

Dioxin Registry Report  
for  
Amchem Products, Incorporated  
Ambler, Pennsylvania

Report Written By  
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## Abstract

The National Institute for Occupational Safety and Health (NIOSH) Dioxin Registry is a compilation of demographic and work history information for all U.S. production workers who synthesized products known to be contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and/or hexachlorodibenzo-p-dioxins (HxCDD). Currently, there are fourteen production facilities and approximately 7000 workers included in the Registry. The first use of this information is a retrospective cohort mortality study for which the comparison group is the U.S. male population. This study will evaluate the causes of death among workers exposed to products contaminated with TCDD and HxCDD.

Amchem Products, Inc. located in Ambler, Pennsylvania produced and/or formulated 2,4,5-T esters and amines and silvex esters from 1949 through 1979. Presented in this report is a compilation of information describing the facility, its processes, its workforce, its personnel records, its medical records, and analytical TCDD data for its products. Based on the information pertaining to the operation of the 2,4,5-T ester production and formulation processes and to the work histories there is enough information to construct a TCDD exposure matrix for this site for the years from 1953 to 1979.

## Introduction

The National Institute for Occupational Safety and Health (NIOSH), Division of Surveillance, Hazard Evaluation, and Field Studies, Industrywide Studies Branch, is conducting an investigation of health effects resulting from occupational exposure to polychlorinated dibenzo-p-dioxins, and in particular 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and/or hexachlorodibenzo-p-dioxins (HxCDD). This study, referred to as the Dioxin Registry, is a compilation of demographic and work history information for all U.S. production workers who have synthesized products known to be contaminated with TCDD and/or HxCDD. The Registry, initiated in 1979, was prompted by animal studies indicating TCDD to be acutely toxic and a chloracneagen, as well as a carcinogen and teratogen (1,2,3,4,5,6,7). TCDD is a contaminant found in 2,4,5-trichlorophenol (2,4,5-TCP) and its sodium salt (NaTCP), which are raw materials used to produce chemical compounds such as 2,4,5-trichlorophenoxyacetic acid (2,4,5-T acid) and 2,2'-methylenebis-(3,4,6-trichlorophene) (hexachlorophene). Currently, there are fourteen production facilities and approximately 7000 workers included in the Registry. The first use of the Registry will be a mortality study for which the comparison group will be the U.S. male population. This study will evaluate the causes of death among workers exposed to products contaminated with TCDD and/or HxCDD.

Amchem Products, Inc. produced and/or formulated 2,4,5-T esters and amines in Ambler, Pennsylvania from 1949 through March 1, 1979. Silvex esters were also produced and/or formulated by Amchem from 1958 through 1971. Presented is a compilation of information and some data pertaining to these operations at the Ambler facility. Descriptions of the facility, workforce, processes, and record systems are included in this report.

## Description and History of the Facility

The Ambler, Pennsylvania facility, located at 300 Brookside Avenue, began operations in 1914 as the American Chemical Products Company producing rust inhibitors for metals. Later the facility was renamed Amchem Products, Inc., and then some time later merged with William H. Rorer, Inc. to become a division of Rorer-Amchem, Inc. In 1977 the Ambler facility was sold to the Union Carbide Corp. and became a subsidiary of the Agricultural Products Division of Union Carbide. Union Carbide operated Amchem until 1980 when it sold the facility to Henkel of America, Inc., a part of the Henkel K Ga A, Dusseldorf, West Germany.

From 1949 until 1969 Amchem purchased 2,4,5-T acid from the Monsanto Company in Nitro, West Virginia. Amchem used the 2,4,5-T acid to produce 2,4,5-T esters, amines, and formulations. From

1970 until March 1, 1979, 2,4,5-T esters were purchased by Amchem from the Dow Chemical Company in Midland, Michigan. These esters were formulated. During this time (1970-1979) Amchem also purchased small amounts of 2,4,5-T acid from Dow Chemical, Marx of England, and Bater of West, Germany to formulate 2,4,5-T amines. Silvex esters were manufactured and/or formulated from 1958 through 1971 and were purchased from Dow Chemical, Marx of England, and an Australian company. Amchem also manufactured and formulated 2,4,-D esters and amines. From 1949 through 1969, Amchem purchased 2,4-D acid from Monsanto which manufactured the 2,4-D acid at their Sauget, Illinois facility. From 1970 through 1979, Amchem purchased 2,4-D esters from Dow Chemical, which manufactured 2,4-D esters at their Midland, Michigan facility. During the peak years of production, 2,4,5-T production reached 500,000 lbs of 2,4,5-T equivalents, and 2,4-D production reached 2,000,000 pounds of 2,4-D equivalents per year. Amchem produced 2,4,5-T products 25% of the time and 2,4-D products 75% of the time using the same equipment. Silvex production time was included as a part of 2,4,5-T production time.

In addition to 2,4,5-T and 2,4-D products, Amchem manufactured and formulated rustproofing chemicals, metal cleaners and conditioners, pickling chemicals, inhibitors, rust remover and preventives, copper coating, strippers, fluxes, heat resisting paints, phosphate-coating and paint-bonding chemicals, herbicides, plant growth regulators, and industrial coatings and adhesives. A list of these products is shown in Table 1.

A plant layout of the Amchem facility in Ambler, Pennsylvania is shown in Figure 1. Buildings 14, 9, 23, and 5, shown in Figure 1, housed 2,4,5-T and 2,4-D production and formulation operations. In Building 14, unloading, storage, esterification, formulation, drumming, and small packaging operations of 2,4,5-T and 2,4-D products took place. Blending and drumming of 2,4,5-T and 2,4-D products were carried out in Building 9. In Building 23, 2,4,5-T and 2,4-D amines were sprayed onto vermiculite to produce a dry formulation. In Building 5, small amounts of silvex ester were produced.

#### Description of the Workforce

The production, formulation, and packaging of 2,4,5-T and 2,4-D products was a part of the Agricultural Chemical Division (ACD) of Amchem; most of the operations for these products were done in Buildings 14 and 9. There were eight workers involved in ACD operations. In the 1950's and the 1960's, the major products were phenoxy herbicides. In the 1970's, the major product was bromoxynil. Three job titles were associated with ACD operations: Chemical Operator, Chemical Mixer, and Packager. The Chemical Operator produced the phenoxy herbicides and performed some formulating. The Chemical Mixer blended the phenoxy ester and amines into formulations and performed some

packaging. The Packager packaged the phenoxy herbicide formulations including drumming in 30 and 55 gallon drums and packaging in 1 and 5 gallon containers. Maintenance workers were also involved in ACD operations. Aside from performing maintenance throughout the Amchem facility, the maintenance men also unloaded tank cars and trucks, pumping the raw materials into storage tanks. The Chemical Operators spent 100% of their time in ACD operations. The Chemical Mixers were dedicated either to ACD or to non-agricultural processes, in a 50:50 ratio, during the 1950's and the 1960's. During the 1970's, about 2/3 of the ACD Chemical Mixers produced phenoxy herbicide formulations and 1/3 made bromoxynil. ACD equipment was operated approximately 12 hours per day.

#### Description of the Processes

Limited information pertaining to Amchem's 2,4,5-T and silvex operations was made available. 2,4,5-T acid was received as a dry powder in either drums or bags. The 2,4,5-T acid was dumped into a glass-lined jacketed vessel which contained an alcohol (usually iso-octyl or n-butoxyethyl alcohol) and a small amount of sulfuric acid catalyst. The vessel was closed, a condenser and scrubber were started, and the vessel was heated to approximately 300° F to form 2,4,5-T ester. Following this reaction, samples were collected to determine the completeness of the reaction, and the vessel contents were allowed to cool. Formulation of the 2,4,5-T ester involved blending the 2,4,5-T ester with emulsifiers and petroleum solvents, and for some formulations, with 2,4-D esters. 2,4,5-T acid was also used to produce 2,4,5-T amines. The 2,4,5-T acid was dumped into a glass-lined vessel containing triethylamine and petroleum solvents. The resulting solution was then mixed for several hours at room temperature. Both 2,4,5-T esters and amines were packaged in 30 and 55 gallon drums and in 1 and 5 gallon containers. Drumming was done by gravity feed and weight actuated shut off. The 1 and 5 gallon packaging was done using vacuum packers. Similar operations were performed to produce and formulate silvex products.

#### Analytical TCDD Data

Analyses of Amchem 2,4,5-T esters for TCDD concentrations are limited. As a part of a survey measuring polychlorodibenzo-p-dioxin content in selected pesticides the U.S. Department of Agriculture measured TCDD concentrations in twelve Amchem 2,4,5-T ester samples produced between 1967 and 1970 and found a mean concentration of 11.3 ug/g (8). As previously stated, the Monsanto Company provided 2,4,5-T acid to Amchem from 1949 through 1969. Analyses performed on 293 Monsanto 2,4,5-T acid samples produced between 1958 and 1969 had a mean TCDD

concentration of 5.9 ug/g (9). Dow provided 2,4,5-T esters to Amchem from 1970 to 1979. Analyses of Dow 2,4,5-T ester samples for this time period gave a mean TCDD concentration of 0.07 ug/g (10).

#### Description of the Personnel Records

The personnel records for all Henkel employees in the U.S. (employed and terminated), and for terminated Amchem employees, contained a detailed work history card or computer sheet listing each department and job title held by the worker since his first date of employment. For Amchem workers terminated after 1974, these were personnel files which contained the detailed work history card as well as application forms, and miscellaneous items such as time sheets.

A list of all persons ever employed by Amchem was used to select the Amchem worker files (about 2000 from the Henkel files.) A 5% sample of the remaining files produced no additional Amchem records. No records were found with a termination date earlier than 1953. To identify the workers with potential exposure to substances contaminated with TCDD, each Amchem record was reviewed for department and job title entries which indicate an assignment to a process area known to be contaminated with TCDD.

The list of departments and job titles considered by Amchem and Union Carbide employees to have had potential exposure to products contaminated with TCDD is provided as Table 2. The departments and job titles were identified in interviews with Henkle (formerly Amchem) employees who had each worked at the facility for about 20 years: Mr. Karl Wiegand; Mr. Robert Applegate, former production supervisor of the Agricultural Chemicals Division (ACD); Mr. Joseph Malozzi, former Amchem chemical operator and supervisor of Production and also Packaging; and Mr. Carl Brown, Union steward. Mr. Applegate had been responsible (as ACD Production supervisor) for the activities in Building 9 and 14, which contained the phenoxy herbicide processes. These interviews also included Union Carbide representatives: Dr. George Landis, a chemist formerly at the Ambler facility; John Leonard, Personnel, Safety and Occupational Health Manager, and Dr. M. Gerald Ott, Director of Epidemiology.

The identification of departments and job titles with potential exposure to 2,4,5-T was accomplished in the interviews. The major agricultural products at Amchem during the 1950's and 1960's were phenoxy herbicides; in the 1970's, Bromoxynil (not contaminated with TCDD) became a major product. The workers in the ACD Production had job titles of Chemical Mixers and Chemical Operators; some had started as Helpers or General Workers. It appears that the Chemical Mixers were dedicated either to Agricultural or to non-agricultural processes, perhaps in a 50:50

ratio during the 1950's and 1960's. During the 1970's about 1/3 of the Mixers would have been assigned to phenoxy herbicide production. It was estimated, by the interviewees, that most packaging and shipping personnel and all receiving department personnel had potential exposure to 2,4,5-T. Consequently, the identification of potentially exposed workers was accomplished by selecting all work history cards with the following departments: Synthesis and Blending Departments, Receiving, Packaging and Shipping. It was not possible to identify the specific maintenance job titles most likely to have exposure from the other maintenance workers; therefore, maintenance workers were not included. Using the criteria in Table 2, 258 workers were identified as having assignments with potential exposure to 2,4,5-T.

#### Medical Records

Medical records were sought in order to identify any workers who had chloracne during the years of 2,4,5-T production. Medical and worker compensation records were obtained, as available, for all workers identified as having potential exposure to 2,4,5-T. Accident and dispensary logs from 1952 to 1979 were also microfilmed.

#### Conclusions

The workers employed in ACD Production at the Amchem Products, Inc. facility in Ambler, Pennsylvania are suitable for inclusion into the Dioxin Registry. Work histories were found from 1953 through 1979 for these workers. Based on the information pertaining to the operation of the 2,4,5-T ester production and formulation processes and to the work histories, there is enough information to construct a TCDD exposure matrix for this site for the years from 1953 to 1979.

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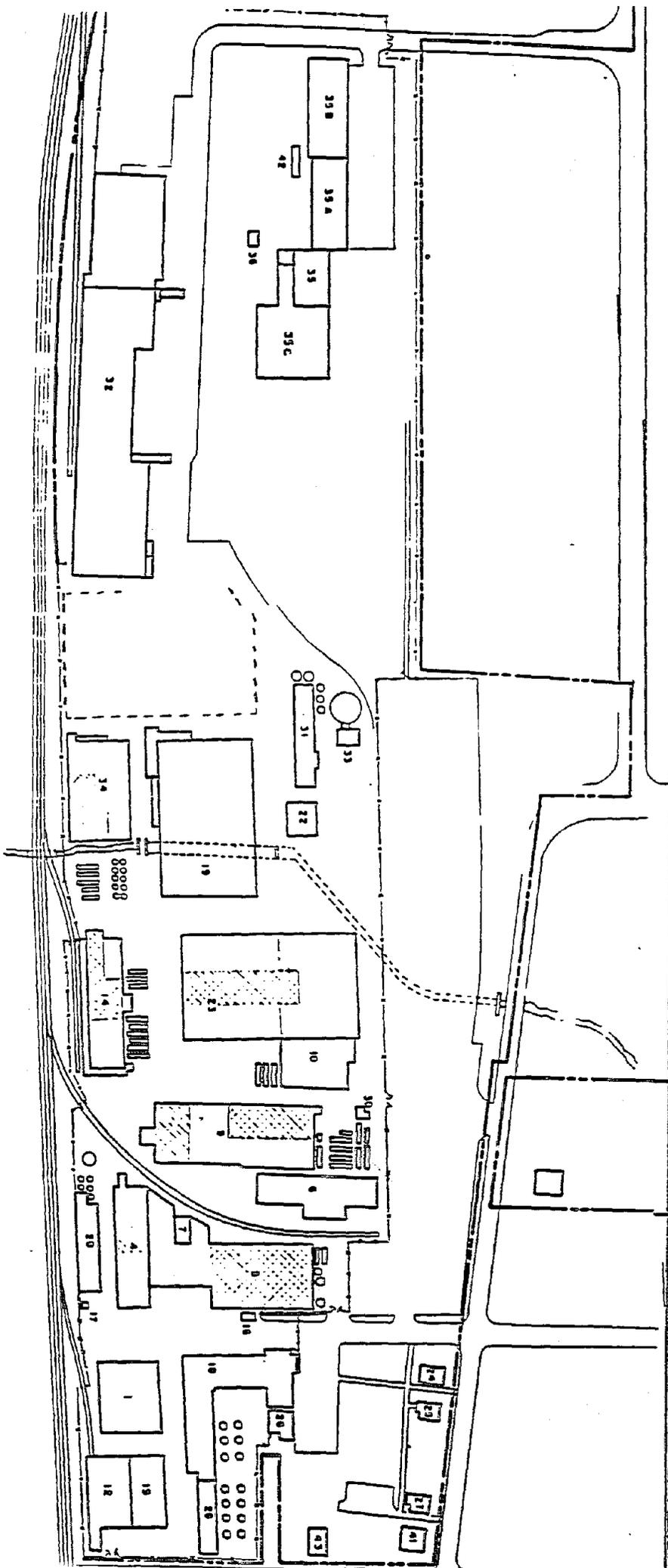


FIGURE 1  
 Anchem Products, Inc.  
 Ambler, Pennsylvania

Table 1  
Amchem Products, Inc. division  
Chemical Products  
1971 through 1980  
Ambler, Pennsylvania

Pesticides

5-Amino-4-chloro-2-phenyl-3 (2H)-pyridazinone  
3-Amino-2,5-dichlorobenzoic acid  
3-Amino-2,5-dichlorobenzoic acid, ammonium salt  
3-Amino -s-triazole  
Amitrole  
Bromoxynil, octanoic ester  
Butralin  
Chloramben  
Chloramben, ammonium salt  
2-Chloroethyl phosphonic acid  
Coumafuryl  
(2,4-Dichlorophenoxy)acetic acid, n-butoxyethyl ester  
(2,4-Dichlorophenoxy)acetic acid, n-butyl ester  
(2,4-Dichlorophenoxy)acetic acid, dimethylamine salt  
(2,4-Dichlorophenoxy)acetic acid, ethyl ester  
(2,4-Dichlorophenoxy)acetic acid, iso-octyl ester  
(2,4-Dichlorophenoxy)acetic acid, isopropyl ester  
4-(2,4-Dichlorophenoxy) butyric acid  
2-(2,4-Dichlorophenoxy) ethanol sulfate, sodium salt  
Ethrel  
3-(1-Furyl-3-acetyethyl)-4-hydroxycoumarin  
Ioxynil  
4-(2-Methyl-4-chlorophenoxy) butyric acid, sodium salt  
1-Naphthalene acetamide  
1-Naphthaleneacetic acid  
1-Naphthaleneacetic acid, ethyl ester  
1-Naphthaleneacetic acid, methyl ester  
1-Naphthaleneacetic acid, sodium salt  
2,3,6-Trichlorobenzoic acid  
2,3,6-Trichlorobenzoic acid, dimethylamine salt  
(2,4,5-Trichlorophenoxy)acetic acid, n-butoxyethyl  
ester  
(2,4,5-Trichlorophenoxy)acetic acid, iso-octyl ester  
(2,3,6-Trichlorophenyl)acetic acid, sodium salt  
2,3,5-Triiodobenzoic acid

General and Compounded Products

Iron phosphate rustproofing  
Undercoat, protective, for aluminum  
Zinc phosphate rustproofing precoating

Source: SRI International Directory of Chemical Producers 1971  
through 1980

Table 2

Department and Job Titles Identifying Amchem  
Workers with Potential Exposure to TCDD

I. Synthesis and Blending <u>Department</u>	<u>Job Titles</u>
ACD Production ACD-Rodine ACD Manufacturing ACP Mfg. ACP Production Agricultural Chemicals Production  Agricultural Products Division Building 9 Building 14 Building 9-14-34 Prod. Ag Rodine Production Ag Rodine	Assistant Supervisor Chemical Mixer Chemical Operator Chemical Operator Bldg. 9 Chemical Operator Helper Chemical Operator Bldg. 9-14-34 Chemical Operator 14 General Worker Helper Leadman Leadman-Chemical Operator Leadman Bldg. 9-14-34 Production Helper Regular Employee Supervisor
II. <u>Receiving Department</u>	<u>Job Titles</u>
Also appears as Receiving plant (only if job title is Material Handling or Receiving Foreman)	Fork Truck Operator General Worker Leadman Material Handler Material Handler Helper Material Handler 1st class Material Handler 2nd class Power Truck Operator Receiver Recorder Warehouse Receiving
III. Foreman	<u>Exclusions for Receiving                      Dept.</u>
	Hormone Process Operator Lanolin Recovery Operator

Table 2 cont.

IV. Packaging Department

Job Titles

Also appears as  
ACD Pkg  
ACP Pkg  
Agric Pkg  
Packaging  
Packing

Asst. Supervisor  
Foreman  
Packer  
Materials Handling  
Agric Pkg  
Packager A  
Packager B  
Supply Man  
Safety Supervisor  
Safety Director  
Supervisor  
Exclude:  
Hort. Pkg

V. Shipping Department

Job Titles

Assist. Supervisor  
Foreman  
General Worker  
Office Asst.  
Sample & Small Order  
Checker  
Shipper  
Shipper 1st class  
Shipper 2nd class  
Shipping Clerk  
Sr. Admin. Clerk

Exclusions for Shipping  
Department:

If job title is Special  
studies related to  
traffic.

VI. Amchem Department Exclusions\*\*

Ag Farm  
Ag Lab  
Ag Research  
Ag Sales  
Hort Pkg  
Hort Research  
MCD Production  
MCD  
Metal Chemicals Division  
Pilot Plant  
Quality Control Lab  
Summer Employees  
Other jobs indicating office work, sales, etc.

\*\* Because the variety of products and activities, it is not possible to identify the particular individuals within these departments who might have had potential exposure to TCDD.