. Given past experience with so-called "inert- substances like vinyl chloride, some attention should be given to at least having OSHA maintain a listing of inerts in case toxicity data are generated suggesting that these chemicals are not inert after all.

We also checked on disclosure of potentially hazardous additives and propellants. Table 6 shows that relatively few companies- only two out of 17- listed stabilizers for 1,1,1-trichloroethane (1,1,1-TCE) or tetrachloroethylene (perchloroethylene). By our calculations, if 1,4-dioxane, a carcinogen, was used as a stabilizer for 1,1,1-TCE (which appeared in all 26 potentially stabilized products) at a concentration of 2 %, all the products should have listed stabilizer or claimed trade secrecy for it. This is because 1,4-dioxane is a carcinogen and HazCom requires listing of carcinogens at concentrations of 0.1% or above. We do not know whether stabilizer, particularly a carcinogen such as 1,4-dioxane or epichloronydrin is present in these products, but OSHA should examine this situation for possible guidance to companies preparing MSDS on stabilizer-containing products.

3Ms listed 1,4-dioxane as a stabilizer that was composed of 1,1,1-trichloroethane and tetrachloroethylene. Penray listed diethylene ether (1,4-dioxane) as an inhibitor for a product containing 1,1,1-trichloroethane. No stabilizers were listed for two other Penray products containing 1,1,1-trichloroethane and/or tetrachloroethylene. Both companies identified 1,4-

dioxane as an animal carcinogen.

Similarly, we checked for disclosure of propellant components in aerosol products. Table 7 shows that not all companies disclosed propellant constituents. These days, the majority of aerosol products use highly flammable propane-isobutane as a propellant, and some use carbon dioxide. Methylene chloride has been used extensively as a propellant or in the propellant phase in auto aftermarket products, especialy spray paints, and vinyl chloride monomer was used in products such as these in the past. As in the case of the stabilizers, some effort should be made to reach aerosol packagers and marketers of aerosol products to call their attention to the importance of disclosing propellant constituents. OSHA should also monitor aerosol constituents to identify health hazards and, in the case of the flammable hydrocarbon propellants, potential for serious injuries (burns) attributable to aerosol use.

3. Health effects information on MSDS

We checked toxicity information for three chemicals to see how well companies were doing with reporting toxicity information on MSDS. This also gave us a chance to see whether and how companies were updating MSDS to include new health hazard information. The HazCom standard does not require updating, but the standard does require that if a company learns of new health hazard information, those data must be included on MSDS within 3 months.

We checked sheets for information on health effects of methylene chloride, tetrachloroethylene and hexane. Table 8 shows that methylene chloride was present in about 1/6 of the products for which we received MSDS, and about 30% of the companies that sent MSDS have methylene chloride in their products. There are only about 1/3 as many products and 1/2 as many companies with tetrachloroethylene or hexane, but we should still be able to get some idea of what companies are writing about these chemicals from our limited sample.

To see how well the companies were doing reporting health effects for our selected chemicals, we constructed a "toxicity profile" for each chemical. Table 9 shows the acute toxic effect we selected for methylene chloride: production of carbon monoxide in the body, with potentially severe effects on people with cardiovascular disorders, smokers, and people with conditions or exposures which cause cardiovascular stress. Table 10 describes the chronic exposure effect we selected to review: cancer. Methylene chloride causes cancer in animals.

Table 11 shows that 9 of the 16 companies marketing products containing methylene chloride made at least some mention of methylene chloride's ability to be metabolized to hazardous carbon monoxide. (If a company both mentioned carbon monoxide production/ oxygen reduction and health effects on sensitive populations, it was counted in that category.) "Elevated carboxyhemoglobin" is a term probably much less comprehensible to workers; 4 of the 9 companies reporting on methylene chloride's metabolism mentioned elevated carboxyhemoblogin on their MSDS.

Companies mentioning carbon monoxide or carboxyhemoglobin production and/or our selected acute toxic effects caused by methylene chloride exposure were: Ashland, Castle, du Pont, 3Ms, Penray, American Hardware Supply, New

York Bronze and W.M. Barr. Ashland, du Pont and 3Ms are large chemical companies. American Hardware Supply is a national distributor of paints and paint-related products. W.M. Barr markets a widely-used paint stripper. The remaining companies are in the auto aftermarket products field. with Penray apparently the largest of the companies.

Ten of 16 companies reported that methylene chloride was a carcinogen (7 companies) or caused tumors(3 companies) in animals. (Table 12). Two of the 6 companies that did not mention carcinogenicity or tumorigenicity prepared their sheets in 1985; the other sheets came out in 1986 and 1987. Since the NTP report was published in January 1986, and results of bioassay reports appear promptly in RTECS online and, presumably, other data bases, the NTP results should have appeared on more sheets.

Ashland, Crest, du Pont, Lubaid (potential carcinogen), Lawson (suspected carcinogen), 3Ms and Penray (suspected carcinogen) reported that methylene chloride causes cancer in animals. Penray reported that methylene chloride was listed as a suspected animal carcinogen by NTP. Loctite and SafetyKleen reported that methylene chloride caused tumors in experimental animals. American Hardware Supply reported that methylene chloride caused "benign mammary tumors in rats and....liver and lung tumors in mice". Loctite is a major manufacturer of adhesives. SafetyKleen is a major distributor of industrial solvents.

In volume 41 of the IARC monographs, IARC designated methylene chloride as having "sufficient" evidence of carcinogenicity in animals. Volume 41, dated 1986, was available in the U.S. during 1987. The only sheet that knowledgeably mentioned IARC was prepared in September 1987, and reported that IARC had placed methylene chloride in group 3 (inadequate evidence), which is incorrect. This sheet was sent in by SafetyKleen.

The "diluting language" found on two methylene chloride sheets merits concern. OSHA should consider the effect of language on sheets that dilutes the effect of warnings or information on health hazards, especially when reports of negative animal or epidemiology studies are used to dilute reports of toxic effects as severe as cancer.

An MSDS from a major chemical company met quite well the criteria set in our toxicity profile for methylene chloride. Table 13 shows 3M's statement on methylene chloride toxicity by the inhalation route. Note that there are no phrases included which dilute the reports of positive findings.

We created a toxicity profile for tetrachloroethylene (perchloroethylene), choosing carcinogenicity in animals as the toxic hazard for which we would check MSDS. Tetrachloroethylene was reported to produce clear evidence of carcinogenesis in animals in an NTP bioassay program technical report dated August 1986. IARC classified tetrachloroethylene as having "sufficient evicence" of cancer in aninmals in a 1987 volume. (Table 14).

Products containing tetrachloroethylene were marketed by Castle, Crest, Kent, 3Ms, Penray, Radiator Specialty, RubberSeal, Sprayway and Unival. Radiator Specialty, Sprayway and Unival are auto aftermarket product distributors.

None of the MSDS for products which contained tetrachloroethylene had any information on the chemical's carcinogenicity. Three of the 10 tetrachloroethylene sheets were prepared in 1987, including a sheet dated July 1987 from 3Ms. Three sheets had no dates at all (this violates the requirements of HazCom), the remainder coming from 1985 and 1986. At least the 1987 sheets could have been expected to include the NTP bioasay results.

Finally, we created a toxicity profile for hexane. Hexane as used in industry today is usually a mixture of hexane isomers, including the neurotoxic n-hexane. (One company stated that it used mixed isomers.)

Material safety data sheets for products containing hexane were submitted by Borden, Castle, Crest, Penray, RubberSeal, TaylorMade, Unival and Loctite. Borden is a major chemical manufacturer. Taylor Made is an auto aftermarket product distributor.

Table 16 shows that although 7 of the 8 companies whose products included hexane listed n-hexane's CAS number, only 2 mentioned neurotoxicity or peripheral neuropathy as a toxic effect. Borden reported peripheral neuropathy as a toxic effect, and Loctite reported neurotoxicity. One other company's sheet stated that "Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage". This statement on the Crest sheet seems to be a general solvents statement along the lines of the chronic toxicity statement developed by the National Paint and Coating Association, and is not directly relevant to hexane exposure.

The hexane results may be the most troubling of all, since the studies demonstrating peripheral neuropathy in workers exposed to n-hexane were done years before HazCom, and this information is common knowledge in the occupational health field.

The Hazard Communication standard requires that a material safety data sheet indicate "whether the hazardous chemical is listed in the NTP Annual Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in IARC monographs (latest edition) or by OSHA". Of 55 companies that had sent material safety data sheets by the end of July, 27 provided no information at all on listing by NTP, IARC or OSHA. The remaining companies provided information on listing by at least one of the agencies. Large companies as well as small ones did not provide this information. For instance, there was no mention of NTP, IARC or OSHA on 3M MSDS.

The standard requires that a material safety data sheet include "the OSHA permissible exposure limit, ACGIH Threshold Limit Value and any other exposure limit used or recommended by the chemical manufacturer, importer or employer preparing the material safety data sheet, where available". Of 55 companies sending sheets in by late July, 24 listed both PELs and TLVs. 25 companies listed TLVs but not PELs and 3 companies listed PELs but not TLVs. 4 companies listed nothing at all. 4 companies' sheets had room for PELs, but nothing was entered in the space provided.

General Motors and 3Ms did not list any PELs. Most of GM's sheets also did not include TLVs. Some companies submitted sheets that fall in more than one category. For instance, two of three PPG sheets had TLVs only, where one sheet had both TLVs and PELs.

4. Other required disclosures

The Hazard Communication standard requires that material safety data sheets bear the "date of preparation of the sheet or the last change in the sheet". Three companies (Jaycees, Crest, Unival) sent in sheets with no dates. One company (Sprayway) sent in sheets dated as of the date on which the computer print-out was generated in reply to our request for material safety data sheets.

Of 195 sheets for which information was collected on preparation date, 12 sheets were prepared before 1985. Sheets prepared or revised in 1987 (71) constituted the single largest group of material safety data sheets classified by preparation year. Eleven sheets were undated (see above).

5. Conclusions

To summarize the results of our study, analysis of data from a sample of MSDS suggests that MSDS and the HazCom standard present both promise and problems. Based on our small sample, it appears that companies are preparing sheets and dispatching them on request with a relatively short turnaround time for non-emergency inquiries from health professionals. This is an improvement from 1980, as is the extent to which full disclosure of product constituents is being made.

However, companies are evidently not doing very well in preparing sheets. Presentation of toxicity data is highly variable as to quantity and quality, and MSDS are evidently not being updated in "real time" as regards addition of new important toxicity data.

Innovative research-based approaches for enforcement of the Hazard Communication standard and changes in the standard to improve MSDS preparation and dissemination are in order. A study similar to this one but more extensive in coverage as regards the number of sheets surveyed should be considered.

OCCUPATIONAL HEALTH
PROGRAM

665 HUNTINGTON AVENUE
BOSTON, MASSACHUSETTS 02115
(617) 732-1260

October 1, 1987

Gentlemen,

In 1980 and again in 1984, we wrote to your company requesting information on certain auto repair and auto care products marketed by your company. Copies of our letters are enclosed.

We are updating our files, and are therefore writing to request your cooperation in this project.

Please send us a material safety data sheet for

Thank you very much for your help with our previous surveys.

If you have any questions about this request for information, please call me at (617) 732-1260, or write to me at the above address.

We look forward to hearing from you soon.

Yours truly,

Myra Karstadt

Myra Karstadt, Ph.D.
Lecturer

mk/em:m

TABLE 1

Mailings Requesting MSDS - Company Replies

Mailing Date	# Mailed	# Total Replies	# MSDS	# need more info don't make have product	# undeliverable
10-5-87	86	57	44	2	11
12-21-87	26	11	9	1	1
07-13-88	16	4	2	2	0
08-10-88*	13				

* results incomplete at time of writing (August 1988)

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TABLE 2

MSDS Received (by States) Through Late July 1988

State	# Requests Mailed	Undeliverable	MSDS	Other
NY	23	7	8	1
NJ	10		4	1
OH*	24		13	1

*One company moved to Ohio from another state.

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TABLE 3

Comparison of 1980 and 1987 Survey Results

	Companies		Products	
Year	Total	Replies	Total	Replies
1980	92	62	253	174
1987	86 (84)	78	219	196

Results through late July 1988

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TABLE 4

Disclosure of Product Composition (1987)

100% disclosed	139
Water-based cleaners	12
Other products	45
(No percentage data)	31
(Proprietary)	24
Total no. of products	196

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TABLE 5

Disclosure of Product Composition (1980)

100% disclosed	35
Partial disclosure	74
Confidential	19
No information	46
Total no. of products	174

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TABLE 6

Stabilizers for Halogenated Hydrocarbons

Compound	Stabilizer listed - Number of Companies
1,1,1 - trichloroethane	2
1,1,1 - trichloroethane + tetrachloroethylene	-

n = 17 companies (total)
26 products (total)

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TABLE 7

Aerosol Products: Disclosure of Propellant Components

Cos. marketing pressurized Products	Cos. disclosing propellants	# of pressurized products	# of pressurized products with propellant disclosed
26	23*	52	43

* Two companies disclosed propellant composition for one or more products and withheld information for one of more products.

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TABLE 8

Reporting of methylene chloride, tetrachloroethylene and hexane on MSDS

Chemical	# of Companies	# of Products (MSDS)
Methylene chloride (dichloromethane)	16	32
tetrachloroethylene (perchbroethylene)	8	10
hexane	8	11

n = 55 companies who sent MSDS. 196 MSDS total.

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TABLE 9

Toxicity Profile: Methylene Chloride (Dichloromethane)

Acute toxicity: Carbon monoxide is produced by metabolism. Carbon monoxide may increase cardiovascular stress in people with heart conditions, people involved in heavy labor, working in hot environments or at high altitudes and cigarette smokers.

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TABLE 10

Toxicity Profile: Methylene chloride (Dichloromethane)

Methylene chloride causes cancer in animals.

IARC Volume 41: Sufficient evidence of carcinogenicity in animals.

NTP Technical Report (bioassay) - January 1986.

Clear evidence of carcinogenicity in

mice (lung and liver tumors, cancer)
female rats (breast tumors)

Some evidence of carcinogenicity in

male rats (breast tumors)

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TABLE 11

Methylene Chloride: Toxicity data on MSDS -- Acute Toxicity

Toxic Effect	Number of Companies
*Increased carbon monoxide/ reduced oxygen level; affects sensitive populations	5
----affects people with cardiovascular problems	4
----affects smokers	2
*Elevated carboxyhemoglobin	4
n = 16 companies total	

*One company double-counted in these two categories.

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TABLE 12

Methylene Chloride: Toxicity Data on MSDS - Cancer

Toxic Effect	Number of Components
Cancer/carcinogen in animals	7
Tumors in animals	3
Not carcinogenic in hamsters and epidemiology studies negative	2*
Not a cancer risk to people	1*

n = 16 companies total

* Companies in this category also reported that methylene chloride causes cancer or tumors in animals

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TABLE 13

Methylene Chloride Toxicity - 3M MSDS

"Inhalation ... Overexposure to methylene chloride vapors may result in lung, liver or kidney effects. Methylene chloride is a potential cancer hazard based on animal studies. Methylene chloride may cause carbon monoxide poisoning, a particular hazard to persons with cardiovascular disease."

MSDS dated July 28, 1986

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TABLE 14

Tetrachloroethylene (Perchloroethylene)

Tetrachloroethylene causes cancer in animals.

IARC Volume 42 (1987) - Sufficient evidence of carcinogenicity in animals.

NTP technical report (bioassay) - August 1986

Clear evidence of carcinogenicity in

mice (liver cancer)
male rats (leukemia, kidney tumors and cancer)

Some evidence of carcinogenicity in

female rats (leukemia)

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TABLE 15

Toxicity Profile - Hexane

N-hexane is neurotoxic (damages nerves). Chronic inhalation exposure may cause peripheral neuropathy (damage to the nerves in the arms and legs).

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TABLE 16

Hexane: Toxicity Data on MSDS

	Number of Companies
CAS # 110-54-3	7
Peripheral neuropathy	1
Neurotoxicity - nerve and brain damage	1

n = 8 companies (total)

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