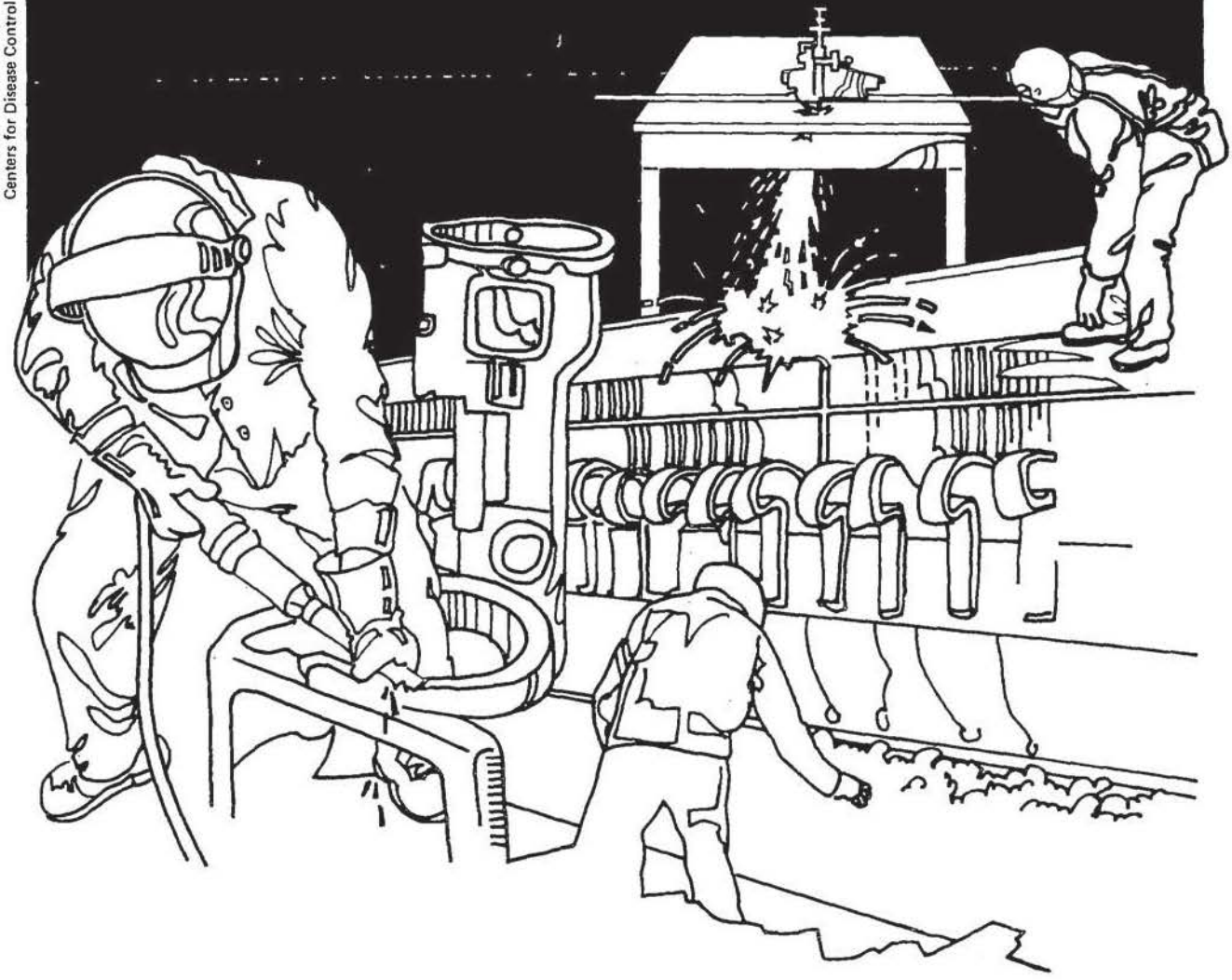
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 82-281-1503
STAUFFER CHEMICAL COMPANY
MORRISVILLE, PENNSYLVANIA

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 82-281-1503
SEPTEMBER 1984
STAUFFER CHEMICAL COMPANY
MORRISVILLE, PENNSYLVANIA

NIOSH INVESTIGATORS:
Walter Chrostek
Denise C. Murphy, Dr. PH

I. SUMMARY

In June 1982, the National Institute for Occupational Safety and Health (NIOSH) was requested to conduct a health hazard evaluation of working conditions at the Stauffer Chemical Company, Morrisville, Pennsylvania. The request stated that as a result of exposures to phosphorus pentasulfide, phosphorus trichloride, sodium acid pyrophosphate (SAPP), chlorinated trisodium phosphate, and phosphoric acid, the employees were experiencing health problems including rashes, eye irritation, headaches, respiratory problems, and nose bleeds.

A site visit on July 28-30, 1982, included a walk-through survey, self-administered health questionnaires, interviews of select employees and a review of medical records and death certificates. On October 19-21 and 27, 1982, environmental air sampling was done for several air contaminants (following paragraph).

Of two air samples for arsenic, four for phosphoric acid, and two for hydrochloric acid, all were below the laboratory limit of quantitation. One air sample for hydrogen sulfide was 1.5 ppm compared to the NIOSH recommendation of 10 ppm. Five air samples for sodium acid pyrophosphate ranged from 0.28 to 10.8 mg/m^3 with a mean of 2.9 mg/m^3 (eliminating one unrealistically high sample of 81 mg/m^3). Three air samples for chlorinated trisodium phosphate (ClTSP) ranged from 0.47 mg/m^3 to 3.9 mg/m^3 with a mean of 2.7 mg/m^3. Since the SAPP and the ClTSP are alkaline, the evaluation criteria of 10 mg/m^3 for nuisance dusts is not appropriate.

The questionnaire responses, personal interviews, record reviews, and consultation with company physicians did not indicate a serious acute health problem. The major symptom was shortness of breath in 17% of 64 production and maintenance workers but smoking histories and underlying pulmonary problems were not studied. Nine (14%) of the 64 production and maintenance workers reported burns from splashed chemicals and welding. Three of four cancer deaths were from lung cancer, but all four deceased workers had long-term histories of cigarette smoking.

Although there are no exposure standards for sodium acid pyrophosphate or chlorinated trisodium phosphate, the exposures may be sufficient to cause or contribute to employee reports of irritation and shortness of breath. Recommendations are included in this report.

KEYWORDS: SIC 2819 (Industrial Inorganic Chemicals), phosphoric acid, phosphorus pentasulfide, chlorinated trisodium phosphate, hydrogen sulfide, arsenic, rashes, skin and eye irritation, headaches, respiratory problems, sodium acid pyrophosphate.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970, NIOSH investigates the toxic effects of substances found in the workplace. On May 27, 1982, a request was submitted by Teamsters Local 929 expressing concern that as a result of exposure to such chemicals as sodium acid pyrophosphate, chlorinated trisodium phosphate, phosphorus pentoxide, and phosphoric acid, the employees were experiencing adverse health effects (specifically, skin rash, eye and respiratory irritation, headaches, and nose bleeds). In response to this request, a site visit was made to the plant during July 28-30, 1982. Activities included an opening and closing conference, a walk-through of the facility, distribution and collection of self-administered questionnaires, personal interviewing of selected workers, and review of available medical records. Environmental sampling was conducted during October 19-21, 1982, and on October 27, 1982. Interim reports were distributed to company officials and union stewards in August and December of 1982.

III. BACKGROUND

Stauffer Chemical Company, at this location, is engaged in producing phosphorus compounds from materials which are shipped from their other plants or purchased from other chemical companies. The compounds of interest during this investigation were phosphoric acid, sodium acid pyrophosphate (SAPP), phosphorus pentasulfide and chlorinated trisodium phosphate. Exposures to phosphorus trichloride could not be evaluated as this product was not being manufactured nor could management give any date when it would be. Each of the above products is manufactured and packaged in separate buildings. Operations in each building are carried out from a central control room by an operator and an assistant or helper. The basic operations are: 1) introduction of the chemicals, 2) reaction, 3) condensing, 4) drying, 5) pulverizing, 6) screening and 7) packaging.

Phosphoric acid is produced by burning elemental phosphorus with air and hydrating the resulting phosphorus pentoxide with water. Various additives are introduced to purify the acid which is made both as commercial and food grade. Phosphoric or superphosphoric acids are made here.

Although there are no medical personnel on-site, there are employees who have been certified to provide first aid on a 24-hour basis. Pre-employment and annual physical examinations are conducted on all employees. The company engages the services of a local physician, for treatment of employees when needed. This is a voluntary choice on the part of the employee. Video-taped health and safety training films, and extensive personal protective equipment are available (and in some cases, mandatory) to all employees.

IV. EVALUATION METHODS

A. Environmental

Phosphorus pentasulfide - This material is very hydroscopic and liberates hydrogen sulfide and phosphoric acid.

Hydrogen sulfide - General area air sampling for hydrogen sulfide was done with long term detector tubes and a pump operating at 5.3 cc/min.

Phosphoric acid, hydrochloric acid - Air samples were collected on acid sorbent tubes with personal sampling pumps operating at 200 cc/min. These samples were analyzed by ion chromatography (NIOSH Method P&CAM 339).[1]

Arsenic - Personal and area air samples were collected on cellulose ester filters with personal sampling pumps operating at 2 lpm. These samples were analyzed for elemental arsenic by atomic absorption spectroscopy (NIOSH Method S-309).[1]

Sodium acid pyrophosphate - Personal breathing zone air samples were collected on pre-weighted, polyvinyl chloride filters with personal sampling pumps operating at 2 lpm. These samples were analyzed gravimetrically (NIOSH Method 29.02).[1]

Chlorinated trisodium phosphate - Personal breathing zone air samples were collected on pre-weighted, polyvinyl chloride membrane filters and analyzed gravimetrically (NIOSH Method 29.02).[1]

B. Medical

A self-administered questionnaire was designed prior to the plant visit. The questions were based on plant processes, raw materials, chemical end products, and related health effects. In addition, demographic information on the workforce was obtained. The questionnaires were distributed to all available salaried workers (non-clerical and non-supervisory) on three shifts and five production lines, and were forwarded to about 16 employees who were laid off and not immediately accessible. The medical investigator met with groups of employees and union representatives to explain the purpose of the study and to answer any questions prior to distribution of the questionnaires.

After reviewing the completed questionnaires, twelve employees were selected for in-depth personal interviews. This selection was based on the type and frequency of reported symptoms. Four of these interviews had to be conducted by telephone the week following the on-site visit.

A review of medical records including information on cancer deaths which occurred among four former Stauffer employees was made. Copies of the forms used for pre-employment and annual physical examinations, and of the OSHA-200 reports for 1981 and 1982 were obtained.

A conference was held with a Stauffer corporate physican to discuss company policy as it pertains to the health and safety of the workforce. Also, telephone contact was made with the plant physician to determine whether he had observed any illness patterns among Stauffer employees.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criteria. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of

occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

The environmental evaluation criteria for the substances of this study follow (in those cases where there are more than one criteria for a substance, the most stringent is used):

Substance	NIOSH (TWA)*	OSHA (TWA)*	ACGIH (TWA)*
Phosphorus	-	0.1	0.1
Phosphorus Pentasulfide	-	1	1
Phosphorus Trichloride	-	3	1.5
Phosphoric Acid	-	1	1
Arsenic	0.002 (15-min)**	0.5	0.2
Sodium Acid Pyrophosphate	-	-	-
Chlorinated Trisodium Phosphate	-	-	-
Hydrogen Sulfide	10	20	10
Nuisance dust	-	15	10

*All air concentrations are in milligrams of substance per cubic meter of air (mg/m^3).

**15-minute sampling period.

B. Toxicology

Phosphorus[2,3] Fumes from yellow phosphorus, which burns spontaneously in air, are an irritant of the respiratory tract and eyes; the solid in contact with skin produces deep thermal burns; prolonged absorption of phosphorus can cause necrosis of facial bones. Signs and symptoms of over-exposure may include irritation of the eyes and respiratory tract, abdominal pain, nausea, jaundice, anemia, pain and loosening of teeth, excessive salivation, pain and swelling of the jaw, skin, and eye burns.

Phosphorus pentasulfide[2,3,4] is an irritant of the eyes and skin. In the presence of moisture, it liberates hydrogen sulfide gas and phosphoric acid. In low concentrations, hydrogen sulfide may cause headache, fatigue, irritability, insomnia, gastrointestinal disturbances, and irritation of eyes and respiratory tract. In high concentrations, severe respiratory effects (paralysis, coma) may occur as well as rapid olfactory fatigue.

Phosphorus trichloride[5] is a severe irritant of the eyes, mucous membranes, and skin, and may produce severe burns. Inhalation of the vapor may cause irritation of the respiratory tract. It may produce severe breathing difficulties which may be delayed as much as a day in onset. Phosphorus trichlororide on contact with the eyes may produce severe burns with permanent eye damage. Swallowing phosphorus trichloride may produce burns of the mouth, throat, and stomach. Long term exposure by repeated inhalation of phosphorus trichloride may cause chronic cough and wheezing. In animal tests, it was also found to cause kidney damage.[6]

Phosphoric acid[2,7] mist is a mild irritant of the eyes, upper respiratory tract, and skin. The dust is especially irritating to skin in the presence of moisture. Skin and eye burns may result from splashes of concentrated solutions, while prolonged and repeated exposure may cause dermatitis.

Arsenic,[2] and compounds, are irritants of the skin, mucous membranes, and eyes. Arsenical dermatoses and epidermal carcinoma are reported risks of exposure to these compounds, as are other forms of cancer. In eight epidemiologic studies, excess lung cancer mortality was observed among worker populations with a history of exposure to inorganic arsenic compounds. In these studies, both the trivalent and pentavalent compounds have been strongly implicated as causes of lung cancer, lymphatic cancer, and skin cancer.[8,9] The NIOSH recommended exposure limit (0.002 mg/m^3 for a 15-minute sampling period) is intended to achieve the greatest, practicable reduction in worker exposure while avoiding spurious sampling results produced by natural background concentrations of inorganic arsenic.[10]

Sodium acid pyrophosphate. No toxological information is available on this compound except that when it is dissolved in water it forms an acidic solution.

Chlorinated trisodium phosphate. The label for this material states that it contains 3.25% sodium hypochlorite and 91.75% trisodium phosphate with an available chlorine of 3.09%.

Chlorine[3] reacts with body moisture to form acids. It is extremely irritating to skin, eyes, and mucous membranes, and may cause corrosion of teeth. Prolonged exposure to low concentrations may produce chloroacne.

VI. RESULTS AND DISCUSSION

A. Environmental

Phosphorus - Exposures to phosphorus were not evaluated in this study since the material is received in tank cars and pumped into holding tanks. The only exposures would result from connecting and disconnecting the tank cars, or maintenance of equipment.

Phosphorus pentasulfide - This material decomposes into hydrogen sulfide and phosphoric acid. Two employee breathing zone samples were collected for phosphoric acid. Both samples were less than 4 micrograms (ug) per sample, which was the lower limit of quantitation. One long term detector tube for hydrogen sulfide was collected at the binning operation and showed an air concentration of 1.5 ppm as compared to the evaluation criteria of 10 ppm. An investigation of the area disclosed that someone used a drum in the area for trash and the moisture in the air caused the phosphorus pentasulfide to liberate the hydrogen sulfide. This matter was immediately corrected.

Phosphoric acid - One personal sample (operator) and one area sample were taken in the acid area. Both samples were less than the laboratory limit of quantitation (4 ug/sample).

Phosphorus trichloride - Due to the low demand for this material at the time of the study, no environmental air sampling could be performed. Management could not foretell when this plant would be in operation.

Arsenic - One personal sample (operator) and one area sample were taken in the acid area. Both samples were less than the laboratory limit of quantitation (0.1 ug/sample).

Sodium acid pyrophosphate (Table 1). Five personal air samples showed air concentrations which ranged from 0.59 to 80.5 mg/m^3. There are not criteria or standards for sodium acid pyrophosphate but even considering the nuisance dust evaluation criteria of 10 mg/m^3, two of the samples (81 mg/m^3 and 11 mg/m^3) exceeded 10 mg/m^3. The calculated 8-hour TWA for the bagger on 10/21/82 would be 37 mg/m^3. It is noted that the 81 mg/m^3 is so high, the validity of the sample might be questionable. The calculated 8-hour TWA for the bagger on 10/27/82 would be 2.2 mg/m^3, but this assumes no other exposures during the work day. The chief causes for the high exposures at the bagging operation were the improper sealing of the bags by the manufacturer, poor maintenance on the local exhaust ventilation system, and dry sweeping of the materials.

There were complaints from this area of rashes and nose bleeds. Sodium acid pyrophosphate on contact with moisture gives an acidic reaction possibly resulting in the reported rashes and nose bleeds.

Chlorinated trisodium phosphate - Three breathing zone air samples ranged from 0.47 to 3.9 mg/M^3 (Table 2). There are no standards for this material. The label states that the available chlorine is 3.09%. The concentrations of chlorine in the airborne dust would range from 0.01 to 0.12 mg/M^3 as compared to the NIOSH criteria of 1.5 mg/M^3. It was noted that the ducts were deteriorated in the drier area. Since chlorinated trisodium phosphate is very hydroscopic it cakes up, necessitating the dumping of the material on the floor. Although a vacuum sweeper was available, brush sweeping was performed.

Since the sodium acid pyrophosphate and the chlorinated trisodium phosphate are alkaline (the chlorinated trisodium phosphate highly so), the evaluation criteria of 10 mg/m^3 is not appropriate. A forthcoming NIOSH criteria document on alkaline dusts will provide guidance for recommended allowable alkaline dust exposures.

B. Medical - Acute Health Problems

Of the 73 questionnaires distributed to the employees, 71 (97%) were completed and returned. Several attempts were made through the union to distribute questionnaires to workers who were unavailable at the time of the on-site visit. These attempts were unsuccessful (11 refusals to participate, 9 "were sent but lost in the mail") and therefore a potential source of bias exists due to the omission of these employees.

The final sample consisted of seventy-one male workers, ranging in age from 25-58 years with mean age of 43 years. Racially, the breakdown was 61 caucasians (86%), 8 blacks (11%), and 2 "others" (3%). Job titles included 27 production workers (38%), 37 maintenance workers or "millwrights" (52%), and 7 "others" such as shipping clerks (10%). Maintenance workers included pipe fitter/bricklayers, welders, electricians, and mechanics. Duration of employment at Stauffer ranged from 5-33 years, with 66% of the workers having worked there for more than 10 years.

A comparison of questionnaire responses showed that both maintenance and production workers reported similar health effects with similar frequency. Shortness of breath was the most common symptom (16% and 19% respectively), followed by skin rash (16% and 11%), and burns (14% and 15%). The "other" group reported only one symptom, shortness of breath (14%). When the "other" group was deleted from the calculations, the percentage of symptoms reported among the two remaining larger groups rose slightly (Table 3). Although bodily insult from inhalation appears minimal, opportunities do exist for dermatological damage from chemicals either in the form of skin rashes and/or burns. Contact may be avoided in several ways which are mentioned in the next section of this report.

A breakdown of the sample by length of employment at Stauffer does not suggest an association between shortness of breath and duration of exposure since the percentage reporting shortness of breath was equal between the group working fewer than ten years at Stauffer's and those employed longer than ten years at the company (Table 4).

From the completed questionnaires, 17 workers were selected for personal interviewing because they reported one or more adverse health effects which they perceived to be work-related. However, once again, there was no noticeable pattern for either type of symptom or specific chemical exposure found among this subgroup. Several employees did specify phosphorus pentasulfide exposure as being the most irritating, but the number was too small to be statistically significant.

Copies of the OSHA-200 forms for 1981 and 1982 were reviewed and only two work-related accidents were recorded, i.e., one fractured finger in 1981 and one electrical burn in 1982.

Telephone conversation with the plant physician did not disclose any noticeable disease or illness patterns over the past two years. He reported that sore backs and muscle strains were the most frequent complaints, and has recommended health-related transfers to other departments for only three employees; two for chemical-related dermatitis, and one for "mental health problems".

Information obtained through consultation with physicians, record review, and personal interviewing and questionnaire response from workers does not suggest that a serious, acute health problem related to the workplace currently exists at the Stauffer plant. The major complaint was shortness of breath, however, no information on smoking history or underlying pulmonary problems was collected. These are potential contributing factors to be considered. Twenty-six percent of the workers experiencing symptom(s) believed it was work-related, however, at least half of these were burns directly related to the welding process.

C. Medical - Cancer Deaths

During interviewing, several workers expressed concern about four cancer deaths among their labor force which they felt were work-related. Review of company medical records revealed that three of the four individuals died from lung cancer. Copies of the death certificates were obtained and confirm this fact. Epidemiologic studies have shown only one of the potential chemical exposures at Stauffer--arsenic--to be positively associated to lung cancer. However, analytical results of environmental sampling for arsenic at selected points in the work process were less than 0.1 microgram/sample filter which is well below the NIOSH recommended exposure level of 0.002 mg/m^3.[10] Currently the potential for arsenic exposure at the worksite is very small as described by the Associate Medical Director for the company (See Appendix).

In addition, several other factors including smoking, have also been shown to be related to lung cancer and as mentioned previously, were not evaluated in this study. However, inquiries made at a later date revealed all four deceased workers to have had a long-term history of cigarette smoking.

At this time, NIOSH is not planning to conduct a full-scale mortality study of the Stauffer workforce. However, if the union and management of the company are interested in pursuing a full-scale mortality study, NIOSH would be available to offer technical advice for designing and implementing the study.

VII. RECOMMENDATIONS

1. In the sodium acid pyrophosphate area, replace the present packaging bags with a type of bag that does not leak. The bags may have to be redesigned or additional glue may have to be applied.

2. Establish a program of maintenance for the duct work in chlorinated trisodium phosphate drying and packaging areas and for the packaging machine in the sodium acid pyrophosphate area.

3. Housekeeping in the chlorinated trisodium phosphate and sodium acid pyrophosphate areas should be improved. Employees were observed dry sweeping the floors. Vacuuming is preferable since it doesn't raise as much dust.

4. Continue the surveillance of workers' health through an expanded annual physical examination which should include: 1) examination of skin, upper respiratory tract, nose, and mouth/teeth; 2) pulmonary function testing. Doing this testing at both the start and end of a work day would be useful; and 3) dental examinations for all workers exposed to phosphorus products on a regular basis.

5. Employees should regularly use personal protective equipment, especially for eyes and skin, to reduce possibilities of burns from splashed chemicals and welding operations.

VIII. REFERENCES

1. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vols 1-7, 2nd ed. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977. (DHEW (NIOSH) publication no. 77-157).

2. Proctor NH, Hughes JP. Chemical hazards of the workplace. Philadelphia: J.B. Lippencott Company, 1978.

3. National Institute for Occupational Safety and Health. Occupational diseases: a guide to their recognition. Revised ed. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977. (DHEW (NIOSH) publication no. 77-181).

4. American Conference of Governmental Industrial Hygienists. Documentation of the threshold limit values. 4th ed. Cincinnati, Ohio: ACGIH, 1980.

5. National Institute for Occupational Safety and Health. NIOSH/OSHA occupational health guidelines for chemical hazards. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1981. (DHHS (NIOSH) publication no. 81-123).

6. Weeks M. Acute vapor toxicity of phosphorus trichloride, and methyl phosphonic dichloride. Amer. Ind. Hyg. Assoc. J. 1964; 25; 470.

7. Hygienic Guide Series. Phosphoric acid. Amer. Ind. Hyg. Assoc. Quart. 1957; 18; 75

8. Tukudome S, Kuratsune M. A cohort study on mortality from cancer and other causes among cangers at a metal refinery. Int. J. Can 1976; 17; 310.

9. Blot W, Fraumeni J. Arsenical air pollution and lung cancer. Lancet 1975; 2; 142.

10. National Institute for Occupational Safety and Health. Criteria for a recommended standard: occupational exposure to inorganic arsenic (revised). Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1975. (DHEW publication no. (NIOSH) 75-149).

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Principal Investigators:

Walter Chrostek
Regional Industrial Hygienist

Denise C. Murphy, Dr. PH
Medical Investigator

Special Acknowledgement for Field Assistance:

William Szabo
Environmental Technician
Stauffer Chemical Company

Originating Office:

Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations, and Field Studies

Report Typed By:

Nanci McElroy
Administrative Clerk

X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Stauffer Chemical Company, Industrial Chemical Division
2. Teamsters Local 929
3. NIOSH, Region III
4. OSHA, Region III

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 1

Results of Air Sampling for Sodium Acid Pyrophosphate

Sample Number	Date	Time	Operation	Air Concentrations* (mg/m^3)
6977	10/19/82	0938-1453	Bin Loading	0.78
291	10/20/82	1010-1537	Bin Loading-Area Sample	0.28
305	10/20/82	0851-1532	Helper	0.59
293	10/21/82	0819-1139	Bagging	2.1
764		1139-1512		80.5
763	10/27/82	1229-1330 1415-1454	Bagging	10.8

*Total particulates.

TABLE 2

Results of Air Sampling for Chlorinated Trisodium Phosphate

Sample Number	Date	Time	Operation	Air Concentrations* (mg/m^3)
765	10/19/82	0909-1521	Operator	0.47
300	10/19/82	0900-1521	Binner	3.6
766	10/21/82	1314-1435	Bagger (100 Bags)	3.9

*Total particulates.

TABLE 3

Percentage and Type of Health Complaint by Questionnaire Response

Symptom*	All 3 Groups (N=71)	Production & Maintenance Workers Only (N=64)
Rash	13%	14%
Nose Bleed	7%	8%
Headache	11%	13%
Eye Irritation	11%	13%
Burns	13%	14%
Shortness of Breath	17%	17%
Teeth Problems	6%	6%

* Thought to be work-related: 19% among all three groups; and 26% among production and maintenance workers only.

TABLE 4

Relationship Between Years at Stauffer and Respiratory Complaints

Complaint	Age		Years with Company	
	<50 years	>50 years	<10 years	>10 years
Shortness of Breath	8 (66%)	4 (33%)	6 (50%)	6 (50%)

APPENDIX

The following paragraph is taken from a written communication dated January 17, 1983 from Doctor Robert Shaw, Associate Medical Director, Stauffer Chemical Company, to Denise C. Murphy, NIOSH, in response to a request for information about potential arsenic exposure at the plant.

"Your second question asks which specific processes might involve potential exposure to arsenic. During phosphoric acid purification, trace amounts of arsenic impurities are removed from liquid phosphoric acid by precipitation in an essentially closed process, including filtration and backwashing the precipitate to storage tanks, followed by contract disposal of the waste in accordance with RCRA. The potential for skin or respiratory exposure is essentially nil and should it exist during leak repair or maintenance, personal protective equipment is utilized to prevent skin contact with residual phosphoric acid. Since the precipitate is always wet, no arsenic containing particulate becomes airborne. This was verified in accordance with OSHA arsenic standard requirements. Breathing zone samples were collected for those employees having the greatest potential for exposure and all results were non-detectable (the limit of detection was less than 1 microgram/cubic meter). This was consistent with findings in our other plants and we conclude that no employees at the plant are occupationally exposed to arsenic."