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September 30, 1986

Joseph C. Ledvina
Vista Chemical Company
15990 North Barker's Landing Road
Houston, Texas 77224

RECEIVED
OCT 1986
DR. R. T. GOTTESMAN

Re: PVC Land Disposal Survey

Dear Joe:

In keeping with our discussion last week, enclosed is a revised and final copy of the results of the Land Disposal of Polyvinyl Chloride (PVC) Survey. I understand that you will be using this as a basis for a presentation to the Vinyl Chloride Safety Association in October. If you have any comments or questions or if I can be of any assistance, please let me know.

Cordially yours,

Peter

Peter L. de la Cruz

Enclosure

cc: W. C. Holbrook
Robert D. Luss, Esq.
Charles E. O'Connell
Lewis R. Freeman, Jr.
Roy T. Gottesman, Ph.D.

LAND DISPOSAL OF POLYVINYL CHLORIDE

This report presents the results of a survey conducted by the Health, Safety and Environment Committee of the Vinyl Institute, a division of the Society of the Plastics Industry, Inc. Survey forms were mailed in June 1986 to members of the Vinyl Institute and the Vinyl Chloride Safety Association.

The responses were combined and presented in the same sequence as the initial survey. Twenty-nine responses were received from 23 companies worldwide. Due to the inapplicability of the survey to responders having only vinyl chloride monomer facilities and because respondents frequently left questions unanswered, responses to individual questions do not total 29.

Participants in PVC Disposal Survey

1. Air Products and Chemicals, Inc.
2. Aiscondel Sociedad Anonima
3. BFGoodrich Co.
4. Borden Chemical
5. CertainTeed Corporation
6. Dow Chemical Company
7. Dutch State Mines
8. Formosa Plastics Corporation Delaware
9. Georgia - Pacific
10. Mitsui Toatsu Chemicals, Inc.
11. Norsk Hydro
12. Occidental Chemical Corporation
13. Pequiven
14. Petroquimica Colombiana S.A.
15. PPG Industries, Inc.
16. Societe Artesienne de Vinyle
17. Solvay & Cie.
18. Tenneco
19. Vista Chemical Company
20. Vulcan Chemical
21. Unknown - 3

1. **Have PVC Wastes From Your Plant Been Land Disposed?**

Yes -- 23

No -- 2

Do not know -- 0

If Yes, Generally Describe the History of Disposal. If Not Land Disposed, Describe How Waste Was Handled.

The majority of respondents indicated that PVC waste has been land disposed both off-site (10 responses) and on-site (5 responses). Two respondents indicated that suitable PVC waste is sold as off-grade or low quality PVC for suitable applications. The non-duplicative portions of individual responses follows.

PVC wastes are placed with municipal garbage for subsequent incineration.

We always have utilized land disposal for PVC solid waste from plant production and wastewater treatment operations. Waste was generally commingled with municipal waste and placed into municipal landfills.

One wastewater treatment pond filled with waste PVC was covered with dirt and seeded.

PVC waste resins were placed in a municipal landfill for approximately 28 years. This material was collected in a primary wastewater settling lagoon and in small settling pits.

Collected and disposed of in landfill; 44 tons in 1985.

Large particles separated from other resin are collected in bins, then loaded onto a truck and dumped at an on-site landfill.

Land disposal on-site in registered disposal area (Class III).

It has been classified as inert and disposed of in places designated for that purpose.

From 1961-78, reactor scrapings and dry scrap to commercial facility; oversize and wastewater treatment plant sludges to on-site sludge ponds, dried, mixed with soil and used for on-site fill. From 1978-85, all scrap, oversize and wastewater sludges to on-site drying ponds. From 1985 to present, all wastes with VCM less than 400 ppm dried and disposed in commercial facility. All greater than 400 ppm segregated and dried on-site.

PVC from settling ponds is dipped out on a one-to-two year basis. This PVC is placed in clay-lined cells in the landfill. Emulsions wastewater goes through primary treatment where solids are removed by flocking with ferric chloride and lime. The resulting sludge is placed in clay-lined cells in the landfill.

Wet waste from effluent treating system goes onto sand filter beds; periodically these are dug out and this is transported off-site. Sand leaching beds have leachate collection. Dry waste not going through effluent treating is sold.

Generally, PVC solids were collected at various sources, such as screen tailings, reactor clean-outs, and effluent sludge filter cake and sent to various county landfill sites. PVC solids were also accumulated over periods of time in various earth lagoons and aeration lagoons, which were periodically excavated and either sold as off-grade PVC or sent to landfill sites. One large earth lagoon filled with approximately 25,000 cubic yards of PVC was capped with a synthetic liner, covered with earth and vegetated on a site adjacent to the plant in the late 1970's.

Small quantities of PVC slurry and/or PVC agglomerates have been disposed in off-site waste disposal lagoons since 1967. Same lagoons are being used by other chemical plants also for waste disposal. History of disposal: From 1968 to 1980 -- Area A lagoons; from 1981 to 1986 -- Areas B lagoons.

Wastewater with PVC suspension is retained in an open air concrete reservoir in which PVC forms a sediment. Once a year we recover this PVC, dry it and sell it for very low quality level applications. Water from this reservoir is treated in the wastewater treatment unit of the factory and reused in suitable units of the process. Scraps and oversize particles are recovered directly from the kettles and dryer and also sold as a low quality PVC.

PVC present only in wastewater pumped from polymerization unit (reactor and storage tanks cleanup water) to decantation basins.

PVC wastes, such as oversized powder, spills, etc. are sold to the customers as off-grades.

PVC wastes have been rarely land disposed -- only oversized particles which were directly pumped out of the reactors. All other wastes are bagged (PE liner) and sold as such.

A total of 23 acres have been used in 43 years. First 17 acres filled by 1977. Use of six adjoining acres under same state permit should last 10 years more to 1997. The company has permit responsibility except for limited previous owner's liability. An aircraft company opened landfill 1943 as U.S. Government war plant. Government leased to previous owner 1945, then sold to them 1950. Production stopped early 1980; previous owner sold to present owner December, 1980. Landfill used as open dump to 1970--liquids, oils, no cover, etc. State began regulating then and granted Permit 1973 as Ind. Waste Disposal Site. Perhaps 70% of volume overall is from 30 years flyash and 37 years PVC sludge disposal. Many scrap tires also buried up to 1970. Permit condition is requirement to collect and treat leachate in event of degradation of groundwater quality. Groundwater quality is monitored by State required quarterly testing of samples from four shallow wells on river side of landfill and wastewater lagoons. Test protocol does include organics--no apparent pollution by prescribed protocol in State evaluation of results. Monitoring will continue as required. The company conducted 1-1/2 years comprehensive study sampling 15 deep and shallow wells around landfill--tested for 129 EPA Priority Pollutants: Many organics, metals, etc. Some organics found at low levels in some wells, but no pollution in the company's interpretation. The company will continue its program on reduced scale. No statute yet limiting designated pollutants in groundwater generally; only where drinking water aquifer is identified. EPA and states are imposing remedial measures on ad hoc basis. The plant landfill groundwater has not been identified as affecting a drinking water supply. The Plant has deposited waste PVC as sludge and scrap on an on-site landfill for some 40 years. Currently, this is about 200 wet tons per month of 50% solids sludge plus 12 dry tons per month of scrap. The sludge contains about 175 ppm of VC and 400 ppm of TCE, both on the wet basis. We have very little and unreliable data on the scrap. The quantity of sludge rose from a low level in the 1940's when the Plant was small to a peak in the 1960's of perhaps four times the current rate. With the onset of regulatory activity in the 1970's, the volume has steadily declined. Scrap quantities followed this same trend. VC and TCE concentrations, however, were probably considerably higher right from the start and only slowly declined until the regulatory push in the 1970's. In 1983-1984, a comprehensive groundwater study was conducted over 1-1/2 years. Six of fifteen wells sampled around the landfill were analyzed for VC and TCE. All were found to have less than 5 ppb of either contaminant. Four of these wells were 20 ft. deep and two were 125 ft. deep. There is no clear-cut explanation of the fate of all the VC and TCE placed in the landfill over the years--biodegradation, migration, etc. However, both government and company believes that these pollutants do not leave company property. This is because of the continuous pumping of six deep (300-400 ft.) process water wells on the site for supply to the PVC production process. Since the normal rainfall in the area is not enough to recharge the deep water layer being pumped at about 600 GPM, the shortfall is being made up through a cone of depression from the nearby river and aquifers off-site around the Plant boundaries. This is confirmed by TCE analyses of the deep wells showing 20-100 ppb, but not by VC concentrations: Less than 1 ppb.

2. Was Disposal On:

Plant Property -- 16

Off-Site -- 3

Municipal Landfill -- 9

Commercial Waste Disposal Facility -- 9

Not Applicable -- 2

Describe the Wastes That Were (Or Are) Being Land Disposed at Each of These Sites.

The majority of respondents indicated that suspension resin is most frequently land disposed. Wastewater and oversize particles are the most common waste type destined for land disposal. The earliest date reported sposal was 1940.

Resin Type	Waste Type	Amount	Residual VCM Level	Dates of Disposal
Suspension	Oversize, wastewater sludge, contamination	Unknown	Unknown	Since 1960
Compound	Contamination	Unknown	Unknown	Since 1960
N/A				
Suspension PVC	Oversize particles	200,000 lbs./yr.	1-400 ppm	1980-Present
Suspension PVC	Regular particles	300,000 lbs./yr.	1-400 ppm	1980-Present
Suspension & emulsion	Wastewater sludge	300,000 lbs./yr.	less than 10 ppm	1980-Present
Suspension	Oversize, wastewater sludge	10,000 lbs./wk.	-----	2 per week
Suspension	Wasterwater sludge	50,000 lbs.	-----	2 per year
-----	Oversize particles	44 tons	-----	1985
Mass resin	Fines, lumps, floor sweepings	12,000 kg/mo.	-----	-----
Suspension, dispersion, latex, mass, compounds	Reactor cleanings, filter cleanings, floor sweepings, drummed latex scrap, compound scrap, screenings, wastewater treatment sludge, coarse charges, etc.	"lots & lots"	RVCM range 0-10,000 ppm in the old days-- today except for infrequent coarse charges the RVCM is always less than NESHAPS allowable.	-----
Suspension	Oversize material to municipal landfill	175 tons/yr.	700 ppm	1963-Present

Compound	Scrap to municipal landfill	50 tons/yr.	-----	1963-Present
Suspension	Resin from settling basin to commercial waste disposal facility	25 tons 45 tons 45 tons	----- ----- -----	1986 1884 1983
Suspension	Oversize particles, burned or contaminated product, resin settled from wastewater	30 yd.^{3}/mo.	Less than 500 ppm	Ongoing
Suspension	Very fine particles from centrifuge	20 tons/ yr.	-----	-----
Suspension	Wasterwater sludge	30 tons/yr.	-----	-----
Dispersion	PVC sludge from cleaning dryer	20 tons/yr.	-----	-----
PVC production, dispersion homopolymer and copolymer, suspension homopolymer and copolymer, PVC calendaring	PVC sludge PVC "scrap"	2400 tons/yr. 50% H_2O 144 tons/yr.	175 ppm Nil to several 1000 ppm	Since 1947 Since 1947
Suspension	Wastewater sludge	6713 dry tons	-----	Late 1979-1984
Suspension	Wastewater sludge	3308 dry tons	4 ppm avg. (16 samp.)	1985
Suspension	Wastewater sludge	2395 dry tons	29 ppm avg. (15 samp.)	1986-Present
Suspension	Wastewater sludge	12,416 dry tons	-----	1979-Present

Suspension & emulsion	Oversize particles, reactor cleanings and waste	-----	-----	Late 1960's
Suspension & emulsion	Wastewater sludge	about 25 mm lbs.	-----	1976-1979
Suspension & emulsion	Oversize particles, reactor cleanings and wastewater sludge	more than 75 mm lbs.	Less than 1 ppm-4000 ppm	1970's to 1st half of 1985
Suspension & emulsion	Oversize particles, reactor cleanings and wastewater sludge	about 5 mm lbs.	Less than 1 ppm to Less than 2000 ppm	1985-Present
Bulk PVC	Powder and crust	80,000/yr.	5 ppm--1000 ppm	1975-Present
Suspension	Oversize particles, sweeps, lumps, pond dredgings	about 4000 tons	Less than 10 ppm	1975-1985
Suspension	Dry scrap, sweepings	30,000 lb./mo. approximately	-----	1961-1978
Suspension	Wet scrap, oversize, wastewater sludge	40,000 lb./mo. approximately	-----	1961-1978
Paste	Dry scrap, sweepings	30,000 lb./mo. approximately	-----	1978-1985
Suspension	Scrap, oversize, wastewater sludge	80,000 lb./mo. approximately	-----	1978-1985
Suspension	Scrap, oversize, wastewater sludge	65,000 lb./mo. approximately	Less than 400 ppm	1985-1986
Paste	Dry scrap, sweepings	10,000 lb./mo. approximately	Less than 400 ppm	1985-1986

Suspension and some PVC latex	Vessel washouts, oversize, spills	Variable -- 0.1-1.0 mm lb./yr.	100 ppm average	1956-1984
Suspension	Wastewater sludge	300 tons/yr.	20 ppm	1972-1984
Suspension, dispersion	Oversize particles wastewater sludge	----	----	----
Suspension	Oversize particles, wastewater treatment	About 200 tons/ yr.	Not measured	Since 1974
Dispersion	Has to be settled before disposal	About 10 tons/ yr.	Not measured	Since 1974
Suspension	Sludge; oversize particles	1000-1500 tons/ yr.	50 ppm down to 1 ppm	1950-present
Dispersion	Oversize particles	50-70 tons/yr.	Less than 10 ppm	1940-present
Compound	Oversize particles	200-300 tons/yr.	100 ppm to 1 ppm	1970-present
Suspension	Oversize particles	55 tons	500 ppm	Last 3 years
Suspension & emulsion	Wastewater sludge	1 g/liters	About 1 ppm	At present
Emulsion	Pebbles	----	About 1 ppm	At present
Suspension	Wastewater sludge, reactor cleaning lumps	200 kg/day	----	1967-1980
Suspension	Wastewater sludge, reactor cleaning lumps	200 kg/day	Less than 5 ppm	1981 to present

4. Were the Residual VCM Levels in These Waste Measured or Estimated?

No -- 6

N.A. -- 2

Measured -- 6

Estimated -- 9

The following are typical comments:

Some measurements were made in 1981.

The residual VCM of the suspension oversize material is based on 1986 measurements.

Some measurements were made but with very few analyses of "scrap" and this 10 years ago.

The VCM levels have been measured for all PVC waste disposed of since 1984. Measurements were done intermittently before that time.

Often measured at less than 5 ppm.

The residual VCM in the PVC waste is estimated. However, the PVC is stripped to below 400 ppm, presently averaging about 100 ppm. Some samples of the PVC waste show as low as 1.0 ppm VCM. The residual VCM in the emulsions wastewater is estimated. However, the emulsions are stripped to less than 10 ppm and all wastewater with greater than 10 ppm is stripped to less than 10 ppm VCM.

5. **Do any of the Land Disposal Facilities Have Groundwater Monitoring? Describe the Groundwater Monitoring System. Number of Wells, Depth, Proximity to Waste, Etc. When Were the Wells Installed?**

Unknown -- 2

N.A. -- 2

Yes -- 3

No -- 9

The majority of respondents indicated that the land disposal facility utilized by the plants are equipped with monitoring wells. The mid-1970's appears to be the earliest installation time for a monitoring system. Repesentative comments follow.

Five monitoring wells approximately 45 ft. deep are located around the circumference of the landfill. The wells were installed prior to the startup of the landfill in 1980. They are located 300 - 1,000 ft. from the cells containing the PVC and the emulsions wastewater sludge. Groundwater samples from the wells are taken and analyzed each six months. However, the samples have not been analyzed for VCM.

Seven groundwater monitor wells are installed around the landfill. The wells are 80-100 ft. deep and were installed in 1985. The wells are located within 100 ft. of landfill waste.

Under a state permit, samples are taken from four shallow wells installed in 1977, at a depth of 12-20 ft. (A map depicting the locations of the landfill and lagoons and the quarterly and annual test protocols are attachments A to this survey.)

Eleven wells were installed about 1980 and vary from 40-80 ft. deep, all outside buffer zone. Most are located 100-200 ft. from the waste although some are up to 1000 ft. away.

Approximately 20 wells were installed on the outside perimeter down to bedrock, about 60-70 ft. deep.

One facility has sludge drying beds, lined with leachate collections and returns. There are approximately six wells, 15-20 ft. deep, immediately adjacent to walls and installed in 1974. At a second facility with unlined sludge drying ponds, approximately six wells, 12-25 ft. deep, surrounding the ponds were installed in the early 1980's. In addition, at a commercial landfill, 8 wells (4 deep and 4 shallow) are located on perimeter of fill.

PVC plant site has groundwater monitoring that includes approximately 33 observation wells penetrating to the first aquatard approximately 60 ft. below ground level. The wells cover an area of approximately 800 acres. Wells are directly adjacent to waste sites and generally down gradient of the waste sites. Most wells were installed in 1982 and 1984. Three other locations all have monitoring wells, but we are not familiar with details.

Off-site No. 1 -- 3 wells, installed 1978, 1 upgradient, 2 down; sampled and analyzed quarterly; average well depth 45 ft. Off-site No. 2 --7 wells (6 at 80 ft. and 1 at 30 ft.); installed 1984; sampled and analyzed quarterly. On-site -- 4 wells installed 1985, 1 upgradient, 3 down.

Area A has 10 wells; Area B has 3 wells, 15-20 meters deep, at a distance of approximately 25 meters from the waste.

6. Has VCM Been Detected in the Landfill? If So, At What Concentration and When Was It First Detected?

Unknown -- 2

N.A. -- 2

No -- 12

Some VCM has been detected in landfills. However, the majority of respondents indicated that either no monitoring has been conducted or, when the landfill was sampled, no VCM was detected. Sample responses follow.

No monitoring for VCM at landfill has been done.

No measurement available.

There is no clear-cut explanation of the fate of all VC and TCE placed in the landfill over the years --biodegradation, migration, etc.

Detected perchlorate.

The landfill was sampled for VCM. The water below the landfill was sampled and no VCM was detected.

Facility 1: 0-1.2 ppm. Well casing is PVC pipe. Facility 2: 0-5 ppb. Facility 3: 0-17 ppb.

VCM has been detected in the groundwater at the PVC plant site. Levels as high as 2.6 ppm of VCM have been detected. First detected in March 1980.

In a recent government survey, no VCM was found.

7. **Do You Have Any Information on VCM in Air Near Land Disposal Facilities. Provide Concentrations and Details on Monitoring System. (This Includes Any Land Disposal Facility Not Just Those With PVC Manufacturing Waste.)**

Have No Information -- 15

N.A. -- 1

The majority of respondents indicated they have no information on VCM in air near landfills. Most respondents who have monitored the ambient air reported no detection of VCM.

No VCM has been detected at local landfills.

None detected. Ambient air is monitored.

No trace on the auto sampled and analyzed detectors which are located at 50 meters from disposal point.

Using handheld VCM detection equipment, sensitive to 1 ppm, VCM was nondetectable.

In 1970's, took a few OSHA bag samples on person walking on top landfill; no VCM detected.

Batelle did a study in the mid 1970's. We objected greatly to the methods and results. The South Coast Air Quality Management District (SCAQMD) in California has lots of information on this topic. We have done some monitoring over the years at landfill/truckdriver operations, and their exposure has always been less than OSHA limits.

We are now starting a monitoring system for measuring ambient VCM. One of the controlled areas will be the wastewater treatment unit--land disposal facilities, but we have no data yet.

Monitoring systems: chromatography of land disposal area, including VCM and PVC plants wastewater. Average: 0.03 mg/m^3, maximum: 0.1 mg/m^3.

8. Provide Any Information You Have on the Stability of VCM in Groundwater. Does It Degrade? Does It Volatilize? Is VCM Bound to the Soil Particles?

N.A. -- 1

Unknown -- 1

No Information -- 13

It does not bind strongly to sediment as is noted in the STAR document of 1975 and other EPA reports. VCM does volatilize readily, as is witnessed by the ease of air stripping and the presence of VCM around landfills, and it does degrade. However, the rate of degradation is considerably less than the rate of volatilization. I expect that most of it escapes into the air. I don't know of any relative rate data.

Some references we have used concerning stability of VCM in groundwater include the following: Mackay, D.M., Roberts, P.V., Cherry, J.A., Transport of Organic Contaminants in Ground Water. ES&T, 1985, Vol. 19, 384-92; Roberts, P.V., Reinhard, M., Valoceki, A.J., "Movement of Organic Contaminants in Ground Water: Implication For Water Supply," Jour. AWWA, 1982, Vol. 74, 408-13. Various EPA documents concerning VCM.

9. Are You Aware of Any Materials That Could Degrade and Form VCM in the Land Disposal Unit or in the Groundwater? Please Provide Details, Copies of Studies, or References.

N.A. -- 1

No -- 12

Yes -- 1

The majority of respondents who had knowledge of materials which could degrade and form VCM in a land disposal unit cited trichloroethylene. Excerpts from individual responses follow.

Studies have shown tetrachloroethylene, trichloroethylene, and dichloroethylene degrade to VCM. See "Anaerobic Transformation, Transport and Removal of Volatile Chlorinated Organics in Groundwater" by Paul R. Wood, Russell F. Lang, and Iris L. Payan of the Drinking Water Research Center, School of Technology, Florida International University, Tamiami Campus, September, 1981.

The following degrade to VCM: EDC; 1, 1, 2 trichloroethane; tetrachloroethane.

See Attachments B and C to this survey for a listing of recent relevant publications on the subject. Both perchloroethylene and trichloroethylene degrade step wise yielding vinylidene chloride which then degrades to vinyl chloride in a generally well recognized fashion. Almost all land disposal units have all four of these chlorinated materials present, both in the landfill, in the gases from the landfill, and in the leachate from the landfill. The Corvina Landfill in California has received an extensive amount of publicity for this reason. The current literature on these subjects is summarized in Volume I of the Second Edition of the Encyclopedia of PVC. There will be some further information in the future Volume 3 of the Encyclopedia.

Vinyl chloride is a problem in groundwater not from leaching from PVC, but from the microbial degradation (i.e. transformation) of chlorinatd solvents under anaerobic conditions to vinyl chloride. This topic is being vigorously researched at this time by a number of university programs. For further information, please contact any of the "experts" listed. (1) Vogel, T.M. and McCarty, P.L. "Biotransformation of Tetrachloroethylene to Trichloroethylene, Dichlorethylene, Vinyl Chloride, and Carbon Dioxide Under Methanogenic Conditions." Applied and Environmental Microbiology, May 1985, p. 1080, Vol. 49, No. 5. (2) Barrio-Lage, G., Parsons, F.Z., Nassar, R.S., and Lorenzo, P.A. "Sequential Dehalogenation of Chlorinated Ethenes," Environ. Sci. Technol. Vol. 20, No. 1, 1986, p. 96. (3) Wood, Paul R., Lang, R.F. and Payan, I.L. "Anaerobic Transformation, Transport and Removal of Volatile Chlorinated Organic In Groundwater." Unpublished manuscript, September 1981, Drinking Water Research Center, School of Technology, Florida International University, Tamiami Campers, Miami, Florida 33199. (4) Kobayashi, H. and Rittmann, Bruce E. "Microbial Removal of Hazardous Organic Compounds." Environ. Sci. Technol., Vol. 16, No. 3, 1982, page 170A.

10. Describe VCM Concentrations in PVC Monitoring Wells Which May Be Attributed to PVC Casing or Casing Cement.

N.A. -- 4

None -- 1

No Information -- 5

No -- 1

None Detected -- 1

Some typical responses were:

Believed nil; made no specific determination.

We did monitoring (mid 1970's) at a commercial landfill with PVC pipe for wells and concluded results were influenced by the pipe RVCM. I can no longer find the data.

Technical articles on this subject have been published in Journal of American Water Works in past 6 years.

The work which the National Sanitation Foundation (NSF) has submitted to FDA on RVCM in food-contact PVC, shows that vinyl chloride is not found in water that has been in contact with rigid pipe if the pipe contains less than about 2 ppm of RVCM. The NSF method is sensitive to about 1 ppb. PVC is the standard material of construction for monitoring wells at Superfund sites and for RCRA groundwater monitoring. To my knowledge, there has not been any problem with VCM from the pipe.

11. **Please Identify Any "Experts" on VCM or Chlorinated Hydrocarbons In Groundwater.**

Names given -- 2

None Known -- 11

Perry L. McCarty
Dept. of Civil Engineering
Stanford University
Stanford, Calif. 94305

Gladys Barrio-Lage
Drinking Water Research Center
Florida International University
Miami, Florida 33199

John T. Wilson
Robert S. Kerr Environ. Research Lab
USEPA
Ada, Oklahoma

C. H. Ward and Edward J. Bouwer
National Center for Groundwater Research
Rice University
Houston, Tx.

Bruce Rittmann
Dept. of Civil Engineering
University of Illinois
Champaign-Urbana, Ill.

Joseph M. Suflita
Dept. of Botany & Microbiology
University of Oklahoma
Norman, OK 73019

Lial Tischer.

Parsons Group at International University in Miami.

Kleopfer group which published a recent article in GS&T.

Mr. Wil ten Berge, DSM, the Netherlands

Mr. J. Prest
P. O. Box 13
The Heath
Runcorn (Cheshire)
U.K.

12. Please Alert Us of Any Situation Where PVC Compound Waste Is Alleged To Be Causing an Environmental Problem Near a Land Disposal Facility

N.A. -- 1

None Known -- 6

No Information -- 2

None for PVC compound waste but numerous instances of vinyl chloride contamination near landfills where chlorinated solvents were disposed and transformed under anaerobic (methanogenic) conditions. See BNA Chemical Regulation Reporter, "Carcinogens: California Officials Probe Conversion of Trichloroethylene into Vinyl Chloride" (Sept. 16, 1983). Another similar instance at a Superfund cleanup site in New Hampshire or Massachusetts.

Firestone has such an alleged problem at the Woodlawn County Landfill near the Perryville, Maryland, PVC plant owned by Occidental Chemical.

13. Have You Had Any Inquiries From Regulatory Agencies Regarding Landfilling of PVC Wastes and/or VCM Content of These Wastes?

No -- 15

N/A -- 1

Yes -- 2

In 1981, state environmental organization requested data on EP Toxicity test for VCM in PVC sludge.

Based on inquiries from state officials who administer the RCRA program, tests were performed which showed that for PVC wastes containing less than 500 ppm VCM, leachate from the waste would contain less than 10 ppm VCM and air exposure to VCM for landfill workers would be below OSHA exposure limitations.

Our landfilling was worked out in an understanding with the authorities. This year they have been showing increasing interest in VCM in wastewater.

14. Please Send Us Any Additional Information You Have Related to This Subject.

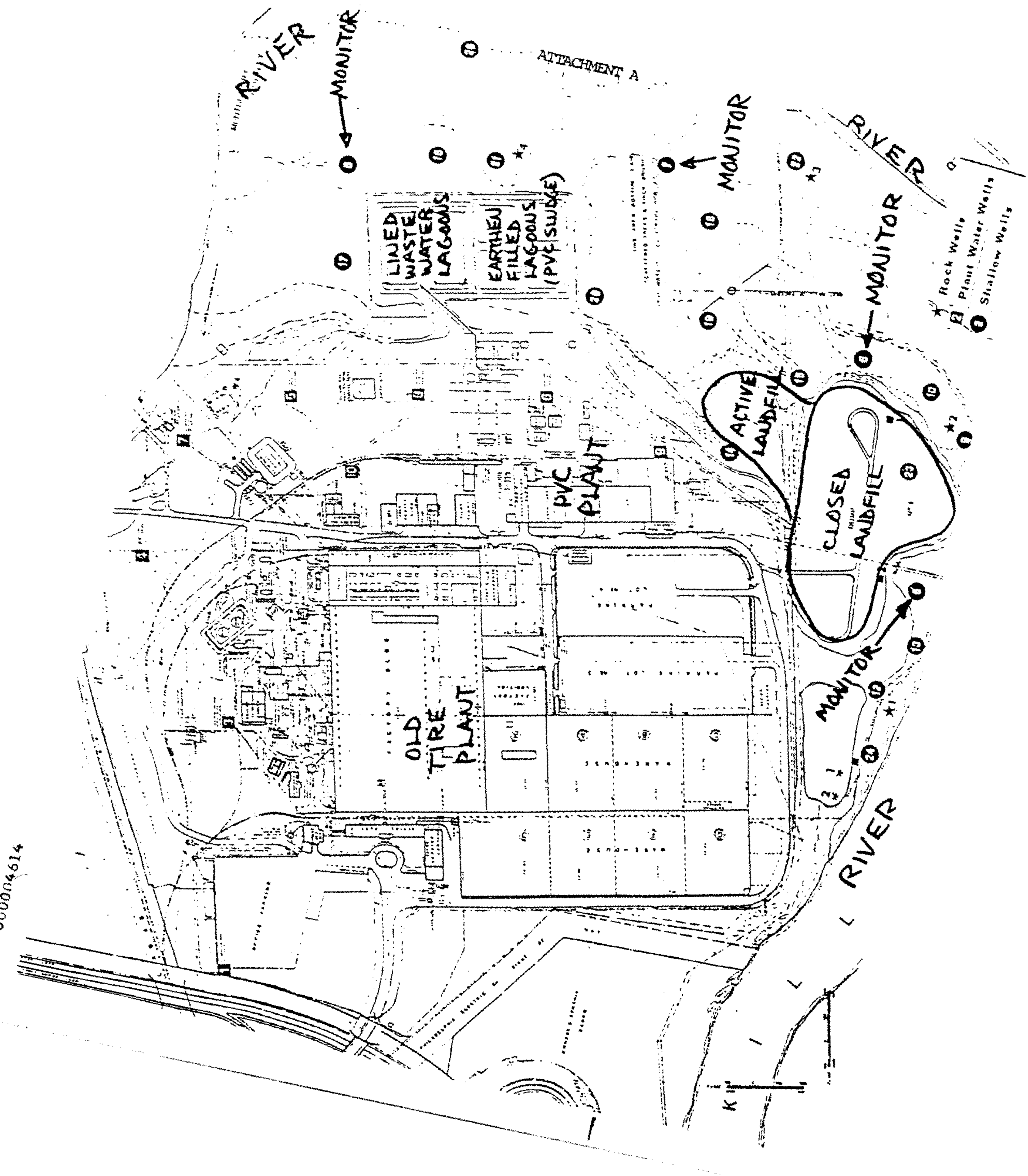
N.A. -- 1

None -- 9

Yes -- 1

According to EPA Region III, groundwater from monitoring wells at Formosa Plastics Corporations PVC plant in Delaware City, Delaware, showed EDC levels up to 3,400 ppb, VCM levels up to 310 ppb and TCE levels of 15-20 ppb. No contamination in nearby residential water wells was found. EPA is seeking a cleanup agreement with Formosa and the former owner, Stauffer Chemical Co. See, BNA Environmental Reporter, pg. 578 (Aug. 15, 1986).

ATTACHMENT A



VVV 0000004614

MONIT'G FLOODPLAIN WELLS - **ATTACHMENT A**

NEW DER TEST PROTOCOLS - FEB. 1986

		QTRLY 3/14/86	6/4/86 ANNUAL DER WILL SPLIT SAMP.	($601/SAMPLE) BACKGROUND 3/14/86
Arsenic (01002)	µg/l	($131/SAMP.)	x ($11)	x
Barium (01007)	µg/l		x (11)	x
Cadmium (01027)	µg/l		x (11)	x
Chromium (01034)	µg/l		x (11)	x
Fluoride (00951)	µg/l		x (8)	x
Lead (01051)	µg/L		x (11)	x
Mercury (71900)	µg/L		x (16)	x
Nitrate (as N) (00620)	mg/l		x (10)	x
Selenium (01147)	µg/l		x (11)	x
Silver (01077)	µg/l		x (11)	x
Coliform Bacteria ( )			($11)	x
Endrin (39390)	µg/l			x
Lindane (39782)	µg/l		(RMC)	x
Methoxychlor (39480)	µg/l			x
Toxaphene (39400)	µg/l			x
2,4,D (39730)	µg/l			x
2,4,5 T P Silvex (39740)	µg/l			x
Radium ( )	pCi/l			x
Gross Alpha ( )	pCi/l			x
Gross Beta ( )	millirem/yr		(RMC)	x
Turbidity (82079)	NTu			x
Chloride (00940)	mg/l		x ($10)	x
Iron (Total (01045)	mg/l		x (11)	x
Manganese (01055)	mg/l		x (11)	x
Phenol (32730)	µg/l		x (20)	x
Sodium (00929)	mg/l		x (11)	x
Sulfate (00945)	mg/l		x (10)	x
Copper (01042)	mg/l		x (11)	x
Zinc (01092)	mg/l		x (11)	x
pH (00403)		x	x (NC)	x
Specific Conductance (00095) (micromhos)		x	x (6)	x
Total Organic Carbon (00680) mg/l		x	x (20)	x
Total Organic Halogen (73115) µg/l		x	x (75)	x
Total Dissolved Solids (70304) mg/l		x	x (10)	x

Attachment B

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Attachment B (Cont.)

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Attachment C

1. Introductory Study of Biodegradation of Chlorinated Methane, Ethane and Ethene Compounds, June 1980 (6 pages) and June 1981 (15 pages).

2. Anaerobic Transformation, Transport and Removal of Volatile Chlorinated Organics in Groundwater, Sept. 1981, 41 pages (Removal Section - 17 pages)

3. Behavior and Fate of Hazardous Organic Chemicals in Contaminated Groundwater, Dec. 1982, 72 pages.

4. Occidental Chemical Corporation's Ying to Werner, May 1983, 2 pages: VC in Soil.

5. Occidental Chemical Corporation's Dietz to Werner, June 1983, 2 pages: Evaluation of Chlorocarbon Degradation Reports from Florida International University.

6. BFGoodrich's Gregg to O'Mara, Oct. 1983, 2 pages: Case Study of Groundwater Contamination by Chloroethenes in Florida.

7. Transformation of Tetrachloroethene and Trichloroethene in Microcosms and Groundwater, Feb. 1984, 4 pages.

8. Anaerobic Degradation of Trichloroethylene in Soil, 1985, 4 pages.

SOURCE: South Coast Air Quality Management District
Air Quality Digest, 9150 Flair Drive, El Monte, CA 91731

Dioxins and Furans Placed on Toxics List

A class of compounds have been added to the state's list of ambient toxic substances. The Air Resources Board (ARB) identified dioxins and furans, carcinogenic by-products of trash incineration, as toxic air contaminants.

A toxic air contaminant, as defined by the ARB, 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."

Currently six of the 47 compounds listed in the ARB's identification process have been identified as toxic. They are benzene, hexavelant, chromium, ethylene dichloride, ethylene dibromide, asbestos, and dioxins. Dioxins and furans were selected for identification as toxic air contaminants because many dioxins have been demonstrated to be carcinogens or have the potential to be carcinogens.

Dioxins and furans, most of which have never been tested carcinogenicity, are emitted into the air from combustion sources as a mixture. They have frequently been formed as unwanted by-products in the manufacture of chemicals based on chlorinated phenols, such as some pesticides and wood preservatives, or polychlorinated biphenyls. None of these materials are manufactured in California, according to a staff report by the ARB, but some are found in pesticides used in the state. Dioxins and furans also are formed when plastics, trash, garbage or wood products are burned.

According to ARB's report, it is difficult to quantify or predict with certainty the presence of these substances because they are not a commercially useful product or reagent, and they are produced at such low levels that state of the art technology is required to detect them.

"Identification of potential sources is based on limited source test information, hypothetical mechanisms or formation, and circumstantial evidence based on the processes performed at a facility," the report states.

The report measures the future impact 10 proposed waste-to-energy plants in Los Angeles County will have on the air. Dioxins and furans would be produced by these plants, but it has not been determined how much will be produced and to what extent a potential hazard to human health would exist.

The ARB and the air quality management districts are mandated to adopt measures to reduce ambient levels of these gases to the lowest level achievable through use of Best Available Control Technology (BACT).

The District's Engineering staff is exploring a Toxic Best Available Control Technology (T-BACT) at present, which, like BACT, would involve a case-by-case review of new stationary sources requiring permits and applying the most efficient control method to reduce emissions.

"T-BACT differs from BACT in that cost effectiveness is not as an important priority as reducing the toxic emissions to the extent possible," said Robert Murray, District Senior Engineering Manager. "If the T-BACT is not feasible, than a dillution and/or substitution method may be considered," Murray said.

Once the Air Resources Board (ARB) and Department of Health Services (DHS) select a compound to enter the toxics identification phase, the ARB circulates a request for the relevent information on health effects of the compound from the public. Approximately two months later the ARB formally request DHS to evaluate the available health effects information for the candidate compound and to prepare recommendations regarding effects.

As a basis for its recommendations DHS reviews all available scientific data associated with the health effects of the compound and makes an assessment of the health risks posed by exposure to the substance. This evaluation includes a discussion of whether a threshold exposure level exists below which effects do not occur.

Simultaneous with preparation of the DHS health evaluation, ARB prepares a comprehensive exposure assessment including information on the compound's usage, emissions or potential emissions, persistence in the environment, ambient concentrations and present or potential public exposure. These two segments -- the exposure assessment and the health effects evaluation --become the risk assessment report which is the technical foundation for determining if the compound should be listed as a toxic air contaminant in California. The ARB makes copies of the draft report available for public comment before it is submitted to the Scientific Review Panel (SRP), which reviews the scientific procedures and methods used, the health and exposure data, and the reports conclusion.

The final decision regarding listing of a candidate substances as a toxic air contamination is made by the ARB after a public hearing. If the ARB concurs with the findings that a compound is a toxic substance and does pose a health risk, the compound is listed by regulation as a toxic air contaminant in the California Administrative Code.

Once a compound has been listed as a toxic air contaminant, the control decision or risk management phase of the air toxics program begins.

*Excerpt from ARB's Air Toxics Update No. 1

VVV 000004619

Emile Nelson 572-6428

LITIGATION UPDATE - VC STANDARD, INDUSTRY VS. GOVERNMENT - AS OF 9/86											
				Emergency Releases							
Company	Where	Prod'n	$ Penalty	RV	RD	MV	LBS. VC	Misc.	Report'g	ROL	2 Yr. Waiver
1 TENNECO	NJ	PVC	50,000	17			10,000				
2 AIR PROD.	KY		24,000								LATE
3 CONOCO	LA		NONE								LATE
4 PPG	LA	VC	NONE								LATE
5 UCC	NJ		30,000			3		YES			
6 AIR PROD.	KY		125,000	20			69,000				
7 SHELL	LA	VC	50,000	15			43,000				
8. CONOCO	OK		125,000	6			166,000		1		
9 CONOCO	LA		100,000	14			10,000		4		
10 CONOCO	MISS		100,000	10	1		27,000				
11 GA-PAC.	LA	PVC	625,000	35			55,000	YES	24	2,000+	
12 BORDEN	MASS	PVC	90,000	2		2	9,400	YES			
13 FIRESTONE	LA	PVC	107,000	21			5,011		21		
14 OCCIDENTAL	NJ	PVC	490,000		43		85,000	YES	12	77	
		TOTAL	1,916,000								

LITIGATION UPDATE - VC STANDARD, INDUSTRY VS. GOVERNMENT - AS OF 9/86

				Emergency Releases							
Company	Where	Prod'n	$ Penalty	RV	RD	MV	LBS. VC	Misc.	Report'g	ROL	2 Yr. Waiver
15 ETHYL	LA	VC	IN LITIGATION	81		17	182,000				
16 OCCIDENTAL	LA	PVC	"	9			2,161		2		
17 GOODRICH	KY		"	20			91,000				
18 GOODRICH La	KY		"	19			57,000	YES			
19 GOODRICH	LA		"	10		12	55,000		YES		
20 BORDEN	LA		"	5			64,000	YES			
21 BORDEN	LA		"	34			23,000		18		
22 DOW	LA	VC	"	10			15,000	YES			
23 DOW	TX	VC	"	10			13,000	YES			
24 FORMOSA	LA		"	8			24,000	YES			
25 PPG	LA	VC	"	24			32,000	YES			
26 UCC	TX		"	2			9,700	YES			
Gen. Prod	FLA										