U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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NIOSH

Health Hazard Evaluation Report

HETA 86-477-1755
CUMBERLAND COUNTY HOMEMAKER
HOME HEALTH AID SERVICE
BRIDGETON, NEW JERSEY

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.

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SUMMARY

On August 12, 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request to investigate health hazards at the Cumberland County Homemaker-Home Health Aid Service. The request was assigned to the New Jersey State Department of Health (NJDOH) for follow-up under the NIOSH-NJDOH Cooperative Agreement. The request was concerned primarily with respiratory and eye complaints related to office work in a facility where incineration of plastic hospital syringes had taken place in the past.

The major emphasis of the investigation was the determination of the health risks of the pyrolysis products (i.e. chemicals given off during burning) of hospital syringes. It was established that the syringes were made from polypropylene; the tips of the syringes from butyl rubber. The predominant combustion products of polypropylene are carbon monoxide, carbon dioxide, and water vapor. Additionally, formaldehyde and crotonaldehyde are generated. In general the pyrolysis/combustion toxicity of polypropylene appears to be similar to polyethylene. Carbon monoxide is considered the primary toxicant from thermal decomposition of polyethylene.

On the basis of a walkthrough evaluation and interviews of employees, it was determined that during the time when incineration of hospital syringes was performed, it was likely that the employees were exposed to combustion products of polypropylene although the exposure diminished with time. The timing of symptoms and the constellation and magnitude of symptoms reported were consistent with exposure to small amounts of polypropylene combustion products.

On the basis of a walkthrough evaluation and interviews of potentially exposed employees, it has been determined that minimal health hazards exist at the Cumberland County Homemaker-Home Health Aid Service from exposure to the combustion products of plastic syringe incineration and from ongoing exposure to dust. Recommendations to relieve workers from continued symptomatology are given at the end of this report.

Key Words: SIC 8059, polypropylene, carbon monoxide, respiratory complaints, mucous membrane complaints.

BACKGROUND

The site of the evaluation was the Cumberland County Homemaker-Home Health Aid Service office which was situated in a wood frame house modified for office work. The office space, made up of five rooms with open doors, was located on the first story of the building; hospital materials, principally air conditioning and heating filters and paper supplies, were stored in an attic above the Service's office area. The building also had a basement containing water and heating services.

In May 1986, the Service leased the office space from a community hospital (situated across the street from the office). At the time of initial occupancy by the Service in May, the hospital was using the kitchen of the converted house for the incineration of plastic syringes being discarded by the hospital. This incineration process had been performed previously in the kitchen for approximately five years, once a day for a period of two to three hours, two to three times a week in an oven designed for this purpose. The incineration was begun in the afternoon overlapping by two to three hours the work schedule of the Service staff. An exhaust fan was located above the incinerator. Window air conditioners operated in summer months. The building has natural ventilation through windows and doors.

Because of acrid smells and a series of complaints including throat irritation, headache, eye burning, nasal stuffiness, nausea and dizziness, registered by eight of the nine employees of the Service, the hospital agreed in early May to do the incinerating after the Service staff had left for the day. In mid-June, because of continuing complaints, the Hospital discontinued the process altogether. The period of exposure thus lasted for approximately three weeks.

Because many of the same complaints persisted beyond mid-June in four of the original eight individuals, the manager of the Service filed a request with NIOSH for a Health Hazard Evaluation. The request was assigned to the New Jersey State Department of Health (NJDOH) for follow-up under the NIOSH-NJDOH Cooperative Agreement.

EVALUATION CRITERIA

1. General

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 are intended to 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, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels.

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 criterion. These combined effects are often not

considered in the evaluation criteria. 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 US Department of Labor, OSHA PELs (Permissible Exposure Limits). 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 occupation disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is only legally required to meet the 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 exposure.

Criteria for exposure limits for the chemicals of concern at the Cumberland County Homemaker-Home Health Aid Service are as follows:

8 Hour Time Weighted Average
(parts per million)

Compound	OSHA	ACGIH	NIOSH
Carbon Monoxide	50	50	35
Formaldehyde	3	1	LFL*
Acrolein	0.1	0.1	-
Crotonaldehyde	2	2	-

* Lowest Feasible Level

2. Toxicity

Carbon monoxide exerts its effects by combining with the hemoglobin in the blood and interrupting the normal oxygen supply to the body tissues. It may aggravate angina pectoris, a chronic heart disease. Almost all of the carbon monoxide that has been inhaled is eliminated through the lungs when the previously exposed person enters an atmosphere free of carbon monoxide. The time required to eliminate half of the gas is 3 to 5 hours depending on the amount of respiration which acts to wash it out of the body.

Formaldehyde is detectable by most people at levels below 1 ppm. It produces mild sensory irritation of eyes, nose and throat at 2 to 5 ppm, becomes unpleasant at 5 to 10 ppm, and is intolerable at levels in excess of 25 ppm. Tissue damage is likely to occur at 25 to 50 ppm. Recovery tends to be complete and rapid.(2) In numerous studies of exposure at 2 to 30 ppm, the subjects complained of prickling irritation of throat, wheezing, headache, and excessive thirst, accompanied by tearing and stinging of eyes. Formaldehyde as a gas or in solution will act as a primary irritant on skin, causing an erythematous or eczematous dermatitis reaction on exposed areas. There is sufficient evidence that formaldehyde gas is carcinogenic to rats according to the International Agency for Research on Cancer.(6)

Acrolein exposure can cause irritation of lungs, dizziness, coughing and shortness of breath. Higher exposure can cause pulmonary edema.

Toxicity of crotonaldehyde is same as that of acrolein.(2) It is a lachrymating material which is very dangerous to eyes.(3)

EVALUATION METHODS

On August 22, 1986, a walkthrough of the facility was conducted by an industrial hygienist from the NJDOH. The purpose of the walkthrough was to "map" the location of Service workers vis-a-vis the small syringe incinerator and to investigate whether other office environmental factors (e.g. dust, provisions for ventilation) might be contributing to the complaints.

An occupational history was taken and a medical questionnaire was administered by a physician from the NJDOH in the course of an interview with five of the workers.

Because the burning process was no longer taking place and thus actual measurement and identification of products of combustion was not possible, a literature review was conducted to identify the combustion products of plastics and known associated health effects.

Several wipe samples taken inside incineration ductwork and submitted for analysis as unknowns revealed no detectable level of contaminants.

RESULTS

The major emphasis of the investigation was 1) on identifying the pyrolysis products of the hospital syringes and 2) determining what if any health risks had been posed by exposure to the identified pyrolysis products.

It was established that the syringes were made from polypropylene; the tips of the syringes from butyl rubber.

The predominant combustion products of polypropylene are carbon monoxide, carbon dioxide, and water vapor.(1),(2) The main irritants generated are formaldehyde and crotonaldehyde(1). In general the pyrolysis/combustion toxicity of polypropylene

appear to be similar to that of polyethylene.(2) Overall, carbon monoxide is considered the primary toxicant from thermal decomposition of polyethylene. Other decomposition products of polyethylene that have been identified under varying conditions include acrolein, formaldehyde, other aldehydes, ketones, fatty acids, methane, ethane, and acetylene.(2)

Formaldehyde generation is optimum (0.015 - 0.018 mol/g) at a temperature of approximately 350°C, and acrolein generation is optimum (0.00016 mol/g) at approximately 400°C.

WALKTHROUGH OBSERVATIONS

Observation suggested that recirculation of exhausted incineration products back into the office work rooms was likely, because the exhaust outlet, air conditioners and windows are located on the same wall. Also, stagnation of the incineration products after the incineration was performed (accumulation of the incinerated vapors in the unventilated building over-night) probably occurred on a regular basis.

The office space, made up of five rooms, was located on the first story of the building and observed to be dusty. The hospital used the attic principally for storage of air conditioning and heating filters and a variety of paper supplies. The Service used the first floor of the building for storing file folders and assorted paper goods. While not measured, it was apparent that there was a considerable dust burden in the building related in part to the large volume of cardboard boxes used for storage as well as inadequate house keeping. The dust, in and of itself, or as a surface for the adsorption of the products of syringe combustion, should be considered one factor responsible for the continuation of worker complaints.

RESULTS OF WORKER INTERVIEWS AND QUESTIONNAIRES

The Director of the Service stated that during the period when the incineration was performed, eight employees complained of several symptoms indicative of respiratory and mucous membrane irritation both during work hours and on the following morning. The Director stated further that even after the incineration had been discontinued in mid-June, four of the original eight continued to report symptoms. The complaints persisted through the time of the NJDOH investigation in August.

All of the five employees willing to be interviewed confirmed the Director's statement. In the four with symptoms, throat irritation, worse during the work hours, continued to occur although less intensely. In one person, complaints of eye irritation continued necessitating several visits to an ophthalmologist who recommended alternative employment. In one other person, symptoms of rhinitis continued and were so incapacitating that this individual had to seek permission (which was granted) to work off-site.

CONCLUSION

On the basis of a walkthrough evaluation and interviews of employees, it was determined that when incineration of hospital syringes was performed it was likely that the employees were exposed to the combustion products of polypropylene. Because these products of combustion could adhere to dust and because dust was in evidence, this exposure likely continued albeit in diminishing amounts for the time through the NJDOH investigation. Against this hypothesis are the negative results of wipe samples taken and analyzed for combustion products.

RECOMMENDATIONS

Although exposure levels were never determined, it is reasonably certain that long term effects are not to be expected due to the brevity and likely low level of exposure. Nonetheless, because of the persistence of symptoms which have and could continue to compromise the work experience at Cumberland County Homemaker-Home Health Aid Service, the following, if they have not already been carried out, are recommendations which are considered basic to remediation of the problem:

a. Remove all mobile objects (furniture, storage items, boxes, etc.) from the present work environment and have those objects essential to the operation of the Service cleaned free of dust using a HEPA filtering vacuum cleaner.

b. Completely clean the entire house with mild detergent and water.

c. The hospital should store all its materials in another building to eliminate the large, difficult to clean surface area for dust to form on and to reduce the production and dissemination of dust by recurrent transit through the work facility.

REFERENCES

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DISTRIBUTION AND AVAILABILITY OF THIS REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through National Technical Information Service (NITS), Springfield, Virginia 22161.

Copies of this report have been sent to:

CUMBERLAND COUNTY HOMEMAKER-HOME HEALTH AID SERVICE
BRIDGETON, NEW JERSEY

U.S. Department of Labor, OSHA, Region II, New York, NY

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