TABLE 11-28. ENERGY CONSUMPTION - BULK POLYVINYL CHLORIDE PLANT (45 MM KG/YR) (100 MM LB/YR) USING CARBON ADSORPTION TO ATTAIN ALTERNATIVE II CONTROL LEVEL CONTINUED

Emission Point	Power Consumption (kwh/yr)	Fuel Consumption MM Kilocalories/yr (MM BTU/yr)
IV. Control of Bulk Storage and Transfer Operation With Carbon Adsorption	870,799	4432 (17,586)
TOTAL (using solvent absorption for control of vent condenser)	2,215,798 (1905 MM Kilocalories)	4432 (17,586)

References

1. EPA, National Environmental Research Center, Research Triangle Park, Environmental Aspects of VCM/PVC (Draft).

2. NAPCA, U. S. Department of Health, Education, and Welfare, Preliminary Air Pollution Survey of Hydrochloric Acid, A Literature Review, Raleigh, North Carolina, October 1969, pp. 3, 4, 12. 13.

3. Scrubber Handbook, Ambient Purification Technology, Inc., July 1972.

4. Sahals, S. L. and Schwartz, R. A., Construction Materials for Wet Scrubbers, Koch Engineering Company, Chemical Engineering Progress, August 1974.

5. Hulswitt, E. E., Adiabatic and Falling Film Absorption of Hydrogen Chloride, Astro Metallurgical Corporation, Chemical Engineering Progress, February 1973.

6. Kemper, S. K., Seiler, E. N., Bowman, D. H., Air Pollution Control Association Journal, March 1970, pp. 139-143.

7. Environmental Protection Agency, "Plastics and Synthetics Point Source Category Effluent Guidelines and Standards," Federal Register, Volume 39, No. 67, April 5, 1974, Part II, pp. 12506, 7.

8. Environmental Protection Agency, "Organic Chemicals Manufacturing Point Source Category. Effluent Guidelines and Standards and Proposed Application to Pretreatment Standards," Federal Register, Volume 39, No. 81, April 25, 1974, Part II, pp. 14678, 9.

9. Schwartz, W. A. et al., Engineering and Cost Study of Air Pollution Control for the Petrochemical Industry Volume 3 Ethylene Dichloride Manufacture by Oxychlorination, Prepared for the Environmental Protection Agency, Houdry Division--Air Products and Chemicals, Inc., Pennsylvania, November 1974, p. ED-39.

10. Joe Mudd (General Tire Company). Telephone conversation with Susan Wyatt (EPA), January 30, 1975.

11. Doug McQuarter (B. F. Goodrich, Louisville, Kentucky). Telephone conversation with Susan Wyatt (EPA) on January 28, 1975.

12. Jay Harpring (Continental Oil Company, Abeerdeen, Mississippi). Telephone conversation with Continental Oil Company on January 30, 1975.

Currently, based on data from several plants, the product resin is estimated to contain a maximum of 500-1,000 ppm vinyl chloride after it has gone through the dryer. Once the particulate is emitted to the atmosphere, it may remain suspended or fall out. Ambient air measurements of polyvinyl chloride particulate have not been made because no technology is currently available for separating polyvinyl chloride particulate from total suspended particulate. Fall-out particulate is frequently observable in the vicinity of process equipment on plant property.

The amount of residual vinyl chloride released from the particulate once it is in the environment has not been quantified. Any health effects associated with inhaled polyvinyl chloride particulate have not been identified or evaluated.

12.1.3 Control Techniques

Particulate (resin) collection devices used in the industry include cyclones and fabric filters. These devices are used either separately, in stages, or in combination and are used primarily to separate the resin from conveying or drying air. The efficiency of the devices corresponds to economic recovery levels and is not necessarily designed for maximum particulate reduction. Table 12-1 lists the different devices used on each facility and subcategorizes the facility where necessary. For instance, it can be seen that four types of dryers are used at polyvinyl chloride plants. Rotary, flash, and fluidized bed dryers are used in the suspension process and spray dryers are used in the dispersion process.

Table 12-1. POLYVINYL CHLORIDE PARTICULATE EMISSION FACTORS

Particulate Sources	Control Technique	Controlled Emissions[1] kg/kg PVC
A. Dryer		
a) Rotary	cyclone baghouse	0.01 0.006
b) Flash	cyclone baghouse	0.0003 0.0001
c) Fluidized Bed	cyclone	
d) Spray	baghouse	0.0017
B. Storage		
a) bins	baghouse	0.0002
b) silos	cyclone baghouse	0.0005
C. Bagging Machine	baghouse	0.00015
D. Bulk Loading	baghouse	0.0002
E. Resin Transfer Points	cyclone baghouse cyclone & baghouse	0.001 0.0009

[1]Obtained from averaging reported particulate emission rates from industrial responses to the May 30, 1974 letter transmitted from Mr. Don R. Goodwin (EPA) under the authority of Section 114 of the Clean Air Act to the management of companies producing polyvinyl chloride.

generally about 97.5 to 99.9 percent.[2,3,4] Fabrics of many different materials have been used. Cleaning of the bags may be done by either reverse air, mechanical shaking, or in the case of socks, just allowing the bag to collapse when not in use. The pressure drop across a fabric filter (excluding the sock type) is relatively high, 3.7 to 33.5 mm Hg (2 to 18 inches of water).

12.1.4 Emission Rates

Estimated polyvinyl chloride particulate emission rates from the various processes in polyvinyl chloride plants using baghouses and/or cyclone control are shown in Table 12-1.

Based on these emission rates, the total polyvinyl chloride particulate emissions from a 136 million kg product/yr (300 million lb/yr) suspension plant containing storage bins, storage silos, bagging machines, bulk loading operations and resin transfer points equipped with baghouses, and rotary dryers equipped with cyclones are estimated to be 211 kg/hr (465 lb/hr). (Due to the control equipment and plant size selected for this example, 211 kg/hr is estimated to represent a much higher than average emission rate.) If it is assumed, for the purpose of considering the worst situation, that this 211 kg particulate/hr contains 1,000 ppm residual vinyl chloride and that all the residual vinyl chloride is released into the atmosphere, the amount of vinyl chloride emissions from this source (the particulate) would be 0.21 kg/hr (0.46 lb/hr). This compares with the total vinyl chloride emission rate of approximately 32 kg/hr (70 lb/hr) from a 136 million kg

resin going into the dryer will be sharply reduced and the quantity of residual vinyl chloride monomer in the resin beyond the dryer will be reduced. However, since proportionately more residual vinyl chloride is removed in the dryer without improved stripping than with it, the reduction in the residual vinyl chloride content of the polyvinyl chloride particulate due to improved stripping will be only from about a maximum of 500-1000 ppm to a maximum of 200-200 ppm using the 211 kg/hr (465 lb/hr) particulate emission rate from the same 136 million kg product/yr suspension plant, but with the reduced maximum residual monomer content (300 ppm instead of 1,000 ppm), the maximum quantity of residual vinyl chloride emitted from the particulate would be reduced from 0.21 kg/hr (0.46 lb/hr) to 0.06 kg/hr (0.14 lb/hr).

As calculated above, for a 136 million kg product/yr suspension plant meeting the proposed standard, the maximum amount of vinyl chloride emissions from polyvinyl chloride particulate would be only 0.01 kg/hr (0.02 lb/hr) or 0.06 lb/hr (0.4 lb/hr), depending on the type of control selected. Since this emission rate is insignificant compared with the total emission rate from the plant and most plants are already equipped with high efficiency particulate collection devices, direct regulation of the particulate does not appear to be warranted.

12.2 HYDROCARBONS

There are many hydrocarbons used at and/or emitted from vinyl chloride and polyvinyl chloride plants besides vinyl chloride. Some of these include vinylidene chloride, vinyl acetate, ethylene, propylene,

REFERENCES

1. Foster, D. Snell, Inc., Economic Impact Studies of the Effects of Proposed OSHA Standards for Vinyl Chloride, September 27, 1974, Exhibit III-7.

2. Letter with attachments from B. R. Leach, Uniroyal Chemical, to Mr. Don R. Goodwin, EPA, June 13, 1974.

3. Confidential reply to a letter from Don R. Goodwin (EPA) sent to industry representatives under the authority of section 114 of the Clean Air Act. (EPA does not yet have permission to name the company. Exact reference will be in the next draft.)

4. Letter with attachments from W. C. Holbrook, B. F. Goodrich Chemical Company to Mr. D. R. Goodwin, EPA, June 17, 1974.

5. Letter with attachments from N. E. Segler, Universal PVC Resin, Inc., to Mr. Don R. Goodwin, EPA, June 14, 1974.

13.1.3 The Promulgated Permanent Standard

On October 4, 1974, after gathering additional information on vinyl chloride through hearings, economic and environmental impact studies, and formal comments, OSHA promulgated a standard for vinyl chloride, polyvinyl chloride, and fabricating plants limiting employee exposure to 1 ppm vinyl chloride (averaged over any eight-hour period) effective as of January 1, 1975. In addition, the regulation established a 5 ppm ceiling (averaged over a 15-minute period) in order to prevent exposure of employees to unacceptable high excursions. The standard also provided for an action level of 0.5 ppm (averaged over an eight-hour period) in order to minimize the impact of the standard on employers who have attained exposure levels well below the permissible limit. Thus, where the results of monitoring demonstrate that no employee is exposed in excess of 0.5 ppm, employers are exempted from the provisions of the standard. The standard also requires monitoring of employee exposure (monthly or quarterly depending on criteria described in the regulation), designation of regulated areas, protective clothing, respiratory protection when the environmental level is not controlled to the permissible exposure limit, emergency procedures, warning signs, medical surveillance, training, and records and reports.

In order to comply with the standard, each plant as of January 1, 1975, was required to institute engineering and work practice controls to reduce exposure levels below the permissible exposure

very high levels of vinyl chloride, and that meeting the 1 ppm standard is technologically infeasible and too costly.[11] At the end of December 1974, the Appeals panel (consisting of three judges) had not reached a decision in the case but did state that the regulation would not go into effect until the panel rendered its decision, and of course then only if the decision was in favor of OSHA. Meanwhile the emergency temporary standard (50 ppm) was in effect.

On January 31, 1975 the appeals panel unanimously upheld the October 4, 1974, OSHA regulation, and stated that it would go into effect in 60 days (about April 1, 1975). The panel further stated the evidence against vinyl chloride's dangers was "quite sufficient" to merit OSHA's restrictions. Noting that much of the evidence was based on animal exposure to the chemical, with only indirect human evidence, the Court stated that, "nevertheless, it remains the duty of (OSHA) to act to protect the working man and to act even in circumstances where existing methodology or research is deficient." As to the argument of the industry that the standards were technically infeasible, the Court ruled that "they simply need more faith in their own technological potentialities."[11]

13.1.6 Relationship of the Proposed EPA Regulations and the Promulgated OSHA Regulation

In response to the OSHA regulation which was originally scheduled to go into effect January 1, 1975, the vinyl chloride industries have adopted some measures which not only reduce employee exposure, but also reduce

to representatives of OSHA and NIOSH; however, there is no deadline for submittal of a formal plan. For these reasons, it is difficult at this time to evaluate the degree to which the OSHA regulation will reduce vinyl chloride emissions to the atmosphere. It is assumed, however, that the plants will respond to the OSHA regulation with a combination of ventilation techniques, emission reduction, and respiratory protection, and that this response will not be uniform.

13.2 Environmental Protection Agency (EPA)

13.2.1 Water Regulations

Although the vinyl chloride and polyvinyl chloride industries will have to meet other effluent guideline regulations for BOD, COD, TSS, and pH, at this time there are no plans for developing a water effluent regulation or a drinking water standard specifically for vinyl chloride. Vinyl chloride concentrations of 2-3 ppm and at times higher have been recorded from manufacturing plant effluents, although it is unlikely that such contamination would persist in water downstream which might be used for drinking purposes, due to the tendency for vinyl chloride to escape from water into the air.[2] Water contamination with vinyl chloride from polyvinyl chloride piping may be a problem although available data do not indicate this to be the case. To date, there is no indication that drinking water contains detectable levels of vinyl chloride.

13.2.2 Pesticide Regulations

On April 26, 1974, and July 19, 1974, EPA published in the Federal Register an emergency suspension order for specific indoor

13.5 Consumer Product Safety Commission

On August 21, 1974, the Consumer Product Safety Commission promulgated regulations which classified any household substance in a self-pressurized container which has vinyl chloride monomer among its ingredients or in the propellant as a "banned hazardous substance" as defined in the Federal Hazardous Substances Act.[8] With regard to the relationship of this regulation and the EPA proposed standards for atmospheric emissions of vinyl chloride, the same reasoning mentioned above for regulation of pesticide, cosmetic, and drug aerosols applies.

13.6 State Regulations

State regulations for hydrocarbons and new construction indirectly reduce vinyl chloride emissions at some plants.

For example, the State of Texas requires that best control technology be employed to control any pollutant (including vinyl chloride) when a source is newly constructed or modified. Three polyvinyl chloride plants in Texas are required to meet this regulation by employing what has been specified by the state as best control technology for each emission point, except the dryer. The dryer stack must be designed so that dispersion calculations indicate that the maximum exposure level is below 1 ppm. These three plants would have to install additional controls to meet the proposed standards. No vinyl chloride plants are currently subject to this regulation.[9]

In addition, Texas can regulate existing vinyl chloride and polyvinyl chloride plants through the State Implementation Plan

References

1. Occupational Safety and Health Administration, Department of Labor, "Occupational Safety and Health Standards--Standard for Exposure to Vinyl Chloride," Federal Register, Vol. 39, No. 194, October 4, 1974, pp. 35890-35898.

2. "EPA Urges Prompt Steps by Chemical Industry to Reduce Vinyl Chloride Air Emissions," Environmental News, EPA, Washington, D. C., June 11, 1974.

3. Environmental Protection Agency, "Emergency Suspension Order Concerning Registrations for Certain Products and Intent to Cancel Registrations," Federal Register, Vol. 39, No. 82, April 26, 1974, p. 14753.

4. Environmental Protection Agency, "Amendment to Emergency Suspension Order Concerning Registrations for Certain Products and Intent to Cancel Registrations," Federal Register, Vol. 39, No. 140, July 19, 1974, p. 26480.

5. Department of Transportation, "Tank Vessels Engaged in Domestic Trade, Vinyl Chloride-Proposed Carriage Requirements," Federal Register, Vol. 39, No. 142, July 23, 1974, pp. 26753.

6. Food and Drug Administration, Department of Health, Education, and Welfare, "Prior-Sanctioned Polyvinyl Chloride Resin," Federal Register, Vol. 38, No. 95, May 17, 1973, p. 12931.

7. Food and Drug Administration, Department of Health, Education, and Welfare, "Vinyl Chloride as an Ingredient of Drug and Cosmetic Aerosol Products," Federal Register, Vol. 39, No. 166, August 26, 1974, p. 30830.

8. Consumer Product Safety Commission, "Self-Pressurized Household Substances Containing Vinyl Chloride Monomer; Classification as Banned Hazardous Substance," Federal Register, Vol. 39, No. 163, August 21, 1974, p. 30112.

9. Telephone conversation between Susan Wyatt (EPA) and Mr. Sam Crowthers, Texas Air Control Board, Austin, Texas, January 7 and February 21, 1975.

10. Telephone conversation between Susan Wyatt (EPA) and Mr. G. Von Bodunger, Air Control Section, Bureau of Environmental Health, LITSRA, New Orleans, Louisiana, January 8, 1975.

11. U.S. Court of Appeals for the Second Circuit, The Society of Plastics Industry, Inc. v. Occupational Safety and Health Administration, 2 OSHC 1496-1504.

Date	Company, Consultant, or Agency	Nature of Action	Location
8/29/74	General Tire & Rubber Company	Plant Visit	A itabula, Ohio
9/4/74	LSU Consultants	Discussion of Stripping Study	B :on Rouge, La.
9/5/74	Houdry Division	VCM & PVC Study	D 'ham, N.C.
9/16/74	Tenneco Chemical	114 Request	3 ilants
9/26/74	B. F. Goodrich	Visit to Corporate Headquarters	C :veland, Ohio
10/1/74	General Tire	114 Request	A itabula, Ohio
10/7/74	Firestone	114 Request	P :tstown, Pa.
10/7/74	B. F. Goodrich	114 Request	A plants
10/7/74 10/8/74 10/9/74	American Chemical	Incinerator Test	L g Beach, Calif.
10/9/74	Shintech	Plant Visit	F eport, Texas
10/9/74	Dow Chemical	Plant Visit	F eport, Texas
10/23/74	Shell Chemical	Plant Visit	D r Park, Texas
10/24/74	Conoco	Plant Visit	O ahoma City, Ok.
10/30/74	Shintech	114 Request	F eport, Texas
10/30/74	Dow	114 Request	F eport, Texas
11/1/74	Diamond Shamrock	114 Request	D r Park, Texas
11/1/74	Conoco	114 Request	2 lants