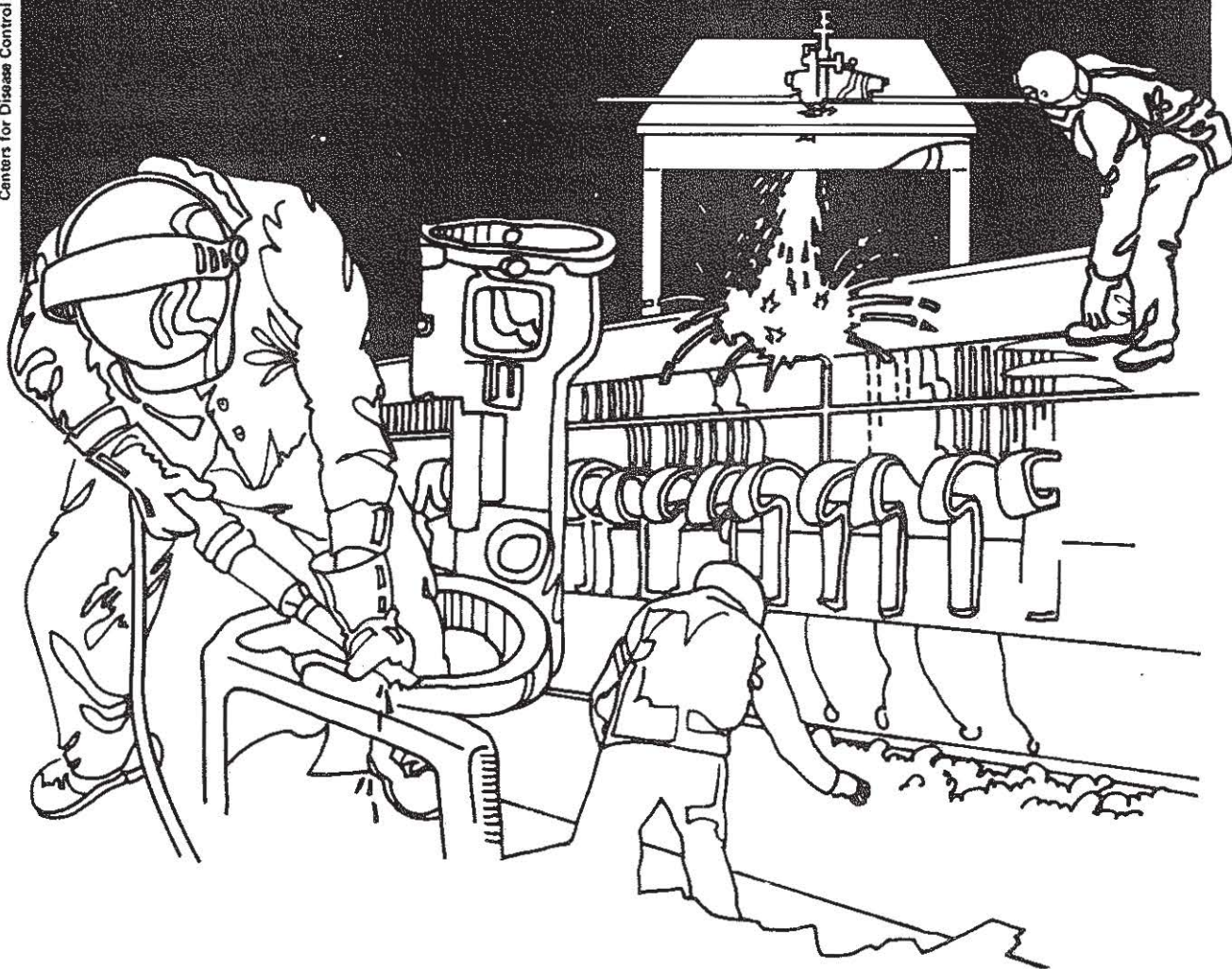


NIOSH



Health Hazard Evaluation Report

HETA 83-090-1326
FORT STANWIX NATIONAL MONUMENT
ROME, NEW YORK

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

I. SUMMARY

In December 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request for a follow-up investigation to evaluate workers' exposures to pentachlorophenol (PCP) at the Fort Stanwix National Monument, Rome, New York. At the time of the study, six National Park Service employees were working in offices at the facility. The Fort was reconstructed in 1976, using pine logs which were pressure treated with PCP. NIOSH first investigated the problem in January 1978.

On February 1, 1983, NIOSH conducted an environmental and medical survey at the Fort. Five air samples were collected and analyzed for PCP by high performance liquid chromatography. Skin and workplace surface contamination of PCP was studied by obtaining wipe samples from each employees' hands and from various office surfaces. Urine samples were collected from each worker and analyzed for PCP by gas chromatography. Each employee was interviewed to determine if he or she was having any work-related health effects.

Air PCP levels were below the limit of detection ($<8\text{ug}/\text{m}^3$) in all of the office locations that were sampled. The OSHA standard is $500\text{ug}/\text{m}^3$, averaged over an 8-hour work shift. PCP was detected on two of the six employees' hands at levels of 60 and $70\text{ng}/\text{cm}^2$. Workplace surface contamination ranged from less than $10\text{ng}/\text{cm}^2$ to $70\text{ng}/\text{cm}^2$.

PCP was detected in three of the six workers' urine at concentrations of 4.6, 7.2, and 16.3 ppb. All four of the control urine samples had PCP levels below the analytical limit of detection of 4 ppb. Two of the six employees reported health problems which they associated with their work. One has a problem with blurry contact lenses while at work. Another has seasonal problems (fall and spring) with sinus headaches and nose irritation which began after starting to work at the Fort.

The results of this study show that PCP exposure among Fort Stanwix workers has been significantly reduced since NIOSH first investigated the problem in January 1978. At that time, PCP crystals were still visible on log surfaces inside many of the buildings. Airborne PCP levels ranged from 14 to $33\text{ug}/\text{m}^3$ with a mean of $20\text{ug}/\text{m}^3$. Urine PCP concentrations ranged from 1400 to 4200 ppb with a mean of about 2000 ppb. Two of the five workers who were interviewed in 1978, reported eye, nose, and throat irritation while working in the Fort. Following the 1978 NIOSH study, interior log walls were washed with ethyl alcohol to remove the PCP contamination.

Based on the results of this evaluation, NIOSH concluded that exposure to pentachlorophenol at Fort Stanwix has been reduced to a level currently considered acceptable. Recommendations for further reduction of PCP exposure are presented in Section VII of this report.

KEYWORDS: SIC 799 (Recreation Services), Pentachlorophenol, PCP, wood preservative chemicals.

II. INTRODUCTION

On December 27, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation request from the United States Department of the Interior to perform a follow-up hazard evaluation at Fort Stanwix National Monument in Rome, New York. The initial hazard evaluation in 1978 was conducted to determine exposure to pentachlorophenol (PCP) in the offices of Fort Stanwick National Monument. The walls of the fort were constructed with PCP-treated logs, many of which were not weathered sufficiently to permit excess PCP to escape prior to construction. After the initial survey, corrective measures were taken to eliminate the PCP exposure, and the primary purpose of the follow-up evaluation was to determine if the corrective measurements have sufficiently reduced PCP exposure.

III. BACKGROUND

Fort Stanwix was reconstructed and opened to the public in May 1976 for bicentennial celebrations. There are two separate office areas in the Fort: One area consists of three administrative offices, all of which have interior paneling covering the PCP logs. The other area consists of an office-store combination which has bare PCP-treated walls exposed. During the summer months, the offices are open to the outside, so they receive plenty of fresh air during that time period.

The year-round office work force consists of six employees: a superintendent, a clerk typist, and an administrative technician who each occupy an administrative office; a park ranger and a park supervisor, both of whom occupy the office store area; and a maintenance employee who moves throughout the fort during a typical work day.

Results of the initial survey conducted by NIOSH in January 1978, were published in May 1978. Environmental air samples taken in the office areas during that study ranged from 14 to 33 micrograms of PCP per cubic meter of air ($\mu\text{g}/\text{m}^3$), all below the OSHA standard of 500 $\mu\text{g}/\text{m}^3$. Spot urinalyses for PCP ranged from 1400 to 4200 parts of PCP per billion parts of urine (ppb) (specific gravity corrected), which is well above levels documented in persons without occupational exposure.^{1,2} Two of the five office workers interviewed during that study reported eye, nose, or throat irritation and headache which they associated with work.

The 1978 NIOSH study concluded that action to reduce exposure to PCP should be taken. Following the NIOSH investigation, interior log walls were washed with ethyl alcohol to remove PCP.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

In this followup survey skin and workplace surface contamination of PCP was studied by obtaining wipe samples from the palmar surface of the right hand of each employee and from various office surfaces. The samples were collected on Whatman smear tabs moistened with distilled water and were analysed by high pressure liquid chromatography. The accuracy and precision of this wipe procedure are limited by variations in surface characteristics that effect sampling efficiency. Thus, the results should only be considered rough measures of relative contamination.

To investigate the possibility of dioxin contamination, a bulk sample of PCP crystals was scraped from a log wall inside the Southeast Casemate. This was the only area of the fort where the crystals were still visible. This sample, which included wood shavings, was extracted with hot benzene and analyzed for 2,3,7,8-tetrachlorodibenzodioxin by high resolution gas chromatography/mass spectroscopy.

NIOSH collected five full-shift air samples in several offices of the Fort on February 1, 1983, to evaluate workers' exposure to airborne PCP. Each air sample was drawn at a flow rate of 1.5 liters per minute through a mixed cellulose ester membrane filter connected in series to a midjet bubbler containing 15 ml of ethylene glycol. After sampling, the filter was removed and added to the bubbler solution. Ten milliliters of methanol was added to each sample prior to analysis by high performance liquid chromatography using ultraviolet detection at a wavelength of 254 nanometers (NIOSH Method S-297).³

B. Medical

1. Urine Specimen Collection and Analyses for PCP

Spot urine specimens were obtained from all six year round employees. Four control urine specimens were obtained from nearby restaurant employees. The specimens were preserved by adding sulfuric acid (H_2SO_4) in the field. They were submitted to the lab for quantitative analyses of pentachlorophenol (PCP) using the Edgerton and Moseman gas chromatographic procedure⁴ with an electron capture detector. The lab analyzed two spiked urine samples using this method as a quality control measure.

2. Health Status Interviews

Each of the six year round office employees were interviewed using general health questionnaires to determine if they were experiencing any symptoms or health problems which they might be associating with the work environment.

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 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. 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 criterion. 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 solely 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.

B. Pentachlorophenol (PCP)^{5,6,7,8}

Pentachlorophenol dust and mist cause irritation of the eyes and upper respiratory tract. Absorption results in an increase in metabolic rate and fever. Prolonged skin exposure causes an acneform dermatitis and solutions of PCP as dilute as 1% may cause irritation if contact is repeated. Human exposure to dust or mist concentrations greater than 1 mg/m³ causes pain in the nose and throat, violent sneezing, and cough; 0.3 mg/m³ may cause some nose irritation; persons acclimated to pentachlorophenol can tolerate concentrations up to 2.4 mg/m³. Pentachlorophenol readily penetrates the skin; systemic intoxication is cumulative and has been fatal. Intoxication is characterized by weakness, anorexia, weight loss, and profuse sweating; there also may be headache, dizziness, nausea, vomiting, shortness of breath, and chest pain. In fatal cases, the body temperature is frequently extremely high and death has occurred as early as three hours after the onset of symptoms. The risk of serious intoxication is increased during hot weather. Persons with impaired liver or kidney function are more susceptible to the effects of pentachlorophenol.

The current OSHA standard for pentachlorophenol is 500 micrograms of pentachlorophenol per cubic meter of air (ug/m³) averaged over an eight-hour work shift. This was adopted from the American Conference of Governmental Industrial Hygienists, Threshold Limit Value (TLV), which is also set at 500 ug/m³.⁹

C. Dioxins¹⁰

The possible presence of polychlorinated dibenzodioxins (PCDDs) was considered during this study of PCP exposure because PCDDs are sometimes present as trace contaminants in PCP and because some PCDD isomers are highly toxic. The isomers vary widely in their acute toxicity, with 2,3,7,8-tetrachlorodibenzodioxin (TCDD) being the most toxic and the most widely studied. On a molecular basis, this compound is the most poisonous synthetic chemical known. Human exposure to 2,3,7,8-TCDD has induced chloracne, polyneuropathy, liver dysfunction, and enzyme elevations. Animal studies have shown the compound to be teratogenic, embryotoxic, carcinogenic, and cocarcinogenic.

The other dioxin isomers have demonstrated much lower degrees of acute toxicity than 2,3,7,8-TCDD. However, their chronic effects have not been fully investigated.

VI. RESULTS AND DISCUSSION

A. Environmental

Two of the six workers were found to have detectable quantities of PCP on their hands (Table I). Skin contamination ranged from less than 10 ng/cm² to 70 ng/cm². Workplace surface contamination ranged from less than 10 ng/cm² to 70 ng/cm².

No 2,3,7,8-TCDD was detected in the bulk sample, but there appeared to be about 1.7 parts per million of 1,2,3,4-TCDD and possibly some other coeluting 3:1 TCDD isomers present. Current exposure to these compounds at Fort Stanwix would not likely be biologically significant, considering the low level of PCP exposure.

The long-term air samples taken in the Administrative Office, Book Store, Interpretation Office, and the Southeast Casemate all showed airborne PCP concentrations below the limits of detection (<8 ug/m³). These air sample results indicate that PCP contamination has been significantly reduced since the 1978 NIOSH investigation. At that time, using the same sampling and analytical method under similar sampling conditions, the PCP levels in five fort office locations ranged from 14 to 33 ug/m³ with a mean of 20 ug/m³.

B. Medical

Results of the urine PCP analyses are shown in Table II. Of the six specimens obtained from the employees, three had levels of PCP above the analytical methods limit of detection which is four parts of urine (ppb). They are 7.2, 16.3, and 4.6 ppb, respectively, which shows a substantial decrease compared to urine levels found in the 1978 health hazard evaluation. All four of the control samples collected from nearby restaurant employees were below 4 ppb, which is consistent with the results of another recent study of PCP exposure where 42 controls had urinary PCP levels of 0.7 - 11.0 ppb.¹¹ This suggests that Fort Stanwick employees may be absorbing small amounts of PCP from the work environment, either through the skin and/or by transfer of PCP from the hand to the mouth causing direct ingestion, or via food or cigarettes.

Of the six employees interviewed, two felt that they had health problems associated with their work. One had a problem with blurry contact lenses mostly occurring at work. Another felt that seasonal (fall and spring) sinus headaches and nose irritation were related to work because the symptoms began after he or she started working at the Fort.

Only one of the employees interviewed during this study was employed at the fort during the previous health hazard evaluation. In 1978, this employee had reported symptoms of headache, eye, nose and throat irritation, but said that they stopped causing a problem sometime after the Fort was cleaned.

VII. CONCLUSIONS AND RECOMMENDATIONS

The results of this study show that PCP exposure among Fort Stanwix workers has been reduced to levels well below what would be expected to pose a health hazard, based on current knowledge. Nevertheless, it would be prudent to continue good housekeeping and hygiene practices that can help prevent potential skin absorption and ingestion of PCP. Employees should avoid skin contact with treated logs and they should wash their hands before eating or drinking, and before leaving work. All work surfaces should be kept clean.

VIII. REFERENCES

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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 NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. National Park Service
2. Fort Stanwix
3. NIOSH, Region II
4. OSHA, Region II

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
Analyses of PCP in Wipe Samples
Fort Stanwix National Monument
Rome, New York
HETA 83-090

February 1, 1983

Sample Description	PCP Contamination (ng/cm ²)*
<u>A. Personal</u>	
Worker #1	N.D.**
Worker #2	70
Worker #3	N.D.
Worker #4	N.D.
Worker #5	60
Worker #6	N.D.
<u>B. Work Surface</u>	
Book Store Counter	70
Wall near Interpreter's Desk	30
Interpreter's Desk	N.D.

*ng/cm² = nanograms per square centimeter

** N.D. = below the limit of detection (<10 ng/cm²)

Table II
Urine Pentachlorophenol Sample Analyses

Fort Stanwix National Monument
Rome, New York
HETA 83-090

February 1, 1983

Sample Description	Nanograms of Pentachlorophenol/ml urine (ppb)
A. <u>Personal</u>	
Worker #1	<4.0*
Worker #2	7.2
Worker #3	<4.0
Worker #4	16.3
Worker #5	4.6
Worker #6	<4.0
B. <u>Controls</u>	
C-1	<4.0
C-2	<4.0
C-3	<4.0
C-4	<4.0

*4.0 nanogram of PCP per ml of urine is the detection limit of the analytical method used.

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