U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

# HEALTH HAZARD EVALUATION DETERMINATION
# REPORT HE 78-49 -553

## NATIONAL STEEL DRUM COMPANY
## PHILADELPHIA, PENNSYLVANIA

JANUARY 1979

## I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) in the metal drum refinishing plant of National Steel Drum Co. in Philadelphia, Pennsylvania on March 20-22, 1978. Environmental samples were taken for iron oxide, total particulate, hydrochloric acid, sodium hydroxide, benzene, toluene, and xylene. Samples were also taken for qualitative analysis to determine the presence of unknown substances. In addition to the environmental sampling, a search was made to determine the vital status of present and past employees in an attempt to determine if there was a statistically significant increase in cancer mortality among this group.

There is not sufficient evidence, environmental or epidemiological, to either prove or disprove the existance of a health hazard at this plant. During the days of this evaluation, of the environmental samples taken, none showed an overexposure to any substance under study. In addition, no known human carcinogens were measured. Because of the few numbers involved, the loss to follow-up of more than 16 percent of the employees, and incomplete information on many of the individuals involved, data analysis could not be performed to substantiate or refute possible increased cancer mortality. Some comparisons, however, were made between the population studied and males in a comparable age group in the state of Pennsylvania.

## II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination 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 the National Technical Information Service (NTIS), Springfield, Virginia. 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:

a. National Steel Drum Co., Philadelphia, Pennsylvania
b. Requestor
c. International Brotherhood of Teamsters, Local No. 500
d. U.S. Department of Labor, Region III
e. NIOSH, Region III

For the purpose of informing the approximately thirty "affected employees", the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place near where exposed employees work.

## III. INTRODUCTION

Section 20 (a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6) authorizes the Secretary of Health, Education, and Welfare following a written request by an 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of the employees at National Steel Drum Company. This request alledged that there had been a number of cancer deaths in the workforce in recent years and was concerned that those deaths were possibly work related. This determination expands on previous interim reports and concludes this health hazard evaluation.

## IV. HEALTH HAZARD EVALUATION

### A. Process Description

This plant cleans and reconditions used steel drums. In addition to residue which might remain in the drum, employees are also potentially exposed to various substances used in the cleaning, shotblasting and painting operations which are the primary activities of this plant.

Used steel drums are trucked into the plant where the initial process is to remove any internal residue. This is usually done by turning the drum upside down, with one of the two top openings over a nozzle, and flushing the drum with water. Drums having a solidified residue, which will not wash out, have metal chains put inside them and are rotated so that the chains will break up and dislodge the residue so it can then be washed out. After flushing with water, the drums are submersed in an alkali (sodium hydroxide) dip tank, flushed internally with acid, neutralized and dried. Employees unloading and initially flushing the drums are potentially exposed to whatever residue might be in the drum. However, these operations are enclosed only on two sides and partially on a third and overhead, so the natural ventilation would tend to keep this exposure low. Employees placing the drums in the alkali tank or on the acid nozzles would be potentially exposed to these substances.

Some drums, instead of being sent through the water-alkali-acid cycle, have the tops removed and are sent through an oven where any residue is incinerated. Potential exposures in this operation are to the worker who removes the top from the drum and to the worker who places them on the oven conveyor. Both are potentially exposed to residue, and the oven man to decomposition and pyrolysis products and carbon monoxide. The oven man, however, is outside and the wind tends to reduce his exposure.

The exteriors of the drums are cleaned by shotblasting in a wheelabrator. They are then painted in an automated spray operation. The employee who feeds the wheelabrator is potentially exposed to dust from the iron shot used in this operation. The feeder and take-off man in the paint spray operation are potentially exposed to paint solvents.

Most other operations performed in this plant are mechanical, such as reshaping and inspection, and the employees performing these tasks are potentially exposed to contaminants from the other operations. Their exposures, however, would be less than to the operators directly involved in those other operations.

B. Evaluation Design

An environmental survey was conducted at this facility on March 20-22, 1978. A walk-through was made on March 20, to become familiar with the processes, locations and materials being used. Personal and area environmental samples were taken in all areas of the plant on March 21. On March 22, employees were interviewed regarding work and medical histories, and physical complaints; ventilation measurements were made.

Environmental samples were obtained with the use of battery powered personal sampling pumps which were calibrated immediately prior to being taken into the field. Acrylonitrile polyvinyl chloride copolymer filters were used to sample for iron oxide and particulate. Cyclone size selectors were used in some samples to collect only the respirable portion. Impingers were used to sample for hydrochloric acid and sodium hydroxide. Charcoal tubes were used to sample for benzene, toluene and xylene. Breathing zone samples were obtained by placing the sampling pump on the belt of the worker and connecting this with flexible tubing to the sampling media positioned in his breathing zone. Area samples were obtained by placing the sampling apparatus near where the workers spent a large portion of their work shift. Sampling rates were 200 cc/minute for organic compounds, 1 lpm with impingers, 1.5 lpm for total particulates and 1.7 lpm for respirable particulates. In addition, samples were taken on charcoal and silica gel solid sorbent tubes to be qualitatively analyzed by gas chromatography and mass spectroscopy to determine if other substances were present at the time of this evaluation. Detector tubes were used to measure carbon monoxide and total hydrocarbon concentrations.

An attempt was made to determine epidemiologically if the death rate of previous employees was abnormal as alledged. Where available, the following information on terminated and presently employed workers was obtained from the records of the National Steel Drum Company:

Name
Last known address
Date of birth
Date of employment
Date of termination, where applicable

From a total of 55 employees, 23 were no longer employed by the company. A search was made to determine the vital status of these 23 men. A certificate of death was requested from the State Department of Vital Statistics for all deceased men.

C. Environmental Criteria

Listed in Table I are maximum exposure levels recommended by OSHA,[1] NIOSH,[2-6] and the American Conference of Governmental Industrial Hygienists (ACGIH)[7] for occupational exposure to the various substances measured at National Steel Drum along with health effects of each substance.

In addition to the substances listed in Table I, some detector tube samples were taken to determine the presence of any hydrocarbon. There is no standard for such measurements since the measuring device responds to the entire range of organic compounds. Also, standards are not listed for any of the compounds found by qualitative analysis since no estimate can be made of the airborne concentration of these compounds.

D. Evaluation Results

1. Environmental

Tables II through V show workplace concentrations of various atmospheric contaminants measured on the day of this evaluation. With the exception of three of the sodium hydroxide samples, all concentrations measured were below the most stringent evaluation criteria. The accuracy of the three sodium hydroxide samples is questionable due to the sampling and analytical methods used. Also, the primary basis for establishing an evaluation criteria for sodium hydroxide at 2 $mg/M^3$ is the presence of pulmonary irritation at that concentration. No irritation was experienced by the NIOSH investigators or by any employee questioned on the days of this evaluation. For these reasons, no over exposure to sodium hydroxide was judged to exist on the days of this study, even though one personal breathing zone sample was at (but did not exceed) the evaluation criteria.

In addition to the abovementioned samples, three solid sorbent tubes were subjected to qualitative analysis to determine if other substances were present at the time of this visit. Included in the list of compounds which the laboratory was able to identify are: trimethyl benzenes, methyl-ethyl benzenes, styrene, acetone, trichloroethane, cyclohexylamine, and butyl cellosolve. Due to the nature of the analysis, these substances were not quantitated.

Ventilation measurements at the paint spray station in the front department indicated an air flow of 100-150 feet per minute (fpm) at the spray point. The air flow at the face of the spray booth was 75-150 fpm with a nearby exit door open, and 100-200 fpm with the same door closed. At the paint spray station in the back department the air flow was 50-100 fpm near the spray nozzles although smoke tube observations indicated much turbulence near the face of the booth. The minimum face velocity for this type of operation should be 100 fpm.[8] Although ventilation measurements indicate that the adequacy of these local exhaust systems is marginal, especially in the back department, the results of samples for paint solvent exposure indicates that the ventilation is adequate.

2. Epidemiological

The search to determine the vital status of the 23 former National Steel Drum employees resulted in 14 men being located. The vital status of those 14 is as follows:

7 - still living
1 - death due to metastatic cancer of the pancreas
4 - deaths due to carcinoma of the lung or bronchea
1 - death due to viral pneumonia
1 - death due to disecting aeortic aneurysm

Data analysis could not be performed because of the few numbers involved, loss to follow-up of more than 16 percent of the employees, and incomplete information on many of the individuals, i.e., smoking history, other exposures. Five of the 7 deaths were due to cancer with 4 of those 5 deaths attributed to lung or broncheal cancer. All deaths involved men employed for ten years or more at National Steel Drum.

E. Summary and Conclusions

There is not sufficient evidence, environmental or epidemiological, to either prove or disprove the existance of a health hazard at this plant. During the days of this evaluation, there were no personal environmental samples taken for any substance which indicate concentrations greater than the evaluation criteria for that substance. However, the primary concern of several employees appeared to be the potential exposure to carcinogenic substances and an increased death rate due to cancer among

previous employees. The qualitative analysis of samples taken in the area where the incoming drums were being unloaded, opened, and washed, indicated the presence of some substances (trichloroethane, styrene, acetone and butyl cellosolve) which, although not necessarily human carcinogens, have been suggested to cause neoplastic or carcinogenic effects.[9]

The attempt to determine if there has been a statistically significant increase in cancer-related deaths in past employees of this plant was also not conclusive. Usual methods of statistical data analysis could not be performed because of the small numbers involved, loss to follow-up of more than 16 percent of the employees, and incomplete information on many individuals, i.e., smoking history, other exposures. Some comparisons, however, can be made between employees of National Steel Drum and males in a comparable age group (35-59 years) in the state of Pennsylvania.*

1. In Pennsylvania, of all male deaths in this age group, approximately 20 percent are due to malignant neoplasms (cancer).

In the National Steel Drum group, 5 of 7 known deaths, approximately 70 percent, were due to malignant neoplasms.

2. In Pennsylvania, of all male deaths in this age group due to malignant neoplasms, approximately 40 percent were malignant neoplasms of the respiratory tract.

In the deaths in the National Steel Drum group due to malignant neoplasms, 4 of 5 deaths, 80 percent, were due to malignant neoplasms of the respiratory system.

Again, the incomplete nature of the data should be recalled. In addition, while no smoking history is available on the deceased former employees of National Steel Drum, the smoking histories of current employees indicate a large percentage of smokers (approximately 80 percent). This would be expected to impact on future mortality data of this group.

## V. RECOMMENDATIONS

Since the residue in the incoming drums currently contains almost any substance, it is advisable to try to reduce employee exposure to those substances, especially the ones which are potential carcinogens. In as far as possible, drums should be selectively purchased for processing and any drums which had previously contained a carcinogen should be refused or handled with special precautions. Local exhaust ventilation should be installed in the area where the incoming drums are initially opened and washed. Ventilation in other locations was adequate except for the paint spray operation in the back department. Routine maintenance and proper equipment operation will probably eliminate the turbulence around that operation and bring the air flow up to recommended levels. Use of safety equipment such as aprons and eye wear should continue.

*Information presented here is for all males in Pennsylvania, 35-59 years of age, according to the 1970 census figures for that state.

Strenuous efforts should be devoted to primary prevention. The greatest reductions in mortality can be achieved by cessation of cigarette smoking and reduction of exposure to other respiratory carcinogens (environmental and occupational). Elimination of combined exposure to cigarette smoke and other airborne carcinogens is particularly important because their effects on lung cancer incidence are often synergistic.

## VI. REFERENCES


1. U.S. Department of Labor, Occupational Safety and Health Administration, OSHA Safety and Health Standards, 29 CFR 1910, Revised January, 1978.

2. Criteria for a Recommended Standard ... Occupational Exposure to Sodium Hydroxide, U.S. Department of Health, Education, and Welfare, 1975, Pub. No. (NIOSH) 76-105.

3. Criteria for a Recommended Standard ... Occupational Exposure to Carbon Monoxide, U.S. Department of Health, Education, and Welfare, 1972, Pub. No. HSM 73-11000.

4. Criteria for a Recommended Standard ... Occupational Exposure to Benzene, U.S. Department of Health, Education, and Welfare, 1974, Pub. No. (NIOSH) 74-137.

5. Criteria for a Recommended Standard ... Occupational Exposure to Toluene, U.S. Department of Health, Education, and Welfare, 1973, Pub. No. HSM 73-11023.

6. Criteria for a Recommended Standard ... Occupational Exposure to Xylene, U.S. Department of Health, Education, and Welfare, 1975, Pub. No. (NIOSH) 75-168.

7. American Conference of Governmental Industrial Hygienists, Documentation of the Threshold Limit Values for Substances in Workroom Air, 1977.

8. Industrial Ventilation, A Manual of Recommended Practice, 13th Ed., 1974, American Conference of Governmental Industrial Hygienists.

9. Suspected Carcinogens, A Subfile of the Registry of Toxic Effects of Chemical Substances, 2nd Ed., U.S. Department of Health, Education, and Welfare, 1976, Pub. No. (NIOSH) 77-149.


## VII. AUTHORSHIP AND ACKNOWLEDGEMENTS


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Table .

Evaluation Criteria

National Steel Drum Company
Philadelphia, Pennsylvania

HE 78-49

| Substance | OSHA Standard | NIOSH Recommendation | Threshold Limit Value | Health Effects[a] |
|---|---|---|---|---|
| Hydrochloric Acid | 5 ppm ceiling[b] | N.A.[c] | 5 ppm ceiling | Respiratory irritation |
| Sodium Hydroxide | 2 mg/M$^3$ | 2 mg/M$^3$ ceiling | 2 mg/M$^3$ ceiling | Airway irritation |
| Iron Oxide | 10 mg/M$^3$ | N.A. | 5 mg/M$^3$ | Benign lung changes |
| Particulate | 5 mg/M$^3$ respirable<br>15 mg/M$^3$ total | N.A. | 5 mg/M$^3$ respirable<br>10 mg/M$^3$ total | Irritation of eyes and upper respiratory tract, reduced visibility, skin damage |
| Carbon Monoxide | 50 ppm | 35 ppm;<br>200 ppm ceiling | 50 ppm | Heart effects |
| Benzene | 10 ppm;<br>50 ppm ceiling | 1 ppm ceiling | 10 ppm | Blood changes, including leukemia |
| Toluene | 200 ppm;<br>300 ppm ceiling | 100 ppm;<br>200 ppm ceiling | 100 ppm | Central nervous system depressant |
| Xylene | 100 ppm | 100 ppm;<br>200 ppm ceiling | 100 ppm | Central nervous system depressant; airway irritant |

(a) Primary effects considered in establishing NIOSH recommended standards when available, otherwise effects described by ACGIH.
(b) Criteria are 8-hour time weighted averages except as noted.
(c) Recommended exposure limits are not available for these substances.

Table II

Sodium Hydroxide Concentrations
HE 78-49

National Steel Drum Company
Philadelphia, Pennsylvania

March 21, 1978

| Description | Time | Concentration |
|---|---|---|
| Area Sample - Front Dept. on Dock near Dip Tank | 8:30 am - 12:07 pm | 0.8 mg/$M^3$ |
| Area Sample - Front Dept. on Dock near Dip Tank | 12:07 am - 3:15 pm | 2.0 |
| Personal Sample - Front Dept. Caustic Line Take-off Man | 8:12 am - 12:00 n | 2.0 |
| Personal Sample - Front Dept. Caustic Line Take-off Man | 12:35 pm - 3:10 pm | 0.5 |
| Area Sample - Front Dept. Between Caustic & Acid Lines | 12:05 pm - 3:15 pm | 3.4 |

Recommended maximum: 2 mg/$M^3$ Ceiling

Table III

Benzene, Toluene & Xylene Concentrations
HE 78-49

National Steel Drum Company
Philadelphia, Pennsylvania

March 21, 1978

| Description | Time | Concentrations | | |
|---|---|---|---|---|
| | | Benzene | Toluene | Xylene |
| | | 0.1 ppm | 6 ppm | 18 ppm |
| Personal Sample - Back Dept. - Painter | 8:25 AM - 12:30 PM | <1 | <1 | 2 |
| Personal Sample - Back Dept. - Painter | 12:30 PM - 2:15 PM | <0.1 | 2 | 3 |
| Personal Sample - Front Dept. - Painter | 8:08 AM - 12:37 PM | <0.1 | 1 | 2 |
| Personal Sample - Front Dept. - Painter | 12:37 PM - 3:10 PM | <0.1 | 0.2 | 0.2 |
| Personal Sample - Front Dept. - Truck Loader | 9:15 AM - 12:40 PM | <0.1 | <0.1 | 0.2 |
| Personal Sample - Front Dept. - Truck Loader | 12:40 PM - 3:10 PM | | | |

Recommended Maximum: Benzene - 1 ppm
Toluene - 100 ppm
Xylene - 100 ppm

Table IV

Iron Oxide and Particulate Concentrate
HE 78-49

National Steel Drum Company
Philadelphia, Pennsylvania

March 21, 1978

| Description | Time | Type | Concentrations | |
|---|---|---|---|---|
| | | | Iron Oxide | Particulate |
| Personal Sample - Front Dept. - Shot Blaster | 8:05 AM - 3:10 PM | Respirable | 0.03 mg/M$^3$ | 0.6 mg/M$^3$ |
| Personal Sample - Back Dept. - Shot Blaster<br>Personal Sample - Back Dept. - Shot Blaster | (8:23 AM - 2:12 PM)<br>(2:30 PM - 3:15 PM) | Respirable | 0.4 | 1.6 |
| Personal Sample - Back Dept. - Inspector<br>Personal Sample - Back Dept. - Inspector | (8:20 AM - 2:11 PM)<br>(2:35 PM - 3:05 PM) | Total | 1.8 | 5.5 |

Recommended Maximum: Iron Oxide - 5 mg/M$^3$
Respirable Particulate - 5 mg/M$^3$
Total Particulate - 10 mg/M$^3$

Table V

Hydrogen Chloride Concentrations
HE 78-49

National Steel Drum Company
Philadelphia, Pennsylvania

March 21, 1978

| Description | Time | Concentration |
|---|---|---|
| Area Sample - Front Dept. - Unloading Dock near Acid Spray | 8:00 AM - 12:05 PM | <0.1 ppm |
| Area Sample - Front Dept. - Unloading Dock near Acid Spray | 12:05 PM - 3:20 PM | <0.1 ppm |

Recommended Maximum: 5 ppm ceiling