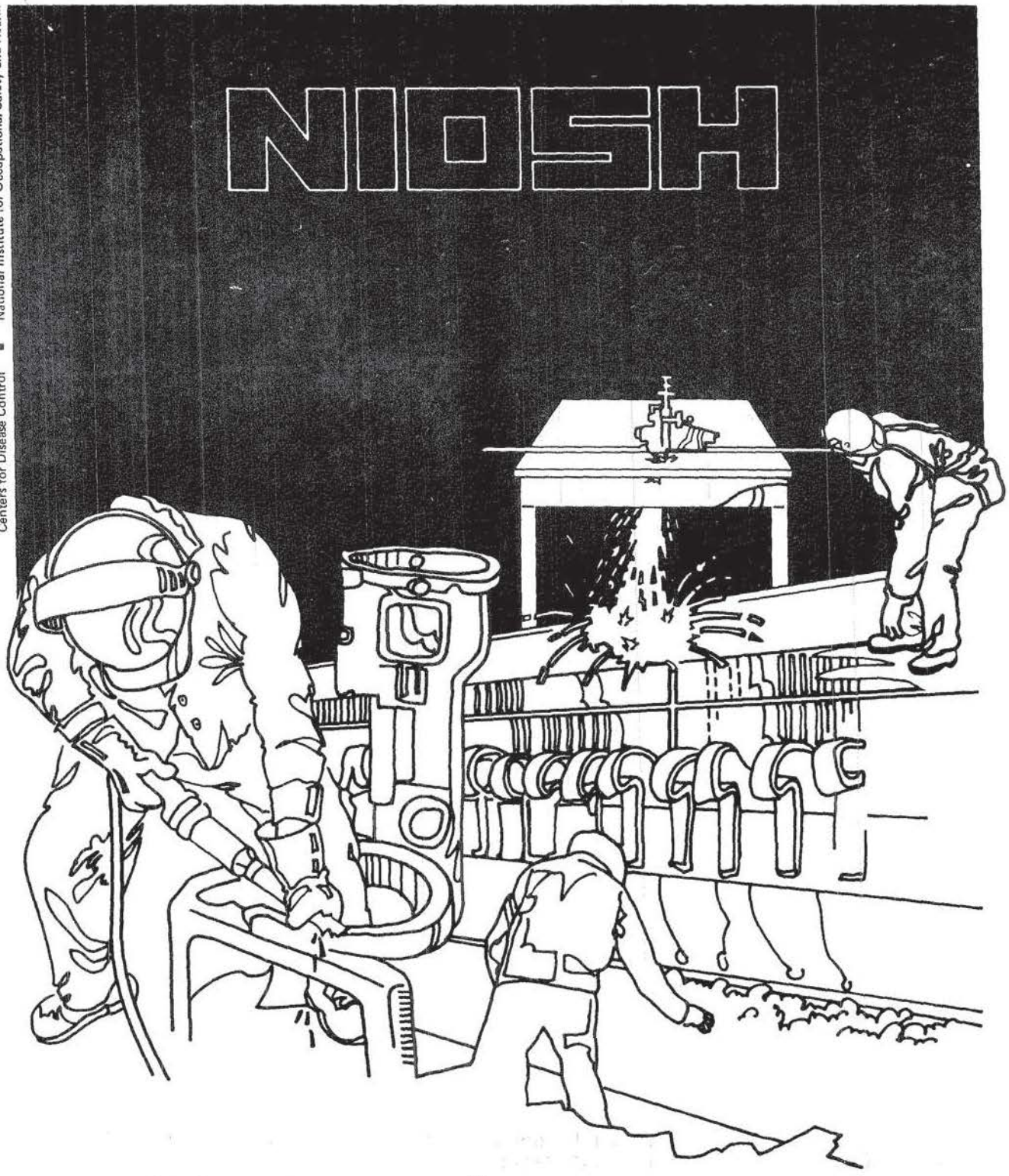
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-085-889
VALLEY CHROME PLATERS
BAY CITY, MICHIGAN

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-085-889
June 1981
Valley Chrome Platers
Bay City, Michigan

NIOSH INVESTIGATORS:
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I. SUMMARY

In November, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request to conduct a Health Hazard Evaluation at Valley Chrome Platers, Bay City, Michigan. The request reported overexposures to chemicals used in hard chrome plating processes and that shop ventilation was poor. Concern was also expressed as to whether there was an association between cardiovascular disorders among plant employees and chrome plating.

The plant employs six workers. Four are platers in the shop. The shop operates on a batch process system. All plating tanks have local exhaust systems.

On January 19-21, 1981, NIOSH investigators obtained personal (breathing zone) air samples for Chromium VI and total chromium. Area air sampling was done for Chromium VI, total chromium, and sulfuric acid. Ventilation and noise measurements were also obtained. Questionnaires were administered individually to all employees.

Personal monitoring of the four platers showed total chromium exposures of 0.009 to 0.011 mg/M^3 (ACGIH recommended maximum level of 0.5 mg/M^3), and Chromium VI values of 0.003 to 0.006 mg/M^3 (NIOSH recommended maximum level of 0.025 mg/M^3). Area samples for Chromium VI and sulfuric acid were below one-tenth of their respective maximum levels of 0.025 mg/M^3 and 1 mg/M^3. One of three area samples for total chromium exceeded the recommended level of 0.5 mg/M^3 (0.81 mg/M^3), and this was observed on the tank having the lowest ventilation rate. Bulk analysis of a plastic masking material used in its molten state on parts demonstrated accumulation of chromium, but concentrations of total chromium and Chromium VI in the area next to the melting pot were very low (0.008 and 0.002 mg/M^3, respectively). Butyric acid and di-sec, octyl phthalate were identified as compounds given off at operating temperatures, both of relatively low toxicity. Butyric acid is responsible for the obnoxious odor. Measurements revealed exceptionally low ventilation rates of the local exhaust system. Chrome spot tests and observation of the break area indicated a need for improved housekeeping, work practices, and personal hygiene efforts. No excessive noise levels were found.

No complaints of chronic respiratory infections and histories of ulcerated or perforated nasal septa were reported by workers. Active chrome ulcers, "holes", or other skin lesions were not observed on platers' hands, and occurrence of these conditions was reportedly infrequent. No other manifestations or permanent injuries associated with chromium or other elements in the plant's environment were reported. Investigation of reported cardiovascular disorders revealed several contributing hereditary and personal factors, none of which could be considered a result of the workplace exposure.

On the basis of the data obtained in this investigation, NIOSH determined that overexposures to plating chemicals did not exist at Valley Chrome Platers. Local exhaust systems were operating below recommended levels. No occupational factors contributing to heart disease were identified. Recommendations for ventilation, housekeeping, and personal protective equipment are given in Section VIII of this report.

KEYWORDS: SIC 3471 (Electroplating, plating, polishing, anodizing and coloring), hard chrome plating, Chromium VI, chromic acid, ventilation, dermatitis, cardiovascular disorders.

II. INTRODUCTION

On November 24, 1980, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request to conduct a Health Hazard Evaluation at Valley Chrome Platers, Bay City, Michigan. The request reported exposures to chemicals used in hard chrome plating processes and concern over poor shop ventilation. Concern was also expressed as to whether there was an association between cardiovascular disorders among plant employees and the chrome plating process.

An initial survey conducted by NIOSH on January 19-21, 1981, included personal and area sampling for chemical contaminants, administration of a questionnaire to all employees, ventilation, and noise measurements.

III. BACKGROUND

A. Plant Description:

Valley Chrome Platers has occupied its present 40 x 100 foot single story facility since 1960. Local exhaust systems are present on all plating tanks. Two offices are located in a small annex, and an old frame building located next to the plant houses employee lunchroom and locker facilities. This frame structure is also used for chemical and general equipment storage.

B. Workforce Description:

The plant workforce consists of 4 full-time electroplaters, one bookkeeper (part-time, 30 hours/week), and one manager. The 6 employees range in age from 25 to 51 years old. There are 5 males and one female. The length of time these individuals have been employed at Valley Chrome Platers, Inc. is as follows: manager - 18 years; bookkeeper - 23 years; platers (4) - 21, 16, 15, and 2 years (the newest individual having 7 years total electroplating experience). All the electroplaters are capable of performing all phases of the plating operation. Additionally, individuals assist with shop maintenance and janitorial functions. Bump caps, safety glasses, and protective gloves are required personal protective equipment. Clean uniforms are provided daily. Platers work 5 days per week, from 6:55 a.m. to 3:25 p.m.

C. Health Care Capabilities:

The company provides each employee with a paid-up health benefits plan. There is no individual physician identified as the "company" physician. On-the-job injuries requiring medical attention are sent to a nearby clinic (equipped with emergency facilities) where care is provided on a fee-for-service basis. Employees use their personal or family physicians for illnesses and routine health care. Currently, pre-employment medical examinations are not required by the company.

D. Process Description

Valley Chrome Platers is engaged exclusively in hard chrome plating. Hard chrome plating, in contrast to decorative plating, is done as a restorative measure or to improve wearability of mechanical parts. Chrome plate is deposited in thicknesses varying from 1/10,000th up to 1/100th of an inch. No machining or fabrication of chrome plated parts is done.

This facility operates as a job shop receiving parts to be plated from a variety of industries, including the automobile industry. Parts are brought to the shop and prepared for plating by first removing any heat treat scale (if necessary) by abrasive blasting, which uses either aluminum oxide grit or a ground glass material. These are glovebox units. The part is then "set-up", by masking off all areas of the part except those to be plated. Materials used for masking are a nonadhesive plastic tape, aluminum tape, wire, and a "plastic" or cellulose acetate butyrate hot dip. The hot dip or Peel-Coat® is heated in a small pot to 350-400°F, and may be reused for several weeks. The part is mounted in a rack and put through a surface preparation process involving submersion in an electrically activated caustic cleaner followed by several rinses including sulfuric acid. A final dip in oxalic acid activates the metal surface before placing it into the chrome plating tank. A clean base metal is required to obtain good plating. The plating tanks contain chromic and sulfuric acid. The only chrome compound used by the shop is chromic acid anhydride. The current flow through the tank solution (from the anode) to the part (cathode) and the time required for plating is determined by surface area and chrome thickness required on the part. When plating is completed, the part is dipped in a still water rinse, the masking material is removed, and the part is given a light coating of a water and oil emulsion. High carbon steel is stress relieved by heating in an industrial oven at 350°F for varying time periods. The plating job is then checked and prepared for shipment or pickup.

This shop also had an automatic plating machine used for large batches of small parts. Due to lack of parts, this unit was not in operation during the survey. The total number of plating tanks is 7 including the automation unit. Other chemicals in use are sodium hydroxide (used to remove plating in a strip tank) and Fumetrol 101® - a liquid mist suppressant used during ventilation malfunctions.

IV. METHODS AND MATERIALS

A. Environmental

The environmental evaluation conducted January 20 and 21, 1981 consisted of ventilation measurements, sound level measurements, personal breathing zone sampling for total chromium and Chromium VI (Cr VI) exposures, and area sampling for total Cr, Cr VI, and sulfuric acid (H_2SO_4) levels. Chromium spot tests were conducted on workers' hands and several surfaces for the detection of the Cr VI ion. A bulk sample of the plastic material used in its

molten state for masking off pieces to be plated, was also collected and subsequently analyzed for total Cr content and organic vapor emissions at melting pot operating temperatures. All personal monitoring and all area sampling (with the exception of the plastic pot) were sampled for a full shift or longer.

1. Ventilation Measurements: Ventilation measurements, both of the exhaust ventilation present on the plating tanks and the makeup air supply ducts, were obtained using a Kurz Air Velocity Meter, Model 441. All the chrome plating tanks had lateral exhaust-end takeoff hoods with the slots located under the gunnels (top ledges) of the tanks. Plating tanks 13, 14, and the automation unit were not evaluated since they were not in operation during the survey.

2. Sound Level Measurements: Sound level measurements were taken using a General Radio Type II Sound Level Meter, Model 1565B equipped with a grazing incidence microphone. The sound level meter was both pre- and post-calibrated at 114 dBC at 1000 cycles per second (Hz). Measurements were taken both on the dBA (slow) setting, weighted to represent the hazard to hearing, and on the dBC (unweighted setting).

3. Total chromium: Sampling for total chromium (the method does not differentiate valences of Cr) was conducted using mixed cellulose ester membrane filters and DuPont 2500 or 4000 sampling pumps calibrated at flow rates between 2 and 3 liters per minute. Personal exposures were obtained by clipping the filter cassette in the workers' breathing-zone - usually on the collar. Area samples were obtained by locating cassettes, clipped to the pumps, on the ledges surrounding the tanks. Samples were analyzed as described in NIOSH Method P & CAM 173.[1] The limit of detection was 0.003 mg chromium/filter.

4. Chromium VI: Sampling for chromic acid mist (specifically Cr VI) was conducted in the same manner as for total Cr, except that polyvinyl chloride filters were used and were analyzed according to NIOSH Method P & CAM 169.[2] The limit of detection of Cr VI was 0.0005 mg/filter.

5. Chromium Spot Test: A qualitative colorimetric test for the presence of Chromium VI was conducted on work surfaces and employees' hands. The test is a modification of the analytical method for Cr VI (P & CAM 169) and involved moistening a filter paper smear tab with distilled water, thoroughly wiping the surface of interest, placing a drop of 1 N H_2SO_4 and one drop of diphenylcarbazide on the filter paper and noting any color change. A reddish-violet color change is indicative of Cr VI. Possible interferences for the diphenylcarbazide method include many of the heavy metals including iron, copper, nickel, and vanadium.[2]

6. Sulfuric Acid: Area samples for sulfuric acid were obtained using DuPont 4000 pumps calibrated between 2 and 3 liters per minute and mixed cellulose ester filters in closed face cassettes. The location of these samples was the same as for the area Cr VI and Total Cr samples. Sampled filters were removed from the cassettes in the field and placed in individual vials. Analysis for sulfuric acid was done according to NIOSH Method P & CAM 268.[3] The limit of detection was considered 0.005 mg of H_2SO_4 per filter.

7. Bulk Sample Analysis: Bulk samples of the masking material Peel-Coat®, consisting of a fresh unused piece and one piece that had been reused for 2-3 weeks, were submitted for determination of total Cr content and an evaluation of organic compounds released at normal melt temperatures. Chromium content was determined by inductively coupled plasma-atomic emission spectroscopy with a lower limit of quantitation for Cr of 0.003 mg (or 3 micrograms - ug) per gram of material. Organic vapor evaluation at melt temperatures was determined by gas chromatography followed by mass spectrometry to identify organic compounds given off at melt temperatures.

B. Medical

Personal interviews and non-directed questionnaires were completed for each of the 6 employees. Medical examinations were not performed. Interviews were conducted to determine if workers experienced any symptoms, chronic conditions or permanent injuries related to exposures to chemicals used in the chrome-plating process, and if the recent incidence of cardiovascular disease, tachycardia (rapid heart beat) and hypertension among plant employees was job related.

V. EVALUATION CRITERIA

Criteria used in evaluating the results of the environmental portion of the investigation were obtained from the following sources: NIOSH Criteria Documents; the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's) for 1980; the OSHA General Industry Standards; and the ACGIH Industrial Ventilation Manual. Criteria used for chemical substances are presented in Table I, while the criteria used to evaluate noise levels and ventilation are presented as part of the tables in which the noise and ventilation results appear (Tables IV and V).

The evaluation criteria presented for chemical and physical agents are considered to represent exposures below which a worker may be exposed over an 8-hour (in the case of NIOSH standards 8-10 hr.) workday, 40 hour workweek without adverse effect. Exposure limits for chemical agents do not include exposures attributable to skin contact or absorption.

Chromium Toxicity

Chromic acid mist and chromium VI materials are severe irritants of the nasopharynx, larynx, lungs, eyes, and skin.

In electroplating operations, workers may experience a variety of symptoms including lacrimation (tearing), inflammation of the conjunctiva, nasal itch and soreness, epistaxis (nosebleeds), ulceration and perforation of the nasal septum, congested nasal mucosa and turbinates, chronic asthmatic bronchitis, dermatitis and ulceration of the skin, inflammation of laryngeal mucosa, cutaneous discoloration and dental erosion. Hepatic injury has been reported from exposure to chromic acid used in plating baths, but appears to be rare.[4] There are no reports of increased lung cancer from exposure to chromic acid alone. Chromium VI oxide, the anhydrous form of chromic acid, has been considered a noncarcinogenic form of chromium VI.[5]

VI. RESULTS

A. Environmental

An inventory of the chemicals used in the plating process was conducted to determine what forms of Chromium VI were in use at the plant. It was determined that the only Chromium VI-containing compounds in use were chromic trioxide, or chromic acid. No other metals were in use and no grinding, machining, or welding of chrome or other metals (except for metal incident to equipment repairs) was performed on the premises.

The results of personal exposure monitoring for Cr VI and total Cr did not indicate any toxic exposures. All values for Cr VI and total Cr were below one tenth of their respective exposure limits of 0.1 mg/M^3 and 0.5 mg/M^3. Personal Cr VI exposure values ranged from 0.003 to 0.006 mg/M^3 and total Cr ranged from 0.009 to 0.011 mg/M^3. See Table II for a listing of results. Chromium VI spot tests conducted on desk, lunchroom and shop surfaces were all positive for the presence of Cr VI contamination. Additionally, the palms and backs of employees' hands were tested and found positive. Employees who wore their gloves throughout most of the day had much weaker Cr VI responses than those frequently removing their gloves to work.

Area sampling values for Cr VI, total Cr, and sulfuric acid were all low with the exception of total Cr on tank 21. Values for Cr VI ranged from 0.001 to 0.011 mg/M^3 (exposure limit 0.1 mg/M^3); total Cr ranged from 0.003 to 0.81 mg/M^3 (exposure limit of 0.5 mg/M^3); and sulfuric acid concentrations were from 0.001 to 0.015 mg/M^3 (exposure limit of 1 mg/M^3). These samples were obtained at the tank edges above the hood slots. Area sampling results are presented in Table III.

Ventilation measurements, presented in Table IV, demonstrated suboptimal exhaust volumes over tanks 11, 12, 21, and 22. Except for Tank 41, which had an exhaust volume of 282 cfm/ft^2 of surface area, the observed exhaust volume in cfm/ft^2 of surface area ranged from 49-127 cfm/ft^2 . The desired exhaust rate is 250 cfm/ft^2 of tank surface area.[6]

Measurements taken at 5 of the 6 air supply ducts indicated makeup air volumes (assuming the average value obtained from the other five ducts for the one located over tank 41) of 18,562 cfm. Tank temperatures were maintained at about 125°F.

Chemical storage was disorganized, especially in the frame building. The integrity of containers of old chemicals was questionable and the proximity of dry chemical storage immediately adjacent to the lunch area is unacceptable.

Sound level measurements taken in the shop are presented in Table V. Levels measured on the dBA (slow) scale were uniform throughout the shop. No levels above 77 dBA were measured. Evaluation criteria (using the dBA scale) considers noise exposure to begin at 85 dBA.[7] Measurements taken on the dBC scale (unweighted) indicated the presence of a significant low frequency noise component from the blowers and rectifiers.

Bulk sample analysis of the Peel Coat® used to mask off parts to be plated demonstrated an accumulation of total Cr in the reused material. The fresh unused sample contained about 0.006 mg of Cr per gram of material. The used material contained about 3 mg of Cr per gram of material. An analysis of substances off-gassing from the material at the operating (melting pot) temperatures of 350 to 400°F indicated that butyric acid and di-sec, octyl phthalate constituted the major compounds vaporizing off. Smaller peaks could not be identified due to lack of reference standards, but appeared to be mainly aliphatic type compounds.

Area samples for Cr VI and total Cr coming off of the Peel Coat® melting pot during normal operations demonstrated levels of 0.002 mg/M^3 and 0.008 mg/M^3, respectively. (See Table III.)

B. Medical

Four of the 6 plant employees work directly in the plating area. All 4 of these employees reported occasional "flu-like" symptoms of headache, nasal irritation (sneezing, runny-nose, etc.), sore throat and eye irritation when exposed to concentrations of chromic acid mist. These symptoms were most commonly noticed in conjunction with malfunctions in the plant's ventilating systems, especially in the areas of plating tank #12 and the automatic plating tank. The usual duration of these symptoms varied among the 4 employees from a few hours, one day, to 3-5 days. Most of these individuals viewed their symptoms as being of a minor nature - not requiring medical attention and not affecting their attendance at work. There were no complaints of chronic

respiratory infections, and histories of ulcerated or perforated nasal septa were not reported. Occasional skin lesions, that seem to take a long time to heal, were reported by one employee, who was observed to have healing cuts and bruises on his hands. Active chrome ulcers, "holes", or other dermatitis were not observed on the hands of any of the 4 platers and none complained of the occurrence of these conditions elsewhere on the body. Generally, these conditions were reported to occur infrequently.

With the exception of one employee, who has some hearing loss attributed to a blower that was removed several years ago, no other manifestations or permanent injuries associated with chromium toxicity or other elements in the plant's environment were reported. The 2 employees who do not work in the plating area, but who occasionally enter that area, were asymptomatic for chromium toxicity. Their exposure to chemicals in the chrome plating process is minimal.

In the past year one employee was diagnosed as hypertensive, another began treatment for tachycardia and a third underwent coronary by-pass surgery following a heart-attack. Further investigation of these events revealed that: smoking, diet and weight were the main diagnostic criteria attributed to the case of hypertension, and the heart-attack case was attributed to a well-documented family history of cardiovascular disease. Although the diagnostic criteria were less clear for the case of tachycardia, this individual reported that his physician did not consider the condition to be job-related.

VII. DISCUSSION AND CONCLUSIONS

The inventory of materials used for plating failed to reveal any substances which would be considered to have long-term or systemic effects at the environmental levels documented during the survey. The Chrome VI compounds in use are considered non-carcinogenic[5] and the majority of the materials used in the plating process are capable of producing health effects of an irritant nature (caustic or acidic).

The chromium spot test revealed widespread Cr VI ion contamination. The "eating room" was urgently in need of attention. Additional sources of chromium contamination resulted from the collection of soiled work clothes on the floor in the same area, chemical storage in an open room adjacent to the break area, and the personal hygiene and housekeeping habits of the employees.

None of the employees' exposures to Cr VI or total Cr exceeded applicable environmental criteria. Likewise only one area sample, for total Cr on tank #21, exceeded the environmental limits. These low levels of Cr VI, total Cr, and sulfuric acid were observed with the ventilation systems operating below what is generally considered recommended exhaust volumes. Note that area samples were taken on the edges of the tanks and that tank #21, in addition to having very low exhaust volumes, had a blower cooled rectifier next to the

tank, which was observed to cause air movement across the tank towards the rectifier. This may have been a contributing factor to the high total Cr level. Tank #21 also was being operated at the highest amperage and had the largest surface area to plate. Surface activity of the plating solutions, i.e. bubbling, appeared to be influenced by amperage levels and the amount of surface area being plated. A layer of solid polypropylene balls was present on top of all plating tank solutions to retain heat and suppress mist formation.

The analysis of the Peel Coat® material demonstrated the presence of butyric acid and di-sec, octyl phthalate vapors at 200°C (390°F). The obnoxious odor of the Peel Coat® is probably due to the butyric acid, the odor threshold concentration occurring at about 0.00028 parts per million (2.8×10^{-4} ppm). The toxicity rating of both butyric acid and di-sec, octyl phthalate is considered moderate to low based on animal data.[8]

Ventilation measurements indicated that the exhaust hoods operating during the survey were exhausting about 7500 cfm with ventilation on tanks 13, 14, and the automation units shut off. Makeup air to the building was about 18,500 cfm. Operation of local exhaust systems in operation on the tanks during the survey, at recommended exhaust volumes, would result in exhausting 15,200 cfm. It is suspected that there would be insufficient makeup air if the 3 remaining units were to operate at recommended exhaust volumes. Several factors must be considered. First, the amount of material being plated, amperage used, and the number of tanks in operation will influence acid mist generation. Based on environmental data it may not be necessary to have all plating tank exhaust systems operating at the recommended 250 cfm per ft^2 of tank surface area,[6] especially if efforts are made to enclose tanks as much as possible during plating operations. All tanks except #21 and #22 have individual ventilation systems. Problems with insufficient makeup air, especially during the colder months may be eliminated by shutting off units not in use or enclosing tanks as much as possible to reduce required exhaust air volume.

Interviews of the 6 plant employees revealed no evidence of chronic manifestations or permanent injuries associated with chromium toxicity. During the 3 days of this investigation, none of the employees reported, or were observed to have, active symptoms associated with exposure to chromium. This does not preclude the fact that there are periods, (usually when the blowers are malfunctioning) when the concentration of mist is sufficient to cause nasal, respiratory and eye irritations. It was estimated that the blower system for tank #12 has malfunctioned five times in the past year - its most recent repair having been completed a few days prior to this investigation. Complaints, regarding mist concentrations in the area of the automatic plating tank, could not be investigated since that tank was not in use at the time of this investigation.

The incidence of chrome ulcers or "holes" seems to be quite low among these workers. Only one employee reported having occasional cuts and skin lesions. Observed while preparing parts to be chrome plated, the employee was working bare-handed, with cutting blades, wire and razor-sharp strips of metal - all of which could easily cause minor cuts and bruises, or severe lacerations if not careful. Gloves appeared to be worn only when he used the sand-blasting machine and when adding parts to or removing them from the plating tanks. Frequent skin contact to chrome plating solutions was apparent. Wearing gloves during most of these procedures, (and preventing contamination of the inner linings) would help reduce the risk of hand injuries and minimize skin contact to plating solutions. While the slow healing of cuts and bruises may, in part, be attributed to not wearing gloves, it may also be affected by a lack of diligent cleaning and bandaging of the sustained wounds. Healing may be further complicated, as the wounds, through repeated exposures to chromic acid solutions, become contaminated and infected. Those employees who reported using work gloves while performing their duties, also reported fewer accidents to their hands and a rare incidence of chrome ulcers.

Investigation revealed that the occurrence of cardiovascular disease, tachycardia and hypertension were most likely coincidental and not associated with chromium toxicity. The strength of the personal and family histories documenting these events, plus the absence in the literature of an association of these conditions to chromium toxicity, supports this conclusion.[9,10,4]

In general, the employees at this plant do not seem to have any severe problems related to chromium toxicity nor any excessive environmental chrome exposures. The symptomatic effects described were viewed by nearly all of the employees as being of a minor nature. Serious concerns from working with the electroplating process were not expressed.

VIII. RECOMMENDATIONS

The following recommendations were discussed with management at the time of the survey:

1. Increase the exhaust airflow from tank #21. Investigate the possibility that the electrical connection for the blower may be wired improperly. Use of removable enclosures over tanks during plating will also reduce required exhaust volumes by reducing the open tank surface area.

2. Repair the eyewash fountain and install an emergency shower.

3. Side shields should be added to the safety glasses, and employees should be encouraged to minimize exposing their hands to chrome plating solutions by wearing their work gloves more often and by avoiding gross contamination of the gloves' inner linings. Because many of the parts that are handled in this plant are bulky and quite heavy, safety shoes with steel reinforced toes are recommended.

4. Because spot-testing revealed the presence of chromium on virtually every surface that was tested; eating, drinking and smoking in the plating area should be discouraged.

5. Relocate chemical storage away from the eating area and institute a more orderly fashion of storage. Remove chemicals no longer in use. Store dry materials in open paper sacks in closed, marked containers.

6. The "eating room", in the building adjacent to the plant, was observed to be quite filthy and in a general state of disarray. A spot-test on the tabletop where food is consumed was strongly positive for chromium. It is recommended that this entire area be thoroughly cleaned and that routine "housekeeping" procedures be established.

7. Provide a collection receptacle for the soiled uniforms presently being collected in piles on the "eating room" floor.

IX. REFERENCES

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XI. DISTRIBUTION AND AVAILABILITY

Copies of this Determination Report are currently 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 the National Technical Information Services (NTIS), Port Royal Road, Springfield, Virginia 22161 (703) 487-4650. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address.

Copies of this report have been sent to the following:

1. Valley Chrome Platers Incorporated, Bay City, Michigan
2. Michigan Department of Public Health
3. Michigan Department of Labor
4. U.S. Department of Labor, Region V
5. NIOSH, Region V

For the purpose of informing the 6 "affected employees" the employer shall promptly post, for a period of 30 calendar days, the Evaluation Report in a prominent place(s) where the exposed employees work.

Table I

Environmental Evaluation Criteria

Valley Chrome Platers
Bay City, Michigan
HE 81-085

Substance	Recommended Exposure Limit in mg/M^3* and Source		Health Effects Considered	OSHA PEL[1] in mg/M^3*
Chromium (III, II compounds and metal as Cr.)	0.5	ACGIH[2]	Considered as having a lower toxicity than Cr VI. Dermatitis, possible pulmonary disease if other metals present.[3]	0.5
Chromium (VI) compounds, as Cr. Water soluble.	0.025 STEL[4]=0.05	NIOSH[3]	Severe irritants of the nasopharynx, larynx, lungs and skin; perforated nasal septa; skin ulceration.[5]	0.1
Sulfuric acid (H_2SO_4)	1	NIOSH[3]	Severe respiratory, skin, and eye irritant; erosion and discoloration of teeth.[5]	1

1. OSHA Safety and Health Standards PEL = permissible exposure limits.[11]

2. ACGIH = American Conference of Governmental Industrial Hygienists.[12]

3. NIOSH Criteria for a Recommended Standard....Occupational Exposure to _____[5,13]

4. STEL = Short Term Exposure Limit indicating the maximum 15-minute exposure limit, four or fewer occurring per day, each a minimum of 60 minutes apart.

* mg/M^3 = milligrams per cubic meter.

Table II

Personal Exposures of Platers to Total Chromium and Chromium VI

Valley Chrome Platers
Bay City, Michigan
HE 81-085

January 20, 1981

Sample Description		Exposures in mg/M^3	
General Location	Duration (min.)	Total Chromium[1]	Chromium VI[1]
East half of shop	495	0.011	0.003
Deep tank and tank 41 areas	491	0.011	0.006
Area 10	505	0.009	0.006
Entire shop	503	0.010	0.005
Evaluation Criteria (See Table I):		0.5	0.1

[1] See Table I.

Table III

Area Concentrations of Total Chromium, Chromium VI, and Sulfuric Acid

Valley Chrome Platers
Bay City, Michigan
HE 81-085

January 20-21, 1981

Date	Sample Description Location	Tank	Temp.	Amps	Duration (minutes)[1]			Concentration in mg/M^3 Total Chromium	Chromium VI	Sulfuric Acid
1/20/81	back ledge	11	120°F	40	459	568	---	0.010	0.008	----
1/20/81	back ledge	12	110°F	5	594	619	575	0.009	0.011	0.013
1/20/81	right side ledge	41	122°F	400	596	621	583	0.003	0.001	0.010
1/20/81	right side ledge	21	115°F	1950	590	617	570	0.81	0.004	0.015
1/21/81[2]	shelf above Peel Coat®		350-400°F		280	235	---	0.008	0.002	----
Evaluation Criteria (See Table I):								0.5	0.1	1

[1] Duration of each sample for a specific substance is given in the same sequence as the concentration, i.e. the first column denotes the duration of the samples for total chromium, etc.

[2] Note: Total Cr sample for Peel Coat® pot taken 1/20/81.

Table IV

Plating Tank Exhaust Ventilation Measurements

Valley Chrome Platers
Bay City, Michigan
HE 81-085

January 20, 1981

Tank	Surface Area (ft^2)	$\frac{W}{L}$ Ratio[1]	Calculated[2] cfm/ft^2	Actual cfm/ft^2
11[3]	14	.14	250	127
12[3]	14	.14	250	110
21[4]	12	.75	250	49
22[4]	12	.75	250	90
41[3]	9	1	250	282

1 $\frac{W}{L}$ ratio = distance across the tank between the slots divided by the length of the sides having the slots. For tanks 11 and 12, W/2 used for W in determining W/L ratio.[6]

2 Calculated values are the recommended airflow (in cfm per square foot of tank surface area) to obtain a minimum control velocity of 150 fpm for hoods on free standing tanks. Should control velocities fall below 150 fpm, the 250 cfm/ft^2 is still considered adequate for control.[6]

3 Tanks 11, 12 and 41 each have their own exhaust fan.

4 Tanks 21 and 22 are connected to the same blower and exhausted through scrubber.

NOTE: All measurements were obtained using a Kurz Air Velocity Meter, Model 441. Psychrometer values for January 20, 1981 in the shop averaged: Wet bulb 54°F; Dry bulb 69°F; relative humidity 37%.

Table V

Shop Area Sound Level Measurements

Valley Chrome Platers
Bay City, Michigan
HE 81-085

January 21, 1981

Location	Measured Levels dBA (slow)	dBC (slow)
Shipping & receiving aisle	74	90
Work station-end of tank 11	75	86-87
Center still rinse tank between 11 and 12	76-77	90
Work station-end of tank 13	75-76	86-87
Front of tank 21	76-77	86-88
Peel Coat® area	75-76	85-87
Front of oven area	75-77	86-88
Front of tank 41	76-77	85-87

Permissible Noise Exposures

Duration per Day (hrs)	OSHA, dBA (slow)	NIOSH, dBA (slow)
8	90	85
6	92	87
4	95	90
3	97	92
2	100	95
1.5	102	97
1	105	100
0.5	110	105
0.25 or less	115	110
		Max. of 115

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1. No power bench tools or abrasive blast unit in operation. Automation unit and blower not operating. Measurements taken with a General Radio Type II Sound Level Meter, Model No. 1565B having a grazing incidence microphone. Pre- and post-calibration at 1000 Hz.

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