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

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 78-79-736

CISSELL MANUFACTURING COMPANY
LOUISVILLE, KENTUCKY

AUGUST 1980

I. SUMMARY

In April 1978, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at the Cissell Manufacturing Company in Louisville, Kentucky. The request specified the following potential toxic exposures: for welders--ozone, fluorides, nitrogen dioxide, iron oxide, manganese, chromium, and total fume; for solders--lead fumes; for paint sprayers--naptha, isobutyl isobutyrate, methyl-n-butyl ketone, isobutyl acetate, isobutyl alcohol, toluene, and xylene; for electroplates--hydrochloric acid, hexavalent chromium, cadmium, and cyanide; for degreasing operators--1,1,1-trichloroethane; and for pattern cutters, sewers, and packers--asbestos.

During the initial phase of the survey, concern was expressed over a suspected excessive death rate due to cancer in the work population at Cissell.

To evaluate these problems, NIOSH conducted an industrial hygiene and epidemiological evaluation. Personal and area samples were obtained during July 1978, and January 1979. Other evaluations included analysis of bulk samples, evaluation of several exhaust and make-up ventilation systems, and personal interviews with selected employees. The epidemiological evaluation consisted of reviewing medical and personnel records, collecting demographic data (e.g., age, sex, date of birth, length of employment, etc.), occupational histories, turnover rate, and years of potential exposure.

During the epidemiological evaluation, NIOSH found that only 3 of the 18 suspected cancer deaths were, in fact, deaths from cancer (2 lung cancer and 1 nasopharynx cancer) and none appeared to be work related.

None of the operations evaluated produced exposures above the NIOSH recommended criteria except for asbestos. The asbestos values ranged from 0.19 to 0.30 fibers per cubic centimeter and these were one to three times the present standard.

Based on the data obtained in this investigation, NIOSH determined that a potential health hazard did exist for workers exposed to asbestos at the Cissell Manufacturing Company in Louisville, Kentucky. NIOSH also determined that a number of work practices and exhaust ventilation problems existed.

No cause/effect relationship was established for the three cancer deaths of workers at Cissell, and the cause is not thought to be of occupational origin.

Recommendations to limit employee exposures to asbestos, improve exhaust ventilation, and institute better work practices are included in the body of this report.

II. INTRODUCTION

On April 15, 1978 an authorized representative of the employees at Cissell Manufacturing Company submitted a request pursuant to Section 20(a)(6) of the Occupational Safety and Health Act of 1970*. The request stated that a number of potential health hazards existed to employees working in the welders, soldering, brazing, paint spray, and electroplating operations. Another major concern of the request was the suspected excess of cancer cases in the work force at Cissell. Finally, after our July 1978 investigation, it was determined that the potential exposure to workers from asbestos should also be assessed.

A SHEFS I report, dated August 9, 1978; an Interim II report, dated March 1, 1979; and letter to Mr. DiNardi-Cissell, dated August 27, 1979 was provided to each of the concerned groups. These communications provided findings and recommendations to correct the problems noted during that stage of the investigation. Portions of that information are also presented in summary in this determination report.

BACKGROUND

Cissell Manufacturing Company produces electro-mechanical machines used for finishing garments in laundries and dry-cleaning industry, coin operated clothes dryers and other industrial laundry equipment, e.g., ironing boards, clothes racks, steamers, etc. In general, these machines are made of castings which are machined and painted; sheet metal which is sheared or punched, degreased, welded into assemblies, phosphatized and painted with a baking enamel; purchased electrical components and fasteners; and screw machined and stamped parts which are plated.

The following is a specific description of those areas and operations evaluated in our investigation and the problems that were found:

1. Welding and Brazing - There are 14 arc welders and two heliarc welders at Cissell. The majority of the welding is a mild-steel type which uses low-hy or flet-weld electrodes. One heliarc welder uses only carbon dioxide gas and the other uses 25% carbon dioxide and 75% argon gas. The metal inert gas (MIG) operations are used with copper wire and helium (25%) and argon (75%) gases. The only other welding performed at the plant was resistance spot welding. The majority of these welding areas had no exhaust ventilation systems. However, there were two stationary welders which had local exhaust systems. Upon inspection of these systems it was determined that they were not operating properly, i.e., the flow rates were below the recommended design requirements necessary to exhaust contaminants at the source. The only other exhaust system available was a portable "SMOGHOG"** system which was not being used during either of our investigations and we were told that it is rarely used.

---

*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 any employee 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.

**Mention of commercial name or products does not constitute endorsement by NIOSH

The brazing processes are performed with natural gas and oxygen and use low temperature type brazing rods. The majority of the work performed here requires only one operator and there was no exhaust ventilation system used in this operation during our surveys.

2. Soldering - There was one main area where soldering was performed and there was four soldering work stations at this location. The majority of the solder used here contained approximately 60-70% lead and 30-40% tin. Each of these work stations had local exhaust ventilation systems. However, based on our last investigation there were still a few systems in this area that had exhaust flow problems below the recommended level required to adequately exhaust the contaminants produced with these processes.

3. Paint Spraying - There are three paint spray booths at Cissell; one large booth on the second floor and two smaller booths on the first floor (one dryer jacket paint booth and one parts and equipment booth). All three booths use electrostatic spray equipment and have water bath-type exhaust ventilation systems. Except for the parts and equipment spray booth on the first floor the two other spray booths were having problems with these water bath exhaust systems.

4. Electroplating Operation - The electroplating operation at Cissell is a large operation which is designed to chrome plate approximately 125 pounds of material (15 runs per day) and 200 pounds (45 runs per day) of cadmium plated materials. There are two operators who work in this department and each performs approximately the same work, i.e., maintaining the quantity and quality of a tanks ingredients, loading and unloading materials from the tanks, clean-up, etc. There are 38 various dipping tanks in this department and except for the water tanks, each has a slot-type exhaust ventilation system.

5. Degreasing Process - There are two vapor-type degreasers used at Cissell and each uses 1,1,1-trichloroethane as the solvent vapor. During our investigation each of the tanks exhaust systems were operating effectively. Also, during our investigation of this operation, it was noted that various personal hygiene problems did exist.

6. Cutting and sewing - This operation is concerned with making the various covers that go on the ironing boards and iron stands. The cutting operation is performed once every three weeks and the operator cuts 350 patterns which takes approximately six hours. The operator first takes reels of fabric, which are lined with asbestos, and rolls the material out onto a long cutting table. The operator then marks the material with a pattern and cuts each of the fabric patterns by hand. The final phase of this operation is to punch holes into the fabric. Once all the patterns have been cut they are then sewn together with other material to make the final cover. The actual sewing operation normally only requires one operator and this process is performed daily. The last phase of this operation requires the operator to sew a label on each of the finished covers. There was no exhaust ventilation provided for either of these jobs.

IV. EVALUATION DESIGN AND METHODS

1. Environmental Methods

A variety of sampling techniques were used to evaluate the suspected contaminants in the various departments surveyed at Cissell. Personal and area samples were taken on a portion of the population from each of the departments of concern. The following is a description of the techniques used:

a. Welding - Nitrogen dioxide, iron oxide, manganese, chromium, total fumes, ozone, and fluoride contaminants were determined by collecting breathing zone samples with a pump adjusted to pull a flow rate of 1.5 liters per minute (lpm). Each of the metals were collected on 37 millimeter (mm) diameter cellulose ester, 0.8 micrometer pore size filters. The filters were clipped to the inside of the subject's helmet, and thus, represented that amount of contaminant in the welders helmet or breathing zone. Samples analyzed for chromium were collected on polyvinyl chloride filters having a pore size of five microns. Fluoride samples were collected on special pre-treated filters designed for collection of both gaseous and particulate fluorides. Ozone samples were collected using a colorimetric gas detection tube device

b. Soldering - The contaminants from the soldering process were collected on a pre-weighed AA 0.8 u pore density cellulose membrane filter at a flow rate of 1.5 lpm with a MSA vacuum pump. The metal was analyzed by digesting the filter in a nitric acid solution and then aspirating the analyte into an atomic absorption spectrophotometer.

c. Paint Spraying - Naptha, isobutyl isobutyrate, methyl-n-butyl ketone, isobutyl acetate, isobutyl alcohol, toluene and xylene contaminants were collected on activated charcoal tubes. Air was drawn through the charcoal tube at a flow rate of 50 and/or 200 cubic centimeters per minute (cc/min) using a battery-powered pump. All of these samples were analyzed by gas chromatography preceded by desorption of the charcoal by carbon disulfide.

d. Electroplating - Cadmium, hydrogen chloride, hexavalent chromium, and cyanide were collected in the electroplating department at Cissell. Samples for cadmium and hexavalent chromium were collected on AA filters at a flow rate of 1.5 lpm for two hours at various locations in the department and these samples were analyzed by atomic absorption. Hydrogen chloride samples were collected at 1 lpm in impingers containing sodium acetate solution for two hours per sample and samples for cyanide were collected in sodium hydroxide solutions and both were analyzed by chloride ion specific electrodes.

e. Degreasing Tanks - 1,1,1-trichloroethane was collected in the degreaser and parts washing area with charcoal tube samples which ran at a flow rate of 50 and/or 200 cc/minute. Both personal and area samples were collected and the samples were analyzed by gas chromotographic procedures.

2. Epidemiological

The epidemiological design and methods used to evaluate the worker population at Cissell consisted of the analysis of various forms of information collected from the personnel records; and discussions with Cissell's physicians and union records.

V. EVALUATION CRITERIA

In this study numerous sources of environmental exposure criteria and existing research data were used to assess the worker's exposure to the suspected chemicals evaluated in the workplace at Cissell.

The exposure limits to toxic chemicals are derived from existing human and animal data and industrial experience to which it is believed that nearly all workers may be exposed for an 8-10 hour day, 40-hour work week, over a working lifetime with no adverse effects. However, due to variations in individual susceptibility, a small percentage of workers may experience effects at levels at or below the recommended exposure limit; a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by development of an occupational illness.

The environmental and medical evaluation criteria used for this investigation are presented in Table I. Recommended environmental limits and/or general information concerning each substance are also listed, i.e., the source of the recommended limits; the present OSHA standard and a brief description of the primary health effects known to date.

VI. RESULTS AND CONCLUSIONS

A. Environmental

Employee exposure to suspected airborne concentrations of ozone, fluorides, nitrogen dioxide, iron oxide, manganese, chromium, total particulate, naptha, isobutyl isobutyrate, methyl-n-butyl ketone, isobutyl acetate, isobutyl alcohol, toluene, xylene, hydrochloric acid, chromium, cadmium, cyanide, 1,1,1-trichloroethane, and asbestos were evaluated. Also, an evaluation of the general and local ventilation systems in the plant was assessed. The following are the results and conclusions of this portion of the evaluation:

1. Soldering and Welding

A total of 25 breathing zone samples were collected at four separate locations during our investigation (Table II, III and IV). All the contaminants that were tested for, i.e., iron oxide, chromium, manganese, total welding fume, lead, ozone, fluorides, and nitrogen dioxide were minimal compared to the recommended standards of 5 mg/M^3, 0.5 mg/M^3, 5 mg/M^3, 10 mg/M^3, 0.05 mg/M^3, 2.5 mg/M^3, and 9.0 mg/M^3 respectively. These results would indicate that a health hazard did not exist during the days we sampled. However, based on the exhaust ventilation problems that existed throughout these areas it is likely that a problem could exist. That is, during both of our surveys exhaust ventilation and work practice problems were noted in both the soldering and welding areas.

a. Exhaust Ventilation - First, a number of exhaust hood changes were instituted in the soldering department based on the recommendations made in our SHEFS I report. These changes were positive in most instances, however, one of the exhaust hoods in this department was designed in a manner which required the hoods to be dismantled from one work table in order to provide exhaust at another work table. This procedure was cumbersome and would often be eliminated by the worker in order to facilitate the job, and thus, increase his exposure.

A number of the exhaust hoods in this area were of elephant trunk-type which had face velocities that ranged from 1000-1500 fpm. This is far greater than the 100 fpm required for this type of operation. However, the distance between the face of the hood and the work operation itself was approximately 18-24 inches which reduced the exhaust flows at the source that is the actual point of operation was 50-75 fpm (which is below the recommended standard). This type of problem also existed with the permanent exhaust hoods in this department, i.e., the stationary canopy exhaust hoods had face velocities greater than a 1000 fpm but the flow rates at the source, or work site, were less than 100 fpm.

During the review of the exhaust systems in the welding area which is located in the corner of the main floor, it was determined that the following problems did exist, and therefore, should be attended to as soon as possible if they have not been: (a) The exhaust system being used in the corner of the welding area appeared to have an electrical problem, i.e., when the power switch was on the system would come on and off at will; (b) Some of the exhaust systems were not being used while welding was being performed in these areas; and (c) A portable exhaust system (Smoghog) had been in this area during both survey periods and the project officer was told that it was not being used.

b. Work Practices - In a number of the welding areas it was noted that both stationary and portable exhaust hoods, as well as flash curtains were available but were not being used while welding operations were being performed.

2. Paint Spraying

Naptha, isobutyl acetate, isobutyl alcohol, toluene, xylene, isobutyl isobutyrate, and methyl-n-butyl ketone were evaluated at three different locations during our surveys (Table V and VI). These tables illustrate the personal breathing zone levels that were found during our investigation in these areas, and again, the exposure levels found were only a fraction of the recommended standards established for these chemicals. Thus, there was no health hazard to the employees in these areas during our investigation. However, there were a number of ventilation problems in the dryer and upstairs paint booths which must be resolved if they have not been to date. Both paint spray booths on the main floor were operating effectively. However, the flow rates obtained on the second floor paint spray booth (50-75 fpm) were below the recommended ventilation criteria of 100 fpm for this type of operation.

3. Electroplating Processes

A total of nine personal samples were collected in the electroplating area (Table VII). Each of the contaminants evaluated here, i.e., cadmium, hydrogen chloride, hexavalent chromium, and cyanide were either a trace of the standard or nondetectable. The entire exhaust ventilation system in this department was upgraded in 1973 and each of the tanks that had cleaners, caustics, and brightness had exhaust flow rates that were equal too or greater than the recommended flow rates for these exhaust systems. Therefore, this department had an extremely well designed system to remove contaminants.

4. Degreasing Operation

The degreasing operation was sampled for 1,1,1-trichloroethane and a total of five samples; two personal and three area samples, were taken for this contaminant (Table VIII). Each of the samples taken at this operation was below the standard of 1,900 mg/M^3. These low levels could be attributed to the effective exhaust-vapor tank which in there had vapor levels 36 inches below the top edge of the tanks.

5. Sewing/Cutting/Packing

The sewing, cutting, and packaging operators were each sampled for asbestos and bulk samples of the suspected contaminant were collected in order to identify the type of asbestos being used (Table IX and X). The various materials being used contained between 50-80% chrysotile. The criteria established for chrysotile is 0.1 fibers/cubic centimeter. As Table X illustrates each of the personal samples taken exceeded the criteria by two to three times the existing standard. Therefore, these employees were exposed to a health hazard during this survey period. There was no exhaust ventilation at any of the operations where the asbestos material was being worked with and there was no personal protection, i.e., respiratory protection, available to these employees.

B. Epidemiological

The Cissell Manufacturing Company employs 269 full time employees, 235 males and 34 females. (No temporary or summer time help is used). There are 16 departments in the production area. Only one shift is run - 7:00am to 3:30pm. The average length of employment is about 20 years with very little turnover. The union representing the employees is the International Association of Machinists and Aerospace Workers, AFL-CIO Local 681. The local union began in 1947.

Over 90% of the plant population is white male and has remained so over the years.

Pre-employment physicals are required for anyone working at the plant. This includes a medical history, urine sugar, blood test, vision and auditory test, and blood pressure testing. Six-month physical examinations are required of all persons in the plating department. All medical reports obtained from the examinations are maintained by Cissell.

The Cissell Company maintains death certificates for all employees found to be deceased, whether retired or not.

It was also determined that the union has kept seniority lists dating back to about 1940, which would be available if needed.

In conclusion, although it was stated that all 10 persons had died of "confirmed cancer" this was not the case. Only three persons died due to cancer (two lung and one nasopharynx) and none of the three cancer deaths had been employed in areas where asbestos or chromate exposures existed. Of the remaining seven deaths cited, two persons died due to heart disease, one of pneumonia, one of pulmonary tuberculosis, one of alcoholism, one of intracerebral hermorrage and one of an unknown cause. There seems to be no extraordinary repetition or obvious trends in the occurrence of any of these deaths.

VII. RECOMMENDATIONS

In view of the findings of NIOSH's environmental and epidemiological study, as well as personal communications with individuals at Cissell, the following recommendations are made to provide a better work environment for the employees covered by this determination. These recommendations are also based on NIOSH's review of the OSHA survey results and the ventilation data given to us by Cissell.

A. Environmental

Whenever possible, engineering controls are the preferred method for decreasing potential environmental exposures to toxic substances for the protection of the employees' health. Therefore, based on the evaluation of the present data and the environmental problems discussed in Part VI, the following recommendations are offered to help ensure the workers' safety and health:

1. Ventilation

The alterations made in the soldering department were positive in most instances, however, the following additional alterations and changes must be made (if they have not been already) in order to make these systems function in a more appropriate manner: (a) Each exhaust hood should have its own exhaust duct. Based on our last survey, two of the stationary hoods in one area of the soldering department use the same elephant trunk-type ducting, i.e., the duct must be moved from hood to hood as a function of the work being performed. This system proved to be inadequate primarily because it required the operator to continually move the duct from site to site. Also, this ducting was cumbersome to remove and install on the hoods; (b) Each of the new hoods that were installed in this area should be modified further, i.e., emphasis should be placed on encompassing only the work area and in a manner that will not interfere with the performance of the operator; and (c) Any operation using portable exhaust hoods should be designed to encompass only that area where the potential contaminants are being generated. Therefore, the hoods should be positioned as close to the point of particle generation as possible, and able to be moved freely from work site to work site.

Both paint spray booths on the main floor were operating effectively. However, the face velocities obtained on the second floor paint spray booth (50-75 fpm) were below the recommended ventilation criteria of 100 fpm for this type of operation. Therefore, a more thorough elevation of this exhaust system must be conducted by Cissell in order to bring the face velocities up to at least 100 fpm at the source, i.e., at the point of particle generation. Factors to consider in this evaluation should be the motor size, fan size, fan belt tension, make-up air sources, the general design of the spray booth, and objects outside the opening of the booth which may hinder the make-up air flow.

Based on the problems noted in the welding areas, the following should be resolved if they have not been already: (a) The exhaust system being used in the corner of the welding area appeared to have an electrical problem, i.e., the power switch on the system would come on and off at will and this should be remedied. (b) Some of the exhaust systems were not being used while welding was being performed in these areas and these systems should be used whenever possible. (c) The portable exhaust system (Smoghog) should be used as often as possible i.e., an example would those welding operations adjacent to the degreasing tank which require confined welding.

2. Work Practices

Work practices in a number of areas need to be improved and each of these should be resolved with the various department supervisors and/or employees if they have not been to date. First, in the paint spray operations the operator and/or the materials being painted should be aligned in the booths in such a way that will not produce spray back and/or reduce the collection efficiency of the booths exhaust system.

Second, in the soldering area there is a need to develop standard procedures for positioning the portable exhaust hoods, i.e., in order to obtain the most efficient exhaust flow rates. Again, an efficient flow rate for these operations is 100 fpm or greater at the point of particle generation. Third, in those welding areas where exhaust systems and/or curtains are available their proper use is essential while welding operations are being performed.

3. Other

Based on the problems mentioned earlier in the second floor paint spray booth, the operators in this area should be provided with NIOSH certified respirators. These respirators must be a combination organic vapor cartridge-type with a high efficiency pre-filter.

Also, based on the asbestos values obtained in the sewing and packing department those individuals working with asbestos should be provided with a dust-type respirator. This respirator should be worn throughout the process where asbestos is used, i.e., from the initial stage of handling the material, as well as through the final stage of cleaning up the work site. It should be kept in mind that this type of protection should be temporary until exhaust ventilation can be installed or a substitute material can be used.

Two additional potential problems were noted during the recent investigaton, and therefore the appropriate steps should be taken to remedy these problems. First, a number of the welding areas did not have curtains separating their operations from other work areas. Thus, these areas should have curtains installed in order to prevent persons in other departments from being burned or incurring eye damage. Second, it was noted that lead chromate, a potential carcinogen, is an ingredient in one of the paints being used at Cissell. If possible, an alternative paint or a substitute ingredient in this paint should be instituted as soon as possible.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted and
Report Prepared By:

Paul Pryor
Industrial Hygienist
Industrial Hygiene Section
Hazard Evaluations and
Technical Assistance Branch
Cincinnati, Ohio

Frank Stern
Epidemiologist/Systems Analyst
Biometry Section
Industry-wide Studies Branch
Cincinnati, Ohio

Originating Office: Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies
Cincinnati, Ohio

Report Typed By: Linda Morris
Clerk-Typist
Hazard Evaluations and Technical Assistance Branch
Cincinnati, Ohio

IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

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

1) Cissell Manufacturing Company
2) International Association of Machinist and Aerospace Workers
3) U.S. Department of Labor, OSHA Region IV
4) NIOSH, Region IV

For the purpose of informing the "affected employees", the employer shall promptly "post" the determination report for a period of 30 days in a prominent place near where exposed employees work.

To Union and Management:

NIOSH is thankful to the employees and management for their cooperation and assistance with this Health Hazard Evaluation. The information gathered from this study will not only assist in maintaining the health and safety of those persons working in this company, but also other similar companies that we investigate.

X. BIBLIOGRAPHY

1. Industrial Hygiene and Toxicology, Second Edition, Frank Patty (editor), Interscience Publishers, 1967, Vol. II.

2. Industrial Toxicology, Third Edition, Hamilton and Hardy, Publishing Service Group, Inc., 1974.

3. "Threshold Limit Values for Chemical Substances in Workman Air," American Conference of Governmental Industrial Hygienist, (1978).

4. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Co., New York.

5. Industrial Ventilation, A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists, 14th, Ed. (1976).

6. Hutchison, M.D. A Guide to Work-Relatedness of Diseases. HEW Publicaton No. (NIOSH) 77-123.

7. U.S. Department of Health, Education, and Welfare. Occupational Diseases, A Guide To Their Recognition, Public Health Service Publication (NIOSH) No. 77-181.

8. Gerande, H.W., The Aliphatic (Open Chain Acyclic) Hydrocarbons, in Industrial Hygiene and Toxicology, Vol. II, 2nd Ed., Patty, Ed., Interscience Publishers, N.Y. 1963, pg. 1195-1196.

9. Sax, I.N., Dangerous Properties of Industrial Materials, 3rd Ed., Van Nostrand Reinhold Co., N.Y., 1968, pg. 857.

10. Arena, J.M., Poisoning, 3rd Ed., Charles C. Thoos, Pub., Springfield Illinois, 1974, pg. 140.

11. Gleason, M.N., R.E. Gosslin, H.C. Hodge, R.P. Smith, Clinical Toxicology of Commerical Products, 3rd Ed., The Williams and Wilkins Company, Baltimore, 1969, Section II. Ingredients Index, pg. 115.

12. National Safety Council: Fundamentals of Industrial Hyiene, Chicago, Illinois, 1971.

13. NIOSH Criteria Document on Lead No. 78-158, (Revised 1978).

14. Occupational Exposures to Lead, U.S. Department of Labor, November 14, 1978.

15. NIOSH/OSHA, "Pocket Guide to Chemical Hazards;" HEW, USPH, CDC, USDL, September 1978.

TABLE I
Environmental Evaluation Criteria
Cissell Manufacturing Company
Louisville, Kentucky
April 1980

Substance	Recommended Environmental Limit[1]	Reference Source	Primary Health Effects[3]	OSHA Standard
Ozone	0.2 mg/M3*	ACGIH[2]	Irritation to eyes, muscular membrane; pulmonary edema; chronic respiratory disease	0.2 mg/M3
Fluoride	2.5 mg/M3	NIOSH	Irritation to eyes; respiratory system	2.5 mg/M3
Nitrogen dioxide	1.8 mg/M3	NIOSH	Cough, chest pain; pulmonary edema, eye irritation	9.0 mg/M3
Iron oxide	5.0 mg/M3	ACGIH	Siderosis (lung disease); chronic cough	10.0 mg/M3
Manganese	5.0 mg/M3	ACGIH	CNS, metal fume fever; tight chest	5.0 mg/M3
Chromium VI	0.5 mg/M3	NIOSH	Ulceration and perforation of nasal septums; inflamed mucous membranes	0.05 mg/M3
Total welding fume	5.0 mg/M3	ACGIH	Different compounds produce various effects therefore, cumulative effect is major concern	5.0 mg/M3
Lead	.05 mg/M3	OSHA/NIOSH	Kidneys, peripheral and CNS, and hematopoietic system. Weakness, tiredness, irritability	0.05 mg/M3
Naptha	400 mg/M3	ACGIH	Light-headedness, drowsiness, irritation of eyes, nose, skin; dermatitis	400 mg/M3
Isobutyl iso-butyrate	.02 mg/M3	NIOSH	Headache, drowsiness, irritation	.02 mg/M3
Methyl-n-butyl ketone (skin)	410 mg/M3	NIOSH	Irritation of eyes, nose; headaches, skin irritation	410 mg/M3
Isobutyl ace-tate (skin)	700 mg/M3	NIOSH	Headaches, drowsiness	700 mg/M3
Isobutyl alco-hol (skin)	300 mg/M3	NIOSH	Irritation of eyes, throat; headaches, drowsiness, skin irritation	300 mg/M3
Xylene	100 mg/M3	NIOSH	Fatigue, weakness; confusion, euphoria	435 mg/M3
Hydrochloric acid	.05 mg/M3	NIOSH	Burning throat; cough, irritation to eyes, skin	
Toluene	100 mg/M3	NIOSH	Dizziness, excitement; drowsiness	200 mg/M3
Cadmium (C)	0.1 mg/M3	NIOSH	Pulmonary edema; cough, chest tightness, headaches; chills, muscle aches, nausea	0.1 mg/M3
Cyanide	5 mg/M3	NIOSH	Asphyxia, weakness, headaches	11 mg/M3
1,1,1, Tri-chloroethane	1900 mg/M3	ACGIH	Irritation of nose, eyes; CNS depression; liver, kidney damage	1,900 mg/M3
Asbestos	0.1 fibers/cc** (Chrysotile)	NIOSH	Carcinogenic; fibrotic changes in lungs; mesothelioma	

(1) All air concentrations are expressed as time-weighted average (TWA) exposures for up to a 10 hour workday unless designated "ceiling".

(2) ACGIH = American Conference of Governmental Industrial Hygienists

(3) References 16 and 25

* mg/M3 = Approximate milligrams of substance per cubic meter of air

** C = A ceiling limit which should not be exceeded

*** ppm = Parts of vapor per million parts of contaminated air by volume

TABLE II

SUMMARY OF AIR SAMPLING FOR OZONE, FLUORIDES, AND NITROGEN DIOXIDE IN THE WELDING OPERATIONS

Cissell Manufacturing Company
Louisville, Kentucky
February 15, 1979

Job Description	Sample Number	Sampling Time (min.)	Ozone (mg/M3)	Fluorides (mg/M3)	Nitrogen Dioxide (mg/M3)	Type of Sample
MIG Welder	N-1	120	--	--	.02	Bz
MIG Welder	N-2	120	--	--	.03	"
Brazer	F-1	240	--	.05	--	"
Brazer	F-2	240	--	.03	--	"
MIG Welder	0-1	120	ND	--	--	"
MIG Welder	0-2	120	ND	--	--	"
Evaluation Criteria			.02 mg/M3	2.5 mg/M3	9.0 mg/M3	
NIOSH Limit of Detection			.02 mg/M3	.02 mg/M3	.005 mg/M3	

mg/M3 = Milligrams of substance per cubic meter of air
Bz = Breathing zone
ND = Non-detectable

TABLE III

SUMMARY OF AIR SAMPLING FOR METALS AND TOTAL WELDING PARTICULATES

Cissell Manufacturing Company
Louisville, Kentucky
February 15, 1979

Job Description	Sample Number	Sampling Time(min)	Iron Oxide Fe_2O_3 (mg/M^3)	Chromium Cr_3 (mg/M^3)	Manganese Mn (mg/M^3)	Total Particulate (mg/M^3)	Type of Sample
Arc Welder	439	180	.47	ND	.03	1.56	Bz
Arc Welder	725	180	.37	ND	.02	1.74	"
Solder	794	220	.03	ND	.01	.41	"
Spot Welder	723	490	.47	ND	.03	.85	"
Arc Welder	721	490	.19	ND	.01	.55	"
MIG Welder	733	120	.18	ND	.12	3.22	"
MIG Welder	806	300	1.07	ND	.08	1.80	"
MIG Welder	444	120	1.35	ND	.12	2.44	"
MIG Welder	712	300	.53	ND	.04	1.07	"
Arc Welder	796	490	.53	ND	.03	1.68	"
Arc Welder	797	180	.10	ND	.01	3.96	"
Arc Welder	673	490	.67	ND	.04	2.85	"
Arc Welder	798	210	1.04	ND	.06	4.07	"
Evaluation Criteria			5 mg/M^3	0.5 mg/M^3	5 mg/M^3	10 mg/M^3	
NIOSH Limits of Detection			6 ug	5 ug	3 ug	0.01 ug	

mg/M^3 = Milligrams of substance per cubic meter of air
Bz = Breathing zone
ND - Non-detectable

TABLE IV

SUMMARY OF PERSONAL AIR SAMPLING FOR LEAD
IN THE SOLDERING DEPARTMENT

CISSELL MANUFACTURING COMPANY
LOUISVILLE, KENTUCKY

April 1980

JOB DESCRIPTION	SAMPLE NUMBER	SAMPLING TIME (Min.)	LEAD
Solderer	AA 1	360	<2
"	AA 2	360	<2
"	AA 3	360	<2
"	AA 4	360	<2
"	AA 5	360	1 mg/M^3
"	AA 6	360	2 mg/M^3
Evaluation Criteria			0.05 mg/M^3
NIOSH Limits of Detection			2 µg

mg/M^3 = Milligrams of substance per cubic meter of air
mg = Milligrams of detection

TABLE V

SUMMARY OF AIR SAMPLING FOR ISOBUTYL ISOBUTYRATE, METHYL-n-BUTYL KETONE ISOBUTYL ACETATE, AND ISOBUTYL ALCOHOL IN THE PAINTING DEPARTMENTS

Cissell Manufacturing Company
Louisville, Kentucky
February 15, 1979

Job Description	Sample Number	Sampling Time(min.)	Isobutyl Isobutyrate (mg/M3)	Methyl-n-Butyl Ketone (mg/M3)	Isobutyl Acetate (mg/M3)	Isobutyl Alcohol (mg/M3)	Type of Sample
Downstairs	CT-7	330	.01	ND	ND	.05	Bz
Upstairs	CT-8	330	ND	ND	ND	ND	Bz
Upstairs	CT-9	330	ND	ND	ND	ND	Bz
Evaluation Criteria			--	100 mg/M3	525 mg/M3	360 mg/M3	
NIOSH Limits of Detection			.02 mg	.01 mg	.01 mg	.01 mg	

mg/M3 = Milligrams of substance per cubic meter of air
Bz = Breathing zone
ND = Non-detectable
mg = Milligrams per detection

TABLE VI
Summary of Personal Air Sampling for Xylene and Toluene
in The Paint Spray Booths

Cissell Manufacturing Company
Louisville, Kentucky
April 1980

Area/Job Description	Sample Number	Sampling Time (min.)	Xylene (mg/M^3)	Toluene (mg/M^3)
Dryer Jacket Booth	1a	340	.98	1.05
Upstairs Booth	2a	340	.45	.45
Upstairs Booth	3a	340	.40	.41
Parts and Equip. Booth	4a	340	.09	.10
Parts and Equip.	5a	340	.08	.16
Upstairs	6a	340	.35	.41
Upstairs	7a	340	.40	.40
Dryer Jacket	8a	340	1.0	1.10
Dryer Jacket	1b	310	ND	.09
Upstairs	2b	310	.95	.81
Upstairs	3b	310	.51	.42
Parts and Equip.	4b	310	.45	.43
Dryer Jacket	7b	310	.08	.24
Dryer Jacket	1c	330	ND	.24
Upstairs	2c	330	1.20	.96
Upstairs	3c	330	.08	ND
Parts and Equip.	4c	330	1.16	1.20
Dryer Jacket	5c	330	.08	.08
Evaluation Criteria			435 mg/M^3	375 mg/M^3
NIOSH Limits of Detection			0.02 mg	0.02 mg

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

TABLE VII

SUMMARY OF AIR SAMPLING FOR CADMIUM, HYDROGEN CHLORIDE, HEXAVALENT CHROMIUM, AND CYANIDE IN THE ELECTROPLATING DEPARTMENT

Cissell Manufacturing Company
Louisville, Kentucky
February 15, 1979

Job Description	Sample Number	Sampling Time(min.)	Cadmium (mg/M3)	Hydrogen Chloride (mg/M3)	Hexavalent Chromium (mg/M3)	Cyanide (mg/M3)	Type of Sample
Plater	DM 812	120	ND	--	ND	--	Bz
Plater	DM 770	120	ND	--	ND	--	"
Plater	H1	120	--	.06	--	--	"
Plater	H2	120	--	.13	--	--	"
Plater	CN1	120	--	--	--	ND	"
Plater	CN2	120	--	--	--	ND	"
Plater	CN3	120	--	--	--	ND	"
Evaluation Criteria			.05 mg/M3	7 mg/M3	.05 mg/M3	5 mg/M3	
NIOSH Limits of Detection			.01 mg	.05 mg	.01 mg	.025 mg	

mg/M3 = Milligrams of substance per cubic meter of air
Bz = Breathing zone
ND = Non-detectable
mg = Milligrams per detection.

TABLE VIII

SUMMARY OF AIR SAMPLING FOR 1,1,1,-TRICHLOROETHANE
IN THE DEGREASING OPERATION

Cissell Manufacturing Company
Louisville, Kentucky
February 15, 1979

Job Description	Sample Number	Sampling Time (min.)	1,1,1-Trichloroethane (mg/M^3)	Type of Sample
Degreaser Operator	CT-1	330	9.28	Bz
Degreaser Operator	CT-2	330	5.13	Bz
Area-3	CT-3	330	45.6	GA
Area-4	CT-4	330	4.31	GA
Area-5	CT-5	330	3.87	GA
Evaluation Criteria			1,900 mg/M^3	
NIOSH Limits of Detection			.01 mg	

mg/M^3 = Milligrams of substance per cubic meter of air
Bz = Breathing zone
GA = General area
mg = Milligrams per detection

Table IX

Summary of Bulk Samples

Field Number	Bulk Description	Asbestos Fiber Type	# Asbestos
B-1	L/W (43 1/2")	Chrysotile	70-80%
B-2	Heavy 10 1/2 lb #2110	Chrysotile	70%
B-3	L/W #5374	Chrysotile	80%
B-4	Durex L/W	Chrysotile	50%

Table X

Summary of Personal Sampling Concentrations Data for Asbestos Fibers

Sample Number	Job Description and/or Classification	Sample Time (hrs)	Sample Volume (Liters)	Fiber Count/Filter	Atmospheric Concentration Fibers >5 um in length of air
1	Packer	6 1/2	590	91,600	*0.19
2	Cutter/Sewer	6 1/2	590	137,000	*0.23
3	Sewer	6 1/2	590	178,200	*0.30
Environmental Criteria (NIOSH)					0.1 fibers/cc

*Exceeds NIOSH criteria and OSHA policy requiring medical examinations.
M^3=Volume of air measured in units of cubic meters.
Fibers/cc=Fibers per cubic centimeter of air.