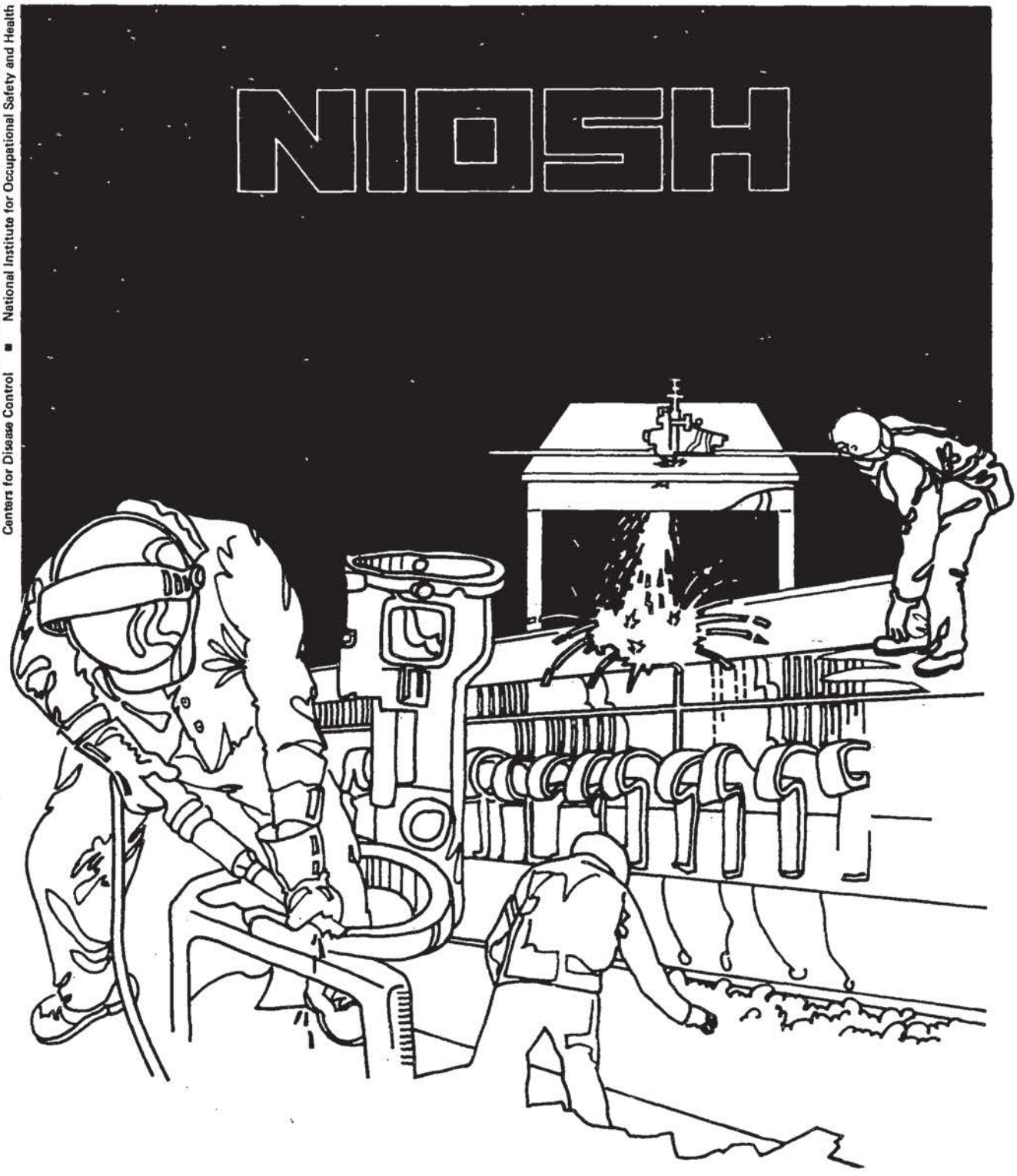
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 83-143-1419
UNITED STATES ASSAY OFFICE
SAN FRANCISCO, CALIFORNIA

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 83-143-1419
FEBRUARY 1984
UNITED STATES ASSAY OFFICE
SAN FRANCISCO, CALIFORNIA

NIOSH INVESTIGATORS:
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I. SUMMARY

On February 8, 1983 the National Institute for Occupational Safety and Health (NIOSH) was requested to evaluate the possible work-relatedness of reported headaches, nausea, and renal disease among employees at the U.S. Assay Office in San Francisco, California. Workers were concerned about exposures to fumes in the melting room and in the adjacent cash division.

On March 8, 1983, two NIOSH investigators conducted a walk through environmental and medical survey of the Assay Office and on March 29-30, April 1, 6, 13 and May 17, 1983, follow-up environmental and/or medical surveys were conducted. Twenty-three air samples were collected to measure exposure to metal fume particulate. Of these, eight air samples considered to be representative of the others were analyzed for silver, cadmium, copper, nickel and zinc. All of these metal fume particulates were detected, but the metal concentrations were well below the appropriate recommended criteria or other evaluation criteria. Five polynuclear aromatic hydrocarbon (PNA) air samples were collected. Two PNA's, fluoranthene and pyrene, were detected. Fluoranthene concentrations ranged from 0.91 to 1.34 micrograms per cubic meter of air (ug/m^3) and pyrene concentrations ranged from 0.97 to 1.58 ug/m^3. These two PNA's are not currently regulated.

Three hydrogen sulfide (H_2S) gas detector tubes were used to monitor the coke crushing operation, but only trace quantities of H_2S were detected.

Three carbon monoxide (CO) gas detector tubes were used to evaluate CO levels in the vault area. Carbon monoxide concentrations ranged from 1-2 ppm which is well below the NIOSH recommended criterion of 35 ppm.

A total of six workers in the melting room and six workers in the cash division were interviewed; medical records were obtained for the melting room workers. No pattern of symptoms or physical findings was found in the interviews or in review of the medical records.

Based on the environmental results and interviews with the employees, NIOSH concluded that no overexposures to environmental contaminants existed on the dates of this survey.

KEYWORDS: SIC 9999, Assay, metal melting, coin melting, battery melting, solvents and renal disease.

II. INTRODUCTION

In February, 1983, the National Institute of Occupational Safety and Health (NIOSH) received a health hazard evaluation request to evaluate the work relatedness of reported headaches, nausea and renal disease among employees at the U.S. Assay Office in San Francisco, California. Employees working in the coin melting room and the cash division were reportedly concerned about exposures to metal fumes from the melting of coins (bronze, copper-nickel, nickel and silver) and chrome plated dies. During the walk through survey, several other concerns were mentioned by the union representative which included; 1) potential overexposure to hydrogen sulfide during the coke crushing operation, 2) potential exposure to polynuclear aromatic hydrocarbons (PNA's) from the quenching oil (release agent) which is used to coat the molds, 3) concern that the exhaust duct insulation tile may contain asbestos, and 4) the cool temperatures perceived by employees working in the vault area.

On March 8, 1983, NIOSH investigators conducted a walk through environmental and medical survey of the U.S. Assay Office melting room. On March 29-30, April 1, 6, 13 and May 17, 1983, NIOSH conducted a follow-up environmental survey. On April 6, 1983 a follow-up medical survey was conducted. Medical records for seven melting room workers were reviewed by the NIOSH medical officer.

The environmental air samplings results were reported to the appropriate individuals as soon as they became available.

III. BACKGROUND

The U.S. Assay Office melting room has been operational since 1937. Five workers and one supervisor work in the melting room five days a week during the hours of about 7:30 a.m. to 4:00 p.m. Employees working in the melting room are provided the following safety equipment: safety tinted glasses, face shield, asbestos gloves and apron, boot covering, ear plugs and safety shoes. A disposable respirator is provided, but employees are not required to wear it.

In 1972, NIOSH conducted an environmental survey of several operations at the U.S. Assay Office. Employees in the melting room were monitored to determine whether they were exposed to metal fume particulates such as copper, zinc oxide, nickel and silver. Seven of the eight air samples exceeded the U.S. Department of Labor (FED-OSHA) silver standard of 0.01 milligrams of silver per cubic meter of air (mg/m^3). None of the air samples analyzed for copper, zinc oxide or nickel fumes exceeded the FED-OSHA Standard of 0.1 mg/m^3, 5.0 mg/m^3 and 1.0 mg/m^3 respectively.

In 1977, a second study was conducted by a contracting industrial hygiene laboratory to evaluate melting room workers' exposure to fume particulates (zinc, copper, silver, and nickel). One of eight air samples exceeded the Federal OSHA standard for silver. None of the air samples analyzed for copper, zinc oxide or nickel fumes exceeded the Federal standards cited above.

PROCESS DESCRIPTION

There are four gas operated furnaces in the melting room; however, only two of the furnaces are usually operated at one time. The furnaces are used to melt condemned coins, coin material and chrome plated dies.

The daily operation begins with the preparation of the furnace and heating of the crucibles. Once the crucibles are hot, the coin is added a bit at a time. Crushed coke is also added to the crucible to keep the metal from sticking to the dipper while pouring the molten metal into the molds. It should be noted that the molds are coated with a quenching oil which acts as a mold release agent. Once the metal is poured into the molds, the metal is allowed to solidify (about 1-2 minutes). The molds are emptied of the red hot metal and placed in a water quenching tank for several minutes. Afterwards, the hot bars are loaded onto a hand truck and stamped with the melt type and melt number.

Bronze coins have been the major coins melted since 1966, but it will be discontinued in several months. Once bronze melting is completed, the percentage of coin melt by metal will be as follows: copper-nickel 80%, silver 10%, and dies 10%. Some of the precious and non-precious metals melted are listed below:

A) Non-precious metals

1. Bronze (e.g. penny) - copper (95%) + zinc (5%), the coins are melted at 2150 F and the melt is poured at 2300°F.

2. Copper-Nickel (e.g. dimes, quarters and half dollars) copper (92%) and nickel (8%), the coins are melted and poured at the about the same temperature as the bronze coins.

3. Nickel coin - Copper (75%) and nickel (25%), the coins are melted at 2600°F and the melt is poured at 2800°F.

B) Precious metals

1. Silver (e.g. commemorative coins) - silver (90%) and copper (10%), the coins are melted at 1760°F and the melt is poured at 1900°F.

2. Gold coins - These are rarely melted, and a special request must be made by the Treasury Department.

C) Dies

These are used to stamp the coins. When the dies are taken out of circulation, the image is ground off, and the dies are stored until they are released by the Treasury Department to be melted.

D) Foreign coins

Foreign coins were minted for 10-15 countries until 1969-1970. The foreign coins consisted of zinc (60%) and copper (40%). No zinc melts have been done since 1970, and no zinc melting will be done aside from the bronze melt.

E) Other

It was reported that in the past, more than 10 years ago, items such as whole old batteries and x-ray film were melted down to retrieve the silver from each. Also, a dried sludge from the floor sweepings and the plumbing traps was melted to retrieve lost metals. It is unclear how often these items were melted. However, this operation is no longer done at the mint.

The coke crushing operation is done about once every two months. Coke which comes as solid "nuggets" is place into a circular table. A heavy metal wheel passes along the table crushing the coke into a fine powder. The powder is used daily around the base of the furnace to keep the crucible from sticking. A "rotten egg" odor (hydrogen sulfide gas) was reportedly produced during the coke crushing operation.

Medical surveillance of the U.S. Assay Office employees includes a yearly audiogram, vision tests and blood pressure measurements.

IV. MATERIAL AND METHODS

1. Environmental:

Several sampling techniques were used to evaluate the suspected air contaminants metal fumes, hydrogen sulfide, PNA's, asbestos and carbon monoxide. Personal and area air samples were collected to characterize worker's exposure. Air samples were collected using two sampling techniques; direct reading gas detector tubes or a sampling train (calibrated vacuum pump and appropriate collection medium) through which a known volume of air is passed. The following is a description of the sampling and analytical techniques used to characterize the airborne concentrations of contaminants.

a) Metal Fumes Particulates:

Air samples were collected using a sampling train and a 37-millimeter, 0.8 micron, mixed cellulose ester membrane filter. The vacuum pump operated at 1.5 liters per minute during most of the workshift. The filters were subsequently analyzed by Inductively Coupled Plasma-Atomic Emission Spectrophotometry (ICP-AES) for a quantitative determination of trace metals.[1] The analytical limit of quantitation for each samples as 1 microgram (ug) per filter.

b) Hydrogen Sulfide (H_2S) and Carbon Monoxide (CO):

NIOSH certified gas detector tubes (H_2S and CO) were used to sample airborne concentrations of these gases. Gas detector tubes must meet the requirements set forth in Title 42, Part 84 in the Code of Federal Regulations (basically ± 35% accuracy at ½ the exposure limit and ± 25% at 1 to 5 times the exposure limit), in order to be certified.

c) Polynuclear Aromatic Hydrocarbons:

Environmental air samples were collected for PNA's using a sampling train (a 37-mm glass fiber filter is connected to a 150 milligram silica gel tube) which operated at 1.5 liters per minute. The tube and filter were subsequently analyzed following the NIOSH Technical Bulletin, TB-001 issued December 1, 1982. The analytical limit of detection was 50 nanogram per sample.

d) Asbestos:

Environmental air samples were collected to measure airborne concentrations of asbestos using a sampling train and a mixed cellulose ester membrane filter-type AA. In addition, bulk samples of the insulation tile were collected and analyzed to determine if asbestos was present, the type and percent according to NIOSH Physical and Chemical Analytical Method (P&CAM) number 245[20].

e) Temperature and Humidity:

A Bendix Psychrometer® model 566-2 was used to measure dry bulb and wet bulb temperatures. The relative humidity is read from a chart using the difference between the two temperature readings.

2. Medical:

Five workers and one supervisor from the melting room were interviewed by a NIOSH medical officer for nervous system, dermatologic, renal system and other symptoms. Medical records for all melting room employees, including another employee recently disabled, were obtained from both the Assay Office health unit and from the employees' personal physicians for review.

V. EVALUATION CRITERIA

A. Environmental:

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 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 ad 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.

EVALUATION CRITERIA

CONCENTRATION/EXPOSURE PERIOD

HETA 83-143

Substance	8-Hour TWA[1]	Ceiling[2]	Source
Copper Fume	---[2]	---	NIOSH
	0.1 mg/m^3	---	FED-OSHA
	0.2 mg/m^3	---	ACGIH
Zinc Oxide Fume	5.0 mg/m^3	15 mg/m^3 (15 min)	NIOSH
	5.0 mg/m^3	---	FED-OSHA
	5.0 mg/m^3	---	ACGIH
Nickel Oxide Fume	0.015 mg/m^3 (CA)[4]	---	NIOSH
	1.0 mg/m^3	---	FED-OSHA
	---	---	ACGIH
Cadmium Oxide Fume	.040 mg/m^3	0.20 mg/m^3 (15 min)	NIOSH
	0.1 mg/m^3	0.3 mg/m^3	FED-OSHA
	---	0.05 mg/m^3	ACGIH
Silver Fume	---	---	NIOSH
	0.01 mg/m^3	---	FED-OSHA
	0.01 mg/m^3	---	ACGIH

EVALUATION CRITERIA

CONCENTRATION/EXPOSURE PERIOD (continued)

HETA 83-143

Substance	8-Hour TWA[1]	Ceiling[2]	Source
Asbestos	CA-Lowest Feasible Limit		NIOSH
	0.5 fibers/cc	10 fibers/cc	FED-OSHA
	0.5 fibers/cc(amosite)	---	ACGIH
	2.0 fibers/cc(chrysotile)	---	ACGIH
Carbon Monoxide	35 ppm	200 ppm	NIOSH
	50 ppm	---	NIOSH
	50 ppm	400 ppm	ACGIH
Hydrogen Sulfide	---	10 ppm (10 min)	NIOSH
	20 ppm	50 ppm (10 min)	FED-OSHA

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1. TWA - Time Weighted Average.
2. Ceiling - ceiling limit, maximum concentration to which an employee may be exposed on a sampling interval which should not exceed 30 minutes unless otherwise specified.
3. mg/m^3 - Milligrams of a substance per cubic meter of air.
4. CA - lowest feasible limit (suspected or confirmed carcinogen based on either (1) limited epidemiological evidence excluding clinical reports of single cases, or (2) demonstration of carcinogensis in one or more animal species by appropriate methods), use best control technology.
5. ppm - parts of a vapor or gas per million parts of contaminated air.

B. Toxicological Effects:

The primary substances identified in this workplace which have potentially toxic effects on the health of exposed workers are polynuclear aromatics (PNA's), asbestos, and metal fumes; many of the exposures for smelter workers employed at the U.S. Mint before 1972 were not well characterized, however. The following section briefly reviews the health effects associated with chronic low level exposure to these substances.

1. Polynuclear Aromatics (PNA's)

As a chemical group, chronic exposure to low levels of (PNA's) may cause skin and lung cancer, as well as direct skin irritation and phototoxic dermatitis (a skin reaction to PNA's in the presence of sunlight). Individual compounds have also been studied: benzo(a)pyrene is considered to be a carcinogen, although it is not currently a regulated carcinogen; fluoranthene and pyrene are suspected of being cocarcinogens, but do not produce tumors by themselves. (3,4,5,6). The vapor is absorbed through the lungs and the liquid or condensed vapor is absorbed through the skin.

2. Asbestos:

Chronic exposure to asbestos fibers in sufficient quantity may cause asbestosis, a lung disease involving fibrosis (scarring) of the lung and progressive respiratory impairment, and at much lower exposure levels, various forms of cancer, including lung gastrointestinal. No safe threshold for exposure has been determined for the prevention of asbestos-related cancer. Asbestos-exposed workers who smoke have a much higher increase in cancer rates than asbestos-exposed workers who do not smoke. Asbestos is primarily absorbed through the lungs, and secondarily by swallowing dusts or phlegm containing asbestos fibers. (3)

3. Metal Fumes:

Chronic exposure to low levels of certain metals, including cadmium and lead, may result in kidney (renal) disease, reproductive impairment, nervous system (central and peripheral), and blooding forming organs (bone marrow). These effects may not be apparent for many years after initial exposure, and laboratory tests such as renal function tests may also be within normal or high normal range for many years before clinical disease is evident. Absortion is primarily through the lungs, and secondarily by ingestion (3,7).

VI. RESULTS AND DISCUSSION

A. Environmental

1. Metal Fumes:

Twenty-three environmental air samples were collected from the melting room, for each type of coin melted to determine the airborne concentrations of metal fume particulates. Of these, eight air samples considered to be representative of the numerous air samples collected were analyzed by ICP-AES to determine the type and quantity of trace metals present (Table I). Those metals identified were silver, cadmium, copper, nickel and zinc. Two of eight air samples detected cadmium at a concentration of 0.004 and 0.007 mg/m^3. All the air samples detected copper which ranged in concentration from 0.006 to 0.036 mg/m^3. Zinc air concentrations ranged from none detected to 0.167 mg/m^3. None of the above exposures exceeded the NIOSH recommended criterion or the other appropriate evaluation criteria cited on page 12. Since none of these air samples detected significant quantities of metals, it is unlikely the remaining 15 air samples would detect excessive air concentrations. Thus, they were not analyzed.

2. Polynuclear Aromatic Hydrocarbons:

A quenching oil (Shell Valuta Oil B®) is used to coat the molds. The petroleum hydrocarbons in the oil are a complex mixture of paraffin, naphthene and aromatic hydrocarbons. Like many petroleum oils, the aromatic hydrocarbons contain polycyclic compounds of various concentrations and structures. Five environmental air samples were collected and analyzed for the following PNA's: fluoranthene, pyrene, Benz(a) anthracene B(a)A, chrysene, Benzo(e)pyrene B(e)P, Benzo(a) pyrene B(a)P. No B(a)A, Chrysene, B(e)P or B(a)P were identified on the air samples; however, fluoranthene and pyrene were present (Table II).

3. Hydrogen Sulfide:

Several gas detector tubes[3] were used to monitor hydrogen sulfide gas generated during the coke crushing operation. Even though H_2S was smelled (odor threshold of 0.13 ppm)[8], only trace quantities of H_2S were detected.

Insulation tiles are used to cover the outside of the exhaust duct that are over the furnaces. The duct in the storage room, adjacent to the melting room, have missing, loose or broken tiles. One area air sample was collected for asbestos, but none was detected. Two bulk samples were collected to determine if asbestos is present. One bulk sample was analyzed for asbestos and none was detected; however, the other bulk sample contained 1-5 percent chrysotile asbestos and about 50 percent amosite asbestos.

Several carbon monoxide gas detector tubes were used to monitor the CO concentrations in the basement (C-vault and sub C-vault). Trace concentrations (1-2 ppm) of CO were detected in the vault and sub-vault which is well below the NIOSH recommended criterion of 35 ppm.

In addition, employees doing heavy work in the basement were concerned about what they perceived to be cold temperatures. The dry bulb temperature was measured to be 66.5° F and relative humidity was calculated to be 59 percent. There are no federal standards regarding comfort temperature ranges. Furthermore, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[9] provide guidelines for indoor climate and health, but these guidelines generally apply to sedentary workers. The sub-basement has a heating system; however, it was reported to be very noisy to those employees working in the vault. Several alternatives are possible in resolving the employees complaints. Employees should wear heavier clothing while working in the vault, and the heating system could be insulated to reduce the noise level in order that the workers would use the heater unit while working in the vault.

B. Medical

A total of six workers in the melting room and six workers in the cash division were interviewed; medical records were obtained for the six current melting room employees. No pattern of symptoms or physical findings was found in the interviews with melting room or cash division employees, or in review of the medical records.

VII. CONCLUSIONS

Based on the environmental air sampling results, medical interviews and review of records, NIOSH concluded that workers, were not exposed to excessive concentrations of metal fumes (zinc, copper, silver and nickel), hydrogen sulfide or asbestos during the dates of this survey. Additionally, employees working in the vault area were not exposed to excessive carbon monoxide concentrations nor were they exposed to excessively cold temperatures.

There were no positive medical finds.

VIII. RECOMMENDATIONS

1. It should be suggested to all workers who were employed in the melting room of the Assay Office during the 1960's and early 1970's, when exposures to heavy metals, industrial solvents and other uncharacterized substances are presumed to have been higher, that they inform their personal physicians of this history.

2. Asbestos tiles located on the furnace exhaust duct which are cracked, chipped or which appear to be flaking should be removed and replaced with a less hazardous material.

3. It is suggested that the quing oil used as a mold release be substituted with a sodium icate wash to eliminate PNA exposure. Meanwhile, a sui respirator should be selected for workers to pre exposures.

IX. REFERENCES

1) NIOSH Manual of Analytical Methods, USDHEW publication number (NIOSH) 79-141.

2) NIOSH Manual of Analytical Methods, USDHEW publication number (NIOSH) 77-157A.

3) Occupational Diseases, A Guide to Their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, June 1977.

4) Proctor NH, Hughes JP. Chemical Hazards of the Workplace. Philadelphia, Pennsylvania: J.B. Lippincott Co., 1978.

5) Coal Liquefaction: Recent Findings in Occupational Safety and Health. NIOSH Special Technical Report, Publication No. 80-122, June 1980.

6) Polynuclear Aromatic Hydrocarbons, Physical and Biological Chemistry, Sixth International Symposium, Edited by Marcus Cooke, Anthony J. Dennis, and Gerald L. Fisher.

7) Occupational Safety and Health Administration Standard for Occupational Exposure to Lead. 29 CFR Part 1910.1025, effective March 1, 1979.

8. NIOSH/OSHA Occupation Health Guidelines for Chemical Hazards, USDHHS publication number (NIOSH) 81-123.

9. ASHRAE Handbook and Product Directory. 1977 Fundamentals, p.8.20.

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XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standard Development and Technology Transfer, 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:

1. U.S. Assay Office, San Francisco, California.

2. American Federation of Government Employees, Local 51.

3. U.S. Department of Labor, Region IX.

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

PERSONNEL AIR SAMPLES COLLECTED
FOR METAL FUME PARTICULATES
AT THE MELTING ROOM

U.S. Assay Office
San Francisco, CA
March/April, 1983

HETA 83-143

Date	Sample #	Job Description	Type Melt	Sample Period	Sample Volume (liters)	Fume Particulate (mg/m^3)[1] Silver	Cadmium	Copper	Nickel	Zinc
3/29	4	(Helper) Breaking bar from mold and oiling mold.	Bronze & Dies	0818 - 1348	495	N.D.[2]	0.004	0.008	N.D.	0.11
3/29	5	Breaking bar from mold, oiling mold and pouring melt.	Bronze & Die	0818 - 1348	495	N.D.	0.007	0.015	N.D.	0.167
3/30	8	Pouring Melt.	Copper-Nickel	0816 - 1403	521	N.D.	N.D.	0.06	0.005	0.018
3/30	9	Pouring Melt.	Copper-Nickel	0820 - 1403	515	N.D.	N.D.	0.036	0.003	0.02
4/01	17	Pouring Melt.	Silver	0828 - 1338	465	0.003	N.D.	0.006	N.D.	0.004
4/01	18	Pouring Melt.	Silver	0827 - 1341	471	0.002	N.D.	0.007	N.D.	N.D.
4/13	202	Die Destruction.	---	0847 - 1345 (several on-off intervals)	258	N.D.	N.D.	0.008	N.D.	N.D.
4/13	207	Die Destruction	---	0846 - 1345 (several on-off intervals)	261	N.D.	N.D.	0.01	N.D.	0.03

1) mg/m^3 - milligrams of a substance per cubic meter of air.
2) N.D. - none detected.

TABLE II

ENVIRONMENTAL AIR SAMPLES COLLECTED

FOR POLYNUCLEAR AROMATIC HYDROCARBONS

U.S. ASSAY OFFICE

MAY 7, 1983

HETA 83-143

Sample	Type	Job Description	Sample Period	Sample Time (min)(1)	Sample Volume (l)(2)	PNA ug/m^3(3)	
						Fluoranthene	Pyrene
1A	P	Pourer	0945 - 1358	63	82	0.916	1.01
2A	P	Pourer	0945 - 1358	63	82	0.96	1.09
3A	A	Attached to Canopy Exhaust hood.	0945 - 1359	63	82	1.34	1.58
5A	P	Helper	1002 - 1358	65	84	0.87	0.97

1) min - minutes
2) l - liters
3) ug/m^3 - micrograms of substance per cub meter of air.