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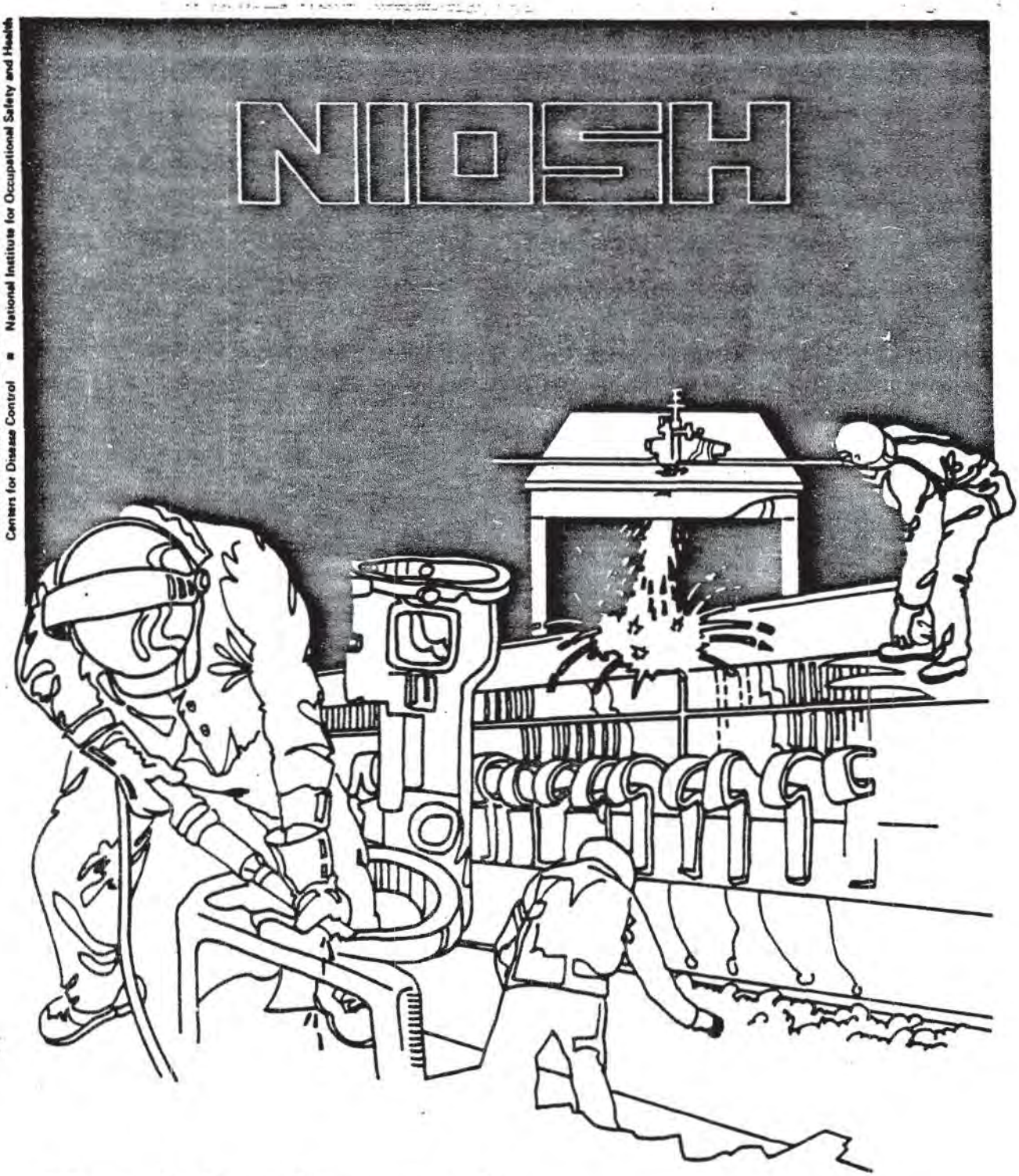

Health Hazard Evaluation Report

HETA 84-213, 391-1619
DULUTH COMMUNITY ACTION PROGRAM
DULUTH, MINNESOTA

PREFACE

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

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

HETA 84-213, 391- 1619
DULUTH COMMUNITY ACTION PROGRAM
DULUTH, MINNESOTA
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I. SUMMARY

On February 27, 1984, the National Institute for Occupational Safety and Health (NIOSH) was requested to evaluate reports of dermatitis and other health problems among personnel working in the Weatherization Program of the Duluth Community Action Program, Duluth, Minnesota. A subsequent request was received by NIOSH on June 11, 1984, regarding employee exposures to vehicle exhaust fumes in the Weatherization Program building.

In April 1984, NIOSH investigators conducted an initial survey visit, and in June 1984, environmental and medical surveys were conducted. Personal and area air samples were collected for total particulate, acetic acid, methylene bisphenyl isocyanate (MDI), and mineral spirits. Workers were surveyed for health problems by means of a self-administered questionnaire.

Instantaneous levels of carbon monoxide ranged from 10 to 40 parts per million (ppm) in the garage area, and 10 to 15 ppm outside the second floor offices while the trucks were being started in the morning (NIOSH recommended standard: 200 ppm ceiling). Eight-hour time-weighted average (TWA) concentrations of total particulate ranged from 4.3 to 34.5 milligrams per cubic meter of air (mg/M^3), with a mean of 13.1 mg/M^3. Two samples exceeded the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 10 mg/M^3, and the Occupational Safety and Health Administration (OSHA) standard of 15 mg/M^3; however, personnel at these sites wore NIOSH/MSHA approved respirators. Eight-hour TWA's of acetic acid measured during silicone caulking ranged from 0.6 to 1.9 ppm, with a mean of 1.4 ppm, and ceiling concentrations ranged from 2.8 to 8.2 ppm, with a mean of 5.6 ppm (OSHA standard: 10 ppm 8-hour TWA; ACGIH short-term exposure limit: 15 ppm). No mineral spirits were detected above 0.1 mg/sample during acrylic caulking. MDI ceiling concentrations of 0.019 and 0.011 mg/M^3, and 8-hour TWA's of 0.005 and 0.003 mg/M^3 were measured in personal and area samples during application of foam sealant (OSHA standard: 0.2 mg/M^3 ceiling; NIOSH recommended standard: 0.05 mg/M^3 10-hour TWA).

Of 26 employees who completed the self-administered questionnaire, all but three worked regularly with both caulk and cellulose. Twenty-three (88%) reported nose or throat irritation within the preceding two weeks; 22 (85%) reported eye irritation. Thirteen (50%) reported work-related shortness of breath. Other commonly reported symptoms included skin irritation (attributed to cellulose and fiberous glass) and dizziness (attributed to caulk).

On the basis of the data obtained during this investigation, NIOSH determined that a potential overexposure to nuisance particulate existed at the time of this survey, although the use of respirators should have greatly reduced this hazard. Symptoms reported by the employees were compatible with exposures to several of the insulating materials with which they worked. Recommendations for alleviating potential hazards are included in Section VIII of this report.

Key Words: SIC 8999, Insulation, Cellulose, Caulk, Mucous Membrane Irritation

II. INTRODUCTION

On February 27, 1984, a representative of the Amalgamated Clothing and Textile Workers Union (ACTWU) requested that NIOSH conduct a health hazard evaluation at the Weatherization Program of the Duluth Community Action Program, Duluth, Minnesota. The requestor was concerned with complaints of dermatitis and other health problems among employees working with various insulating materials used for weatherizing homes. On June 11, 1984, NIOSH received a subsequent request from the ACTWU local union to evaluate exposures of Weatherization employees to vehicle exhaust fumes.

On April 3 & 4, 1984, NIOSH investigators conducted an initial survey. An opening conference was conducted with representatives of the management and local union during which background information was obtained relating to the basis for the request, the workforce, substances used, and the nature of the insulation operations. On the following day, individual worksites were visited and observations were made of various activities being conducted. On June 19, 1984, a medical survey was conducted during which workers were surveyed for health problems by means of a self-administered questionnaire. On June 20 & 21, 1984, an environmental survey was conducted during which personal and area air samples were collected to assess employee exposures to the various substances used in the weatherization activities and exhaust fumes in the weatherization offices during vehicle starting.

III. BACKGROUND

The Duluth Community Action Program, Inc. (DCAP), Duluth, Minnesota, is a private, non-profit corporation which provides fuel assistance and home weatherization for low income residents in the Duluth area. The Weatherization Program is responsible for administering, coordinating, and conducting the various activities involved in weatherizing homes to increase their energy efficiency. At the time of the initial survey, the Program employed approximately 45 persons. Thirty-four of these individuals were classified as "technicians" and were responsible for carrying out the day-to-day weatherization activities.

The headquarters for the DCAP Weatherization Program is housed in a multi-level building, with the office space located on the upper floors and material storage and garage space located on the facility's lower level. Weatherization technicians usually work in groups of two or three, each assigned to a small truck which is parked in the garage area of the building. Each morning, appropriate supplies for the day's activities are loaded into the truck, and the teams drive to their designated work assignment. The amount of time spent by each crew at any one location may range from one to two days, depending on the amount of person-hours and materials expended. In some instances, more than one crew may work at a single location. The types of weatherization activities carried out at each residence are largely determined by a previously conducted energy audit.

Several insulating materials are used in the majority of the activities carried out by the Weatherization Program employees. These include:

1) Cellulose Insulation Application - Cellulose insulation is composed primarily of dry newsprint, with borax and boric acid added for fire resistance. This task requires a minimum of two employees. One employee dumps bags of the cellulose into a hopper located off the rear of the weatherization truck, and a motor at the bottom of the hopper blows the insulation material through a long hose to its point of application. Its flow and distribution are controlled by a second employee through the use of a regulator on the end of a hose. The cellulose is generally distributed directly between the rafters of attics or into holes drilled in the outside walls of the residences.

2) Caulking - Three basic types of caulk were used in the weatherization activities at the time of the survey. A silicone caulk was used primarily in basements and other indoor and outdoor areas where appearance was not critical. Acrylic latex caulk, which could be painted to blend with woodwork, etc., was used in indoor living areas. A copolymer caulk was used only in outdoor applications. The various caulks were supplied in tubes and applied manually using caulking guns.

3) Foam Sealant Application - The foam material used in the weatherization activities was composed of a moisture curable polyurethane resin, polymers of methylene bisphenylisocyanate (MDI) and a fluorocarbon propellant, all contained in a pressurized cannister. Although not utilized on a regular basis, this material was occasionally required to fill the larger size cracks and openings for which the use of caulk was not feasible.

4) Fiberglass Application - Fiberglass was used in a variety of applications, such as wrapping ductwork, insulating attics and crawl spaces, etc. The fiberglass used was the commercially available type which was supplied in rolls with a backing material on one side.

5) Miscellaneous - Several other activities take place which use a variety of other materials. Spray painting of doors, windows and other parts was periodically conducted. Roof vents were occasionally installed.

A variety of types of personal protective equipment was used by the employees in carrying out these tasks. The types of NIOSH/MSHA approved respiratory protection which were available included: half-mask respirators with dusts, fumes, and mist cartridges (used for blowing cellulose in attics); half-mask respirators with organic vapors cartridges (indoor caulking); and disposable dust masks (loading cellulose into hoppers). Protective clothing such as disposable coveralls was used in activities such as working with fiberous glass, and protective gloves were used in a variety of activities. Administrative controls included a semi-informal break policy when

working in hot or confined areas, with employees encouraged to open doors and windows for ventilation when possible.

IV. MATERIALS AND METHODS

A. Environmental

1) Carbon Monoxide

On June 20 & 21, 1985, an environmental survey was conducted at the Duluth Community Action Program. Area samples, designed to reflect general air concentrations of carbon monoxide, were collected in the garage area and in a second floor stairwell of the Weatherization office building. Samples were collected using a Drager® hand-pump and Drager® Carbon Monoxide 5/c colorimetric indicator tubes during a 45-minute period at the start of the work-shift as trucks were started and left the garage area.

2) Insulation Components

Personal samples, designed to reflect employee exposure, were collected near the breathing zone of the employees to assess airborne exposures to the various insulating materials and their components being used at four separate residential locations where insulating activites were being conducted. The samples were collected using battery-powered sampling pumps connected via Tygon® tubing to the collection media. The number of samples, collection medium, pump flow rate, and method of analysis are described below according to the specific type of insulation material which was being used.

a) Cellulose Insulation
Five pre-weighed polyvinyl chloride (PVC) filter samples were collected at 1.5 liters per minute (Lpm) for analysis of total particulate weight by gravimetric weighing.[1]

b) Caulk
Four Supelco ORBO-53 silica gel sorbent tube samples were collected at approximately 200 cubic centimeters of air per minute (cc/min) for analysis of acetic acid by NIOSH method No. 7903.[1]

Three charcoal sorbent tubes, one high volume sample collected at approximately 1 Lpm for screening purposes, and two tubes collected at approximately 200 cc/min, were analyzed for mineral spirits by NIOSH method No. 1550 with modifications.[1]

c) Foam Sealant
Two reagent-impregnated glass fiber filter samples were collected at approximately 1.0 Lpm for analysis of MDI by NIOSH Method P&CAM 347.[2]

A complete listing of the location and duration of sample collection is provided in Tables 1 through 4.

B. Medical

On June 19, 1984, a medical survey was conducted during which workers were surveyed by means of a self-administered questionnaire that addressed symptoms, type of work done, exposures, and the use of personal protective equipment.

V. EVALUATION CRITERIA

A. General

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for 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 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, 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 at the level set by the evaluation criterion. These combined effects are often not considered in 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: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is required by the Occupational Safety and Health Act of 1970 (29 USC 651, et seq.) to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits (STEL) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

B. Specific Substances

1) Carbon Monoxide - Carbon monoxide can be produced as a waste product of the incomplete combustion of fuel in gasoline-powered engines. In the human body, carbon monoxide combines with hemoglobin to form carboxyhemoglobin, which interferes with the ability of blood to carry oxygen to the tissues. The typical signs and symptoms of carbon monoxide poisoning are headache, dizziness, drowsiness, nausea, vomiting, collapse, coma, and death. Carbon monoxide at low levels may initiate or enhance deleterious myocardial alterations in individuals with certain pre-existing heart conditions.[3] The NIOSH recommended standard for carbon monoxide is 35 ppm for up to a 10-hour TWA, and a ceiling concentration of 200 ppm.[3] The ACGIH recommended TLV and the present OSHA standard for carbon monoxide are 50 ppm as an 8-hour TWA; in addition ACGIH recommends a STEL of 400 ppm.[4,5]

2) "Nuisance" Particulate - The bulk of the material composing the cellulose insulation would be considered to be nuisance dust. In contrast to fibrogenic dusts which cause scar tissue to be formed in the lungs when inhaled in excessive amounts, so-called "nuisance" dusts are stated to have little adverse effect on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. The nuisance dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lung when inhaled in sufficient amount. However, the lung-tissue reaction caused by inhalation of nuisance dusts has the following characteristics: (1) The architecture of the air spaces remains intact, (2) Collagen (scar tissue) is not formed to a significant extent, and (3) The tissue reaction is potentially reversible.[6]

   Excessive concentrations of nuisance dusts in the workroom air may seriously reduce visibility, may cause unpleasant deposits in the eyes, ears and nasal passages, or may cause injury to the skin or mucous membranes by chemical or mechanical action per se, or by the rigorous skin cleansing procedures necessary for their removal.[6] The current OSHA standard for nuisance particulates is 15 milligrams per cubic meter of air (mg/M^3) as total dust, and 5 mg/M^3 as respirable dust as an 8-hour TWA.[4] ACGIH recommends a TLV of 10 mg/M^3 for total dust.[5] There is presently no NIOSH recommended standard for nuisance dust.

3) Sodium Tetraborate Pentahydrate - This material, along with boric acid, is used as a fire retardant in cellulose insulation.

Tetraborates may cause acute irritation when they come in contact with the mucous membranes of the eyes, nose, and respiratory tract. They also may cause irritation from skin contact. Sufficient studies have not been conducted to date to establish if inhalation of these substances can cause chronic respiratory effects.[6] The ACGIH TLV for sodium tertraborate pentahydrate is 1 mg/m^3 as an 8-hour TWA.[5] There is presently no NIOSH recommendation or OSHA standard for sodium tetraborate pentahydrate.

4) Acetic Acid - Silicone caulking compounds may contain an acetoxy functional siloxane which can emit acetic acid upon exposure to moist air or water.[7] Short-term exposure to acetic acid vapors may produce irritation of the eyes, nose, throat, and lungs. Eye irritation has been noted at concentrations below 10 ppm, and unacclimatized humans may experience extreme eye and nasal irritation at concentrations in excess of 25 ppm. Exposure to 50 ppm or more is intolerable to most persons and results in intense lacrimation and irritation of the eyes, nose, and throat. Acetic acid is also a primary skin irritant, and individuals with pre-existing skin disorders may be more susceptible to this effect.[8] While there is no NIOSH recommended standard, both the ACGIH TLV and the OSHA standard for acetic acid is 10 ppm as a 8-hour TWA, and ACGIH recommends a STEL of 15 ppm as a 15-minute TWA.[4,5]

5) Mineral Spirits - Mineral spirits are used as a solvent in some acrylic latex caulks, and are generally composed of a mixture of hydrocarbons that have a boiling range of 150 - 200°C.[7,9] Exposure to mineral spirits at concentrations of 2,500 mg/M^3 and greater have been shown to cause nausea and vertigo in humans. Mineral spirits have also been shown to cause dermatitis.[9] The NIOSH recommended standard for mineral spirits is 350 mg/M^3 for up to a 10-hour TWA, and 1,800 mg/M^3 as a 15-minute ceiling.[9] No environmental limits specifically for mineral spirits have been set by ACGIH or OSHA.

6) MDI - MDI is a strong irritant of the eyes and mucous membranes, and repeated or prolonged exposure of the skin to MDI may cause a rash.[8] MDI vapor is also a respiratory irritant and a potent respiratory sensitizer. With continuing exposure, a person can become hypersensitive (allergic) to it, and further exposure, even to extremely low levels, may trigger asthmatic episodes. The NIOSH recommended standard for MDI is 0.2 mg/M^3 as a 10 minute ceiling concentration, and 0.05 mg/M^3 as a TWA.[8] The ACGIH TLV and the current OSHA standard are a ceiling concentration of 0.2 mg/M^3.[4,5]

7) Fiberous glass - Glass fibers used in insulation materials range from 5 to 15 microns in diameter and are usually coated with a binder (e.g. a phenol-formaldehyde-type resin) and a lubricant (e.g., mineral oil).[6] The primary health effects associated with larger diameter fibers (above 3.5 microns) involve skin, eye, and upper respiratory tract irritation. On the basis of currently available information, NIOSH does not consider fiberglass to be a substance

that produces cancer as a result of occupational exposure; however, NIOSH considers the hazard potential of fiberous glass to be greater than that of nuisance dust.[10] The NIOSH recommended standard for fibrous glass is 5 mg/M^3 of air for up to a 10-hour TWA.[10] The ACGIH, citing the lack of evidence of adverse health effects from inhaled fiberous glass dust, recommends a TLV of a nuisance-type dust, 10 mg/M^3 as an 8-hour TWA.[6]

VI. RESULTS

A. Environmental

The results of the five detector tube measurements taken in the garage area during the half-hour period when trucks were leaving the building at the start of the work shift showed instantaneous levels of carbon monoxide ranging from 10 to 40 ppm, with a mean of 27 ppm. Measurements conducted on the stairwell outside the second floor offices showed instantaneous concentrations of 10 and 15 ppm during this period. No measurements exceeded the NIOSH recommended ceiling of 200 ppm.

The results of the personal samples collected for the various components of the insulation materials are presented in Tables 1 - 4. Two types of TWA's are presented in these tables. Since most of the activities required only a portion of the workshift to complete, the first TWA presented represents a TWA concentration for the actual duration of the task being conducted (or sampling period). Assuming uniform material usage and exposure conditions, this value would be appropriate for comparison to ceiling criteria. In addition, these values could also be used to provide a "rough" estimate of what the 8 or 10-hour TWA would be if the operation had been conducted over the entire length of the shift under similar exposure conditions. The second TWA presented is a calculated 8-hour TWA which assumes no additional exposure to the substance during the remainder of the workshift. This TWA is appropriate for comparison to 8 and 10-hour evaluation criteria.

As seen in Table 1, concentrations of total particulate exceeded the evaluation criteria for nuisance dust. The highest concentrations were present in personal samples collected during the blowing of cellulose into attic areas, with 8-hour TWA's of 20.8 and 34.5 mg/M^3 found at the two different sites monitored. Both values exceeded the ACGIH recommended TLV of 10 mg/M^3 and the OSHA standard of 15 mg/M^3 for an 8-hour TWA. Concentrations were significantly lower when blowing insulation in outside walls (5.2 mg/M^3) and during the loading of the hopper off the back of the weatherization truck (5.2 and 4.3 mg/M^3). It should be noted that all personnel working at these activities were wearing NIOSH/MSHA approved respiratory protection, which if properly used and fitted, should have greatly reduced the actual exposures.

Table 2 shows concentrations of acetic acid measured during the application of silicone caulk. Eight-hour TWA's ranged from 0.6 to 1.9 ppm, with a mean of 1.4 ppm. All values were below the OSHA 8-hour TWA

of 10 ppm. Ceiling concentrations of acetic acid ranged from 2.8 to 8.2 ppm, with a mean of 5.6 ppm. Although some probability of sample loss existed due to the presence of analyte on the backup sections of the sorbent tubes, these values would still be expected to be below the ACGIH STEL of 15 ppm.

Table 3 shows that although mineral spirits were detected directly above a bulk sample of fresh acrylic caulk, they were not detected in either of the two personal samples collected during the application of the caulk (limit of detection: 0.1 mg/tube).

Table 4 shows ceiling concentrations of 0.019 and 0.011 mg/M^3 for MDI in a personal and area sample, respectively. The calculated 8-hour TWA's for these samples were 0.005 and 0.003 mg/M^3. These concentrations of MDI were below the OSHA ceiling standard of 0.2 mg/M^3 and the NIOSH recommended standard of 0.05 mg/M^3 as a TWA.

B. Medical

Twenty-six questionnaires were completed; these were from 15 men, 10 women, and one person of unspecified gender. The workers ranged in age from 25 to 58 years (one person's age unknown), with a median of 36. Twenty-four were white, one was Asian, and one was Native American. The 26 respondents had worked for the Duluth Community Action Program for 6 to 46 months, with a median of 20 months. Twelve (46%) were current cigarette smokers; 22 (85%) reported exposure to cigarette smoke (theirs, a co-worker's, or a homeowner's) at the job site.

Twenty-three (88%) of the 26 respondents reported currently working with both caulk and cellulose on a regular basis. Seventeen (74%) of the 23 who answered the question reported exposure to solvents, with the average daily exposure time ranging from one-quarter to one hour, typically half an hour. Twenty-two (85%) reported using respiratory protection at work; in about one-third of the cases this was apparently limited to a dust mask.

Twenty-three (88%) of the respondents reported work-related nose or throat irritation within the preceeding two weeks; 22 (85%) reported eye irritation. Only one person reported neither symptom. Thirteen (50%) reported work-related shortness of breath. Other commonly reported symptoms included (a) itching and skin irritation, attributed to cellulose and fibrous glass; and (b) dizziness, attributed to caulk. Other, less frequently reported symptoms included nausea, headache, and fatigue, which were attributed to caulk, solvents, and "carbon monoxide" (vehicle exhaust in the truck bay).

VII. DISCUSSION

A. General

The majority of the materials used by the employees of the

Weatherization Program should not present a health hazard under normal conditions of use. However, there are several factors which might increase the hazard potential of these materials. These include the following:

1) Frequency of use - While a homeowner may use these materials infrequently, the employees of the Weatherization Program come into contact with many of the insulating materials on a day-to-day basis. Therefore, special attention should be given to identifying and preventing any problems associated with repeated use of these substances. Examples of these would be materials which could cause pulmonary problems or allergic reactions, and materials which could cause dermatitis from repeated contact.

2) Conditions of use - Since many of the areas where insulating materials are required often are poorly ventilated (e.g. basements, attics), some components of the materials being used may reach concentrations in excess of those which would normally be encountered during use in the outdoors or in well ventilated areas. It is therefore necessary to examine each material in light of the individual area in which it is to be utilized and to make decisions as to the need for improving ventilation or utilizing personal protective equipment.

3) Heat Stress - While this would not be expected to be a problem for much of the year due to the relatively cool climate of Duluth, it should none the less be considered during the warmer times of the year. Working in the confined areas or in the outdoors in hot weather presents a potential for heat related problems, particularly while performing demanding physical activities. These problems can be further intensified by the use of negative pressure respirators which may add to the physiological demands on the body during the performance of moderate or higher levels of work.

4) Hazards from existing materials - Since many of the houses requiring weatherization are older, hazards associated with existing building materials must also be considered. Asbestos, in particular, is a material which was widely used in the past as an insulating material. This would present a special hazard if present in a deteriorated state that would render it friable or capable of becoming airborne.

B. Survey Results

The results of the environmental samples indicated that the greatest potential for overexposure to the materials examined during this survey appeared to occur during the blowing of cellulose in attics. While the samples indicated excessive exposure to nuisance dust, the potential for overexposure to other components of the cellulose insulation also was present. Sodium tetraborate pentahydrate, although not specifically measured in the samples, was present in the bulk cellulose insulation in sufficient concentration that it could also have exceeded the ACGIH TLV.

The remaining samples collected during the environmental survey did not indicate any exposures in excess of the evaluation criteria. However, based on the results of the medical questionnaires, there was still a substantial number of employees reporting symptoms that they attributed to the various materials used. It is probable that instances of acute respiratory or eye irritation could have been caused by brief exposures to high contaminant concentrations, for example, application of a large amount of caulk over a short time in a poorly ventilated area or applying fiberglass directly overhead in a small work area. Such instances would seemingly indicate a need for improving ventilation in the area, or as a second choice, the use of eye and/or respiratory protection. Instances of skin irritation, while frequently reported, should be easily amenable to control through a combination of good work practices, good personal hygiene, and the use of proper personal protective equipment.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Since the time that the original request was submitted, increased emphasis has been placed on safety and health by the Weatherization Program of the Duluth Community Action Program. Following a site visit by a member of the International Union's Safety and Health Department which prompted the request, the use of some materials (e.g., specific caulking compounds) and work practices (e.g., drilling asbestos siding) were discontinued. Material safety data sheets and toxicity information are now collected for all materials in use. Specific policies and guidelines regarding work practices and personal protective equipment have been developed for the various job tasks. Select employees responsible for overseeing the safety and health program have received some training and attempts have been made to utilize the available safety and health expertise in the area for consultation. All of these efforts are commendable and should greatly help to enhance the programs effectiveness and help alleviate any potential problems which might arise from the use of the various materials used in weatherization.

Following is a list of general recommendations for working with the various insulation materials. Most of these recommendations have already been implemented, but they are provided below for the purpose of reinforcing current policies and procedures and for providing guidance for the development of any new procedures.

A. Material Selection

1. Material Safety Data Sheets should be obtained for all materials and their contents should be evaluated prior to use.

2. Consideration should be given to substituting less toxic materials in instances where:
   a) the materials contain components of relatively high toxicity, or
   b) the materials cause repeated health problems or complaints among employees.

B. Engineering Controls

The use of local exhaust ventilation is often not feasible due to the constantly changing work environments. However, problems associated with poor ventilation can be minimized through maximizing the effects of natural ventilation so as to increase fresh air movement, (i.e., by opening existing windows and doors to create cross-ventilation). In addition, the use of portable fans or air moving devices might further facilitate air movement and vapor dillution in certain situations.

C. Personal Protection

1. Respirators - In situations where exposures cannot be effectively controlled by other means, the use of respiratory protection may be necessary. Based on the information collected during this survey, employees should continue to use NIOSH/MSHA approved respiratory protection when blowing cellulose insulation in attics or other confined areas. In addition, appropriately selected respiratory protection should be used in instances where employees encounter respiratory irritation or when work conditions indicate the possibility that high dust or vapor concentrations may be generated. A respiratory protection program should be in place to assure proper selection, fitting, use, and care of respirators. Employees required to use respirators should receive medical examinations to determine if they are physically able to perform work while wearing a respirator.

2. Protective Eyewear - Tight-fitting goggles may help to reduce eye irritation encountered when working with irritating materials. In addition, safety glasses should be worn when using saws or other powered portable tools that present the possibility of eye injury.

3. Protective Clothing - Decisions on whether to wear gloves or other protective clothing will depend on the nature of the work, as well as the nature of the materials involved. Protective gloves should be used when working with materials that cause irritation of the skin from direct contact, present a potential for dermatitis from repeated contact, or might be absorbed through the skin to cause other toxic effects. The gloves used should be of a type designed to protect against the substance of concern. In some instances, such as when working with fiberglass, some workers may become toughened to the fibers and may not need to wear gloves; others who may not have become "hardened" could experience irritation from intermittent exposure.

   Additional protective clothing should also be considered on the basis of specific job activity. Materials such as fiberglass can collect on work clothing and cause irritation as they work themselves through the garment with repeated wear. For jobs which involve contact with large amounts of irritant dust, disposable coveralls or regularly laundered work clothes may be necessary to prevent skin irritation.

D. Work Practices

The utilization of proper work practices is the area where the employees can make the greatest contribution to a safe and healthful workplace, both for themselves and their fellow workers. A few examples of such practices are given below.

1. Any contact with or disturbance of materials believed to contain asbestos should be avoided.

2. Spray painting and use of solvents should be conducted outdoors or in well-ventilated areas to prevent the buildup of toxic or flammable vapor concentrations.

3. Fiberous glass materials should be cut using proper techniques that minimize fiber dispersion. When working in confined spaces, materials should be pre-cut when possible to minimize the fiber concentration in the work area itself.

E. Administrative Controls

To prevent the possibility of heat-related illness during warm weather, a sufficient number of short breaks should be included in work in a hot environment. Jobs requiring the use of negative pressure respirators during the performance of moderate to heavy work may require more frequent breaks than usual.

F. Personal Hygiene

Since a variety of materials can cause skin problems, good personal hygiene is of primary importance if dematologic problems are to be avoided or minimized. Employees should be instructed to use available hand washing facilities on a regular basis.

G. Employee Training

Employees should be properly trained regarding all job safety and health procedures. This training should occur at the start of employment for any new hire, at the initiation of any new job procedure, and periodically thereafter. In addition to training in safe job procedures, employees should receive training on the proper use of respirators and other personal protective equipment. Employees should be instructed to report any health problems related to material usage so that the possible need for further protective measures can be assessed.

H. Vehicle Exhaust

In order to reduce the possibility of a buildup of excessive concentrations of carbon monoxide or other vehicle exhaust gases, engines should be frequently maintained to provide for efficient fuel combustion. Garage doors should be kept open during starting, and trucks should not be "warmed-up" in the garage area, but should be driven outside immediately after starting.

X. REFERENCES

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XII. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from the NIOSH publications office at the Cincinnati, address. Copies of this report have been sent to the following:

A. Duluth Community Action Program, Inc.
B. Amalgamated Clothing and Textile Workers Union - Twin City Joint Board
C. U. S. Department of Labor, OSHA - Region V
D. NIOSH Regional Offices/Divisions

TABLE 1
Results of Personal Samples Collected for Total Particulate
Duluth Community Action Program, Inc.
(June 20 & 21, 1984)

Job Description	Sample Time (minutes)	Sample Volume (Liters)	TWA Concentration for Sample Duration (mg/M3)	8-hour* TWA Concentration (mg/M3)
Cellulose Blowing (attic)	43	64.5	232.1	20.8
Hopper Loading (on truck)	57	85.5	7.4	0.9
Cellulose Blowing (outside walls)	156	234.0	16.1	5.2
Cellulose Blowing (attic)	130	195.0	127.4	34.5
Hopper Loading (on truck)	120	180.0	17.1	4.3
Evaluation Criteria: Nuisance Particulate				10 (ACGIH) 15 (OSHA)

TABLE 2
Results of Personal Samples Collected for Acetic Acid
Duluth Community Action Program, Inc.
(June 20 & 21, 1984)

Job Description	Sample Time (minutes)	Sample Volume (Liters)	TWA Concentration for Sample Duration (ppm)	8-hour* TWA Concentration (ppm)
Silicone Caulking (basement)	40	8.0	2.8	0.6
Silicone Caulking (basement)	103	20.6	8.2**	1.8**
Silicone Caulking (basement)	124	26.5	7.4**	1.9**
Foam Application (basement - this employee was not working directly with caulk, but was working in the same area as the employee represented by the previous sample.)	131	26.2	4.1**	1.2**
Evaluation Criteria:			15 STEL (ACGIH)	10 (OSHA)

*8-hour values are calculated on the assumption that no additional exposure occurred during the remainder of the 8-hour work shift.
**A probability of sample loss exists due to high levels of acetate (22 - 25%) found on the back sections of these tubes.

Abbreviations: mg/M^3 - milligrams of contaminant per cubic meter of air
ppm -parts of contaminant per million parts of air
TWA - Time-weighted average

TABLE 3

Results of Environmental Samples Collected for Mineral Spirits
Duluth Community Action Program, Inc.
(June 20 & 21, 1984)

Job Description	Sample Time (minutes)	Sample Volume (liters)	TWA Concentration (mg/m3)
Acrylic Caulking (interior)	44	8.8	< 0.1 mg/tube
Acrylic Caulking (interior)	126	26.6	< 0.1 mg/tube
Bulk Area - Above Fresh Acrylic Caulk	65	65	76.9

TABLE 4

Results of Environmental Samples Collected for Methylene Bisphenyl Isocyanate
Duluth Community Action Program, Inc.
(June 21, 1985)

Job Description	Sample Time (minutes)	Sample Volume (Liters)	TWA Concentration for Sample Duration (mg/M3)	8-hour* TWA Concentration (mg/M3)
Foam Applicator (basement)	132	132	0.019	0.005
Area: Mid-Room/ during foam application	128	192	0.011	0.003
Evaluation Criteria:			0.2 (OSHA)	0.05 (NIOSH)

*8-hour values are calculated on the assumption that no additional exposure occurred during the remainder of the 8-hour work shift.

Abbreviations: mg/M^3 - milligrams of contaminant per cubic meter of air
TWA - Time-weighted average

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