U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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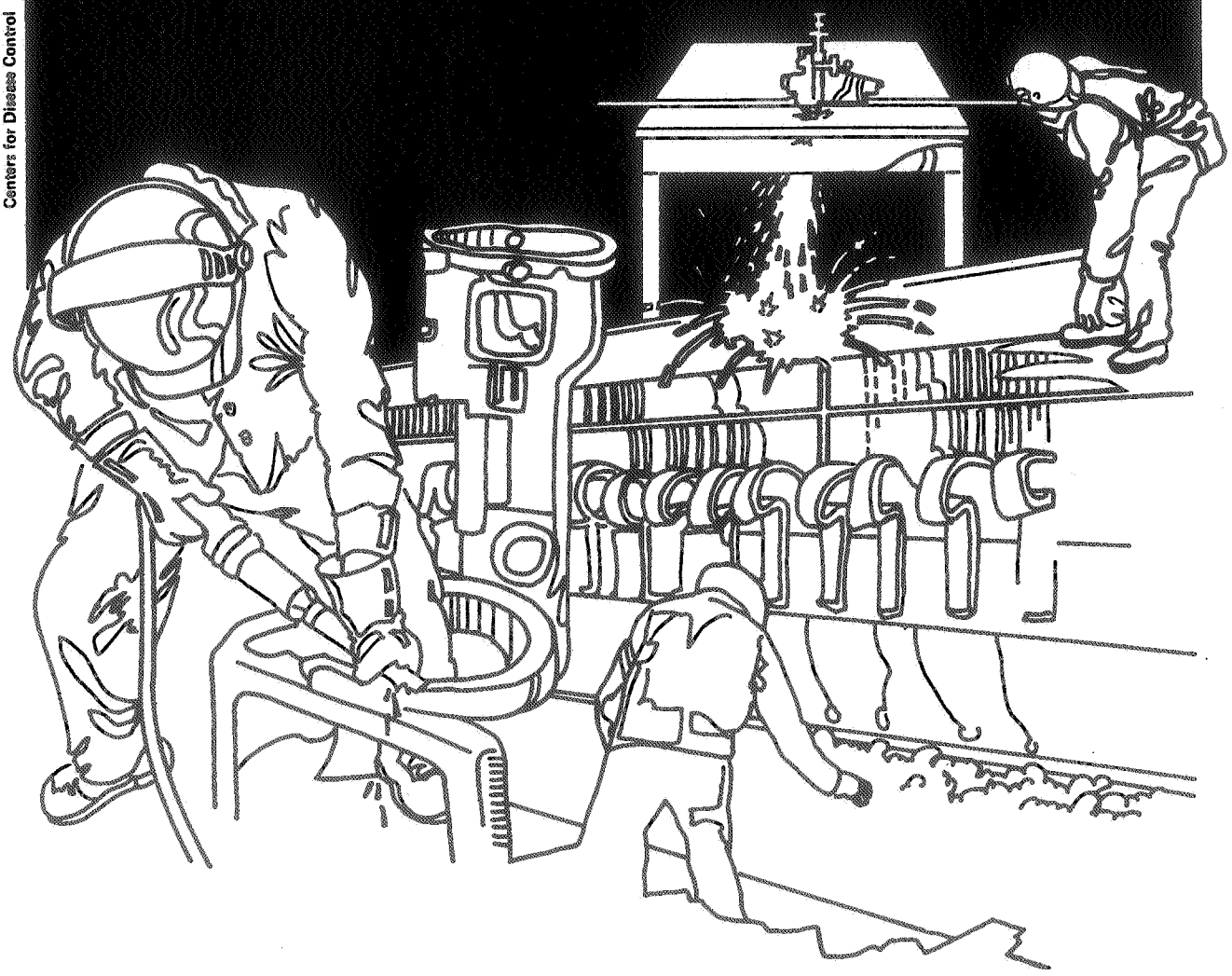
NIOSH



Health Hazard Evaluation Report

HETA 81-188-1046
FEDERAL CORRECTIONAL INSTITUTION
MIAMI, FLORIDA

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.

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FEBRUARY, 1982
FEDERAL CORRECTIONAL INSTITUTION
MIAMI, FLORIDA

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I. SUMMARY

On February 16, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation request from the Superintendent of Industries, Unicor, Federal Prison Industries Incorporated, Federal Correctional Institution (FCI), Miami, Florida. The request was prompted by complaints of headaches, dizziness, nausea, and other symptoms from prison inmates who were assembling electronic components and cable connectors in the "Industry Building". On May 12-14, 1981, NIOSH conducted an industrial hygiene survey to determine the extent of occupational exposures to solvent vapors and solder fumes.

Personal exposures were determined by collecting air samples for 1,1,1-trichloroethane (methyl chloroform) and lead fumes during soldering operations and by sampling methyl ethyl ketone (MEK) and toluene-2,4-diisocyanate (TDI) vapors while inmates were working with potting compounds.

Results from the air samples indicated the highest exposures to MEK and to methyl chloroform were 89.2 and 15 parts per million (ppm) respectively. The NIOSH recommended exposure limits for these substances are considerably higher, 350 ppm for methyl chloroform and 200 ppm for MEK. Airborne lead fumes were not detected on any of the samples. One of the potting compounds (PR 1592) used on large multi-pin cable connectors was found to contain residual TDI. TDI vapor was detected in the breathing zone of one inmate during the heating, mixing, and curing of this compound. The average concentration during a one hour personal sample was 0.013 ppm. TDI is a strong irritant of the eyes, mucous membranes, and skin, and is also a potent sensitizer of the respiratory tract. NIOSH recommended a workplace environmental exposure limit of 0.005 ppm (0.035 mg/M^3) as an 8-hour time weighted average. General dilution ventilation was found to be inadequate because no mechanism was available to open outdoor air dampers on the roof-mounted airconditioning system.

On the basis of the environmental data obtained during this investigation and due to the lack of proper ventilation in the potting section, NIOSH has determined that a potential health hazard did exist for inmates working with potting compound resins which contain residual TDI. However, the symptoms of TDI exposure are not consistent with the symptoms reported by the inmates at the Miami FCI, and no explanation can be provided at this time which would explain the liver function test abnormalities among exposed inmates.

KEYWORDS: SIC 9223, potting-compounds, methyl ethyl ketone, PR 1592, 1,1,1-trichloroethane, toluene-2,4-diisocyanate, soldering, lead, electronics, cable assembly, liver disease

II. INTRODUCTION

On February 16, 1981, the Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) received a request from the Federal Prison Industries Incorporated, Unicor, to evaluate working conditions in the Industry Building at the Federal Correctional Institution (FCI), Miami, Florida. The request concerned exposure of inmates and staff members to methy ethyl ketone (MEK), 1,1,1-trichloroethane (methyl chloroform), and soldering fumes during the assembly of electronic cables.

NIOSH conducted an industrial hygiene investigation at the Miami FCI on May 12-14, 1981. The purpose of the investigation was to observe work practices, to interview inmates working in the facility, to inspect the Industry Building ventilation and airconditioning system, and to evaluate work place exposures by collecting personal and general area atmospheric samples for solvent vapors and soldering fumes.

III. BACKGROUND

The Miami FCI is a medium security prison built approximately 5 years ago. In order to provide employment opportunity for qualified inmates, Unicor operates industries inside federal prisons. The industries are self-supported through non-appropriated funds provided from profits on government contracts. Unicor began its electronic cable assembly industry at the Miami FCI in September, 1980.

Approximately 40 inmates are employed to assemble standard coaxial cables, small interphone amplifiers, and large multi-pin cables. Coaxial cable is cut to proper length, ends are stripped, outer shield combed, and the center wire is fluxed and tinned. A special pin is soldered to the center wire and the connector is then fastened to the cable. Cable connectors and solder joints are cleaned of excess flux using 1,1,1-trichloroethane which is dispensed from a 4 oz. container at each soldering station. Rosin flux and 1,1,1-trichloroethane are also used in soldering the components and wiring of small amplifier assemblies. Seven to eight inmates are involved in soldering operations. The solder is rosin core, 60 percent tin and 40 percent lead.

Plugs and jacks are soldered to the large multi-wire cables at two work stations located inside a special environmentally controlled room. After soldering, cables are sent to the Potting Section. Cable plugs and jacks are pre-potted with just enough potting to cover the solder joints. After 24 hours the cable plugs and jacks are placed in electrically heated molds. More potting compound is then forced through a small hole in the mold with a pneumatic injector gun. After curing molds are opened, plugs and jacks are trimmed, and excess potting is cleaned off the molds and cables with MEK. Three inmates work in the Potting Section.

Two different compounds were being used by the Potting Section on the day of the NIOSH investigation. Both compounds, PR 420 and PR 1592, were manufactured by Products Research and Chemical Corporation, Burbank, California. PR 420 is used as a primer to coat the surfaces of the connectors for better adherence of the PR 1592 which is the primary potting compound for the cable connectors. According to the manufacturer, PR 420 and PR 1592 have the following compositions:

PR 420 Part A (curing agent)

- An aromatic polyisocyanate containing some residual methylene bisphenyl isocyanate (MDI).

PR 420 Part B

- A mixture of solvents and pigments.
  -lead chromate (12%)
  -cyclohexanone
  -trichloroethylene
  -chlorobenzene

PR 1592 Part A (curing agent)

- An aromatic diamine related to 3,3'-methylene bis [(6-amino-dimethyl) ester of benzoic acid], (CAS No. 31383-81-0). According the the manufacturer the compound has been chlorinated and has a threshold limit value (TLV) of 5 ppm, but this was not confirmed.

PR 1592 Part B (resin)

- A polyurethane prepolymer which contains some residual toluene-2,4-diisocyanate (TDI).

Only very small amounts of the primer compound were used and sampling for the specific components of PR 420 was not considered necessary. No sampling and analytical method was available for determining the airborne concentration to the aromatic diamine compound used as the curing agent in PR 1592.

IV. EVALUATION METHODS

Based on the information provided by the supplier of the potting compounds and the Superintendent of Industries, Unicor, Miami FCI, an environmental investigation was conducted by a NIOSH industrial hygienist on May 12-14, 1981. Following an opening conference with the Superintendent, the NIOSH investigator conducted a walk-through tour of the industrial facility with the Shop Foreman. Cable assembly processes were observed; building heating, ventilation, and airconditioning (HVAC) systems were inspected; and atmospheric samples were collected. Medical records were reviewed with the assistance of the FCI Hospital Administrator, and the Chief of Health Programs.

A. Environmental Evaluation

Atmospheric samples were collected to determine personal (breathing zone) exposures to lead fumes and 1,1,1-trichloroethane vapors during soldering operations. Airborne lead samples were collected on 37 millimeter membrane filters (AA type) mounted in 2-piece plastic cassettes. To determine personal exposures, filter cassettes were attached to the workers' shirt collar. A measured volume of air was pulled through the filters using battery powered air sampling pumps set at a calibrated flow rate of 1 liter per minute (LPM). The filters were analyzed for lead content using an atomic absorption spectrophotometer in accordance with NIOSH Method No. S-341. 1,1,1-trichloroethane was collected on organic vapor-adsorbing charcoal tubes. These small glass tubes, each containing 150 milligrams of activated charcoal, were also attached to the workers' shirt collars. A measured volume of air was drawn through the tube at a flow rate of approximately 100 cc of air per minute using a small battery powered pump. The amount of 1,1,1-trichloroethane vapor collected in the tube was determined by gas chromatography according to NIOSH Method No. S-328.

The MEK exposure for inmates working in the potting section was determined by collecting personal and general area air samples on vapor-adsorbing silica gel tubes. A measured volume of air was drawn through the tubes at a flow rate of approximately 20 cc per minute. The limited adsorbing capability of silica gel for MEK required that the tubes be replaced after about one hour of sampling to prevent exceeding the recommended 3 liters total sample volume. The samples were analyzed using a gas chromatograph according to OSHA Method No. 16 (modified).

TDI was also sampled in the Potting Section because potting compound PR 1592 (Part B) contained an undetermined amount of residual TDI, and worker exposure to TDI vapor during heating, mixing, and curing of the potting compound was considered a possibility. Air samples were collected and analyzed using the recently developed NIOSH Method P & CAM 326. A known volume of air was drawn through a glass tube containing two sections of glass wool coated with a special reagent which reacts with TDI vapor to form a TDI derivative (2,4,-TDIU). The glass wool tubes were connected to battery powered air sampling pumps set at a flow rate of 1 LPM. In the laboratory the 2,4,-TDIU is washed from the glass wool with dichloromethane, and the dichloromethane solution is analyzed by high pressure liquid chromatography (HPLC) with an ultraviolet detector.

B. Bulk Sample Analysis of Potting Compounds

Bulk samples of the potting compound, PR 1592 (parts A and B) and the primer compound PR 420 (parts A and B) were submitted to the NIOSH laboratory for identification of vapors released during use, mixing, and curing of these compounds. Initially, samples of PR

1592, Part A (curing agent); PR 420, Part A (curing agent) and Part B (solvent and pigments) were screened by gas chromatography (FID) to see if organic solvents were present. If components were detected, the compounds were reanalyzed by gas chromatography/mass spectrometry (GC/MS) to identify the components. The PR 1592 Part B (resin) was not analyzed because the composition information provided by the supplier was considered adequate. Considerable difficulty was encountered in analyzing the PR 1592 Part A. Other analytical techniques including infrared spectroscopy (IR) and direct probe high performance mass spectrometry were used in an effort to identify this substance.

C. Building Ventilation

The roof-mounted HVAC system was inspected to locate the source and amount of outdoor air supplied to the building and to inspect the condition of the air filters. Because the outdoor air intake vent was fully closed, no air flow measurements were taken.

D. Medical Records Review

Reports of health problems from inmates working in the potting section were discussed with the Superintendent of Industries, the Hospital Administrator, and the Chief of Health Programs.

V. EVALUATION CRITERIA

A. Environmental Criteria

The environmental criteria described below are intended to represent airborne concentrations of substances to which workers may be exposed for eight hours a day, 40 hours per week for a working lifetime without adverse health effects. Because of wide variation in individual susceptibility, a small percentage of workers may experience discomfort from some substances at concentrations at or below the recommended criteria.[1] A smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction. The time-weighted average (TWA) exposure refers to the average concentration during a normal 8-hour workday. The Short-Term Exposure Limit is the maximum allowable concentration, or ceiling, to which workers can be exposed during a period of up to 15 minutes, provided that no more than four excursions per day are permitted, with at least 60 minutes between exposure periods.

The primary sources of environmental evaluation criteria considered for this study were: 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) federal occupational health standards. The criteria judged most appropriate for this study are as follows:

Substance	Short Term Exposure Limits (15 Min.)	8-Hour Time Weighted Average	Source
Methyl ethyl keytone	300 ppm	200 ppm	ACGIH
		200 ppm	OSHA
		200 ppm	NIOSH
1,1,1-trichloroethane	450 ppm	350 ppm	ACGIH
		350 ppm	OSHA
	350 ppm	200 ppm*	NIOSH
Lead		0.05 mg/M^3	OSHA
TDI	0.02 ppm		OSHA
	0.02 ppm		ACGIH
	0.02 ppm	0.005 ppm	ACGIH**
	0.02 ppm	0.005 ppm	NIOSH

* NIOSH Action limit
** ACGIH Notice of Intended Changes for 1981

NOTE: ppm = parts of substance per million parts of air (by volume)
mg/M^3 = milligrams of substance per cubic meter of air

B. Toxicity

The adverse health effects from excess exposure (exposures to airborne concentrations above the evaluation criteria) are summarized below:

1. Methyl ethyl ketone (MEK)

MEK is an irritant of the eyes, mucous membranes, and skin. At high concentrations it causes narcosis in animals, and it is expected that severe exposure in humans will produce the same effect. In humans, short-term exposure to 300 ppm was "objectionable", causing headache and throat irritation; 200 ppm caused mild irritation of the eyes; 100 ppm caused slight nose and throat irritation. MEK can be recognized at 25 ppm by its odor, which is similar to acetone but more irritating. The TLV recommended by the ACGIH (200 ppm) was established at a level to prevent injurious effects and minimize complaints about odor and irritation.[2]

2. 1,1,1-Trichloroethane (methyl chloroform)

1,1,1-trichloroethane is irritating to the eyes on contact. Exposure to the vapors will depress the central nervous system. Symptoms include dizziness, incoordination, drowsiness, increased reaction time. Unconsciousness and death can occur from exposure to excessive concentrations.[3] A few scattered reports have indicated mild kidney and liver injury in humans from severe

exposure; animal experiments have confirmed the potential for liver, but not for kidney injury. Skin irritation has occurred from experimental skin exposure to the liquid and from occupational use.[2]

3. Lead

Inhalation of lead dust and fumes is the major route of lead exposure in industry. A secondary source of exposure may be from ingestion of lead dust contamination of food, cigarettes, or other objects. Once absorbed lead is excreted from the body very slowly. The absorbed lead can damage the kidneys, peripheral and central nervous systems, and the blood forming organs (bone marrow). These effects may be felt as weakness, tiredness, irritability, digestive distrubances, high blood pressure, kidney damage, mental deficiency, or slowed reaction times. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women. The new OSHA standard for lead in air is 0.05 mg/M^3 as an eight hour time-weighted average for daily exposure.[4]

4. Toluene-2,4-diisocyanate (TDI)

TDI is a strong irritant of the eyes, mucous membranes, and skin, and is also a potent sensitizer of the respiratory tract. In sufficient concentrations TDI causes irritation of the eyes, nose, and throat, a choking sensation, and a productive cough. Depending on the length of exposure and level of concentration above 0.5 ppm (3.6 mg/M^3), respiratory symptoms will develop with a latent period of four to eight hours. Although the acute effects may be severe, a more important consideration is that respiratory sensitization can occur in susceptible individuals after repeated exposure to levels of TDI as low as 0.02 ppm (0.14 mg/M^3). Initial symptoms are often night time shortness of breath or cough with progression to asthmatic bronchitis. After symptoms subside, a return to work can cause an acute and severe asthmatic attack almost immediately or within a few hours.[2] A person who has become sensitized to TDI must avoid future exposure completely. Some decrease in lung function, in the absence of symptoms, has been observed in some workers exposed to TDI for long periods of time, even at concentrations as low as 0.002 ppm (0.014 mg/M^3)[5]. The ACGIH TLV (0.02 ppm) was set at a level which was believed to be low enough to prevent respiratory sensitization. After a thorough review of the literature available at the time, NIOSH recommended a workplace environmental standard of 0.005 ppm (0.035 mg/M^3).[6] More recent findings by Wegman et.al. indicates that even this low value may not protect sensitized workers.[7]

VI. RESULTS AND DISCUSSION

A. Air Sampling Results

The use of 1,1,1-trichloroethane during soldering tasks did not cause significant concentrations of vapor to be present in the inmates' breathing zone. Exposure to 1,1,1-trichloroethane ranged between 7.7 - 15 ppm. These levels are well below the evaluation criteria of 350 ppm and would not be sufficient to cause central nervous system depression. Although the odor of 1,1,1-trichloroethane is perceptible above 16 ppm it does not usually become objectionable until concentrations approach 500 ppm. Although the solder used was 40% lead, measureable airborne lead exposure did not occur during any of the soldering operations. The melting temperature was probably well below that which would produce lead fumes. Lead was not detected in any of the samples collected. The analytical sensitivity was reported by the NIOSH lab to be 0.003 mg/sample which would provide a detection limit of between 0.010 - 0.035 mg/M^3. The individual sample results for the soldering tasks monitored are presented in Table 1.

MEK exposures detected in the Potting Section are presented in the first part of Table 2. MEK levels ranged from 5.4 - 89.2 ppm. The highest exposures measured on two consecutive days were for the same inmate, 89.2 and 64.2 ppm respectively. This is perhaps the result of poor work practices. This individual was frequently using MEK to clean potting compound from his hands. Fortunately, the amount of MEK being used was small and the resulting exposures to MEK vapors were below the concentration (200 ppm) which would be expected to cause adverse health effects, such as headache and eye irritation. However, the MEK levels detected in the Potting Section are sufficient to cause occasional nose and throat irritation for a few individuals who may be more susceptible to these type of symptoms.

The results from personal samples collected for TDI vapor during the heating, mixing, and curing of the potting compound, PR 1592 are presented in the lower half of Table 2. All three inmates working in the Potting Section were sampled on two consecutive days. Air sampling was conducted for only one hour due to the limited capacity of the treated glass wool collection media. In one of the 6 samples collected, TDI was detected at a concentration above the recommended NIOSH 8-hour time weighted average exposure limit of 0.005 ppm. Due to the limited sampling time, a full 8-hour exposure could not be monitored. It is possible the 0.02 ppm ceiling limit may have been exceeded at some time during the one hour sampling period. The results indicate that use of the PR 1592 in the Potting Section does present a potential health hazard from exposure to TDI. There is an increased risk for respiratory sensitization for inmates working with this compound since no local exhaust ventilation is provided.

B. Results of Analysis of Potting Compounds

Solutions of PR 420 Part A in carbon disulfide and PR 420 Part B in carbon disulfide as well as the head space from a heated sample mix of PR 420, Parts A and B were analyzed by GC/MS. Major components identified in these compounds are presented below:

PR 420 Part A (curing agent)
-chlorobenzene

PR 420 Part B
-cyclohexanone
-trichloroethylene
-unidentified chlorinated compounds
-toluene
-methyl isobutyl ketone (MIBK)

PR 420 Head Space Analysis After Heating and Mixing Parts A & B
-chlorobenzene
-trichloroethylene
-cyclohexanone
-carbon dioxide
-methyl ethyl ketone (MEK)

The analytical results did not fully agree with the information provided by the supplier (see section III). Products Research reported chlorobenzene to be a component of PR 420 Part B, yet NIOSH found chlorobenzene to be present only in PR 420 Part A. The aromatic polyisocyanate, containing residual methylene bisphenyl isocyanate (MDI), could not be identified in PR 420 Part B using GC/MS analysis.

A solution of PR 1592 Part A (curing agent) in acetone was analyzed by GC and then by GC/MS. The principal component was identified as methyl anthranilate which has a grape-like odor. The mass spectrum from the direct probe high performance mass spectrometry analysis of PR 1592 Part A indicated a compound with the empirical formula $C_{17}H_{18}N_2O_4$ was the best fit. Based on this mass spectral and the infrared analysis data, the chief component of PR 1592 Part A appears to be 4,4'-methylene bis(2-carbomethoxyaniline). The CAS number for this compound is 34481-84-0 and is listed in the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS) as entry CB3315000 which reports the compound to have a toxic dose of 490 grams per kilogram of body weight in rats when administered orally. This compound is also called methylene bis(2-amino dimethyl ester) of benzoic acid. The methyl anthranilate identified by GC/MS in PR 1592 Part A was probably an impurity or precursor of this compound.

The NIOSH analysis is partially consistent with the information provided by the supplier, Products Research. They identified PR 1592 Part A as an aromatic diamine "related" to 3,3'-methylene bis(6-amino-dimethyl) ester of benzoic acid, (CAS # 31383-81-0). However, Products Research reported that PR 1592 Part A was

chlorinated and had a TLV of 5 ppm, yet the mass spectrum produced from this compound did not indicate the presence of any chlorine atoms and from information available in the RTECS, there was no indication that a TLV of 5 ppm had been established.

The GC/MS head space analysis of vapors released during heating and mixing of PR 1592 A and B was not effective in identifying any compounds. This may have been the result of poor mixing of the A and B components. Had TDI vapor been released during the heating or mixing process, the GC/MS method used probably would not have been able to detect or positively identify it.

C. Building Ventilation

Outside air ventilation was not provided to the Industry Building. Outdoor air louvers on the roof mounted HVAC system were fully closed. There was no control device available to hold louvers open against the negative air pressure created by the fan. Several filters were very dirty and some had fallen out of place. Periodic servicing of the HVAC system (filter replacement, cleaning, etc.) was, at the time of this survey, not provided by the FCI. Private contractors provided HVAC service only for unscheduled repairs. No local exhaust ventilation had been provided for the Potting Section.

D. Results of Medical Records Review

Inmates had complained of headaches, dizziness, nausea, and other symptoms they associated with the use of MEK in the potting section. Liver function tests were abnormal for one of the inmates experiencing symptoms. As a result, at least 13 others were tested; liver enzymes were elevated in 3 of them, all of whom had worked in the potting section. Another recently arrived inmate was ill in March 1978 and had elevated liver enzymes.

VII. CONCLUSIONS

Based on the results of air samples collected during this evaluation, NIOSH has determined that inmates working in the Unicor cable assembly facility at the Miami FCI were not exposed to hazardous concentrations of lead fumes or 1,1,1-trichloroethane during soldering operations or to hazardous levels of MEK in the Potting Section. There was, however, a potential health risk for inmates working in the Potting Section because of possible exposure to TDI vapor during heating, mixing, and curing of PR 1592 potting compound.

It does not appear that the abnormal liver enzyme results can be attributed to workplace exposures to MEK or TDI vapor. Although chlorinated solvents such as carbon tetrachloride have been reported to potentiate the toxic effects of MEK on laboratory animals,[8] there was no significant exposure to chlorinated

solvents detected in the Potting Section during this survey. Although some chlorinated compounds were identified in PR 420, only very small amounts of this primer compound are used. There were no reports of respiratory symptoms which would indicate that sensitization to TDI had occurred among the inmates who worked in the Potting Section.

VIII. RECOMMENDATIONS

The following recommendations were provided by NIOSH in an interim report to the Miami FCI following the initial NIOSH survey in May, 1981:

1. Fresh air louvers on the HVAC system should be opened slightly to provide at least 15 percent fresh air vs. recirculated air. Air filters should be checked and replaced as needed monthly.

2. Additional soldering fume control fans, like those used in the controlled environment room, should be used at other work stations where smoke from rosin core solder enters a worker's breathing zone. Pyrolysis products from rosin core flux may be irritating to membranes of the eyes, nose, and throat. Pyrolysis products of rosin core flux include acetone, methyl alcohol, aliphatic aldehydes, carbon dioxide, carbon monoxide, methane, ethane, abietic acid, and related diterpene acids.

3. A local exhaust system should be provided for the potting section. A lateral draft exhaust hood designed to pull contaminated air away from the workers' breathing zone would probably be the most effective.

4. Liver profile tests should be done on all inmates newly assigned to the potting section to establish baseline values. Inmates currently working in the potting section should be tested and then rechecked every 6 months. Inmates who test positive should be screened for drug abuse by conducting urine tests.

5. Smoking should be prohibited in all areas where MEK is used, including the potting section. MEK has a flash point of 24° F and is classified as a flammable liquid.

6. Protective gloves in more than one size should be provided inmates who would likely have direct skin contact with solvents and/or potting compounds.

7. Plunger or pump cans should be provided for filling flux and solvent bench dispensers. Using five gallon cans to fill 4 oz. containers frequently causes spills.

Since the interim report was issued the cable factory at the Miami FCI has been transferred to Memphis and the industry building now houses a textile sewing operation. It is suggested that the results from this study be shared with other Unicor facilities where cable assembly or use of potting compounds takes place. Unicor should insure that all potting compounds are used only under conditions where adequate local exhaust ventilation is provided. Although no further cluster of abnormal liver function tests have been reported by any FCI since this study was conducted, it should not be readily assumed that no hazard exists, especially under conditions where ventilation is less than adequate. In the future, should abnormal liver profiles be detected by the Federal Prison Industries which could be associated with electronic component or cable assembly processes, NIOSH should be notified.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

1. Unicor, Miami Federal Correctional Institution
2. Dade County Dept. of Public Health
3. U.S. Department of Labor, OSHA, Region IV
4. TEC/FAP, OSHA Region IV
5. NIOSH, Region IV
6. Designated State Agencies

XI. REFERENCES

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TABLE 1

1,1,1-TRICHLOROETHANE AND LEAD FUME EXPOSURE
DURING SOLDERING OPERATIONS

FEDERAL PRISON INDUSTRIES
FEDERAL CORRECTIONAL INSTITUTION
MIAMI, FLORIDA
HETA 81-188

May 13-14, 1981

Job Classification	Type Sample	Sampling Time	Concentration Trichloroethane (ppm)	Concentration Lead Fumes (mg/M^3)
May 13				
Soldering Amplifiers	personal	8:55am-10:49am	8.4	ND
" "	personal	9:20am-10:50am	10.8	ND
Pin Soldering	personal	9:06am-10:52am	10.3	ND
Tinning Center Wire	personal	9:12am-10:53am	14.7	ND
" " "	personal	9:17am-10:51am	9.5	ND
Soldering Multi-pin Plugs and Jacks	personal	9:22am-10:55am	14.8	ND
" "	personal	9:25am-10:55am	13.2	*
May 14				
Soldering Multi-pin Plugs and Jacks	personal	8:11am-1:50pm	11.7	ND
" "	personal	8:12am-1:50pm	15.0	*
Tinning Center Wire	personal	8:29am-10:00am	7.7	ND
Environmental Criteria			350.0[a]	0.050[b]
Limits of detection in milligrams per sample =			0.01	0.002

a. ACGIH TLV for 1981
b. Current OSHA standard for lead (CFR 1910.1025)

ND = None Detected
* = Not Sampled

TABLE 2
FEDERAL PRISON INDUSTRIES
FEDERAL CORRECTIONAL INSTITUTION
MIAMI, FLORIDA
HETA 81-188

METHYL ETHYL KETONE (MEK) EXPOSURE
FOR INMATES WORKING IN THE POTTING SECTION
May 13-14, 1981

Job Classification	Type Sample	Sampling Time	Sample Volume (liters)	MEK Concentration (ppm)
May 13				
Potting Cables	personal	8:25am-10:47am	2.93	89.2
" "	personal	8:28am-10:48am	2.96	11.5
Prepotting Cables	personal	8:31am-10:48am	3.53	24.1
Btw. Potting Tables	area	8:33am-11:30am	3.73	8.2
Cable Repair	personal	8:43am-10:54am	3.14	5.4
May 14				
Mixing Potting and Potting Cables	personal	7:58am-1:50pm	4.76	64.2
" "	personal	8:00am-1:50pm	6.12	33.9+
Environmental Criteria				200.0*
* ACGIH TLV and NIOSH Recommended Standard				
+ Sample break through possible due to excessive sample volume				
Limit of Detection in mg/sample =				0.01

TOLUENE DIISOCYANATE (TDI) EXPOSURE FOR INMATES
WORKING IN THE POTTING SECTION
May 13-14, 1981

Job Classification	Type Sample	Sampling Time	Sample Volume (liters)	TDI Concentration (ppm)
May 13				
Mixing Potting and Potting Cables	personal	9:42am-10:42am	59.1	ND
" "	personal	" "	58.5	ND
" "	personal	" "	58.2	0.0132
May 14,				
Mixing Potting and Potting Cables	personal	9:20am-10:20am	59.1	ND
" "	personal	" "	58.5	ND
" "	personal	" "	58.2	ND
Environmental Criteria:				
NIOSH Recommended Standard and Proposed ACGIH TLV (8-hour TWA)				0.005
" " " " " STEL (ceiling limit)				0.02
Current OSHA Standard as 15 minute ceiling limit				0.02
Limit of Detection in mg/sample =				0.003

ND = None Detected

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
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