U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 72-42-76

STEEL TOOL AND ENGINEERING COMPANY
22152 PENNSYLVANIA ROAD
TAYLOR, MICHIGAN 48180
SEPTEMBER 1973

I. TOXICITY DETERMINATION

It has been determined that the level of substances (total dusts and respirable dusts, containing trace amounts of nickel, chromium, cobalt, molybdenum, and iron; and operations involving 1,1,1-trichloroethane, trichloroethylene, ethylene dichloride and acetone) covered by this report are not toxic at concentrations (8-hour time-weighted average) found in the workers' environment during normal operations in the grinding room, "Acryloid", degreaser, and solvent test areas. This conclusion is based on the following pertinent information: (1) the environmental concentrations of the substances investigated at the time of the environmental survey were less than those known to affect health and less than 80% of the health standards for these substances; and (2) no history of symptoms or occupational disease was found during employee interviews. Heat measurements at the time of the survey did not indicate that excessive heat was a problem.

It has been further determined that the level of substances are potentially toxic during the following operations and do result in unnecessary exposure of employees.

A. The average concentration of the breathing zone samples is 2,230 mg/M^3 for 1,1,1-trichloroethane during solvent test operations in the furnace room. Employees normally work only a few hours a day during such operations and hence, the 8-hour time-weighted average does not exceed the Federal Standard of 1,900 mg/M^3. Also, a few employees did complain of occasional headaches when conducting solvent tests over extended periods of time during the day.

B. The unvented hot drying of parts in the "Acryloid" area results in concentrations up to 620 mg/M^3 of acetone and 120 mg/M^3 of ethylene dichloride at about 3' from the operation. These concentrations are very near the Federal Standards of 2,400 mg/M^3 for acetone, and 200 mg/M^3 for ethylene dichloride when considering the combined effects of these substances. It is felt that concentrations may well exceed these limits under certain conditions such as elevated ambient temperatures and the use of a new or hotter air blower when replacement is necessary. Although employees are not normally working in the path of the air blower the practice of unvented drying of parts does produce potentially toxic concentrations of organic vapors.

C. The use of unvented machines and/or inadequate ventilation of machines in the grinding room resulting in generation of inordinate amounts of dust. This conclusion is based upon: (1) visual observation of a cloud of dust while both sandblasters were operating; and (2) employee interviews complaining of occasional coughs during operation of unvented or inadequately-vented machines such as the cutting wheel or large grinder. It is noted that such operations are normally

short-term operations (e.g., few hours) and the levels may become toxic if conducted over longer periods of time.

Further details on the above items are discussed in Section IV of this report.

It was recommended that consideration be given to: (1) the general improvement of the ventilation systems in the solvent test area and grinding room, and for providing a hood or appropriate enclosure for the drying operation in the "Acryloid" area; (2) implementing a more active health and safety program; and (3) a few other general recommendations consistent with good health and safety practices for diminishing or obviating any potential hazards from the exposure of the 10 employees to the substances covered by this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U. S. Post Office Building, Room 508, Fifth & Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a. Steel Tool and Engineering Company
b. Authorized Representative of Employees
c. U. S. Department of Labor - Region V
d. NIOSH - Regions V and VII

For the purposes of informing the approximately 12 exposed employees, the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work for a period of 30 calendar days

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 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from anauthorized representative of employees of the Steel Tool and Engineering Company. The request covered the exposure of employees to dusts during various types of grinding and sandblasting operations, heat, degreasing operations, solvent test operations, and "Acryloid" glue operations. The company specializes in manufacturing high-temperature alloy components for the gas turbine industry. They receive the basic castings from outside vendors for machining and fabrication into gas turbine parts such as low pressure turbine shroud parts for jet engines. Subsequent contacts with the manufacturers of the stainless castings indicated that chromium, cobalt, molybdenum, nickel, and iron should be considered in the evaluation of dusts. The special glue "Acryloid" is primarily a mixture of ethylene dichloride and acetone. The solvent used for tests is 1,1,1-trichloroethane Trichloroethylene is used in the degreasing operations. There are about 10 employees involved in the operations covered by the request and production is primarily confined to day shift only.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

The production area primarily involves various types of machines (e.g., lathes, mills, slotting, drilling, stamping, etc.) and was not covered by the request and hence, is not considered further in this report. The operations covered by the request were confined to the grinding, "Acryloid" gluing, degreasing, and organic test areas as described below.

The grinding area is a 21' by 24' by 12' high room which contains: a 2-wheel grinder, 1 cutting wheel, 2 polishing grinders, 1 EAG Electrolytic Grinder, 1 small slotter, 1 large grinder, 1 abrasive cut-off saw, 1 small metal sandblast glove box enclosure, and 1 medium metal sandblast glove box enclosure. With few exceptions (e.g., cutting wheel, etc.) all operations contained some ventilation and are vented through a dust filtering system or cyclone-bag type system into the grinding room. The EAG Grinder is enclosed and is vented without filtration to the outside. The EAG Electrolytic Grinder uses an electrolyte solution which is a water-based solution of Potassium Nitrate, Potassium Citrate, Rochelle Salt, and Sodium Nitrate. These compounds are considered of low toxicity and are used as food preservatives, buffer in foods, and fertilizer. They are not currently under consideration for establishing a health standard for occupational exposure. The sandblasting glove boxes use either amorphous glass beads or aluminum oxide based type beads as the sandblasting medium for cleaning metal parts. Hence, free silica was not a consideration in sandblasting operations or the grinding operations of stainless steel parts. The room is in close proximity of the furnace room and reportedly becomes hot and stuffy during days of high humidity and ambient temperature.

The "Acryloid" gluing area (12' by 15') is an 8' high enclosure (open ceiling) in the main production area. The operation involves the glue operator placing metal parts into a 3' by 3' by 3' hood and spraying them with acryloid solution (9 parts acetone and 1 part "Acryloid" which is primarily ethylene dichloride). After a few minutes, the metal parts are placed on an open bench where the parts are dried by using hot air from a hairdryer. This is not considered good practice as it results in acetone and ethylene dichloride becoming airborne, and such operations should be accomplished under good ventilation conditions. It is necessary to touch-up some of the parts with the "Acryloid" solution and this is done by other operators using small brushes and amounts of solutions at their work benches.

The degreasing operation involves placing metal parts in a 5-10 gallon container (with holes). The bucket is suspended in the degreaser above the trichloroethylene solution (heated to 180°F) for a specific time for cleaning. The degreaser (6' by 6' by 4' with top slot ventilation and cooling surface) was recently installed and is a commercial unit manufactured by the Electro-Chemicals Division, Diamond Shamrock Corporation. The degreaser is used a maximum of 70 hours per month.

A metal hood (3' by 3' by 3' and vented to atmosphere at roof) is provided for test operations involving the use of 1,1,1-trichloroethane. The bottom of the hood is a basin which contains 5 gallons of solution and the basin has a metal cover when not in use. The test operation involves dipping the metal part in the solution and standing the metal part in an upright position to observe the continuity of the honeycomb. The test operator then shakes the part and hands

it to the packer who places it in a wooden box. This operation is normally on an intermittent basis for a few hours each day.

B. Evaluation Design

Following the preliminary observational survey (June 28, 1973) which facilitated recognition of the most probable health hazards, it was necessary to return to the facility to conduct a more in-depth analysis of employee exposure to the hazards covered by this report. The procedures used to assess the validity of the alleged hazards included on-site worker interviews, discussions with management and labor personnel, walk-through inspection of the workplace, collection of bulk samples for analysis and identification of primary health hazards; and the collection of general area and personal air samples for laboratory analysis were obtained during the final survey conducted on September 12-13, 1972. During both surveys, workers were individually questioned about their occupational history and medical well-being. Pointed questions were asked about the presence of symptomatology.

C. Evaluation Methods

Due to the small number of people involved in this evaluation, all worker responses to the medical interviews were assessed empirically. Bulk samples of the dusts and compounds noted above were collected during the preliminary survey to obtain appropriate sampling and analytical procedures for those contaminants which may become airborne in potentially hazardous concentrations.

Samples for total dust, nickel (Ni), chromium (Cr), cobalt (Co), Molybdenum (Mo), and Iron (Fe) (the major ingredients in the stainless steels) were collected on preweighed 37 mm diameter esters of cellulose membrane (HA) filters. Samples for salts (e.g., EAG Machine--Potassium Nitrate, etc.) were obtained on preweighed glass fiber (GF) filters. Samples for aluminum oxide and/or amorphous glass (sandblasting medium) were collected on polyvinyl chloride (PVC) filters. All air samples for organic solvents and compounds were collected on charcoal air sampling tubes. All samples were collected using appropriate standard sampling techniques and equipment for personal, breathing zone, and general area samples. The sample results are indicative of the exposure levels one may find during normal operations for an 8-hour time-weighted average.

All of the 44 air samples were analyzed by the Division of Laboratories and Criteria Development, NIOSH, Cincinnati, Ohio and approximately 170 analytical determinations were made to evaluate the working environment. Eleven HA Filters were analyzed for total dust; and Ni, Cr, Co, Mo, and Fe by gravimetric and atomic absorption procedures respectively. Four glass fiber filters were analyzed for salts (e.g., Potassium Nitrate, etc.) by the gravimetric method. Three polyvinylchloride (PVC filters) samples were analyzed for aluminum oxide by x-ray method; and total dust or glass (amorphous) by gravimetric method. All of the 26 air samples (charcoal tubes) were analyzed for 1,1,1-trichloroethane, trichloroethylene, ethylene dichloride, acetone, and other organic solvents using standard gas chromatographic procedures.

D. Evaluation Criteria

1. Environmental Standards

The Occupational Health Standards as promulgated by the U. S. Department of Labor (Title 29 Code of Federal Regulations, Chapter XVII, Part 1910, Subpart 1910.93, entitled "Air Contaminants") applicable to substances of this evaluation are as follow:

Substance	8-Hour Time-Weighted Concentration	
	P.P.M[a]	mg/M3[b]
Respirable Dust (Inert or Nuisance)	---	5.0
Total Dust (Inert or Nuisance)	---	15.0
Nickel (Ni-Dusts)	---	1.0
Chromium (Cr-metal and insoluble salts)	---	1.0
Cobalt (Co-metal fume and dust)	---	0.1
Molybdenum (Mo-insoluble compounds)	---	15.0
Iron (Fe-as iron oxide)	---	10.0
Acetone	1,000	2,400
Trichloroethylene	100[c]	535
Methyl Chloroform (1,1,1-trichloroethane)	350	1,900
Ethylene Dichloride (1,2 dichloroethane)	50[d]	200

a. Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure.

b. Approximate milligrams of compound per cubic meter of air.

c. Trichloroethylene also has a health standard of an acceptable ceiling concentration of 200 P.P.M., and acceptable maximum peak above acceptable ceiling concentration for an 8-hour shift of 300 P.P.M., for 5 minutes in any 2 hours.

d. Ethylene Dichloride also has a health standard of an acceptable ceiling concentration of 100 P.P.M. (400 mg/M3) and acceptable maximum peak above ceiling concentration for an 8-hour shift of 200 P.P.M. (800 mg/M3) for 5 minutes in any three hours.

Occupational Health Standards are established at levels designed to protect workers occupationally exposed to a substance on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

2. Biological Norms

The following is a brief resume of the pathologic effects of substances considered in this evaluation:

Respirable Dust and Total Dust (Inert or Nuisance Dust) - Nuisance dusts have little adverse effect on the lungs and do not produce significant disease or toxicity when exposures are kept under control. These dusts are biologically

inert in that when inhaled the architecture of the alveoli remains intact; little or no scar tissue is formed and any reaction provoked is reversible. Excessive concentrations in workroom air may reduce visibility, cause unpleasant accumulation in the eyes, ears, or nose and secondarily cause injury to the skin due to the vigorous cleansing procedures necessary for their removal.

Nickel (Ni-dusts) - Epidemiologic evidence suggests that the hazards presented by insoluble nickel compounds is perhaps not so great as evidenced in some of the nickel refineries. The concentrations associated with the increase in the nasal, sinus, and lung cancer are considerably higher than the health standard of 1 mg/M^3 which is felt should preclude any significant increase in carcinoma. The specific carcinogenic agent has not yet been determined.

Chromium (Cr-metal and insoluble salts) - Dermatitis has occurred from various chromic salts and trivalent chromium compounds have been found to react with protein. The health standard of 1 mg/M^3 of insoluble chromium is recommended to prevent pulmonary disease or other toxic effects such as dermatitis.

Cobalt (Co-metal fume and dust) - Chronic pneumonitis has been produced in workers and in animals from cobalt metal. Non-progressive lung changes frequently improved considerably upon removal from exposure. Hypersusceptibility also appears to be involved as some of the pulmonary responses occurred at low exposure levels and varied in intensity. A dermatitis of the allergic type has also been reported from contact with cobalt and its compounds.

Molybdenum (Mo-insoluble compounds) - It is generally concluded that molybdenum compounds exhibit a low order of toxicity. Transitory irritation of mucosal surfaces can occur at high concentrations of molybdenum compounds. The toxicity is considered on the order of nuisance dusts.

Iron (Fe-as iron oxide) - Iron and iron salts are generally considered to be of low orders of toxicity and are essential constituents of the human body. These needs are met by dietary intake. Excessive ingestion seldom results in toxicity since absorption from the gastrointestinal tract is limited to body need. However, the inhalation of iron oxide particulates may eventually result in the benign pneumoconiosis (ciderosis) manifested solely by radiographic stippling of the lungs. This condition results in few, if any, symptoms and causes no disability.

Acetone - Acetone is considered one of the least toxic of the common solvents. Concentrations above 2400 mg/M^3 cause minor irritation of the eyes and nose. Acetone exposure produces a narcotic type effect with local irritant of the mucous membranes.

Trichloroethylene - Trichloroethylene has been classified as an acute narcotic at high concentrations with some chronic narcotic effects noted at concentrations around 200 ppm or 1070 mg/M^3. Trichloroethylene exposure essentially depresses the central nervous system with symptomatology ranging from headaches, dizziness, vertigo, tremors, nausea, and vomiting, sleepiness, fatigue, light-headedness, to unconsciousness. Experience has also shown that long-term exposures may result in liver damage. There is evidence from experience in this country that exposures from trichloroethylene at concentrations below 535 mg/M^3 will not cause liver damage, serious central nervous system effects, or similar symptomatology.

Methyl Chloroform (1,1,1-trichloroethane) - Methyl Chloroform produces depression of the central nervous system. Physiologically it acts as an anesthetic and causes depression of the central nervous system (somnolence in coordination, semi-consciousness, coma). It has essentially no capacity to produce chronic injury from either single or repeated exposures.

Ethylene Dichloride (1,2 Dichloroethane) - Animal studies have indicated liver and kidney injury and opacities of the cornea from ethylene dichloride exposures. There have been some episodes of occupational intoxication with nausea and vomiting the predominating symptoms. Ethylene dichloride exposure at chronic levels depresses the central nervous system. The recommended limit of 200 mg/M^3 is sufficiently low to prevent injury and minimize the effect on the central nervous system or the incidence of nausea and related symptoms.

Physical Agent:

Heat---Hot Environments - The physical effects of excessive exposure to environmental heat are determined to a large extent by factors other than actual temperature. Workload, rest periods, water and salt supplementation, clothing, general physical fitness, and acclimatization are all extremely important in determining levels at which effects can be expected to become manifest. In general, well adults performing continuous moderate work can easily tolerate a wet black globe temperature of 79°F without developing heat disorders.

Heat fatigue is the mildest of the heat disorders and is characterized by decreased ability to concentrate, tiredness, and irritability. Heat prostration (heat collapse, exhaustion, or syncope) results in weakness, dizziness, vertigo, nausea, blurred or dim vision and mild muscular cramps which may progress to a listless, apprehensive semicomatose state. In severe cases unconsciousness may result due to complete circulatory collapse even though the body temperature remains normal. The prognosis is excellent and the condition is usually transient. Heat cramps are sudden, severe muscular cramps resulting from excessive physical exertion in high temperatures due to perspiration. This condition occurs mainly among unacclimated individuals performing extremely severe physical labor in very hot environments such as stokers, miners, firemen, etc. The most severe heat disorder is heat hyperpyrexia (sunstroke, heat stroke). In this condition a profound disturbance of the heat-regulating mechanism occurs following prolonged exposure to excessively high temperatures requiring prompt medical attention. This heat disorder is largely a problem of the elderly non-working age population and the severity of the syndrome is usually related to an already compromised physical state due to heart, kidney, or other underlying diseases.

E. Evaluation Results and Discussions

1. Environmental Survey Results - September 12-13, 1972

a. Grinding Area

There were 10 personal air samples and 4 general area air samples (11 HA filters and 3 PVC filters) obtained during the survey. The maximum result for the total airborne dust loading (which includes respirable and non-respirable dust) was 1.4 mg/M^3 which is less than 10% of the Federal Standard of 15 mg/M^3 for total dust.

If the total dust was considered as all respirable dust, all sample results (maximum - 1.4 mg/M3) would be less than 30% of the Federal Standard of 5 mg/M3 for respirable dust. The 11 HA filter samples were also analyzed for Ni, Cr, Co, Mo, and Fe and all results were less than 10% of the Federal Standards for these contaminants as noted in Section IV D 1 of this report. It is further noted that even if the Cr (Chromium - maximum result of .059 mg/M3) were considered as soluble chromic or chromus salts that the sample results would be less than 15% of the Federal Standard of 0.5 mg/M3 for such Cr salts. Four personal and general area air samples (glass fiber filter) were obtained to collect salts (i.e., Rochelle Salt, potassium citrate, potassium nitrate, and sodium nitrate) to further evaluate operations involving the EAG machine. As previously noted, these salts are not considered very toxic and the maximum sample result of 0.4 mg/M3 for such salts would not be considered hazardous to employees in the immediate vicinity of the EAG machine. Samples were obtained from the EAG operator, Polishing operator, Radius operator, Grinding operator, and the Sand-blasting operator.

b. "Acryloid" Area

In considering 2 or more hazardous substances having similar pathophysiologic effects such as 2 organic solvents, their combined effect must be considered. Hence, in the absence of information to the contrary, the effects of different solvents, must be considered as additive: that is, if the sum of the concentration X compound divided by its health standard plus the sum of Y compound divided by its health standard exceeds unity (1), then the health standard for the mixture would be considered as being exceeded. Em is used for the sum total and should not exceed 1. Please refer to Section VII, Table A of this report for a more detailed explanation on this matter.

Twelve breathing zone and general area samples (charcoal tubes) were obtained and analyzed for acetone, 1,1,1-trichloroethane, trichloroethylene, and ethylene dichloride. For the spray operator (inside the area) and a bench operator (outside the area--hand brushing parts) the estimated Em is less than .2 which is less than 20% of the combined Federal Standards for such compounds. The operations involving the spray operator are such that she avoids the vapors generated by the drying of parts (hot air from hairdryer at knee level), and the bench operator is normally outside of the "Acryloid" area. The maximum exposure occurred when an operator worked a few hours on the bench (inside area) opposite the spraying/drying operation and resulted in an estimated 8-hour time-weighted average Em of less than 0.3 or less than 30% of the combined Federal Standards. Although the exposure results are within acceptable limits, the sample results do indicate a need to provide for a hood or adequately vented enclosure of the drying operation inside of the "Acryloid" area. For instance, a general area sample on the bench directly opposite the drying operation resulted in air levels of 620 mg/M3 for acetone and 120 mg/M3 for ethylene dichloride.

c. Degreasing Area

Six breathing zone and general area samples (charcoal tubes) were obtained during the survey. Although there were no degreasing operations conducted during the survey, the NIOSH investigators and the plant foreman conducted a series of operations which would simulate good, average, and marginal work practices involving the use of the degreaser. The maximum for the compounds detected resulted in a

maximum estimated Em of less than 0.40 for an 8-hour period. In considering the hours of use of the degreaser and other sample results, the Em would be significantly less than 0.20 or less than 20% of the combined Federal Standards. This is a relatively new unit and should not present a problem as long as it is used within the specified limits and recommendations of the manufacturer.

d. Solvent Test Operations (Furnace Room)

Eight breathing zone and general area samples (charcoal tubes) were obtained during the survey. These operations were noted for about 2 hours by the NIOSH investigators during the period covered by the survey. In order to estimate the results, the following information is based upon the maximum breathing zone sample result and assuming operations were conducted for a period of 4 hours during an 8-hour shift. This would result in an estimated Em of about 0.8 or 80% of the combined Federal Standards for the mixture. To assure visibility for the test, it is necessary to have the front of the hood open, and the metal parts (while still wet with solvent) are taken out of the hood and packaged. This plus the existing ventilation system offers a partial explanation of the elevated results. The company rotates employees on this job during the shift, however, this operation does provide for a significant exposure to employees, particularly if the operation were continued for over 4 hours daily by the same employees. The average concentration of the breathing zone samples is 2,230 mg/M^3 for 1,1,1-trichloroethane which exceeds the Federal Standard of 1,900 mg/M^3 for 1,1,1-trichloroethane on an 8-hour time-weighted average.

e. Heat

It has been determined that "substances" as presently defined in Section 20(a)(6) of the Act, do not include physical agents such as heat. However, in order to assist management, and as heat was mentioned in the request, we conducted a cursory heat survey.

The following measurements were taken during the afternoon of September 12, 1972 to evaluate the heat stress problem in the grinding room only. Outside readings - psyschrometer dry bulb of 70°F and wet bulb of 66°F; Inside readings - psychrometer dry bulb of 77°F and wet bulb of 68.5°F; Globe Back Ball of 77°F; dry bulb of 78°F; wet bulb of 68.5°F; and an air velocity of 40 feet per minute (fpm). These measurements yield a wet bulb-globe temperature (WBGT) of 71°F. The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for heat stress indicate that a WBGT of 71°F is well within the established limit of environmental heat load which may be safely tolerated by workers even at very strenuous work with prolonged exposure.

The close parallel between outside (ambient) conditions and the in-plant measurements suggest that the problem is largely related to climatic rather than process factors. The vapor pressure (or relative humidity) is low enough to permit adequate heat removal by sweating. The rather small margin between the globe temperature and dry bulb temperature indicates that the radiant heating problem is of minor concern. If the employee complaints regarding hot working conditions prevail, some relief could be expected from the proper usage of man-cooling fans to increase the air velocity at the workplace above the measured value of about 40 fpm. The conclusion to be drawn from the data is that the conditions at the

worksite did not present a significant health hazard with regard to heat stress at the time of survey. It is noted that when outside conditions are high one could expect the inside conditions of the grinding room to be high also. Although heat stress is not an apparent problem, a copy of "Criteria for a Recommended Standard....Occupational Exposure to Hot Environments" is enclosed as a guideline for exposure to hot environments.

f. Ventilation of Operations

A cursory ventilation survey was made concerning all operations covered by this report. The following is a brief resume of those operations which need further evaluations for improving or providing a ventilation system(s). In this regard, ventilation requirements for certain operations are promulgated by the U. S. Department of Labor in Section 1910.94, Part 1910--"Occupational Safety and Health Standards", Chapter XVII, Title 29--Labor as published in the Federal Register, Volume 37 on October 18, 1972.

The hood in the furnace room (Solvent Test Operation) provides a face volocity on the left side of 40 fpm and on the right side of 100 fpm. The air flow is such that it may draw air in one side and blow it out the other side and is inadequate if there is any significant movement in or around the hood. The practice of placing wet parts in containers outside of the hood also gives rise to unnecessary airborne organic contaminants in concentrations which may become potentially toxic. The hood should be modified to provide for adequate ventilation during test and drying operations.

There is no provision for containing the organic vapors generated from the drying operations in the "Acryloid" area. Provision should be made for providing an adequately-vented enclosure or hood for such drying operations.

The ventilation systems (except for EAG machine) in the grinding room provide for filtration and subsequent discharge of air back into the room which is not considered the best practice, and needs modification and/or proper maintenance. For instance, both sandblasters were placed in operation after completion of the environmental survey which resulted in a cloud of dust in the immediate vicinity of the sandblasters. This indicated that the filtration system is either inadequate with both sandblasters operating or the system is not properly maintained. Consideration should be given to venting the exhaust air after filtration to the outside of the building. The ventilation systems provided adequate flow of air at the point of operation for those operations being conducted at the time of the survey, but may be inadequate if additional operations are conducted simultaneously or if the pressure drop in the filtration system is significantly greater due to inadequate maintenance or changing of the filter. Also, at least one piece of machinery (e.g., cutting--abrasive wheel) has no ventilation and apparently generates considerable amounts of airborne dusts from discussions with employees. There were 5 operations (EAG, polishing, radius, grinding, and sandblasting) being conducted in the grinding room at the time of the survey.

2. Medical Survey Results

The medical evaluation and employee interviews were conducted during the initial observational visit and the environmental survey. The following is a brief resume of the medical findings. Employee interviews were centered on respiratory con-

ditions, dermatitis, headaches, irritation of nose, eyes, and other complaints which could be attributed to exposures to the contaminants in question.

Seven women and 2 men working in the grinding room, "Acryloid" area, degreaser area, and solvent test areas were interviewed and a few other employees talked about their general health and jobs. Most of the employees interviewed had no physical problems, although a few did complain about an occasional cough during certain short-term operations (e.g., cutting-abrasive wheel operation, operation of both sandblasters) in the area which generate visible clouds of airborne dust, and 1 employee tended to sneeze, cough, and develop "a taste in her mouth" during such operations. One employee complained of 22 lbs. of weight gain in the last 3 years, swollen glands and an occasional cough. Another employee indicated very vague type problems such as weak legs, chest discomfort, diarrhea, fatigue, etc., but no real problem which could be attributed to or associated with occupational exposures. One employee commented that minor respiratory tract infections tended to persist for longer periods of time. Two employees mentioned occasional short-term headaches or dizziness when working with organic compounds over long periods of time and the employees request other work as they are frequently rotated from one job to another. A number of individuals obviously had preexisting respiratory problems of diverse etiology (i.e., asthma, smokers' cough, etc.). No symptoms suggestive of continuous excess exposures to organic solvents, dusts, metallic compounds, or heat were elicited although a few persons in the grinding room did complain about heat in the summer. However, further questioning did not reveal any real heat stress problems other than some fatigue at the end of the day. No employee had any complaints (e.g., dizziness, headache, coughing, etc.) due to environmental conditions at the time of the survey.

There is no pattern of long-term symptomatology or illness which emerges from the interviews. Based on the medical interviews and observations, there is no evidence of a long-term hazard to the workers interviewed. However, there are occasional short-term symptoms (i.e., cough, dizziness, headache) from a sufficient number of employees which are indicative of workers being exposed to concentrations of dusts and organic compounds which may be potentially toxic.

3. Discussion of Evaluation

It is our conclusion that a hazardous exposure from the dusts and organic compounds to the workers in the above areas does not exist. This conclusion is reached due to the absence of significant long-term medical symptomatology and the environmental results (based on an 8-hour time-weighted average exposure of employees to the dusts and organic vapors studied) were below those concentrations which have been noted to produce toxic effects. However, visual observations (both sandblasters operating), employee interviews, and some environmental sample results indicated that the levels of the substances evaluated in this report may be potentially toxic at concentrations found in the workers' environment if these exposures were on a continuous 8-hour basis. An exit interview was held with representatives from management to discuss the initial results and observations of the survey. A similar exit interview was held with the authorized representative of employees. Recommendations were made at that time to obviate the potential hazards and to provide for a more desirable working environment.

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Seven women and 2 men working in the grinding room, "Acryloid" area, degreaser area, and solvent test areas were interviewed and a few other employees talked about their general health and jobs. Most of the employees interviewed had no physical problems, although a few did complain about an occasional cough during certain short-term operations (e.g., cutting-abrasive wheel operation, operation of both sandblasters) in the area which generate visible clouds of airborne dust, and 1 employee tended to sneeze, cough, and develop "a taste in her mouth" during such operations. One employee complained of 22 lbs. of weight gain in the last 3 years, swollen glands and an occasional cough. Another employee indicated very vague type problems such as weak legs, chest discomfort, diarrhea, fatigue, etc., but no real problem which could be attributed to or associated with occupational exposures. One employee commented that minor respiratory tract infections tended to persist for longer periods of time. Two employees mentioned occasional short-term headaches or dizziness when working with organic compounds over long periods of time and the employees request other work as they are frequently rotated from one job to another. A number of individuals obviously had preexisting respiratory problems of diverse etiology (i.e., asthma, smokers' cough, etc.). No symptoms suggestive of continuous excess exposures to organic solvents, dusts, metallic compounds, or heat were elicited although a few persons in the grinding room did complain about heat in the summer. However, further questioning did not reveal any real heat stress problems other than some fatigue at the end of the day. No employee had any complaints (e.g., dizziness, headache, coughing, etc.) due to environmental conditions at the time of the survey.

There is no pattern of long-term symptomatology or illness which emerges from the interviews. Based on the medical interviews and observations, there is no evidence of a long-term hazard to the workers interviewed. However, there are occasional short-term symptoms (i.e., cough, dizziness, headache) from a sufficient number of employees which are indicative of workers being exposed to concentrations of dusts and organic compounds which may be potentially toxic.

3. Discussion of Evaluation

It is our conclusion that a hazardous exposure from the dusts and organic compounds to the workers in the above areas does not exist. This conclusion is reached due to the absence of significant long-term medical symptomatology and the environmental results (based on an 8-hour time-weighted average exposure of employees to the dusts and organic vapors studied) were below those concentrations which have been noted to produce toxic effects. However, visual observations (both sandblasters operating), employee interviews, and some environmental sample results indicated that the levels of the substances evaluated in this report may be potentially toxic at concentrations found in the workers' environment if these exposures were on a continuous 8-hour basis. An exit interview was held with representatives from management to discuss the initial results and observations of the survey. A similar exit interview was held with the authorized representative of employees. Recommendations were made at that time to obviate the potential hazards and to provide for a more desirable working environment.

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VII. TABLE A (attached)

TABLE A

OCCUPATIONAL SAFETY AND HEALTH STANDARDS
SUBPART G - OCCUPATIONAL HEALTH AND ENVIRONMENTAL CONTROL
(Code of Federal Regulations, Title 29, Chapter XVII, Part 1910)

PART 1910 -- OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1910.93 AIR CONTAMINANTS

Part B(2)(i) In case of a mixture of air contaminants an employer shall compute the equivalent exposure as follows:

$$Em = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \ldots \frac{C_n}{L_n}$$

Where:

Em is the equivalent exposure for the mixture,

C is the concentration of a particular contaminant,

L is the exposure limit for that contaminant, from Table G-1, G-2, or G-3,

The value of Em shall not exceed unity (1).

(ii) To illustrate the formula prescribed in subdivision (i) of this subparagraph, consider the following exposures

Material	Actual concentration of 8-hour exposure	8-hour time-weighted average exposure limit
Acetone (Table G-1)	500 ppm	1,000 ppm
2-Butanone (Table G-1)	45 ppm	200 ppm
Toluene (Table G-2)	40 ppm	200 ppm

Substituting in the formula, we have:

$$Em = \frac{500}{1,000} + \frac{45}{200} + \frac{40}{200}$$

$$Em = 0.500 + 0.225 + 0.200$$

$$Em = 0.925$$

Since Em is less than unity (1), the exposure combination is within acceptable limits.