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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-89-456

CHRYSLER DETROIT TANK PLANT
WARREN, MICHIGAN

JANUARY 1978

I. TOXICITY DETERMINATION

A NIOSH Health Hazard Evaluation was conducted at the Chrysler Detroit Tank Plant, Warren, Michigan, at the request of an employee representative of the United Auto Workers, Local 1200. The purpose of this study was to evaluate the exposure of employees working in or near the production welding departments to stainless steel welding fumes containing chromium, hexavalent chromium (VI), inorganic nickel, iron oxide, manganese, and fluorides.

Based on the data collected during the environmental survey on March 8-11, 1977, it has been determined that:

A. Production "tack" and "firm" welders in both the hull and turret welding departments are exposed to hazardous levels of chromium, hexavalent chromium and inorganic nickel. Welders, air arc burning or "scarfing" hulls and turrets, were exposed to excessive levels of inorganic nickel; however, environmental measurements indicate hazardous levels of chromium and hexavalent chromium compounds were not associated with the scarfing process.

B. A few welders are occasionally exposed, for short durations, to excessive concentrations of iron oxide fume above the evaluation criteria of 10 mg/M^3, as recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), for short term exposures up to 15 minutes.[1] The time weighed average exposure for all welders was below 5 mg/M^3, with the highest exposure measured at 1.88 mg/M^3 for the scarfer working at Station 12.

C. Although the fluoride coated stainless steel welding rods contain manganese, only 4 out of 72 samples detected manganese levels above the maximum allowable concentration of 5 mg/M^3. The welding fumes sampled contained fluorides but the concentrations detected were below a level which would be considered health hazardous.

The National Institute for Occupational Safety and Health (NIOSH) recommends that all forms of inorganic nickel compounds and certain forms of chromium (VI) be controlled as carcinogens[2,3]. In December 1975, NIOSH transmitted its criteria for a recommended standard on chromium (VI) to the Occupational Safety and Health Administration (OSHA). This criteria document recommends that exposure to chromium (VI) not be greater than 1 µg Cr (VI)/M^3 unless the employer can demonstrate that only non-carcinogenic chromium (VI) compounds are present in the workplace. A time weighted average (TWA) concentration of 25 µg Cr (VI)/M^3 is permitted for non-carcinogenic chromium (VI). In May, 1977, NIOSH completed its criteria document on inorganic nickel and recommended that all forms of inorganic nickel be controlled to insure that workplace concentrations be limited to 15 µg inorganic nickel/M^3 (TWA).

In view of the fact that welders are consistently exposed to welding fumes containing inorganic nickel and chromium (VI) in excess of the NIOSH recommended levels, and considering; that chromium (VI) has been found to cause increased respiratory mortality among workers, and that lung cancer and nasal cancer can result from inhalation of nickel, a health hazard is judged to exist for welders working in the hull and turret welding departments.

No work-related health problems or symtoms were detected during a NIOSH Medical Investigation conducted at the plant on January 18 & 19, 1977. All welders chest x-rays were within normal limits and employee interviews did not indicate that welders had suffered any unusual respiratory problems.

Although, at the time of the survey , there was no indication that welders had suffered adverse health affects from their exposure to stainless steel welding fume, it is recommended that preplacement and annual medical surveillance of exposed workers be implemented as soon as possible. This surveillance should include: pulmonary function tests, chest x-rays, comprehensive medical and work histories, and a complete physical examination with particular attention given to the lungs, upper respiratory tract and skin. The use of air supplied welding helmets should be mandatory for all welders and effective engineering and administrative controls are needed to reduce airborne concentration of welding fumes containing inorganic nickel and chromium (VI).

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

After 90 days the report will be available through National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address. Copies have been sent to:

1. Chrysler Detroit Tank Plant, Warren, Michigan
2. Commander, Army Tank Office, U.S. Army Tank Automotive Command
3. Authorized Representative for Employees, UAW Local 1200
4. United Auto Workers International, Detroit, Michigan
5. U.S. Department of Labor - Region V
6. NIOSH - Region V

For the purpose of informing the approximately 184 affected employees, the Determination Report shall be posted for a period of 30 calendar days in a prominent place(s) near where exposed persons work.

III. INTRODUCTION

Section 20(a) (6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a) (6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an employer of authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees to evaluate employee exposure to welding fumes, sparks and radiation generated from production arc welding and air-arc burning (scarfing) performed on armor steel castings used in the assembly of the U.S. Army M60A1 Battle Tanks. Because arc welding radiation is a physical agent, NIOSH was not authorized to investigate this potential hazard under the regulations governing the Health Hazard Evaluation.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The Chrysler Detroit Tank Plant, in Warren, Michigan is operated by Chrysler Corporation, but all facilities are government owned and under jurisdiction of the U.S. Army Tank Automotive Command. Built in 1942, the facilities were and are still used as the assembly plant for Army battle tanks. The M60A1 is currently in production and during the time of this survey, the plant employed approximately 700 production workers and was producing 3-4 tanks per day when operating to full capacity.

Approximately 125 production arc welders were assigned to the Hull and Turret Welding Departments. "Tack" welders working in these departments positioned and spot welded numerous fixtures to the inside and around the top and bottom of the outside of the hull or turret castings. These spot welds were later "firm" welded to provide for required strength. Roll over equipment such as hull "barrels" and turret positioners were used to rotate castings to provide horizontal welding surfaces. Each hull and turret casting is moved from station to station with overhead cranes as the welding tasks progress. Time required for complete welding production on each hull and turret is approximately two weeks.

Fluoride flux coated, 3/8" and 1/4" stainless steel electrodes were used for both "tack" and "firm" welding. The stainless steel alloy used for the welding rod core wire was approximately 19-20% chromium and 10% nickel. Carbon electrodes were also used for air arc burning or "scarfing" of hull castings located at Station 12 in the hull welding department. Welders would occasionally scarf out hull openings to allow for proper fit and closing of hull hatches and doors. Previous industrial hygiene studies by Chrysler had indicated that very high welding fume concentrations could occur during the scarfing process;[4] however, the fumes contained a lower percentage of chromium due to the use of carbon electrodes.

After all welding is completed and inspected, the hull and turret were thoroughly washed with a steam injected, kerosene based emulsion cleaner, then water rinsed, and air dried. The wash booth was located in the hull welding area and was equipped with overhead exhaust ventilation.

Due to a shortage of tanks, the army has scheduled increased production quotas for the plant through November, 1977. Additional arc welders will be needed as production builds to the required 5.8 tanks per day.

B. Evaluation Design (Environmental)

An initial screening survey was conducted on August 26 & 27, 1976 in order to tour the production facilities and observe the welding operations in progress. Seventy one employees working in or near the hull and turret welding areas were selected for confidential, non-directed interviews, in order to determine if they had experienced any adverse health effects, or noted symptoms as a result of their exposure to the welding fumes. In addition to the standard non-directed interview, additional comments were solicited from production welders regarding their use of the air supplied welding helmets provided by Chrysler to control a welder's exposure.

The results of the employee interviews are contained in Table 1. Forty-five, out of the 71 employees interviewed, reported symptoms which in their opinion had been caused by conditions which existed in their work environment. Of these 45, 24 had reported more than one symptom.

There were numerous complaints about lack of adequate ventilation, and many employees reported that conditions were especially bad during the winter months. It was observed during the initial survey that the air within the hull and turret welding areas was clouded and hazy from welding fumes.

It was decided upon completion of the initial screening survey that a follow up environmental and medical study would be necessary to fully assess employee exposure to welding fumes. Because previous studies conducted by the U.S. Army Environmental Hygiene Agency and Chrysler Corporation had not considered non-welder exposure, the follow up environmental study was designed to include air sampling in the tool room, the heavy repair departments and the over head crane cabs.

C. Evaluation Design (Medical)

The initial medical survey was made on January 18, 1977. A walk-through tour of the plant and the specific working area that was allegedly causing problems were evaluated so that the medical investigator could get an overall picture of the problem.

On January 18 & 19, 1977, the medical investigator interviewed, made visual skin inspection of workers in the area, and reviewed the company health records of 35 employees who worked as welders or who worked in areas adjacent to the welding area.

D. Evaluation Methods (Environmental)

An extensive environmental survey was conducted on March 8-11, 1977 and resulted in the collection of 269 atmospheric samples. Separate samples were collected in order to evaluate exposure to the various components of the welding fume, consisting of chromium, iron, nickel, manganese, chromium (VI), and fluorides. Representative welder breathing zone samples were collected for all types of welding tasks commonly performed throughout the welding departments. Air samples were also taken from the overhead cranes, tool room and heavy repair areas.

Samples to be analyzed for heavy metals were collected on 37mm, cellulose ester filters having a pore size of 0.8 microns. Samples to be analyzed for chromium (VI) were collected on polyvinyl chloride filters having a pore size of 5 microns. Samples to be analyzed for fluorides were collected on special pre-treated filters designed for collection of both gaseous and particulate fluorides. The filters were pre-treated with a solution of 50% ethanol - 10% sodium formate, in accordance with the instructions recommended in the NIOSH criteria document for inorganic fluorides.[5]

All filters were placed in 3 piece, field monitor cassettes and attached to portable, battery operated air sampling pumps, operating at a flow rate of 1.5 liters per minute. Sampling equipment was worn by the employees throughout their work shift and all air sampling pumps with appropriate filter assemblies were calibrated prior to use. Filters were changed as necessary to prevent a reduction in air flow due to filter loading. Short term 15 minute samples were taken for chromium, iron, nickel, and manganese in order to determine peak or ceiling concentrations during time periods or near locations where high level welding fume concentrations were likely to occur.

Personal atmospheric samples for welders were collected inside the welding helmets. Filters were either taped to the inside wall of the helmet or positioned on the collar in such a way, that the helmet, when in the down position, covered the filters.

To compare the amount of total chromium to the amount of chromium in the hexavalent state, separate but simultaneous samples were collected. The samples were analyzed by the Utah Biomedical Test Laboratories in Salt Lake City. Chromium (VI) was determined by using the specific diphenylcarbizide method. Airborne metals were analyzed using atomic absorption spectrophotometry. Pre-treated filters which were used for fluoride collection were analyzed with the specific ion electrode method.

The emulsion cleaner used for cleaning hulls and turrets in the wash booth contained solvents with a fairly high percentage of aromatic hydrocarbons. To determine if solvent vapors, containing benzene or other toxic hydrocarbons were present in the wash booth, the breathing zone of the worker in the wash booth was sampled during the washing and rinsing of one hull and one turret. A bulk sample of cleaning solution was also obtained for chemical analysis. The atmospheric samples were collected on vapor absorbing charcoal tubes using low flow sampling pumps set at approximately 100 cc of air per minute. The atmospheric and bulk samples were analyzed using a gas chromatograph.

An attempt was made to detect the presents of ozone in the welding area but was not possible due to a malfunction in the direct reading instrumentation just prior to the start of the survey.

E. Evaluation Criteria

1. Toxic Effects

The toxicity of welding fumes is dependent on the type of metal being welded and the process and electrodes used. The American Conference of Government Industrial Hygienists has recommended that welding fume exposure be evaluated on the basis of individual consituents which are likely to be present when welding stainless steel, cadmium, or lead coated steel, and other metals such as copper and nickel.[6] The adverse health effects which could result from the excessive exposure to the toxic substances identified as present in the stainless steel welding fume at the Chrysler Detroit Tank Plant are summarized below.

Chromium - Under environmental conditions where oxygen is present, chromium exists in 3 principal forms: elemental chromium or chromium metal; trivalent chromium of chromium (III) including chromite and soluble chromous and chromic salts; and hexavalent chromium or chromium (VI) compounds as chromates, dichromates or chromic acid anhydride (CrO_3).

The dusts of chromium metal and its insouble salts, chiefly the chromites, are considered to be relatively non-toxic. Pulmonary fibrosis may occur but the toxic effects associated with exposure are usually mixed exposures with more toxic hexavalent chromium compounds.[7] The soluble chromic and chromous salts have no established toxicity although sensitization dermatitis may occur. The compound hexaquachromium trichloride can react with protein. Sarcoma was included in 1 of 35 rats implanted with chromic acetate in the thigh muscle and was reported as evidence of weak carcinogencity of this soluble trivalent compound. Some investigators believe that all persons sensitized to hexavalent chromium are also sensitive to the trivalent form but this has not been firmly established.[8]

Contact dermatitis, skin ulcers, irritation and ulcertation of the nasal muccosa, and perforation of the nasal septum have resulted from contact with chromium (VI) materials. Other effects, such as kidney and liver damage, pulmonary congestion and edema, epigastric pain, and erosion and discoloration of the teeth have been reported on occasion. In addition to these effects exposure to some chromium (VI) compounds have been associated with an increased incidence of lung cancer. Evidence derived from animal

studies also indicated that certain hexavalent chromium compounds are carcinogens. There is evidence to support the theory that solubility of a chromium (VI) material has some influence on its carcinogencity (i.e. highly soluble chromium (VI) materials have not been found to be carcinogenic) but at the present time data is insufficient to accurately identify carcinogenic chromium (VI) materials solely on the basis of solubility.[3]

Inorganic Nickel - Lung cancer and nasal cancer can result from inhalation of nickel. The average latency period for induction of these cancers appears to be about 25 years.

Nickel compounds, other than nickel carbonyl, do not appear to manifest any exceptional symptoms of acute toxicity in humans. Nickel can cause dermatitis (nickel itch) expecially if there is appreciable skin contact with nickel - containing materials, such as nickel solutions. Sensitization to nickel in all forms may also occur. Some individuals may develop a sensitivity to nickel regardless of precautions taken to prevent exposure.[2]

The NIOSH decision to consider inorganic nickel a carcinogen is based primarly on evidence presented in epidemiologic studies of nickel refinery workers which show an excess number of deaths from lung and nasal cancer which were believed to be caused by worker exposures to airborne nickel compounds. However, the NIOSH criteria document for inorganic nickel does indicate that additional epidemiologic studies are needed to determine the risks of developing nickel - related cancers in occupations which have not been adequately studied, such as welding, plating, and refining nickel oxide ore.

Iron oxide fume - Inhalation of iron oxide fume or dust gives rise to apparently benign pneumoconiosis termed siderosis. Prolonged, excessive exposure over a period of 6 to 10 years is usually required before changes recognizable by X-ray can occur. The iron deposition in the lungs gives X-ray shadows which may be indistingusable from fibrotic pneumoconiosis.[9]

Managanese - The main toxic effect is to the central nervous system. Early symptoms of managanese poisoning include languor, sleepiness and weakness in the legs. Emotional difficulties, such as uncontrollable laughter and a tendency to fall frequently when walking have been reported in advanced cases of manganese poisoning. A high incidence of pneumonia has also been associated with exposure to dusts and fumes of some manganese compounds.[10]

Fluorides - Long Term exposure to excessive airborne fluoride concentrations can cause skeletal fluorosis (osteosclerosis or increased bone density due to excessive absorption and retention of fluorides). Severe osteosclerosis can result in moderate to crippling restrictions in movement of the spine. Soluble and acidic fluorides can cause skin, eye and respiratory irritation.[4] Complaints of nose bleeds and "sinus trouble" have been reported from welders exposed to fluorides.[9]

2. Environmental Levels

The environmental levels selected as evaluation criteria for the health hazard determination in this investigation are the exposure limits recommended by NIOSH or the American Conference of Governmental Industrial Hygienists (ACGIH). The airborne concentration limits, for toxic substances found in the workplace, are designed to protect the health and safety of exposed workers. It is believed that concentrations below these limits represent conditions under which nearly all workers may be repeatedly exposed 8-10 hours per day, 40 hours per weeks, without suffering adverse health affects.

The NIOSH Recommended Standards and the ACGIH Threshold Limit Values (TLV) have been selected as the evaluation criteria values since they are the most current. For many toxic substances these values are more strigent than the Federal Standards currently enforced by the Occupational Safety and Health Administration (OSHA).

	Exposure Limit		
Substance	NIOSH[a]	ACGIH[b]	OSHA[c]
Non-Carcinogenic* Chromium (VI)	25ug/M^3(TWA)	0.1mg/M^3(TWA)	0.1mg/M^3(C)
Carcinogenic* Chromium (VI)	1ug/M^3(TWA)**	0.1mg/M^3(TWA)	-
Soluble Chromous & Chromic Salts, as Cr	0.5mg/M^3(TWA)	0.5mg/M^3(STEL)**	0.5mg/M^3(TWA)
Chromium metal & insoluble salts, as Cr	1.0mg/M^3(TWA)	1.0mg/M^3(TWA)**	1.0mg/M^3(TWA)
Inorganic Nickel	15ug/M^3(TWA)**	0.1mg/M^3(TWA)	1.0mg(TWA)
Iron Oxide Fume	5mg/M^3(TWA)	5mg/M^3(TWA)** 10mg/M^3(STEL)**	10mg/M^3(TWA)
Manganese	5mg/M^3(C)	5mg/M^3(C)**	5mg/M^3(C)
Fluorides	2.5mg/M^3(TWA)**	2.5mg/M^3(TWA)	2.5mg/M^3(TWA)

TWA = Time Weighted Average
STEL = Short Term Exposure Limit (15 minutes duration)
C = Ceiling Limit

* NIOSH has defined "non-carcinogenic" chromium (VI) to be chromium (VI) in monochromated and dichromates (bichromates) of hydrogen, lithium, sodium, potassium, rubidium, cesium, amonium and chromium (VI) oxide. "Carcinogenic" chromium (VI) comprises any chromium (VI) material not included in the group above, such as lead, zinc and calcium chromates.

** The exposure limits chosen as evaluation criteria for the health hazard determination of this evaluation.

a. As recommended by NIOSH criteria documents or NIOSH/OSHA Standards Completion Program Draft Technical Standards

b. As recommended by the ACGIH (TLV list for 1976)

c. Federal Standards from Table Z-1, Z-2 and Z-3 29 CFR 1910,1000

F. Evaluation Results and Discussion (Medical)

A total of thirty-five (35) employees were interviewed. The Demographic data is presented in Table 2. During the interviews, the employees did not have complaints they believed were work related (see Table 3 and 4). Employees were more concerned over the sanitary condition of the water fountain and rest room. The medical investigator had the opportunity to use these facilities and did find them to be in poor sanitary condition. The visual check of the hands and face revealed no lesions other than normal scratches from working with the metal or heavy equipment.

Upon reviewing the company health records of the employees with the company physician, it is noted that the employees had only seen the physician or nurse for headaches, colds, stomach pains, flash burns, and trauma. A review of the chest X-rays of the employees, with the company physician, revealed all X-rays to be within normal limits. Table 5 shows a summary of the radiologist reports on the employees.

The company had drawn blood specimens on all welders working with chromium for blood chromium levels, but had to destroy the specimens because the company could not find a lab to analyze the specimens.

After carefully reviewing all data collected on this visit and reviewing material available to the medical investigator on chromium, it was determined that medically, no work-related health problems and/or symptoms existed at the time of this medical survey.

G. Evaluation Results and Discussion (Environmental)

The results of atmospheric sampling for welding fume, on March 8-10, 1977 are presented in Table 6 and 7. The data contained in Table 6 represents the results from full shift sampling for chromium, iron oxide and nickel, and the simultaneous sampling for chromium (VI). Inorganic fluoride concentrations and peak iron oxide, chromium, nickel and manganese levels, as determined from short term samples, are presented in Table 7. The time weighted average concentrations are not an 8 hour TWA but are based on actual sampling duration. The estimated welding task duration time (in hours) is the approximate time a welder was working at his welding station. The tables identify which welders sampled were wearing air supplied welding helmets.

It should be noted that most welders sampled during the survey performed welding tasks only 4-5 hours during their 8 hour shift. Random 15-60 minute time and motion studies, for hull line and barrel welding, indicated actual arc-time averaged 43% (Range 17%-81%) of a work cycle. From this data it is estimated that arc-time is approximately 2 hours per shift for hull line and barrel welders. Tack welders arc-time would probably be less than 2 hours. This work schedule is a contributing factor in reducing a welders' exposure to welding fume over an 8 hour shift.

The atmospheric chromium concentration data is presented in Table 8. This data does not support the previously reported Chrysler data which had demonstrated that approximately 70% of the total airborne chromium was in the hexavalent state.[11] Only 5 of 44 chromium samples were greater than 60% chromium (VI) and 32 samples were less than 20% chromium (VI). The wide variation in the precentage of chromium (VI) vs total chromium could be attributed to differences in the amount of welding fume collected on each filter. The U.S. Army Environmental Hygiene Agency reported that comparative sampling within a given helmet could differ from 7-80%.[11] It is of interest that 3 samples for chromium (VI) collected from welders working in barrel #2 were in excess (greater than 100%) of the amount of total chromium collected from the breathing zone of these same welders.

The constituents of the stainless steel welding fume sampled which exceeded the evaluation criteria are presented in Table 9. These exposures are considered excessive and the table lists all jobs or locations which may be health hazardous due to high concentrations of airborne chromium, chromium (VI), nickel, manganese and iron oxide. Airborne fluoride concentrations were within acceptable levels. Tool room and heavy repair personnel were not exposed to excessive welding fumes during this survey.

Benzene was not detected in the breathing zone samples from the wash booth, nor was benzene detected in the bulk sample of the soap solution being used to clean the hulls and turrets. The lower limit of detection was 0.01mg per charcoal tube sample or 1mg/ml for the bulk sample.

V. RECOMMENDATIONS

1. The air supplied welding helmets should be provided to all welders and their use should be mandatory for both "tack" and "firm" welders.

2. A new dilution ventilation system presently under study by the U.S. Army Corps of Engineers should be installed and made operational as soon as possible. Although this system would not likely reduce airborne chromium (VI) levels below the NIOSH recommendation of 1ug chromium/M^3 of air, this combined with the use of air supplied welding helmets should afford welders adequate protection.

3. If possible, the use of welding rods with reduced chromium and nickel content should be considered.

4. Preplacement and periodic medical surveillance programs should be implemented as soon as possible. This surveillance program should include: pulmonary function testing, chest X-ray, comprehensive medical work histories, and a complete physical examination. The pulmonary function studies should include Forced Vital Capacity (FVC), Forced Expiratory Volume at 1 second (FEV_1), and Mean Maximal Expiratory Flow (MMEF). Following preplacement examinations, follow-up studies should be conducted every 3 years for welders under 35 years of age, every 2 years for welders 35-45 and yearly for all welders over age 45.

5. Additional studies should be undertaken by Chrysler's Industrial Hygiene Section or the U.S. Army Environmental

Hygiene Agency to determine if stainless steel welding fume contains only non-carcinogenic chromium (VI).

6. Accurate medical records should be kept of all injuries, illness and deaths of workers exposed to stainless steel welding fumes. These records should be kept as part of both the personnel and medical record.

VI. REFERENCES

1. ACGIH; Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with intended changes for 1976.

2. Criteria for a Recommended Standard-Occupational Exposure to Inorganic Nickel, NIOSH, HEW, Washington D.C. May, 1977.

3. Criteria for a Recommended Standard-Occupational Exposure to Chromium (VI), NIOSH, HEW, Washington D.C. 1975.

4. Inter Company Correspondence, Chrysler Industrial Hygiene welding fume survey, February 16, 1973.

5. Criteria for a Recommended Standard-Occupational Exposure to Inorganic Fluorides, NIOSH, HEW, Washington D.C. 1975, Appendix II.

6. ACGIH; Documentation of the Threshold Limit Values; Supplements for Those Substances Added or Changed, Years 1974-1975, Welding Fumes, Not Otherwise Classified.

7. NIOSH/OSHA Draft Technical Standard; Set 0, Chromium metal and insoluble chromium salts.

8. NIOSH/OSHA Draft Technical Standard, Set 0, soluble chromous and chromic salts.

9. NIOSH/OSHA Draft Technical Standard, Set 0, Iron oxide fume.

10. ACGIH; Documentation of the Threshold Limit Values, 3rd Edition, 1971.

11. Industrial Hygiene Special Study (IZ) No. 35-040-75176, U.S. Army Environmental Hygiene Agency, Evaluation of Air-Supplied Welding Helmets, 28 April-May, 1975.

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TABLE 1
Employee Interview Results
Initial Environmental Survey
March 1977

Chrysler Tank Plant
Warren, Mich
HE 76-89

DEPT.	SYMPTOMS REPORTED																			
	Sinusitis	Breathing Difficulties	Flash Burns	Burning Eyes	Head-ache	Cough	Dry or Sore Throat	Dermatitis	Arthritis	Nose Bleeds	Heart Pains/ Dizziness	Upset Stomach	Ulcer	Chest Burns	Finger Numbness	Smokers	Non-Smokers	Total Number Interviewed	
301 Room	2			1	1			1		1						3	1	4	
340 Stores	1																1	1	
340 ic Opr.			1													2		2	
360 Room																1		1	
430 et Wld.		2		3		4										10	2	12	
431 Weld.	4	4	2	1	1	4	3				1			1		4	7	11	
432 Weld.	1	1	2			1	1	1								2	5	7	
433 Line.	2	2		1		1	1	1	1		1	1				7	3	10	
434 et Plat	1	1	1	1												3	1	4	
435 Parts	1																1	1	
505 ection	1															3		3	
506 ection																1		1	
541 iage	2	1	1		1											4		4	
560 y Rep.		3			1	2	2	1			1	1			1	7	3	10	

TOTAL---------71

COMMENTS ON AIR SUPPLY WELDING HELMET

1. Seven interviewed dislike helmet and don't use it.
2. Six interviewed liked helmet but don't use it.
3. Nine interviewed like and use helmet.
4. Eleven interviewed never used helmet or it is not available.
5. Nine interviewed dislike helmet but do use it.

Chrysler Plant
Warren, Michigan
HE 76-89

TABLE 2
Demongraphic data

January 1977

Sex	Race	Job Discription	Years in this job	Years at Chrysler	Smoke	Complaints
M	C	Welder	22	4	Yes	Shortness of Breath
M	C	Welder	17	5	Yes	Productive Cough
M	C	Welder	13	1	Yes	None
F	B	Welder	1	1	Yes	None
M	C	Welder	1	1	Yes	Chest Pains, Sore throat, Productive Cough
M	B	Welder	13	16	Yes	None
M	C	Welder	1	1	Yes	Sore Throat
M	C	Tool Room	29	29	Yes	None
M	C	Heavy Repair	16	16	No	Sore Throat
M	C	Heavy Repair	16	16	No	None
M	B	Heavy Repair	16	16	Yes	None
M	C	Heavy Repair	16	16	No	None
M	C	Heavy Repair	5	5	No	None
M	C	Inspector	10	10	No	Sore Throat, Shortness of Breath
M	C	Heavy Repair	4	4	No	None
M	B	Heavy Repair	9	25	Yes	Shortness of Breath, Burning of Eyes
M	C	Welder	18	18	No	None
M	C	Inspector	7	30	Yes	Tightness in Chest
M	C	Heavy Repair	2	2	No	Burning Eyes
M	C	Welder	1	1	No	Nose Bleeding, Sore Throat, Chest Tightness
M	C	Crane Operator	20	20	Yes	Burning Eyes, Sore Throat, Chest Tightness
M	B	Welder	18	6	Yes	Burning of Eyes
M	C	Welder	2	2	Yes	Productive Cough, Chest Tightness, Sore Throat, Nose Bleeds
M	C	Welder	1	1	Yes	Productive Cough, Sore in Nasal Cavity
M	B	Welder	33	33	Yes	Sore Throat
M	C	Welder	28	28	No	None
F	B	Welder	7	7	No	None
M	B	Welder	2	2	No	Productive Cough
M	C	Welder	7	7	Yes	None
M	C	Welder	17	3	Yes	None
M	B	Welder	7	7	No	Nose Bleeds, Chest Pains, Sore Throat
M	B	Welder	30	16	Yes	None
M	B	Welder	4	4	No	None

Chrysler Plant
Warren, Michigan
HE 76-89

TABLE 3

Summary of Demographic Data

January 1977

		AGE			LENGTH OF EMPLOYMENT AT CHRYSLER (Years)			LENGTH POSITION HELD (Years)		
		RANGE	MEDIAN	AVERAGE	RANGE	MEDIAN	AVERAGE	RANGE	MEDIAN	AVERAGE
Welders										
Caucasian	13	19-60	37	40.3	1-28	3	6.4	1-28	13	11.3
Black	8	28-52	44	41.6	2-33	10	14.3	2-33	10	14.3
(Black Female)	2	30-55	43	42.5	1-7	4	4.0	1-7	4.0	4.0
Tool Room										
Caucasian	1	55	--	--	29	--	--	29	--	--
Black	0	--	--	--	--	--	--	--	--	--
Heavy Repair										
Caucasian	6	23-55	40	39.3	2-16	15	9.8	2-16	15	9.8
Black	2	51-62	56	56.5	9-16	12	12.5	16-25	20	20.5
Crane Operator										
Caucasian	1	47	--	--	20	--	--	20	--	--
Black	0	--	--	--	--	--	--	--	--	--
Inspector										
Caucasian	2	52-54	53	53	10-30	19	20.0	7-10	8	8.5
Black	0	--	--	--	--	--	--	--	--	--

	M	F								
Cau	23	0	19-60	47	42.5	1-30	5	10.4	--	--	--
Black	10	0	28-61	50	44.6	7-30	12	13.3	--	--	--
Black	0	2	30-55	43	42.6	1-7	4	4.0	--	--	--

Chrysler Plant
Warren, Michigan
HE 76-89

TABLE 4

Summary of Interview

January 1977

POSITION	NUMBER INTERVIEWED	TIGHTNESS OF CHEST	SORE IN NASAL CAVITY	SHORTNESS OF BREATH	PRODUCTION COUGH	CHEST PAINS	SORE THROAT	NO COMPLAINTS	BURNING OF EYES	NOSE BLEED
Welders	19	2	1	1	5	2	6	11	1	3
Tool Room	1							1		
Heavy Repair	8			1			1	5	2	
Inspector	1	1		1			1			
Crane Operator	2	1					1		1	

TABLE 5
Radiologist Report
January 1977

SEX	RACE	JOB TITLE	RADIOLOGIST REPORT	DATE OF REPORT
M	C	Welder	Questionable unlining mediastinum	2-25-72
M	C	Welder	Neg	6-11-75
M	C	Welder	Neg	7-18-75
M	C	Welder	Neg	7-14-75
M	C	Tool Room	Bronchials	7-20-68
M	C	Heavy Repair	Neg	4-26-73
M	C	Welder	Increase vascular markings	4-30-70
M	C	Welder	Neg	7-16-75
M	C	Crane Oper.	Neg	6-07-74
M	B	Welder	Neg	6-05-75
M	C	Welder	Bronchials	10-23-73
M	C	Welder	Neg	1-29-76
M	B	Welder	Old adhesion	6-12-75
M	C	Welder	Neg	4-30-75
M	B	Welder	Cardiac fullness	5-09-75
M	C	Welder	Neg	*7-23-73
M	B	Welder	Neg	*2-17-75
M	B	Welder	Linear scarring in the right apex - linear densities are noted at both lung base having the appearance of liner fibrosis or discord ateleclatic change. No evidence of acute parenchymal consolidation or pulmonary mass	5-13-75
M	B	Welder	Neg	4-27-73
M	B	Welder	Pneumoconiosis	*6-05-75
M	C	Welder	Hypertrophicosteroarthritis	*5-01-75

* Pending new report from radiologist

TABLE 6

Results of Environmental Sampling for Fumes of Chromium, Iron Oxide and Nickel and for Chromium VI (Collected March 8, 1977)

Department Job/Location	Sample Duration	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Cr VI Ug/M^3	Est. Weld. Task Duration Time (hr.)	Comments
Department 4831	March 8, 1977							
Hull welding-Nose inside	0845-1225	Std.	0.06	0.66	30	-		
"	1226-1450	"	0.11	1.14	80	-		
"	TWA		0.08	0.85	49.8	11.9	5	Filters on collar under helmet
Department 4831								
Tack welding outside hull	0805-1235	Std.	0.02	0.17	70	-		
"	1237-1445	"	0.04	0.25	5			
"	TWA		0.03	0.20	49.1	*<0.3	5.5	Filters on collar under helmet
Department 4833 (hull line)		Air						
Firm welding inside hull	0730-1200	Supply	0.02	0.18	10			
"	1202-1451	"	0.01	0.04	<10			Filters taped to inside of
"	TWA		0.016	0.13	<10	<0.3	5	helmet when worn
Tack welding inside hull	0745-1050	Std.	0.12	0.79	80			Works in front end of hull
"	1052-1420	"	0.11	0.63	60			
"	1421-1458	"	0.32	1.41	140			
"	TWA		0.13	0.78	77	25.8	5	Filters on collar under helmet
		Air						
Firm welding inside hull	0735-1205	Supply	0.04	0.21	10			Works in partially confined space
"	1207-1445	"	0.03	0.17	<10			
"	TWA		0.036	0.20	<10	7.1	5	Filters taped inside helmet
Department 4831								
Area Sample (Bay K-21)	0900-1450	N/A	0.06	0.58	50	32.6	N/A	Near main aisle intersection
Department 4832								
Welding- Barrel No. 4	0725-1140	Std.	0.20	0.99	110	121.5		Finished welding at 1255
(Shock Mounts)	1143-1428	"	0.06	0.48	30	<0.9		
	TWA		0.15	0.79	79	<74	4.5	Filters taped inside helmet

TABLE 6

(Collected March 8th, 1977)

Department Job/Location	Sample Duration	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Cr VI Ug/M^3	Est. Weld. Task Duration Time (hrs.)	Comments
Firm welding-Barrel #2	0736-1210	Std.	0.15	0.64	80	0.9		
	1215-1432	"	0.23	0.89	100	346.0		
	TWA		0.18	0.72	87	132	3.5	Filters taped inside helmet
Scarfing-Station 12	0741-1115	Std.	0.03	2.66	50	2.6		Finished scarfing at 1315 but remained in Station 12 area
	1121-1426	"	0.02	0.99	20	1.1		
	TWA		0.025	1.88	36	1.9	3	Filters on collar under helmet
Firm welding-Barrel #2	0822-1115	Std.	0.25	1.16	150	-		Suffered injury at 1315 - Sent to dispensary
	1116-1313	"	0.37	1.39	190	-		
	0822-1225	"	-	-	-	*150.2		
	1228-1313	"	-	-	-	1708.1		
	TWA		0.30	1.25	166	394.5	2.5	Filters taped inside helmet
Firm welding-Barrel #1	0803-1440	Air Supply	0.02	0.16	9	2.2	3.5	Filters inside helmet - finished welding 1335
Department 4833 Area Sample (hull line)	0806-1445	N/A	0.03	0.31	20	5.7	N/A	Located 6' above walkway at Station 3
Department 4830 Firm welding-Positioner	0718-1049	Air Supply	0.22	0.94	120			
	1052-1506	"	0.09	0.42	50			Filters taped inside helmet when welding
	TWA		0.15	0.65	81	855	6	
Tack welding outside turret	0727-1450	Std.	0.06	0.44	50	11.6	4	Filters on collar under helmet when welding
Firm welding-Positioner	0748-1005	Std.	0.07	0.34	30			
	1007-1514	"	0.21	0.94	120			Filters taped inside helmet when welding
	TWA		0.16	0.72	87.2	167.8	5	

TABLE 6

(Collected March 8 & 9, 1977

Department Job/Location	Sample Duration	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ug/M^3	Cr VI Ug/M^3	Est. Weld. Task Duration Time (hrs.)	Comments
Tack welding inside turret	0809-1451	Air Supply	0.04	0.30	30	1.0	4	Filter on collar outside helmet 1.5 hr.- inside rest of time
Department 4830 Area Sample (on hoist support)	0825-1520	N/A	0.008	0.10	5	<0.3	N/A	Between Bay K-22 and K-23
Department 4960 (Heavy Repair) Tank Repairman	0833-1516	None	0.008	0.07	<3	<0.4	None	Filter plug removed 0945 on Cr VI sample
Tank Repairman	0832-1509	None	0.006	0.09	<3	<0.3	None	
Tank Repairman	0837-1514	None	0.003	0.06	<3	<* 0.3	None	
Department 4960 Area Sample (Bay L-23)	0842-1511	N/A	0.006	0.05	<3	<0.3	N/A	Above desk - Near turret Positioner #4
Department 0310 (Tool Room) Tool Maker	0908-1454	None	0.03	0.14	6	<0.4	None	Spent much of day away from Tool Room
Tool Maker	0912-1448	None	0.02	0.14	4	0.8	None	
Department 0310 Area Sample (Bay J-16)	0915-1502	N/A	0.02	0.13	9	0.9	N/A	Top of locker on west Tool Room wall
Department 0440 Area Sample (Crane Cab)	March 9, 77 0724-1509	N/A	-	-	-	<0.3	N/A	Crane K-1 over Hull area
Area Sample (Crane Cab)	0801-1525	N/A	-	-	-	<0.3	N/A	Crane K-6 over Turret area

TABLE 6

(Collected March 10th, 1977)

Department Job/Location	Sample Duration	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Cr VI Ug/M^3	Est. Weld. Task Duration Time (hrs.)	Comments
Department 4833 (Hull Line) March 10, 1977								
Firm welding inside/out-	0710-1020	Std.	0.09	0.52	60			Worked 70% inside & 30% outside
side	1030-1450	"	0.06	0.38	40			on rear hull section (Station 6)
	TWA		0.07	0.44	48	11.3	4.5	Filters under helmet when welding
Tack welding inside hull	0715-0925	Std.	0.03	0.75	<10	*5.3		Worked inside on fron hull sectio
	0925-1510	"	0.04	0.43	30	1.3		(Station 5)
	TWA		0.037	0.52	<25	3.1	4	Filters under helmet when welding
Firm welding outside hull	0750-0957	Std.	0.15	0.83	80			Worked Station 8 on hull line
	0957-1430	"	0.05	0.27	30			
	TWA		0.08	0.48	46	21.8	3	Filters under helmet when welding
Firm welding inside hull	0730-1010	Std.	0.25	1.07	130	Not Taken		Worked front hull section at
	1010-1215	"	0.10	0.42	50	"		Station 8
	1215-1355	"	0.33	1.22	150	"		
	1355-1520	"	0.93	3.81	490	"		
	TWA		0.35	1.42	178	-	6	Filters under helmet when welding
Department 4832								
Barrel #2 - inside	0710-0935	Std.	0.37	1.82	230	3724		PVC Filter loading noted on Cr VI
	0936-1430	"	0.16	0.86	110	227		sample @ 0935
	TWA		0.23	1.18	150	1382	Unknown	Filters under helmet when welding
Barrel #2 - inside	0715-1115	Unknown	0.27	1.35	170	*2686		
	1116-1435	"	0.08	0.36	360	49.6		
	TWA		0.18	0.90	256	1491	Unknown	Filters under helmet when welding
Scarfing Station 12	0721-1106	Std.	0.04	3.16	60	1.2		
	1107-1501	"	0.03	0.18	6	<0.6		
	TWA		0.035	1.64	32.5	<0.9	Unknown	Filters under helmet when welding

TABLE-6

(Collected March 10th, 1977)

Department Job/Location	Sample Duration	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Cr VI Ug/M^3	Est. Weld. Task Duration Time (hrs.)	Comments
Department 4833								
Area Sample (Bay K-17)	0750-1507	N/A	0.05	0.35	30	23	N/A	Work table near hull line - Station 7
Area Sample (Bay K-15)	0811-1505	N/A	0.03	0.20	10	8.9	N/A	Above walkway near hull line - Station 10
Area Sample (Bay K-15)	0804-1505	N/A	0.03	0.85	30	0.9	N/A	Five ft. above floor on crane post - Station 12
Department 4830								
Welding/Scarfing (Turret)	0733-0828	Std.	0.55	2.27	250			Welding
	0832-1223	"	0.008	0.54	5			Periodic welding & grinding
	1226-1255	"	0.13	14.01	340			Scarfing & grinding (wore dustmask)
	1258-1440	"	<0.009	0.16	<10			Minimum welding
	0733-1255	"				1.9		
	1258-1440	"				<1.4		
	TWA		0.09	1.6	<61.8	<1.8	3	Filters under helmet when welding
Turret Grinding	0804-1526	None	0.009	0.34	3	0.3	None	Filters on collar
Turret tack welding	0816-1457	Std.	0.04	0.27	30	0.5	4	Filters under helmet when welding
Department 4830								
Area Sample (Bay K-23)	0748-1527	N/A	0.009	0.12	<3	<0.3	N/A	On hoist support for turret bird cage
Department-Tracking Repair								
Area Sample	0731-1528	N/A	0.008	0.09	<3	<0.3	N/A	On building support beam near Station 12
Department 0310 (Tool Room)								
Tool Maker	0807-1453	None	0.009	0.34	<3	<0.3	None	
Area Sample	0742-1512	N/A	0.01	0.16	3	<0.3	N/A	Tool Room central location on table
Department 0440								
Area Sample (Crane Cab)	0718-1503	N/A	-	-	-	<0.3	N/A	Crane K-1 above hull welding

*Analysis of these samples may be in error due to the possibility of interfering substances being present.

Ug/M^3 = Micrograms of contaminant per cubic meter of air.
Mg/M3 = Milligram of contaminant per cubic meter of air.

TABLE 7 (Collected March 9, 1977)

RHE 76-89
Chrysler Detroit Tank Plant
Warren Michigan
Department
Job/Location

Results of Short Term Sampling for Chromium, Iron Oxide Nickel and Manganese full shift sampling for Fluorides

Sampling Periods	Type Helmet	Conct. Cr Mg/M^3	Conct. Fe_2O_3 Mg/M^3	Conct. Ni Ug/M_3	Conct. Mn Mg/M^3	Conct. Fl Mg/M^3	Est Weld Mask Duration time (hr)	Comments
Dept. 4833 (Hull Line)								
Firm Welding - Station 8								
0720-0742	Std.	0.2	1.0	120	0.3			
1217-1232	"	0.4	1.7	220	0.4			
1253-1305	"	<0.2	0.9	<200	0.3			
0720-0950	"					*0.18		
0950-1200	"					*0.16		
1202-1450	"					*0.46		Filters under helmet
TWA		-	-	-	-	0.28	4.5	when welding
Firm welding inside hull								
Station 7	Air							
0911-0926	Supply	4.9	16	1600	7.6			Worked inside front hull
1210-1225	"	4.4	15.6	1400	6.7			section which was par-
1336-1351	"	5.3	18.2	1600	9.3			tially enclosed. Fil-
0730-1204	"					0.05		ters under helmet when
1204-1430	"					*0.37		welding.
TWA		-	-	-	-	0.16	4	
Tack welding inside hull								
Station 6								
0817-0832	Std.	<0.2	1.4	<200	0.2			
0940-0955	"	0.3	1.7	<200	0.4			
1224-1239	"	0.4	1.7	200	0.4			
1350-1430	"	0.2	0.7	100	0.2			
0735-0945	"					0.15		
0947-1122	"					0.11		Filters under helmet
1202-1500	"					*0.13		when welding
TWA		-	-	-	-	0.13	3.5	
Dept. 4831								
Tack welding outside hull								
0750-1007	Std.	0.2	1.3	90	0.2			
1007-1022	"	<0.2	3.0	<200	0.2			Welding and scarfing
1319-1334	"	0.6	2.3	400	0.7			Tack welding
1334-1347	"	2.4	10.4	1000	2.5			
0750-1007	"					0.27		Scarfing and welding
1007-1245	"					0.05		
1245-1357	"					0.70		
1357-1445	"					*0.52		Scarfing
TWA						0.30	5	Filters on collar under helmet

TABLE 7

(Collected March 9, 1977)

Department Job/Location	Sampling Periods	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Mn Mg/M^3	Fl Mg/M^3	Est Weld Task Duration Time (hr.)	Comments
Dept. 4831 Area Sample	0842-1505	N/A	0.01	0.4	10	0.03	*0.01	N/A	On table near scarfing
Dept. 4832 Outside firm weld - Barrel #2	0814-0829	Air Supply	0.6	2.1	∠200	0.7			
	0924-0939	"	∠0.2	2.1	300	0.1			
	1215-1230	"	∠0.2	0.3	∠200	∠0.1			Filters taped inside helmet
	0715-1445	"					0.01	5	
Outside firm weld - Barrel #2	0835-0850	Std.	0.3	5.8	∠200	0.4			
	0935-0950	"	0.6	2.4	∠200	0.8			
	0953-1008	"	0.2	1.7	∠200	0.3			
	1210-1225	"	0.2	0.9	∠200	0.2			
	1227-1242	"	0.5	1.6	∠200	0.6			
	1246-1301	"	∠0.2	0.4	∠200	∠0.1			
	0735-1114	"					0.13		
	1116-1449	"					0.06		Filters taped inside helmet
	TWA		-	-	-	-	0.10	Unknown	
Outside firm weld Barrel #2	0811-0826	Std.	0.4	2.3	300	0.5			
	0950-1005	"	0.3	1.4	∠200	0.3			
	1245-1300	"	1.3	3.7	600	1.5			
	1359-1414	"	∠0.2	0.6	∠200	0.2			
	1415-1430	"	1.0	3.1	400	1.2			
	0725-1040	"					0.18		
	1041-1454	"					*0.18		
	TWA		-	-	-	-	0.18	Unknown	Filters taped inside helmet.
Inside welding Barrel #2	0826-0841	Std.	1.6	6.2	700	1.9			
	1035-1050	"	0.6	2.5	300	0.7			
	1224-1244	"	1.9	8.0	1000	2.1			
	1326-1349	"	0.3	1.2	200	0.4			
	1355-1410	"	0.8	3.3	400	1.0			
	0800-0928	"					*0.70		
	0930-1436						*0.45		
	TWA		-	-	-	-	0.51	Unknown	Filters inside helmet when worn

RHE 76-89

TABLE 7

(Collected March 9, 1977)

Department Job/Location	Sampling Periods	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Mn Mg/M^3	Fl Mg/M^3	Est Weld Task Duration Time (hr.)	Comments
Scarfing Station 12	0941-1235	Std.	0.05	5.6	100	0.2			
	1238-1455	"	0.06	1.8	600	0.1			Filters on collar under helmet. Fl. conct. very low as expected
	0720-0940	"					*0.04	Unknown	
Dept. 4832 Area Sample (Station 12)	0756-1109	N/A	0.03	13.0	230	0.3			Filter mounted on crane post 5ft. above floor in center of Station 12
	1110-1503	"	0.03	2.0	430	0.09			
	TWA	"	0.03	7.0	339	0.18	-	N/A	
Dept. 4833 (hull line) Area Sample	0751-1142	N/A	-	-	-	-	0.21		Filter located on work table near Station 4 of hull line
	1149-1450	"	-	-	-	-	0.14		
	TWA		-	-	-	-	0.18	N/A	
Dept. 4830 Firm welding, Turret Positioner	0849-0907	Air Supply	2.4	7.7	900	2.2			Welding inside
	1209-1225	"	1.5	4.7	500	1.4			" outside
	1227-1245	"	0.3	1.2	100	0.4			" "
	1246-1302	"	2.1	6.7	800	2.1			" "
	0727-1202	"					0.57		Filter taped inside helmet when welding
	1203-1302	"					1.68		
	1303-1457	"					*0.45		
	TWA		-	-	-	-	0.69	4	
Firm welding turret	1020-1036	Std.	2.6	8.6	900	2.7			Welding outside
	1038-1058		0.9	3.0	300	0.9			" inside
	1352-1409		0.7	2.4	300	0.7			" outside
	0735-1126						*0.53		
	1214-1409						*0.40		Filter under helmet when welding
	TWA		-	-	-	-	0.49	-	

TABLE 7

Department Job/Location	Sampling Periods	Type Helmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Mn Mg/M^3	Fl Mg/M^3	Est. Weld Mask Duration Time (hr.)	Comments
Tack welding turret	1208-1223	Std.	<0.2	0.7	<200	0.2			welding outside
	1223-1238	"	0.2	0.9	<200	0.2			Welding inside
	1238-1252	"	<0.2	0.5	<200	0.1			one man welding outside
	1252-1308	"	<0.2	0.4	<200	0.1			Filter on collar under
	0743-1403	"					0.10		under helmet when
	1404-1502	"					0.30		welding
	TWA		-	-	-	-	0.13	2.5	
Tack welding, inside turret	1109-1121	Std.	<0.2	0.3	<200	<0.1			
	1211-1230	"	<0.1	0.2	<100	<0.1			
	1231-1337	"	10.4	36.8	4500	11.5			Filter heavily loaded
	1338-1355	"	<0.2	<0.2	<200	<0.1			even though welding
	0750-1121	"					0.05		was not continous.
	1211-1458	"					0.63		
	TWA		-	-	-	-			Filter under helmet
							0.31		when welding
Scarfing turret	0810-0825	Std.	0.2	25.7	600	1.0			Wore dust mask under
	0828-0843	"	0.3	82.8	2100	3.0			hood when scarfing.
	0925-0941	"	0.2	0.7	<200	0.2			Grinding & welding
	1210-1235	"	2.9	10.1	1300	2.9			Outside firm welding
	0810-0923	"					0.04		Filter not in cassettee
	0925-1240	"					0.36		back up pad analysis
	1242-1456	"					0.01		Grinding
	TWA		-	-	-	-	0.19	1.5	
									Filter taped in hood when welding
Dept. 4830 Area Sample	0935-0955	N/A	<0.2	0.3	<200	<0.1			
	0956-1012	"	<0.2	0.4	<200	<0.1			N/A located on hoist
	1315-1335	"	<0.1	<0.2	<100	<0.1			support
	1335-1353	"	<0.2	<0.2	<200	<0.1			
	0750-1506	"	-	-	-	-	0.02		

TABLE 7

(Collected March 9 & 10, 1977)

Department Job/Location	Sampling Periods	Type Pelmet	Cr Mg/M^3	Fe_2O_3 Mg/M^3	Ni Ug/M^3	Mn Mg/M^3	Pl Mg/M^3	Pst Weld Mask Duration Time (hr.)	Comments
Dept. 4960 (Heavy Repair) Area Sample (Bay L-23)	0804-1509	N/A	<0.01	0.1	<10	0.01	*0.002	N/A	Above desk-near turret positioner #4
Dept. 0310 (Tool Room) Area Sample (Bay J-16)	0918-1017	N/A	<0.05	<0.06	<50	<0.02			Top of loacker on west tool room wall
	1018-1033		0.3	8.5	300	0.5			
	1034-1458		<0.1	2.8	<100	0.2	0.03	N/A	
Dept. 0440 Area Sample (Crane Cab)	0724-1509	N/A	0.01	0.3	10	0.02		N/A	Crane K-1 over hull area
Area Sample (Crane Cab)	0801-1525	N/A	0.01	0.1	<10	0.02		N/A	Crane k-6 over turret area
Area Sample (Crane Cab)	March 10 0718-1503	N/A	0.01	0.2	70	0.02	0.03	N/A	Crane K-1 over hull area
Dept. 4833 Firm welding inside hull	0730-1010	Std.	-	-	-	-	*0.14		
	1010-1215	"	-	-	-	-	*0.10		
	1218-1355	"	-	-	-	-	0.69		
	1355-1520	"	-	-	-	-	*0.93		Filters under helmet
	TWA						*0.40	6	when welding
Dept. 4831 Nose welding	0743-0758	Std.	0.3	1.4	<200	0.3			Used PVC by mistake
	0932-0948	"	1.3	4.4	400	1.6			continous welding
	0948-1003	"	1.7	5.2	600	2.0			in nose
	1050-1105	"	0.2	1.5	200	0.2			continous welding
	1211-1226	"	0.2	0.8	200	0.3			in nose
	0740-1003	"					*0.65		welding inside cente
	1003-1105	"					0.30		center of hull
	1205-1323	"					0.86		
	1323-1450	"					*1.76		
	TWA						0.90	6	Filter on collar inside helmet when welding

*These samples were collected using filters which were poorly seated in cassettee holder, considerable error is possible.

TABLE 8
Chromium vs Chromium (VI) levels

RHE 76-89
Chrysler Detroit Tank Plant
Warren, Michigan
*Analysis of these substances may in error due to possibility of interfering substances

	Ug/M^3 Cr	Ug/M^3 Cr VI	%Cr VI
Dept. 4811 - March 8, 1977			
Nose welding inside	80	11.9	14.8
Tack welding outside hull	30	*∠0.3	∠1
Area Sample (Bay K-21)	60	32.6	54.3
Dept. 4832 - March 8, 1977			
Shack mounts welding - Barrel #4	150	∠74	∠49.3
Firm welding - Barrel #2	180	132	73.3
" " " #2	300	*394.5	131.5
" " " #1 (Air Supply)	20	2.2	11.0
Scarfing - Station 12	25	1.9	7.6
Dept. 4832 - March 10, 1977			
Welding inside barrel #2	230	1382	600.9
" " " #2	180	*1491	828.3
Scarfing - Station 12	35	∠0.9	∠2.6
Dept. 4833 - March 8, 1977			
Firm welding inside hull (Air Supply)	16	∠0.3	∠1.9
" " " " (Air Supply)	36	7.1	19.7
Tack welding " "	130	25.8	19.8
Area Sample (hull line Station 3)	30	5.7	19.0
Dept. 4833 - March 10, 1977			
Firm welding inside/outside	70	11.3	16.1
" " outside hull	80	21.8	27.3
" " inside hull	350	178	50.9
Tack " inside hull	37	*3.1	8.4
Area Sample (hull line Station 7)	50	23.0	46.0
Area Sample (hull line Station 10)	30	8.9	29.7
Area Sample (Station 12)	30	0.9	3.0
Dept. 4830			
Firm welding - Positioner (Air Supply)	150	855	570
Tack welding outside turret	60	11.6	19.3
" " inside " (Air Supply)	40	1.0	2.5
Firm welding - Positioner	160	167.8	104.9
Area Sample (Host Support)	8	∠0.3	∠3.8

TABLE 8

Chromium vs Chromium(VI) levels

	Ug/M^3 Cr	Ug/M^3 Cr VI	%Cr VI
Dept. 4830 March 10, 1977			
Welding/Scarfing (Turret)	90	$\lesssim$1.8	$\lesssim$20
Tack welding - turret	40	0.5	1.3
Grinding Turret	9	0.3	3.3
Area Sample (Bay K-23)	9	$\lesssim$0.3	$\lesssim$3.3
Dept. 4960 (Heavy Repair) March 8, 1977			
Tank Repairman	8	$\lesssim$0.4	$\lesssim$5
" "	6	$\lesssim$0.3	$\lesssim$5
" "	3	*$\lesssim$0.3	$\lesssim$10
Area Sample (Bay L-23)	6	$\lesssim$0.3	$\lesssim$5
Tracking Repair, March 10, 1977			
Area Sample	8	$\lesssim$0.3	$\lesssim$3.8
Dept. 0310 (Tool Room) March 8, 1977			
Tool Maker	30	$\lesssim$0.4	$\lesssim$1.3
" "	20	0.8	4
Area Sample	20	0.9	4.5
Dept. 0310 (Tool Room) March 10, 1977			
Tool Maker	9	$\lesssim$0.3	$\lesssim$3.3
Area Sample	10	$\lesssim$0.3	$\lesssim$3.0
Dept. 0440 (Crane Cab)			
Area Sample Crane K-1 March 9, 1977	10	$\lesssim$0.3	$\lesssim$3
" " " K-6 " " "	10	$\lesssim$0.3	$\lesssim$3
" " " K-1 March 10, 1977	10	$\lesssim$0.3	$\lesssim$3

TABLE 9

RHE 76-89
Chrysler Detroit Tank Plant
Warren, Michigan

Job/Locations With Excessive Welding Fume Concentrations

Total Chromium

TWA Evaluation Criteria = 1.0 mg/M^3 for insoluble Chromium & Chromium metal
STEL " " 0.5 mg/M^3 for Soluble chromous and chromic Salts

Job/Location	Sampling Period	Type Helmet	mg/M^3
Firm Welding Inside Hull	1355-1520	Std.	0.93
Welding/Scarfing (Turret)	0733-0828	Std.	0.55
Firm Welding Inside Hull	0911-0926	Air Supply	4.9
" " " "	1210-1225	"	4.4
" " " "	1336-1351	"	5.3
Tack welding outside hull	1319-1334	Std.	0.6
" " " "	1334-1347	Std.	2.4
Outside firm welding (Barrel 2)	0818-0829	Air Supply	0.6
Outside firm welding (Barrel 3)	0935-0950	Std.	0.6
" " "	1227-1242	"	0.5
Outside firm welding (Barrel 2)	1245-1300	Std.	1.3
" " "	1415-1430	Std.	1.0
Inside welding (Barrel 2)	0826-0841	Std.	1.6
" "	1035-1050	"	0.6
" "	1224-1244	"	1.9
" "	1355-1410	"	0.8
Firm welding, Turret Positioner	0849-0907	Air Supply	2.4
" " " "	1209-1225	"	1.5
" " " "	1246-1302	"	2.1
Firm welding Turret	1020-1036	Std.	2.6
" " "	1038-1058	"	0.9
" " "	1352-1409	"	0.7
Tack welding, inside turret	1231-1337	Std.	10.4
Firm welding outside turret	1210-1235	Std.	2.9
Nose welding	0932-0948	Std.	1.3
" "	0948-1003	"	1.7

Chromium VI

TWA Evaluation Criteria = 1 ug/M^3 for Carcinogenic Cr VI
" " " = 25 ug/M^3 for Non Carcinogenic Cr VI

Job/Location	Sampling Period	Type Helmet	ug/M^3
Hull welding - Nose inside	0845-1450	Std.	11.9
Tack welding inside hull	0745-1050	Std.	25.8
Firm welding inside hull	0735-1445	Air Supply	7.1
Dept. 4831 Area Sample	0900-1450	N/A	32.6
Welding-Barrel 4	0725-1428	Std.	<74
Firm welding - Barrel 2	0736-1432	Std.	132
Scarfing - Station 12	0741-1426	Std.	1.9

TABLE 9

cont. Chromium VI

Job/Location	Sampling Period	Type Helmet	ug/M^3
Firm welding - Barrel 2	0822-1313	Std.	*394.5
Firm welding - Barrel 2	0803-1440	Air Supply	2.2
Hull line Area Sample	0806-1445	N/A	5.7
Firm welding - turret positioner	0718-1506	Air Supply	855
Tack welding outside turret	0727-1450	Std.	11.6
Firm welding - turret positioner	0748-1514	Std.	167.8
Tack welding inside turret	0809-1451	Air Supply	1.0
Firm welding hull	0710-1020	Std.	11.3
Tack welding inside hull	0715-1510	Std.	*3.1
Firm welding outside hull	0750-1430	Std.	21.8
Firm welding inside hull	0730-1520	Std.	178
Welding inside - Barrel 2	0710-1430	Std.	1382
Welding inside - Barrel 2	0715-1435	Unknown	*1491
Hull line area sample (Sta. 7)	0750-1507	N/A	23
" " " " (Sta.10)	0811-1505	N/A	8.9
Turret welding & scarfing	0733-1440	Std.	41.8

* Analysis of these samples may be in error due to the possibility of interfering substances being present.

Iron Oxide (Fe_2O_3)

TWA Evaluation Criteria = 5 mg/M^3 for Iron Oxide fume

Job/Location	Sampling Period	Type Helmet	Mg/M^3
Area Sample - Station 12	0756-1503	N/A	7.0

STEL Evaluation Criteria - 10 mg/M^3 for Iron Oxide fume

Job/Location	Sampling Period	Type Helmet	Mg/M^3
Turret Scarfing & Grinding	1226-1255	Std.	14.01
Firm welding inside hull	0911-0926	Air Supply	16.0
"	1210-1225	"	15.6
"	1336-1351	"	18.2
Tack welding outside hull	1334-1347	Std.	10.4
Area Sample - Station 12	0756-1109	N/A	13.0
Tack welding inside turret	1231-1337	Std.	36.8
Scarfing turret	0810-0825	Std.	25.7
"	0828-0843	"	82.8
Firm welding outside turret	1210-1235	"	10.1

Inorganic Nickel

TWA Evaluation Criteria = 15 ug/M^3 for elemental nickel and all nickel compounds except organonickel

cont. Inorganic Nickel Table 9

Job/Location	Sampling Period	Type Helmet	Mg/M^3
Nose welding inside hull	0845-1450	Std.	49.8
Tack welding outside hull	0805-1445	Std.	49.1
Tack welding inside hull	0745-1458	Std.	77.0
Dept. 4831 Area Sample	0900-1450	N/A	50.0
Shack mounts welding Barrel 4	0725-1428	Std.	<74
Firm welding - Barrel 2	0736-1432	Std.	87
Scarfing - Station 12	0741-1426	Std.	36
Firm welding - Barrel 2	0822-1313	Std.	166
Hull line Area Sample	0806-1445	N/A	20
Firm welding turret positioner	0718-1506	Air Supply	81
Tack welding outside turret	0727-1450	Std.	50
Firm welding - turret positioner	0748-1514	Std.	87.2
Tack welding inside turret	0809-1451	Air Supply	30
Firm welding hull	0710-1450	Std.	48
Tack welding inside hull	0715-1510	Std.	<25
Firm welding outside hull	0750-1430	Std.	46
Firm welding inside hull	0730-1520	Std.	178
Inside welding - Barrel 2	0710-1430	Std.	150
Inside welding - Barrel 2	0715-1435	Unknown	256
Scarfing - Station 12	0721-1501	Std.	32.5
Hull line area sample Sta. 7	0750-1307	N/A	30
Station 12 area sample	0804-1505	N/A	30
Welding/Scarfing turret	0733-1440	Std.	<61.8

Manganese & Manganese Compounds

Ceiling Limit Evaluation Criteria = 5 mg/M^3

Job/Location	Sampling Period	Type Helmet	mg/M^3
Firm welding inside hull	0911-0926	Air Supply	7.6
"	1210-1225	"	6.7
"	1336-1351	"	9.3
Tack welding inside turret	1231-1337	Std.	11.5

Fluorides

TWA Evaluation Criteria = 2.5 mg/M^3 for Gasseous & particulate Fl.

Job/Location	Sampling Period	Type Helmet	mg/M^3

None: All samples collected indicate airborne fluoride concentrations are below 2.5 mg/M^3