CDC
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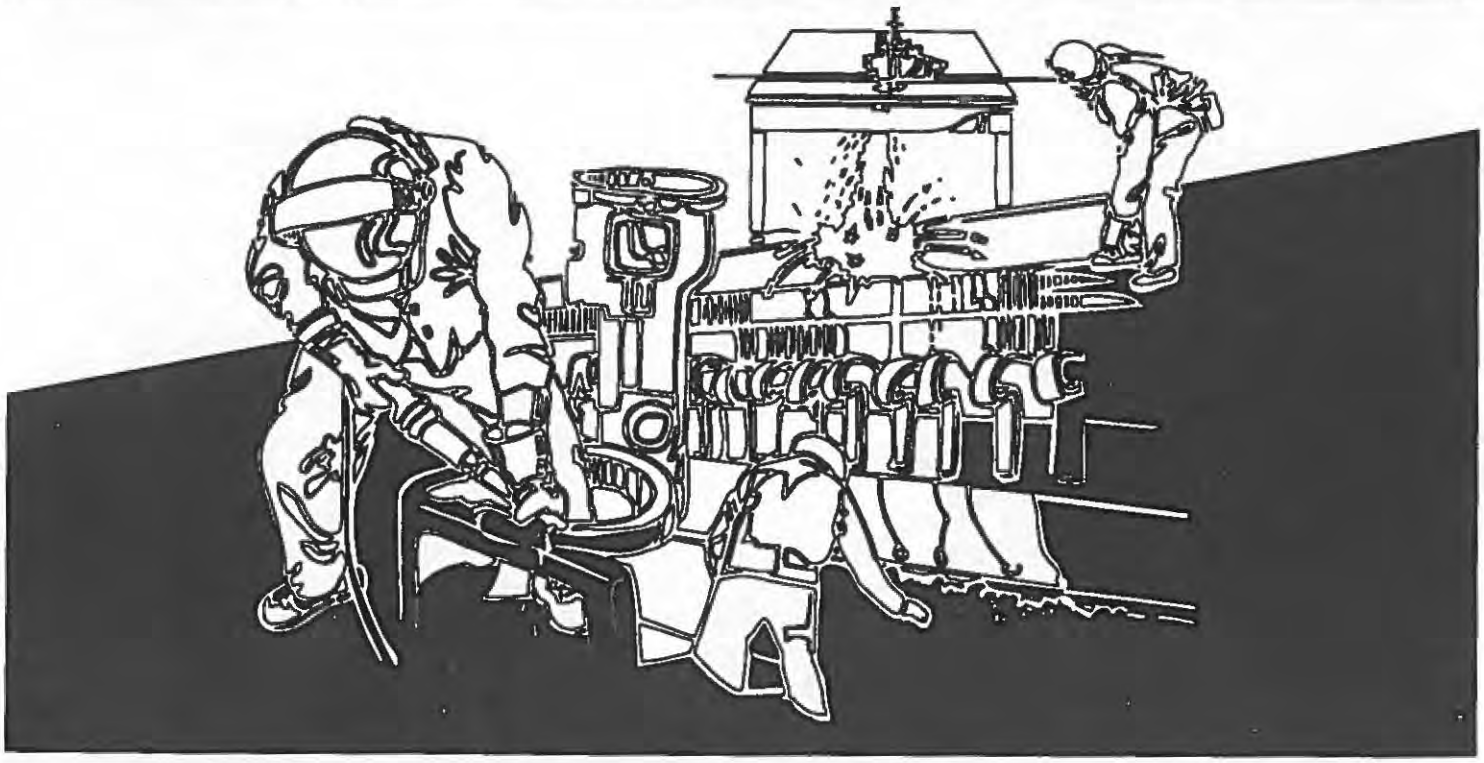
NIOSH HEALTH HAZARD EVALUATION REPORT

HETA 92-140-2264
T-L IRRIGATION COMPANY
HASTINGS, NEBRASKA



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

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 and 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.

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T-L IRRIGATION COMPANY
HASTINGS, NEBRASKA

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I. SUMMARY

In February 1992, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request for a Health Hazard Evaluation (HHE) concerning adverse health effects possibly resulting from exposures occurring during the operation of a tube mill in Building 41 at the T-L Irrigation Company in Hastings, Nebraska. Specifically, the requestors were concerned about metal fume fever (MFF) from exposure to the galvanizing process, carbon monoxide from a farm tractor used in the building, and unsafe machinery.

On April 15 - 16, 1992, NIOSH investigators conducted a walkthrough inspection of Building 41 and collected personal breathing zone (PBZ) and general area (GA) air samples for metal fumes and carbon monoxide (CO), performed GA noise measurements, evaluated local exhaust ventilation at the tube mill, and conducted medical interviews with all seven of the workers present. The OSHA 200 Logs from 1990, 1991, and the first quarter of 1992, were reviewed to ascertain the types of injuries and illnesses encountered at the facility.

Fourteen PBZ samples and one GA sample for metals were collected for the foreman, the scarfer, and the remaining five employees producing hydraulic tubing. Eight-hour time weighted average (TWA) PBZ concentrations of zinc oxide ranged from 0.27 to 2.8 mg/m^3. The eight-hour TWA PBZ concentration of results for iron oxide fume ranged from 0.003 to 0.02 mg/m^3. The GA sample above the welder indicated eight-hour TWA concentrations of 1.8 mg/m^3 for zinc oxide fume and 0.003 mg/m^3 for iron oxide fume. All sampling results were below relevant evaluation criteria. Seven PBZ samples for CO revealed a mean eight-hour TWA concentration of 6 ppm, well below the NIOSH REL of 35 ppm. Face velocity measured at the canopy hood over the high-frequency welder was 350 feet per minute (fpm). Air velocity measured near the point of fume generation was 125 fpm. This is within the range of capture velocities of 100-200 fpm recommended for welding. While duct velocity was not assessed at this facility, a duct velocity of 1400-2000 fpm has been recommended for zinc oxide fume. Noise measurements collected in Building 41 were in excess of 90 Db(A) at three different areas of the process; the high frequency welder, the tube cutting area, and the tube testing area.

Private medical interviews revealed that four of the seven workers had no complaints or symptoms. One employee had occasional irritation of the nose and throat. One worker occasionally noted a metal taste after

galvanizing but denied any other medical symptoms. One worker noted a past acute illness involving headaches, nausea, chills, and fever while working as a scarfer. He was subsequently given different duties and has had no problems since his job relocation. Review of the OSHA 200 logs for 1990, 1991, and January through March, 1992, showed that the two entries from Building 41 were secondary to crush injuries. There were no entries of MFF, asthma, or other respiratory illnesses.

Based on the medical interviews, the occurrence of metal fume fever (MFF) or any symptoms attributable to metal fumes do not appear to be an ongoing problem at this facility. This investigation identified only one possible case of MFF at this facility in the past three years. Metal fume and carbon monoxide exposures were well below relevant evaluation criteria and do not appear to be a health hazard with this process. Noise level evaluations indicated that worker noise exposures may be excessive and further testing should be done by the employer to determine the extent of the employees' exposures.

Keywords: SIC 3523 (Farm Machinery and Equipment), Tube Mill, Zinc Oxide, Iron Oxide, Metal Fume Fever, Noise.

II. INTRODUCTION

On April 15-16, 1992, investigators from the National Institute for Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation (HHE) at T-L Irrigation Company in Hastings, Nebraska. This HHE was the result of a February 5, 1992 request concerning adverse health effects among employees working at the tube mill in Building 41. Specifically, employees were concerned about metal fume fever (MFF) from exposure to airborne contaminants from the galvanizing process, exposure to carbon monoxide from a farm tractor used in the building, unsafe machinery, and ceiling exhaust fans reportedly covered with plywood.

On April 15, 1992, NIOSH investigators held an opening conference with employer and employee representatives and conducted a walkthrough inspection of Building 41. On April 16, 1992, NIOSH investigators returned to Building 41 and collected personal breathing zone (PBZ) and general area (GA) air samples for metal fumes, performed GA noise measurements, evaluated local exhaust ventilation at the tube mill, and conducted medical interviews with all seven of the workers present. At the end of the day, preliminary results and recommendations were presented to employee and employer representatives in a closing conference.

III. BACKGROUND

T-L Irrigation Company manufactures hydraulic pivot irrigation systems for farming. The company employs approximately 100 people, who work in ten production and two warehouse buildings. Approximately 80 of the employees have worked for T-L for at least five years, and 60 for more than ten years.

Building 41 houses the tube mill. The building is approximately 200 feet long and 75 feet wide. The building, constructed of brick and concrete, was built in 1945 as part of a Naval Ammunition Depot. It has been modified to accommodate the current process, which began operation about ten years ago. Two to five people work in Building 41 when the tube mill is not running, and about seven employees work there when the mill is in operation. The mill normally runs nine hours a day, one day a week. At the time of the site visit, however, the mill was running two days a week.

The tube mill forms half-inch, one-inch, or one and one-quarter-inch hydraulic tubing from coiled galvanized steel. A coil of galvanized steel is placed on a spindle (the uncoiler) using a propane-powered fork-lift truck. The beginning of the new coil is gas tungsten arc-welded to the end of the old coil. Rollers form the flat steel into tubing, and the edges are then joined using high-frequency welding. The welding apparatus is ventilated by a canopy hood. An employee (the scarfer) removes excess metal from the newly welded seam. A metallizing gun sprays zinc, from zinc wire, onto the seam to

galvanize the seam. The metallizing gun is fully enclosed and the enclosure is equipped with local exhaust ventilation. The tubing is then cooled (the coolant is a hydrotreated napthenic base oil with a germicide; the germicide contains approximately 50% tris (hydroxymethyl) nitromethane). The coolant is used throughout the process, from forming through pressure testing. Next, the tubing is cut into 40-foot lengths, which dimples the ends. The ends are rounded (de-dimpled), compression fittings are attached at either end, and the tubes are pressure tested to 3000 pounds per square inch. Following pressure testing, the tubes are blown dry with compressed air to remove the remaining coolant. The end of the tubing from which the coolant escapes is placed in a small enclosure equipped with local exhaust ventilation. The tubing is next capped to protect the interior from contamination, bundled in groups of 32 tubes, and loaded onto a trailer using an electric hoist. Coolant collects in a floor sump and is cycled through the process again. When the trailer is fully loaded, it is backed out of the building with a farm tractor. The trailer was moved out of and back into Building 41 once on the day samples were collected.

The process runs at about 180 feet per minute, resulting in the average production of 1200 to 1500 lengths of tubing each day. On April 16, 1992, 1263 lengths of tubing were produced by the tube mill. At the end of the process, an employee cleans the rollers and welding area using water. The enclosure for the metallizing gun is also cleaned with a putty knife, which produces large amounts of zinc-containing dust. On days the tube mill is not running, employees process the tubing remaining from the previous production run.

T-L Irrigation Company requires employees to wear safety shoes and eye protection. The company recently purchased a half-mask air-purifying respirator and required the scarfer to use it without fit-testing or a determination of the employee's medical fitness to wear a respirator. Disposable respirators and ear plugs are available to employees, but these are rarely used. T-L Irrigation Company does not have a respiratory protection program or a hearing conservation program. An employee who is an emergency medical technician responds to injuries and provides first-aid. Medical care is provided by a local hospital, with a local physician serving as the company physician when one is needed.

IV. MATERIALS AND METHODS

A. Medical

All seven employees present in Building 41 were interviewed to elicit information regarding job tasks, duration of employment, use of personal protective equipment, possible exposures, medical symptoms potentially related to work, and health concerns. The OSHA 200 Logs were reviewed from 1990, 1991, and the first quarter of 1992 to ascertain types of injuries/illnesses encountered at the facility.

B. Environmental

On April 16, 1992, fourteen PBZ and one GA air samples were collected for metals in Building 41. The GA air sample was collected at the scarfer's work station. PBZ samples were collected for all seven employees fabricating tubing on April 16, 1992. Two partial-period, consecutive samples were collected in the breathing zone of each employee. The first sample was collected from the beginning of production, at approximately 8:00 a.m., to around 12:30 p.m. The second sampling period began at approximately 12:30 p.m. and ended when tube mill clean-up ended following the day's production of tubing, at about 2:00 p.m. The area sample ran from 8:12 a.m. to 1:50 p.m. Samples were collected and analyzed in accordance with NIOSH Method 7300.[1] Samples were collected on 37-mm diameter, 0.8-μm pore-size mixed cellulose ester filters in three-piece polycarbonate cassettes, connected to a battery-powered sampling pump via a length of Tygon tubing. Samples were collected at a flow rate of 2 liters per minute. PBZ samples were collected for carbon monoxide using length of stain diffusion tubes.

Both the face velocity and capture velocity of the canopy hood over the high frequency welder were evaluated using a thermoanemometer (Series 490 mini-anemometer, Kurz Instruments, Inc., Carmel Valley, CA). Noise in Building 41 was measured using a type II sound level meter operating in the slow response mode and the A-weighted scale (Model 215 sound level meter, Quest Electronics, Oconomowoc, WI). The sound level meter was field calibrated before and after sampling according to the manufacturer's directions.

V. EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to ten hours a day, forty hours a week for a working lifetime without experiencing adverse health effects. However, it is important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled to the limit set by the evaluation criterion. These combined effects are often not considered by the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure.

Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent becomes available.

The primary sources of environmental evaluation criteria for the workplace are the following: 1) NIOSH Criteria Documents and Recommended Exposure Limits (RELs), 2) the U.S. Department of Labor, OSHA Permissible Exposure Limits (PELs), and 3) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs).[2-4] The OSHA PELs may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; in contrast, the NIOSH-recommended exposure limits are primarily based upon the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing those levels found in this report, it should be noted that employers are legally required to meet those levels specified by an OSHA PEL.

A time-weighted average exposure level (TWA) refers to the average airborne concentration of a substance during a normal eight- to ten-hour workday. Some substances have recommended short-term exposure limits (STELs) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from brief high exposures.

A. <u>Noise</u>

Occupational deafness was first documented among metalworkers in the sixteenth century.[5] Since then, it has been shown that workers have experienced excessive hearing loss in many occupations associated with noise. Noise-induced loss of hearing is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss greater than that resulting from the natural aging process. This noise-induced loss is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.[6]

While loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are much less common than the insidious hearing loss due to chronic noise exposure. Typically, the latter begins to develop at 4000 or 6000 Hz (the hearing range is 20 Hz to 20000 Hz) and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized. Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. Although the primary frequencies of human speech range from 200 Hz to 2000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components.[7]

The OSHA standard for occupational exposure to noise (29 CFR 1910.95) specifies a maximum PEL of 90 dB(A)-slow response for a duration of eight hours per day.[8] The regulation, in calculating the PEL, uses a 5 dB time/intensity trading relationship. This means that in order for a person to be exposed to noise levels of 95 dB(A), the amount of time allowed at this exposure level must be cut in half in order to be within OSHA's PEL. Conversely, a person exposed to 85 dB(A) is allowed twice as much time at this level (16 hours) and is within his daily PEL. Both NIOSH, in its Criteria for a Recommended Standard, and the ACGIH, in their TLVs, propose an exposure limit of 85 dB(A) for eight hours, 5 dB less than the OSHA standard.[4,9] Both of these latter two criteria also use a 5 dB time/intensity trading relationship in calculating exposure limits.
Time-weighted average (TWA) noise limits as a function of exposure duration follow:

Duration of Exposure	Sound Level (dB(A))	
(hrs/day)	NIOSH/ACGIH	OSHA
16	80	85
8	85	90
4	90	95
2	95	100
1	100	105
1/2	105	110
1/4	110	115
1/8	115	*
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* No exposure to continuous or intermittent noise in excess of 115 dB(A).
**Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

The OSHA regulation has an additional action level (AL) of 85 dB(A), at which an employer shall administer a continuing, effective hearing conservation program when the TWA value exceeds the AL. The program must include monitoring, employee notification, observation, an audiometric testing program, hearing protectors, training programs, and recordkeeping. All of these requirements are included in 29 CFR 1910.95, paragraphs (c) through (o). The OSHA noise standard also states that when workers are exposed to noise levels in excess of the OSHA PEL of 90 dB(A), feasible engineering or administrative controls shall be implemented to reduce the workers' exposure levels. Also, a continuing, effective hearing conservation program shall be implemented.

B. Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, tasteless gas produced by incomplete burning of carbon-containing materials; e.g., natural gas. The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea. These initial symptoms may advance to vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. Coma or death may occur if high exposures continue.[10-15]

Both the NIOSH REL and the OSHA PEL for CO are an eight hours per day, 40 hours per week TWA exposure of 35 ppm, and a ceiling limit of 200 ppm.[2,3] The NIOSH REL of 35 ppm is designed to protect workers from health effects associated with COHb levels in excess of 5%.[10] The ACGIH recommends an eight-hour TWA TLV of 50 ppm, with a ceiling level of 400 ppm. Currently, the ACGIH has published a notice of an intent to change the TLV to 25 ppm as an eight-hour TWA.[4] In addition to these standards, the National Research Council has developed a CO exposure standard of 15 ppm, based on a 24 hours per day, 90-day TWA exposure.[16]

C. Zinc

Zinc metal is used in galvanizing, in electroplating, in dry cells, in alloys, and as zinc oxide in pigments. Inhalation of freshly formed zinc oxide fume causes a self-limited influenza-like illness termed metal fume fever (MFF).[13] MFF is characterized by a complex of symptoms that includes fever, chills, sweats, nausea, fatigue, throat irritation, cough, headaches, muscle aches, and joint pain.[21] The onset of symptoms is usually preceded by thirst and a metallic taste. An attack usually occurs 4 to 8 hours after exposure and may last up to 24 hours, usually with complete recovery. Symptoms commonly affect previously unexposed workers or workers who have returned to work after a several day rest period; hence, attacks tend to be most severe on the first day of the workweek.[22]

The OSHA PEL for zinc oxide fume is 5 mg/m^3 as an eight-hour TWA, with a STEL of 10 mg/m^3.[3] The 1992-1993 ACGIH TLV and the NIOSH REL for zinc oxide fume are identical to the OSHA values.[4,17]

D. Iron

Inhalation of iron oxide fume causes siderosis, an asymptomatic condition often referred to as a "benign pneumoconiosis" because of its appearance on chest x-ray. Exposures of six to ten years are usually required before changes recognizable by x-ray occur; the retained iron material produces x-ray shadows that are indistinguishable from a true pneumoconiosis.[13] In one study of 25 welders exposed to iron oxide fume at concentrations ranging from 0.65 to 47 mg/m^3 for an average of 18.7 years, eight had shadows on

chest x-ray consistent with siderosis, but there was no reduction in pulmonary function.[13]

The OSHA PEL for iron oxide fume (as iron) is 10 mg/m^3 as an eight-hour TWA.[3] Both the ACGIH TLV and the NIOSH REL are 5 mg/m^3.[4,17]

VI. Results

A. Medical

1. Interviews

Private medical interviews were conducted with all seven employees present in Building 41 on April 16, 1992. Three of the seven employees had been employed one month or less. Two of these three workers had no complaints or symptoms, and one employee had occasional irritation of the nose and throat. The worker presently acting as a scarfer in Building 41 (employed at T&L for 19 years) performs this job only periodically as needed. This worker occasionally noted a metal taste after galvanizing but denied any other medical symptoms. The three remaining employees had worked in building 41 for five or more years. One worker noted a past acute illness, including headaches, nausea, chills, and fever, after exposure to fresh zinc oxide fume while working as a scarfer. He was subsequently given different job duties and has had no problems since. The other two employees denied any medical symptoms. All those interviewed denied any knowledge of previous employees being ill or injured. Four of the seven were current smokers and smoked while working.

2. OSHA 200 Log Review

Review of the OSHA 200 Logs for the entire facility for 1990, 1991, and January through March, 1992, showed the majority of injuries were musculoskeletal, such as strains or contusions, lacerations, or ocular foreign bodies. The two entries from Building 41 were secondary to crushing injuries. There were no entries of metal fume fever, asthma, or other respiratory illnesses.

B. Environmental

1. Metals

Fourteen PBZ samples and one GA sample for metals were collected on April 16, 1992. PBZ samples were collected for the foreman, the scarfer, and the remaining five employees producing hydraulic tubing. The samples were analyzed for the following metals in accordance with NIOSH Method 7300: aluminum, arsenic, barium, beryllium, calcium, cadmium, cobalt,

chromium, copper, iron, lithium, magnesium, manganese, molybdenum, nickel, lead, phosphorous, platinum, selenium, silver, sodium, tin, tellurium, thallium, titanium, tungsten, vanadium, yttrium, zinc, and zirconium.[1] A small quantity of aluminum was detected on one of the fourteen samples, and a small quantity of magnesium was detected on two of them. Eight-hour TWA concentrations of zinc oxide fume ranged from 0.27 to 2.8 mg/m^3. Eight-hour TWA iron concentrations ranged from 0.003 to 0.02 mg/m^3. The GA sample above the welder had eight-hour TWA concentrations of 1.8 mg/m^3 for zinc oxide fume and 0.003 mg/m^3 for iron. All of these results are less than the evaluation criteria for zinc oxide and iron oxide fumes.

2. Carbon Monoxide

Seven PBZ samples for carbon monoxide were collected on April 16, 1992. Potential carbon monoxide sources in Building 41 include the farm tractor, the fork-lift truck, and cigarette smoke. Carbon monoxide sampling revealed a mean eight-hour TWA concentration of 6 ppm; all exposures were well below the evaluation criteria for carbon monoxide.

3. Ventilation

The air velocity measured at the face canopy hood was 350 feet per minute (fpm). Air velocity measured near the point of fume generation was 125 fpm. This is within the range of capture velocities of 100-200 fpm recommended for welding.[18] Although replacement air* is not provided to Building 41, an overhead door in the wall opposite the tube mill is partially open except on the coldest days, according to employees in the building. According to the employee responsible for maintaining the ventilation system, the ductwork must be cleaned periodically to maintain adequate system performance. This may be the result of inadequate duct velocity, which leads to particulate depositing in the duct. A duct velocity of 1400-2000 fpm has been recommended for zinc oxide fume.[18]

4. Noise

Area noise measurements collected in Building 41 revealed noise (a) in excess of 90 dB(A) at the high frequency welder (probably as a result of the tube cutter nearby), at the tube cutter, and at the apparatus that receives tubing after the cutter and advances it to the de-dimpler; and (b) greater than 95 dB(A) at the hood designed to receive coolant blown from the tubing by compressed air.

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*Replacement air is a ventilation term used to indicate the volume of controlled outside air supplied to a building to replace air being exhausted.

VII. CONCLUSIONS

Based on employee interviews, and review of the OSHA 200 Logs, only one possible episode of metal fume fever, occurring three years ago, was identified. While zinc oxide fume, which is a common cause of metal fume fever, is produced in the welding of galvanized steel and metal-spraying with zinc wire, the processes in this facility appear to be adequately ventilated and controlled.

Further evaluation of noise in Building 41 is required to determine the extent of employee exposure. If employees are over-exposed to noise, then noise controls can be devised that are based on the noise evaluation and analyses.

Excessive carbon monoxide exposure does not appear to be a problem. The limited use of the tractor to move the trailer, during the NIOSH investigation, did not result in carbon monoxide concentrations in excess of the relevant evaluation criteria.

VIII. RECOMMENDATIONS

The following recommendations should reduce potential exposures in the workplace which may adversely affect the health and safety of the workers at T-L Irrigation Company. They are based on observations of the process and work areas, medical interviews, and environmental sampling results.

A. Noise

Although a consultant had recently performed noise measurements in Building 41 prior to our HHE, noise dosimetry and detailed noise analyses are necessary to assess more thoroughly the employees' TWA noise exposure and to determine the sources of, and means to control, excessive noise.

Noise dosimetry should be performed for each employee during a typical day of the tube mill operation to obtain representative noise exposure levels. If eight-hour TWA levels equal or exceed 85 dB(A), a hearing conservation program which complies with the OSHA standard, 29 CFR 1910.95, must be implemented. The program must include monitoring, employee notification, observation, an audiometric testing program, hearing protectors, training programs, and recordkeeping requirements. All of these requirements are included in 29 CFR 1910.95, paragraphs (c) through (o). The OSHA noise standard also states that when workers are exposed to noise levels in excess of the OSHA PEL of 90 dB(A), feasible engineering or administrative controls shall be implemented to reduce the workers' exposure levels. NIOSH recommends that these measures be implemented when noise levels exceed 85 dB(A).

B. Respiratory Protection

If T-L Irrigation Company requires the scarfer to utilize respiratory protection, a respiratory protection program must be developed and implemented as required by the OSHA standard, 29 CFR 1910.134. This standard applies to the use of both respirators with elastomeric facepieces and disposable respirators. The results of air sampling conducted in the scarfer's breathing zone indicated that this job does not require the use of a respirator. The respiratory protection program must include the following provisions:

1. Written standard operating procedures governing the selection and use of respirators
2. Selection of respirators based upon the hazards to which workers are exposed
3. Instruction and training of the user in the proper use of respirators and their limitations
4. Regular cleaning and disinfection of respirators. Respirators used by more than one worker must be cleaned and disinfected after each use
5. Respirator storage in a convenient, clean, and sanitary location
6. Inspection and maintenance of respirators
7. Regular surveillance of work area conditions and the degree of employee exposure or stress
8. Regular evaluation of the program to assure that it remains effective
9. Initial and periodic review of an employee's physical ability to wear a respirator
10. The use of respirators approved or accepted by NIOSH and the U.S. Department of Labor, Mine Safety and Health Administration.

C. Metal Particulate Exposure

While no over-exposures to metal fume were noted as a result of air sampling, workers should be educated about the potential health effects from exposure to metal fume (e.g., metal fume fever). If symptoms associated with exposure to metal fume do arise, the workplace should be promptly evaluated to determine whether control measures are functioning properly.

D. Safety and Health Training

During interviews, many workers, including those with several years experience, had little knowledge of safety and health issues as it relates to this process. Periodic worker training specific to the hazards encountered in the tube mill should be instituted.

E. Safety

1. Because of the possibility of eye contact with coolant splashes and sprays, Building 41 should be provided with an eyewash capable of delivering at least 1.5 liters of water per minute for 15 minutes.[20] Several models are available at reasonable cost.

2. Eye protection which meets the requirements of ANSI Z87.1-1989, including prescription glasses, should be the only eyeware permitted to be worn in Building 41.

3. A guard or warning device should be placed between the spool where the coil is unwound and the beginning of the tube mill to prevent accidental laceration by the coil strip.

4. A safety concern raised in the HHE request was the result of an injury that occurred to an employee who was pinched by the jig that holds tubing for pressure testing. A guard or other protective mechanism should be placed on the clamps which couple with the tubing during pressure testing.

F. Coolant and its Components

1. Potential exposures to coolant and its components that may result from using compressed air to remove coolant from tubing following pressure testing should be evaluated.

2. Due to the use of coolant throughout the process, the company should provide sufficient work clothing to allow workers to change their clothes daily or when they become saturated with coolant. The continuous wearing of dirty or coolant-saturated garments and/or contact with coolants can lead to problematic skin dryness, irritation, and dermatitis.

   While interviewed employees were not presently experiencing skin problems from exposures to workplace coolants, this could become a future problem. Gloves and barrier creams may be used to reduce hand exposures. Additionally, hand moisturizing creams should be made available, and their usage encouraged, for workers with frequent coolant exposure.

G. **Personal Hygiene**

1. Currently, employees eat at a small table adjacent to the production area. They should not be allowed to eat and drink in the work area. Instead, eating and drinking should be done in an uncontaminated area removed from the production area.

2. Smoking should be prohibited in the work area and smoking cessation encouraged. NIOSH recommends that workers should not be involuntarily exposed to tobacco smoke.[18] Exposure to environmental tobacco smoke (ETS) may be responsible for irritant symptoms and can exacerbate allergic symptoms. Further, NIOSH has determined that ETS poses an increased risk of lung cancer and possibly heart disease to occupationally exposed workers.[19] The best method for controlling worker exposure to ETS is to eliminate tobacco use from the workplace and to implement a smoking cessation program. Until tobacco use can be completely eliminated, the employer should make efforts to protect nonsmokers from ETS by isolating areas where smoking is permitted. Separate smoking areas with dedicated ventilation are a means to accomplish this. Air should be exhausted directly outside and not recirculated within the building or mixed with the general dilution ventilation for the building. ASHRAE recommends 60 cubic feet per minute (cfm) per person of outside or transfer air be supplied to the smoking area. A negative pressure should be provided to prevent airflow back into the non-smoking workplace.[19]

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