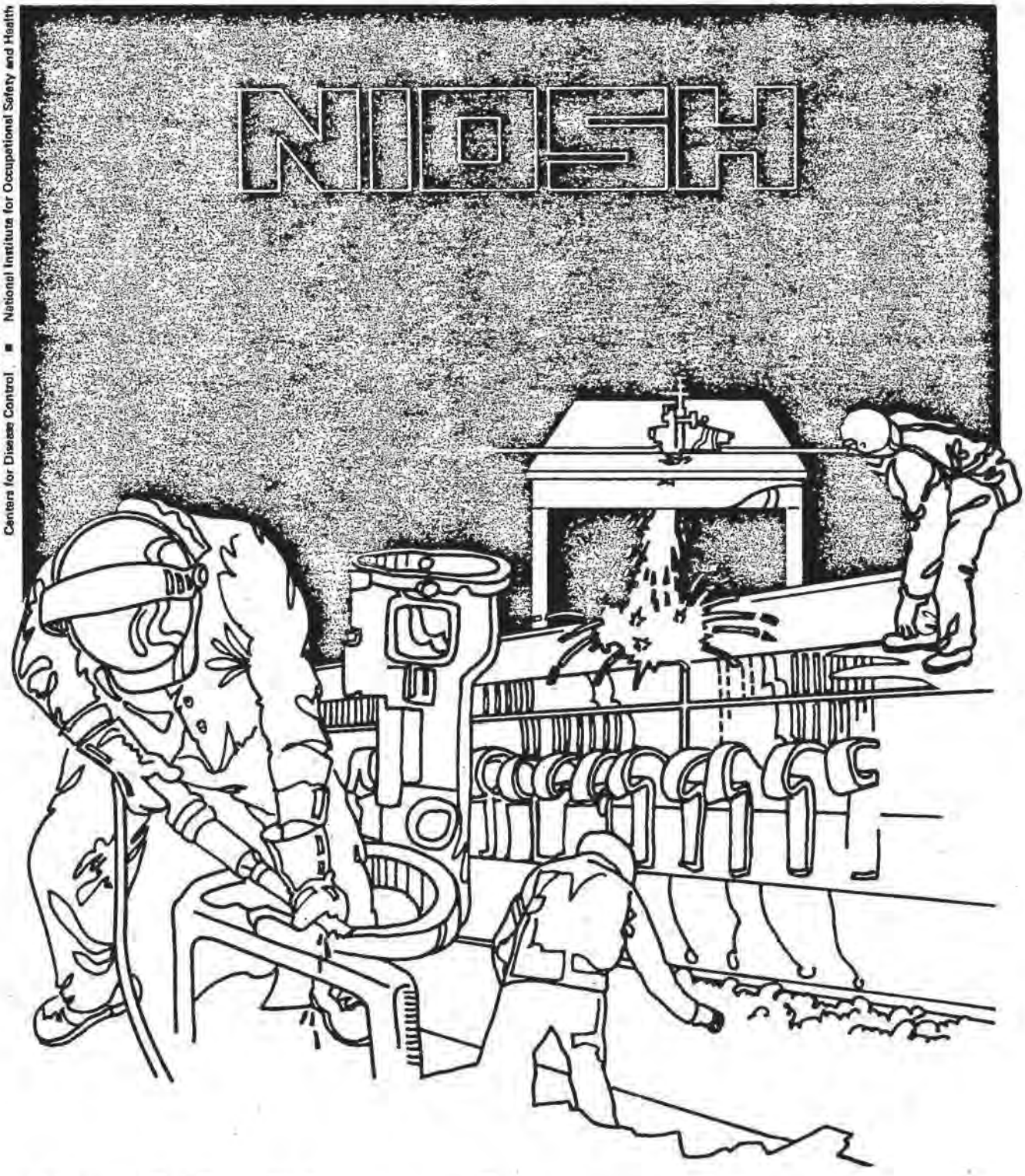
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health




# Health Hazard Evaluation Report

HETA 82-390-1345
PUBLIC SAFETY BUILDING
UPPER DARBY, 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 82-390-1345
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PUBLIC SAFETY BUILDING
UPPER DARBY, PENNSYLVANIA

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## I. SUMMARY

In September 1982, the National Institute for Occupational Safety and Health (NIOSH) was requested by local public health officials to investigate possible health hazards in the Public Safety Building, Upper Darby, Pennsylvania. Several cancer cases, including some deaths, had been reported among police detectives there. Concern developed over the issue of whether these cancers might have resulted from exposures at the Public Safety Building. In November 1982, NIOSH investigators conducted an initial survey of the Public Safety Building and of the previous police headquarters in the Upper Darby Municipal Building. Ventilation systems were evaluated in both buildings. Bulk samples of five types of fingerprinting powders were collected for analysis of polynuclear aromatic hydrocarbons. Samples of a gun-cleaning solution were collected for identification of component solvents. Using self-administered questionnaires, officers or their widows provided information on employment history, personal habits, and family cancer history.

No irregularities in the ventilation system were identified. Two of the fingerprint powder samples contained polynuclear aromatic compounds: 2.8 ug fluoranthene and 4.0 ug pyrene per gram in one; 13 ug phenanthrene, 15 ug fluoranthene, and 25 ug pyrene per gram in the other. The major components of the gun-cleaning solution were ammonia, denatured alcohol, and kerosene.

Questionnaire data were obtained for 17 current officers, one former officer, and four deceased officers. Four had cancer of the large intestine; one had cancer of the urinary bladder; one had malignant melanoma; and one had metastatic adenocarcinoma, primary site unknown. Officers with colon or urinary bladder cancer were not significantly older but worked for the police department longer than officers without cancer. Officers with abdominal cancer reportedly consumed fewer alcoholic beverages per month than did officers without cancer, but differences in the sources of information make this finding suspect. With respect to reported coffee drinking, cigarette smoking, and family cancer histories, officers with abdominal cancer were not significantly different from officers without cancer.

An apparent excess of cancer, predominantly of the large intestine, exists among the police detectives. The data from our investigation fail, however, to show an association of these cancers with exposure to the Public Safety Building. Such an association is unlikely according to current theories on tumor induction periods. The environmental results of this study indicate that a potential health hazard exists in using the Sirchie "Gray" and "Silk Black" fingerprint powders. The use of these powders should be discontinued in favor of powders with no polynuclear aromatic hydrocarbons.

KEYWORD: SIC 9221 (Police protection), Carbon Black, Polynuclear aromatics, Phenanthrene, Fluoranthene, Pyrene, Cancer, Carcinogen, Fingerprint Powders.

## II. INTRODUCTION

In September 1982 NIOSH received a request from the Director of Public Health, Upper Darby, Pennsylvania, to evaluate possible health hazards in the Emil T. D'Alesio Public Safety Building. In the previous two years, three cancer-related deaths were reported to have occurred among a detective force consisting of 16 officers. All 16 had worked on the second floor of the building. In addition to these deaths, three other detectives on the force had been diagnosed as having cancer and had received treatment.

On November 2 and 3, 1982, NIOSH representatives visited the Public Safety Building to discuss the request and plans for investigation with representatives of the Chiefs of Police, the Fraternal Order of Police, and the Upper Darby Health Department. Following these discussions, NIOSH investigators conducted a medical and environmental evaluation of the building. Active and retired employees were interviewed regarding work history, personal habits, and familial cancer histories. Information about deceased officers was obtained through interviews with their widows. Walk-through surveys were conducted in the Public Safety Building and of the Upper Darby Municipal Building, which housed the police department offices from 1930 to 1976. Bulk samples of fingerprinting powders and a gun-cleaning solution were collected for analysis of suspected and known carcinogens.

## III. BACKGROUND

From 1930 to 1976, the Police Department offices were located in the Upper Darby Municipal Building. During this time, all firing range practice was conducted outdoors; no indoor firing range was present in the Municipal Building.

In 1976, the Police Department moved its offices from the Upper Darby Municipal Building to the Emil T. D'Alesio Public Safety Building, a recently renovated two-story brick structure. Offices of the police detective force occupy the second floor of this building.

## IV. EVALUATION DESIGN AND METHODS

### A. Medical

This study was designed to (1) determine if an excess number of cancers had occurred in police detectives and whether any cancer type was predominant; (2) determine if differences in personal habits or family cancer histories were associated with cancer prevalence; and (3) identify any carcinogenic substances to which detectives would have been typically exposed in their work over the last 20 to 30 years, the expected induction period for non-leukemic cancers.

All 18 employees who worked on the second floor and five employees who worked on the first floor or in the basement of the Public Safety Building completed self-administered questionnaires in November 1982. This initial canvassing was conducted to address concerns among employees that the temporal association of the cancer diagnosis and the relocation of the Police Department to its new headquarters implied exposure to a carcinogen in the new office space. Non-officer respondents, however, were excluded from most statistical analyses of the questionnaire data in order to focus the investigation on risk factors unique to the police officers with cancer.

NIOSH investigators mailed questionnaires to former police officers known to have cancer and to widows of officers whose deaths were cancer-related. After receiving permission from the officer or next-of-kin, NIOSH investigators reviewed the medical records for each cancer case reported.

Officers having urinary bladder or gastrointestinal tract cancers were grouped together for purposes of statistical analysis. The biological basis for combining these cancer types is that they involve the major excretory pathways for most carcinogenic substance body burdens.

B. Environmental

Ventilation systems were evaluated for both the Public Safety Building and the previous police headquarters in the Municipal Building. The evaluation consisted of visual inspection and review of building blue prints. A survey of possible chemical exposures identified fingerprint dusting powders and a gun-cleaning solution as substances detectives have frequently encountered in the past and continued to use. Bulk samples were collected for analysis of polynuclear aromatic hydrocarbon (PNA) content of five fingerprint dusting powders: (1) Sirchie "Gray"; (2) Sirchie "Hi-Fi Magnetic Gray"; (3) Sirchie "Silk Black"; (4) Sirchie "Indestructible White"; and (5) Criminal Research Products "Magnetic Red". One-half gram of each powder sample was filtered through a 0.5 micron FH filter to remove particulate material. A 10 ul aliquot of the filtrate was analyzed by high pressure liquid chromatography using a Vydac 201 TP reverse phase column and a Varian VariChrom ultraviolet detector. Detection limits for PNA's using this method are 1.0 ug fluoranthene, 1.5 phenanthrene, and 1.5 ug pyrene per gram of sample. Bulk samples of both the "old" and "new" Hoppe's gun-cleaning solution were analyzed by gas chromatography for identification of component solvents using NIOSH Method 127 with the following modifications: (1) for the desorption process, an aliquot of each sample was injected into 1 ml of carbon disulfide; (2) the gas chromatograph used was a Hewlett-Packard Model 5731A equipped with a flame ionization detector; (3) the column make was 20' x 1/8 stainless steel 10% SP-1000 on 80/100 Supelcoport; and (4) the oven conditions were 75' C isothermal. The limit of detection for benzene using this modified method is 0.6% per sample.

## V. EVALUATION CRITERIA

### A. Carbon black[1,2]

Exposures to carbon black may cause adverse pulmonary and cardiac changes. Repeated contact of skin with carbon black may produce a marked embedding of carbon in hair follicles, producing black spots on the skin. Carbon black may contain various polynuclear aromatic hydrocarbon compounds which may pose a cancer risk. The OSHA standard[3] for carbon black is an 8-hour time-weighted average (TWA) concentration of 3.5 mg/M$^3$. This is also the NIOSH recommended standard for carbon black not containing PNA's; if PNA's are present, NIOSH recommends that exposure to carbon black not exceed 0.1 mg/m$^3$.

### B. Polynuclear aromatic hydrocarbons[4]

Exposure to polynuclear aromatics may produce reddening, burning, and itching of skin; photophobia; conjunctivitis; and skin and lung cancer. The PNA's benzo(a)pyrene, benzathracene, chrysene, and phenanthrene are carcinogens. Anthracene, carbazole, fluorathene, and pyrene may also cause cancer, but this has not been well documented. There is no OSHA standard or NIOSH recommended standard for PNA's per se. Because PNA's are carcinogenic, NIOSH recommends that exposure be kept as low as possible.

## VI. RESULTS

### A. Medical

Questionnaire data were obtained for 23 current employees, one former officer, and four deceased officers. One former officer declined participation in the study. All subjects were white and not of Hispanic origin. Six of the current employees were female secretaries. Medical record review confirmed seven cases of cancer among male officers as follows: one case each of malignant melanoma (a cancer of the skin), urinary bladder transitional cell carcinoma, and carcinoma of the colon in active or retired officers; three cases of colon adenocarcinoma in deceased officers; and one case of metastatic adenocarcinoma, primary site unknown, in a fourth deceased officer.

The mean job duration was less for officers without cancer (17.6 years) than for officers with abdominal cancer (22.8), ($t = 2.05$, d.f. = 18, $P = 0.05$). The mean age of officers without cancer (43 years) was not significantly different than that of officers with abdominal cancer (50 years, age at time of cancer diagnosis) ($t = 1.93$, d.f. = 18, $P = 0.07$). Of the 15 officers who did not have cancer, two reported cancers in siblings and one did not know if cancer had been diagnosed in an immediate family member. Of the four officers who had abdominal cancer, one had a father who had skin and liver cancer.

Thus, officers with abdominal cancer were no more likely to have an immediate family member with cancer than were officers who had no cancer themselves (odds ratio = 2.0, 95% confidence limits: 0.13 -31.5). Officers with abdominal cancer had more siblings (mean of 4.4 per officer) than did officers without cancer (mean 1.9), ($t = 2.0$, d.f. = 18, $P = 0.05$). The average parental age, at time of interview or at time of death, was no different for officers with abdominal cancer (66 years) and those without cancer (63 years) ($t = 0.76$, d.f. = 17, $P = 0.5$).

Officers without cancer had substantially higher monthly consumption of alcoholic beverages than did officers with abdominal cancer. But because of the large differences and the great potential for reporting (recall) bias (cases' next of kin vs. non-cases themselves) this finding is suspect. Cumulative coffee consumption was compared using the product of known years of coffee drinking and yearly cups of coffee as extrapolated from reported daily coffee drinking habits. No appreciable difference was detected between officers without cancer and those with abdominal cancer. Similarly, with respect to cigarette smoking, there was no significant difference in mean number of pack-years between officers without cancer (4185) and officers with abdominal cancer (5658) ($t = 0.50$, d.f. = 17, $P = 0.6$). The coffee and smoking data are, of course, subject to the same potential reporting bias as the alcohol data.

B. Environmental

Both buildings' ventilation systems had the capability for adequate volume exchange throughout the buildings, including the indoor firing range in the Public Safety Building, a facility which receives minimal use. Carbon black and polynuclear aromatic hydrocarbons (PNA's) were detected in two of the fingerprint dusting powders. The PNA concentrations were 2.8 ug fluoranthene and 4.0 ug pyrene per gram of Sirchie "Gray" powder; and 13 ug phenanthrene, 15 ug fluoranthere, and 25 ug pyrene per gram of Sirchie "Silk Black" powder. The major components of both samples of the gun-cleaning solution were ammonia, denatured alcohol, and kerosene. No detectable amounts of benzene were present in either sample, despite its listing among the labeled contents of the "old" solution.

## VII. DISCUSSION AND CONCLUSIONS

The most common cancer identified by this study of police detectives involved the large intestine. Differences in possible occupational carcinogenic exposures may be reflected by number of years on the force, as officers tend to perform the same sequence of duties as they rise in rank. The mean job duration of officers with abdominal cancer tended to be longer than

that of officers without cancer. Several interpretations of this difference are possible: officers with abdominal cancer (1) were older and therefore had worked longer; (2) may have been exposed for a longer period of time to one or several carcinogens; and/or (3) may have been exposed briefly to one or several carcinogens early in their careers and lived long enough for tumors to occur.

While these cancers may or may not be related to an occupational exposure, it is interesting to note that a recent NIOSH study[5] identified a statistically significant excess number of large intestine cancers in deaths reported to a policemen's benefit association. The cancer cluster in that proportionate mortality ratio study may, as in this study, only represent a cluster of events with no biological basis.

A potential health hazard may exist in using the Sirchie "Gray" and "Silk Black" powders since (1) they contain PNA's, which are known causes of lung and skin cancer, and (2) the lowest levels at which PNA's cause cancer have not been established.

## VIII. RECOMMENDATIONS

1. Use of the Sirchie "Gray" and "Silk Black" powders should be discontinued if technically acceptable powders which contain no PNA's are available. When possible, all dusting should be done in a ventilated laboratory hood in order to reduce the likelihood of breathing any carbon black dust. When using a lab hood is impractical, the person performing the dusting should wear a respirator designed to filter pneumoconiosis-producing dusts.

2. Officers should wear impervious gloves when using gun-cleaning solutions. Gun-cleaning should be performed in well-ventilated areas, such as in a laboratory hood or outdoors.

## IX. REFERENCES

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## XI. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. Upper Darby Police Department
2. Fraternal Order of Police, Upper Darby
3. Upper Darby Health Department
4. Pennsylvania Department of Health
5. NIOSH, Region III
6. OSHA, Region III

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