INDUSTRIAL HYGIENE REPORT

WALK-THROUGH SURVEY OF WOOD PRESERVATIVE PRODUCTION FACILITY at

VULCAN MATERIALS COMPANY
Chemicals Division
Wichita, Kansas

Survey conducted by

Stewart-Todd Associates, Incorporated

May 23, 1979

Report written by

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July 23, 1979

Industrial Hygiene Section
Industrywide Studies Branch
Division of Surveillance, Hazard Evaluations and Field Studies
National Institute for Occupational Safety and Health
Cincinnati, Ohio

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Worker exposures to pentachlorophenol (PCP) were determined at Vulcan Materials Company (SIC-2861) in Wichita, Kansas, on May 23, 1979. The survey was part of a NIOSH industrial hygiene assessment of the wood preservative materials industry. The company had a safety and industrial hygiene program, as well as a medical surveillance program. Medical services were provided by a local clinic. Range-finding air sampling was conducted during regular operations at potential exposure sites and yielded concentrations below analytical detection. Limited area sampling in the production facility revealed that PCP concentrations were below the limits of detection.

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CONTENTS

PURPOSE OF SURVEY:	This walk-through survey was conducted as a part of the Phase II study of the INDUSTRIAL HYGIENE ASSESSMENT OF NEW AGENTS -III, NIOSH Contract No. 210-78-0060. Specifically, this survey was for the first group which includes all agents used in wood preserving. This facility was selected on the criteria set forth in the Study Proposal based on information gathered in Phase I.
EMPLOYER REPRESENTATIVES CONTACTED:	Dennis Lindsay, Product Manager (205) 877-3507 James M. Boyd, Plant Manager (316) 524-4211 Donald Brownfield, Asst. Plant Manager (316) 524-4211 Wm. M. Minish, Production Manager (316) 524-4211
EMPLOYEE REPRESENATIVES CONTACTED:	Gerry Walters, President International Union of Operating Engineers Local #119 - AFL-CIO
ACKNOWLEDGEMENTS:	James L. Oser, NIOSH Battelle Columbus Laboratories (Richard E. Heffelfinger, Ph.D.)
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	Primary Manufacturer 2869

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NIOSH Project Officer: James L. Oser
Principal Investigator: Alan S. Todd

ABSTRACT

A preliminary survey of the Vulcan Materials Company, Wichita, Kansas Pentachlorophenol manufacturing plant, was done as partial fulfillment of obligations to the National Institute for Occupational Safety and Health under Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents - III." The field site visit of May 23, 1979 provided familiarization with current and past process methods and controls utilized to reduce exposure. Employee training and work practices, as well as general occupational educational efforts were evaluated along with historical data and experience from air monitoring. Periodic medical monitoring program methods and clinical data also were provided on the plant employees. Range finding air sampling was conducted during regular operations at potential exposure sites and yielded non-detectable results analytically. The limited area sampling conducted did not indicate excessive air concentration in the production facility during the monitoring period. Too few samples were obtained to analytically compare the Dow and NIOSH methods for determining airborne PCP.

INTRODUCTION

Stewart-Todd Associates, Incorporated, in conjunction with the National Institute for Occupational Safety and Health, under Contract No. 210-78-0060, "Industrial Hygiene Assessment of New Agents - III," conducted a preliminary industrial hygiene survey at Vulcan Materials Company, Wichita, Kansas, on May 23, 1979. This plant manufactures pentachlorophenol (PCP), one of the three major preservative chemicals used for wood treatment. The plant was selected from the group of three PCP producers as being representative of a typical chemical manufacturing facility which uses the basic industrial chlorination processes and techniques.

The purpose of the preliminary survey is to gain familiarity with process methods, potential or known exposure conditions, and test sampling methods and determine the need for comprehensive field investigations to evaluate long-term health effects associated with PCP. The information obtained through this research effort will be utilized in either criteria documents or technical reports on the wood preservative industry.

DESCRIPTION OF THE FACILITY

The pentachlorophenol manufacturing facility of Vulcan Materials Company was built in 1958. Flakes are produced by the chlorination of phenol in the presence of a catalyst at elevated

temperatures. All process materials have remained the same since the initial start-up of the unit.

Equipment additions and modifications have been made in the plant over the years to optimize production. In 1972, a flaker holdtank was added between the secondary chlorinator and the flaker for the purpose of providing a more continuous process flow of materials and increasing production volume. In 1964, a rotating kiln was installed for heat treating the penta flakes to give the finished product a polished appearance and reduce sublimation.

The penta operation is located in one major building of approximately 5000 sq. ft. It is a four-level steel structure enclosed on two sides with sheet metal panels and open-grate floors throughout all the upper levels, with the exception of the control room which is on the fourth floor. The reactor building and adjacent outside loading and unloading areas are located on 1/6 acre.

DESCRIPTION OF WORKFORCE

Ten people are employed as Class I and III Operators in the pentachlorophenol facility. Production is conducted as a 4-shift per week, 24 hours per day, 7-days per week operation, with two operators per shift and two relief personnel. The Class I Operator's tasks include charging the primary reactor with raw materials, unloading phenol tank cars, operating the chlorination reactors, taking product stream samples and directing his assistant operator. The Class III assistant Operator is

responsible for maintaining the kiln and flaker, packaging the penta product, and assisting the supervising operator. The operators are also reponsible for a limited amount of the maintenance conducted on the unit, such as replacement of leaking seals. Members of the plant-wide maintenance crew, however, are called in for major repair work or equipment breakdown.

All the employees are members of the AFL-CIO International Union of Operating Engineers, (Local No. 119). There are no women currently employed in the Penta plant, nor have any worked there since the 1958 start-up.

DESCRIPTION OF PROCESS

Glazed pentachlorophenol flakes are produced in a batch-type reaction system using phenol and chlorine with aluminum chloride as a catalyst. Vulcan Materials Company manufactures the chlorine for use in the PCP plant and purchases the other materials from independent suppliers.

Phenol and chlorine gas are pumped into the primary reactor vessel where partial chlorination occurs at elevated temperatures. The chlorophenols are transferred to the secondary reactor where aluminum chloride catalyst is added, and the chlorination process is completed. The reaction time for the primary and secondary chlorination varies from 5-15 hours.

The molten pentachlorophenol is pumped to the holdtank and then to the flaker, a water-cooled rotating drum on which penta crystallises and is flaked off. It is then transferred to a rotating kiln where cycles of cool and hot air produce a polished penta flake resistant to sublimation. Seventy percent (70%) of the glazed penta flake is shipped in tank trucks and loading is done via an enclosed conveyor system. A limited amount of bagging (50 lb.), drum filling (300 lb.) and box (1 ton) filling is also done in a small room on the first level.

Off-gases from the chlorination process, hydrochloric acid and excess chlorine gas, are removed by the acid adsorption section. Excess chlorine is reacted with phenol and recycled to the primary chlorinator. Hydrochloric acid is stripped from the absorber and sent to the deep-well disposal system. Other chlorinated contaminants are neutralized with caustic and disposed of by the deep-well system.

The flaker and kiln are equipped with individual exhaust ventilation and scrubbing systems. Bagging and drum-filling stations are also exhausted with local ventilation and a baghouse air cleaner. All exhaust equipment was installed either for the purpose of minimizing product loss or for exposure control.

Air flow measurements to evaluate the efficiency of the air handling systems are not routinely taken. Any significant loss

of material through equipment leaks is generally sufficient to cause respiratory irritation and, therefore, would warrant immediate repair.

Product stream samples are collected several times during the chlorination process in order to evaluate the degree of reaction completion. Specific gravity determinations are conducted on samples taken from the primary chlorinator and crystal-point measurements are taken near the end the secondary chlorination phase. The latter samples are analyzed in a laboratory hood located on the third level and the specific gravity determination is made directly at the primary reactor sampling port.

DESCRIPTION OF PAST EXPOSURES

Medical data on penta employees was forwarded to EPA in 1976 as part of Vulcan's RPAR response. An accompanying letter from the company's President, Lee K. Bailey, indicated that with the exception of a few instances of dermatitis or minor skin rashes, there have not been any significant medical findings related to occupational exposures during the past fifteen years of PCP production. The Plant Manager, Mr. James Boyd, also reiterated this during the preliminary survey discussions.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE, AND SAFETY PROGRAMS

Vulcan Materials Company has a medical surveillance, industrial hygiene, and safety program for its employees. The medical and

safety programs date back to the start of the production operations; whereas, the industrial hygiene program was formalized 4-5 years ago.

Periodic physical examinations are required for all employees in the penta plant. Medical tests which have been routinely conducted include chest x-ray, audiogram, vision, pulmonary function, complete blood counts, liver function tests, and urinalysis. Prior to 1978, these services were provided by Dr. Clifton Schopf and Dr. Harold Parker of the Family Practice Clinic, Wichita, Kansas. Currently, Dr. Lyle Cartwright of the Minor Emergency Center West, Wichita, is on call for all medical treatment and the company provides transportation to his office. Within the last year, Dr. Irving Tabershaw of TOMA has been retained for a comprehensive medical evaluation of all plant employees. Plans are being made also to hire a part-time physician at the plant.

The Industrial Hygiene program was started 3 years ago by the company's Chemicals Division Level Industrial Hygienist, Mike Dolan. In 1978, Vulcan Materials hired Donald Groover as the Industrial Hygienist for the Witchita chlorinated chemical production facility. He is responsible for conducting air monitoring and evaluating occupational exposures throughout the plant. He also functions as part of the safety program which reports directly to the Plant Manager.

Periodic air sampling in the penta plant has been done since March, 1977 using various impinger (caustic solution) and filter methods. Peak and long-term breathing zone and area samples have been taken. Operator exposures have ranged from "none detected" to 0.30 mg/m^3 and area samples taken throughout the unit have varied from "none detected" to 1.35 mg/m^3. All air samples are analyzed by the R & D Laboratory located on site. OSHA has also conducted an inspection of the plant which included air monitoring in the penta unit. Levels were within current OSHA limits. Mr. Groover has taken noise measurements throughout the PCP plant. Results indicated there were no excessive employee exposures.

The Safety and Health Supervisor for Vulcan Materials is Dave Moller. Monthly Management/Union safety meetings are held and periodic walk-through inspections of the plant are conducted. The company also utilizes a safety suggestion system providing the employees with an opportunity to participate in the safety program.

All new employees must go through an orientation session in which the safety rules for handling penta and its solutions are discussed. Routes of potential exposure to PCP - inhalation, ingestion, and skin absorption - and resultant health effects are reviewed. They are then given a tour of the facility and a handout describing personal hygiene and work practices, housekeeping, and disposal methods to be followed.

Shower facilities and change room with a dual locker system to separate street and work clothing are provided. Employees are told to remove any clothing that becomes grossly contaminated, shower and use another set of clean clothing.

Hardhats, safety glasses, safety shoes, and escape respirators are required to be worn by all employees of the penta plant at all times. The company provided all the above protective equipment as well as goggles, face shields, rubber boots, and gloves, which are used as needed or required for certain operations. Slicker suits, cannister respirators approved for organic vapor and acid gas, Scott Air Packs, and air line respirators are also maintained for non-routine turn-around or emergency purposes. All employees have been formally instructed on cleaning, storing, and maintaining their own respiratory equipment. Respirators are fit-tested by the negative/positive pressure technique and are checked for seal fit during the initial employees' training sessions. In general, respirators are used for only short periods of time; e.g., when there is a valve or pump seal leak. Periodic training on the use of protective gear and safety procedures during routine and emergency situations is conducted for all employees on a rotating basis at least once per year. These sessions are held at the monthly safety meetings.

The penta operators are responsible for a weekly inspection of fire extinguishers, safety showers, and respiratory equipment. Safety showers and eye washes are located on each level of the PCP unit. The employees generally eat in the control room.

They alternate their lunch breaks so one Operator is always on duty.

INSPECTION OF THE PLANT

An industrial hygiene walk-through survey of the PCP plant was conducted following the preliminary discussions with plant personnel. Mr. W. M. Minish, Production Manager of the Chemicals Division, provided the basic description of production equipment, process flow, and air handling systems. Personal protective gear and supplies were examined along with a review of plant work practices and personal hygiene.

DESCRIPTION OF SURVEY METHODS

Area air sampling was done on the second, third, and fourth levels adjacent to equipment and product sampling ports, where the greatest potential operator exposures were thought to occur. PCP was not readily detected by odor during the walk-through survey and equipment set-up. Since two air sampling methods were being compared, relatively high air concentrations of PCP were desired in order to collect sufficient material within the 2-3 hour sampling period for analytical detection. Therefore, air samples were taken on the molten product side of the flaker hood (second level), and adjacent to the sampling port for the secondary chlorinator (third level), and primary chlorinator (fourth level). Product stream samples were collected at both the primary and secondary chlorinator during

the air monitoring. In mid-afternoon as the sampling equipment was being turned off and disassembled, a seal leak occurred at the secondary chlorinator. The released fume was highly irritating, however, under the circumstances, sampling was not possible. The PCP operators, using MSA escape respirators, goggles, and rubber gloves immediately began the necessary repair work.

The recommended NIOSH impinger sampling and analytical procedure S-297, and a silica gel absorption method were used for collecting airborne PCP. Bendix BDX-41 air sampling pumps pre- and post-calibrated with a Universal Pump Calibrator, Model 302, were operated at flow rates of approximately 1.5 liters per minute (LPM) for the NIOSH method and 0.5 LPM for the silica gel tube.

The sampling train for the NIOSH procedure including a pre-filter of 0.8 micron Millipore type AA filter, supported by a stainless steel screen in a three piece cassette, and connected in series with a midget bubbler containing 15 ml of ethylene glycol. This was followed by a second empty midget bubbler acting as a trap to protect the sampling pump from solvent splashover or condensation. The samples were analyzed by a high pressure liquid chromatography with an ultraviolet detector. The lower limit of detection was 12.5 µg PCP.

Samples collected on silica gel were desorbed with methylene chloride and analyzed using gas chromatography and a flame ionization detector. The lower limit of detection was 20 µg PCP.

RESULTS

The analytical results for the pentachlorophenol collected on silica gel tubes were all below the limits of detection; i.e., less than 0.31 mg/m^3 based on a sampling volume of 65 liters. The sample collected by the NIOSH method was also below the limit of detection. In this case, less than 0.05 mg/m^3 based on a sample volume of 233 liters. One impinger sample was lost in transit and one sampling pump was not functioning properly on the day of the survey. Therefore, there was only one PCP determination by the NIOSH method. (See Appendix A). The sampling and analytical procedures, therefore, cannot be compared from this data because all air concentrations were non-detectable. The silica gel method, however, was the simplest to use and would be more practical when conducting personal breathing zone (BZ) sampling.

DISCUSSION

Sampling results are representative of typical operating conditions as described by plant personnel and approximate employee exposures for the specific locations evaluated.

Monitoring was done while the operators were taking product stream samples and, therefore, should have included potential peak exposure periods. However, either the sampling equipment was upwind of the operation or the peak concentration was of too short a duration for analytical detection. The air monitoring equipment was located in the closest proximity to potential sources of PCP exposure without interfering with operator movements. Short peak exposures do occur, as evidenced by the seal leak, but were not documented during this survey.

APPENDIX A

VULCAN MATERIALS, INC. — ANALYTICAL RESULTS - PRELIMINARY WALK-THROUGH — NIOSH Contract No. 210-78-0060 — Survey Date: 5/23/79 — Prepared: July 26,

SAMPLE DESCRIPTION	PUMP# SAMPLE#	SAMPLING TIME (min)	FLOW RATE TOTAL AIR VOLUME	COMPONENT	CONCENTRATION µg	mg/m³	ppm
AREA SAMPLES							
BZ Height - 4th Level - Control Room Level - Pump setting on pipe leading to sampling port for primary chlorinator - Operator opened and closed valve to take samples	BDX-106 SIL-001	12:12p-3:02p 170 min.	0.393 LPM 66.8 liters 0.0668 m³	Pentachlorophenol (PCP)	<20	<.30	< 60
	BDX-101 Impinger A	12:12p-3:02p 170 min.	1.41 LPM 233 liters 0.2397 m³	Pentachlorophenol	<12.5	<.05	<10
BZ Height - 3rd Level - Adjacent secondary chlorinator near sample collection port for crystal-point. Operator took sample and ran measurement under hood. (Seal leak occurred here at end of sampling period).	BDX-89 SIL-002	12:23p-3:00p 157 min.	0.559 LPM 0.0878 m³	Pentachlorophenol	<20	<.23	<46
	BDX-82 Impinger D	12:23p-3:00p 157 min.	1.54 LPM 0.242 m³	Pentachlorophenol (Lost sample in transit)			
Second Level - Top of flaker on molten side adjacent small door opening used to check product flow	BDX-80 SIL-003	12:49p-2:58p 129 min.	0.5 LPM 0.645 m³	PCP	<20	< .31	< 62
	BDX-33 Imp-E	Pump was not functioning properly, impinger solution was used as a blank.					

1/3-

Vulcan Materials Company

CHEMICALS DIVISION / P. O. BOX 7000 • BIRMINGHAM, ALABAMA 35223 • TELEPHONE 205 877-3000

TECHNICAL DATA SHEET

Code No: 7-1-0

Pentachlorophenol
(C_6Cl_5OH)

SPECIFICATIONS

GLAZD®

CHARACTERISTICS	SPECIFICATIONS
Physical Form	Polished Flakes
Color	Light Brown
Particle Size	Passes thru #3 mesh
Pentachlorophenol	86.0% min.
Total Chlorinated Phenols	96.0% min.
Inert Ingredients	4.0% max.
Crystallization Point	180.0°C. min.
Alkali Insolubles	0.5% max.

CONTAINERS

50 pound net, 50.6 pound gross P.E. coated multi-wall kraft bag

300 pound fibre-pak drums; bulk, minimum 40,000 pounds, pneumatic unloading

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1367

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing, Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME	EMERGENCY TELEPHONE NO.
Vulcan Materials Co., Chemicals Division	316-524-5751
ADDRESS (Number, Street, City, State, and ZIP Code): P. O. Box 7689, Birmingham, Ala. 35223	
CHEMICAL NAME AND SYNONYMS: Pentachlorophenol	TRADE NAME AND SYNONYMS: Penta
CHEMICAL FAMILY: Chlorinated Hydrocarbons	FORMULA: C_6Cl_5OH

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)

SECTION III - PHYSICAL DATA

BOILING POINT (°F.) (decomposes)	590	SPECIFIC GRAVITY (H_2O=1)	1.978
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT, VOLATILE BY VOLUME (%)	0
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ =1)	N/A
SOLUBILITY IN WATER	Negligible		
APPEARANCE AND ODOR: Light brown or tan granular solid. Pungent odor only when hot			

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used): None	FLAMMABLE LIMITS: N/A	Lel	Uel

EXTINGUISHING MEDIA: N/A

SPECIAL FIRE FIGHTING PROCEDURES: Self contained breathing equipment should be worn by personnel in the area.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Products from combustion may contain hydrogen chloride and other toxic substances.

(Continued on reverse side)

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE: 0.5 mg/M^3

EFFECTS OF OVEREXPOSURE: Causes irritation to skin or respiratory tract. Can be absorbed through skin. Harmful if swallowed.

EMERGENCY AND FIRST AID PROCEDURES: Wash exposed areas with soap and water. If swallowed, induce vomiting and contact physician.

SECTION VI - REACTIVITY DATA

STABILITY			CONDITIONS TO AVOID
	UNSTABLE		
	STABLE	X	

INCOMPATABILITY (Materials to avoid)

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen chloride, chlorine and other toxic substances.

HAZARDOUS POLYMERIZATION			CONDITIONS TO AVOID
	MAY OCCUR		
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Can easily be placed in bags or other containers. Toxic to fish and wildlife. Do not allow to contaminate water.

WASTE DISPOSAL METHOD: May have salvage value. Contact manufacturer.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type): Canister, dust filter

VENTILATION		
	LOCAL EXHAUST: To remove dust	SPECIAL
	MECHANICAL (General)	OTHER

PROTECTIVE GLOVES	EYE PROTECTION
Rubber	Safety glasses-goggles-face shield

OTHER PROTECTIVE EQUIPMENT: Rubber suit and shoes.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Avoid breathing dust or vapors and contact with skin.

OTHER PRECAUTIONS: Keep dry.

SAFETY RULES FOR HANDLING
PENTACHLOROPHENOL AND ITS SOLUTIONS

WARNING: Pentachlorophenol is a toxic pesticide chemical! Keep out of reach of children! It may be fatal if inhaled, swallowed, or absorbed through the skin! In handling the dry chemical or its solutions, the following rules must be used and enforced:

1. Do not breathe dust, vapors or mist. Use respiratory protection.

2. Avoid skin contact with dust or solutions. Keep well covered with clean clothing, gloves and shoes. Change clothing when it becomes contaminated.

3. Do not get dust or mist in eyes. Wear goggles during handling operations.

4. Wash thoroughly at the end of each handling operation, especially prior to eating, drinking or smoking. Bathe or shower daily. Change clothing at end of shift before going home.

5. Read and understand all warnings and instructions for use which appears on the label. Ask for explanation of anything you do not understand.

6. Read and understand the information on the Material Safety Data Sheet supplied by the manufacturer. Ask for explanation of anything you do not understand.

PERSONAL HYGIENE PRACTICES
PENTACHLORPHENOL PRODUCTION

a. At the start of each shift, dress in freshly laundered work clothing. This includes a complete attire of long sleeve coveralls, underwear, stockings and gloves.

b. During the work day, anytime that clothing becomes grossly contaminated, it should be removed as soon as feasible, a shower taken and clean clothing used for redressing.

c. At the end of each shift, all clothing, including underwear and stockings should be placed into an impermeable labeled container for subsequent laundering.

d. All work clothing should be laundered in the plant or by a suitable commercial laundry, experienced in handling contaminated work clothing.

e. At the end of each shift, each man should thoroughly shower.

f. A dual-locker system should be employed to segregate street from work clothing.

g. No work clothing should be taken outside the plant fence.

h. Rubbers should be worn over work shoes while in the production areas and removed before entering office, locker and lunchrooms.

i. A smock should be worn or contaminated work clothing should be changed to clean clothing before entering the lunchroom.

j. Hands and face should be thoroughly washed before using the restroom facilities, eating, smoking or entering a lunchroom.

k. Lunchroom facilities should be separated from the locker room.

l. Smoking and food should not be allowed in production areas where pentachlorophenol is being used.

GENERAL INFORMATION ABOUT PENTACHLOROPHENOL:

Pentachlorophenol, commonly called penta, like other chemicals that possess biological activity, will cause discomfort, actual harm to the body and even death unless it or the formulations made from it, are handled properly. Penta and its formulations have been used industrially since the late 1930's. No health problems have been encountered in its use where proper procedures for handling were practiced. Good personal hygiene is one of your best protections against exposure to and possible poisoning by penta.

Penta can enter the body by ingestion, inhalation or skin absorption. In addition, penta and its solutions are very irritating to the eyes. Goggles or face shield are the best protection. Penta in the eye should be washed out immediately with flowing water. Continue washing for about 15 minutes.

Ingestion of penta will most likely occur while eating or drinking. For this reason, always keep food out of the work area. You must always wash face and hands before eating.

Inhalation can occur when penta gets in the air, either as dust or as vapors given off by a hot solution or by hot freshly treated material. The lungs pass the oxygen you breathe directly into the bloodstream and they can pass chemicals, too. This makes breathing the most direct way of getting penta into the blood. Once there, it is carried to all parts of the body where it can cause damage. The body organs most readily affected are the liver and kidneys. Respiratory protection should be used

when there is a danger of inhalation. If you are a smoker, do not carry cigarettes around in the work area because they can become contaminated. Keep them in a locker with your street clothes. Wash your hands before smoking, because the heat of the cigarette can vaporize the penta thus allowing it to pass directly to your lungs.

HOUSEKEEPING: Like personal hygiene, housekeeping is an extremely important factor in working safely with a pesticide. If penta gets on a switch, doorknob or on a valve handle, you can be sure it will get on some worker's hands and be transferred to his mouth, eyes, and other exposed body areas. If it gets spilled on the floor it will be picked up on shoes and tracked to locker rooms, lunch rooms and elsewhere. Eventually it will be stirred up and end up in the air you breathe.

Good housekeeping means not leaving a pile of penta or a puddle of solution on the floor until the end of the day before cleaning it up. Your own safety and health depend on cleaning up the mess as soon as it appears and then fixing any leak that caused the spill. If you clean up dry penta with a broom, do so very cautiously so as not to stir up a lot of dust. The best system to use is a vacuum fitted with a special filter. Always check with your supervisor about the cleanup method for large spills. Don't forget to protect yourself with proper safety apparel during the cleanup procedure.

WASTE DISPOSAL: After you have cleaned up equipment or spills of penta you then will have the problem of getting rid of the waste. Pesticide wastes should not be thrown out onto a rubbish heap or poured down a sink. Approved disposal methods will vary with locality. Your supervisor should be aware of local regulations and restrictions. The disposal of bags, drums, boxes or other containers in which penta was packaged is subject to the same regulations.

3/7/78