U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 80-37-725

TEXACO, INCOPRORATED
CASPER, WYOMING

JULY 1980

I. SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) received a request from Local Union 2-230, Oil Chemical Atomic Workers, for a Health Evaluation at Texaco, Incorporated, Casper, Wyoming. The request concerned employee exposure to welding fumes in the welding shop. On April 30 and May 1, 1980, environmental measurements were made to determine employee exposures to: iron oxide, manganese, aluminum, copper, nickel, lead, and fluoride. Employees were interviewed regarding work histories and general physical condition.

Levels of iron oxide ranged from 0.1 mg/M^3 to 1.3 mg/M^3 (permissible exposure limit 5.0 mg/M^3). Manganese ranged from less than detectable to 0.05 mg/M^3 (permissible exposure limit 5.0 mg/M^3). Aluminum ranged from less than detectable to 0.04 mg/M^3 (permissible exposure limit 5.0 mg/M^3). Copper ranged from less than detectable to 0.01 mg/M^3 (permissible exposure limit 0.1 mg/M^3). Nickel ranged from less than detectable to 0.01 mg/M^3 (permissible exposure limit 0.015). Lead and fluoride were found to be less than detectable. All samples were below the most recent environmental criteria.

A non-directed questionnaire designed to elicit symptomatology possibly related to health problems arising from the work environment was completed on five exposed workers. The questionnaire failed to identify work-related employee health problems.

Based on the environmental sampling results, employees interviews, and available toxicological information, NIOSH concludes that a health hazard did not exist in the welding operations at the time of this study on April 30 and May 1, 1980. Recommendations to aid in providing a safe and healthful working environment are present in the report.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the workplace. On December 5, 1979, NIOSH received a request from Local Union 2-230, Oil Chemical Atomic Workers, for a Health Hazard Evaluation at Texaco, Incorporated, Casper, Wyoming. The request alleged employee exposures to welding fumes in the welding shop.

III. BACKGROUND

Texaco, Incorporated, Casper, Wyoming, is a refiner of petroleum products. The request for a Health Hazard Evaluation was for the welding shop where employees were exposed to welding fumes. The welding shop building is approximately 50' x 20' and houses six welders, all of whom are certified and work 7:30 a.m. to 4:30 p.m., 5 days per week. The types of welding include submerged arc, tungsten inert gas (TIG), and metal inert gas (MIG); heavy steel is welded using one of the welding processes listed above. The welding shop is provided with local exhaust ventilation and electrostatic precipitators.

IV. EVALUATION DESIGN AND METHODS

To evaluate the welding environment, samples were collected for iron oxide, manganese, aluminum, copper, nickel, lead, and fluoride. Samples were collected on 37 millimeter filters using pumps operated at 1.5 liters per minute on the outside of the welding helmets. The iron oxide, manganese, aluminum, copper, nickel, and lead samples were analyzed by atomic absorption spectroscopy using physical and chemical analysis Method (P&CAM) No. 173. Fluoride samples were analyzed according to (P&CAM) Method No. 212 using a fluoride electrode.

A non-directed questionnaire designed to elicit symptomatology possibly related to health problems arising from their work environment was completed on five workers directly exposed.

An interim report was distributed on May 20, 1980, reporting the findings to date and the future action to be taken.

V. EVALUATION CRITERIA

A. Environmental

Three sources of criteria are generally used to assess workroom concentrations of air contaminants: (1) NIOSH criteria for recommended

---

*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 and Human Services, following a written request by 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.

standards, (2) recommended Threshold Limit Values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) 1979, and (3) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910.1000), January 1978. NIOSH criteria and ACGIH TLV's represent the most recent and relevant recommendations and are given prominence in this evaluation.

	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M^3)		
Substance	NIOSH Criteria for Recommended Standard	TLV	Current OSHA Standard
Iron Oxide	—	5.0	---
Manganese	--	5.0"C"	---
Aluminum	--	5.0	---
Copper	--	0.2	0.1
Nickel	0.015	1.0	1.0
Lead	--	0.15	0.05
Fluoride	2.5	2.5	2.5

mg/M^3 = approximate milligrams of substance per cubic meter of air

"c" = ceiling concentration which should never be exceeded

TLV's or Occupational Health Standards for substances are usually established at levels designed to protect workers occupationally exposed for 8 hours per day, 40 hours per week basis over a working lifetime. Because of a wide variation in individual susceptibility, some workers may experience ill effects at or below the designated levels. Thus an evaluation of the workplace can not be based entirely upon comparisons made against such TLV's or standards, as various TLV's and standards do not represent absolute protection of all workers. Setting legal standards and enforcement is a responsibility of the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA).

B. Health Effects

1. Iron Oxide -- Iron oxide is relatively non-toxic. Chronic exposures to high concentrations do cause a disease called siderosis. The main complication of this disease is that it prevents getting a good X-ray of the lungs in case another lung disease occurs. Siderosis does not decrease pulmonary function or cause any other metabolic disturbances. However, exposure to iron oxide and other welding fumes may lead to clinical lung disease (bronchitis). (Reference 1)

2. Manganese -- Chronic manganese poisoning is a clearly characterized disease which results from the inhalation of fumes or dust of manganese. The central nervous system is the chief site of damage. If cases are removed from exposure, some improvement frequently occurs. However, there may be some residual disturbance in gait and speech. When the disease is well established, the result is permanent disability. (Reference 1)

3. Aluminum -- Aluminum rarely causes an occupational health hazard and is relatively non-toxic. Inhalation of finely divided aluminum powder may cause a form of pulmonary fibrosis. (Reference 1)

4. Copper -- Copper exposures may occur by ingestion and inhalation. Copper is an irritant to the eyes, nose and respiratory tract. It causes perforation of nasal septum, metal fume fever, and dermatitis. Ingestion may produce nausea, vomiting, and diarrhea. Chronic exposures may produce pigment cirrhosis of the liver. Maintaining a worker's exposure below 0.1 mg/M^3 for an 8-hour time weighted average (TWA) should protect the worker from any of these effects. (Reference 2)

5. Nickel -- Exposures to nickel are commonly found in welding procedures. The most toxic route of entry is by inhalation. Nickel is an irritant, sensitizer, and carcinogen. Signs and symptoms of nickel overexposures include gingivitis, stomatitis, and metallic taste. Acute symptoms include metal fume fever and nickel itch. Dermatitis with eczema may occur later. Carcinoma of the nasal sinuses and lungs may result from chronic exposure. (Reference 3)

   Occupational exposure to nickel should be controlled so that workers are not exposed to concentrations greater than 15 ug/M^3. (Reference 4)

6. Lead -- Prolonged exposure to lead or its inorganic compounds from inhalation or ingestion of vapor, fume, or dust results in gastrointestinal disturbances such as anorexia, weight loss, malnutrition, colic, constipation, and abdominal discomfort and tenderness. Neurologic symptoms can include weakness, lassitude, tremor, insomia, and motor weakness that may include paralysis of the extensor muscles of the wrist and ankles. Encephalopathy can result with the most severe lead exposure. (Reference 1)

7. Fluoride -- Chronic exposure to fluoride may cause anorexia, nausea, vomiting, constipation, weight loss, weakness, shortness of breath, and stiffness of joints. It may also produce fluorosis. (Reference 5)

VI. EVALUATION RESULTS AND DISCUSSION

Results of environmental samples collected for iron oxide, manganese, aluminum, copper, nickel, lead, and fluoride are given in Table I. All air levels were below the recommended environmental criteria, and as such, they are not considered to present a health hazard.

Employee interviews with five welders performing duties in the welding shop failed to identify definite work-related health problems in that specific work area.

Based on the environmental sampling results, employees' interviews and available toxicological information, NIOSH concludes that a health hazard did not exist at the time of this survey on April 30 and May 1, 1980.

VII. RECOMMENDATIONS

1. In order to insure maximum collection efficiency for any airborne dust continued special efforts should be made to maintain all mechanical exhaust systems in good working order.

2. Good personal hygiene and work practices should be observed by all employees. Washing of hands before eating, drinking, and smoking will help reduce possible contamination from chemical substances.

VIII. REFERENCES

1. U.S. Department of Health, Education, and Welfare, PHS, NIOSH; Occupational Disease: A Guide to their Recognition, U.S. Government Printing Office, 1977.

2. Plunkett, E.R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, pp. 114-115.

3. Plunkett, E.R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, pp. 287-288.

4. NIOSH Criteria for a Recommended Standard...Occupational Exposure to Inorganic Nickel, DHEW (NIOSH) Publication No. 77-164, Cincinnati, Ohio, 1977.

5. Plunkett, E.R. Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, pp. 188-190.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted and
Report Prepared By:

Raymond Ruhe
Industrial Hygienist
Industrial Hygiene Section
Hazard Evaluations and Technical
Assistance Branch
Cincinnati, Ohio 45226

Environmental Evaluation:	Bobby J. Gunter, Ph.D. Regional Industrial Hygienist NIOSH-Region VIII Denver, Colorado
Analytical Laboratory Services:	Measurement Support Branch Cincinnati, Ohio
Originating Office:	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations, and Field Studies Cincinnati, Ohio 45226
Report Typed By:	Monica Whitlock Clerk Typist Industrial Hygiene Section

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Publications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of this report have been sent to:

1. Texaco, Incorporated, Casper, Wyoming
2. Authorized Representatives of Employees
3. U.S. Department of Labor - Region VIII
4. NIOSH - Region VIII

For the purpose of informing the approximately 10 "affected employees" the employer shall promptly "post" for a period of 30 calendar days the determination report in a prominent place(s) near where exposed employees work.

FAIRCHILD INDUSTRIAL PRODUCTS
75 MALL DRIVE
COMMACK, NY 11735

TABLE I

SOLVENT CONCENTRATIONS
(milligrams per cubic meter of air (mg/M^3))
4-4-80

Location	Sample Volume (liters)	Freon 113	Isopropanol	Methyl Chloroform	Toluene	Perchloro-ethylene
Pressure Test	53	49.5	1.3	6.4	0.4	2.8
Contact Assembly	14	430.	—	8.5	0.7	3.5
P.C. Board Assembly	39	24.2	1.8	8.7	0.5	5.1
Pressure Switch Assembly	64	39.8	5.0	8.1	0.3	4.2
CVR Assembly*	67	35.9	5.9	16.7	1.1	9.3
Corner Bench	49	43.1	1.6	6.3	0.2	3.0
Electronic Testing	37	53.6	1.9	9.4	0.5	3.8
Electronic Assembly	20	48.5	1.0	14.2	1.0	6.9
OSHA Permissible - Limit		7600 TWA	980 TWA	1900 TWA	750 TWA 1125 ceiling	680 TWA 1350 ceilir
NIOSH Recommended - Limit			980 TWA 1960 ceiling/ 15 min.	1900 1900/15 min. ceiling	375 TWA 750 ceiling /10 min.	340 TWA 680 ceilir 10 min.

*2.7 mg/M^3 of tetrahydrofuran was identified in the sample. It is an eye and mucous membrane irritant and is used as a resin solvent. The OSHA Permissible Exposure Limit is 590 mg/M^3.

FAIRCHILD INDUSTRIAL PRODUCTS
75 MALL DRIVE
COMMACK, NY 11735

TABLE II

SOLVENT CONCENTRATIONS*
(milligrams per cubic meter of air (mg/M^3)
(4-24-80)

Location	Sample Volume (liters)	Freon 113	Methyl Chloroform	Isopropanol	Perchloroethylene
Rack near drying table (general air)	210	6.8	15.5	3.4	9.2
Rack near feed end of wave made (general air)	280	7.4[A]	10.5	2.5[A]	10.1
Boat rack near drying table (general air	350	5.4[A]	11.6[A]	3.4[A]	12.5
Wave machine attendant (breathing zone)	46	17.3	47.6	15.2	93.1

*No Toluene was detected in this group of samples.

[A]Analysis of these samples indicated solvent in the "back-up" section of the collection media. Actual concentrations were probably greater than those reported.

FAIRCHILD INDUSTRIAL PRODUCTS
75 MALL DRIVE
COMMACK, NY 11735

TABLE III

PHYSICOLOGICAL
RESPONSE TO
SOLVENTS

Solvent	Symptoms of Exposure
1,1,2 - trichloro - 1,2,2 - trifluoroethane (Freon 113)	Mild throat irritation, conjunctivitis, drowsiness, loss of concentration, loss of coordination, dermatitis (prolonged use).
1,1,1 - trichloroethane (methyl chloroform)	Eye irritation, mucous membrane irritation, Central nervous system depression (incoordination, disturbance of equilibrium), dermatitis.
Isopropyl alcohol	Eye, nose and throat irritation, Central nervous system depression.
Toluene	Dizziness, headache, weakness, confusion
Perchloroethylene	Eye, nose and throat irritation, dizziness, headache.