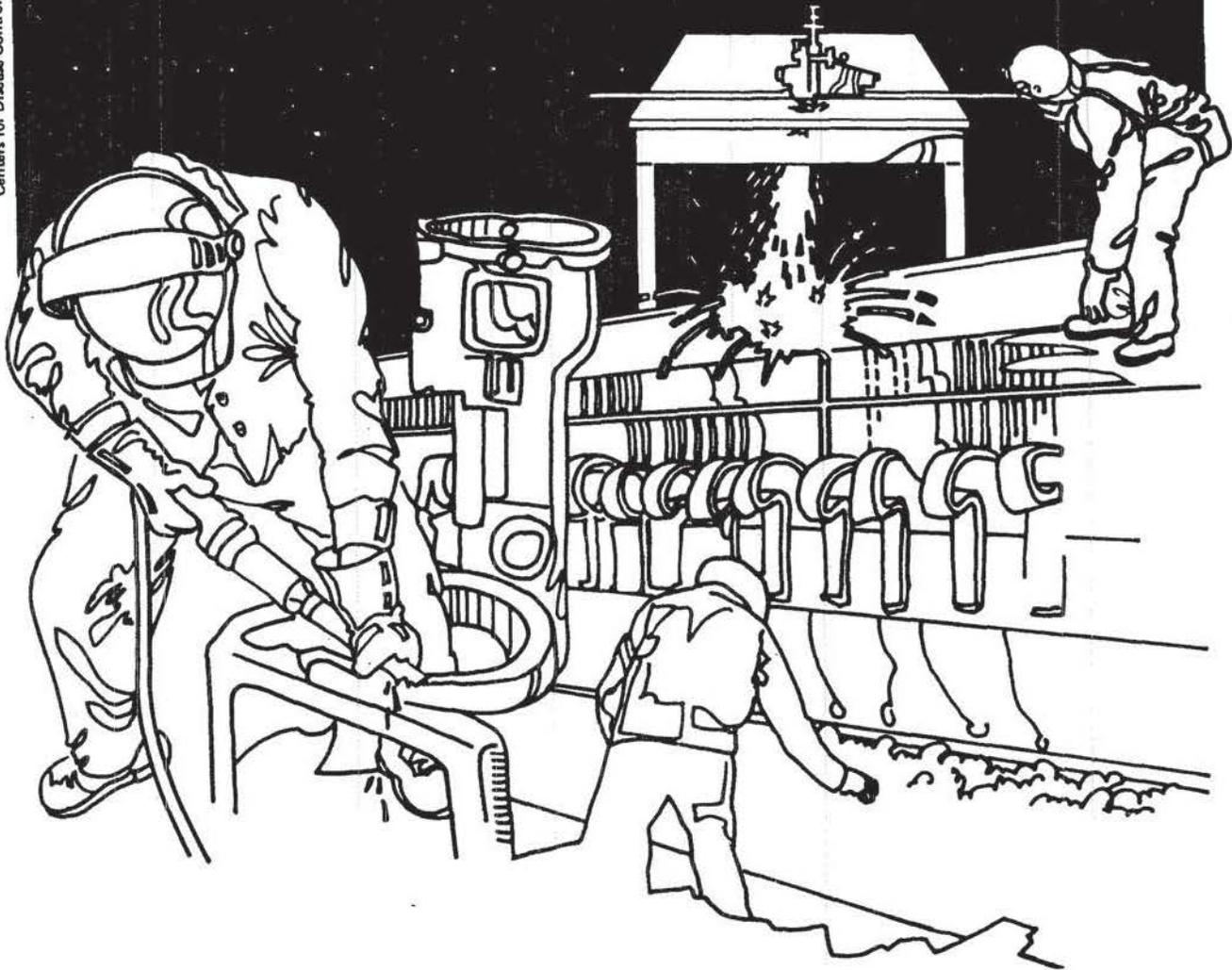


NIOSH



Health Hazard Evaluation Report

HETA 81-163-1190
GTE SYLVANIA
WINCHESTER, KENTUCKY

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

On January 14, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request to investigate five cases of sarcoidosis which occurred over a five-year period among 750 employees who manufacture specialty light bulbs at GTE Sylvania, Winchester, Kentucky.

The medical/epidemiological evaluation consisted of interviews with the five patients, a review of their medical and personnel records, a search for commonalities among the cases, and an attempt to determine usual incidence rates for sarcoidosis in the general population. The environmental evaluation consisted of two days of environmental monitoring for a number of potential contaminants including halogenated gases, metals, methyl alcohol and isopropyl alcohol.

NIOSH found that only four of the five identified cases had sarcoidosis as a final diagnosis, three of which were biopsy-confirmed. The fourth had no biopsy, but the other medical findings were characteristics of sarcoidosis. No commonalities other than working at the same plant were identified. No adequate comparison rates for this population were found. Published prevalence rates of sarcoidosis are quite variable, and apparently highly dependent on geographic location, sex, race, and method of detection.

Environmental sampling was conducted in various locations throughout the facility. Materials evaluated environmentally included halogenated gases, (hydrogen bromide, methyl iodide, and dibromomethane) isopropyl alcohol, ethyl alcohol, methyl alcohol, n-amyl acetate, and inorganic metals including lead, aluminum, silver, iron, zinc, magnesium, phosphorus, and beryllium. Airborne concentrations for all personal exposures were well below currently acceptable limits. The highest airborne concentration for a personal sample, as compared to the current environmental criteria, was 0.48 mg/m³ of zinc per cubic meter of air. This value is approximately 10% of the current NIOSH, OSHA, and ACGIH criteria of 5.0 mg/m³. Short term sampling using certified direct reading indicator tubes revealed airborne concentrations of SO₂ ranging from 0.5 to 8.0 parts per million parts of air, in the glass flare-forming room. The plant does not, and reportedly has never used beryllium, and none was found on environmental samples.

Four cases of sarcoidosis occurring among lamp workers over a five-year period were identified. NIOSH found no commonalities among the group other than working at the same plant. There were no biologically significant occupational exposures, and specifically, no exposure to beryllium. We were unable to establish a causal relationship between the cases and the work environment.

KEYWORDS: SIC 3641 (Electric Lamps), Sarcoidosis, Sulfur Dioxide, Methyl Iodide.

II. INTRODUCTION

On January 14, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request to investigate five cases of sarcoidosis among 750 employees engaged in the manufacture of speciality bulbs at GTE Sylvania, Winchester, Kentucky.

On February 25, 1981, a NIOSH epidemiologist and an occupational health nurse conducted a walk-through survey of the plant. On March 31, they conducted a second survey accompanied by an industrial hygienist. The first interim report was distributed in July 1981; the second in January 1982.

The five cases of sarcoidosis were diagnosed over the five-year period, 1975 to 1980, and occurred among a plant population of about 750. Four of the five cases were women; all were white. Two of the four women were sisters. Work involving soldering was reported to be a common factor among the five cases.

In 1980 a female employee of the plant was reported to have died from possible tuberculosis meningitis. This prompted a plant-wide TB screening program by state health officials. NIOSH contacted the person who coordinated this survey and learned that they had done approximately 100 chest x-rays and 900 TB (PPD) skin tests. Results of the chest x-rays revealed no new cases of tuberculosis. It was learned later that this employee's death was actually not related to tuberculosis.

III. BACKGROUND

GTE Sylvania's Winchester facility employs about 770 people. It began operation in 1953, at which time only flash bulbs were manufactured. Presently, over 750 different lamps are produced for use in projection equipment, theater and studio lighting, flood lights, spot lights, flash bulbs, and a variety of other uses.

Four types of specialty bulbs (lamps) are manufactured: (1) infra red, (2) incandescent projection, (3) quartz projection, and (4) par lamps. Infra red lamps are produced by inserting a metal filament inside a glass stick (rod). The unit is flushed with an inert gas (usually argon) and sealed at each end. Finally, contact buttons and ceramic shields are added to each end. Incandescent lamps are produced by joining a preformed globe with a metal filament. Next, the glass globe is drawn together at the bottom and formed into a wafer. The lamp is then filled with an inert gas mixture (usually nitrogen and argon) and the end is closed (tipped). These lamps are later joined to one of a number of different anodized aluminum bases. Quartz lamps are manufactured by joining a tungsten filament with a fused silica bulb. The bulb is filled with a halogen gas mixture and subsequently assembled into a base or reflector housing. Par lamp production is

similar to that of incandescent projection lamps. A preformed reflector is joined with a metal filament. A lens cover is added manually and subsequently heated and shaped to the desired contour. These lamps are filled with a gas mixture (either nitrogen or an argon mix) and placed in an appropriate base.

There are a number of processing operations in the production of these bulbs, generally they fall into two main categories: (1) high speed continuous line operations, and (2) manual processing steps performed at individual stations. Continuous operations include paint spray lines, gas-filling lines, and lamp part production. Manual operations include spot welding, tig welding, lead and silver solder, and buffing. There are other operations which do not fit in either of the above categories. In dichroic, for example, lamp parts are placed into a chamber where a coating is applied by heating two sources (silicon monoxide and zinc sulfide) after evacuating the chamber.

IV. METHODS AND MATERIALS

A. Medical/Epidemiological

The goals of the medical/epidemiological investigation were to confirm the cases of sarcoidosis, look for commonalities of work and exposure among cases, and to determine how unusual this number of cases was. Each of the five employees reported to have sarcoidosis was interviewed and questioned about the circumstances leading to the diagnosis of sarcoidosis, work history, outside activities and potential sources of chemical exposure away from work. In addition, their medical records were requested from their private physicians for review. Because of the known similarities of chronic beryllium disease and sarcoidosis, NIOSH interviewed company officials and reviewed records to determine if beryllium was presently or had ever been used at this plant.

To determine if the number of cases of sarcoidosis in this population was unusually high, information on population rates for comparison was sought. The medical literature on sarcoidosis was reviewed and formal and informal contacts were made with persons knowledgeable in the subject at several institutions including the university medical centers in Lexington and Cincinnati and the Mayo Clinic in Minnesota. The latter group is currently compiling regional prevalence statistics for the community it serves.

B. Environmental

Airborne sampling was conducted during two shifts to characterize employee exposures at the Winchester facility. Because the etiologic agent of sarcoidosis is unknown, and, because of the variety of materials used at this facility, the NIOSH industrial

hygienist decided to sample for a variety of occupational contaminants. Personal and area airborne samples were collected for analysis. Most area samples were used to assist the laboratory in analyzing personal samples. A few area samples were used to characterize airborne contaminants in specific plant locations. Materials sampled for and the corresponding collection media are as follows: iodine-impregnated silica gel tubes/halogenated gases; charcoal tubes/ethyl acetate, isoamyl acetate, ethyl alcohol, and isopropyl alcohol; silica gel tubes/methyl alcohol; mixed cellulose ester membrane filters and polyvinyl chloride filters/inorganic metals.

All long term airborne samples were collected by attaching the required collection media, via flexible tubing, to a battery-operated pump calibrated at 50 cubic centimeters per minute for gases and vapors, 1.5 liters per minute (LPM) for personal metals samples, and 2.0 LPM for area metals samples. Following collection in the field, all samples were sent to NIOSH laboratories for analysis. Short term airborne samples were collected with certified direct reading indicator tubes in conjunction with the corresponding detector tube pump.

Hydrogen bromide samples were analyzed using ion chromatography following the procedure outlined in NIOSH Method P&CAM No. 310.¹ Methyl iodide and dibromomethane samples were analyzed with a gas chromatograph equipped with a flame ionization detector. Methyl iodide samples are normally analyzed using NIOSH Method P&CAM No. S98.² The technique used is suitable in this instance as evidenced by the fact that there was no breakthrough of methyl iodide onto the backup section of the silica gel tube.

Charcoal tubes were analyzed using gas chromatography. Varying analytical methods were used depending upon the specific material being analyzed for. Isopropyl alcohol was analyzed according to NIOSH Method P&CAM No. S65, n-ethyl acetate was analyzed according to NIOSH Method P&CAM No. S51, ethyl alcohol was analyzed according to NIOSH Method P&CAM No. S56, and isoamyl acetate was analyzed according to NIOSH Method P&CAM No. S45.²

Personal silica gel samples were analyzed for the materials identified on the area tubes. All silica gel tubes were analyzed using a gas chromatograph equipped with a flame ionization detector according to NIOSH Method P&CAM No. 247.³

Area metals samples were ashed with nitric and perchloric acids. The residues were dissolved in dilute acid and the resulting solutions were analyzed using inductively coupled plasma-atomic emission spectroscopy for trace metal content. This technique quantitated the area samples for 28 different metals including aluminum, iron, lead, and beryllium. The results of this analysis were used in determining which metals to analyze for on the personal samples.

Personal metals samples were analyzed using atomic absorption spectroscopy according to NIOSH Method P&CAM No. 173.³ Specific metals analyzed for were zinc, aluminum, silver, magnesium, lead, and iron. Not all six metals were analyzed for on each personal sample. In addition, one sample collected in the cement mix area was analyzed for acid-soluble phosphate using an adaptation of NIOSH Method P&CAM No. 216.³ The analyte actually determined was phosphate, but the result was converted to phosphorous by multiplying by a correction factor.

Airborne concentrations of SO₂ collected with certified direct reading indicator tubes were read and recorded in the field.

Smoke tubes were used to evaluate air flow patterns on local exhaust ventilation equipment located in the soldering, dichroic and glass buffing areas.

V. EVALUATION CRITERIA

A. Sarcoidosis^{4,5}

Sarcoidosis is a disorder in which characteristic nodules (granulomas) are found in many different organs of the body. These granulomas are a form of inflammatory response by the body. The symptoms and tissue changes are not unique to this disease and are similar to those found in other diseases such as histoplasmosis, tuberculosis, and chronic beryllium disease. To establish the diagnosis of chronic beryllium disease it is necessary to document significant beryllium exposure or to demonstrate beryllium in affected tissue. While several theories have been postulated as to the etiology of sarcoidosis, no organic or inorganic chemicals have been consistently identified in sarcoid tissue and no cause, occupational or otherwise, has been identified.

The prevalence of sarcoidosis is not well known. In the United States, for instance, the prevalence rate is estimated at 7/100,000. Surveys in several western European countries have shown rates ranging from 7.5 to 64 per 100,000. In the U.S. sarcoidosis occurs 10 to 20 times more frequently in blacks. Females are slightly more affected. Rates are generally higher in the Southeast, and local geographic variations exist.

B. Environmental

Environmental criteria used to evaluate airborne concentrations at the Winchester facility are Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PEL), NIOSH recommended standards and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV).^{6,7,8} Following is a discussion of specific environmental criteria for those materials detected in the highest concentration.

1. Sulfur Dioxide

The NIOSH recommendation is 0.5 parts sulfur dioxide per million parts of air (ppm) for up to a 10-hour time-weighted average (TWA), 40-hour work week. The OSHA PEL is 5.0 ppm as an 8.0-hr. TWA, and the ACGIH TLV is 2.0 ppm, also as an 8.0-hr. TWA.

2. Methyl Iodide

The OSHA PEL for methyl iodide is 28.0 milligrams per cubic meter of air (mg/m^3) based on an 8.0-hour TWA. The ACGIH TLV is 10.0 mg/m^3 based on an 8.0-hr. TWA. NIOSH has no specific recommendation for methyl iodide, but ACGIH considers methyl iodide to be a potential human carcinogen.⁷ NIOSH considers that there is no safe level of exposure to carcinogens.^{9,10}

VI. RESULTS

A. Medical/Epidemiological

Review of the medical records of the five employees reported to have sarcoidosis revealed that while all five had sarcoidosis as a preliminary diagnosis, only four (one male, three female) had it as the final diagnosis. Of these four, three were biopsy-confirmed. The diagnosis of the fourth case was based on the presence of a characteristic clinical picture (signs, symptoms, response to treatment).

The age range of the four cases was 27 to 34 years; seniority at the plant ranged from three to ten years. The interval from starting date at the plant to date of diagnosis ranged from two to five years.

Questioning of these individuals revealed no commonalities (hobbies, jobs, vocations, neighborhood) other than the fact that they all worked at the same plant. There was no job operation that was experienced by all four. There was no evidence that beryllium had ever been used at the plant.

In attempting to determine if the number of cases was unusually high for this population, we sought comparison rates and found that the published prevalence rates on sarcoidosis are highly variable. Published rates vary according to geographic region as well methods of detection; e.g., in countries such as Sweden where mass chest x-ray screening is done, the disease is more likely to be detected.

NIOSH contacted researchers at the Mayo Clinic who are compiling statistics on regional prevalence of sarcoidosis in the area of Minnesota served by the Mayo Clinic. At the time of this report these data are not available. Informal communication with persons at the University of Cincinnati and University of Kentucky knowledgeable about sarcoidosis revealed no additional insights.

B. Environmental

Table I presents results of airborne sampling for halogenated gases. Six samples were analyzed for hydrogen bromide and three samples were analyzed for methyl iodide and dibromomethane. All gases were below the limit of detection except for one area sample collected in the quality control test lab. Methyl iodide was detected on this sample at a concentration of 33.4 milligrams per cubic meter (mg/m^3). This concentration is above the OSHA permissible exposure limit of $28.0 \text{ mg}/\text{m}^3$ and the American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Value of $10.0 \text{ mg}/\text{m}^3$.^{5,6} ACGIH considers methyl iodide to be a suspect human carcinogen.⁷

Table II presents the results of airborne monitoring with charcoal tubes. The highest concentration was $1.5 \text{ mg}/\text{m}^3$ for isopropyl alcohol. This value is less than 1.0% of the current environmental criterion, which is $980 \text{ mg}/\text{m}^3$ for NIOSH, OSHA, and ACGIH.^{6,7,8}

Table III presents results of airborne sampling for methyl alcohol. On three of the four samples collected, methyl alcohol concentrations were below the limit of detection. On one sample, a trace of methyl alcohol was found, but the amount was too low to be quantitated. All concentrations are well below current environmental criteria.^{6,7,8}

Table IV presents the results of airborne sampling for inorganic metals. Most metals analyzed for were below the limit of detection. The highest concentration was for zinc, on a sample collected at the Dichroic Operation. The concentration was $0.48 \text{ mg}/\text{m}^3$, which is less than 10% of the current NIOSH, OSHA, and ACGIH criterion of $5.0 \text{ mg}/\text{m}^3$ for zinc oxide fume.^{6,7,8}

Table V presents the results of short term airborne sampling for sulfur dioxide (SO_2) using certified direct reading indicator tubes. SO_2 was not detected in the engineering lab or dichroic chamber area. SO_2 was detected in the glass flare-forming room with one of three glass flare-forming machines in operation. Two readings, taken 18 inches from the SO_2 source, indicated levels of 3.0 - 8.0 parts per million (ppm). One reading, taken 10 feet from the SO_2 source, revealed an airborne concentration of 0.5 ppm. Although these values were obtained with short term samples and the environmental criteria for SO_2 are based on full shift samples, they do indicate a potential for employee exposure to airborne SO_2 in the range of current environmental criteria. This potential is strengthened by the fact that only one machine was operating. NIOSH recommends a time-weighted average value of 0.5 ppm. The current OSHA permissible exposure limit is 5.0 ppm. The current ACGIH threshold limit value is 2.0 ppm.^{6,7,8}

Local exhaust ventilation equipment appeared to be working satisfactorily as indicated by flow pattern checks made with smoke tubes. Those machines equipped with local exhaust ventilation seemed to function adequately with one exception. A tapered hood had been removed from the flexible duct of one of the individual soldering stations leaving only the duct (considered to be a plain opening hood) which is not as efficient for local exhaust as a tapered hood.¹¹ In addition, some hoods were further away from the solder operation than others. Smoke tube tests indicated that the hoods positioned nearer to the soldering operation were more efficient. This is consistent with the guidelines presented in the ACGIH Industrial Ventilation manual. The manual recommends placing the hood as close as possible to the contaminant because the required exhaust air volume varies with the square of the distance from the source.¹¹

Local exhaust equipment had recently been installed on the dichroic chamber. The equipment included a hood whose shape conformed to the chamber door (at the front end of the chamber). The hood surrounded the upper third of the chamber door. It was designed to capture fugitive contaminants emitted during loading or unloading operations. Checks of the air flow pattern using smoke tubes indicated that the hood worked satisfactorily when the door was opened to approximately one foot. The effectiveness of the hood decreased however, as the door was opened further.

VII. DISCUSSION

Four cases of sarcoidosis were identified among a group of approximately 750 employees over a five-year period. NIOSH was unable to establish any causal relationship between the cases and the work environment. No beryllium exposure, past or present, was identified.

Because adequate prevalence data are not available on sarcoidosis, it is difficult to determine how unusual this number of cases is for this population. Periodic contact with union and company officials has not revealed any new cases at the plant. Individuals at the pulmonary division of the University of Kentucky have been made aware of the situation and have agreed to contact us if they can provide any additional information or insights.

Results of environmental sampling for airborne contaminants indicates that during the NIOSH field survey, employees were not exposed to concentrations of airborne materials exceeding any current environmental criteria. However, one area sample for methyl iodide was in excess of both the OSHA PEL and the ACGIH TLV. In addition, this material is considered to be a potential human carcinogen by ACGIH. This sample was an area sample and no employees worked continuously in the immediate area where it was taken. It is difficult to assess the significance of this one area sample. Discussions with both union and management officials subsequent to the field survey revealed that methyl iodide is no longer used at the Winchester facility. Employees

working in the glass flare-forming room should be monitored environmentally for SO₂ exposure. Area airborne SO₂ concentrations obtained using direct reading indicator tubes indicate the potential for employee exposure to SO₂ at/or above the current NIOSH recommended level.

The evaluation of the local exhaust ventilation equipment indicated that in general the equipment worked satisfactorily.

VIII. RECOMMENDATIONS

1. All local exhaust equipment at the soldering area should be inspected and repaired or replaced as needed. All hoods should be positioned as close as possible to the soldering operation it is exhausting.
2. When unloading the dichroic chamber, the door should be opened approximately 12 inches for a few minutes to better allow the local exhaust hood to capture any airborne materials escaping from the chamber.
3. The glass flare-forming operation should be evaluated environmentally. Detector tube readings obtained while only one of three machines was in operation indicate a potential for employee exposure to sulfur dioxide.

IX. REFERENCES

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XI. 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. GTE Sylvania, Winchester, Kentucky
2. Authorized Representative of Employees, Local 1608, United Auto Workers of America.
3. Requestor - Confidential
4. NIOSH, Region III
5. OSHA, Region III

For the purpose of informing the approximately 700 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
 AIRBORNE CONCENTRATIONS OF HALOGENATED GASES
 PERSONAL AND AREA SAMPLES

GTE SYLVANIA
 WINCHESTER, KENTUCKY
 APRIL 1-2, 1981

LOCATION	SAMPLE TYPE	DATE	SAMPLE PERIOD	VOLUME (LITERS)	GAS ANALYZED FOR	CONCENTRATION (mg/m ³)
Tipping Machine	Area	4-1-81	0752-1531	22.1	HBR	LLD
Tipping Machine	Area	4-1-81	0805-1526	22.7	HBR	LLD
Gas Mixer	Personal	4-2-81	0650-1443	24.9	HBR	LLD
Gas Mix Area	Area	4-2-81	0618-1542	28.4	HBR	LLD
Tipping Oper. Pilot Plant	Personal	4-2-81	0755-1546	23.1	HBR	LLD
Tipping Pilot Plant	Area	4-2-81	0755-1544	27.4	HBR	LLD
Quality Test Lab-North Window	Area	4-1-81	0800-1524	22.3	MI DM	33.4 LLD
#2 Double End Tipper-Right Side	Area	4-1-81	0748-1532	22.7	MI DM	LLD LLD
#2 Double End Tipper-Right Side	Area	4-1-81	0750-1531	25.8	MI DM	LLD LLD

HBR - Hydrogen Bromide, MI - Methyl Iodide, DM - Dibromomethane,
 LLD - Below the Limit of Detection (HBR - 1.0 ug, MI - .03 mg).

Environmental Criteria (mg/m³): Hydrogen Bromide - NIOSH - None
 OSHA - 10.0 (8 hr TWA)
 ACGIH - 10.0 (8 hr TWA)

Methyl Iodide - NIOSH - None*
 OSHA - 28.0 (8 hr TWA)
 ACGIH - 10 (8 hr TWA)*

Dibromomethane - None

* Considered to be a potential occupational carcinogen.

TABLE II

AIRBORNE CONCENTRATIONS OF MATERIALS COLLECTED ON CHARCOAL TUBES
PERSONAL AND AREA SAMPLESGTE SYLVANIA
WINCHESTER, KENTUCKY
APRIL 1-2, 1981

LOCATION	TYPE	DATE	SAMPLE TIME	VOLUME (LITERS)	MATERIAL ANALYZED FOR	CONCENTRATION (mg/m ³)
Pilot Plant Near Tipper Operation	Area	4-1-81	1000-1528	18.2	Isopropyl Alcohol	1.5
Getter Application Operator	Personal	4-2-81	0740-1513	24.7	Isopropyl Alcohol	1.2
					Ethyl Alcohol	1.3
					n-amy1 Acetate	.48
					Isoamy1 Acetate	LLD
Dichroic Operator	Personal	4-2-81	0825-1526	21.5	Isopropyl Alcohol	Trace*

LLD - Below the limit of detection.

* - Substance found on sample, but not in sufficient quantity to be quantitated.

Environmental Criteria (mg/m³): Isopropyl Alcohol - NIOSH - 980.0 (up to a 10 hr TWA)
OSHA - 980.0 (8 hr TWA)
ACGIH - 980.0 (8 hr TWA)Ethyl Alcohol - NIOSH - None
OSHA - 1900.0 (8 hr TWA)
ACGIH - 1900.0 (8 hr TWA)n-Amy1 Acetate - NIOSH - None
OSHA - 525.0 (8 hr TWA)
ACGIH - 530.0 (8 hr TWA)Isoamy1 Acetate - NIOSH - None
OSHA - 525.0 (8.0 hr TWA)
ACGIH - 525.0 (8.0 hr TWA)

TABLE III

AIRBORNE CONCENTRATIONS OF METHYL ALCOHOL SAMPLES
PERSONAL AND AREAGTE SYLVANIA
WINCHESTER, KENTUCKY
APRIL 1-2, 1981

LOCATION	TYPE	DATE	SAMPLE TIME	VOLUME (LITERS)	CONCENTRATION (mg/m ³)
Double End Tipper in Basement	Area	4-1-81	1000-1528	14.3	Trace*
Dichroic Operation	Area	4-2-81	0825-1526	17.3	LLD
Getter Application Operator	Personal	4-2-81	0740-1513	22.2	LLD
Cement Mix-Operator	Personal	4-2-81	0621-1416	23.9	LLD

LLD - Below the limit of detection

* - Substance found on sample, but not in sufficient quantity to be quantitated.

Environmental Criteria (mg/m³) - NIOSH - 260.0 (up to a 10 hr TWA)
OSHA - 260.0 (8 hr TWA)
ACGIH - 260.0 (8 hr TWA)

TABLE IV
 AIRBORNE CONCENTRATIONS OF INORGANIC METALS
 PERSONAL SAMPLES

GTE SYLVANIA
 WINCHESTER, KENTUCKY
 APRIL 1-2, 1981

JOB AND/OR LOCATION	DATE	SAMPLE TIME	VOLUME (LITERS)	MATERIAL ANALYZED FOR	CONCENTRATION (mg/m ³)
Dichroic Operator	4-2-81	0735-1100 1130-1516	650	Zn	.48
Getter Application	4-1-81	0734-1458	670	Zn Al	LLD LLD
Cement Mixer	4-1-81	0728-1055 1145-1425	550	P	.10
Glass Buffer	4-2-81	0712-1458	700	Al	LLD
Soldering (Lead)	4-1-81	0722-1510	700	Pb Ag Fe	LLD LLD <.01
Soldering (Silver)	4-1-81	0725-1514	700	Pb Ag Fe	LLD LLD LLD
Soldering ¹ (Lead)	4-2-81	0722-1500	690	Pb Ag Fe	LLD LLD .01
Soldering (Silver)	4-2-81	0717-1502	700	Pb Ag Fe	LLD LLD <.01
Tig Welding	4-1-81	0720-1455	680	Zn Fe Al Mg	<.01 .08 LLD LLD
Tig ² Welding	4-2-81	0645-1105	390	Zn Fe Al Mg	LLD .04 LLD LLD

¹ Employee would not wear pump. Pump placed in employees' work location.

² Sample for one-half shift. Filter covering remainder of shift was invalid.

TABLE IV (CONTINUED)

JOB AND/OR LOCATION	DATE	SAMPLE TIME	VOLUME (LITERS)	MATERIAL ANALYZED FOR	CONCENTRATION (mg/m ³)
IR Mount Spot Welding	4-1-81	0714-1506	710	Pb	LLD
				Zn	LLD
				Fe	LLD
IR Mount Spot Welding	4-2-81	0727-1520	710	Pb	LLD
				Zn	LLD
				Fe	LLD

< - Less than

LLD - Below the limit of detection (Zn-1.0 ug, Al-15.0 ug, P-1.0 ug, Mg-1.0 ug, Pb-3.0 ug, Ag-1.0 ug, Fe-3.0 ug).

Environmental Criteria (mg/m³):

Lead	- NIOSH - .05 (up to a 10.0 hr TWA) OSHA - .05 (8.0 hr TWA) ACGIH - .15 (8.0 hr TWA)
Aluminum (Metal and Oxide)	- NIOSH - None OSHA - None ACGIH - 10.0 (8.0 hr TWA)
Silver	- NIOSH - None OSHA - (Metal and Soluble Compounds) - 0.01 (8.0 hr TWA) ACGIH - (Metal) - 0.1 (8.0 hr TWA)
Iron (Oxide Fume)	- NIOSH - None OSHA - 10.0 (8.0 hr TWA) ACGIH - 5.0 (8.0 hr TWA)
Zinc (Oxide Fume)	- NIOSH - 5.0 (up to a 10.0 hr TWA) OSHA - 5.0 (8.0 hr TWA) ACGIH - 5.0 (8.0 hr TWA)
Magnesium (Oxide Fume)	- NIOSH - None OSHA - 15.0 (8.0 hr TWA) ACGIH - 10.0 (8.0 hr TWA)
Phosphorus (Nuisance Dust)	- NIOSH - None OSHA - 15.0 (8.0 hr TWA) ACGIH - 10.0 (8.0 hr TWA)

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
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