The Vinyl Institute

A Division of The Society of The Plastics Industry, Inc.

August 28, 1989

TO: The VI Health, Safety & Environment Committee

RE: California Air Resources Board Draft Report on Vinyl Chloride

Enclosed is material I received today from Peter de la Cruz relating to the development of a report by the California Air Resources Board outlining "Public Exposure To, Sources, and Emissions of Vinyl Chloride in California". As noted, the comment period on the preliminary draft closes on September 8th; a revised draft will then be developed with a 20-day comment period before the final draft is forwarded to the Scientific Review Panel.

If you have separately received this document and filed or plan to file comments, please let me know.

As the material I received notes that "landfills are the largest source category of vinyl chloride emissions in California", I have copied the appropriate VI Technical Committee contacts.

Meredith

Meredith N. Scheck
Assistant Director

MNS/pmb
enclosure
cc: C. Bush
J. Krokosky
R. Gottesman

VVV 000005260

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August 28, 1989

VIA TELECOPIER

Meredith M. Scheck
The Vinyl Institute
Wayne Interchange Plaza II
155 Route 46 West
Wayne, New Jersey 07470

Re: CARB Draft Report on Vinyl Chloride

Dear Meredith:

Enclosed is a cover letter and the executive summary from a preliminary draft report on vinyl chloride being prepared by the California Air Resources Board (CARB). Comments are requested by September 8, 1989. Since the deadline is fast approaching, we may wish to contact CARB and determine whether later filed comments will be accepted.

The enclosure is all the materials that I have. I understand that Goodyear sent a copy of this to Goodrich, but I am not sure who at Goodrich received the materials. If the entire document is needed, you or I can obtain it from Ed Nowak at Goodyear (216-796-7417).

Please let me know if I can be of any further assistance.

Cordially yours,

Peter

Peter L. de la Cruz

Enclosure

cc: Ed Nowak
Larry Thomas
Robert W. Sherman
Lewis R. Freeman, Jr.

STATE OF CALIFORNIA
George Deukmejian, Governor

AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

August 1, 1989

Dear Sir or Madam:

Draft Report on Vinyl Chloride

As you requested, enclosed for your review and comment is the preliminary draft report on vinyl chloride.

Public review of this report includes two comment periods. The first comment period begins with the mailing of this report and you have until September 8, 1989 to submit your written comments to us. The staffs of the Air Resources Board (ARB) and Department of Health Services (DHS) will review and respond to all the comments received. Your comments and our responses to them will be compiled in Part C of the report and where appropriate, the report will be revised.

The revised report will be mailed out to you and other members of the public for a second and final review. It will include Parts A, B and C of the report as well as an Executive Summary which summarizes Parts A and B. At this stage, the ARB and DHS staff will only accept comments on the Executive Summary and any revisions made to the draft report. A 20 day comment period will be given for your review; comments received and our responses will then be incorporated as an addendum to Part C. After reviewing all public comments, the final draft report along with Part C will then be submitted to the Scientific Review Panel for its review.

The Scientific Review Panel has requested that all public comments be directed to the ARB during these two comment periods. Please note that, in accordance with this process, the Panel will not receive or consider any comments submitted directly to it, or received by the ARB after the close of each comment period.

In order for your comments to be considered on this version of the report, they must be received by September 8, 1989 and submitted to:

Mr. Robert Barham, Chief
Toxic Air Contaminant Identification Branch
Air Resources Board
Attn: Vinyl Chloride
P. O. Box 2815
Sacramento, CA 95812

If you have any questions concerning the report or the comment procedure, please contact Mr. Richard Corey of the Substance Evaluation Section at (916) 323-8543.

Sincerely,

Peter D. Venturini, Chief
Stationary Source Division

Enclosures

cc: Scientific Review Panel

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PRELIMINARY DRAFT

TECHNICAL SUPPORT DOCUMENT

PART A

PUBLIC EXPOSURE TO, SOURCES, AND EMISSIONS OF VINYL CHLORIDE IN CALIFORNIA

REPORT TO THE AIR RESOURCES BOARD ON VINYL CHLORIDE

Principal Author
Richard Corey

Contributing Authors
Tom Parker
Chris Nguyen
Paul Allen
Steve Hui

Reviewed and Approved by:

Joan Denton, Manager
Substance Evaluation Section

Robert Barham, Chief
Toxic Air Contaminant Identification Branch

Peter D. Venturini, Chief
Stationary Source Division

July 1989

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I.

INTRODUCTION

Part A of this report is an evaluation of vinyl chloride's uses, emission sources, ambient and indoor air concentrations, and population exposure in California. Also included are discussions of the physical properties and atmospheric persistence of vinyl chloride. California Health and Safety Code Section 39655 states that substances listed by the U.S. Environmental Protection Agency (EPA) as hazardous air pollutants (Section 112 of the Clean Air Act) shall be identified as toxic air contaminants (TACs) by the Air Resources Board (ARB). Therefore, because the EPA has listed vinyl chloride as a hazardous air pollutant, the ARB is directed by statute to identify vinyl chloride as a TAC.

The ARB is the state agency responsible for the identification of TACs in their non-pesticidal uses. The California Health and Safety Code Section 39655 defines a TAC as "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health." The findings of the Part A report are considered with the health effects findings (Part B report) of the Department of Health Services (DHS) to determine if a compound should be identified as a TAC by the ARB.

In 1978, the ARB adopted an ambient air quality standard for vinyl chloride of 10 ppb for a 24-hour average. The standard represented the limit of detection for vinyl chloride at the time it was adopted.

Vinyl chloride is an extremely volatile compound that is primarily used for the production of polyvinyl chloride (PVC). PVC is fabricated for use in several products of which many are used by the

construction industry. In California, the identified sources of vinyl chloride emissions are landfills, PVC production and fabrication facilities, and sewage treatment plants.

Available information indicates that landfills are the largest source category of vinyl chloride emissions in California. Vinyl chloride has been measured in the ambient air near hazardous waste and municipal waste landfills. Numerous studies have documented the presence of vinyl chloride in the landfill gas of these and other landfills, and have shown that vinyl chloride can be formed in landfills where chlorinated organic compounds have been disposed. Therefore, because disposal of such chlorinated compounds is prevalent, the staff recommends that all landfills (hazardous and municipal) in the state be regarded as potential vinyl chloride emission sources.

In this report, ambient monitoring data and meteorological data are used with an atmospheric dispersion model to estimate population exposure to vinyl chloride near two California landfills. The modeling results show that people living near these landfills are exposed to elevated levels of vinyl chloride. The results also imply that people residing near other landfills in the state may be exposed to elevated levels of vinyl chloride. In addition to estimating ambient air exposure, this report also evaluates indoor air exposure to vinyl chloride.

Based on limited monitoring data, indoor air exposure to vinyl chloride is probably not significant for the majority of the population. However, for people residing near landfills, inhalation of indoor air may represent the most significant source of vinyl chloride exposure. This is because vinyl chloride can migrate underground from landfills and accumulate in nearby structures. The concentrations of vinyl chloride measured in homes located near landfills have been reported to be several times greater than the corresponding ambient concentrations.

Part B

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Prepared by: California Department of Health Services

Principal Editor:

Norman Gravitz, Ph.D., MPH, Staff Toxicologist

Reviewed by:

George V. Alexeeff, Ph.D.
Michael J. Lipsett, M.D.
Douglas N. Cox, Ph.D. (California Public Health Foundation)

Based in part on work submittted by:

Carla C. Christensen and C. Tucker Helmes,
Biological and Environmental Chemistry Department,
SRI International, 333 Ravenswood Avenue,
Menlo Park, California 94025,
Under Contract 85-86676 (045A)

and by:

Deborah Grady, M.D., M.P.H.
School of Medicine,
University of California, San Francisco,
and
Allan Smith, M.D., PH.D. University of California, Berkeley

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1.0 Executive Summary

Vinyl chloride is a short-chain halogenated hydrocarbon used predominantly in the manufacture of polyvinyl chloride and various packaging and construction products. Vinyl chloride has a very low degree of acute toxicity, with two-hour inhalation LD_{50} values ranging from 27,419 ppm in mice to 236,215 ppm in rabbits and guinea pigs. Exposure to high concentrations can lead to narcosis, cardiovascular and respiratory irregularity, convulsions, cyanosis and death. Several human deaths have been attributed to occupational exposure to very high levels of vinyl chloride. Autopsies of these patients revealed congestion of the liver, spleen and kidneys. Acute toxicity symptoms are thought to occur above 100 ppm.

Chronic exposure of workers to vinyl chloride has been shown to lead to "vinyl chloride disease", characterized by occupational acro-osteolysis, vasospasm of the hands similar to Raynaud's syndrome, dermatitis, circulatory and central nervous system alterations, thrombocytopenia, splenomegaly and changes in liver function. Eight symptoms commonly reported by workers exposed to vinyl chloride (including dizziness, headaches and nausea) were observed even at dose levels below 50 ppm.

Vinyl chloride has been shown to induce cancer in animals *in utero*, but has not been shown to cause any other reproductive or

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developmental effects in rats, mice and rabbits. Epidemiologic studies of families of vinyl chloride workers or communities having vinyl chloride processing facilities suggested the possibility of an increased incidence of birth defects and spontaneous abortions among people at risk; however, subsequent reviews of these studies have concluded that there is inadequate evidence to link environmental or paternal exposure to vinyl chloride with birth defects or spontaneous abortions in humans.

The noncarcinogenic effects occur at concentrations near or above 10 ppm, which is greater than four orders of magnitude above possible general ambient levels in California (0.5 ppb). The noncarcinogenic effects also occur at concentrations greater than 3 orders of magnitude above the highest concentrations measured near landfills (10 ppb). Consequently, DHS staff do not expect noncarcinogenic adverse health effects to occur from acute or chronic exposures to vinyl chloride in ambient air.

The International Agency for Research on Cancer (IARC), the United States Environmental Protection Agency (EPA) and the California Department of Health Services (CDHS) have identified vinyl chloride as a chemical for which there is sufficient evidence of carcinogenicity in both humans and experimental animals. Chronic inhalation and oral exposures of rats, mice and hamsters to vinyl chloride have been associated with an increased incidence of malignant and benign tumors at several sites including the liver, lung, mammary gland and the nervous system. In humans,

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epidemiological studies of occupationally exposed workers have linked vinyl chloride exposure to development of a rare cancer, liver angiosarcoma, and have suggested a relationship between exposure and lung and brain cancers.

Although pharmacokinetic studies in humans exposed to vinyl chloride are rare, limited evidence indicates that, following inhalation of low levels of vinyl chloride (3 to 24 ppm), up to 71% (with a mean value of 42%) of the given dose may be absorbed. Vinyl chloride absorption appears to depend on its metabolism, which is a dose-dependent, saturable process. Due to saturation of the enzyme systems responsible for the metabolism of vinyl chloride (cytochrome P-450 and alcohol dehydrogenase), exposure to concentrations above approximately 250 ppm will not necessarily lead to an increasing incidence of tumor development. Metabolism of vinyl chloride leads to formation of chloroethylene oxide and chloroacetaldehyde, two reactive intermediates which undergo covalent binding to cellular macromolecules and are thought to be responsible for the toxic effects of vinyl chloride. These and other metabolites may be further metabolized and excreted in the urine. Unmetabolized vinyl chloride is eliminated primarily in exhaled air.

Vinyl chloride is mutagenic in both prokaryotic and eukaryotic test systems, with significantly greater genotoxicity seen after metabolic activation. DHS staff have found no evidence of a carcinogenic threshold level and because vinyl chloride is

mutagenic, the staff recommends that vinyl chloride be considered as not having a threshold for carcinogenicity.

Several animal carcinogenicity and human epidemiological studies of occupationally exposed workers have been analyzed for risk assessment purposes. Although actual exposure levels are not known, exposure estimates have been used to evaluate the Waxweiler et al. (1976) study of vinyl chloride workers. Based on these estimates, DHS staff has calculated that a lifetime exposure to 0.485 ppb might result in an incremental individual cancer risk of 1×10^{-6} (assuming liver, brain and lung cancer are all related to vinyl chloride exposure). This yields a risk estimate of 2.1×10^{-6}/ppb. In the case that only liver cancer is assumed to be linked to exposure, a lifetime exposure to 1.0 ppb may be expected to result in a risk of 1.0×10^{-6}. Due to inadequate exposure data, follow-up time and other methodological problems, DHS staff suggest that the human risk estimates be used only for comparative purposes. Evaluation of animal experiments by the linearized multistage model yields a range of human risks spanning from 1.8×10^{-3}/ppb to 3.9×10^{-6}/ppb, with most estimating a risk of between 10^{-4} and 10^{-5}/ppb. Evaluation of animal tumorigenicity data indicates that vinyl chloride's carcinogenic potency is dependent on sex, tumor site and age of exposure. Taking these factors into account, DHS staff believe that the human risk estimates are consistent with those obtained for laboratory animals. The staff of DHS recommends that the animal data be used to evaluate the risks resulting from vinyl chloride exposure. Consequently, the

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range of risks estimated from analyses of animal studies and recommended by DHS for regulatory purposes lie between 3.9×10^{-6}/ppb and 1.8×10^{-3}/ppb.

Vinyl chloride has not been detected in the ambient air of California (limit of detection = 0.5 ppb) except at certain "hot spots". Air Resources Board (ARB) staff has monitored vinyl chloride emissions from the BKK hazardous waste site in West Covina and the OII landfill in Monterey Park. Estimates of peak exposure concentrations for maximally exposed receptors range from 2 to 10 ppb at the BKK landfill and from 0.6 to 9 ppb at the OII site. Air Resources Board staff has estimated that between 17,000 and 131,000 individuals may be exposed to 1 ppb at the BKK site. A lifetime exposure of 131,000 residents to 1 ppb would be associated with an upper bound estimate of 0.5 to 236 excess cancer cases. The calculations represent the upper range of plausible excess cancer risk: the actual risk, which cannot be calculated, may be insignificant. Based on the finding of vinyl chloride-induced carcinogenicity and the results of the risk assessment, DHS staff finds that vinyl chloride is an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.

The Vinyl Institute

A Division of The Society of The Plastics Industry, Inc.

July 27, 1989

TO: The VI Health, Safety & Environment Committee

RE: Proposed Clean Air Legislation: Listing of Vinyl Chloride and Polyvinyl Chloride

As you may be aware, legislation introduced in the Congress (S.816, HR2585) to amend the Clean Air Act contains a "Prevention of Sudden, Accidental Releases" provision. The proposed legislation directs the EPA Administrator to promulgate a list of not less than 50 substances "which may, as a result of sudden events, be released in concentrations that may reasonably be anticipated to cause acute adverse health effects in humans". The proposed legislation then directs that the list shall include 28 specified chemicals, including polyvinyl chloride and vinyl chloride.

As a result of contracts made with congressional staff by Margaret Rogers (SPI's Director of Federal Government Affairs) we learned that the list of chemicals is drawn from information contained in an about-to-be finalized EPA contractors report "Acute Hazardous Events Data Base" (contractor: Industrial Economics, Inc., Cambridge, Massachusetts).

I have reviewed all the data entries for both vinyl chloride and polyvinyl chloride. Charts summarizing the information are enclosed. Briefly, the PVC data base is a "fire events" data base, made up entirely of submissions to the New Jersey Office of Fire Safety.

On July 18th, Margaret arranged a meeting with EPA staff responsible for this project. Several SPI staff participated (including me), as well as Laurie Micciche of Occidental's Washington office. As a result of that meeting, two things were promised:

1. A letter to EPA with suggestions for language to be incorporated on the contractor's final report clarifying the data base and its use.

2. I promised a letter to EPA staff addressing the information on the data base, as it relates to PVC. I will, of course, forward that letter to you.

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Information in this report has already been quoted from during legislative hearings. As this issue will be debated throughout the legislative consideration of amendments to the Clean Air Act, any information you have on specific events in which your company is listed would be useful. It goes without saying that all activity will be carefully coordinated with CMA. The current legislative status is that Congress will be adjourned August 4th-September 6th. If you have any questions, please call.

Meredith N Schreck

MNS/pmb
cc: L. Micciche, Occidental
M. Rogers, SPI
G. Lefebvre, BFGoodrich

POLYVINYL CHLORIDE

ENTRY	CATEGORY	DATE	COMPANY	CAUSE	SUBSTANCES LISTED	DEATHS	INJURIES	EVACUATIONS	DATA SOURCE
1	Deaths	5/27/86	Airlite Aluminum Kearny, NJ	Fire,exp./ smelting furnace	PVC, toluene diisocyanate, methylene chloride, isocyanate, styrene, chlorine	2	0	yes	PEI
2	Deaths	3/21/85	Oliver Brown Trucking Plainfield, NJ	Fire, exp./ warehouse	PVC pipes	1	50	8250	UPI
3	Injuries	7/16/85	Unknown Cedar Rapids, Iowa	sparking/ workers' torch	PVC, HCl	0	56	10,000	NYT
4	Injuries	11/2/85	Public Service Electricity & Gas	electrical short/ underground vault	PVC	0	11	0	NJ2
5	Injuries	3/20/85	Flexon Industries Plainfield, NJ	Arson	PVC, polypropylene polyethylene	0	yes	yes	NJ2
6	Evacuations	3/18/85	Jacks Auto Wreckers Monroe Township	Fire, exp.	PVC, phosgene, rubber tires, oil	0	0	yes	NJE
7	Evacuations	10/29/84	A Plastics Industries Unknown, NJ	Fire, exp., vandalism suspected	polystyrene, PVC, polypropylene	0	0	0	NJE
8	Evacuations	10/29/84	A Plastics Industries Paterson, NJ	Fire, exp.	polystyrene, PVC, polypropylene	0	0	yes	NJ2
9	Evacuations	9/23/80	Rileo Rubber Hamilton Township, NJ	fire, exp.	PVC, hydrogen cyanide, styrene	0	0	yes	NJ2
10	Evacuations	2/10/86	Unknown Unknown Location	Fire, exp./ probably powerline	PVC	0	0	yes	NJ2
11	Air	7/18/82	Specialty Display Fairfield, NJ	Fire, exp.	PVC, HCl	unknown	unknown	unknown	NJ2
12	Air	3/31/82	Polysar East Brunswick, NJ	Fire, exp., storage container	PVC, oil, rubber	unknown	unknown	unknown	NJ2
13	Air	12/18/86	B & G Plastic Jersey City, NJ	Fire, exp.	PVC, polystyrene	unknown	unknown	unknown	PEI

EPA ACUTE HAZARDOUS EVENTS DATA BASE
VINYL CHLORIDE

CATEGORY	DATE	COMPANY	CAUSE	SOURCE
Deaths				
5	1/12/64	Thompson Chemical	Human error, reactor vessel	MMA
1	5/13/86	BFGoodrich Petricktown	Equipment failure, leaking reactor	NJ2
Injuries				
2	7/3/83	Formosa Plastics	Railcar equipment fail.	NRC
8	9/19/80	Great American	Tank overheating	NTP
1	2/2/84	CE Casting	Loading	NRC
5*	9/28/82	Il. Central Gulf RR	Driver drinking	NTP
3*	7/26/80	Il. Central Gulf RR	Derail	NTP
Evacuations				
Workers*	4/19/83	Union Carbide	Rupture disk failure	NRC
Workers	5/16/83	PPG Westlake	Equipment failure	NRC
36*	9/9/81	Shell Oil	Derail	NTP
Workers	5/5/80	Keysor	Fire/exp.	LAT
4,000*	6/9/85	Cottonbelt RR	Derail	UPI
Workers	2/16/82	Consolidated RR	Derail equipment fail.	NJ2
Workers	6/10/85	Union Carbide	Rail valve leak	NRC
Workers	10/14/82	Conoco	Open valve	NRC
300*	2/26/80	Consolidated Rail	Derail	APR
Quantity				
	1/5/81	LaPorte Chemical	373 upset reactor	TXA
	7/2/82	LaPorte Chemical	1500 equipment failure	TXA
	5/5/83	LaPorte Chemical	2000 human error	TXA
	4/16/85	LaPorte Chemical	392 equipment failure	TXA
	12/9/83	Dow, Freeport	22500 equipment failure	NRC
	12/18/83	Conoco (MS)	229 human error	NRC
	2/15/83	Conoco, Aberdeen	2200 overheat valve	NRC
	8/27/83	Conoco, Aberdeen	4000 equipment failure	NRC
	10/31/84	Air Products, Ky.	275 equipment failure	NRC
	12/9/83	Dow, Texas	3000 unknown	TXA
	5/21/85	Air Products	300 equipment failure	NRC
	9/23/84	Hercules	8500 human error	NRC
	8/13/85	Air Products, Ky.	45900 gasket failure	NRC
	3/29/86	Air Products, Ky.	200 equipment failure	NRC
	3/17/86	PPG, La.	155 equipment failure	NRC
	8/5/82	Conoco	133 overpressure	NRC
	6/9/82	Conoco	885 equipment failure	NRC
	5/22/82	Georgia Pacific	12090 reactor overheat	NRC

5/25/82	Dow Chemical	4000 equipment failure	NRC
2/3/82	Georgia Pacific	250 equipment failure	NRC
1/23/84	Conoco, Aberdeen	300 equipment failure	NRC
4/24/85	Vista Polymers	650 valve open	NRC

Legend:

* Chemicals in addition to vinyl chloride listed.

Sources Searched:

APR	Associated Press	1980-1986
NRC	National Response Center	1983-1986
NTP	New Orleans Times Picayunne	1980-1986
LAT	Los Angeles Times	1980-1986
MMA	March and LcLennon	1956-1984
UPI	United Press International	1980-1985