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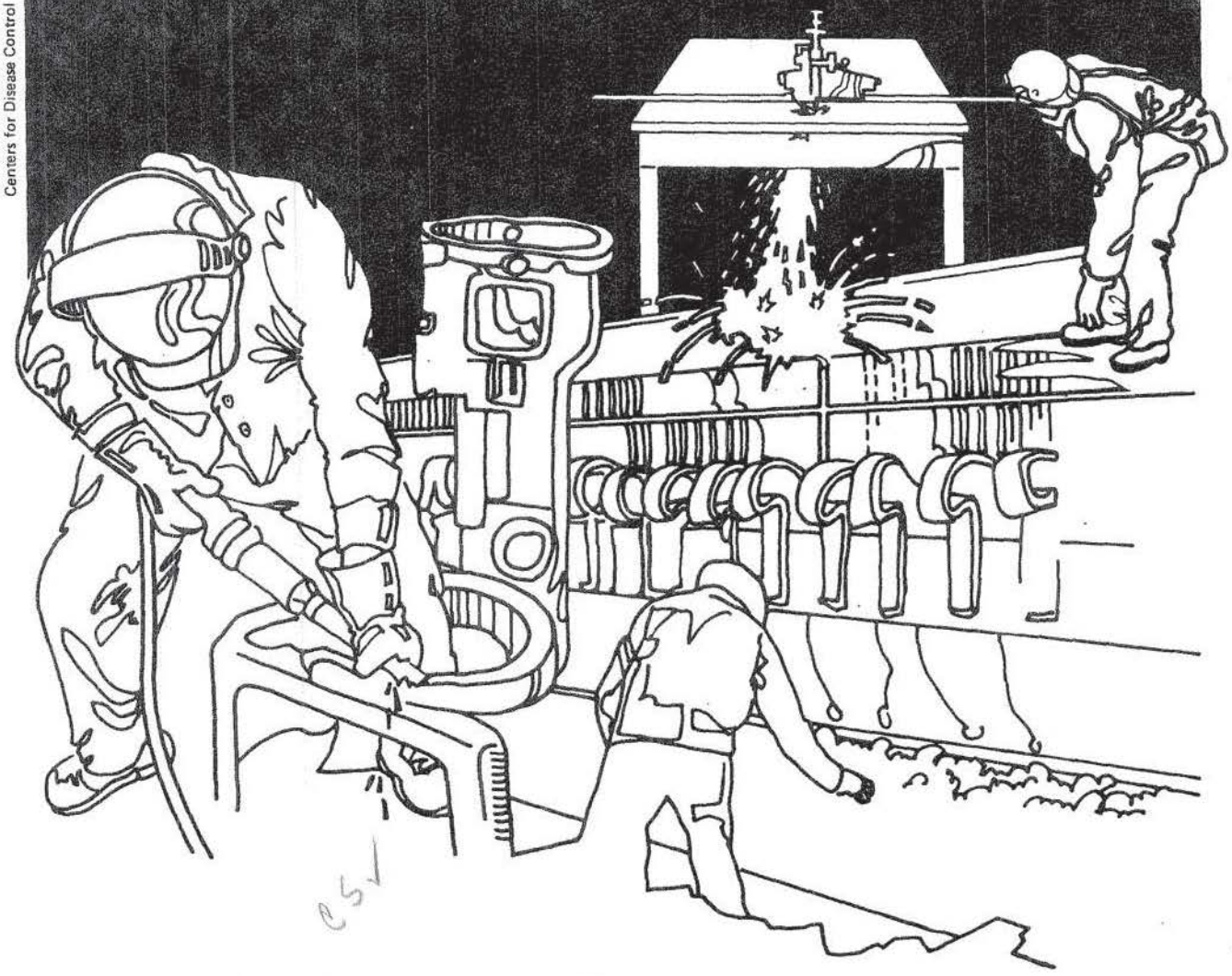

Health Hazard Evaluation Report

HETA 80-147-1076
CALHIO CHEMICAL COMPANY
PERRY, OHIO

HETA 80-147-1076
MARCH 1982
CALHIO CHEMICAL COMPANY
PERRY, OHIO

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I. SUMMARY

On May 5, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the United Steelworkers of America to evaluate occupational exposures of approximately 60 workers employed in fungicide production at the Calhio Chemical Company, Perry, Ohio. Workers were potentially exposed to materials including Captan®, Folpet®, perchloromethylmercaptan, phthalimide, tetrahydrophthalimide, iodine, chlorine, carbon tetrachloride, and carbon disulfide. The request listed hypertension, tumors, lethargy, respiratory problems, kidney disease, vascular disease, gastrointestinal disorders, and skin and eye damage as symptoms which prompted this request. On June 18, 1980, NIOSH investigators initiated a combined environmental/medical evaluation with a walk-through survey. On August 12 to 14, 1980, personal and area environmental samples were collected for the substances listed above. Plant employees were interviewed and administered a medical questionnaire.

Concentrations of Folpet ranged from nondetectable to 4.1 milligrams per cubic meter (mg/cu meter). Phthalimide concentrations ranged from nondetectable to 0.8 mg/cu meter. Tetrahydrophthalimide concentrations ranged from nondetectable to 0.5 mg/cu meter. The limit of detection for each was approximately 0.1 mg/cu meter. For the purposes of this evaluation, the recommended maximum concentration for these compounds is 5 mg/cu meter. A trace (<5 parts per million) of carbon disulfide was detected on one short-term, detector tube, area sample. None of the other compounds were present in measurable concentrations.

Among 66 current or former employees interviewed, 13 had a history of hypertension; 6 had a history of heart attack, congestive heart failure, or cardiac arrythmia; 10 reported acute bronchitis; and 2 each reported chronic bronchitis and pneumonia. Other reported illnesses were intestinal ulcers (5 cases), tumor or cancer (4 cases), diabetes (3 cases), kidney stones (1 case), and caustic burns of the eyes (1 case). The acute symptoms which were reported are nonspecific and not necessarily related to occupational exposure, although the most commonly reported symptoms involved eye irritation, which is typical of exposure to Captan and Folpet.

Based on the results presented in this report, NIOSH concludes that employees at the Calhio Chemical Company were not overexposed to any materials in their work place during the days of this evaluation. With the exception of one person, an employee dumping material to be reworked, most environmental exposures were an order of magnitude below the recommended criteria. Illnesses reported during the course of the medical portion of this evaluation do not appear in greater numbers or at earlier ages than one would expect in the general population.

KEYWORDS: SIC 2879 (Pesticides and Agricultural Chemicals), Captan®, Folpet®, perchloromethylmercaptan, phthalimide, tetrahydrophthalimide, iodine, chlorine, carbon tetrachloride, carbon disulfide, fungicide

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970, NIOSH investigates the toxic effects of substances found in the work place. On May 5, 1980, a request was received from a representative of the United Steelworkers of America, District 28, Local Union 13860, to conduct such an investigation at the Calhio Chemical Company plant in Perry, Ohio. A previous health hazard evaluation conducted at this facility (Report No. 74-93-296, June 1976) found "no evidence of an excessive incidence of chronic disease in workers ... which could be associated with any of the substances in use." The request for a second evaluation expressed concern about exposure of the approximately 60 employees of this plant to Captan (N-[(trichloromethyl)thio]-4-cyclohexene-1,2-dicarboximide), Folpet (N-[(trichloromethyl)thio]phthalimide), perchloromethylmercaptan (PMM), and tetrahydrophthalimide (imide), stating that the union had noticed a "rise in a wide range of illnesses believed to be caused by long- and short-term exposures on the job" as a result of process changes since the initial evaluation. These illnesses included hypertension, tumors, lethargy, respiratory problems, kidney damage, vascular disease, gastrointestinal disorders, and skin and eye damage.

An initial visit was made to the plant on June 18, 1980, to discuss the request and ensuing evaluation with company and union representatives and to conduct a walk-through survey, during which NIOSH representatives observed the various manufacturing processes, collected bulk samples of some compounds for subsequent laboratory testing, and made spot measurements of volatile materials using a photoionization analyzer. On July 28, 1980, a letter was sent to both company and union, summarizing the work done on June 18 and presenting toxicity information requested during that visit.

On August 12 to 14, 1980, a combined environmental/medical evaluation was conducted. Environmental samples were collected for Folpet, Captan, phthalimide, tetrahydrophthalimide, perchloromethylmercaptan, carbon tetrachloride, carbon disulfide, mercaptan, and chlorine. Employees were interviewed regarding work history and health problems. The results of the environmental portion were presented by letter to the company and union on December 31, 1980, with medical results sent to both on January 14, 1982.

III. BACKGROUND

Calhio Chemical Company produces two fungicides: Folpet and Captan. At the time of the initial visit in June 1980, the plant was manufacturing only Captan, which is the major product of this facility. Captan is produced by reacting the sodium salt of tetrahydrophthalimide with perchloromethylmercaptan (PMM). Folpet, which was being manufactured during the August 1980 visit, is produced

by reacting the sodium salt of phthalimide (PI) with PMM. Both products are filtered, dried, and packed in 50-pound bags for shipment.

The PMM for manufacture of either fungicide is prepared in batch reactors by chlorinating carbon disulfide in the presence of an iodine catalyst. In addition to the raw materials, sulfur monochloride and carbon tetrachloride are produced as by-products in the reactors. The PMM is separated from the waste sulfur chlorides by distillation.

The manufacturing process occurs predominantly in a closed system and exposure occurs primarily as the result of process leaks, accidental spills, or maintenance work. Three sample points are available for obtaining process samples for quality control purposes. Each sample point is equipped with local exhaust ventilation. There is also a bagging station for the final products equipped with local exhaust ventilation. Maintenance work was being performed in several locations during the evaluations; this type of work may result in nonroutine exposure to some workers, especially mechanics and their helpers.

The employees with the highest potential exposures to toxic materials, notably the baggers and the employee who was opening and dumping material for reworking, are provided with powered air-purifying helmets, which provide a flow of filtered air in front of the workers face.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Subsequent to the receipt of this request in May 1980, the NIOSH project officer contacted the requester and the company to obtain information regarding materials and processes of interest. A computer search was made for information on the toxicity of Captan, Folpet, phthalimide, imide, and PMM. On June 18, 1980, a visit was made to the plant to obtain additional information on operational parameters and discuss the conditions of the evaluation with representatives of management and labor. This discussion and the ensuing observations throughout the plant resulted in the development of a list of materials considered to be the most probable sources of toxic exposures. Listed below are the substances for which environmental measurements were made, along with the sampling and analytical method used for their measurement. Both personal and area samples were collected. In some cases, one sample could be analyzed for two or more compounds.

Short-term area monitoring was made using a photoionization analyzer with an ionization potential of 11.7 electron volts. Small bulk samples (approximately 20 ml) of Folpet, Captan, PI, and imide were collected and forwarded to the NIOSH Division of

Physical Science and Engineering for use in development and testing of sampling and analytical methods for these materials.

IODINE---Samples were collected on charcoal impregnated with potassium hydroxide at a flow of 100 cc/minute using a battery-powered sampling pump for up to 6 hours. Analysis was by ion chromotography.

FOLPET, CAPTAN, PHTHALIMIDE, TETRAHYDROPHTHALIMIDE---These four compounds were collected simultaneously on mixed cellulose acetate filters in series with Chromosorb W sorbent tubes. Airflow was 1.0 liter per minute (lpm) for approximately a full work shift. The filters were analyzed by high-pressure liquid chromotography. The sorbent tubes were analyzed by gas chromatography for Folpet and Captan, since any PI or imide present would be quantitatively collected on the filters. (This method is being written for inclusion in a future volume of the NIOSH Manual of Analytical Methods.)

PERCHLOROMETHYLMERCAPTAN---This substance was sampled on activated charcoal (100 cc/minute for full shift), but the analytical method proved to be inadequate. An attempt was made to develop an acceptable sampling/analytical method, but this proved to be beyond the scope of this evaluation. Therefore, PMM samples were not analyzed and no PMM results were reported.

MERCAPTANS, CARBON TETRACHLORIDE, CARBON DISULFIDE, CHLORINE---Length-of-stain detector tubes were used to make short-term measurements of these compounds at locations where they would be expected to be found in highest concentrations.

AIR VELOCITY---Measurements of air velocity at points of local exhaust ventilation were made using a thermal anemometer.

B. Medical

The medical evaluation consisted of personal interviews conducted by a NIOSH physician and occupational health nurse. Information was obtained via a standardized questionnaire. The questionnaire included questions on demographics and use of cigarettes and alcohol, directed questions about occurrence of acute symptoms during the previous day's work shift, and directed questions regarding past history of several illnesses about which employees had expressed concern. Local union officials had notified employees prior to the NIOSH visit to maximize participation in the survey. Several current employees who were absent during the survey and retired employees whose names were provided by union officials were contacted by telephone and interviewed with the same questionnaire.

V. EVALUATION CRITERIA

Various criteria proposed by NIOSH, OSHA, and the American Conference of Governmental Industrial Hygienists (ACGIH) for airborne concentrations of the chemicals measured in this evaluation are listed in Table I of this report for those compounds with established levels. These criteria are the maximum concentrations of each substance to which most individuals can be exposed for 8 hours per day or 40 hours per week (or for other durations where indicated) without adverse health effects. In most cases, the occupational exposure limits are the same from each reference, but in those cases where there is a difference, the NIOSH recommended standard or the most stringent value is the criteria used for the purposes of this evaluation. Table I also lists the major health effects or sites of action of those chemicals.

At the present time, there are no established criteria for Folpet, PI, or imide. A brief review of the toxicity of these compounds plus Captan and PMM are given below.

FOLPET is reported to have a low acute toxicity via skin absorption, inhalation, and ingestion, and to cause some irritation. Rats and dogs show a high tolerance to long-term exposure by ingestion. Tests for carcinogenic potential in mice, rats, and dogs has proved negative.[8]

CAPTAN also has a low acute toxicity via skin, inhalation, and ingestion, although it has been shown to be an irritant and a moderate skin sensitizer in guinea pigs. A 2-year ingestion study in rats showed a reduction in weight gain at high concentrations, but no signs of systemic toxicity. There is insufficient evidence to conclude that either Captan or Folpet is teratogenic or carcinogenic. Tests for mutagenic potential have shown an ability to produce gene mutations in some systems, although not universally.[8] Exposure studies on the teratogenic effect of Captan and Folpet have not been conclusive.[9] Amounts up to 100 ppm Captan and 50 ppm Folpet are allowed in harvested food.

PHTHALIMIDE and TETRAHYDROPHTHALIMIDE are metabolites of Folpet and Captan, and as such probably have no greater systemic toxicity than their precursors. The ACGIH recommends a threshold limit value of 5 mg/cu meter for Captan.[3] For the purposes of this evaluation, this value would seem appropriate to apply to Folpet, PI, and imide as well.

PERCHLOROMETHYLMERCAPTAN is a strong eye, throat, and chest irritant at low concentrations and can also cause nausea. Pulmonary edema followed by death in mice and cats has been reported following 15-minute exposure at 45 ppm.[3] The ACGIH recommends a threshold limit value of 0.1 ppm.

VI. RESULTS AND DISCUSSION

A. Environmental

Photoionization measurements made on June 18, 1980, failed to detect the presence of any volatile material (ionization potential 11.7 electron volts). Measurement of personnel exposures made during the August visit indicated no overexposure of employees to tetrahydrophthalimide, phthalimide, Folpet, Captan, iodine, carbon tetrachloride, mercaptan, carbon disulfide, or chlorine on the days when these samples were taken. Tables II and III, attached, show the results for tetrahydrophthalimide, phthalimide, and Folpet, and the results of direct reading (length-of-stain) detector tubes, respectively. The chromatograms of the 24 samples listed in Table II were also inspected to determine if Captan was present, even though it was not being produced at the time of the evaluation. As would be expected, all were below the limit of detection for the analytical method (approximately 0.1 mg of Captan per cubic meter of air).

In addition to the samples listed in the attached tables, three samples were also taken for iodine: one on the day-shift relief operator on August 13th, one area sample near the R 6 filter wheel on August 14th, and one in the PMM area near the top of the C 1 reactor on August 14th. All three were approximately 7 hours duration and all were below the limit of detection of the analytical method (approximately 20% of the maximum recommended environmental level of 0.1 ppm).

Ventilation measurements made in the packing area at the bag-filling station showed air velocities in the capture plane ranging from 400 to 700 feet per minute (fpm) and up to 3,000 fpm at the duct entry. Airflow at the bag flattener was 75 to 150 fpm. These velocities appear adequate both from the point of providing adequate protection (packers' exposures were consistently 0.3 mg Folpet/cu meter), and from the point of proper recommended design criteria. (The ACGIH[10] recommends a capture velocity range of 200 to 500 fpm for active generation of contaminant into zone of rapid air motion.) In addition, general room air movement up to 100 fpm was measured, resulting from natural currents through open doorways and fans.

The air velocity in the hood, where the employee was dumping material to be reworked, had a face velocity ranging from 50 to 150 fpm. The flow on the left side of that hood was consistently lower (range 50 to 75 fpm) than the center (100 to 150 fpm) or the right side (100 to 150 fpm). The hood would appear to be marginally acceptable from the values of the face velocity (a velocity of 150 fpm is recommended).[10] The exposure of the employee at this work station is also consistently the highest of any person monitored.

If the Folpet, PI, and imide exposures are considered additive, as they might well be since their biologic effects are similar, the average exposure for the 2 days samples is almost 5 mg/cubic meter (disregarding the effects of the air-purifying helmet). This would be near the exposure established as a criteria for this evaluation. This increased exposure is probably due to either the dust created before the material is dumped into the hood or to a swirling effect, which throws dust back out of the hood into the employees breathing zone, or both.

B. Medical

Sixty-six current and two former employees were interviewed. They included 58 men (55 white, 3 black) and 8 women (7 white, 1 black). Their mean age was 41 years (20 to 64) and mean duration of employment at Calhio was 6.8 years (range <1 to 26).

Acute Symptoms

Table IV shows the frequency of symptoms which were reported to have developed during the previous day's work shift. There were four symptoms (burning eyes, itching eyes, tearing of eyes, and nasal irritation) reported by more than 10% of those interviewed. Although these symptoms are nonspecific, they can be caused by exposure to either Captan, Folpet, or perchloromethyl mercaptan.

We attempted to determine if the incidence of these acute symptoms was different among smokers (n=33) than among nonsmokers (n=26). Thirteen (39%) of the smokers and 11 (42%) of the nonsmokers reported symptoms of eye or mucous membrane irritation (X^2=0.05, p>0.5). Ten of the smokers (30%) and four of the nonsmokers (15%) reported chest discomfort or respiratory symptoms (p>0.2, Chi Square 2X2 test). The difference between smokers and nonsmokers is not statistically significant for either of these categories of symptoms.

History of Illnesses

The original hazard evaluation request mentioned concern that several cardiovascular, respiratory, intestinal, and other diseases among employees could be related to occupational exposures. We attempted to evaluate this problem by asking each interviewee about a history of the illnesses that were mentioned in the original request. To evaluate for possible work-relatedness of disease, we included only those diseases with onset after the person had begun work at Calhio.

The most commonly reported illnesses were cardiovascular and respiratory problems.

1. Cardiovascular Disease

Thirteen employees had a history of hypertension. They included 10 white males, one black female and two white females. Their mean age was 51 years (range 32 to 62). Three were current smokers and one was a former smoker. ("Former smokers" included persons who had stopped smoking within the past 5 years. Persons who had stopped smoking at least 5 years ago or who had never smoked were included together as "nonsmokers".)

Six employees had a history of myocardial infarction (heart attack), congestive heart failure, or cardiac arrythmia. Their mean age was 56 years (range 40 to 58); all were white males. Five of these persons had a history of hypertension, one was a current smoker and one was a former smoker.

2. Respiratory Disease

Ten employees had a history of acute bronchitis. Their mean age was 44 years (range 23 to 58). Five of them were current smokers and eight had a history of chronic bronchitis. One individual, who was not a smoker, reported having developed acute and chronic bronchitis and bronchial asthma after starting work at the plant; that person had no prior history of respiratory disease.

In addition, there were two persons who had a history of chronic bronchitis and two with a history of pneumonia. These four persons were all smokers.

3. Other Diseases

After cardiovascular and respiratory diseases, the most commonly reported illness was intestinal ulcers. Five employees had a history of ulcer disease; all were white males; three were smokers. Their mean age was 55 years (range 52 to 56).

Four employees reported a tumor or cancer which was diagnosed after starting work at the plant. These included: one person with thyroid cancer, one person with vocal cord cancer, one person who had two benign breast tumors, and one person who had a benign bone tumor and a benign tumor in the neck.

Other illnesses which were reported included diabetes (3 persons), kidney stones (one person), and caustic burns of the eyes (one person).

The acute symptoms which were reported are nonspecific and not necessarily related to occupational exposure. It is noteworthy, however, that the most commonly reported symptoms involved eye irritation, which is typical of exposure to Captan or Folpet. (Folpet was being produced when the survey was done.) Furthermore, there was no statistically significant difference in the incidence of symptoms between smokers and nonsmokers, suggesting that the symptoms were not solely due to irritation from cigarette smoke. Thus it seems likely that chemical exposure was responsible for at least some of the reported symptoms.

The cardiovascular and respiratory diseases reported most commonly among Calhio employees are relatively common diseases in the general population. Intestinal ulcers, thyroid cancer, and benign breast tumors are also found fairly frequently in the general population. It does not appear that the reported illnesses are occurring in greater numbers or at earlier ages than one would expect in the general population.

There are several problems which make it difficult to draw firm conclusions about work-relatedness of these illnesses among the employees. The population we interviewed included virtually all then-current production employees but only two former employees. Thus the population interviewed did not include a representative sample of former employees, who may have had a long history of occupational exposure before leaving the company, and whose history of health or illness after leaving is unknown. The size of the population (66) may be so small that increases in illnesses related to occupational exposures would be difficult to detect. It appears that at least one of the employees developed a chemical bronchitis after starting work at the plant, but it is often difficult to make valid statistical associations between exposures and outcomes in small populations.

VII. RECOMMENDATIONS

Exposures should be kept to a minimum through the continued use of control technology. Employees should be further protected by use (when necessary) of protective glasses or goggles, dust masks, and respirators. All production-line employees should be instructed in the need and proper use of such protective equipment.

The continuing effort of the parent company, Stauffer Chemical, in its medical-monitoring program is encouraged.

Periodic observations and measurements should be made of various work practices, starting with the rework-dumping operation, to assure continued safe and healthful work conditions.

VIII. REFERENCES

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. United Steelworkers of America, Local 13860
2. United Steelworkers of America, Pittsburgh, Pennsylvania
3. Calhio Chemical Company, Valley City, Ohio
4. NIOSH, Region V
5. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

Summary of Exposure Limits* and Health Effects
for Substances Measured at Calhio Chemical Company

HETA 80-147

SUBSTANCE	OSHA PEL**	ACGIH TLV***	NIOSH RECOMMENDATION	HEALTH EFFECTS	REFERENCE
Captan	----	5 mg/cu meter	----	Irritant Effects	3
Perchloromethylmercaptan	0.1 ppm	0.1 ppm	----	Eyes, respiratory system, liver, kidney, skin	3,4
Carbon Tetrachloride	10 ppm, 25 ppm ceiling, 200 ppm acceptable maximum peak above ceiling for 5 minutes in any; 4 hours	5 ppm 20 ppm STEL	2 ppm (1-hour sample)	CNS, eyes, lungs, liver, kidney, skin, cancer suspect agent	4,5
Carbon Disulfide	20 ppm, 30 ppm Ceiling, 100 ppm acceptable maximum peak above ceiling for 30 minutes	10 ppm skin	1 ppm	CNS, PNS, CVS, eyes, kidneys, liver, skin	4,6
Chlorine	1 ppm	1 ppm, 3 ppm STEL	0.5 ppm Ceiling (15 minutes)	Lungs, respiratory system	4,7
Iodine	0.1 ppm Ceiling	0.1 ppm Ceiling	----	Respiratory system, eyes, skin, CVS, CNS	4

* Limits are 8-hour time-weighted averages unless otherwise stated.
** For OSHA standards, see Reference No. 2.
*** For ACGIH TLV's, see Reference No. 3.

TABLE II

Tetrahydrophthalimide (Imide), Phthalimide (PI), and Folpet Concentrations

Calhio Chemical Company
Perry, Ohio
HETA 80-147

August 13-14, 1980

LOCATION	DAY	DURATION	CONCENTRATION (mg/m^3) THPI	PI	FOLPET
Shift Mechanic	8/13	0750 - 1430	<0.1	<0.1	<0.1
Mechanic, Deep Well Area	8/13	0800 - 1415	<0.1	<0.1	<0.1
Maintenance	8/13	0810 - 1450	<0.1	<0.1	<0.1
Janitor	8/13	0825 - 1425	<0.1	<0.1	<0.1
Dumping Rework	8/13	0830 - 1425	0.5	0.5	4.1
Packer	8/13	0720 - 1435	<0.1	<0.1	0.3
Packer	8/13	0720 - 1435	<0.1	<0.1	0.3
Relief Operator	8/13	0730 - 1450	<0.1	<0.1	1.9
Relief Operator	8/13	0740 - 1425	<0.1	0.4	<0.1
R 4 Operator	8/13	0745 - 1425	<0.1	0.3	<0.1
Relief Operator	8/13	0745 - 1425	<0.1	<0.1	<0.1
Area Sample, Near Bagging Operation	8/13	0900 - 1445	0.1	0.1	0.7
Area Sample, Near Bagging Operation	8/13	0900 - 1445	0.1	0.1	1.4
Packer	8/14	0720 - 1355	<0.1	<0.1	0.3
Packer	8/14	0720 - 1355	<0.1	<0.1	0.3
Tank Farm Operator	8/14	0730 - 1355	<0.1	<0.1	<0.1
PMM Operator	8/14	0740 - 1355	<0.1	<0.1	<0.1
R 4 Operator	8/14	0740 - 1415	<0.1	0.3	<0.1
Shift Mechanic	8/14	0745 - 1320	0.2	0.2	0.4
Maintenance Man, R 4 Area	8/14	0750 - 1425	<0.1	<0.1	0.3
Maintenance Man, All Plant	8/14	0800 - 1355	<0.1	<0.1	<0.1
Dumping Rework	8/14	0805 - 1355	0.6	0.8	3.2
Area Sample, Near R 6 Filter Wheel	8/14	0815 - 1355	<0.1	0.3	<0.1
Area Sample, Near Top of C 1 Reactor	8/14	0825 - 1350	<0.1	<0.1	<0.1

TABLE III

Detector Tube Samples

Calhio Chemical Company
Perry, Ohio
HETA 80-147

August 13-14, 1980

SUBSTANCE	LOCATION	DAY	TIME	RESULTS
Mercaptan	Package Area	8/13	1115	N.D.*
Carbon Tetrachloride	Package Area	8/13	1115	N.D.
Mercaptan	Dumping Rework	8/13	1130	N.D.
Carbon Tetrachloride	Dumping Rework	8/13	1130	N.D.
Mercaptan	R 6 Area	8/13	1140	N.D.
Carbon Tetrachloride	R 6 Area	8/13	1140	N.D.
Carbon Disulfide	R 6 Area	8/13	1140	N.D.
Carbon Disulfide	PMM Area	8/13	1400	Trace (<5 ppm)
Mercaptan	PMM Area	8/13	1400	N.D.
Mercaptan	Packing Area	8/14	0945	N.D.
Mercaptan	R 6 Area	8/14	1000	N.D.
Carbon Disulfide	R 6 Area	8/14	1000	N.D.
Chlorine	PMM Area	8/14	1015	N.D.
Carbon Disulfide	PMM Area	8/14	1015	N.D.

* N.D. = None Detected

TABLE IV

Symptoms Reportedly Developed During Previous Day's Work Shift
Results of August 12-13, 1980, Interview Survey

Calhio Chemical Company
Perry, Ohio
HETA 80-147

SYMPTOM	NUMBER (%) OF EMPLOYEES REPORTING
Dry Throat	6 (9.7)
Sore Throat	2 (3.2)
Burning Eyes	14 (22.6)
Itching Eyes	7 (11.3)
Tearing of Eyes	9 (14.5)
Nasal Irritation	10 (16.1)
Nasal Discharge	5 (8.1)
Chest Discomfort	3 (4.8)
Coughing	6 (9.7)
Wheezing in Chest	1 (1.6)
Shortness of Breath	5 (8.1)
Difficulty Breathing	1 (1.6)
Nausea/Vomiting	0 (---)
Headache	5 (8.1)
Dry/Irritated Skin	4 (6.5)
Skin Rash	2 (3.2)

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