BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Estimating Exposure to
Dioxin-Like Compounds;
Review Draft, June 1994

COMMENTS OF THE SPI VINYL INSTITUTE

The Vinyl Institute
65 Madison Avenue
Morristown, New Jersey 07960
(201) 898-6699

CTL014734

COMMENTS OF THE VINYL INSTITUTE
ON EPA'S REVIEW DRAFT REPORT:
ESTIMATING EXPOSURE TO
DIOXIN-LIKE COMPOUNDS

The Vinyl Institute is pleased to submit these Comments in response to the Environmental Protection Agency's (EPA) draft document entitled: "Estimating Exposure to Dioxin-Like Compounds" (Reassessment)(June 1994)(External Review Draft). The Vinyl Institute (VI), a division of The Society of the Plastics Industry, Inc. (SPI), is a not-for-profit trade association representing manufacturers of vinyl chloride monomer (VCM), polyvinyl chloride (PVC), and ethylene dichloride (EDC).[1/]

The multi-volume draft represents the Agency's reassessment of the health risks of exposure to 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) and chemically similar compounds. Because the draft reassessment refers to claims that dioxin may be emitted during the production of vinyl chloride and associated products including polyvinyl chloride (PVC), the

---

1/ Members of the Vinyl Institute are responsible for the majority of the domestic production volume of vinyl chloride and polyvinyl chloride. VI's members include: Borden Chemicals and Plastics Limited Partnership, CertainTeed Corporation, The Dow Chemical Company, The Geon Company, Georgia Gulf Corporation, Occidental Chemical Corporation, PPG Industries, Inc., Shintech, Inc., Union Carbide Chemicals and Plastics, Vista Chemical Company, and West Lake PVC Corporation.

SPI is a 2,000 member not-for-profit trade organization representing all segments of the plastics industry in the United States. The Society's members include processors and manufacturers of plastics and plastics products, suppliers of raw materials, processors and converters of plastics resins, and manufacturers of accessory equipment for the plastics industry. Founded in 1937, SPI is the major national trade association of the plastics industry.

Vinyl Institute and its member companies have a substantial interest in the draft Reassessment.[2]

I. SUMMARY

The Vinyl Institute's comments will focus on those portions of the Reassessment that identify ethylene dichloride, vinyl chloride monomer, and polyvinyl chloride resin as an emission source of dioxins. Our comments are:

(1) At present, there is insufficient data to make a detailed assessment of the EDC/VCM/PVC industry's role as a source of dioxins. However, our current analyses indicate that the EDC/VCM/PVC industry is a minimal emission source. At an August 1994 meeting with EPA, the Vinyl Institute pledged to cooperate with the Agency's efforts to better characterize the industry's status as a potential source of dioxin emissions. Subsequently, the Institute has accelerated its efforts to generate the relevant data for submission to EPA in 1995. The first data set is included with these comments. These data consist of analyses of polyvinyl chloride pipe resin, which represents the major portion of PVC resin production. The data show that neither dioxins nor furans were detected in the samples. Thus, PVC pipe resin is not a source of dioxin.

[2] Reassessment pp. 24-25, 102, 3-33 - 3-35, 3-83 - 3-85, 3-95, 3-124, and 3-127.

(2) As EPA has noted, data from the European manufacturers of EDC/VCM/PVC may not be directly comparable to the U.S. vinyl industry. While currently available European data has limitations, to the extent that there are similarities, the European data show EDC/VCM/PVC manufacturing facilities are minimal contributors to overall dioxin emission.

(3) There is no scientific basis to support speculation that fugitive ("diffuse") emissions from the EDC/VCM/PVC manufacturing process are a source of dioxin emissions.

(4) The Reassessment states that waste combustion accounts for 95% of all known emissions, with municipal and medical waste incineration being the dominant sources. The scientific literature is clear that the operating parameters of combustors are the critical factor in dioxin generation, not the composition of the waste feed stream. A new study that analyzed over 1,700 test results from incinerators and similar combustor equipment at 155 facilities concluded that there is no relationship between the chlorine content of waste and dioxin emissions from combustion processes.[3]

---

[3] *The Relationship Between Chlorine In Waste Streams and Dioxin Emissions From Combustors*, The American Society of Mechanical Engineers, Draft January 6, 1995.

(5) Fires involving polyvinyl chloride products, such as house fires, are a negligible source of dioxins. According to our analyses, the upper estimate of the annual dioxin/furan contribution from air emissions due to PVC in house fires is in the order of 0.3 grams.[4/]

(6) There are weaknesses in using the unvalidated toxicity equivalency factors (TEFs) to characterize the toxicity of the various substances that are similar to 2,3,7,8-TCDD. Moreover, the use of different model systems introduces additional uncertainty.

Finally, we support the comments filed by the Chemical Manufacturers Association (CMA) and its Chlorine Chemistry Council, in which the VI and many of its members are active members.

II. INDUSTRY DATA COLLECTION EFFORTS UNDERWAY TO PROVIDE DATA ON DIOXIN EMISSIONS FROM U.S. EDC/VCM/PVC RELATED SOURCES

The Reassessment reported recent claims that dioxins may be emitted during the production of vinyl chloride monomer and associated products. The Reassessment further

[4/] William F. Carroll, *Is PVC in House Fires The Great Unknown Source of Dioxin?*, The Vinyl Institute.

stated that these claims have been strongly disputed by the industry and that insufficient emission data are currently available to make an independent evaluation.[5]

The vinyl industry agrees with EPA that there is insufficient data from US EDC/VCM/PVC manufacturing plants to conclusively quantify the dioxin emissions from this industry. The industry has initiated an effort to develop the data to characterize potential dioxin emissions from manufacturing processes. The study entails: (1) the development of sampling and testing protocols for the accurate measurement of dioxins at possible emission points; (2) identification of point sources to be tested; (3) obtaining samples and testing; and (4) evaluation and reporting of data.

The VI is strongly committed to this effort, and plans to complete testing and provide the results of these tests as available over the coming year. The first data set is described in the following section.

[5] Reassessment pp. 24-25, 102, and 3-33 - 3-35.

III. PVC PIPE RESIN ANALYSES SHOW THAT PVC RESIN IS NOT A SIGNIFICANT SOURCE OF DIOXIN

As part of the emission source study, the Vinyl Institute intends to characterize PVC resins and other product streams. Because pipe grade PVC resin represents the largest volume of overall PVC resin production, this type of resin was selected for analysis first.[6] While the data is being validated, the preliminary results show no statistically significant amounts of dioxin or furans.

Eleven samples were collected and submitted by six domestic manufacturers of PVC pipe grade resin to Triangle Laboratories of RTP, Inc. The companies used sampling kits provided by Triangle Labs. Following EPA Method 8290, Triangle employed high resolution gas chromatography and high resolution mass spectrometry and analyzed for the 17 specified dioxin and furan congeners. The minimum detection limits varied by congener and sample, but generally ranged from 0.2 to 0.5 parts per trillion (ppt).

No dioxins or furans were detected in 10 of the 11 the resin samples, but one analysis merits explanation. Triangle observed octachlorinated dibenzo-*p*-dioxins (OCDD) in the blank and one resin sample. However, the difference between the observed level in the

[6] Approximately 10 billion pounds of PVC resin were domestically produced in 1993. Of this, nearly 6.3 billion pounds were used in building and construction. Rigid pipe and tubing (except fittings) accounted for 3.9 billion pounds. SPI, *Facts and Figures of the U.S. Plastics Industry*, pp. 80-81 (1994 ed.).

blank and the observed level in the resin sample was not statistically significant. The table which follows shows the minimum detection limits on a congener-specific basis for each sample. The detection limits appear in parentheses, *e.g.*, (0.2). The brackets around the OCDD blank figure shown in the MDL column, *i.e.*, {1.2}, are described by Triangle as referring to the "estimated maximum possible concentration." The statistically insignificant number mentioned previously appears in the OCDD row under sample number 124. Therefore, no dioxins or furans were detected.

SPI VINYL INSTITUTE – TRIANGLE LABORATORIES OF RTP
POLYVINYL CHLORIDE PIPE RESIN ANALYSES
1/10/95 PRELIMINARY, UNVERIFIED DATA – DETECTION LIMITS (ng/kg) (ppt)

CONGENER	MDL[a]	101	111	117	122	124	130-1	147	159	161	169-1	169-2
2,3,7,8 TCDF	(0.2)	(0.5)	(0.5)	(0.6)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0.2)
TOTAL TCDF's	(0.2)	(0.5)	(0.5)	(0.6)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0.2)
1,2,3,7,8 PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0.4)
2,3,4,7,8 PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.7)	(1.0)	(0.8)	(0.4)	(0.3)
TOTAL PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0.4)
1,2,3,4,7,8 HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.5)	(0.3)	(0.7)	(0.8)	(1.2)	(0.3)	(0.2)
1,2,3,6,7,8 HxCDF	(0.2)	(0 6)	(0.4)	(0.6)	(0.3)	(0.4)	(0.2)	(0.5)	(0.6)	(0.9)	(0.2)	(0.2)
2,3,4,6,7,8 HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	(0.2)
1,2,3,7,8,9 HxCDF	(0.3)	(0.8)	(0 6)	(0.8)	(0.4)	(0.5)	(0.3)	(0.7)	(0.9)	(1.3)	(0.3)	(0.2)
TOTAL HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	(0.2)
1,2,3,4,6,7,8 HpCDF	(0.2)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.3)	(0.7)	(0.9)	(2.1)	(0.2)	(0.2)
1,2,3,4,7,8,9 HpCDF	(0.4)	(1 1)	(0.7)	(1.0)	(0.6)	(0.6)	(0.4)	(1.1)	(1.3)	(3.6)	(0.4)	(0.3)
TOTAL HpCDF	(0.3)	(0.9)	(0.6)	(0.8)	(0.5)	(0.5)	(0.3)	(0.9)	(1.0)	(2.6)	(0.3)	(0.3)
OCDF	(0.5)	(1.5)	(1.0)	(1.3)	(1.1)	(1.1)	(0.5)	(1.6)	(2.6)	(8.1)	(0.6)	(0.5)
2,3,7,8 TCDD	(0.3)	(0.6)	(0.7)	(0.8)	(0.5)	(0.8)	(0.3)	(0.7)	(.001)	(0.7)	(0.4)	(0.4)
TOTAL TCDD	(0.3)	(0.6)	(0.7)	(0.8)	(0.5)	(0.8)	(0.3)	(0.7)	(.001)	(0.7)	(0.4)	(0.4)
1,2,3,7,8 PeCDD	(0.5)	(1.0)	(1.0)	(1.1)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.5)
TOTAL PeCDD	(0 5)	(1.0)	(1.0)	(1.1)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.5)
1,2,3,4,7,8 HxCDD	(0.4)	(1.0)	(0.9)	(1.1)	(0.7)	(0.9)	(0.4)	(1.1)	(1.5)	(2.5)	(0.5)	(0.4)
1,2,3,6,7,8 HxCDD	(0.4)	(0.9)	(0.8)	(1.0)	(0.6)	(0.8)	(0.4)	(1.0)	(1.4)	(1.9)	(0.4)	(0.4)
1,2,3,7,8,9 HxCDD	(0.4)	(1.0)	(0.8)	(1.0)	(0.7)	(0.8)	(0.4)	(1.1)	(1.4)	(2.2)	(0.5)	(0.4)
TOTAL HxCDD	(0.4)	(1.0)	(0.8)	(1.0)	(0.7)	(0.8)	(0.4)	(1.1)	(1.5)	(2.1)	(0.5)	(0.4)
1,2,3,4,6,7,8, HpCDD	(0.5)	(1.4)	(1.0)	(1.3)	(0.9)	(1.0)	(0.6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.5)
TOTAL HpCDD	(0.5)	(1.4)	(1.0)	(1.3)	(0 9)	(1.0)	(0 6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.5)
OCDD	{1 2} b/	(2.0)	(1.3)	(1.7)	(1.4)	4.4 b/	(0.7)	(2.0)	(3.4)	(9.1)	(0.8)	(0.6)

a/ Minimum Detection Limit for blanks.

b/ "{1.2}" indicates Estimated Maximum Potential Concentration (EMPC). The laboratory deemed a difference between the EMPC and sample 124 readings for OCDD to be statistically insignificant. Detection of OCDD in sample 124 supports the conclusion that the EMPC figures for the blank are in fact OCDD.

IV. EUROPEAN DATA ON DIOXIN EMISSIONS IS NOT DIRECTLY COMPARABLE TO THOSE OF U.S. MANUFACTURERS, BUT THE DATA INDICATES EDC/VCM USE IS A MINIMAL SOURCE OF DIOXIN

Some data on dioxin emissions have been developed by European vinyl manufacturers. As EPA notes: "It is unclear whether EDC/VCM/PVC production and emission control methods are sufficiently similar worldwide to know whether these factors should apply in the United States."[7] We agree that there are limitations in relating this data directly to U.S. industry. However, even with these limitations, the European data help to confirm that EDC/VCM production is a minimal source of dioxin emissions in the U.S. Applying European emission factors to U.S. industry gives a range of dioxin emissions of 0.45 to 23 g TEQ/yr. This contrasts with the range of 3,000 to 29,000 g TEQ/yr for total estimated emissions from all sources in the United States given in EPA's draft Reassessment.

V. OPERATING PARAMETERS, NOT THE LEVEL OF CHLORINE IN THE FEED STREAM, IS THE CRITICAL FACTOR IN THE EMISSION OF DIOXINS FROM THE COMBUSTION PROCESS

The draft Reassessment identified combustion processes as the largest source of dioxins. There has been considerable debate as to the real impact of chlorine and/or PVC products in the waste stream on the emissions of dioxin from incineration devices.

---

[7] Reassessment at 3-35.

In 1987, the New York State Energy Research and Development Authority (NYSERDA) sponsored a commercial scale incineration study, which was co-sponsored by numerous regulatory agencies including EPA, as well as the Vinyl Institute, and the American Society of Mechanical Engineers (ASME). The NYSERDA study showed that the amount of PVC in the waste stream did not have an effect on dioxin emissions in properly controlled and operated municipal waste incinerators. Other studies have corroborated this finding.

We are pleased to inform the agency of a new report prepared under the auspices of ASME, by Rigo and Rigo Associates Inc., in association with A.J. Chandler and Associates, Ltd., and Energy & Environmental Research Corporation. The study is entitled "The Relationship between Chlorine in Waste Streams and Dioxin Emissions from Combustors" (ASME Report). In short, this study shows no demonstrable relationship between chlorine feed and combustor dioxin and furan emissions. Although this is a draft document that is currently undergoing peer review, we suggest that it is worthy of EPA's immediate consideration. The conclusions of the ASME Report are best captured by the authors' abstract which follows.

This study investigated the impact waste feed chlorine content and PVC plastics have on PCDD/F emissions from combustion facilities. The effort was not intended to develop emission factors, evaluate control system performance or assess PCDD/F *relationships in liquid effluents or solid residues. The data were obtained mostly from full-scale tests. Seminal laboratory studies were used to suggest the form relationships might take and help identify significant confounding factors which must be taken into account.*

Over 1,700 Municipal Waste Combustor (MWC), Hazardous Waste Incinerator (HWI), Medical Waste Incinerator (MWI), Waste Fired Boiler (WFB), Cement Kiln (CK), Biomass Combustor (BMC), and Laboratory- Bench and Pilot-Scale Combustor (LBP) test results from 155 facilities, many with multiple units, were analyzed to determine whether there is a relationship between PCDD/F emissions and chlorine. Chlorine feed concentration ranged from less than 0.1 percent for many BMC up to 80 percent for some HWI. The chlorine feed concentration was between these two extremes for most of the other sources and generally spanned at least an 8:1 range in each category.

Separating chlorine bearing waste from combustor feed stocks has no effect on the composition of PCDD/F emitted from combustion facilities. In most cases, the quantity is also unaffected. No general conclusion can be drawn regarding the impact of reducing waste chlorine content, since some affected facilities display increases and others decreases with increasing chlorine in the feed. *(emphasis in original)*

The data were carefully checked to identify errors and statistical outliers, standardized to common reference conditions and analyzed to determine if there were any changes in either the signature (composition) or quantity of PCDD/F. Changes that were greater than measurement method imprecision were studied to determine whether they were related to differences in waste stream or flue gas chlorine content.

Detailed analysis of the signatures was done using Cluster Analysis. Signatures for data collected at the same sampling point within a combustor family (i.e., MTW, HWI, etc.) were all the same unless the run produced a significant number of below detection limit values. Some facilities displayed signature differences exceeding PCDD/F measurement method imprecision between sampling locations. No changes in PCDD/F profile were associated with differences in chlorine content.

A general review, using a combination of Canonical Correlation Analysis and simple Linear Regression, found no statistically significant relationship between chlorine and PCDD/F concentrations for the majority of the facilities (57 of 75) with sufficient simultaneous data to detect a statistically significant trend. Eight facilities displayed decreasing PCDD/F concentrations with increasing chlorine. Ten facilities displayed an increase.

Analysis of Variance (ANOVA) and engineering modeling techniques were combined using Multivariant Linear Regression to analyze three major controlled experiments at Municipal Waste Combustors during which PVC, mixed plastics or salt was spiked into the feed. No relationship was found between PCDD/F concentrations and chlorine. This finding is contrary to the published interpretation of the Horsholm experiment; however, that interpretation was based on an incomplete, thermodynamically incorrect model and excluded valid data points while keeping statistical outliers.

Similar techniques were employed to analyze the results of the major parametric MWC studies conducted under the auspices of Environment Canada, Environmental Protection Agency, New York State Energy Research and Development Authority and the Great Lakes Regional Council of Governors. No statistically significant relationship between PCDD/F quantities and chlorine was found.

HWIs taken as a whole show no relationship between PCDD/F and chlorine concentrations in the waste being burned. Examination of individual facilities reveals that some have been tested over a 10:1 range of chlorine contents, up to almost 80% chlorine, and display no relationship whatsoever. Eighteen percent of the facilities, however, showed an increase, while 18 percent showed a decrease.

Cement Kilns displayed no PCDD/F concentration increase with increasing chlorine feed rate. This is not surprising since chlorine is frequently added to remove natural alkalis and produce Portland cement meeting federal and state construction standards. The four waste fired boilers showed decreasing PCDD/F with increasing chlorine, but boiler design and cofiring fuel differences confound this finding. Biomass combustors produce PCDD/F, but there is too little simultaneous PCDD/F and chlorine data to determine if there is a general trend. One test replacing salt laden wood with higher chlorine sludge displayed reduced PCDD/F emissions.

The same mixed picture is found for MWIs with 15 percent showing an increase and 7 percent showing a decrease in PCDD/F concentrations with increasing chlorine feed.

Peer review of this document is expected to be completed in the near future. The VI will submit the final ASME Report to EPA promptly.

VI. POTENTIAL EMISSIONS OF DIOXINS FROM FIRES INVOLVING PVC DEEMED MINUSCULE

Three recent studies all support the position that PVC in fires produces minimal amounts of dioxin. First, a 1992 paper by Drs. Engelmann and Skura of Hoechst AG[8] concluded: "During the combustion of chlorous compounds, traces of dioxins and furans are constantly found. The quantities emitted from accidental fires, are, however, on the whole so small that they do not cause measurable increase in the overall level of dioxins and furans in the environment. The health risks posed, and actual damage caused to people are the result of heat and carbon monoxide, and any additional harm caused by dioxins during or after fires or this kind is extremely unlikely."

Second, a paper by Dr. Gerhard Binder of Arbeitsgemeinschaft PVC and Umwelt eV in 1993[9] reviewed a wide range of well known fires involving PVC. Dr. Binder stated: "The analysis and evaluation of these fires demonstrates that, in contrast to widely held belief, a major conflagration, even when various large quantities of PVC are involved, does not lead to the formation of large quantities of polychlorinated dibenzodioxins and dibenzofurans." He added that in the immediate vicinity of fires only slightly increased levels of dioxins were found; fire residues and soot containing dioxins could be cleaned up

---

[8] Dr. Engelmann and Dr. Skura, *PVC in Accidental Fires. The Formation of Dioxins and Furans*, Hoechst AG, May 1992.

[9] Dr. Gerhard Binder, *Experiences With Fires With a PVC Involvement*, Arbeitsgemeinschaft PVC and Umwelt eV, July 1993.

under public health guidelines; and firefighters did not display increased levels of dioxin contamination.

Most recently, a recent study by William F. Carroll, Jr., Ph.D., of the Chlorine Chemistry Council evaluated the potential for the release of dioxins from house fires containing PVC building materials. This study concludes that potential releases would be of no significance. A copy of the paper, entitled: "Is PVC in House Fires the Great Unknown Source of Dioxin?", is enclosed.

In the paper, Dr. Carroll estimates the annual PCDD/F contribution of burning PVC in house fires utilizing dioxin generation data from warehouse fires involving PVC, U.S. building statistics, and fire loss data. The upper estimate for air emissions is 0.3 grams; a minuscule proportion of the 9,200 grams annual air emissions estimated by EPA.[10] The upper estimate is 11.8 grams as ash; however, there is good reason to believe the actual amount may be one to two orders of magnitude lower.

Collectively, these three studies support the conclusion that PVC in fires is a minuscule potential source of dioxins.

---

[10] Reassessment at 3-8.

VII. THE VINYL INDUSTRY IS NOT A FUGITIVE DIOXIN EMISSION SOURCE

Fugitive emissions from a chemical process may result from a variety of sources, including small imperfections in the seals isolating the process from ambient air, *e.g.*, flanged pipe joint gaskets, rotary pump seals, valve stem glands and packing, *etc.* Consequently, the relative magnitude of these emissions is small, particularly for a process like VCM/EDC production, in which advanced containment and continuous monitoring technology are used in commercial practice.

EDC is subject to regulation under EPA's comprehensive regulation for organic hazardous air pollutants.[11] This regulation imposes stringent standards to minimize emissions from process vents, wastewater operations, storage vessels, transfer operations and equipment leaks. In addition, although the current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for EDC is 50 parts per million (ppm) based on an 8-hour time-weighted average (TWA), for many years, the industry followed, as a voluntary guideline, the 10 ppm threshold limit value (TLV) issued by the American Conference of Governmental Industrial Hygienists (ACGIH).[12] When the OSHA

[11] 40 C.F.R. Parts 60 and 63. This rule is often referred to as the hazardous organic NESHAP or HON. Vinyl chloride is also subject to the HON. In addition, EDC, Vinyl chloride, and PVC resins are also subject to a separate vinyl chloride standard. *See* 40 C.F.R. §§ 61.60-61.71.

[12] 29 C.F.R. § 1910.1000.

PEL for EDC was reduced to 1 ppm between 1989 and 1992, the industry implemented manufacturing practices to comply with these workplace exposure limits through a comprehensive fugitive emissions control program.[13/]

When a process stream under pressure is flashed at ambient conditions (as occurs in a leak to the atmosphere), the vapor fraction formed is enriched in the more volatile components roughly according to their vapor pressures. Nonvolatile constituents stay in the liquid phase and are confined to the process. Therefore, the content of fugitive emissions consists almost entirely of only the most volatile components of the process streams.

If dioxins and furans are present in a EDC/VCM process stream, their concentrations in the volatile fugitive emission are vanishingly small.[14/] Assuming a leaking EDC/VCM process stream contained as much as 1 part per trillion dioxins and furans, given the relative volatilities of these components (VCM/EDC/dioxins = $3 \times 10^3/3 \times 10^1/10^{-5}\text{-}10^{-9}$), the weight fraction of dioxins in a hypothetical fugitive emission would be 3×10^{-22} to 3×10^{-23}, which is essentially zero. These analyses show that the vinyl industry is not a fugitive dioxin emission source.

13/ For additional background, *see*, P. de la Cruz & D. Sarvadi, "OSHA PELs: Where do we go from here?", Am. Ind. Hyg. Assoc. J. pp. 55(10):894-900 (1994).

14/ The volatility of dioxins is extremely low. The vapor pressures at 25°C of the tetra- through octachloro congeners of dioxins and furans range from 10^{-6} to 10^{-9} mm Hg. Fitzer, B.D. and R.A. Hites, Environ. Sci. Technol. 22(ll), 1362-4 (1988). For comparison, the vapor pressure of vinyl chloride at 25°C is about 3×10^3 mm Hg.

VIII. TEF RELEVANCY

Comments filed by the Chemical Manufacturers Association (CMA) address the weakness of using the unvalidated toxicity equivalency factors (TEFs) to characterize the toxicity of the various substances that are similar to 2,3,7,8-TCDD. Most of the TEFs are based on results from model systems, such as *in vitro* induction of particular enzymes in cell cultures. These model systems frequently give discordant results when run in different laboratories, thus presenting reproducibility problems. Moreover, the use of different model systems, *e.g.*, fish egg viability versus cell culture enzyme induction, introduces more uncertainty.

This is of particular concern because, while the VI does not believe that the EDC/VCM/PVC industry is a major source of 2,3,7,8-TCDD, European studies suggest that other congeners, mostly *octa* furans, may be emitted in the EDC/VCM process. As EPA is aware, the initial TEF for *octa* congeners in 1987 was zero. The 1989 update changed the TEF from zero to 0.001. EPA should note the speculative nature of the TEFs for congeners based on model systems. Although the toxic equivalency (TEQ) methodology has provided a convenient mechanism for estimating comparable risks of untested mixtures of dioxin congeners, CMA raises important questions concerning the expanded use of the TEQ methodology to estimate risks for non-cancer health effects and establishing regulatory emission limits. EPA should review the basis and use of the TEQ methodology ith the

Science Advisory Board. The TEQ methodology may be a helpful tool, but its limitations must be recognized in regulatory decision making.

IX. CONCLUSIONS

In summary:

(1) There is insufficient data to make a detailed assessment of the EDC/VCM/PVC industry's role as a source of dioxins. However, our current analyses indicate that, at worst, the EDC/VCM/PVC industry is a minimal emission source. The Vinyl Institute has accelerated its efforts to generate the relevant data for submission to EPA in 1995. The first data set is included with these comments. These data consist of analyses of polyvinyl chloride pipe resin, which show that dioxins and furans were not detected in the samples.

(2) While data from the European manufacturers of EDC/VCM/PVC may not be directly comparable to the U.S. vinyl industry, to the extent that there are similarities, the European data show EDC/VCM/PVC manufacturing facilities are minimal contributors to overall dioxin emission.

(3) There is no scientific basis to conclude that fugitive emissions from EDC/VCM/PVC manufacturing are a source of fugitive dioxin emissions.

(4) Operating parameters of combustors are the critical factor in dioxin generation, not the composition of the waste feed stream. There is no relationship between the chlorine content of waste and dioxin emissions from combustion processes.

(5) Fires involving polyvinyl chloride products, such as house fires, are not a significant source of dioxins.

(6) There are weaknesses in using the unvalidated toxicity equivalency factors (TEFs) to characterize the toxicity of the various substances that are similar to 2,3,7,8-TCDD. In addition, the use of different model systems introduces additional uncertainty.

Finally, the industry is committed to a better characterization of this industry's status as a potential source of dioxin emissions and takes this opportunity to renew its pledge to EPA to work cooperatively to minimize the emission of dioxin-like substances.

Respectfully submitted,

Robert H. Burnett / TLB

Robert H. Burnett
Executive Director

Attachments

Wm. Carroll House Fires Paper
ASME Report

January 13, 1995

SPI VINYL INSTITUTE - TRIANGLE LABORATORIES OF RTP
POLYVINYL CHLORIDE PIPE RESIN ANALYSES
1/10/95 PRELIMINARY, UNVERIFIED DATA -- DETECTION LIMITS (ng/kg) (ppt)

CONGENER	MDL[a]	101	111	117	122	124	130-1	147	159	161	169-1	169-2
2,3,7,8 TCDF	(0.2)	(0.5)	(0.5)	(0.6)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0 2)
TOTAL TCDF's	(0.2)	(0.5)	(0.5)	(0.6)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0.2)
1,2,3,7,8 PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0.4)
2,3,4,7,8 PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.7)	(1.0)	(0.8)	(0.4)	(0.3)
TOTAL PeCDF	(0.3)	(0.6)	(0.6)	(0.7)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0 4)
1,2,3,4,7,8 HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.5)	(0.3)	(0.7)	(0 8)	(1.2)	(0.3)	(0.2)
1,2,3,6,7,8 HxCDF	(0.2)	(0.6)	(0.4)	(0.6)	(0.3)	(0.4)	(0.2)	(0.5)	(0.6)	(0.9)	(0.2)	(0.2)
2,3,4,6,7,8 HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	(0.2)
1,2,3,7,8,9 HxCDF	(0.3)	(0.8)	(0.6)	(0.8)	(0.4)	(0.5)	(0.3)	(0.7)	(0.9)	(1.3)	(0.3)	(0.2)
TOTAL HxCDF	(0.3)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	(0.2)
1,2,3,4,6,7,8 HpCDF	(0.2)	(0.7)	(0.5)	(0.7)	(0.4)	(0.4)	(0.3)	(0.7)	(0.9)	(2.1)	(0.2)	(0.2)
1,2,3,4,7,8,9 HpCDF	(0.4)	(1.1)	(0.7)	(1.0)	(0.6)	(0.6)	(0.4)	(1.1)	(1.3)	(3.6)	(0.4)	(0 3)
TOTAL HpCDF	(0.3)	(0.9)	(0.6)	(0.8)	(0.5)	(0.5)	(0.3)	(0.9)	(1.0)	(2.6)	(0.3)	(0.3)
OCDF	(0.5)	(1.5)	(1.0)	(1.3)	(1.1)	(1.1)	(0.5)	(1.6)	(2.6)	(8.1)	(0.6)	(0.5)
2,3,7,8 TCDD	(0.3)	(0.6)	(0.7)	(0.8)	(0.5)	(0.8)	(0.3)	(0.7)	(.001)	(0.7)	(0.4)	(0.4)
TOTAL TCDD	(0.3)	(0.6)	(0.7)	(0.8)	(0.5)	(0.8)	(0.3)	(0.7)	(.001)	(0.7)	(0.4)	(0.4)
1,2,3,7,8 PeCDD	(0.5)	(1.0)	(1.0)	(1.1)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.5)
TOTAL PeCDD	(0.5)	(1.0)	(1.0)	(1.1)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.5)
1,2,3,4,7,8 HxCDD	(0.4)	(1.0)	(0.9)	(1.1)	(0.7)	(0 9)	(0.4)	(1.1)	(1.5)	(2.5)	(0.5)	(0.4)
1,2,3,6,7,8 HxCDD	(0.4)	(0.9)	(0.8)	(1.0)	(0.6)	(0.8)	(0.4)	(1.0)	(1.4)	(1.9)	(0.4)	(0.4)
1,2,3,7,8,9 HxCDD	(0.4)	(1.0)	(0.8)	(1.0)	(0.7)	(0.8)	(0.4)	(1.1)	(1.4)	(2.2)	(0.5)	(0.4)
TOTAL HxCDD	(0.4)	(1.0)	(0.8)	(1.0)	(0.7)	(0 8)	(0.4)	(1.1)	(1.5)	(2.1)	(0.5)	(0.4)
1,2,3,4,6,7,8, HpCDD	(0.5)	(1.4)	(1.0)	(1.3)	(0.9)	(1.0)	(0.6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.5)
TOTAL HpCDD	(0.5)	(1.4)	(1.0)	(1.3)	(0.9)	(1.0)	(0.6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.5)
OCDD	{1.2} b/	(2.0)	(1.3)	(1.7)	(1.4)	4.4 b/	(0.7)	(2.0)	(3.4)	(9.1)	(0.8)	(0.6)

a/ Minimum Detection Limit for blanks.
b/ "{1.2}" indicates Estimated Maximum Potential Concentration (EMPC). The laboratory deemed a difference between the EMPC and sample 124 readings for OCDD to be statistically insignificant. Detection of OCDD in sample 124 supports the conclusion that the EMPC figures for the blank are in fact OCDD.

SPI VINYL INSTITUTE -- [illegible]ANGLE LABORATORIES OF RTP
POLYVINYL CHLORIDE PIPE RESIN ANALYSES
1/13/95 **REVISED DATA** -- DETECTION LIMITS (ng/kg) (ppt)

CONGENER	MDL a/	101	111	117	122	124	130-1	147	159	161	169-1	169-2
2,3,7,8 TCDF	(0.3)	(0.5)	(0.5)	(0.7)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0.3)
TOTAL TCDF's	(0.3)	(0.5)	(0.5)	(0.7)	(0.4)	(0.6)	(0.3)	(0.5)	(0.7)	(0.6)	(0.3)	(0.3)
1,2,3,7,8 PeCDF	(0.4)	(0.6)	(0.6)	(0.9)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0.4)
2,3,4,7,8 PeCDF	(0.4)	(0.6)	(0.6)	(0.8)	(0.5)	(0.8)	(0.3)	(0.7)	(1.0)	(0.8)	(0.4)	(0.4)
TOTAL PeCDF	(0.4)	(0.6)	(0.6)	(0.8)	(0.5)	(0.8)	(0.3)	(0.8)	(1.0)	(0.8)	(0.4)	(0.4)
1,2,3,4,7,8 HxCDF	(0.4)	(0.7)	(0.5)	(0.9)	(0.4)	(0.5)	(0.3)	(0.7)	(0.8)	(1.2)	(0.3)	(0.3)
1,2,3,6,7,8 HxCDF	(0.3)	(0.6)	(0.4)	(0.7)	(0.3)	(0.4)	(0.2)	(0.5)	(0.6)	(0.9)	(0.2)	(0.2)
2,3,4,6,7,8 HxCDF	(0.4)	(0.7)	(0.5)	(0.8)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	{0.19}
1,2,3,7,8,9 HxCDF	(0.4)	(0.8)	(0.6)	(0.9)	(0.4)	(0.5)	(0.3)	(0.7)	(0.9)	(1.3)	(0.3)	(0.3)
TOTAL HxCDF	(0.4)	(0.7)	(0.5)	(0.8)	(0.4)	(0.4)	(0.2)	(0.6)	(0.8)	(1.1)	(0.3)	{0.19}
1,2,3,4,6,7,8 HpCDF	(0.3)	(0.7)	(0.5)	(0.8)	(0.4)	(0.4)	(0.3)	(0.7)	(0.9)	(2.1)	(0.2)	(0.3)
1,2,3,4,7,8,9 HpCDF	(0.5)	(1.1)	(0.7)	(1.2)	(0.6)	(0.6)	(0.4)	(1.1)	(1.3)	(3.6)	(0.4)	(0.4)
TOTAL HpCDF	(0.4)	(0.9)	(0.6)	(1.0)	(0.5)	(0.5)	(0.3)	(0.9)	(1.0)	(2.6)	(0.3)	(0.3)
OCDF	(0.7)	(1.5)	(1.0)	(1.6)	(1.1)	(1.1)	(0.5)	(1.6)	(2.6)	(8.1)	(0.6)	(0.6)
2,3,7,8 TCDD	(0.5)	(0.6)	(0.7)	(0.9)	(0.5)	(0.8)	(0.3)	(0.7)	(1.0)	(0.7)	(0.4)	(0.5)
TOTAL TCDD	(0.5)	(0.6)	(0.7)	(0.9)	(0.5)	(0.8)	(0.3)	(0.7)	(1.0)	(0.7)	(0.4)	(0.5)
1,2,3,7,8 PeCDD	(0.7)	(1.0)	(1.0)	(1.4)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.6)
TOTAL PeCDD	(0.7)	(1.0)	(1.0)	(1.4)	(0.8)	(1.1)	(0.4)	(1.4)	(1.7)	(1.5)	(0.6)	(0.6)
1,2,3,4,7,8 HxCDD	(0.6)	(1.0)	(0.9)	(1.3)	(0.7)	(0.9)	(0.4)	(1.1)	(1.5)	(2.5)	(0.5)	(0.5)
1,2,3,6,7,8 HxCDD	(0.5)	(0.9)	(0.8)	(1.2)	(0.6)	(0.8)	(0.4)	(1.0)	(1.4)	(1.9)	(0.4)	(0.4)
1,2,3,7,8,9 HxCDD	(0.6)	(1.0)	(0.8)	(1.2)	(0.7)	(0.8)	(0.4)	(1.1)	(1.4)	(2.2)	(0.5)	(0.5)
TOTAL HxCDD	(0.6)	(1.0)	(0.8)	(1.2)	(0.7)	(0.8)	(0.4)	(1.1)	(1.5)	(2.1)	(0.5)	(0.5)
1,2,3,4,6,7,8, HpCDD	(0.8)	(1.4)	(1.0)	(1.6)	(0.9)	(1.0)	(0.6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.6)
TOTAL HpCDD	(0.8)	(1.4)	(1.0)	(1.6)	(0.9)	(1.0)	(0.6)	(1.5)	(1.9)	(3.3)	(0.6)	(0.6)
OCDD	{1.3} b/	(2.0)	(1.3)	(2.1)	(1.4)	4.4 b/	(0.7)	(2.0)	(3.4)	(9.1)	(0.8)	(0.7)

a/ Minimum Detection Limit for blanks.
b/ "{1.3}" indicates Estimated Maximum Potential Concentration (EMPC). The laboratory deemed a difference between the EMPC and sample 124 readings for OCDD to be statistically insignificant. Detection of OCDD in sample 124 supports the conclusion that the EMPC figures for the blank are in fact OCDD.

CTL014758