SB

141

received 2/2/88 #D CS without $200.00 fine.

5-0337P ✓
Hein
02/01/88

Original sponsors: Josephson, Sturgulewski and Uehling

IN THE SENATE BY THE JUDICIARY COMMITTEE

CS FOR SENATE BILL NO. 141 (Judiciary)

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act relating to hazardous painting certification; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 18 is amended by adding a new chapter to read:

CHAPTER 63. HAZARDOUS PAINTING CERTIFICATION.

Sec. 18.63.010. HAZARDOUS PAINTING CERTIFICATE REQUIRED. A person may not employ or contract with a professional painter to perform hazardous painting for compensation unless the painter holds a current valid hazardous painting certificate issued by the department.

Sec. 18.63.020. ISSUANCE OF CERTIFICATE. (a) An application for issuance of a hazardous painting certificate shall be on a form prescribed by the department. An application for initial issuance of a certificate shall include proof that the applicant completed an approved basic hazardous painting certificate program not more than 30 days before the application was received by the department. An application for certificate renewal shall include proof that the applicant completed an approved supplemental hazardous painting certificate program not more than 30 days before the date the application was received by the department.

(b) The department shall issue a hazardous painting certificate to an applicant who has completed an application and submitted a certificate fee. A certificate is valid for three years.

Sec. 8.63.030. FEE. The commissioner shall establish the triennial fee for a hazardous painting certificate by regulation. The

fee must reflect the department's approximate costs or projected costs for the hazardous painting certification program.

Sec. 18.63.040. CERTIFICATE PROGRAMS. (a) The department shall

(1) establish requirements for basic and supplemental hazardous painting certificate programs;

(2) review, and approve or disapprove, programs proposed by contractors, labor organizations, public and private schools, vocational education institutions, and others;

(3) assist persons who propose programs to meet requirements for approval.

(b) A basic hazardous painting certificate program must include instruction and written and practical testing in methods of ventilation, respirator selection, chemical reaction to body tissue, proper use of painting tools, knowledge of relevant health and safety laws and regulations, including relevant portions of state occupational safety and health standards adopted by reference under 8 AAC 61.010, and other appropriate subjects. A basic hazardous painting certificate program may not exceed 16 hours of instruction and testing. A supplemental hazardous painting certificate program shall include instruction and written and practical testing necessary to ensure that a person who completes the program will be knowledgeable about new developments and changes related to hazardous painting that have occurred since the person completed a basic hazardous painting certificate program.

(c) A hazardous painting certificate program conducted by an employer of a person enrolled in the program may include safety instruction required under AS 18.60.066.

Sec. 18.63.050. INSPECTIONS AND CITATIONS. The department shall

(1) inspect job sites to assure that persons performing

hazardous painting are certified as required under AS 18.63.010 and are performing the work safely; and

(2) issue citations to persons who employ or contract with a professional painter in violation of AS 18.63.010.

Sec. 18.63.060. REGULATIONS. The department may adopt regulations necessary for the implementation of this chapter.

Sec. 18.63.070. PENALTY. The department may impose a civil fine of not more than $1,000 on a person who violates this chapter or a regulation adopted under this chapter.

Sec. 18.63.100. DEFINITIONS. In this chapter

(1) "department" means the Department of Labor;

(2) "hazardous painting" means the application of a substance containing a pigment or containing or combined with a toxic or hazardous substance, as defined in AS 18.60.105, in vaporized, liquid, or particulate form to create a coating that will adhere to a surface to protect or preserve the surface; "hazardous painting" does not include the application of water-based paint that does not contain emulsion epoxies or isocyanates;

(3) "professional painter" means a painting contractor, an employee of a painting contractor, or a person engaged in the business of painting, but does not include a casual laborer, a commercial artist, or a person who creates artworks.

* Sec. 2. AS 18.63.020, 18.63.030, 18.63.040, 18.63.060, 18.63.070, and 18.63.100, added by sec. 1 of this Act, take effect immediately under AS 01.10.070(c).

* Sec. 3. AS 18.63.010 and 18.63.050, added by sec. 1 of this Act, take effect January 1, 1989.

5-0337T
Hein
02/02/88

#2) CS with $200.00 fine

Original sponsors: Josephson, Sturgulewski and Uehling

IN THE SENATE BY THE JUDICIARY COMMITTEE

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Sec. 18.63.060. REGULATIONS. The department may adopt regulations necessary for the implementation of this chapter.

Sec. 18.63.070. PENALTY. The department may impose a civil fine of not more than $200 for a first violation, and not more than $1,000 for a subsequent violation, of this chapter or a regulation adopted under this chapter.

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Gundersen Painting

JAN 2 3 1988

January 25, 1988

Alaska State Legislature
Capital Building
Juneau, Alaska 99811

Dear Legislators:

To my knowledge there are currently bills in the legislature that would make it law for painters who apply hazerdous mat- erials to become certified. Many of these materials are great health hazards if not treated properly. This bill would greatly assit in protecting the health of the applicator, co workers, etc.

If this bill were passed it would also help stop the influx of out of state painting contractors and painters. It would also help to stop the so called "fly by night" painters who often times give our industry a bad reputation.

As a professional painter and painting contractor, I feel that for the betterment of our industry, this bill would be in our best interest.

Very truly yours,

Gary Gundersen

Gary Gundersen
GG/dg

GARY GUNDERSEN OWNER • PHONE (907) 456-8287 • 438 CARLTON DRIVE • FAIRBANKS ALASKA 99701

Bush Painting, Inc.

P.O. Box 60031 Fairbanks, Alaska 99706 (907) 452-8024 / 452-8098 FAX (907) 452-6566

January 22, 1988

Alaska State Legislature
Capital Building
Juneau, Alaska 99811

JAN 26 1988

Dear Legislators:

There are currently bills in the Senate (SB #141) and House (HB #201) that would create statutes for licensing painters in Alaska who apply hazardous materials. This legislation, if passed, shall assist greatly in protecting the health & safety of our employees, our co-workers, and the public from unnecessary exposure to these harmful chemical agents.

As well, this legislation will help the industry regulate itself through better preparing trade persons for the safe and productive use of these products while insuring that employers are conscious of their obligation to limit the possible dangers to the public.

As professionals who work with these materials and hire painters, we recognize the merits of the proposed legislation, and believe that it is in our and the states best interest to license painters who work with those hazardous protective coatings our industry specifies.

Therefore, we urge you to assist us as employers, and our employees in passing this legislation.

Sincerely,

William F Bush Jr.

Bush Painting, Inc.

William F. Bush, Jr.
Vice President - Estimator

P.O. Box 60031
2124 Van Horn Rd.
Fairbanks, Alaska 99706

(907) 452-8024
452-8098
FAX 452-6566

(907) 452-8690

21 Glacier Avenue
Fairbanks, Alaska 99701

APPROVED

Painting Company

January 25, 1988

JAN 25 1988

Alaska State Legislature
Capital Building
Juneau, Alaska 99811

Dear Legislators,

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As professionals who work with these materials and hire painters, we recognize the merits of the proposed legislation, and believe that it is in our and the states best interest to license painters who work with those hazardous protective coatings our industry specifies.

Therefore, we urge you to assist us as employers, and our employees in passing this legislation.

Sincerely,

Steve Moeller
Partner

STATE OF ALASKA
THE LEGISLATURE

POUCH Y · STATE CAPITOL
JUNEAU, ALASKA 99811
907·465·3800

LEGISLATIVE AFFAIRS AGENCY

MEMORANDUM January 30, 1988

SUBJECT: Hazardous painting certification and worker right to know - CSSB 141 (L&C)

TO: Senator Jalmar Kerttula

FROM: Edward H. Hein EHA
Legislative Counsel

You have asked why CSSB 141 (L&C), relating to hazardous painting certification, includes requirements for instruction and testing beyond what is mandated under AS 18.60.066, Alaska worker right to know law.

As 18.60.066 requires an employer to conduct a safety education program for employees who will be exposed to toxic or hazardous substances or physical agents in the course of their work. The only requirements of the program are that it inform employees of (1) the location, properties, and health effects of the substances or agents; (2) how the employees could be exposed and what precautions to take; and (3) the location, purpose, use, and limitations of protective equipment in the workplace. No certification is given to those who complete the program. No minimum number of hours of instruction, and no testing, is required.

The hazardous painting certificate program is more specific. The basic certificate program must include 16 hours of instruction and testing relating to ventilation, respirators, chemical reactions, use of tools, and knowledge of health and safety laws and regulations. The supplemental certificate program does not have any minimum number of hours required, but does require instruction and testing (at page 2, line 20, "training" should be changed to "testing"; see corresponding language at line 12) necessary to bring an employee up to date on developments and changes in hazardous painting during the three years since the painter last received training. (A certificate is valid for three years and may be renewed only if the painter completes the supplemental course within 30 days before renewal.)

The language at page 2, lines 25 - 27 of the bill directs an employer who offers a hazardous painting certificate program to incorporate into it the safety education program required under AS 18.60.066. This is intended to make it easier for both the employee and the employer by avoiding duplication. It is also a reminder to employers that they are still required to comply with AS 18.60.066.

There is one problem that needs to be considered, however. Safety education under AS 18.60.066 is required only if the employee has not previously received the instruction with respect to a toxic or hazardous substance or physical agent to which the employee could be exposed, and only when the employee is about to embark on a new work assignment. In other words, a painter must complete a certificate program every three years, but may need to receive safety education every time he or she performs a new work assignment. Because the employee's needs for the two types of instruction may not necessarily coincide, and because they may be duplicative, it might be more prudent to simply allow an employer who offers a certificate program to combine it with the safety education program, rather than to require it. But any amendment making that change probably should also make clear that the employer must comply with both statutes.

Note that the hazardous painting certificate program need not be offered by a painter's employer; it may be offered by anyone who received approval from the Department of Labor. The safety education program, however, must be provided by all employers covered under the statute.

If you have any further questions or comments on this matter, feel free to contact me at your convenience.

EHH:mkr
020/wkb2

Bill No. Committee Substitute for Senate Bill 141 (L&C) Date January 15, 1988

Title "An Act relating to hazardous painting certification."

Contact: Richard Arab
465-4856

Eileen Plate
465-2700

Committee Substitute for Senate Bill 141 is designed to assure the competency of persons employed to perform hazardous painting in the state and thereby prevent harmful exposures to workers who apply toxic and hazardous paints, to their co-workers and to the public.

Under the provisions of this bill, persons who are employed to perform hazardous painting must complete an approved training program and be certified. The training program would consist of instruction in and a demonstration of each person's knowledge and skill in using safe work practices and appropriate protective equipment. The bill limits the certification requirements to only the more hazardous painting applications and thereby excludes from the certification requirements low toxicity water-based paints widely used in residential painting.

Today, many solvents, metals, pesticides, isocyanates, and carcinogens are applied to surfaces in Alaska because highly resistant surfaces are needed for the harsh environment which exists in many parts of the state. Exposure to those toxic and hazardous substances can cause a variety of adverse health effects. For example:

- Nerve and brain damage, including memory and coordination impairment, result from chronic solvent exposures. Hepatitis and increased incidence of accidents also result from acute solvent exposures;
- Heavy metal poisoning occurs from exposure to lead, cadmium and other metals;
- Asthma and analylactic shock occurs from isocyanate exposures;
- Pesticide poisoning occurs from exposure to wood preservative additives such as penta chlorophenol.
- Heart attacks can occur from overexposure to methylene chloride; and
- Cancer can result from exposure to chromate paint pigments and benzene solvents;

These occupational diseases and injuries can be prevented by using appropriate work practices and proper protective equipment. The public and building occupants near painting projects can be better warned and protected by certified painters who use appropriate isolation and curing times. Workers' families, as well as other members of the community, need to be protected from the exposure to toxic material, such as lead chromate, brought home on the individual worker's person or clothing.

POSITION PAPER/Department of Labor

Under the provisions of this bill, the Department of Labor would establish minimum requirements for certification training programs; review and approve such programs; issue certificates to persons who present evidence of having completed an approved training program; and enforce the certification requirements.

The effective date set out in Section 3 of the bill needs to be changed. The Department recommends a January 1, 1989, effective date. This will provide the lead time needed to develop the training program curriculum and to educate employers on the certification requirements. The industry will likewise need this lead time to have training programs in place and workers trained by the effective date.

The Department supports the provisions of this bill.

APPROVED:

Jim Sampson, Commissioner
Department of Labor

STATE OF ALASKA
1988 LEGISLATIVE SESSION

BILL VERSION: CSSB 141 (L&C)
PUBLISH DATE: _____

FISCAL NOTE

REQUEST:

Revision Date: _____
Title: "An act relating to hazardous painting certification."
Sponsor: Josephson
Requestor: Senate Judiciary

Agency Affected: Labor
BRU: Labor Standards and Safety

Components: Occupational Safety and Health

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93
PERSONAL SERVICES		64.8	77.5	77.5	77.5	77.5
TRAVEL		10.0	5.0	5.2	5.3	5.5
CONTRACTUAL		13.2	17.3	17.8	18.4	18.9
SUPPLIES		1.1	1.4	1.4	1.5	1.5
EQUIPMENT		1.6	0	0	0	0
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0	90.7	101.2	101.9	102.7	103.4
CAPITAL						
REVENUE	0	100.0	150.0	50.0	100.0	150.0

FUNDING: (Thousands of Dollars)

GENERAL FUND		90.7	101.2	101.9	102.7	103.4
FEDERAL FUNDS						
OTHER						
TOTAL	0	90.7	101.2	101.9	102.7	103.4

POSITIONS:

FULL-TIME		2.0	2.0	2.0	2.0	2.0
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

Tom Stuart by ASB

Prepared by: Tom Stuart, Director
Division: Labor Standards and Safety
Phone: 465-4870
Date: 1/15/88

Approved by Commissioner: Jim Sampson
Date: 1/15/88
Agency: Labor

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)

This bill would require the department to adopt regulations covering persons who are employed in "hazardous painting." The department would issue certificates, for a fee, to persons who complete an approved training course. The department would also enforce the provisions of the bill by inspections and through the issuance of citations.

Expenditures:

In order to effectively administer this program the department would require two new positions, an Industrial Hygienist I, and a Clerk Typist III. The Industrial Hygienist would help develop the required regulations and training program guidelines. Also, a tracking system would be created to monitor approved training programs and to account for certificates and fees. This position would travel to inform employer and employee organizations of the new law.

The Clerk Typist III would begin work six months after the Hygienist. This would allow time for the regulations to be developed and implemented. The Clerk would then process the requests for certification and operate the in-house tracking systems.

Revenues:

It is estimated that 1,000 persons will take the required training course and apply for a certificate during the last six months of FY 1989. During the second year, the number of applications is expected to increase to 1,500 as most persons who want to be certified will have completed training by the end of FY 1990. During the third year, the number of applicants is estimated to drop to approximately 500 as only new entrants into the painting occupation will need certification. In FY 92 and FY 93, activity is expected to increase as persons who received certificates in FY 89 and FY 90 must be re-certified. (The certification will be valid for three years).

Estimated Revenue:

	FY 89	FY 90	FY 91	FY 92	FY 93
Certificates Issued	1,000	1,500	500	1,000	1,500
Fee	$ 100	$ 100	$ 100	$ 100	$ 100
	$100,000	$150,000	$50,000	$100,000	$150,000

Assumptions:

1. An effective date of July 1, 1988 for the program except for the certification requirement that will go into effect on January 1, 1989.

2. The certificate fee would be established at $100.

3. Inflation on non-personal services items will be 3% per year.

Position Title	No. of Positions	Range/Step	Barg. Unit
Industrial Hygienist I	1	19A	GGU

Time Status	Staff Months	Location	Election District
PFT	12	Anchorage	

Type of Expenditure		Amount
1	2	3
Salary	40.032	
Benefits	12.009	
Premium Pay		
Other		
Total Personal Services		52,041
Travel		10,000
Contractual		9,700
Commodities		700
Equipment		1,600
Other		
Total Cost		74,041

Funding Source for Total Cost	
Federal Receipts 1002	
G. F. Match 1003	
General Fund 1004	74,041
GF Program Receipts 1005	
Other	

Justification

This position would work on developing the required regulations and training programs necessitated by the bill. Also, the position would develop an in-house system to keep track of the training programs and certificate holders. As training programs are implemented, this position would ensure compliance with the provisions of this bill.

Costs include $10,000 for travel to inform workers and employers of the new law. Normal contractual, commodities and one-time furniture purchases are also included.

Request For New Position

Agency Labor

BRU Occupational Safety and Health

Component Occupational Safety and Health

FY 89

Position Title	No. of Positions	Range/Step	Barg. Unit
Clerk Typist III	1	8A	GGU

Time Status	Staff Months	Location	Election District
PFT	6	Anchorage	

Type of Expenditure		Amount
1	2	3
Salary	9,786	
Benefits	2,936	
Premium Pay	--	
Other	--	
Total Personal Services		12,722
Travel		0
Contractual		3,522
Commodities		350
Equipment		0
Other		0
Total Cost		16,594

Funding Source for Total Cost		
Federal Receipts	1002	
G. F. Match	1003	
General Fund	1004	16,594
GF Program Receipts	1005	
Other		

Justification

This clerical position would provide support for the in-house tracking system and would process the requests for certification. Costs include normal contractual and commodities.

The position would start six months after the program has begun to allow time for the regulations and tracking system to be implemented. The position would work 12 months after the first year.

Request For New Position

Agency Labor

BRU Occupational Safety and Health

Component Occupational Safety and Health

Revised Date

FY 89

SB 141; committee RCVD 1-26-88

FATALGRAM

August 8, 1987 Construction

Description of Accident A worker was transferring paint and solvents from a 55 gallon drum to a five gallon can in an old machine shop. The paint and solvents were being transferred using a small metal spigot, and it took several minutes to fill a five gallon can from the drum. The worker apparently was trying to put out a cigarette when a fire started causing both the can and the drum to explode. The worker died of the burns he suffered in the fire.

Accident Prevention Recommendations

1. The employer should not have allowed workers to smoke in an area where flammable liquids were being handled. Subparagraph 05.060(b)(1)(C) of the Alaska Construction Code prohibits smoking at or in the vicinity of operations which constitute a fire hazard. As part of such a policy, the machine shop should have been posted with "No Smoking" signs. The employer should also have, per Alaska's Right-To-Know law and regulations, provided information and training on how to safely handle toxic, hazardous and flammable materials to all employees who were required to handle such materials.

2. Work areas in which paint and solvents are transferred should be provided with adequate ventilation to lower the concentration of flammable vapors. This might have prevented the type of rapid combustion that occurred in this accident.

The New York Times

—NEW YORK, SUNDAY, APRIL 12, 1981—

Toxic Paint Chemicals Raise Alarm as Threat To Health of Workers

By BEN A. FRANKLIN
Special to The New York Times

WASHINGTON, April 11 — Three years ago, in response to an increasing number of its members who were reporting strange and debilitating illnesses, the International Brotherhood of Painters and Allied Trades started running an "Ask the Doctor" column in its journal. The letters poured in.

"I told the foreman I was getting numb around the mouth and in my hands," one painter wrote. "A stationary object would move as I walked toward it," wrote another. And according to another, "When we came in to work each day we had to haul dead rats out of the rooms we had painted the night before."

There are about 400,000 painters, paint makers, sign painters, silk screen printers and tile and carpet layers in the United States who work with coatings or adhesives made with aromatic hydrocarbons and other solvents, often in places without enough ventilation. Many of them have complained for years of dizziness or intoxication while on the job.

But recently, as paint manufacturers have incorporated new chemicals in their products and as the toxicity of some, such as toluene and benzene, have become more widely known, many industry, Government and union officials have come to share the conclusion of Frank Raftery, the painters' union president, who said:

"Toxic chemicals are a major threat to painters that rivals or exceeds the better-known health threats to asbestos workers and even to coal miners."

Dr. John Froines, a Government toxicologist who is acting director of the National Institute for Occupational Safety and Health, agreed that the chemical compounds in paint presented "new and serious problems."

"We are concerned about the hazards of painting to such an extent," he said, "that we are conducting extensive research into the carcinogenic and neurotoxic effects in the workplace. Obviously, further research is needed to evaluate these problems."

Neurotoxins are poisons that destroy nerves or nervous tissue, resulting in neuropathy, or a dysfunction of the way the nervous system usually works.

Major segments of organized labor have shown increased concern about the effects that these and other toxic substances have upon employees in the workplace. In the last year the painters' union, the United Automobile Workers and the American Federation of Labor and Congress of Industrial Organizations have set up special departments to investigate the problem.

Few Actions Against Makers

Relatively few negligence or product liability cases have been brought against the manufacturers of the chemicals, paints, lacquers, adhesives and plastics that contain potentially neurotoxic formulations with names like methyl-n-butyl ketone, toluene diisocyanate and dimethylaminopropionitrile. According to Rodney Wolford, an occupational safety official at the painters' union, the first symptom of neuropathy is depression, and "the poisoned workers find it very hard to write us about it, much less to bring lawsuits."

Among painters and others exposed to solvents for long periods in poorly ventilated areas, the symptoms of toxicity often begin with on-the-job dizziness, exhilaration, headache, blurred vision and slurred speech. Sometimes they progress to hallucination and permanent disorientation, paralysis and other symptoms of injury to the central nervous system.

A mortality study conducted for the painters' union among workers in New York found their life expectancy to be 11 years less than the average American's.

In 1975, a pioneering medical survey of 1,400 painters, paint makers, tile and carpet layers and wood finishers found that 71 percent of those studied reported some toxin-related disorientation on the job. As many as 4 percent said they had lost consciousness while working.

The study by Dr. Irving J. Selikoff of Mount Sinai Medical School found that painters exposed to solvents were more likely to have accidents, such as falls from scaffoldings, and that they had potentially dangerous difficulties driving home from work.

Study by Johns Hopkins

More recently, a study of paint hazards by the Johns Hopkins University School of Public Health found that there were "minimally, over 300 toxic materials and 150 carcinogens potentially present in paints." Fifty-seven percent of the paint solvents identified in the study are listed in the Registry of Toxic Substances compiled by the occupational safety institute.

One of the first acts of the Reagan Administration was to table a proposal for more explicit labeling of all the hundreds of thousands of products containing chemicals that are known to cause symptoms of toxicity in high concentrations. The products are used by an estimated 25 million American workers, according to the Labor Department's Occupational Safety and Health Administration, which developed the proposed regulations in nearly five years of negotiation with the chemical industry.

Under the proposal, the labels would have listed the products' ingredients, given more specific directions for their use and described symptoms and treatment of toxic reactions.

A Labor Department spokesman said that, at the request of the Chemical Manufacturers Association, the proposed regulations were being reconsidered as part of the Administration's plan for a general reduction in regulations. It is not clear when regulations will be proposed again or, if they are, in what form.

State Action Sought on Rules

Since the proposed labeling regulations have been tabled, representatives of labor have been moving on state legislatures in an effort to enact all or part of the labeling rules on a state-by-state basis.

But if states adopted conflicting requirements for the labeling or the use of potentially toxic substances, one chemical trade association official said, "That would drive the industry right up the wall, and we might end up actually going for some Federal regulation."

Industry spokesmen differ on how hazardous the paint chemicals are as well as on the need for better labeling. Robert A. Roland, president of the chemical manufacturers' organization here, calls his industry, which makes other toxic substances in addition to solvents, "the second-safest in the country, next only to the dry goods and retail industry."

The association contends that the proposed Federal regulations were far too stringent.

But Patrick Hord, an industrial hygienist at the National Paint and Coatings Association, which Mr. Roland ran until he moved to the chemical association a year ago, said that "from our standpoint, there is a need for some sort of further hazard warnings on paint products."

Most consumers who take a weekend to paint a bedroom or an apartment are relatively free from toxic risks because many of the most popular consumer products are water-soluble latex-based paints, which have not been proved harmful. If oil-based paints that contain solvents are used by do-it-yourself painters, exposure is usually for brief periods.

But risks to artists are often high because they repeatedly use the same kinds of solvents and chemicals as do workers for commercial painting companies, "with no more knowledge of the hazards than you see in industry," according to Michael McCann, an industrial hygienist at the Center for Occupational Hazards in New York. Those exposed to varying degrees of risk, he said, included artists, silk screeners, bone jewelry makers and stained-glass makers.

Today, according to OSHA, a new chemical compound, potentially a new neurotoxin, mutagen or carcinogen, or all of the above, comes into the American workplace every 20 minutes of every working day.

The labels on most containers reveal little about the contents, with most bearing only trade names. And manufacturers who might otherwise list contents are confronted with "nested trade names," raw materials supplied to them by other manufacturers who decline to disclose the contents on the ground that they are trade secrets. The containers for some paint products for industrial use bear only code numbers.

Existing Federal regulations require the manufacturers of each potentially toxic substance to file with the agency a "material safety data sheet," theoretically available to workers exposed to toxic agents. But according to the Labor Department, the data sheets, if they are ever seen by those who could benefit from them, are often barely more informative than the labels.

Alarm Rises Over Paint Chemicals as Health Threat

The New York Times/Nik Kleinberg

A painter wearing a protective air mask spraying overhead pipes at a construction site on Long Island

Among the important information that safety advocates say is missing from most labels are instructions on the early symptoms of overexposure or emergency treatment.

"Remove to fresh air," is a commonly advised remedy on paint labels for toxic effects such as intoxication or unconsciousness. But for many professional painters, long-term exposure brings either habituation or sensitization, a form of allergy.

"We don't hear about a lot of these solitary cases because the first symptom is depression," Mr. Wolford of the painters' union said in an interview. "The sick painters are out there, sitting at home depressed and unemployed."

Most Benefit Claims Are Denied

"Many painters don't go soon enough to a doctor," he continued. "Most doctors know very little about neurotoxic illness. Most of these people don't get workmen's compensation benefits because it is very hard to show that these exotic illnesses are work-related. There is often a long latency period before symptoms arise, so 98 percent of the claims are denied.

"In the end, their friends reject them because they act queer and they are paranoid. People are apt to say they are 'drunk.'"

Even neurotoxic epidemics affecting large numbers of people have only recently attracted wide public or scientific attention in America. But in the Scandinavian countries, studies of spray painters in the 1930's revealed gross distortions among them in behavioral problems and neuropathy — slowness in nerve conduction, for example — and lower life expectancy. Strict labeling and protective equipment rules have been invoked since then.

Study by Soviets Cited

And a translation of Russian literature on industrial neurotoxins, published here in 1978 by the occupational safety institute, also showed a wider use by doctors there of "behavioral and neuro-physiological methods" in the early diagnosis of chemical toxicity.

One Soviet study of worker habituation to industrial poisons was cited by Mr. Wolford of the painters' union as explaining "why some of our people have 'the Monday blues' and can't wait to get back to the job that is killing them after a weekend." He added, "They say they actually — better when they work every day with this stuff than when they're away from it because their bodies develop a craving for aromatic hydrocarbons."

The Journal of the American Medical Association, saying that it knew of no previous such case, reported in February 1980 that several humored workers making polyurethane foam in two unrelated plastics factories had suffered an unusual neuropathy: They had difficulty urinating and had painfully distended bladders. Some of the men were impotent.

Symptoms at Second Plant

A new compound called dimethylaminopropionitrile had come on the market, advertised as an improved catalyst in polyurethane foam production, and companies in Jessup, Md., and Marblehead, Mass., began using it. After two doctors in Baltimore reported neuropathic symptoms among workers at the Maryland plant, Rebecca Moreland, a public health nurse, was assigned to investigate the cases. She telephoned Dr. David Wegman at the Harvard School of Public Health for help in isolating a suspected neurotoxin. That was on a Friday.

The next Monday, Dr. Wegman called her back with the requested aid and with some news.

Over the weekend, he reported, 11 workers at the Marblehead polyurethane plant had discovered they had similar

Solvents as Intoxicants

A Florida jury recently found Brother Albert McAleer of Dallas Local 53, innocent of driving while intoxicated because he apparently was suffering from symptoms of inebriation caused by exposure to solvents.

Brother McAleer was arrested last March after police said his car was weaving on the road. But testimony at his trial indicated that a routine day of painting had made Brother McAleer's blood-alcohol reading go from a normal level of 0.01 on a Breathalyzer test to 0.11 by exposure to painting materials. Florida's legal level of intoxication is 0.10. But not all solvents register on a breathalyzer test.

In the April 1979 issue of The Painters and Allied Trades *Journal*, Dr. Edwin C. Holstein of New York's Mount Sinai School of Medicine addressed this issue in his Ask The Doctor column. He said,

"In the Mount Sinai study of health hazard in the painting trades, we found that most painters have suffered light-headedness, dizziness or mental confusion from working with solvents and other materials.

"Some painters have even blacked out. Epoxy is one of the worst offenders.

"One whiskey is not going to make you black out. But liquor affects your brain the same way that the solvents do. So the two together are double trouble, and may be enough to put you out. Likewise sleeping pills, tranquilizers, 'nerve pills,' sedatives and even many nonprescription cold remedies do not mix well with solvents—or liquor!

"So here are some do's and don'ts if you are working with substances that make you light-headed:

"1) DO make every effort to provide good ventilation while you work. Perhaps fans ought to be a standard part of a painter's equipment.

"2) DO be double-certain that you use every safety measure possible on ladders, scaffolds and other dangerous places. Painters have a very high accident rate. We suspect, but have not yet proven, that this is because so many painters are 'drunk' from the solvents they breathe.

"I believe that a light-headed or 'high' painter on a scaffold is in danger. Learn to be conscious of safety every minute, and develop automatic work habits that will protect you from danger.

"3) DON'T get the solvents on your clothes or skin if at all possible. Many of them will go right through your skin and into your body. This will increase the light-headedness.

"4) DON'T drive until the 'high' feeling has worn off. For most painters this takes 10 to 30 minutes in fresh air.

"5) DON'T drink or take tranquilizers, sedatives or cold remedies until you are home.

"6) DO see your doctor if you black out. It could be due to heart trouble, epilepsy or other disorders."

ly" if restrictive legislation on VDTs places a burden on manufacturers of the equipment, and a burden on those who use the VDTs, so that their productivity is diminished.

Most of the representatives of business groups said, however, that while they opposed the bill to create the committee, if the bill is passed they will help the committee in its investigations, so its work will be completed with all available data.

Many of those who testified gave the same statements at a hearing held the week of March 7 before the General Assembly's General Law Committee, which has proposed a bill that would require inspections of VDTs every six months by the manufacturer to test for radiation. The bill also would set a minimum size for characters on the VDT screen, and require manufacturers to warn of the need for operator rest periods and frequent eye examinations.

Litigation

FORMER PAINTERS FILE ACTIONS FOR DAMAGES ALLEGEDLY DUE TO PAINT COMPOUND EXPOSURES

Five former workers seeking damages against two chemical manufacturers based on injuries incurred from alleged exposure to toxic substances contained in spray paint compounds filed suit Feb. 22 in federal court in Oregon.

Of the five separate lawsuits initiated by individual workers in the U.S. District Court for the District of Oregon, the initial suit is styled *William J. Wight v. E.I. duPont de Nemours and Co. and Mobay Chemical Corp.* (No. 83-285). The companion suits which named the same defendants were filed on behalf of Francisco Salazar, Robert R. Edwards, James R. Chaffer, and Ross D. Wright (Nos. 83-286, 83-287, 83-288, and 83-289).

The cases arose after the plaintiffs, employees of the Freightliner Corporation, had been working for the company for periods ranging from three to 10 years. During "much" of that time, according to the complaints, the employees were working as spray painters. Paint used included compounds called "Imron" polyurethane enamel and a hardening or drying agent designated as "192S Activator" which contained "Desmodur N-75" produced by both E.I. du Pont de Nemours & Co. and Mobay Chemical Corporation.

The complaints alleged that the paint was composed of "highly toxic substances" such as isocyanates, chromates, toluene and lead, which when sprayed released "fumes and fine particles extremely harmful to workers' lungs and other organs." They also charged that exposure of employees to these substances resulted in permanent injuries including symptoms of asthma, respiratory impairment, pleuritic chest pain, weakness, dizziness, and dulled mental capacities. Furthermore, according to the pleadings, these conditions prevented employees from continuing in their employment as painters or in occupations involving any exposure to chemicals.

In the complaints, the plaintiffs asserted that the liability of both Du Pont and Mobay was based on the companies' alleged negligence in failing to label the paint compounds to adequately warn of dangers presented by contents of the paint and to designate procedures for avoiding injuries. The complaints further alleged that Du Pont breached its warranty to the company which purchased the paint and to Freightliner's employees that the product was fit and safe for the use intended.

Damages sought by each of four of the former employees amounted to $500,000 compensatory and $500,000 punitive damages, and for the fifth employee, totalled $1.5 million in both compensatory and punitive damages.

Arbitration

REFUSAL BY EMPLOYEE TO PERFORM TASK JUSTIFIES SUSPENSION BUT NOT DISCHARGE

An employer was justified in disciplining an employee who refused to climb to the top of a 145-foot radio tower to install lightning protection equipment, but the proper remedy was suspension without pay and not discharge, Arbitrator Jonas B. Katz ruled.

The disagreement in *In the Matter of J. B. Powell & Sons, Inc. and International Brotherhood of Electrical Workers, Local Union No. 369, AFL-CIO* (No. 82K/24979) arose as a result of the employee's twice refusing to mount a tower in contravention of his superior's orders. On both occasions he made an independent determination that the tower was unsafe.

Powell is engaged in the sale and installation of lightning protection equipment which requires placement of rods on structures up to several hundred feet high. The grievant had installed devices on structures more than 300 feet high and towers approximately 80 feet high.

On the first day of the assignment grievant and an apprentice arrived at the site but did not proceed with the installation. Instead, they waited for the company sales manager, Downey. Grievant told Downey that he believed the tower was unsafe, the cable was too heavy to carry up the tower, and that another pulley and safety belt were required. The sales manager instructed the employees to return to headquarters. A few days later the two were reassigned to the same job site.

They were issued new safety belts and a new pulley. Although grievant climbed to a height of 130 feet that morning he refused to go any higher because he thought the top of the tower was unsafe. After informing Samuel Clubb, vice president of sales, of this refusal he was assured by Clubb that the structural safety of the tower had been checked with the contractor who erected it. Clubb arrived at the site, reiterated the fact that the tower was safe, and gave grievant the option of completing the task or being discharged. Clubb then proceeded to install the lightning rod himself. Grievant was discharged.

The arbitrator held that an employee who refuses to perform work assignments is guilty of insubordination and subject to appropriate discipline, including discharge. The exception to this rule is where performance of the assigned work would involve an unusual or abnormal safety or health hazard. The exception does not apply where the hazard is inherent in the employee's job. In the instant case the arbitrator held that the safety hazard exception does not apply because the work assignment at issue involved a safety hazard intrinsic to the nature of the employee's work.

A reasonable man standard was applied to the facts. The arbitrator concluded on that basis that a reasonable man would not have found that an undue risk was involved in completing the assignment. Nevertheless, since no precedent had been set by the employer that refusal to perform work would result in discharge, and since the arbitrator felt the grievent's belief in the unsafe conditions was genuine, albeit erroneous, the penalty was reduced from discharge to suspension without pay.

North Carolina

STATE TO EXEMPT FROM ROUTINE VISITS 77 FIRMS USING CONSULTATION SERVICES

RALEIGH, N.C. — (By a BNA Staff Correspondent) -- Some 77 North Carolina employers were found to qualify for

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Chlorex	Synonym for Dichloroethyl Ether
Chlorinated Benzenes*	Skin, eye, mucous membrane irritation; drowsiness; loss of coordination; unconsciousness.
Chlorobiphenyl	Synonym for Chlorodiphenyls
Chlorodiphenyls*	Chloracne (skin disorder); eye, nose and throat irritation; liver damage; stillbirth; edema; juandice; loss of appetite; abdominal pain; fatigue; suspected carcinogen.
2-Chloroethanol	Synonym for Ethylene Chlorohydrin
Chloroethene	Synonym for Vinyl Chloride
Chloroethylene	Synonym for Vinyl Chloride
Chloroform*	Suspected carcinogen; irritation; liver enlargement; cardiac arrest; narcosis.
Cloromethane	Synonym for Methyl Chloride
Chloromethyloxidrane	Synonym for Epichlorohydrin
Chloropropylene Oxide	Synonym for Epichlorohydrin
Chromates*	Lung cancer; skin ulcerations.
Chrome Compounds	Lung cancer; skin lacerations.
Chromium*	Dermatitis; pulmonary sensitization; corrosive effect on mucous membranes; allergic sensitization; coughing and wheezing; headache, loss of breath; fever; weight loss; increased risk of lung cancer.
Chrysolite	Synonym for Asbestos
Cinnemene	Synonym for Styrene
Cinnemol	Synonym for Styrene
Cinnemenol	Synonym for Styrene
Clay	Lung disease.
CO	Synonym for Carbon Monoxide
Coal Naptha	Synonym for Benzene
Cobalt*	Irritation of skin and eyes; dermatitis, sensitization; asthma; pneumonia.
Copper*	Skin, eye, respiratory irritation; nasal congestion; nausea; vomiting; gastric pain; diarrhea.
Cresol*	Corrosive to all tissues; blindness from eye contact; skin rash; systemic poisoning, muscle weakness; liver and kidney damage.
Cresylic Acid	Synonym for Cresol
Cresylol	Synonym for Cresol
Crocidolite	Synonym for Asbestos
Cyclohexane*	Eye and respiratory irritation; drowsiness; dermatitis; narcosis; coma; dizziness; nausea.
Cyclohexanol*	Irritation of eyes, nose, throat and skin; narcosis.
Cyclohexanone*	Irritation of eyes, skin and mucous membranes; central nervous system problems; narcosis.

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS

Substance	Potential Health Effects
Acetic Acid*	Irritation of eyes, nose, throat and lungs; chronic bronchial irritation; bronchopneumonia and pulmonary edema; kidney failure and destruction of red blood cells (ingestion).
Acetic ether	Synonym for Ethyl Acetate
Acetone*	Irritation; narcosis; dermatitis; headache; nausea; light-headedness, loss of coordination.
Acetylene Dichloride	Synonym for Dichloroethylene
Acetylene Tetrachloride	Synonym for Tetrachloroethane
Actmolite	Synonym for Asbestos
Alcohols (Methanol, Ethyl Alcohol)	Blindness; narcosis
Alicyclic hydrocarbons	Dermatitis; eye irritation, dizziness; coma; diarrhea.
Alykyd (Resin)	Blood changes, narcosis.
Allyl Glycidyl Ether	See Epoxy
Amianthus	Synonym for Asbestos
Aminobenzene	Synonym for Aniline
Aminophen	Synonym for Aniline
Amosite	Synonym for Asbestos
Amphibole	Synonym for Asbestos
Amyl Acetate*	Irritation; narcosis; headache; drowsiness.
Amyl Alcohol	Irritation of eyes, upper respiratory tract, skin, nose and throat; nausea, vomiting, headache, double vision, disorientation; muscular weakness.
Aniline*	Eye irritation; corneal damage; headache; weakness; irritability; drowsiness; loss of breath; unconsciousness; skin discoloration.
Anol	Synonym for Cyclohexanol
Anthophyllite	Synonym for Asbestos
Antimony*	Skin, eye, nose and throat irritation; inflammation of the gums; anemia; ulceration of nasal septum and larynx; dermatitis; pulmonary congestion; coma; vomiting; liver or kidney damage.
Aromatic Hydrocarbons	Defatting of skin; dermatitis; narcosis; eye irritation; olfactory fatigue; chronic blood changes.
Arsenic*	Skin disorders; irritation of eyes, ears, nose, mouth, and respiratory system; skin cancer; death from ingestion; liver damage.
Artificial Ant Oil	Synonym for Furfural

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Arylamine	Synonym for Aniline
Ascarite	Synonym for Asbestos
Asbestos*	Scarring of the lungs; lung, stomach and colon cancer; asbestosis; mesothelioma.
Barium*	Irritation of eyes, nose, throat and skin.
Benxole	Synonym for Benzene
Benzene*	Anemia; blood damage; leukemia.
Benzene Hexahydride	Synonym for Cyclohexene
Benzend Tetrahydride	Synonym for Cyclohexene
Benzine	Synonym for Naptha
Benzol	Synonym for Benzene
Benzoline	Synonym for Petroleum Spirits
Beta-chloroethyl Alcohol	Synonym for Ethylene Chlorohydrin
Beta-dichloroethane	Synonym for Dichloroethane
Beta-ketapropane	Synonym for Acetone
Bis-2-chloroethyl Ether	Synonym for Dichloroethyl Ether
Bromoethane	Synonym for Methyl Bromide
1-Butanol	Synonym for N-Butyl Alcohol
Butanone	Synonym for Methyl Ethyl Ketone
Butyl Hydroxide	Synonym for N-Butyl Alcohol
Butyric alcohol	Synonym for N-Butyl Alcohol
Cadmium*	Loss of appetite; weakness, nausea; vomiting; rapid pulse; inflammation of lungs; cough, soreness of chest; metal fume fever; chemical pneumonitis; emphysema.
Carbinol	Synonym for Methyl Alcohol
Carbolic Acid	Synonym for Phenol
Carbon Black*	Skin cancer; lung disease (dust).
Carbon Dichloride	Synonym for Tetrachloroethylene
Carbon Disulfide*	Central nervous system damage; dizziness; impairment of mental and motor skills; irritation of skin, eyes and nose; skin blistering; loss of consciousness; impotency; defective memory; cardiovascular disorders; arteriosclerosis.
Carbon Monoxide*	Oxygen starvation; headache; dizziness; neasea; vomiting; coma; enhancement of heart disease.
Carbon Tetrachloride*	Irritation; narcosis; hepatitis; jaundice; kidney failure; stomach pains; central nervous system depression; kidney damage; nausea; vomiting; liver problems.
Cellosolve	Eye irritation; blood abnormalities; lung and kidney damage in animals.

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Chlorex	Synonym for Dichloroethyl Ether
Chlorinated Benzenes*	Skin, eye, mucous membrane irritation; drowsiness; loss of coordination; unconsciousness.
Chlorobiphenyl	Synonym for Chlorodiphenyls
Chlorodiphenyls*	Chloracne (skin disorder); eye, nose and throat irritation; liver damage; stillbirth; edema; juandice; loss of appetite; abdominal pain; fatigue; suspected carcinogen.
2-Chloroethanol	Synonym for Ethylene Chlorohydrin
Chloroethene	Synonym for Vinyl Chloride
Chloroethylene	Synonym for Vinyl Chloride
Chloroform*	Suspected carcinogen; irritation; liver enlargement; cardiac arrest; narcosis.
Cloromethane	Synonym for Methyl Chloride
Chloromethyloxidrane	Synonym for Epichlorohydrin
Chloropropylene Oxide	Synonym for Epichlorohydrin
Chromates*	Lung cancer; skin ulcerations.
Chrome Compounds	Lung cancer; skin lacerations.
Chromium*	Dermatitis; pulmonary sensitization; corrosive effect on mucous membranes; allergic sensitization; coughing and wheezing; headache, loss of breath; fever; weight loss; increased risk of lung cancer.
Chrysolite	Synonym for Asbestos
Cinnemene	Synonym for Styrene
Cinnemol	Synonym for Styrene
Cinnemenol	Synonym for Styrene
Clay	Lung disease.
CO	Synonym for Carbon Monoxide
Coal Naptha	Synonym for Benzene
Cobalt*	Irritation of skin and eyes; dermatitis, sensitization; asthma; pneumonia.
Copper*	Skin, eye, respiratory irritation; nasal congestion; nausea; vomiting; gastric pain; diarrhea.
Cresol*	Corrosive to all tissues; blindness from eye contact; skin rash; systemic poisoning, muscle weakness; liver and kidney damage.
Cresylic Acid	Synonym for Cresol
Cresylol	Synonym for Cresol
Crocidolite	Synonym for Asbestos
Cyclohexane*	Eye and respiratory irritation; drowsiness; dermatitis; narcosis; coma; dizziness; nausea.
Cyclohexanol*	Irritation of eyes, nose, throat and skin; narcosis.
Cyclohexanone*	Irritation of eyes, skin and mucous membranes; central nervous system problems; narcosis.

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Cyclohexene*	Irritation of eyes, skin and respiratory system; drowsiness.
Cyclohexatriene	Synonym for Benzene
Cyclohexyl Alcohol	Synonym for Cyclohexanol
Cyclohexyl Ketone	Synonym for Cyclohexanone
Diacetone	Dermatitis; irritation of eyes, mucous membranes; narcosis; headache, nausea; light-headedness; vomiting, dizziness; loss of coordination.
Diacetonyl	Synonym for Diacetone
Diaminobenzene	Synonym for Phenylene Diamine
Dibromoethane	Redness, blistering, ulceration of skin; skin sensitization; eye and respiratory irritation; respiratory injury; in animal experiments, injury to liver and kidneys.
Dichloroethane	Dermatitis; eye damage; nausea; vomiting; mental confusion; dizziness; pulmonary edema.
Dichloroethyl Ether	Eye, throat, lung irritation; bronchitis.
Dichloroethylene	Dermatitis; irritation of mucous membranes; narcosis; dizziness; nausea; vomiting; intoxication; kidney problems.
Dichloroethyl oxide	Synonym for Dichloroethyl Ether
Dichloromethane	Synonym for Methylene Chloride
1-4-Diethylene Dioxide	Synonym for Dioxane
Diethyleneimide Oxide	Synonym for Morpholine
Diethylene Oxide	Synonym for Tetrahydrofuran
Diglycidyl Ether	See Epoxy
Dimethylacetonyl Carbinol	Synonym for Diacetone
Dimethylbenzene	Synonym for Xylene
Dimethycarbinol	Synonym for Propyl Alcohol
Dimethylbutyl Acetate	Synonym for Sec-Hexyl Acetate
Dimethyl Formamide*	Nausea, vomiting; colic; liver damage; high blood pressure; dermatitis; flushed face.
Dimethyl Ketone	Synonym for Acetone
Diphenylmethane Disocyanate	Synonym for Methylene Bisphenyl Isocyanate
Dioxane*	Suspected carcinogen; irritation; drowsiness; dizziness; stomach pain; liver and kidney damage; drying and cracking of skin.
Disocyanates (TDI, MDI)	Irritation of nose, throat, lungs; asthma.
Disocyanatotoluene	Synonym for Toluene Disocyanate
EB	Synonym for Ethyl Benzene
Epichlorohydrin*	Irritation of eyes, skin and respiratory tract; nausea; vomiting; abdominal pain.
Epoxy	Skin disease and sensitization; lung disease and sensitization; nausea; lung damage; kidney damage.

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Esters	Anesthesia; irritation; nervous system or brain damage.
1,2-Ethanediol	Synonym for Ethylene Glycol
Ethanetetrachloride	Synonym for Tetrachloroethane
Ethanoic Acid	Synonym for Acetic Acid
Ethanol (Ethyl Alcohol)*	Irritation, headache, drowsiness, tremors, fatigue.
Ethenyl Ester	Synonym for Vinyl Acetate
Ethinyl Trichloride	Synonym for Trichloroethylene
Ethyl Acetate*	Irritation of eyes, skin and mucous membranes; drowsiness; unconsciousness.
Ethyl Acetone	Synonym for 2-Pentanone
Ethyl Acrylate*	Irritation of eyes, respiratory system and skin.
Ethyl Alcohol	Irritation of eyes, nose, skin and respiratory tract; headache; drowsiness; tremors; fatigue.
Ethyl Benzene*	Irritation of mucous membranes, respiratory tract, eyes, nose, throat and skin; dermatitis; narcosis; cramps; respiratory paralysis; slow reaction time; decreased manual dexterity.
Ethyl Benzol	Synonym for Ethyl Benzene
Ethyl Ester*	Synonym for Ethyl Formate
Ethyl Formate	Irritation of eyes and respiratory system; narcosis.
Ethyl Hydroxide	Synonym for Ethyl Alcohol
Ethyl Hydrate	Synonym for Ethyl Alcohol
Ethyl Methanoate	Synonym for Ethyl Formate
Ethyl Methyl Ketone	Synonym for Methyl Ethyl Ketone
Ethyl Propenoate	Synonym for Ethyl Acrylate
Ethyl Silicate	Irritation of eyes and nose; in animal experiments, caused anemia and lung, liver and kidney damage.
Ethylene Bromide	Synonym for Dibromoethane
Ethylene Chloride	Synonym for Dichloroethane
Ethylene Chlorohydrin*	Eye, nose, throat and skin irritation; nausea; vomiting; dizziness; headache, delirium, low blood pressure; unconsciousness.
Ethylene Dibromide*	Synonym for Dibromoethane
Ethylene Dichloride*	Irritation; narcosis; pulmonary edema; liver and kidney damage; suspected carcinogen.
Ethylene Glycol*	Central nervous system damage; respiratory and heart failure; abnormal blood formation; kidney and brain damage.
Ethylene Tetrachloride	Synonym for Tetrachloroethylene
Ethylene Trichloride	Synonym for Trichloroethylene
Ethylic Acid	Synonym for Acetic Acid
Fiberglass	Skin irritation; lung irritation; possible lung cancer.

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Formaldehyde-based resins*	Eye, nose, throat, respiratory and skin irritation; asthma.
Formic Acid	Synonym for Ethyl Formate
Furfural*	Eye, skin and mucous membrane irritation; allergic dermatitis; photosensitivity; headache; fatigue; itching of throat; tears; loss of sense of tast; numbness of tongue; tremor.
Furfuraldahyde	Synonym for Furfural
Furfuryl Alcohol*	Irritation of eyes, skin, nose, mouth; shakes.
Furol	Synonym for Furfural
Fusel oil	Synonym for Amyl Alcohol
Glycidol* (epoxy)	Dermatitis; serious allegeries.
Glycol	Synonym for Elthylene Glycol
Glycol Cholrohydrin	Synonym for Ethylene Chlorohydrin
Glycol Dichloride	Synonym for Dichloroethane
Grain Oil	Synonym for Amyl Alcohol
Heptane	Lightheadedness; stupor; loss of appetite; nausea; dermatitis; chemical pneumonia; unconsciousness.
Hexahydrobenbene	Synonym for Cyclohexane
Hexahydrophenol	Synonym for Cyclohexanol
Hexalin	Synonym for Cyclohexanol
Hexamethylene	Synonym for Cyclohexane
Hexyl Acetate	Synonym for Sec-Hexyl Acetate
Hydralin	Synonym for Cyclohexanol
Hydroxycyclohexane	Synonym for Cyclohexanol
Hexone	Synonym for Methyl Isobutyl Ketone
2-Hexanone	Synonym for Methyl N-Butyl Ketone
Hydroxybutane	Synonym for N-Butyl Alcohol
4-Hydroxy-4 Methyl-2-Pentanone	Synonym for Diacetone
Hydroxytoluene	Synonym for Cresol
Iron	(Inhalation of fumes) Irritation; lung disease; giddiness; fever; pulmonary edema; liver damage; vascular injury; central nervous system degeneration.
Isoamyl Acetate	Synonym for Amyl Acetate
Isoamyl Alcohol*	Irritation; narcosis; skin cracking; nausea; diarrhea.
Isobutyl Alcohol*	Irritation; drowsiness; skin dryness.

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Isocyanates (TDI, MDI, HDI, polyurethane paints)	Asthma-like attacks; reduction of lung capacity over time; sensitizer.
Isophorone	Irritation of eyes, nose, throat; narcosis; dermatitis; headache; dizziness.
Isopropanol	Synonym for Propyl Alcohol
Isopropyl Acetate*	Irritation; narcosis.
Isopropyl Acetone	Synonym for Methyl Isobutyl Ketone
Isopropyl Alcohol*	Irritation, drowsiness, dizziness; central nervous system depression.
Isopropyl Glycidol Ether*	See Epoxy
Ketones (solvents)*	Narcosis; loss of feeling or tingling in hands and feet; dermatitis; dizziness; vomiting; loss of coordination.
Lead*	Fatigue; irritability; sleeplessness; joint pain; stomach pain; damage to blood formation; anemia; kidney, brain and nervous system damage; sterility; impotence; damage to fetus; genetic damage.
Ligroin	Synonym for Naptha
Manganese*	Diseases of lungs and nervous system; cirrhosis of the liver; metal-fume fever.
MBK	Synonym for Methyl N-butyl Ketone
MDI	Synonym for Methylene Bisphenyl Isocyanate
MEK	Synonym for Methyl Ethyl Ketone
Melamine	Eye, nose, throat, respiratory and skin irritation; asthma.
Mercury*	Inflammation of gums; loss of teeth; thyroid problems; nervousness; irritability; kidney, brain and nervous system damage.
Methane Carboxylic Acid	Synonym for Acetic Acid
Methane Disocyanate	Synonym for Methylene Bisphenyl Isocyanate
Methanol	Synonym for Methyl Alcohol
Methyl Acetate*	Irritation of nose and throat; headache; drowsiness; optic atrophy.
Methyl Acetic Ester	Synonym for Methyl Acetate
Methyl Acrylate*	Irritation of eyes, upper respiratory tract and skin.
Methyl Alcohol*	Headache, blurred vision; liver damage; constricted field of vision; dermatitis; damage to cornea of eye; blindness.
Methylamyl Acetate	Synonym for Sec-Hexyl Acetate
Methylbenzene	Synonym for Toluene
Methylbenzol	Synonym for Toluene

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Methyl Bromide*	Irritation of eyes, skin, respiratory system; dermatitis; pulmonary edema; visual disturbances; nausea; vomiting; sleeplessness; disorientation, tremor in hands; stupor; muscular pains; speech disturbances.
Methyl Butyl Ketone*	Peripheral neuropathy (numbing or paralysis of arms and legs
Methyl Chloride*	Dizziness; nausea; vomiting; visual disturbances; staggering; slurred speech; convulsions; coma; liver and kidney damage.
Methyl Chloroform*	Synonym for Trichloroethane
Methyl Collosolve	Liver, kidney, blood and nervous system damage; brain disease; anemia; headache; sluggishness; weakness; drowsiness; pulmonary edema; renal failure.
Methyl Ester	Synonym for Methyl Acetate
Methyl Ethanoate	Synonym for Methyl Acetate
Methyl Ethyl Ketone	Irritation; narcosis; dermatitis.
Methyl Formate*	Eye and nose irritation; visual disturbances; central nervous system depression.
Methylisoamyl Acetate	Synonym for Sec-Hexyl Acetate
Methylisobutyl Carbinol	Synonym for Sec-Hexyl Acetate
Methyl Isobutyl Ketone	Irritation; narcosis; dermatitis; headache; nausea; lightheadedness; vomiting; dizziness; loss of coordination.
Methyl Methacrylate*	Irritation of eyes, nose and throat; dermatitis; narcosis.
Methyl Methanoate	Synonym for Methyl Formate
Methyl N-butyl Ketone*	Dermatitis; irritation of eyes and mucous membranes; narcosis; headache; nausea; lightheadedness; vomiting; dizziness; loss of coordination; peripheral nerve degeneration.
2-Methyl-2-Pentanol-4-one	Synonym for Diacetone
4-Methyl-2-Pentanone	Synonym for Methyl Isobutyl Ketone
Methyl Phenol	Synonym for Cresol
Methyl Propenoate	Synonym for Methyl Acrylate
Methyl Propyl Ketone (MPK)	Synonym for 2-Pentanone
Methylene Bichloride	Synonym for Methylene Chloride
4-4-Methylene-bis*	Suspected carcinogen.
Methylene Bisphenyl Isocyanate*	Irritation of the eyes, skin, respiratory tract; bronchitis; pulmonary edema; nausea; vomiting; abdominal pain, asthma; decrease in lung function.
Methylene Chloride*	Irritation; narcosis; numbness; pulmonary edema; arrythmia; dizziness; hallucinations; coma; central nervous system depression; liver and kidney damage.

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Methylene Dichloride	Synonym for Methylene Chloride
Methylstyrene	Synonym for Vinyl Toluene
MIBK	Synonym for Methyl Isobutyl Ketone
Mica*	Lung disease.
Mineral Spirits	Synonym for Petroleum Spirits
Mineral Thinner, Mineral Turpentine	Synonym for Petroleum Spirits
MKB	Synonym for Methyl Butyl Ketone
Monochloroethylene	Synonym for Vinyl Chloride
Morpholine*	Visual disturbances; nose, eye, skin and respiratory irritation.
Naptha (Coal Tar)*	Light-headedness, drowsiness, irritation of eyes, nose and skin; dermatitis; cancer (may contain benzene).
Naptha (Petroleum Distillates)	Central nervous system depression; lung irritation; nausea.
Naphthalene*	Eye, skin, bladder irritation; headache; confusion, excitement; nausea; vomiting; malaise; abdominal pain; profuse sweating; jaundice; blood in urine; renal shutdown.
Napthalin	Synonym for Naphthalene
N-butanol	Synonym for N-butyl Alcohol
N-butyl Alcohol	Skin, eye, nose, throat irritation; dizziness; headache; drowsiness.
N-butyl Glycicol Ether*	See epoxy
N-hexane	Peripheral neuropathy (numbing or paralysis of arms or legs); irritation; permanent central nervous system damage.
N-propyl Acetate*	Eye, skin, mucous membrane irritation; headache; drowsiness; unconsciousness.
N-propyl Alcohol*	Synonym for Propyl Alcohol
Nitrobenzene*	Irritation; narcosis; cyanosis; spleen and liver damage; headache; vomiting; weakness; disorientation; unconsciousness; coma.
Nitrobenzol	Synonym for Nitrobenzene
Nitroparaffins	Irritation of eyes, skin, upper respiratory tract; in animal experiments, narcosis; loss of appetite; nausea; vomiting, diarrhea; headache.
N-butyl Methyl Ketone	Synonym for Methyl N-butyl Ketone
N-propyl Alcohol	Irritation, drowsiness, dermatitis.
Oil of Mirbane	Synonym for Nitrobenzene
Oxytoluene	Synonym for Cresol

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Painter's Naptha	Synonym for Petroleum Spirits
Para-dioxane	Synonym for Dioxane
PCB	Synonym for Chlorodiphenyls
Pentachlorophenol*	Irritation of eyes, skin, nose and throat, sneezing and coughing; weakness; anorexia; weight loss; sweating, dizziness; nausea; vomiting; chest pain; fever.
Pentane*	Irritation; dermatitis; chemical pneumonia.
Pentanol	Synonym for Amyl Alcohol
2-Pentanone*	Irritation of eyes, skin and mucous membranes; coma; narcosis.
Pentyl Alcohol	Synonym for Amyl Alcohol
Perchloroethylene*	Synonym for Tetrachloroethylene
Perchloromethane	Synonym for Carbon Tetrachloride
Petroleum Benzine	Synonym for Naptha
Petroleum Ether	Synonym for Naptha
Petroleum Naptha	Synonym for Naptha
Petroleum Spirits	Skin irritation; central nervous system depression; narcosis.
Phehethylene	Synonym for Styrene
Phene	Synonym for Benzene
Phenol*	Eye, nose, throat, respiratory and skin irritation; asthma; nasal congestion; kidney and liver damage; paleness; weakness; sweating; headache; ringing in ears; shock; skin discoloration; difficulty in swallowing; diarrhea; lack of appetite; fainting, dizziness; mental disturbances.
Phenyl Glycidyl Ether*	See Epoxy
Phenylamine	Synonym for Aniline
p-Phenylene Diamine*	Irritation of pharynx and larynx; bronchial asthma; dermal sensitization.
Phenylethane	Synonym for Ethyl Benzene
Phenylethylene	Synonym for Styrene
Phenyl Hydride	Synonym for Benzene
Phenylmethane	Synonym for Toluene
Pimelic Ketone	Synonym for Cyclohexanone
Polychlorinated Diphenyl	Synonym for Chlorodiphenyls
Potato Spirits, Potato Oil	Synonym for Amyl Alcohol
1-Propanol	Synonym for Propyl Alcohol
Potassium Hydroxide	Synonym for Sodium Hydroxide
2-Propanone	Synonym for Acetone
Propyl Alcohol*	Eye and respiratory irritation; central nervous system depression; narcosis.
Propyl Acetone	Synonym for Methyl N-butyl Ketone
N-propylcarbinol	Synonym for N-butyl Alcohol
Proplylic Alcohol	Synonym for Propyl Alcohol

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Pyridine*	Irritation of eyes, mucous membranes and skin; skin sensitization; photosensitization; narcosis; headache; dizziness; insomnia; nervousness; diarrhea; vomiting; liver and kidney injury.
Pyroacetic Ether	Synonym for Acetone
Pyroligeous Acid	Synonym for Acetic Acid
Pyromucic Aldehyde	Synonym for Furfural
Sec-Hexyl Acetate*	Eye irritation; headache; narcosis.
Silica*	Silicosis (lung disease); emphysema; scarring of lungs.
Sodium Hydroxide*	Dermatitis; pulmonary irritation.
Solvents	Dermatitis; headaches; nausea; dizziness; sleepiness; drunkenness; coma; eye irritation; kidney and liver damage; leukemia; liver cancer; menstrual problems; genetic changes (depending on type of solvent).
Solvent Naptha	Synonym for Petroleum Spirits
Stoddard Solvent	Eye, nose, throat irritation; dizziness; dermatitis.
Styrene*	Headache; nausea; loss of appetite; liver damage; blood disorders; suspected to cause nervous system damage.
Styrol	Synonym for Styrene
Styrolene	Synonym for Styrene
Sulfate Wood Pulp Waste	See Turpentine
Sum-dibromoethane	Synonym for Dibromoethane
Sym-dichloroethane	Synonym for Dichloroethane
Sym-dichloroethylene	Synonym for Dichloroethylene
Symdichloroethyl Ether	Synonym for Dichloroethyl Ether
Talc*	Frequently contains asbestos; talcosis (lung disease).
TDI	Synonym for Toluene Disocyanate
Tetrachloroethane	Tremors; limb numbness; liver dysfunction; narcosis; delirium; convulsion.
Tetrachloroethylene	Dermatitis; eye and nose irritation; central nervous system depression; liver injury; dizziness; staggering gait; slowing of mental ability.
Tetrachloromethane	Synonym for Carbon Tetrachloride
Tetraethoxy Silane	Synonym for Ethyl Silicate
Tetraethyl Orthosilicate	Synonym for Ethyl Silicate
Tetrahydrofuran	Irritation of eyes and upper respiratory system; nausea; dizziness; headache.
Tetrahydro-1-4-Oxazine	Synonym for Morpholine

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Tetramethylene Oxide	Synonym for Tetrahydrofuran
Tin Compounds*	Throat and eye irritation; headache; vertigo; psychoneurotic disturbances; cough; abdominal pain; vomiting; urine retention; slight paralysis; skin burns.
Toluene*	Blood changes; narcosis; suspected carcinogen.
Toluene Disocyanate*	Irritation of eyes, skin and respiratory tract; bronchitis; pulmonary edema; nausea; vomiting; abdominal pain; asthma; decrease in lung functions.
Tolyene Disocyanate	Synonym for Toluene Disocyanate
Toluol	Synonym for Toluene
Tolyethylene	Synonym for Vinyl Toluene
Tremolite	Synonym for Asbestos
Trichloroethane*	Synonym for Trichloroethylene
Trichloroethylene*	Irritation; narcosis; arrythmia; dermatitis; headache; dizziness; tremors; nausea; vomiting; sleepiness; fatigue; intoxication.
Tricresol	Synonym for Cresol
Trimethyl-2-Cyclohexene-1	Synonym for Isophorene
Trike	Synonym for Trichloroethylene
Turpentine	Irritation; pulmonary edema; dermatitis; narcosis; convulsions; kidney and bladder damage; sensitization.
Urea	Eye, nose, throat, respiratory and skin irritation; asthma.
Varnish Maker's Naptha	Synonym for Petroleum Spirits
Varnish and Paint Maker's Naptha (VPN)*	Synonym for Petroleum Spirits
Vinegar Acid	Synonym for Acetic Acid
Vinegar Naptha	Synonym for Ethyl Acetate
Vinyl Acetate	Skin irritation; narcotic.
Vinyl Benzene	Synonym for Styrene
Vinyl Chloride*	Skin and eye irritation; central nervous system depression; nausea; dulling of visual and auditory responses; cancer (liver, lung, lymphatic system).
Vinyl Ester	Synonym for Vinyl Acetate
Vinyl Toluene	Irritation of eyes, skin, upper respiratory track; drowsiness.
White Spirits	Synonym for Petroleum Spirits
White Tar	Synonym for Naphthalene

*Included in California List of Hazardous Substances

TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Xylene*	Irritation; narcosis; pulmonary edema; stomach pain; nausea; liver and kidney damage.
Xylol	Synonym for Xylene
Zinc Oxide*	Dermatitis; metal fume fever.

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TOXIC SUBSTANCES USED IN THE PAINTING INDUSTRY AND THEIR POTENTIAL HEALTH EFFECTS
(Continued)

Substance	Potential Health Effects
Xylene*	Irritation; narcosis; pulmonary edema; stomach pain; nausea; liver and kidney damage.
Xylol	Synonym for Xylene
Zinc Oxide*	Dermatitis; metal fume fever.

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Editorial

February 1986

Solvent Neurotoxicity:

The Current Evidence

In view of the current debate regarding the nature and extent of solvent-related neurotoxicity, a brief review of relevant scientific issues and recent research findings seems useful. Unfortunately, as interest increases, the literature expands proportionately, and the authors have reviewed only a fraction of the available work in an attempt to summarize the current state of knowledge and to indicate the directions for future research.

Exposure, Absorption, Distribution, and Excretion

Exposure to solvents is ubiquitous in modern industry.[1] The list of chemical substances is long and many commercial products consist of combinations of several organic compounds. Systemic absorption is accomplished through lung[2] or skin[3] and is facilitated by a variety of host- and substance-specific factors.[4]

During the initial absorption period, solvents tend to be distributed to organs in concentrations proportional to regional blood flow.[5] As a result, during acute exposure, CNS solvent uptake proceeds rapidly and, if sufficient concentrations are reached, acute intoxication may result. The potential for causing acute intoxication varies widely among different organic solvents: those with low blood solubility (eg, methyl chloroform) reach saturation at relatively low blood concentrations and, consequently, cause less transient CNS disruption.[5] High solubility solvents (eg, styrene) show the potential for progressively increasing blood concentration, with attendant increasing risk, which is increased even further by physical exercise. Agent-specific lipid solubility characteristics and organ-specific lipid content also determine the tissue deposition. Nervous system tissue, with its high lipid content, is thus a repository for lipophilic organic solvents.

Address correspondence to: National Institute for Occupational Health, 1600 Clifton Rd, Atlanta, GA 30333 (Dr Baker).

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Excretion occurs primarily through renal or pulmonary routes. Most agents have relatively short (ie, hours to days) whole body half-lives. Exposure to multiple agents or drugs (eg, ethanol) may prolong excretion.[6]

Peripheral Nervous System

A characteristic distal, symmetrical sensimotor peripheral neuropathy has been clearly demonstrated following exposure of humans and animals to several specific solvents: *n*-hexane, methyl-*n*-butyl ketone (MBK), and carbon disulfide. This disorder has characteristic histologic features (focal axonal swelling with distal axonal degeneration), predictable dose-response relationships, well-described clinical-pathologic correlates, and a relatively consistent clinical course.[7] Thus, the evidence for implicating these substances as human neurotoxic agents is well developed. Although peripheral nervous system (PNS) toxicity of these agents is most apparent clinically, all have been shown in animal studies[7] to damage the CNS as well.

Less convincing evidence exists linking mixed solvent exposure to clinically significant peripheral nerve disorders. Obviously, where commercial solvents are contaminated by known neurotoxic agents (eg, MBK in methyl ethyl ketone formulations) peripheral neurotoxic effects may occur. In the commonest circumstance of exposure to solvent mixtures, such as that encountered by painters or lacquerers, epidemiologic studies have shown increased rates of adverse PNS symptoms and electrophysiologic abnormalities on nerve conduction testing and electromyography. As recently summarized by Seppalainen[8] for the First International Conference on Solvent Toxicity held in Stockholm in October 1984, increased risk of PNS disorders appears to be present in certain populations. However, the relationship of those disorders to specific agents has not been elucidated. Furthermore, clear distinctions between clinical and subclinical neuropathy have not been made in all studies, rendering interpretation difficult. In studies of currently exposed groups, the rates of PNS toxicity have been less than CNS effects.

Most of the confusion and disagreement regarding ...ent neurotoxicity relates to CNS effects. In view of ...mplexity of CNS function and of solvent exposures, ...is controversy is not surprising.[9] To achieve some ...iformity of diagnosis, a World Health Organization (WHO) working group recently proposed a syndrome ...ategorization scheme for CNS conditions caused by exposure to toxic workplace chemicals, including solvents, metals, and pesticides (Tables 1 and 2). The acute intoxicating effects of organic solvents have been well recognized for years; the symptoms consist of feelings of dizziness, lightheadedness, and incoordination. Transient psychomotor impairment frequently accompanies such symptoms.[10] Such studies of acute episodes do not demonstrate consistent effects on tests of psychomotor function, with the exception of reaction time, at exposure ...

TABLE 1

Acute Organic Mental Disorders

A. Acute intoxication
1. Pathophysiology: pharmacologic effect
2. Duration: minutes or hours; no sequelae
3. Clinical: acute CNS depression, psychomotor impairment
B. Acute toxic encephalopathy
1. Not clearly documented with organic solvents
2. Pathophysiology: cerebral edema, CNS capillary damage
3. Duration: hours or days; may cause permanent deficits
4. Clinical: coma, seizures

TABLE 2

Chronic Organic Mental Disorders

A. Organic affective syndrome
1. Pathophysiology: unclear
2. Duration: days or weeks; no sequelae
3. Clinical: Depression, irritability, loss of interest in daily activities
B. Mild chronic toxic encephalopathy
1. Pathophysiology: unclear
2. Course: insidious onset; Duration: Weeks or Months; reversibility: variable
3. Clinical: fatigue, mood disturbances, memory complaints, attentional complaints
4. Reduced CNS function
a. Psychomotor function (speed, attention, dexterity)
b. Short-term memory
c. Other abnormalities common
C. Severe chronic toxic encephalopathy
1. Pathophysiology: unclear, often associated with structural CNS damage
2. Course: insidious onset; Duration: indefinite, usually irreversible
3. Clinical manifestations
a. Loss of intellectual abilities of sufficient severity to interfere with social or occupational functioning
b. Memory impairment
c. Other
1) Impairment of abstract thinking
2) Impaired judgment
3) Other disturbances of cortical function
4) Personality change
4. Reduced CNS function
a. Types of abnormalities similar to mild chronic toxic encephalopathy
More pronounced and pervasive functional deficits
b. Some neurophysiologic and neuroradiologic tests abnormal

Termination of exposure ... return of function and loss of symptoms. Acute toxic encephalopathy associated with cerebral edema is well-recognized as an effect of excessive exposure to lead, mercury, and other toxic agents. The condition has not been described as a characteristic finding in excessive short-term solvent exposure.

Evidence does exist that three chronic conditions occur in individuals with solvent exposure. The mildest, organic affective syndrome, as recently defined in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III),[11] represents a reversible mood disorder which occurs in individuals with chronic solvent exposure.[12] Typical symptoms include increased fatigue, irritability, depression, and loss of interest in daily activities. Other toxic substances (eg, lead[13]) also appear to cause this syndrome, which reduces upon removal from exposure to the offending agent.[14] Although difficult to distinguish from other conditons, this syndrome does have characteristic clinical features that allow for identification of affected individuals, the most important of which are the temporal relationship of symptoms to sustained solvent exposure and the consistent pattern of symptom reporting among people with this condition.

Chronic toxic encephalopathy of mild or severe degree has been reported among solvent-exposed individuals. In addition to cognitive and mood symptoms, persons with these conditions display evidence of functional impairment, particularly reduction in psychomotor and short-term memory ability (Table 2). The most convincing scientific evidence derives from studies of individuals who have abused solvent-containing products. For example, four patients were found to have evidence of severe, multifocal CNS damage with cortical, cerebellar, and brainstem atrophy, electrophysiologic abnormalities, and neuropsychological deficits following prolonged inhalation abuse of toluene.[15] Epidemiologic studies of solvent-exposed populations (Table 3) have shown neurobehavioral changes that have varied between studies due to differences in exposure, measurement of health effect, study design, and analysis strategy.[5] Other investigations have shown increased rates of solvent exposure in patients with dementia-like syndromes[27,28]; these studies are difficult to interpret in that broad case definitions were used which included a variety of neuropsychiatric conditions. Further case-referent studies are needed to clarify the results of those two investigations. More restrictive case definitions should be used for future studies than were used in previous research.

The conclusion from these studies is that there appear to be syndromes of solvent-related CNS dysfunction of varying severity with similar qualitative features. As the severity increases, reversibility becomes progressively less likely and demonstrable structural abnormalities (eg, cortical atrophy) progressively more likely. The underlying pathogenesis of toxic encephalopathy due to solvents is unclear and requires further study. The lack of consistent dose-response relationships in chronic epidemiologic studies makes it difficult to determine whether current exposure to levels below accepted PELs is truly hazardous. In fact, a recent US study[29] failed to observe consistent neurobehavioral def-

Exposure/Population	Subjective Symptoms	Visual/Motor Performance	Memory	Verbal Concept Formation	Mood	References
Car painters	+*	+	+	+	+	Hanninen et al[16]
Lacquerers	+				+	Struwe et al[12]
Car painters	+					Husman[17]
House painters	+	+	+	+	+	Arlien-Soborg et al[18]
Spray painters	+	+	+	−		Elofsson et al[19]
House painters		+	−			Hane et al[20]
Solvent-poisoned	−	+	+	−		Lindstrom[21]
Viscose rayon		+	+	−		Harkonen[22]
Laminators		+	−	−		Harkonen et al[23]
Jet fuel-exposed		+	−			Knave et al[24]
Printers		−	+	−		Hanninen[25]
Steel workers		+			−	Ansheim Olson[26]
Dry cleaners		−				Tuttle et al[27]
Viscose rayon	+	+	−	+	+	Hanninen[28]
Styrene-exposed		+	−			Lindstrom et al[29]
Methylene chloride		−	−			Cherry et al[30]
Industrial painters	+	+	+			Ansheim Olson[31]
Toluene		+	−			Iregren[32]
House painters		+	+			Lindstrom et al[33]
Carbon disulfide		−	−			Putz-Anderson et al[34]
Toluene		−	−	+		Cherry et al[35]
Solvent-exposed		+	−			Cherry et al[36]
Solvent-exposed	+	+	−	+	+	Gregerson et al[37]

* + = adverse effect was observed; − = effect was tested for but not observed.

icits and current exposure documented at levels well below relevant PELs.

Other Neurologic Targets

A variety of other neurologic syndromes have been associated with exposure to specific solvents.[5] These include cerebellar ataxia (toluene), trigeminal and facial neuropathy (trichloroethylene contaminated with dichloroacetylene), parkinsonism (carbon disulfide), psychosis (carbon disulfide and toluene), and optic neuropathy (methanol). These associations derive mostly from case reports and dose-response relationships are lacking.

Future Trends

In view of the broad use of solvents in US workplaces[40] and the variety of neurologic syndromes attributed to excessive solvent exposure, much attention will be focused on the issue of solvent neurotoxicity in the future. In European countries, increasing numbers of workers are receiving compensation benefits for chronic solvent neurotoxicity. In response to this trend and other issues, the WHO Regional Office for Europe convened a working group to recommend diagnostic criteria for chronic CNS solvent toxicity in June 1985. The recommendations of that group correspond to the categorization scheme described in this article (Tables 1 and 2).

Although the available studies are in many cases imperfect, the accumulated evidence indicates that PNS and CNS toxicity is occurring in workers with excessive exposure. As yet unresolved are the difficult issues of dose-response relationships and pathogenetic mechanisms. In view of the vulnerability and limited regenerative capacity of the nervous system and the obvious functional importance of an intact nervous system, protection of neurologic function is of extreme importance. To accomplish this goal, prudence dictates that solvent exposure be controlled through accepted industrial hygiene measures. Medical monitoring of exposed workers should be reserved for selected situations in which degree of exposure (or solvent absorption) can be measured along with specific tests of nervous system function. Epidemiologic studies that carefully quantify both exposure and effect in long-term prospective investigations are essential to improve our understanding of this complex issue.

Authors' note (added in proof): A recent international workshop[41] has refined and clarified the terminology noted in Table 2 and has indicated directions for correct practice and future research. In this scheme, the mildest form of CNS dysfunction (type 1) was described as "central nervous system symptoms" rather than "organic affective syndrome." Mild toxic encephalopathy was subdivided into two types depending upon the predominant neurobehavioral deficit: sustained mood or personality change (type 2A) or intellectual impairment (type 2B). Severe chronic toxic encephalopathy (type 3) was felt to have features characteristic of dementia as defined in DSM-III.[11]

In light of current knowledge, certain control strategies are felt to be appropriate[41]:

1. Routine environmental monitoring should be performed to assure that current exposure limits, particularly those for peak exposures, are not exceeded.
2. Substitution of less toxic solvents for those with demonstrated high neurotoxic hazard should be accomplished.
3. Comprehensive worker training and educational

idence of solvent neurotoxicity, the individual's exposure should be controlled, preferably by removal to a solvent-free work environment. Follow-up of the individual should be performed to evaluate the course of the health condition.

Edward L. Baker, MD, MPH
Occupational Health Program
Harvard School of Public Health
Boston, Massachusetts

Lawrence J. Fine, MD, DrPH
Occupational Health Program
University of Michigan
Ann Arbor, Michigan

References

1. Burgess WA: *Recognition of Health Hazards in Industry*. New York, John Wiley and Sons, 1981.

2. Astrand I: Uptake of solvents from the lungs. *Br J Ind Med* 1985;42:217–218.

3. Bird MG: Industrial solvents: Some factors affecting their passage into and through the skin. *Ann Occup Hyg* 1981;24:235–244.

4. Lauwerys RR: *Industrial Chemical Exposure: Guidelines for Biological Monitoring*. Davis, CA, Biomedical Publications, 1983.

5. Baker EL, Smith TJ: Evaluation of exposure to organic solvents. In Harrington JM (ed): *Recent Advances in Occupational Health*. London, Churchill Livingstone, 1984, vol 2.

6. Waldron HA, Cherry N, Johnston JD: The effects of ethanol on blood toluene concentrations. *Int Arch Occup Environ Health* 1983;51:365–369.

7. Spencer PS, Schaumburg HH: Organic solvent neurotoxicity: Facts and research needs. *Scand J Work Environ Health* 1985; 11(suppl 1):53–60.

8. Seppalainen AM: Neurotoxicity of organic solvents in occupational exposure. *Scand J Work Environ Health* 1985;11(suppl 1):61–64.

9. Johnson B, Xintaras C (eds): *Prevention of Neurotoxic Disease in Working Populations*. Geneva, World Health Organization, in press 1986.

10. Gamberale F: The use of behavioral tests in the assessment of solvent toxicity. *Scan J Work Environ Health* 1985;11(suppl 1):65–74.

11. *Diagnostic and Statistical Manual of Mental Disorders*, ed 3. American Psychiatric Association, Washington DC, 1980.

12. Struwe G, Mindus P, Jonsson B: Psychiatric ratings in occupational health research: A study of mental symptoms in lacquerers. *Am J Ind Med* 1980;1:23–30.

13. Schottenfeld MD, Cullen MR: Organic affective illness associated with lead intoxication. *Am J Psychiatry* 1984;141:1423–1426.

14. Baker EL, White RF, Pothier LJ, et al: Occupational lead neurotoxicity: Improvement in behavioral effects after reduction in exposure. *Br J Ind Med* 1985;42:507–516.

15. Lazar RB, Ho SU, Melen O, et al: Multifocal central nervous system damage caused by toluene abuse. *Neurology* 1983;33:1337–1340.

16. Hanninen H, Eskelinen L, Husman K, et al. Behavioral effects of long-term exposure to a mixture of organic solvents. *Scand J Work Environ Health* 1978;4:240–255.

17. Husman K: Symptoms of car painters with long-term exposure to a mixture of organic solvents. *Scand J Work Environ Health* 1980;6:19–32.

18. Arlien-Søborg P, Bruhn P, Gyldensted C, et al: Chronic painter's syndrome. *Acta Neurol Scand* 1979;60:149–156.

19. Hanninen H: Psychological test methods: Sensitivity to long-term chemical exposure at work. *Neurobehav Toxicol* 1979;1:157–161.

20. Hane M, Axelson O, Blume J, et al: Psychological function changes among house painters. *Scand J Work Environ Health* 1977;3:91–99.

21. Lindstrom K: Changes in psychological performances of solvent-poisoned and solvent-exposed workers. *Am J Ind Med* 1980;1:69–84.

22. Härkönen H: Relationship of symptoms to occupational styrene exposure and to the findings of electroencephalographic and psychological examinations. *Int Arch Occup Environ Health* 1977;40:231–239.

23. Härkönen H, Lindstrom K, Seppalainen AM, et al: Exposure-response relationship between styrene exposure and central nervous functions. *Scand J Work Environ Health* 1978;4:53–59.

24. Knave B, Anshelm Olson B, Elofsson S, et al: Long-term exposure to jet fuel. II. A cross-sectional epidemiologic investigation on occupationally exposed industrial workers with special reference to the nervous system. *Scand J Work Environ Health* 1978;4:19–45.

25. Hanninen H: Psychological test methods: Sensitivity to long-term chemical exposure at work. *Neurobehav Toxicol* 1979;1:157–161.

26. Anshelm Olson B, Gamberale F, Gronqvist B: Reaction time changes among steel workers: A longitudinal study. *Int Arch Occup Environ Health* 1981;48:211–218.

27. Tuttle TC, Wood GD, Grether CB: *A Behavioral and Neurological Evaluation of Dry Cleaners Exposed to Perchlorethylene*. Cincinnati, National Institute for Occupational Safety and Health, 1977.

28. Hanninen H: Psychological picture of manifest and latent carbon disulfide poisoning. *Br J Ind Med* 1971;28:374–381.

29. Lindstrom K, Härkönen H, Hernberg S: Disturbances in psychological functions of workers occupationally exposed to styrene. *Scand J Work Environ Health* 1978;4:129–139.

30. Cherry N, Venables H, Waldron HA, et al: Some observation on workers exposed to methylene chloride. *Br J Ind Med* 1981;38:351–355.

31. Anshelm Olson B: Effects of organic solvents on behavioral performance of workers in the paint industry. *Neurobehav Toxicol Teratol* 1982;4:703–706.

32. Iregren A: Effects of psychological test performance of workers exposed to a single solvent (toluene): A comparison with effects of exposure to a mixture of organic solvents. *Neurobehav Toxicol Teratol* 1982;4:695–701.

33. Lindström K, Wickström G: Psychological function changes among maintenance house painters exposed to low levels of organic solvent mixtures. *Acta Psychiatry Scand* 1983;67(303):81–9.

34. Putz-Anderson, Albright B, Lee S, et al: A behavioral examination of workers exposed to carbon disulfide. *Neurotoxicology* 1983;41:67–78.

35. Cherry N, Venables H, Waldron H: British studies on the neuropsychological effects of solvent exposure. *Scand J Work Environ Health* 1984;10(1):10–12.

36. Gregersen P, Angelso B, Nielsen TE, et al: Neurotoxic effects of organic solvents in exposed workers: An occupational, neuropsychological, and neurological investigation. *Am J Ind Med* 1984;5:201–226.

37. Axelson O, Hane M, Hogstedt C: Current aspects of solvent-related disorders. In Zenz C (ed): *Developments in Occupational Medicine*. Chicago, Year Book Medical Publishers, 1980.

38. Mikkelsen S: A cohort study of disability pension and death among painters with special regard to disabling presenile dementia as occupational disease. *Scand J Soc Med* 1980;18:34–43.

39. Mairlish NA, Langolf GD, Whitehead L, et al: A behavioral evaluation of workers exposed to mixtures of organic solvents. *Br J Ind Med*, in press 1986.

40. *Survey Analysis and Supplemental Tables*, vol. 3. National Institute for Occupational Safety and Health, National Occupational Hazard Survey, Cincinnati, US Dept of Health, Education and Welfare, 1977.

41. Baker EL, Bus JS, Cranmer JM, et al: Workshop on Neurobehavioral Effects of Solvents: Consensus Summary. *Neurotoxicology* 1985;6:99–102.

Table XVI

38 Compounds of the Paint Industry and 49 Ways They Can Ruin Your Health

38 Chemical Culprits of the Paint Industry and the Trades that use Them

A—Food Industries
B—Other Industrial Occupations
C—Paint Manufacturers
D—Painters
E—Sandblasters and Metal Finishers
F—Tanners
G—Titanium Dioxide Manufacturers

38 Compounds of the Paint Industry and 49 Ways They Can Ruin Your Health	NEUROLOGICAL: Blindness	Central Nerv. Syst. Damage	Dizziness	Exhilaration	Fatigue	Headaches	"High"ness	Insomnia	Light Headedness	Loss of Coordination	Loss of Visual Acuity	Mental Confusion	Nausea	Paralysis	Prenarcotic Symptoms (General)	Slowed Reactions	Tremors of Muscles	Unconsciousness	RESPIRATORY: Asthmatic Attacks	Bronchitis	Emphysema	Fibrosis	Irritation of Lung Tissue	Irritation of Nose & Throat	Irrit. Trachea & Bronchial Tubes	Lung Cancer	Lung Congestion	Obstructive Ventilatory Dysfunction	Pneumoconiosis / Pneumonitis	Pulmonary Edema	Respiratory Tract Cancers	Shortness of Breath	Silicosis	DIGESTIVE: Diarrhea	General Digestive System Complaints	Intestinal Cancer	Loss of Appetite	Stomach Cancer	Ulcers	Vomiting	ORGANS: Heart Damage	Kidney Damage	Liver Damage	MISC.: Anemia	Death	Dermatitis	Irritation of the Eyes	Irritation of the Skin	Leukemia	A	B	C	D	E	F	G
Acetic Acid																																																				
Alcohol																																																				
Aliphatic Hydrocarbons																																																				
Ammonia																																																				
Antimony																																																				
Aromatic Hydrocarbons																																																			
Asbestos																																																				
Barite																																																				
Benzene																																																				
Bichromates																																																				
Boric Acid																																																				
Cadmium Compounds																																																				
Carbon Tetrachloride																																																				
Chlorinated Hydrocarbons																																																				
Chromium Compounds																																																				
Crystalline Silica																																																				
Esters																																																				
Glycols																																																				
Ketones																																																				
Lead Compounds																																																			
Manganese Oleate																																																			
Magnesium Carbonate																																																			
Methylene Chloride																																																			
Mineral Spirits																																																			
Naptha																																																			
Oxalic Acid																																																			
Pigment Dust																																																			
Shellac																																																			
Silica Compounds																																																			
Sodium Hydroxide																																																			
Sulfuric Acid																																																			
Titanium Dioxide																																																			
Toluene																																																			
Turpentine																																																			
Vinyl Chloride																																																			
Wood Dust																																																			
Xylene																																																			
Zinc Compounds																																																			

"Departments of Neurology and Neuroradiology, Rigshospitalet, [illegible]

Chronic painters' syndrome

CHRONIC TOXIC ENCEPHALOPATHY IN HOUSE PAINTERS

P. ARLIEN-SØBORG, P. BRUHN, C. GYLDENSTED AND B. MELGAARD

Seventy house painters were examined after being referred because organic solvent intoxication or dementia was suspected. In 50 cases no competitive etiological factors to the cerebral symptoms other than exposure to organic solvents could be disclosed. In these, neuropsychological examination showed signs of intellectual impairment in 39 patients and neuroradiological examination by PEG or CT demonstrated the presence of cerebral atrophy in 31 patients; 38 patients studied with CT were compared to an age-matched control group regarding maximum sulcus width, and a highly significant difference was found. It is argued that long-term exposure to turpentine substitute – often thro[illegible]d with acute intoxication symptoms – gradually may lead to th[illegible]ent of a chronic brain syndrome, which we have called the "chr[illegible]painters' syndrome".

Key words: Toxicity – turpentine substitute – painters – encephalopathy – intellectual impairment – cerebral atrophy – chronic brain syndrome.

Epidemiological studies (*Hane et al.* 1977) and case reports (*Axelson et al.* 1976) have indicated that professional painters under long-term exposure to organic solvents may develop a chronic organic brain syndrome dominated by memory impairment, fatigue, personality changes, headache, and dizziness.

This report presents a group of professional house painters, who in their daily work were exposed to organic solvents. The majority have over the years experienced recurrent acute intoxication symptoms and gradually developed signs of a chronic brain syndrome. The results of our investigations as well as those in the literature will provide the background for the delineation of a "chronic painters' syndrome" as a clinical entity.

MATERIAL AND METHODS

Seventy house painters have been studied in our departments during the past 4 years. All patients were referred for examination because organic solvent intoxication or dementia was suspected. Competitive etiological factors, such as head injury accompanied

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tions demonstrated a different disease as a possible cause of the clinical symptoms and signs were also excluded. The remaining 50 painters, in whom no etiological factors other than organic solvent exposure were disclosed, are the subjects of our study.

All were males, the mean age being 47 years (range 24–63 years). Based on psychological examination, the premorbid level of intelligence was considered within normal limits in all but one subject who was just below normal range. All had a minimum of 7 years' basic school education and were skilled painters.

Mean exposure time was 27 years (range 8–50 years).

Since we were specifically interested in investigating the effects of long-term exposure, no patients were examined immediately after a working day. The exposure-free interval was 5 days to 5 years. Three patients were seen approximately 5 days after their last working day, three after 2 weeks and the remaining more than 1 month after.

Standard examinations included EEG, otoneurological examination, ophthalmological examination, roentgenogram of the chest, and ECG. Liver and kidney function were evaluated biochemically. Patients in whom symptoms and clinical findings indicated a peripheral neuropathy had additional neurophysiological investigations, which included measurement of sensory and motor nerve conduction velocities.

The presence and location of cerebral atrophy was evaluated in all patients by neuroradiological methods. These were fractional pneumoencephalography (PEG) and cranial computerized tomography (CT). With PEG (film focus distance 90 cm) the following values measured on the roentgenograms have been regarded as the upper limits of normal: Evans' ratio = 0.30 (anterior horn width divided by the inner skull breadth), maximum cella media distance = 45 mm, width of the third ventricle = 7.5 mm (*Lauber* 1965, *Vogel* 1973) and maximum hemispheric sulcus width = 3 mm (*Davidoff & Dyke* 1946, *Larsby & Lindgren* 1940).

CT was performed by the EMI Mark I and CT 1010 computer tomographs (the scanning plane parallel with the orbitomeatal plane). The linear measurements of the ventricles and sulci were obtained with dividers on the polaroid pictures and multiplied by 3.3 (the minification factor of the apparatus).

Cerebral measurements from the 38 painters examined by CT were matched and compared with those from 38 males of similar age from a material previously published of 100 normal persons (*Gyldensted* 1977).

In all 50 subjects neuropsychological examination was performed by a clinical psychologist to evaluate the presence of intellectual impairment. As five subjects were tested in other hospitals, partly with tests different from those used in our department, only the conclusion of these tests are included in the material.

The neuropsychological examination focused on a number of behavioral dimensions and was administered in a standardized manner to the 45 painters tested in our department. These were:

1) immediate verbal memory span (digit span and sentence repetition)
2) verbal learning and memory (paired associates)
3) visuo-spatial learning and memory (visual gestalts)
4) visuo-constructional praxis (cube test)
5) concept formation (similarities, Kasanin-Hanfmann)
6) vigilance and psycho-motor speed (continuous visual reaction times).

Five patients were still working as painters while 18 had changed jobs.

RESULTS

EEG was normal in 37 patients, slightly abnormal in seven and moderately abnormal in two.

The neurological examination demonstrated the presence of a rapid intermittent tremor in six patients. Clinical signs in nine cases indicated a peripheral neuropathy which was neurophysiologically verified in three.

Otoneurological examination revealed abnormalities in 18 of 42 patients examined. Twelve had reduced caloric vestibular reaction. One had vestibular hyperreactivity and in six preponderance was found.

In 10 patients an elevation in blood alanin aminotransferase was found. Other biochemical investigations were all normal.

Neuroradiological examination

All 12 painters investigated with PEG were found to have brain atrophy: three had ventricular enlargement, three broad hemispheric sulci, and six combined central and cortical atrophy. Among the 38 painters studied with CT, brain atrophy was found in 19, 13 had broad hemispheric sulci (6.6 mm, Figure 1), five ventricular enlargement, and one had combined central and cortical atrophy.

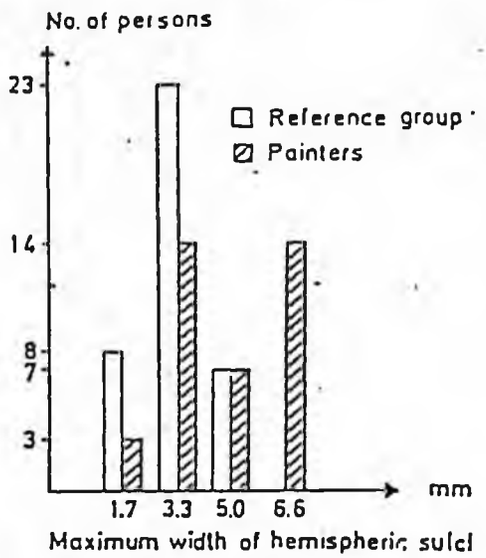

Figure 1. Comparison between the sulcus width, as measured by CT, from 38 professional painters and 38 normal males of similar age. The difference is statistically significant (P = 0.0004).

	(n)
Memory impairment, forgetfulness	45
Excessive fatigue, weariness	38
Inability to concentrate	30
Irritability, low frustration tolerance	29
Headache	29
Dizziness	24
Apathy, lack of initiative	21
Anxiety, nervousness	21
Depressions, low spirits	19
Bursts of perspiration	17
Alcohol intolerance	15
Abdominal pains, diarrhea, nausea	13
Impotence, reduced libido	11
Blurred vision	11

Table 2. Classification of 50 subjects in regard to degree of intellectual impairment based on neuropsychological tests

Degree of impairment	(n)
None	9
Suspected or doubtful	2
Slight	14
Slight to moderate	11
Moderate	11
Moderate to severe	3
Severe	0

Table 3. Frequency of difficulties experienced in the different neuropsychological tests (n = 45)

Test	(n)	%
Visual gestalts (memory)	29	64
Digit span	28	62
Paired associates (learning)	27	60
Sentence repetition	24	53
Visual gestalts (learning)	22	49
Paired associates (memory)	22	49
Cube test	21	47
Similarities, Kasanin-Hanfmann	19	42
Reaction times (variability)	16	36
Reaction times (general slowing)	14	31

sulcus width between the 38 painters studied by CT and the control group ($P = 2\alpha = 0.0004$, Wilcoxon-Mann-Whitney test, Figure 1). Concerning the ventricular size, no difference could be statistically guaranteed between the two groups ($P = 2\alpha > 0.1$).

Neuropsychological examination

The persistent complaints presented by the 50 painters are listed in Table 1. Care was taken to eliminate symptoms which were experienced only during or immediately after exposure. Thirty-nine of 50 subjects were characterized as intellectually impaired in various degrees (Table 2). In the impaired subjects, slight to moderate cognitive deterioration was predominant. Severe dementia, characterized by disorientation, marked personality disturbances and inability to pass the neuropsychological test battery were not seen.

Table 3 indicates how frequent impaired performance was observed. Memory functions in their various aspects were most often affected. Difficulties in visuo-contructional praxis and verbal concept formation were present in about half of the subjects. Disorders of vigilance and psychomotor slowing was seen in one-third of the sample. (The psychometric data will be published separately.) Five patients showed neither intellectual impairment nor cerebral atrophy.

DISCUSSION

A variety of organic solvents have been shown to produce encephalopathy (*Defalque* 1960, *Lindström et al.* 1976, *Stewart* 1968, *Gamberale & Hultengren* 1972, *Hänninen et al.* 1976), as well as peripheral neuropathy (*Herskowitz et al.* 1971, *Mendell* 1974, *Davenport et al.* 1976, *Seppäläinen & Tolonen* 1974) in exposed workers.

Turpentine substitute is an organic solvent which consists of a mixture of aliphatic and aromatic hydrocarbons.

House painters in their daily work use a large amount of turpentine substitute and the use has been rapidly increasing in recent years. This is primarily due to increasing use of oil-based paint and an altered technique of application which enables the painter to cover lager surfaces per day. Thus evaporation is increased and exposure as well. Organic solvents are absorbed mainly through the lungs, but may also pass through the skin (*Shugaev* 1969). Due to their lipidsolubility they will easily pass cell membranes in the organism, including the blood brain barrier, and primarily be contained in lipid-containing organs. High concentrations are therefore found in the central and peripheral nervous system (*Shugaev* 1969). Some solvents are metabolized in the organism, especially in the liver. The metabolites of several compounds

not very toxic whereas its metabolite styrene oxide is very harmful (*Parkki et al.* 1976). Most organic solvents are exhaled unchanged through the lungs while a smaller part is excreted through the kidneys, either unchanged or metabolized to low molecular compounds. A few high molecular metabolites are excreted in the bile.

Solvents partly are excreted within a few hours after exposure, but may also be found in expired air several days after exposure. When the organism is exposed to more than one toxin, the total effect may be synergetic (*Shrivastav et al.* 1976). This may have some implication regarding the toxicity of turpentine substitute since this solvent is a mixture of different hydrocarbons. In industry, workers are commonly exposed to more than one organic solvent and often mixtures of several compounds are used.

Solvents react on the cell membranes in the central as well as the peripheral nervous system. A change in permeability results in altered neuronal function (*Shrivastav et al.* 1976), which may explain the acute toxic effect.

Chronic neurotoxic effects may be explained by the formation of chemically and biologically reactive intermediates which are able to denature or bind to cell macromolecules (*Savolainen* 1977).

Three previous controlled studies have shown that in workers exposed to carbon disulfide (*Hänninen* 1971), in car painters (*Hänninen et al.* 1976), and in house painters (*Hane et al.* 1977), intellectual impairment could be demonstrated by means of psychological testing. The exposed workers were compared to a matched group of non exposed workers. It is noteworthy also, that in two of these studies (*Hane et al.* 1977, *Hänninen et al.* 1976) prior psychological testing carried out during military service showed no difference between the groups.

The present neuropsychological results are in accordance with previous studies. They include dysfunction of auditory memory span, recent visuospatial and verbal memory and learning (Table 1).

EEG changes are uncommon among our patients, which is noteworthy, since this is frequently seen in acute intoxications.

Previously only functional impairments in psychological tests in exposed workers have been described. In our study neuroradiological examinations have furthermore demonstrated structural changes. This indicates that long-term exposure to organic solvents can result in irreversible damage to the brain.

It may be argued that no proof has been produced as to the specificity of this organic brain syndrome. There are, however, certain characterstic features in our group of painters. The presence of acute intoxication symptoms with improvement over weekends and holidays have often preceded the more chronic symptom. The clinical picture has been dominated by asthenia,

anxiety and depressive complaints combined with headache and dizziness, especially in the initial phase.

Consequently, many of our painters have been regarded and treated for several years as neurotic or depressive patients. The fatigue, and especially the emotional complaints seem to present themselves more frequently in this group of painters than what is usually seen in a population of patients with presenile dementia. Also symptoms from the autonomic nervous system are frequent. In many ways the symptoms described here show similarity to the clinical picture of neurasthenic dementia called the KZ-syndrome, as described by *Thygesen et al.* (1970).

Recently, *Freemon* (1976) and *Wells* (1978) have published surveys on the most common causes of dementia. In approximately 50 % the cause remains obscure. One of the possible etiologies may be exposure to organic solvents – which is used in increasing amounts – as in our material where no other plausible cause could be demonstrated.

Future preventive measures should focus on minimizing organic solvent exposure in painters. It is particularly important that behavioral measures are taken into consideration when determining threshold limit values and that chemicals, before being introduced in industry, undergo biological testing regarding their toxicity.

REFERENCES

Axelson, O., M. Hane & C. Hogstedt (1976): Fallbeskrivningar av kroniskt psykoorganiskt syndrom hos byggnadsmålare. Läkartidn. *73*, 317–318.

Davenport, J. G., D. F. Farrell & S. M. Sumi (1976): Giant axonal neuropathy caused by industrial chemicals. Neurol. *26*, 919–923.

Davidoff, L. M. & C. G. Dyke (1946): The normal encephalogram. Lea and Febiger, Philadelphia.

Defalque, R. J. (1960): Pharmacology and toxicology of trichlorethylene. Clin. Pharm. Ther. *2*, 665–688.

Freemon, F. R. (1976): Evaluation of patients with progressive intellectual deterioration. Arch. Neurol. *33*, 658–659.

Gamberale, F. & M. Hultengren (1972): Toluene exposure: Psychological functions. Scand. J. WK Environ Hlth. *4*, 131–139.

Gyldensted, C. (1977): Measurements of the normal ventricular system and hemispheric sulci of 100 adults with computed tomography. Neuroradiol. *14*, 183–192.

Hane, M., O. Axelson, J. Blume, C. Hogstedt, L. Sundell & B. Ydreborg (1977): Psychological function changes among house painters. Scand. J. WK Environ Hlth. *3*, 91–99.

Herskowitz, A., N. Ishii & H. Schaumburg (1971): N-hexane neuropathy. New. Engl. J. Med. *285*, 82–85.

Hänninen, H. (1971): Psychological picture of manifest and latent carbon disulphide poisoning. Br. J. Industr. Med. *28*, 374–381.

long-term exposure to a mixture of organic solvents. Scand. J. WK Environ Hlth. *4*, 240–251.

Larsby, H. & E. Lindgren (1940): Encephalographic examinations of 125 institutional epileptics. Acta Psych. Neurol. *15*, 337–352.

Lauber, H. L. (1965): Das pneumoencephalogramm. Messverfahren bei Erwachsenen. Barth, München.

Lindström, K., H. Härkönen & S. Hernberg (1976): Disturbances in psychological functions of workers occupationally exposed to styrene. Scand. J. WK Environ Hlth. *2*, 129–139.

Mendell, J. R. (1974): Neuropathy and methyl N-butyl ketone. New Engl. J. Med. *290*, 1263–1264.

Parkki, M. G., J. Marniemi & H. Vainio (1976): Action of styrene and its metabolites styrene oxide and styrene glycol on activities of xenobiotic biotransformation enzymes in rat liver *in vivo*. Toxicol. Appl. Pharmacol. *38*, 59–70.

Savolainen, H. (1977): Some aspects of the mechanism by which industrial solvents produce neurotoxic effects. Chem. Biol. Interact. *18*, 1–10.

Seppäläinen, A. M. & M. Tolonen (1974): Neurotoxicity of long-term exposure to carbon disulphide in the viscose rayon industry. A neuropsychological study. Scand. J. WK Environ Hlth. *11*, 145–153.

Shrivastav, B. B., T. Narahashi, R. J. Kitz & J. D. Roberts (1976): Mode of action of trichlorethylene on squid axon membranes. J. Pharmacol. Exp. Ther. *199*, 179–188.

Shugaev, B. B. (1969): Concentrations of hydrocarbons in tissues as a measure of toxicity. Arch. Environ Hlth. *18*, 879–882.

Stewart, R. D. (1968): The toxicology of 1,1,1-trichloroethane. Ann. Occup. Hyg. *11*, 71–79.

Thygesen, P., K. Hermann & R. Willanger (1970): Concentration camp survivors in Denmark. Dan. Med. Bull. *17*, 65–108.

Vogel, T. (1973): Statistische Untersuchungen zur Frage der Normgrenzen des Pneumoencephalogramms des Erwachsenen. Fortschr. Neurol. Psychiat. *41*, 55–122.

Wells, C. E. (1978): Chronic brain disease. An overview. Am. J. Psychiat. *135*, 1–12.

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P. Arlien-Søborg, M.D.
Rigshospitalet
Department of Neurology
DK-2100 Copenhagen Ø
Denmark

Occupational Fact Sheet* Version I - June 1984

PAINTERS

This fact sheet is an introduction to the potential hazards of paints and coatings. Because of the variable nature of paint composition, some knowledge of the specific product you are using is necessary to fully understand the hazards of that product. The container label may list much of this information. A Material Safety Data Sheet for each product is available from the manufacturer and may be on hand at your supplier. Chemical Fact Sheets prepared by the New York State Department of Health on paint-related materials are listed at the end of this sheet. By using these information sources, you can learn about the measures you can take to prevent adverse health effects from paints.

Painters use many types of products. In addition to several kinds of paint (oil, latex, urethane, etc.), they may use varnishes, lacquers, stains, strippers and wood preservatives. Each has its own composition and toxicity. Paints and coatings, whether oil-based or water-based, consist of three basic components: thinners, binders, and pigments. The thinner or solvent may be water or some liquid such as vegetable oil or mineral spirits that allows the mixture to be spread. Binders form the film of dried material and are usually natural resins, drying oils or synthetic polymers. Binder and solvent combined are called the vehicle of the coating. Pigments, either metallic salts or synthetic dyes, provide color and improve the film quality. Additives, such as fungicides and stabilizers, may be present depending upon the properties required of the coating. The table on page two is a list of typical materials used in paint and coating formulations.

The most likely kinds of exposure from paint will be by inhalation of solvent fumes and through skin contact. Although many of the ingredients of paint are considered hazardous in pure form, when incorporated into a paint formulation they pose little risk. For example, pure chromium pigments are of concern since they can cause severe skin reactions and when ingested, cause damage to liver and kidneys. Inhalation of chromium fumes and dust may also cause lung damage and cancer. For the paint formulator who handles large quantities of pure pigment, this is a real concern. For the paint applicator, the pigment is locked into the final coating and poses little, if any danger except in unusual circumstances, such as sanding of painted surfaces, heating painted surfaces for welding or paint removal, or the ingestion of peeling paint chips by small children. As with any chemical, you must determine the primary hazards for the job you are doing.

THINNERS AND SOLVENTS:

Paints and lacquers contain liquids which suspend pigments and dissolve oils and additives. The liquid may be one chemical or, more commonly, a combination of chemicals. The same chemicals may be used to thin the paint, as temperature or method of application requires. These liquids evaporate after application, leaving behind the pigments and binders that form the final surface coating.

Most solvents are both fire and health hazards. Because they are intended to evaporate, they can form flammable mixtures in the air and may enter the body when inhaled. Some solvents may even be absorbed through the skin. Generally, skin contact can cause drying, irritation, and an increased risk of infection. If absorbed through the skin or inhaled, solvents can cause systemic effects, such as damage to liver and kidneys. Nerve damage can also occur, with symptoms of numbness in arms and legs, dizziness and nausea.

Liquid paint strippers contain many of the same solvents used in paint, and other chemicals that react with paint. The components of strippers evaporate very rapidly and may be more hazardous than paint solvents. Good ventilation, protective equipment, and proper work practices are essential in avoiding overexposure to paint solvents and strippers.

* Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health.

PAINT PRODUCTS*

Paint	Vehicle		Pigments	Additives
	Thinner	Binder		
Latex house or wall	ethylene glycol water	polyvinyl acetate, acrylic or styrene butadiene elastomers, emulsifying agents alkyd resin vegetable oils or resins	titanium dioxide zinc oxide inert fillers	mercury compounds as fungicides (exterior paints)
Oil-flat wall, gloss & floor enamels house & trim semi gloss	mineral spirits linseed oil	alkyd resin or oil varnish	titanium dioxide lithopone zinc oxide white lead basic lead chromate inert fillers	
metallic paint	vegetable oil, varnish, linseed oil, aromatic thinners, mineral spirits	petroleum resin coumarone indene resin	metal or metal alloy	
asphalt, screen enamel, stove enamel	oil or varnish mineral spirits	asphalt or Gilsonite	carbon black	
stains wood fillers	vegetable oil, varnish mineral spirits	Gilsonite or asphalt alkyd resin	aniline dyes fillers	pentachlorophenol
varnishes	vegetable oil, varnish, mineral spirits	alkyd resin polyurethane resin phenolic resin	fillers	
anticorrosion	pine oil petroleum ether ethyl alcohol kerosene methylene chloride	rosin coal tar paraffin plastic thickener	zinc chromate lead chromate red lead oxide basic lead carbonate zinc oxide lead monoxide	ammonium hydroxide arsenic cuprous oxide mecuric oxides metallic soap rust retardant bis(tributyltin) oxide
lacquers	cottonseed oil ethyl alcohol ethyl acetate butyl alcohol butyl acetate toluene aliphatic hydrocarbons	nitrocellulose ester gum (esters of resin acids) vinyl resins acrylic resins	lead oxide	nitric acid magnesium oxide
automotive under coatings	fish oil vegetable oil aromatic hydrocarbons alphatic hydrocarbons	alkyd resins phenolic resin	iron oxide silicates lead salts zinc salts titanium dioxide	

* This table lists typical compositions. Check the label or MSDS for the product you use.

BINDERS:

The substances used as binders in the coatings industry are synthetic and natural resins and drying oils. Synthetic resins are most commonly used today; they include alkyd, polyester, phenolic, amino, epoxy, polyurethane, acrylic, hydrocarbon and silicone resins. Synthetic resins consist of many small molecules linked together in a long chain, with small amounts of free, or unlinked, molecules present. The free components of many different resins can cause eye, nose and throat irritation. Since these free molecules make up a small part of the entire coating formulation, the inhalation hazard is minimized. However, a few individuals may experience an allergic asthmatic reaction after initial contact with formaldehyde, a component of certain phenolic and amino resins, or the isocyanate vapors of polyurethane resins. This reaction can be triggered at extremely low levels. Skin contact with epoxy resins can cause itching, redness, swelling and blistering of the skin. Exposure to formaldehyde or isocyanates can result in allergic skin rashes.

Natural resins include Dammar, East India resin, Congo, rosin, Shellac and Gilsonite. Contact with certain natural resins can cause skin irritation. When heated, rosin and Gilsonite fumes can cause irritation of the nose, throat and lungs.

The oils used for drying purposes are primarily linseed, tung, oiticica, fish and dehydrated castor oils. These oils do not contribute significantly to the adverse health effects of paints.

PIGMENTS:

Paint pigments are particles dispersed in liquid or solid binders that impart color and hiding power, and improve hardness and durability. Paint formulations may contain any number of different pigment compounds. While inhalation of pigment dusts or ingestion of particles may cause ill effects, when combined into paint formulations these routes of exposure are infrequent.

Metallic salts are commonly used as pigments. Lead pigments, while often replaced by less toxic substances, are still used in industrial applications. The hazards of lead in paints are primarily due to ingestion of paint chips by children. Exposure to lead can also be from sanding or burning, used in paint removal. Lead dust can be carried home on clothing and can affect other family members. Lead can accumulate in the body over a period of time. Long term exposure to low levels can cause severe effects, including nervous system, digestive and blood disorders. Lead exposure of either parent before pregnancy can increase the chances of miscarriage or birth defects. If lead pigments are used, a warning statement is required on the label. "Fume-Proof" or "Fume-Resistant" denotes no lead content.

Other metals used include chromium, cadmium, titanium, zinc, iron and copper. Contact with these metals from paint mixtures is rare, but can occur in certain circumstances, as described for lead. If heated, some metals can cause metal fume fever, characterized by chills, fever, aching muscles, headache, nausea, vomiting, diarrhea and stomach pain. Inhalation of cadmium or chromium dusts can cause lung irritation or injury. Contact with certain chromium or cadmium compounds is associated with an increased risk of cancer of the lung, prostate or kidney.

Extenders or fillers are substances which have little hiding power by themselves but are used to conserve more expensive hiding pigments, to control flow properties and to improve brushability and mechanical strength. Some of the commonly used extenders are talc, clay, calcium silicate, calcium carbonate, magnesium carbonate, barium sulfate, and silicon oxide. Dust from these substances can cause irritant effects. However, when already combined in paint formulations, they do not contribute to any adverse health effects.

ADDITIVES:

Several different properties can be given to a coating by including additives in the formulation. Additives can control flow, penetration, pigment suspension and bubble or wrinkle formation. They can also provide resistance to insects or mildew, to extremes in temperature and moisture, and can preserve the coating and extend its service-life.

Metallic soaps are commonly found in coating formulations. These compounds are made up of metals such as:

copper, iron, lead, mercury, tin, and zinc;

and another chemical usually listed as:

lineolate, naphthenate, octoate, oleate, palmitate, stearate, or tallate, and others.

The amount of metallic soap in a formulation is small, minimizing the hazard of exposure. However, some metals (lead, mercury) can accumulate once they enter the body and this may result in poisoning. A special warning statement should appear on the label if the coating contains mercury at or above 0.02% or lead. For information concerning exposure to metals, see Pigment section above.

Organo-metallic compounds such as phenylmercury oleate and dibutyltin dioctoate are used in formulations as preservatives and fungicides. Organic tin can cause irritation of the eyes, throat and skin. Severe exposures may cause liver and nervous system damage if swallowed or inhaled.

Organic mercury may also cause irritation of the eyes and respiratory system and allergic skin rashes may occur. Higher exposures or continued exposure over a long period of time may cause mercury poisoning. Symptoms can include numbness and tingling of the lips, hands and feet; tunnel vision; hearing difficulties and emotional disturbances. In severe cases these effects may become permanent. Onset of symptoms may be delayed for months.

Chlorinated phenols, such as pentachlorophenol, are another class of compounds used as preservatives and fungicides. They may be present in concentrations up to 0.5%. Skin contact is the most common route of exposure. Symptoms include pain and inflammation at the point of contact. Prolonged exposure can cause chemical acne, profuse sweating and elevated temperature. Some chlorinated phenols are readily absorbed through the skin and this has resulted in at least one fatality.

PROTECTIVE MEASURES:

The two most likely kinds of exposure from paint products are through inhalation of vapor and skin contact. Good ventilation is a necessity. This may mean painting only when weather permits opening windows or supplying forced ventilation where needed. In spray painting operations, a protective mask may also be required if droplets are carried into the breathing zone. Skin contact can be avoided by wearing coveralls, a hat and, if necessary, gloves. If you do get paint on large areas of skin or clothing, remove the contaminated clothing and wash affected area promptly.

Although eye contact and ingestion are accidental types of exposures, you should be prepared for this possibility. Because you cannot remove paint from the eye with normal paint cleaners, having emergency water on hand is advised. Avoid storing, preparing, or eating food in the work area, and be sure to clean your hands thoroughly before touching food. And, because paint solverts will be in the air, you should not smoke while painting.

Chemical Fact Sheets are available from the New York State Department of Health on the following paint related chemicals:

Acetone	Isopropyl alcohol(Isopropanol)	Nickel
Benzene	Kerosene	Pentachlorophenol(PCP)
2-Butanone(MEK)	Lead	Petroleum distillates
Chromium	Manganese	Petroleum ether
Copper	Mercury	Titanium dioxide
Ethyl alcohol(Ethanol)	Methyl alcohol(Methanol)	Toluene
Ethylene glycol	Methylene chloride	Xylenes
Gasoline	Mineral Spirits	Zinc
Iron	Naphthalene	

For additional information:
Contact the Safety Officer or Industrial Hygienist at your worksite or the Bureau of Toxic Substance Assessment, Tower Building, Empire State Plaza, Albany, New York 12237.

Bill No. Committee Substitute for Senate Bill 141 (L&C) Date January 15, 1988

Title "An Act relating to hazardous painting certification." Contact: Richard Arab 465-4856

Eileen Plate 465-2700

Committee Substitute for Senate Bill 141 is designed to assure the competency of persons employed to perform hazardous painting in the state and thereby prevent harmful exposures to workers who apply toxic and hazardous paints, to their co-workers and to the public.

Under the provisions of this bill, persons who are employed to perform hazardous painting must complete an approved training program and be certified. The training program would consist of instruction in and a demonstration of each person's knowledge and skill in using safe work practices and appropriate protective equipment. The bill limits the certification requirements to only the more hazardous painting applications and thereby excludes from the certification requirements low toxicity water-based paints widely used in residential painting.

Today, many solvents, metals, pesticides, isocyanates, and carcinogens are applied to surfaces in Alaska because highly resistant surfaces are needed for the harsh environment which exists in many parts of the state. Exposure to those toxic and hazardous substances can cause a variety of adverse health effects. For example:

- Nerve and brain damage, including memory and coordination impairment, result from chronic solvent exposures. Hepatitis and increased incidence of accidents also result from acute solvent exposures;
- Heavy metal poisoning occurs from exposure to lead, cadmium and other metals;
- Asthma and analylactic shock occurs from isocyanate exposures;
- Pesticide poisoning occurs from exposure to wood preservative additives such as penta chlorophenol.
- Heart attacks can occur from overexposure to methylene chloride; and
- Cancer can result from exposure to chromate paint pigments and benzene solvents;

These occupational diseases and injuries can be prevented by using appropriate work practices and proper protective equipment. The public and building occupants near painting projects can be better warned and protected by certified painters who use appropriate isolation and curing times. Workers' families, as well as other members of the community, need to be protected from the exposure to toxic material, such as lead chromate, brought home on the individual worker's person or clothing.

POSITION PAPER/Department of Labor

Under the provisions of this bill, the Department of Labor would establish minimum requirements for certification training programs; review and approve such programs; issue certificates to persons who present evidence of having completed an approved training program; and enforce the certification requirements.

The effective date set out in Section 3 of the bill needs to be changed. The Department recommends a January 1, 1989, effective date. This will provide the lead time needed to develop the training program curriculum and to educate employers on the certification requirements. The industry will likewise need this lead time to have training programs in place and workers trained by the effective date.

The Department supports the provisions of this bill.

APPROVED:

Jim Sampson, Commissioner
Department of Labor

STATE OF ALASKA
1988 LEGISLATIVE SESSION

BILL VERSION: CSSB 141 (L&C)
PUBLISH DATE: _____

FISCAL NOTE

REQUEST:

Revision Date: _____
Title: "An act relating to hazardous painting certification."
Sponsor: Josephson
Requestor: Senate Judiciary

Agency Affected: Labor
BRU: Labor Standards and Safety
Components: Occupational Safety and Health

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 88	FY 89	FY 90	FY 91	FY 92	FY 93
PERSONAL SERVICES		64.8	77.5	77.5	77.5	77.5
TRAVEL		10.0	5.0	5.2	5.3	5.5
CONTRACTUAL		13.2	17.3	17.8	18.4	18.9
SUPPLIES		1.1	1.4	1.4	1.5	1.5
EQUIPMENT		1.6	0	0	0	0
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0	90.7	101.2	101.9	102.7	103.4
CAPITAL						
REVENUE	0	100.0	150.0	50.0	100.0	150.0

FUNDING: (Thousands of Dollars)

GENERAL FUND		90.7	101.2	101.9	102.7	103.4
FEDERAL FUNDS						
OTHER						
TOTAL	0	90.7	101.2	101.9	102.7	103.4

POSITIONS:

FULL-TIME		2.0	2.0	2.0	2.0	2.0
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

Tom Stuart by [illegible]

Prepared by: Tom Stuart, Director
Phone: 465-4870
Division: Labor Standards and Safety
Date: 1/15/88

Approved by Commissioner: Jim Sampson
Date: 1/15/88
Agency: Labor

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)

This bill would require the department to adopt regulations covering persons who are employed in "hazardous painting." The department would issue certificates, for a fee, to persons who complete an approved training course. The department would also enforce the provisions of the bill by inspections and through the issuance of citations.

Expenditures:

In order to effectively administer this program the department would require two new positions, an Industrial Hygienist I, and a Clerk Typist III. The Industrial Hygienist would help develop the required regulations and training program guidelines. Also, a tracking system would be created to monitor approved training programs and to account for certificates and fees. This position would travel to inform employer and employee organizations of the new law.

The Clerk Typist III would begin work six months after the Hygienist. This would allow time for the regulations to be developed and implemented. The Clerk would then process the requests for certification and operate the in-house tracking systems.

Revenues:

It is estimated that 1,000 persons will take the required training course and apply for a certificate during the last six months of FY 1989. During the second year, the number of applications is expected to increase to 1,500 as most persons who want to be certified will have completed training by the end of FY 1990. During the third year, the number of applicants is estimated to drop to approximately 500 as only new entrants into the painting occupation will need certification. In FY 92 and FY 93, activity is expected to increase as persons who received certificates in FY 89 and FY 90 must be re-certified. (The certification will be valid for three years).

Estimated Revenue:

	FY 89	FY 90	FY 91	FY 92	FY 93
Certificates Issued	1,000	1,500	500	1,000	1,500
Fee	$ 100	$ 100	$ 100	$ 100	$ 100
	$100,000	$150,000	$50,000	$100,000	$150,000

Assumptions:

1. An effective date of July 1, 1988 for the program except for the certification requirement that will go into effect on January 1, 1989.

2. The certificate fee would be established at $100.

3. Inflation on non-personal services items will be 3% per year.

Position Title	No. of Positions	Range/Step	Barg. Unit
Industrial Hygienist I	1	19A	GGU

Time Status	Staff Months	Location	Election District
PFT	12	Anchorage	

Type of Expenditure		Amount
1	2	3
Salary	40.032	
Benefits	12,009	
Premium Pay		
Other		
Total Personal Services		52,041
Travel		10,000
Contractual		9,700
Commodities		700
Equipment		1,600
Other		
Total Cost		74,041

Funding Source for Total Cost	
Federal Receipts 1002	
G. F. Match 1003	
General Fund 1004	74,041
GF Program Receipts 1005	
Other	

Justification

This position would work on developing the required regulations and training programs necessitated by tha bill. Also, the position would develop an in-house system to keep track of the training programs and certificate holders. As training programs are implemented, this position would ensure compliance with the provisions of this bill.

Costs include $10,000 for travel to inform workers and employers of the new law. Normal contractual, commodities and one-time furniture purchases are also included.

Request For New Position

Agency Labor

BRU Occupational Safety and Health

Component Occupational Safety and Health

Revised Date

FY 89

Position Title	No. of Positions	Range/Step	Barg. Unit
Clerk Typist III	1	8A	GGU

Time Status	Staff Months	Location	Election District
PFT	6	Anchorage	

Type of Expenditure		Amount
1	2	3
Salary	9,786	
Benefits	2,936	
Premium Pay	--	
Other	--	
Total Personal Services		12,722
Travel		0
Contractual		3,522
Commodities		350
Equipment		0
Other		0
Total Cost		16,594

Funding Source for Total Cost		
Federal Receipts	1002	
G. F. Match	1003	
General Fund	1004	16,594
GF Program Receipts	1005	
Other		

Justification

This clerical position would provide support for the in-house tracking system and would process the requests for certification. Costs include normal contractual and commodities.

The position would start six months after the program has begun to allow time for the regulations and tracking system to be implemented. The position would work 12 months after the first year.

Request For New Position

Agency Labor

BRU Occupational Safety and Health

Component Occupational Safety and Health

Revised Date

FY 89

STATE OF ALASKA 1987 LEGISLATIVE SESSION
FISCAL NOTE

Bill Version: CSSB 141 (L&C)
Publish Date:

REQUEST:

Revision Date:
Title: "An Act relating to hazardous painting certification."
Sponsor: Josephson
Requestor: Senate Labor and Commerce

Agency Affected: Labor
BRU: Occupational Safety and Health
Components: Occupational Safety and Health

EXPENDITURES/REVENUES: (Thousands of Dollars)

OPERATING	FY 87	FY 88	FY 89	FY 90	FY 91	FY 92
PERSONAL SERVICES		64.8	77.5	77.5	77.5	77.5
TRAVEL		10.0	5.0	5.2	5.3	5.5
CONTRACTUAL		13.2	17.3	17.8	18.4	18.9
SUPPLIES		1.1	1.4	1.4	1.5	1.5
EQUIPMENT		1.6	0	0	0	0
LAND & STRUCTURES						
GRANTS, CLAIMS						
MISCELLANEOUS						
TOTAL OPERATING	0	90.7	101.2	101.9	102.7	103.4
CAPITAL						
REVENUE		200.0	100.0	50.0	150.0	75.0

FUNDING: (Thousands of Dollars)

GENERAL FUND		90.7	101.2	101.9	102.7	103.4
FEDERAL FUNDS						
OTHER						
TOTAL		90.7	101.2	101.9	102.7	103.4

POSITIONS:

FULL-TIME		2	2	2	2	2
PART-TIME						
TEMPORARY						

ANALYSIS: (Attach a separate page if necessary)

(See attached)

Prepared by: Tom Stuart, Director
Division: Labor Standards and Safety
Phone: 465-4870
Date: 4/14/87

Approved by Commissioner: Jim Sampson
Agency: Labor
Date: 4/14/87

Distribution (by preparer):
Legislative Finance
Legislative Sponsor
Requestor
Office of Management and Budget
Impacted Agency(ies)
Senate Secretary

Fiscal Note Analysis

CSSB 141 (L&C)

This bill would require the department to adopt regulations concerning persons who are employed in "hazardous painting." The department would issue certificates, for a fee, to persons who complete an approved training course. The department would also enforce the provisions of the bill by inspections and through the issuance of citations.

Expenditures

In order to effectively run this program the department would require two new position, an Industrial Hygienist I and Clerk Typist III. The Industrial Hygienist would help develop the regulations to enforce this bill. Training program guidelines would be developed, and fees for certifications set. Also, an in-house tracking system would be created to monitor approved training programs and to account for certificates and fees. This position would travel to inform employer and employee organizations of the new law.

The Clerk Typist III would begin work six months after the Hygienist. This would allow time for the regulations to be developed and implemented. The Clerk would then process the requests for certification and operate the in-house tracking systems.

Revenues

We are estimating 2,000 persons will take the required training course and apply for a certificate the first year. This would cover persons employed to paint commercially as well as those self-employed. During the second and third year we estimate the number of applications would drop by 50%, but in the fourth year the number will increase as re-certification will be required. (The certification will be valid for three years).

Estimated Revenues:

	FY 88	FY 89	FY 90	FY 91	FY 92
Certificates Issued	2,000	1,000	500	1,500	750
Fee	100	100	100	100	100
	200,000	100,000	50,000	150,000	75,000

Assumptions

1. An effective date of July 1, 1987.
2. The certificate fee would be established at $100.
3. Inflation of non-personal services items will be 3% per year.

Position Title	No. of Positions	Range/Step	Barg. Unit	Gov.	Approv.	Disapp.
Industrial Hygienist I	1	19A	GGU			

Time Status	Staff Months	RP Number	Location	Election District	Leg.		
PFT	12		Anchorage				

Type of Expenditure		Amount
1	2	3
Salary	40,032	
Benefits	12,009	
Premium Pay	---	
Other	---	
Total Personal Services		52,041
Travel		10,000
Contractual		9,700
Commodities		700
Equipment		1,600
Other		
Total Cost		74,041

Receipt Code	Funding Source		Amount
	Federal Receipts	1002	
	G. F. Match	1003	
	General Funds	1004	74,041
	I-A Receipts	1005	
	Program Receipts	1028	
	CIP Receipts	1061	
	Other		

For B&M Use Only
Key Number __ __ - __ __ - __ __ - __ __ - __ __

Justification

This position would work on developing the required regulations and training programs necessitated by the bill. Also, the position would develop an in-house system to keep track of the training programs and certificate holders. As training programs are implemented, this position would ensure compliance with the provisions of this bill.

Costs include $10,000 for travel to inform workers and employers of the new law. Normal contractual, commodities and one-time furniture purchases are also included.

Request For New Position

Agency Labor
BRU Occupational Safety and Health
Component Occupational Safety and Health

FY 87

Position Title	No. of Positions	Range/Step	Barg. Unit	Gov.	Approv.	Disapp.
Clerk Typist III	1	8A	GGU			
Time Status	**Staff Months**	**RP Number**	**Location**	**Election District**	**Leg.**	
PFT	6		Anchorage			

Type of Expenditure		Amount
1	2	3
Salary	9,786	
Benefits	2,936	
Premium Pay	---	
Other	---	
Total Personal Services		12,722
Travel		0
Contractual		3,522
Commodities		350
Equipment		0
Other		0
Total Cost		16,594

Receipt Code	Funding Source		Amount
	Federal Receipts	1002	
	G. F. Match	1003	
	General Funds	1004	16,594
	I-A Receipts	1005	
	Program Receipts	1028	
	CIP Receipts	1061	
	Other		

For B&M Use Only
Key Number __ __ - __ __ - __ __ - __ __ - __ __

Justification

This clerical position would provide support for the in-house tracking system and would process the requests for certifications. Costs include normal contractual and commodities.

The position would start six months after the program has begun to allow time for the regulations and tracking system to be implemented. The position would work 12 months after the first year.

Request For New Position

Agency Labor
BRU Occupational Safety and Health
Component Occupational Safety and Health

FY 87