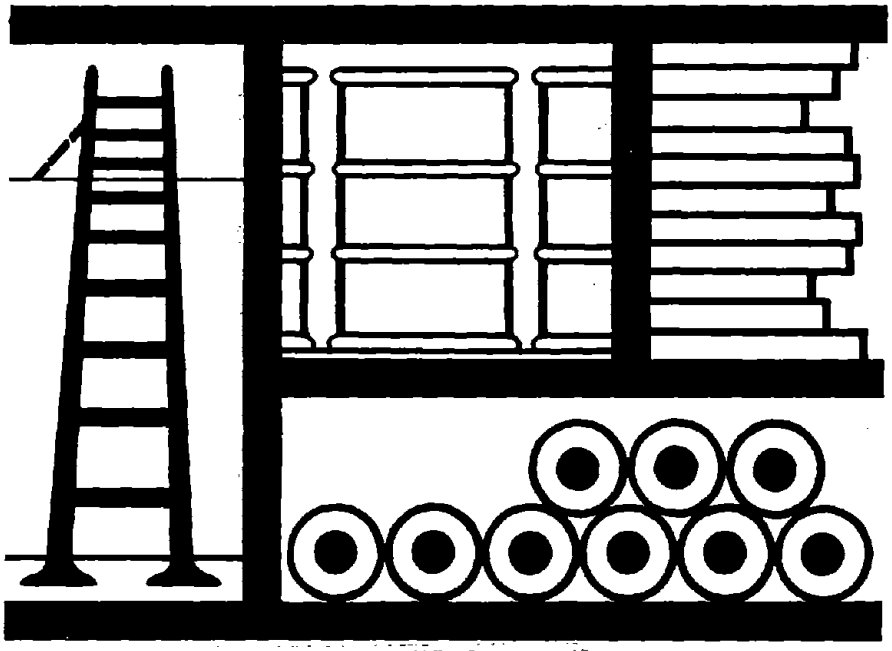
NIOSH

HEALTH & SAFETY GUIDE FOR THE COMMERCIAL ROOFING INDUSTRY



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health

50272-101

NIOSH-00108448

REPORT DOCUMENTATION PAGE	1. REPORT NO. 78-194	2. NA	3. Recipient's Accession No. PB82 103052
4. Title and Subtitle: Health and Safety Guide for the Commerical Roofing Industry			5. Report Date: September, 1978
			6. NA
7. Author(s): Anonymous			8. Performing Organization Rept. No. NA
9. Performing Organization Name and Address: NIOSH, Division of Technical Services, U.S. Department of H.E.W., Cincinnati, Ohio			10. Project/Task/Work Unit No. NA 11. Contract(C) or Grant(G) No. (C) (G) NA
12. Sponsoring Organization Name and Address: Same as Above			13. Type of Report & Period Covered: NIOSH numbered publication 14. NA

15. Supplementary Notes

NA

16. Abstract (Limit: 200 words)

Guidelines for safe work practices in the commercial roofing industry (SIC-1761) are presented. Hazards are identified and specific preventive measures are proposed. High risk operations are identified and hazards relating to emissions of hot bitumen, tearoff operations, burns, organic solvent exposure, climatic extremes, lifting devices, perimeter guards, power lines, ladders, tankers and towing kettles, materials handling, and equipment cleaning are described. Considerations for worker training and provisions for medical and first aid care are also discussed. OSHA standards applicable to roofing practices are listed.

17. Document Analysis a. Descriptors

Chemical-exposure, Materials-handling, Work-practices, Work-environment, Risk-factors, Climatic-factors, Industrial-equipment, Emergency-care, Health-services, Standards

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement: Available to the Public	19. Security Class (This Report): NA	21. No. of Pages: NA
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77)

HEALTH AND SAFETY GUIDE

FOR

THE COMMERCIAL ROOFING INDUSTRY

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Division of Technical Services
Cincinnati, Ohio

September 1978

ACKNOWLEDGMENTS

This guide was prepared under the direction of Gerald J. Karches, Chief, Technical Information Development Branch (TIDB), National Institute for Occupational Safety and Health (NIOSH), with the help of individuals from the NIOSH Regional offices. Information was obtained from roofing contractors, unions, state and federal agencies, trade associations, insurance companies, university researchers, NIOSH studies, and through site visits at various locations. P. A. Froehlich, Chief, Technical Publications Development Section, TIDB, had responsibility for preparation of the guide. Principal contributor to its development was Peter A. Doob, Industrial Hygienist, TIDB. Gregory M. Coffey, Writer-Editor, Information Support Services Section, edited the document.

DHEW (NIOSH) Publication No. 78-194

CONTENTS

INTRODUCTION. 1
SITUATIONS OF GREATEST RISK
AND RECOMMENDED PREVENTIVE MEASURES 4
Rushed jobs. 4
Inhalation of, and skin exposure
to, the emissions of hot bitumen 6
Tearoff operations 21
Thermal burns. 27
Organic Solvents used in roofing 36
Roof openings and holes. 40
Extremes of climate. 41
Lifting apparatus. 45
Perimeter guarding 49
Power lines. 54
Ladder safety. 55
Driving tankers and towing kettles 57
Materials handling 58
Safe Cleaning of equipment that
has held hot pitch or asphalt. 62
TRAINING. 63
MEDICAL AND FIRST AID CONSIDERATIONS. 65
MAJOR OSHA STANDARDS APPLICABLE TO ROOFING. . . . 67
SOURCES OF ADDITIONAL INFORMATION 69

INTRODUCTION

Roofing is one of the few industries that rivals underground coal mining--an industry well-known for its hazards--for disabling work injuries. For this reason roofing was one of the five original Occupational Safety and Health Administration (OSHA) target industries, and it later became an OSHA target health industry.

Because of the physical injury hazards found in roofing work, roofing contractors pay some of the highest worker's compensation premiums in the nation. Physical injuries, however, may be only a part of the problem facing roofers--the health effects of roofing work have not been thoroughly investigated.

This publication is intended to help identify hazards in the commercial roofing industry and to suggest preventive measures. Many of the remedies suggested were observed during field visits. Others remain to be developed and tested. Note that substitute methods of greater or equal effectiveness are in no way discouraged.

The Occupational Safety and Health Act, created to assure a safe and healthful place of employment for all workers, places full responsibility for employee protection on the employer. Although OSHA regulations for the construction industry apply generally to roofing, some recognized hazards discussed in this publication are not yet subject to specific regulations. Such known hazards are covered by the Act's general duty clause, which requires employers to protect employees from these dangers--despite the lack of a specific regulation--but leaves

the methods selected up to the employer. At press time work was underway in two areas to clarify the safety obligations of contractors. First, OSHA was considering recommendations for changes in certain of the construction standards (Title 29 Part 1926 of the Code of Federal Regulations, Subparts L and M--ladders, perimeter guarding, and hole and opening guarding). These recommendations were made by its Construction Safety and Health Advisory Committee. Second, the National Institute for Occupational Safety and Health (NIOSH) had begun work on developing a recommended standard for the roofing industry.

Assistance in evaluating occupational hazards and devising remedies can be acquired (at no cost) from several sources listed in the back pages of this guide. Such sources include state consultation programs, OSHA area offices, and NIOSH regional offices. Note that the Act allows for the granting of experimental variances from specific standards--the employer with a better idea for employee protection may well be able to substitute it with OSHA's approval.

The table below gives some insight into the structure of the roofing industry as a whole.[1] These 1971 figures, however, include architectural sheet metal workers and residential roofers. The latter group is heavily represented in the first two categories (1-3 and 4-7 employees).

Numbers of Contractors	Average Number of Employees	Total Employees
5531	1-3	11,000
2600	4-7	14,000
2400	8-19	32,000
1050	20-50	31,000
250	50-100	18,000
65	100+	7,800

This publication is limited to "commercial" roofing. By this term we refer to all built-up and floating membrane roof work--including tearoff, repair, and resaturant jobs-- and all waterproofing work performed by roofing contractors. The term "bitumen" is used in this guide to refer to both asphalt and coal tar pitch only where both are meant to be included. The trade term "hot" refers to either melted pitch or asphalt or both. The term "pitch" refers only to coal tar pitch.

The situations of greatest risk discussed below were selected on the basis of job site visits, worker's compensation data, roofing accident studies performed for the National Bureau of Standards and for NIOSH, behavioral studies performed for NIOSH, toxicological studies analyzed in NIOSH criteria documents, NIOSH health hazard evaluations and air sampling studies, and discussions with roofing contractors, employees, trade associations, and the union representing commercial roofers. Work situations not mentioned in this section are not necessarily low-risk--a publication of this type and size is only intended to address major hazards of wide applicability.

SITUATIONS OF GREATEST RISK AND RECOMMENDED PREVENTIVE MEASURES

RUSHED JOBS are a recurrent contributing cause to roofing injuries and disease. Roofing is seasonal work in many areas of the country. Toward the end of the season, especially when winter weather or a rainy season arrives early, and during work seasons that follow particularly severe weather, the number of roofs needing work multiplies. This provides an incentive to tighter job scheduling, and thus to working faster. Further, as a labor-intensive industry, contractors have every reason to seek as fast a pace as quality work and safety will allow. In addition, changes in weather from day to day, or hour to hour, can be obvious inducements to complete enough of the job to prevent an approaching rain storm from damaging the contents of a building being reroofed.

Whatever the reasons for quickening the pace of a job, the contractor, crew leader, and employees should be aware of some of the common problems encountered in such situations. Below are examples of what <u>can</u> happen when the pace of work accelerates.

1. Rather than using a larger kettle, an undersized one may be fired at too great a rate and at elevated temperatures to speed melting and thus increase kettle output. In such situations, inhalation exposure to kettle emissions is increased, as is the risk of a kettle flash.
2. Protective equipment may be left dirty or unused.
3. Perimeter protection and the guarding of roof holes and openings may be inadequate or overlooked.

4. Ladders and bitumen pipes may not be tied off.
5. Materials handling and housekeeping may become sloppy.
6. Equipment defects may be overlooked.
7. To speed the mopping, bitumen may be applied at temperatures exceeding the equiviscous temperature (EVT) stated by the supplier.
8. Risk of severe fatigue or heat stress under unfavorable temperature, wind, and humidity conditions may be increased.
9. Driving of highway vehicles may be performed at excessive speeds for the load and road conditions, or with loads inadequately secured.
10. Inexperienced or inadequatley trained employees hired to supplement the existing crew(s) may be called upon to perform tasks for which training and experience are essential to a safe operation.

The point here is that all the preventive measures recommended in the following sections depend upon a work pace that does not impair the judgment of employees, encourage unsafe shortcuts, or create too great a physical burden on the human body. No amount of training in proper work practices, use of protective equipment, or proper operation of engineering controls can protect the roofer faced with frequent demands for rush work. And in those instances where rush jobs are the rule rather than the exception, training to develop work habits that are incompatible with rush work will likely be viewed by roofers as irrelevant.

INHALATION OF AND SKIN EXPOSURE TO THE EMISSIONS OF HOT BITUMEN (coal tar pitch and asphalt) should be limited to the levels recommended by NIOSH in its proposed standards for these materials published in September 1977. [2,3] These levels were selected after extensive review of the scientific literature pertaining to the known and potential health hazards posed by asphalt and by coal tar products. Because asphalt and pitch were thought to differ considerably in their health hazard potential, the NIOSH recommended standards allowed for considerably greater inhalation exposure to asphalt than to coal tar products.

When NIOSH investigators sampled asphalt and coal tar pitch emissions in roofers' breathing zones in 1977, [4] it was found that many of the persons working with pitch were overexposed. The greatest overexposure occurred at kettles lacking load insertion devices. For workers handling asphalt, the situation was considerably different. Most were <u>not</u> overexposed according to the NIOSH recommended standard, with the exception of operators of kettles not equipped with load insertion devices. Bitumen mist exposure during cold-process and resaturant jobs was not examined in this study.

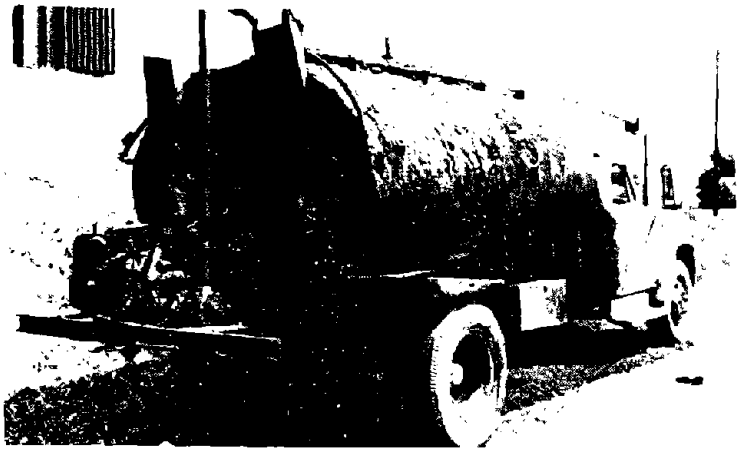
Most roofers are well aware of the short-term effects of exposure to pitch emissions. Pitch fumes are typically very irritating to the breathing passages, as well as to eyes and skin. However, many roofers may not know that pitch fumes contain known and suspected carcinogens--chemicals that may start a tumor growing that might not show up as cancer for 10, 20, or more years. A 1976 study of the causes of death among composition roofers [5] showed that the group studied had as much as twice the rate of death, from respiratory tract and stomach cancers and from nonmalignant respiratory diseases (such as emphysema), as the U.S. male population in general. This study did not determine the cause(s) of the

increased risk, and does not allow conclusions to be drawn without further investigation.

Preventing employee exposure to hot bitumen emissions may be accomplished through the use of engineering controls, personal protective equipment, improved work practices, and administrative controls. Because engineering controls (1) protect all the employees in an area, including non-roofing trades, (2) do not burden the employee with protective equipment, and (3) can be designed to be more effective than personal protection sources, such controls are the preferred solution to job hazards in roofing just as in other construction and manufacturing industries.

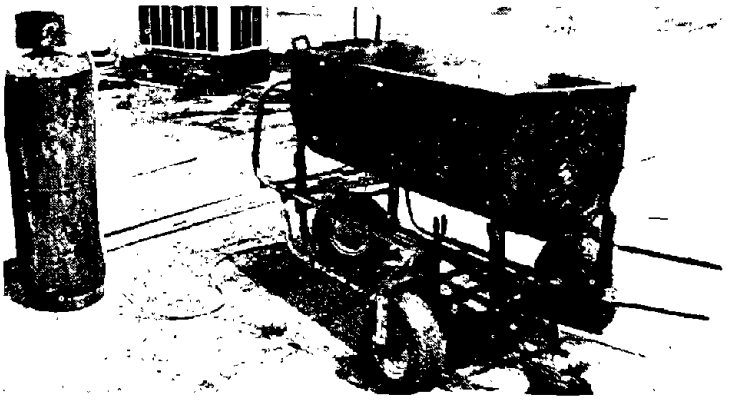
Engineering controls can contain, eliminate, or thermally destroy bitumen emissions. Enclosure is one example of containment. A tanker confines the bulk of the hazardous emissions, since it need not be opened on site for loading. The emissions produced by a tanker are discharged above the breathing zone of ground workers, and are generally well-diluted before reaching roof level.

FIG. 1



TANKER

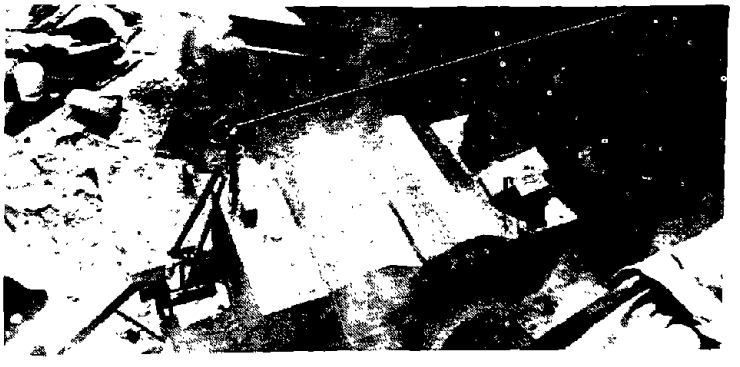
FIG. 2



LIDLESS KETTLE

Kettle emissions can also be contained. Figures 3 & 4 show kettles operating on a calm day next to a one-story building. Even with their covers closed these kettles produced considerable visible emissions. A good seal around the edge of such covers is hard to maintain due to thermal warping, dents, etc. However, some progress has recently been made in this area by reinforcing the covers and by creating a better seal. A thick asbestos rope designed to become coated with bitumen during kettle operation is used to provide the improved seal. Another problem with covers is that they have to be repeatedly lifted to add solid bitumen, and are frequently left entirely open.

FIG. 3



KETTLE WITH LIDS CLOSED

FIG. 4

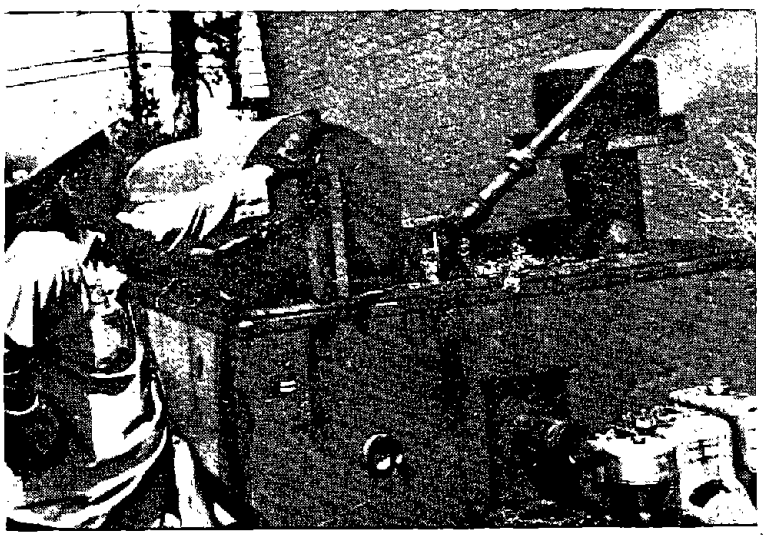
EMISSIONS ESCAPING FROM KETTLE WITH LIDS CLOSED

By contrast, the kettle in Figures 5 & 6 shows a far lower level of visible emissions. In Figure 5 the kettle tender has placed a keg of asphalt into the inner cylinder of a load insertion device. In Figure 6 the outer cylinder is closed--only then can the inner cylinder be rotated to add the keg to the melt. Load insertion devices are available for both new kettles and for retrofitting older models.

FIG. 5

LOADING A KETTLE WITH DUAL CYLINDER LOAD INSERTION DEVICE

FIG. 6



OUTER CYLINDER ON LOAD INSERTION DEVICE CONFINES EMISSIONS AND PREVENTS SPLASH BURNS

In addition to containing emissions, such devices can provide significant protection against splash burns (see Thermal Burns section below). It should be noted, however, that load insertion devices can CREATE safety problems if they are improperly designed or used. Kettle explosions have occurred in two instances involving insertion devices--one where the loading doors on a mail slot type were propped open and another where the asphalt level was allowed to fall to a point where the heated firing tubes were exposed (the latter presumably because the particular insertion device didn't allow for continuous observation of the liquid level).

An explosion can only occur when the concentration of fumes in the kettle is between the upper and lower explosive limits. Above the upper limit the mixture is too rich. Below the lower limit it is too lean. Moreover, an explosion will not occur until the flash point temperature of the melt is reached and a spark, flame, or other ignition source is provided. An exception to the ignition requirement occurs if the

temperature is high enough to reach the autoignition level. A kettle operating normally will never reach the autoignition temperature, unless unusually hot surfaces are created, such as by operating with exposed firing tubes. By contrast, a kettle can all too easily be heated to the flash point temperature of the melt if the operator or heat regulating device doesn't prevent it.

An operator might prop open the door or access port of a load insertion device or run an uncontrolled kettle with the lid open for the following reasons: (1) to keep track of the melt level, (2) to distribute chunks over the surface of the melt more easily, (3) to make the loading of bitumen chunks easier, or (4) to prevent explosions. Keeping track of the melt level and preventing explosions are closely related. Kettles equipped with load insertion devices must have a simple and effective means for the operator to determine the level of the melt in order to prevent intentionally defeated controls or inadvertantly exposed firing tubes. The unequal distribution of chunks over the surface of the melt represents a challenge to designers of load insertion devices, although using a large enough kettle for the job may help minimize the problems arising from less than optimal distribution of chunks in the melt. Defeating the insertion device to make loading easier can be eliminated by correcting the offending work practice or by using a control design (such as the dual cylinder type illustrated) that makes the practice impossible and eases loading as well (larger chunks or whole kegs can be added). The proper use of load insertion devices should be a part of the training given to kettle operators.

Besides containment, attempts to control bitumen emissions have also been made through filtration or condensation of emissions, or by returning them to the burner or to an afterburner for destruction. These controls, called emission eliminators, were first introduced in those areas of the country where

smog was a serious problem. Such air pollution controls also serve to keep the emissions out of the kettle operator's breathing zone. These controls are offered as an option on many new kettles and tankers. Some are available for retrofitting existing equipment.

Emission eliminators can be divided into two groups--those that employ powered air movers and those that do not. In certain situations powered emission eliminators can contribute to the kettle explosions discussed earlier. Since these devices draw fresh air into the kettle as they operate, they may reduce the concentration of contained emissions from a "too rich to flash" level to a concentration within the explosive limits. Properly designed and maintained powered emission eliminators, however, could lower the emission concentration to a level "too lean" to support combustion. Presently available air sampling data [4] do not reflect the emissions exposures of operators using kettles with effective load insertion devices. For this reason it cannot be determined at this time whether allowable breathing air levels of bitumen emissions--particularly pitch--can be met with effective load insertion devices alone, without the necessity for emission eliminating devices or administrative controls (limiting the length of time a worker is exposed).

The discussions below of temperature regulation and reduction do not dispute the necessity for maintaining the equiviscous temperature (EVT) for the particular batch of bitumen at the point of application. However, the cooler a kettle is run, the lower the concentration of the emissions it produces. This means lower breathing hazards and a diminished chance for fires or explosions. The recommendations below are intended to help the contractor run the kettle at the lowest temperature consistent with the applicable EVT.

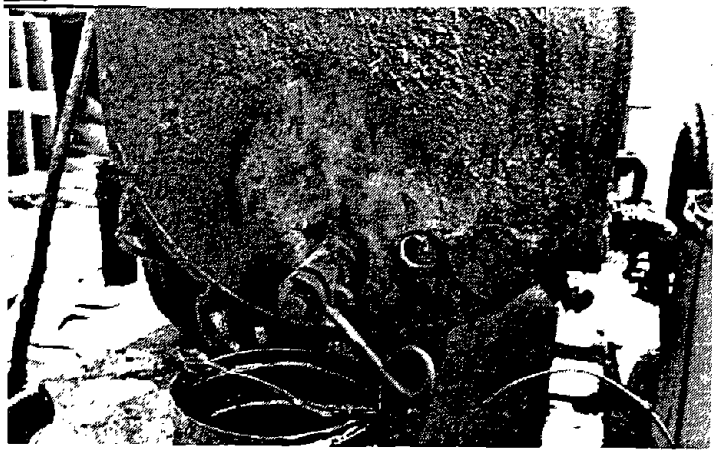
In addition to containment and elimination methods, temperature regulation is another engineering control that can significantly reduce bitumen emissions. Automatic torch regulators are available that thermostatically control kettle temperature. A recent innovation in this area involves the use of thermocouples for accurate kettle temperature measurement and control. Thermocouples are advantageous for this application since they contain no moving or delicate parts, and, being electrical devices, can be part of a rugged thermostatic control device for regulating the heat source.

It is possible, although less effective, to monitor kettle temperature with (1) a hand-held, or (2) remote readout, or (3) direct-reading kettle-mounted thermometer, and to regulate the torches manually based on the readings taken. However, on many older kettles, the kettle-mounted thermometer may not have been mounted by the manufacturer in the most effective location and may not have been sufficiently rugged. One private study [6] showed that kettle temperature was frequently 50-150 degrees F higher than the dial thermometer indicated. Since the temperature of the "hot" was highest at the top of the melt and adjacent to the firing tubes, the study recommended that the temperature sensor be located near the firing torch heating surface. For operation at the lowest temperature consistent with the EVT, it is desirable to measure both "hot spot" and kettle output temperatures separately at the pump inlet area and near the surface of the melt or tubes.

Figure 7 shows a rusted-out thermometer on a kettle. Here another source of temperature monitoring is clearly necessary. (Spitting in the hot, a time-honored technique, is not sufficiently accurate.) Figure 8 shows a thermometer with a protective collar in good working order. Regardless of the type of temperature monitor and regulator used, the device(s) need to be checked against a calibrating

unit on a regular basis, such as monthly. In addition, a log should be kept to ensure that temperature readings are taken at regular intervals for both kettles and tankers, and that the temperature near the surface of the melt stays at least 25 degrees F below the flash point for thermostatically regulated kettles and at least 50 degrees F below the flash point for manually controlled kettles.

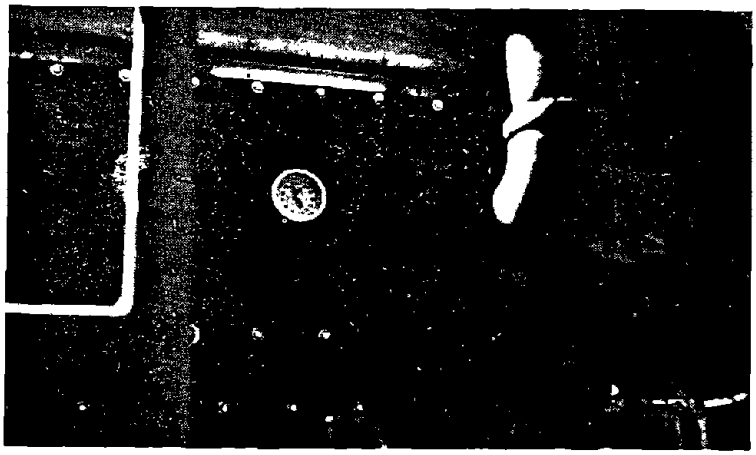
FIG. 7



KETTLE WITH NONFUNCTIONAL THERMOMETER

Besides regulating kettle temperature to help minimize emissions and prevent overheating, reducing the temperature can also significantly diminish harmful emissions (as well as cut sludge deposit formation). However, a problem presented by lowering the kettle temperature is that the temperature of the material dispensed from hot luggers becomes correspondingly lower. For the kettle to be run at the lowest temperature consistent with the temperature required for mopping or machine application (the EVT), the hot pipe, hot lugger, mop cart, and mechanized applicator should all be

FIG.8



COLLAR HELPS PROTECT THIS KETTLE THERMOMETER

insulated, where practical, to minimize heat loss from the time the hot leaves the kettle until the time it is applied to the deck.

The considerations pertinent to temperature regulation and reduction for kettles and insulation for downstream components apply also to tankers.

Personal respiratory protection is required in those situations where asphalt or coal tar pitch emissions in the breathing zone exceed the levels allowed by OSHA. A survey performed by NIOSH in 1977 [4] showed that roofing workers in three broad categories were overexposed to coal tar pitch emissions--kettle tenders, tearoff workers, and hot roof installers (moppers, felt layers, mechanized equipment operators, etc.). When this guide went to press a second NIOSH sampling survey was planned for late 1978. For this reason the respirator recommendations for emissions protection made here are limited to the roofers most seriously overexposed: kettle operators and hot pitch waterproofers. A more comprehensive respiratory protection recommendation should be available upon completion of the NIOSH recommended standard (criteria document) for roofing work.

For employees involved in asphalt work and operating kettles equipped with effective and properly maintained load insertion devices, respirators should not be necessary to meet existing standards. Whether a respirator is necessary for pitch work in such situations will depend on various factors: wind conditions, kettle temperature, length of time spent near the kettle, and whether administrative controls are used. It may be necessary in pitch work to measure the level of pitch emissions in the breathing air of the kettle operator under several environmental conditions to be sure that the particular load insertion device on a pitch kettle is adequate to prevent the operator from being overexposed. Note that pitch kettles equipped with both an effective load insertion device and an effective emission eliminator will likely be adequate to protect against overexposure to pitch emissions without the need for a respirator or administrative controls.

For employees operating pitch kettles without load insertion devices or uncontroled asphalt kettles, respiratory protection will very likely be required in order to meet the OSHA standards or the NIOSH recommendations.

For employees applying pitch or asphalt in poorly ventilated areas, such as those using pitch below-grade for waterproofing work, respiratory protection will very likely be necessary to meet the OSHA standards or NIOSH recommendations.

Where respiratory protection is required to protect kettle operators or waterproofers against overexposure to asphalt or pitch emissions, a powered air purifying respirator is recommended. Stress on the employee is minimal since this is a battery-powered, portable, supplied-air type mask. However, such respirators are presently approved only for protection against particulates, and not for organic

vapors. If exposure to organic vapors exceeds allowable levels, it is recommended that kettle operators be provided with Type C supplied-air respirators with full facepiece under positive pressure. If organic vapor levels do not exceed allowable levels and if heat stress is not excessive, a single-use dust mask may be suitable for asphalt kettle tenders.

FIG.9

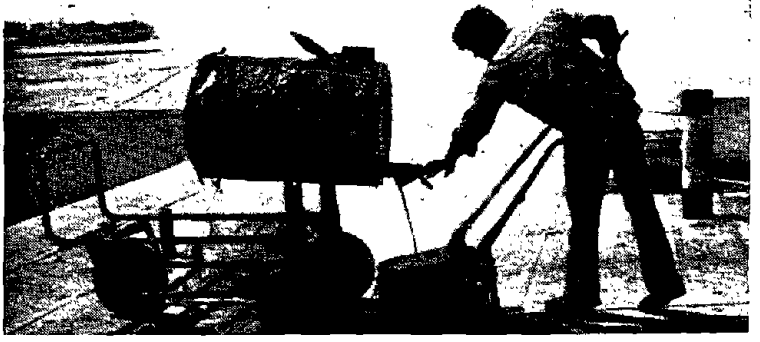
WATERPROOFING WITH HOT PITCH BELOW GRADE

To protect against severe skin and eye irritation caused by pitch emissions in combination with sunlight such emissions should be minimized, and the skin covered and eyes protected, to the greatest degree practical. Full-body coveralls, gloves, and goggles are recommended. If ambient heat, humidity, and wind do not allow for adequate skin protection in reasonable comfort, a time of day when conditions are more favorable, such as early morning, should be considered. Administrative controls, such as limiting the time spent during the day handling pitch, may be necessary for adequate skin protection. Barrier creams containing opaque sun screens may be useful for exposed skin areas--pastes containing zinc oxide, titanium dioxide, or benzophenone are worth trying. The need for skin protection against pitch emissions is underscored by the long association of occupational exposure to coal tar products with excess skin cancer rates. [2]

Work practices can also minimize the breathing of, or skin contact with, bitumen emissions, especially where transfers occur--kettle to bucket, pipe to hot lugger, lugger to mop cart, mop to deck, etc. To minimize the concentrations of emissions in the breathing zone, several steps should be taken. Note that the ones that follow are only a few of those possible. One valuable practice is to stand upwind of the hot whenever feasible, such as is shown in Figure 10. The workers in Figures 10 and 11, although preventing overflows (and thereby burns) by keeping a hand on the valve handle, are required to stand too close to the source of bitumen emissions. In the situations shown in these Figures, doubling the distance between the emissions source and the person operating the valve would significantly cut the concentration of emissions in the worker's breathing zone. A possible solution is to provide a hinged extension on the valve handle so that the employee could operate it from a greater distance.

The hinge would allow for collapsing the extension when the valve is closed to prevent accidental discharge.

FIG. 10



DRAWING-OFF FROM HOT LUGGER

FIG. 11

DRAWING-OFF FROM KETTLE

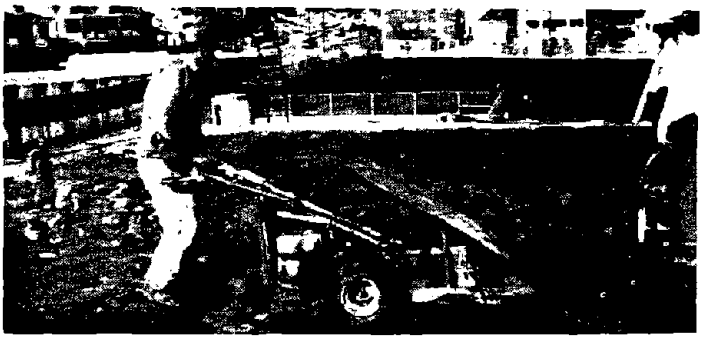
Another emission-reducing work practice is to use a kettle that is large enough so that there is no temptation, during peak loading/melting periods, to leave the lid open (on kettles where there is no load insertion device), or to defeat a load insertion device (to allow for uninterrupted loading), or to run the kettle at elevated temperatures to increase the kettle output beyond the design level.

FIG. 12

WORKING UPWIND OF MECHANIZED HOT-DISPENSING EQUIPMENT (WIND LEFT TO RIGHT)

TEAROFF OPERATIONS can present serious dust problems. Power brooming, scratching, cutting, and chiseling equipment can create relatively large amounts of airborne dusts, especially during dry weather. The problem dusts include pitch, asbestos, and possibly the slag used for graveling. Note that slag components vary depending on the slag source. Skin and eye irritation due to pitch dusts closely resembles that due to pitch emissions. Breathing of asbestos fibers can lead to serious lung disease.

FIG. 13



CHISEL TYPE TEAROFF EQUIPMENT

Although from 1974 to 1978 pitch dusts were not regulated as hot pitch emissions [7], the absence of evidence that these dusts are toxicologically different is expected to result in identical treatment by OSHA of pitch dust and pitch emissions in the near future. The approach recommended for protecting tearoff workers against dangerous dust and fiber exposures involves four basic measures:

1. To the greatest degree possible, prevent the dust from becoming airborne. Many people wet the roof before starting tearoff work. Since this wetting down doesn't necessarily reach the inner plys, it may be inadequate by itself for controlling the dust problem. An alternative method might involve equipping tearoff equipment with a permanently mounted water spray head positioned to direct a water stream close to the point of dust generation. If the hose required to provide pressurized water were undesirable, one alternative would be a machine-mounted water tank with a machine-operated pressure pump. If water spray controls are not practical, an alternative could be to incorporate a suction device on the equipment whose intake hood would intercept the dust stream, capture particles, and carry them to a bag attached to the equipment for subsequent disposal. The combination of hosing down the roof plus using a suction device on tearoff machinery to bag dusts could solve many tearoff dust problems.
2. Well-designed engineering controls should prevent skin and eye irritation from pitch dusts produced by machinery. However, if wetting down tearoff debris doesn't keep the dust down or is not feasible, personal respiratory protection may be necessary for employees doing manual tearoff, or loading or sweeping tearoff debris. Similarly, employees operating tearoff equipment may require respiratory protection if machine controls are not fully protective, are not feasible, or are being fabricated.

   When respiratory protection is required, employees should be provided with a NIOSH-approved toxic dust mask at the beginning

of each shift when tearoff or handling of tearoff debris is performed. Single-use respirators are advantageous since they can be discarded, and thus don't require decontamination and parts inspection. Note that employees should be cautioned not to allow the inner surface of the respirator to become contaminated, such as by leaving it in a dusty area during a break or lunch period, or by pushing it up onto the hair. If the inside becomes contaminated, the mask should be replaced. Otherwise, skin irritation underneath the respirator may become a problem. Note also that disposable respirators that lack an exhalation valve may be too hot for use under high heat conditions.

3. Explain to tearoff workers the hazards presented by exposure to pitch dust and asbestos fibers so they will understand the necessity for keeping engineering controls in good repair and adjustment, for properly wetting the roof and debris during tearoff, and for using the respirator provided (if one is required). Explain also that the dusts that are small enough to actually enter the lungs are invisible; they may be present in breathing air even after the visible dust cloud dissipates.
4. Minimize the number of workers in the vicinity of employees operating tearoff machinery if excessive dust is created.

To protect the hands, clean gloves with wrist ties and no gauntlet should be provided at the beginning of each day's tearoff work. Employees should be instructed to exchange them for clean ones if the insides become contaminated or if they become excessively sweaty. Impermeable gloves (rubber or plastic types) should be avoided--they are easily torn by sharp debris and can become unbearably hot in warm weather. Since most general purpose gloves

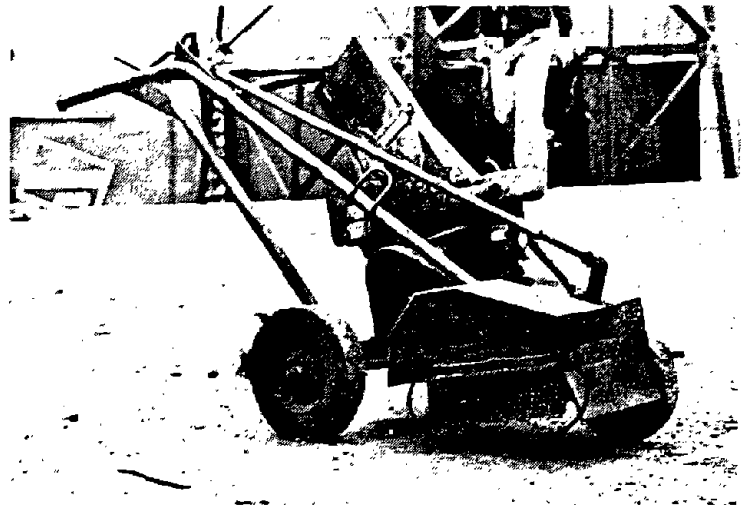
provide poor protection against nails, "foam glass," flashing, and other sharp materials often found in tearoff debris, employees should be trained to handle tearoff scraps with a tool whenever practical. It is recommended that clean full-body coveralls--preferably white ones to reflect radiant heat--be provided daily by the employer for tearoff workers. It is advisable for gloves and coveralls to be laundered by the employer in order to prevent exposure of family members to toxic tearoff dusts that can be carried home on work clothing.

FIG. 14

WORKING UPWIND OF A POWER BROOM

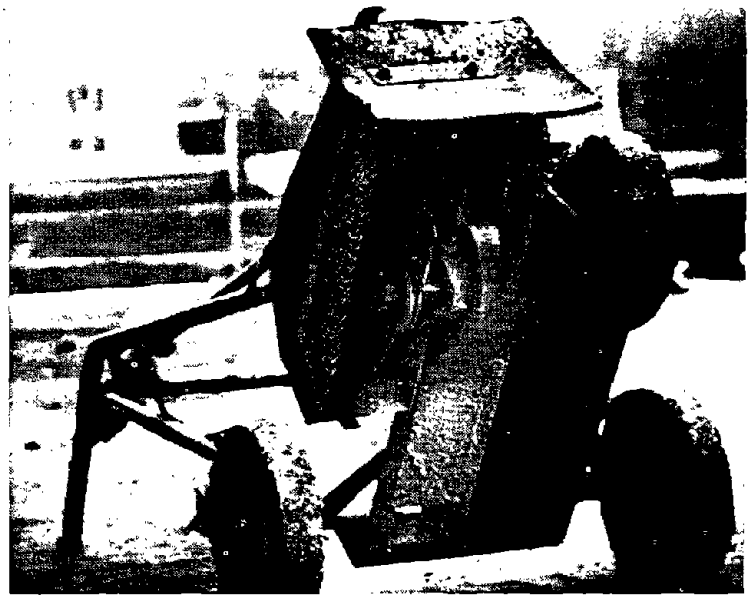
Face-shields or goggles should be provided for tearoff workers to protect the eyes against irritation by pitch dust and against flying debris (from the equipment or wind-blown). Note that of the two, goggles are likely to be less comfortable during hot weather. However, if eye irritation from pitch dust remains a problem despite engineering controls, the face-shield alone is not providing sufficient eye protection, and goggles or better controls are needed.

FIG. 15



CHAIN TYPE GUARD ON ROOF CUTTER

FIG. 16



BLADE TIP OF ROOF CUTTER IS POINT OF DUST GENERATION

Whether the employer or employee furnishes the personal protective equipment mentioned above--goggles, face-shield, coveralls, gloves, respirator-the employer is obligated under OSHA to see that it is used where necessary.

Scrap from tearoff work is usually shoveled into a wheelbarrow or other carrier and carted to a dump chute, bulk waste container, or truck adjacent to the building. If properly stabilized, scrap may also be lowered on a hoist. A chute is required (unless a hoist is used) for heights over 20 feet. Where dumping into a chute or truck from a roof lacking a parapet, a wheel stop (such as a length of 4 x 4) should be secured to the roof perimeter at each dumping position. Otherwise, a worker may fall trying to control a wheelbarrow that slips over the edge. Guardrails are necessary on either side of the dumping position, preferably extending at least 6 feet on each side. A chain should be provided, to be fastened across the opening between the guardrails when the dumping area is not in use. A sign that states "DUMP AREA" in large letters should be attached to the guardrail. The chain and sign are intended to alert roofers that this is not a ladder descent area.

FIG. 17

DUMPING FROM A WET ROOF

Figures 17 and 18 show situations where no wheel stop and no guardrail were used--the employee has no protection. In the case shown in Figure 17, there was no wind, but the roof was wet; a slip during dumping could have led to a fall.

FIG. 18

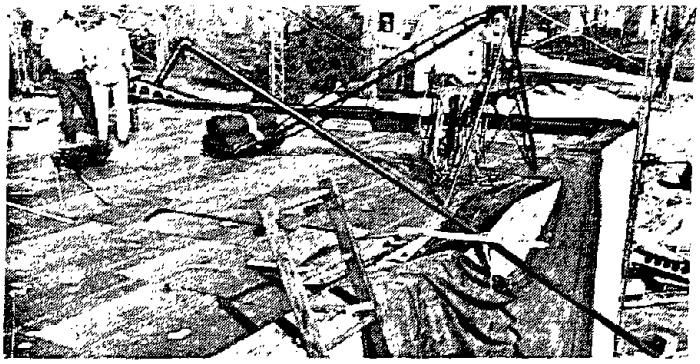
DUMPING OVER A PARAPET

THERMAL BURNS are one of the commonest injuries in the commercial roofing industry. Hot bitumen may contact the skin or eyes as a result of a splash, from contact with a freshly-coated surface, or from a kettle flashing, a hot pipe leaking, a hot lugger or mop cart overflowing, a bucket of hot dropping, sticking, or sloshing, etc.

Splashes of hot from transfer operations involving a hot pipe can be minimized by (1) taking steps to see that the pipe doesn't shift during use, such as by tying it off (Figure 19) and by providing a stable support structure that isn't subject to collisions with ground workers or vehicles, (2) inspecting the pipe couplings, valving, and pump for defects before the job is started, (3) firmly attaching a flexible metal "spider" to the discharge end of the pipe to feed the hot directly into the lugger (see Figure 20), (4) making sure that a kettle or tanker is closely attended when hot is being pumped, and

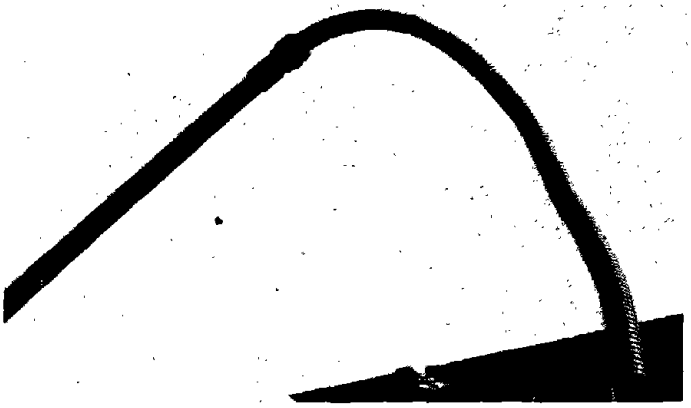
(5) cautioning employees, when using torches to clear clogs in hot bitumen pipes, to make sure pump pressure is off and the pipe outlet is pointed in a safe direction (the employee in Figure 21 should have stood to one side of the outlet).

FIG. 19



HOT PIPE TIED OFF FOR STABILITY

FIG. 20



FLEXIBLE METAL SPIDER FOR FILLING LUGGERS

Hot splashes resulting from the transfer of hot in a pail can be minimized by (1) attaching a lid that permanently covers half the top such that the covered portion is carried next to the employee to provide a splash shield, (2) inspecting pails periodically for

FIG. 21

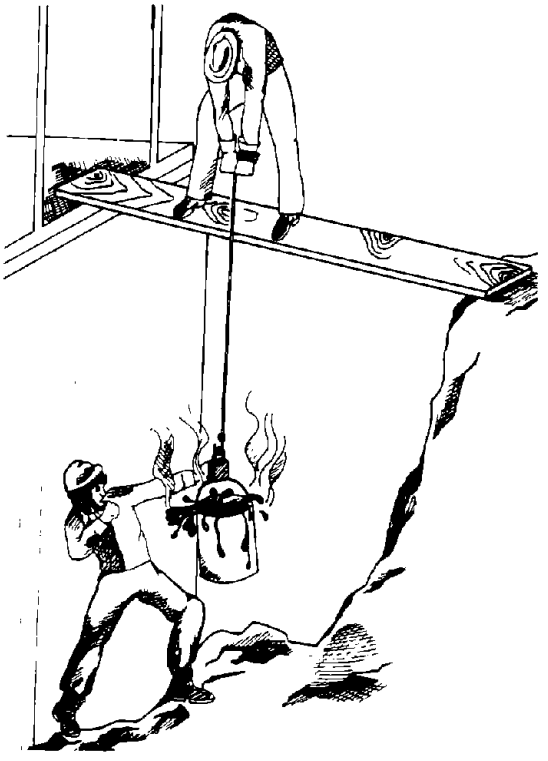
MELTING A CLOG WITH A TORCH

deterioration, such as at the bail welds, (3) cautioning new employees about lifting pails that have become stuck to the deck, (4) keeping deck clutter to a bare minimum to prevent tripping while carrying the hot (see Figure 22), (5) using only a securely-covered pail when lowering or raising hot to a different level (see Figure 23), (6) not filling the pail above the 2/3 point, (7) never carrying a bucket of hot up or down a ladder, and (8) never using mastic buckets for handling the hot.

FIG. 22

TRIPPING HAZARD

FIG. 23



SPLASH BURN HAZARD FOR WATERPROOFERS

When hoisting buckets of hot, only pails with secured covers should be used. The hot should be raised by a hoist and not by an employee on the roof standing at the edge with a rope. The hook on the hoisting line should have a safety clasp to prevent the pail from falling should the hoist jerk or the pail snag on an obstruction. The hoist line and hook attachment point should be inspected daily for defects, and should be replaced or repaired as soon as any defects are spotted.

The hoist should be set up at a position on the roof that allows the lifting corridor to be as clear of obstructions as possible. The pail should be steadied as it begins its ascent (see Figure 24). Once it is steady, the hoisting employee (and any

others nearby) should keep clear of the area where the bucket would fall in the event of a mishap (Figure 25). It may be necessary to rope off this area and to provide a sign warning of overhead work if several employees (including other trades) are working in the vicinity of the hoist operation. If the hoist used has a fixed boom, the receiving employee may be able to avoid leaning over the edge (Figures 26 and 27) by snagging the rope just above the hook with a pole hook and then drawing it to a position where the bail can be safely grabbed. The preferred solution, however, is to use a swing-boom hoist.

FIG. 24

STEADYING THE HOT

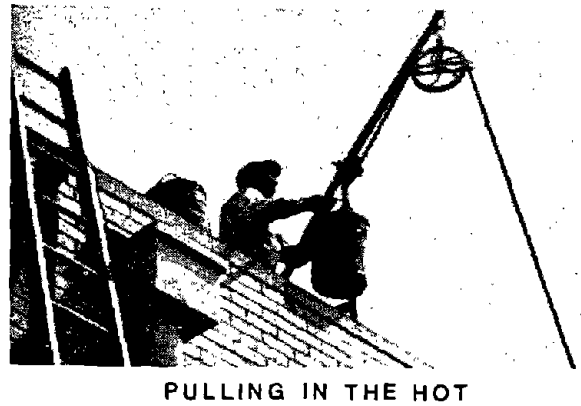
FIG. 25

HOISTING THE HOT

FIG. 26

REACHING FOR THE HOT

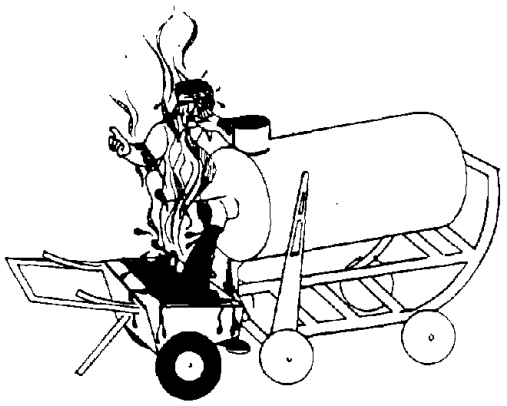
FIG. 27



PULLING IN THE HOT

Hot bitumen has also caused burns as it is drawn from hot luggers. Where the draw-off cock is too far from the vessel being loaded, splashes may occur, especially on windy days (see Figure 28). A flexible metal hose or welded pipe extension can remedy this problem. It is also important to regularly inspect the lugger for deterioration of the tank or valve.

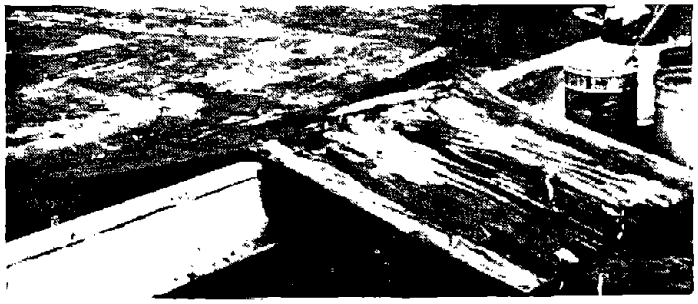
FIG. 28



SPLASHES FROM HOT LUGGER

Although the situation shown in Figures 29 and 30 did not cause burn injuries, it was a close call. A makeshift ramp (Figure 29) had been used to get the lugger across an expansion joint. Besides being too steep, the ramp had many splintered ends where the plywood sheet had been partially broken (to form the ramp) at the center, creating a tripping hazard. The employee pulling a freshly-filled lugger had the lugger yanked from his grasp when it stalled on this steep ramp; the hot shifted, and the lugger tipped over backwards.

FIG. 29



INADEQUATE RAMP

FIG. 30

LUGGER ACCIDENT CAUSED BY POOR RAMP

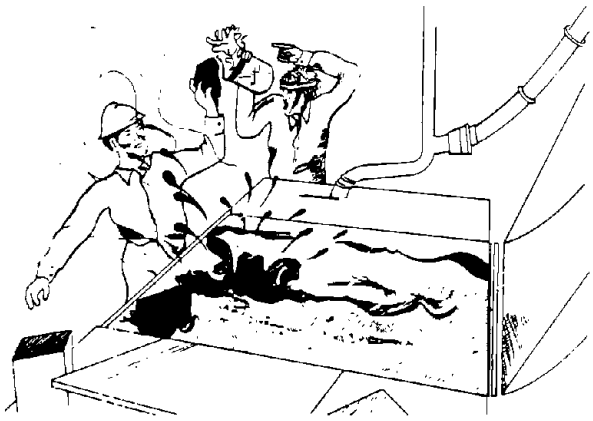
There was no safe way to use this ramp. A running approach might have caused the ramp to break on the upside or the hot to shift on the downside, in either case risking a disfiguring spill onto the employee and others in the vicinity. It is important that ramps and other devices used to raise and lower hot bitumen (and materials, equipment, etc.) are of sound design and condition for the use intended, and are secured against movement where necessary.

The lesson of this accident is broader, though: employees should never take shortcuts when handling hot--not on the roof or on the ground. One such shortcut involves tossing, rather than placing, bitumen in the kettle when load insertion devices are not used. Another involves failure to wear a face mask and gloves (Figure 31) when working near the kettle. It should be noted that a properly designed load insertion device, such as that pictured in Figures 5 and 6, can offer considerable protection against skin and eye burns for employees loading or working near the kettle.

Kettle flashes can lead to very serious burns. Flashing is caused when the hot reaches the flash point temperature, emissions are within the explosive limits (concentration not too lean or too rich), and an ignition source is provided. While the flash

point for asphalt varies with the crude used to produce a particular batch, it is usually in the range between 350 and 550 degrees F. This does not mean that it is safe to run a kettle up to just below the flash point temperature--(1) the temperature sensor may not be located near the surface of the melt (or other suitable hot spot) and may not be accurate, (2) a kettle lacking thermostatic controls may reach or exceed the danger point before the operator becomes aware of the situation, and (3) emissions problems increase substantially at elevated temperatures. It is recommended that kettle or tanker temperature be kept at least 50 degrees F below the flash point as a safeguard against flashing. However, the recommendation for thermostatically controlled equipment in good working order and properly calibrated is at least 25 degrees F below the flash point.

FIG. 31



THROWING RATHER THAN PLACING CHUNKS IN THE MELT

To lessen the severity of burns that occur despite the measures recommended above, emergency chemical cold packs should be included in at least two first aid kits--one on the roof, one on the ground.

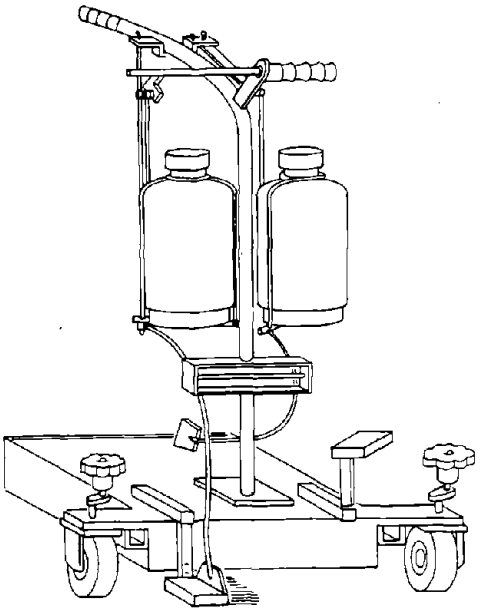
ORGANIC SOLVENTS USED IN ROOFING can present several hazards to roofers. Among the solvents of concern are mineral spirits, tetrahydrofuran, and gasoline.

Mineral spirits and other petroleum distillates are frequently used as the solvent vehicle in cold-process (cutback) asphalt applications, as well as in resaturant products. Since these materials are sprayed, typically over a large surface area, inhalation of the spray and evaporation after spraying can create a breathing hazard. Employees working in the vicinity of such an application should be provided with an approved organic vapor respirator for use both during spraying and thereafter until the coating is either substantially dry or covered. Using a respirator that has an integral dust pad or dust prefilter would help protect against breathing airborne bitumen mist as well.

Tetrahydrofuran is a solvent used for welding sheets of PVC plastic together to form a floating membrane roof. Its characteristics are similar to those of other ethers--it is extremely flammable, it can burn the skin or eyes if splashed, and it can affect the central nervous system if breathed, causing dizziness, headache, nausea, weakness, etc. Such central nervous system effects could indirectly cause accidents due to altered judgment and impaired muscular control. These effects, if manifested, should disapear after exposure is terminated. Effects of breathing tetrahydrofuran repeatedly over a period of months or years have not been thoroughly documented. When this solvent is used in devices that allow the worker to stand while the welding takes place at roof level (see Figure 32), the

concentration in the breathing zone should be low enough to make respiratory protection unnecessary. However, when it is applied directly to roofing material at close range, such as with squeeze bottles, respiratory protection may be required, depending on wind conditions, volume of use, temperature, and other factors.

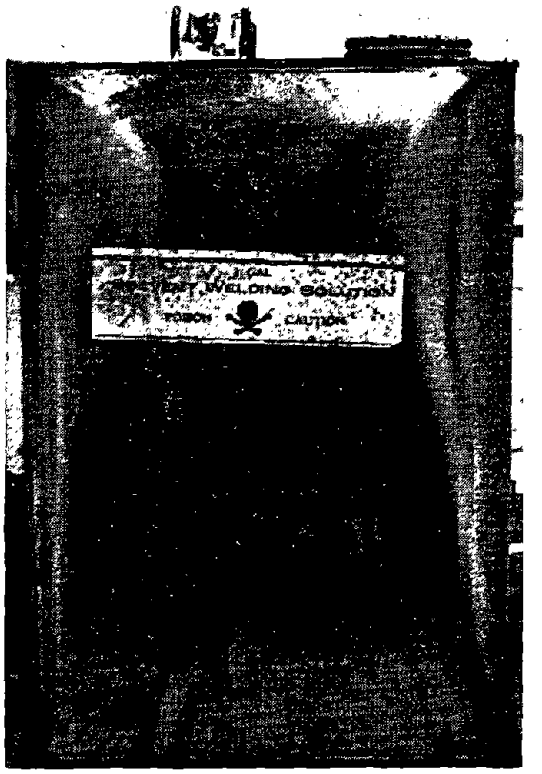
FIG. 32



PVC ROOF SEAM WELDER

Whenever solvents are used in roofing work, they should be so labelled that employees are made aware of their hazards and of necessary precautions. In Figure 33 the label tells too little. There is no indication that the tetrahydrofuran is highly flammable, or that it can have narcotic effects, possibly increasing the risk of physical injuries. The preferred solution is to insist that suppliers provide properly labeled containers and to always ask for a material safety data sheet for every potentially hazardous material. NIOSH can assist in identifying the components of products for which a list of the contents is not available. See the back pages of this guide for further information.

FIG. 33



WELDING SOLVENT

Gasoline, which has relatively poor solvent properties, has nevertheless been extensively used for cleanup purposes on roofing sites due to its ready availability (Figure 34). Gasoline destroys the skin's natural barriers to irritation and infection, and is even absorbed through perfectly healthy skin as well as more rapidly through cuts and scratches. Gasoline presents a serious fire hazard if people are smoking in the vicinity or other ignition sources are present. Furthermore, its vapors are toxic. Leaded gasoline contains lead in the antiknock additive and should not be breathed. Unleaded gasoline contains benzene, a chemical that increases the risk of leukemia. DO NOT ALLOW GASOLINE TO BE USED AS A SOLVENT.

FIG. 34

WASHING UP

It is recommended that cleanup be made part of the job so that the employer can ensure that it is done safely and is not neglected or postponed. If cleanup required is extensive, check to see that gloves are being routinely worn, and that other skin areas are covered as much as practical. Barrier creams are available which, if applied at the start of the day, make cleanup considerably easier. Note that waterless hand cleaners are preferable to gritty types for two reasons--they are better at removing water-insoluble materials (such as bitumen), and they don't abrade the skin's natural barriers nearly as much. Should solvent still be necessary for effective cleanup, mineral oil is recommended.

Should a worker be overexposed to solvents and become nauseated, dizzy, or weak, he or she should be removed from further exposure. DO NOT allow a person in this condition to use a ladder, operate machinery, drive a car or truck, etc. If symptoms are severe, or persist, get medical attention immediately.

ROOF OPENINGS AND HOLES are serious hazards in any roofing operation unless properly safeguarded. Roofers with plenty of roof surrounding them often feel safe from falling, and may therefore be less observant of unprotected openings. A combination of partial perimeter guarding plus a warning line provides some protection against perimeter falls from "flat" decks under good weather conditions. However, the only safe method for working near roof openings is to construct standard guardrails attached to the inner surface of the opening, at least for those openings that are flush with the deck. Roof openings with a suitable raised lip may allow an alternative--nailing a strong plywood sheet over the opening.

Regardless of which method of protection is used, the protective structure should be designed so that it does not have to be removed until <u>after</u> the roof surrounding the opening is completed. For example, plywood nailed over a <u>flush</u> opening would prevent necessary edge work, and would therefore not be an appropriate method in such situations.

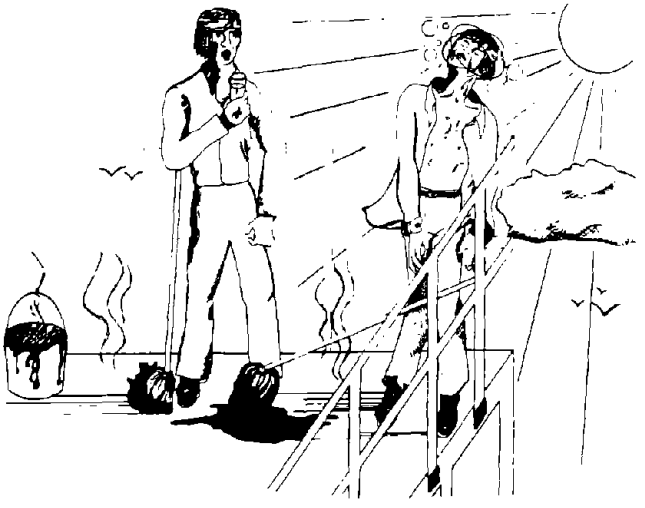
EXTREMES OF CLIMATE require careful consideration if injury and sickness are to be prevented. Working in especially hot or cold weather places extra demands, or stresses, on the body. Since either temperature extreme leads to earlier fatigue--and with it, the increased likelihood of accidents--it is important that demands made on employees be adjusted in such situations.

Potable water should be readily available on both the roof and ground during hot weather. Increased sweating reduces the body's supply of salt, as well as of water, and can lead to heat-based exhaustion (Figure 35). It is important in such weather to replace lost salt, especially if the worker is not used to working in hot weather. The preferred method is to take increased salt along with food. This avoids problems of nausea and vomiting which may occur with salt tablets. Although many employees might prefer to work bareback or in shorts, working without fully covering the body subjects the worker (1) to possible burns from splashes or spills of hot, which can be severe and disfiguring, (2) to the hazards associated with overexposure to the sun (including sunburn and an increased risk of skin cancer), and (3) to the severe skin irritation caused by pitch emissions in combination with sunlight.

Working in windy weather presents predictable hazards. Insulation boards and other materials with large surfaces may catch the wind, throwing a person handling them off balance (Figure 36), and they can also strike fellow employees. Under such conditions it is advisable to use smaller boards in order to

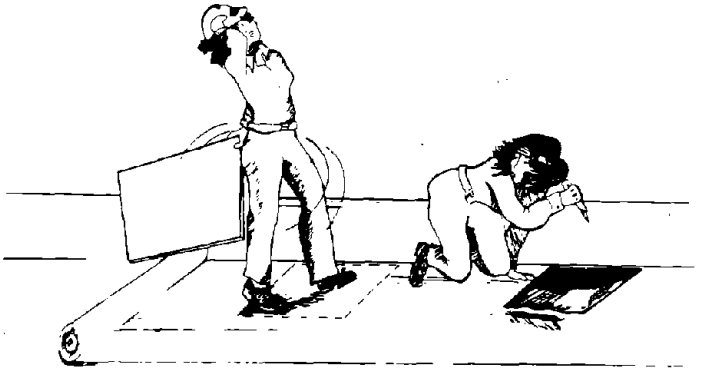
reduce wind load--3 x 5 or 2 x 4, rather than 4 x 8' sheets. Windy conditions can also increase problems with blowing dust and debris during tearoff operations. "Foreign object in eye" injuries are frequently encountered under such conditions when eye protection is not used.

FIG.35



HEAT STRESS

FIG.36

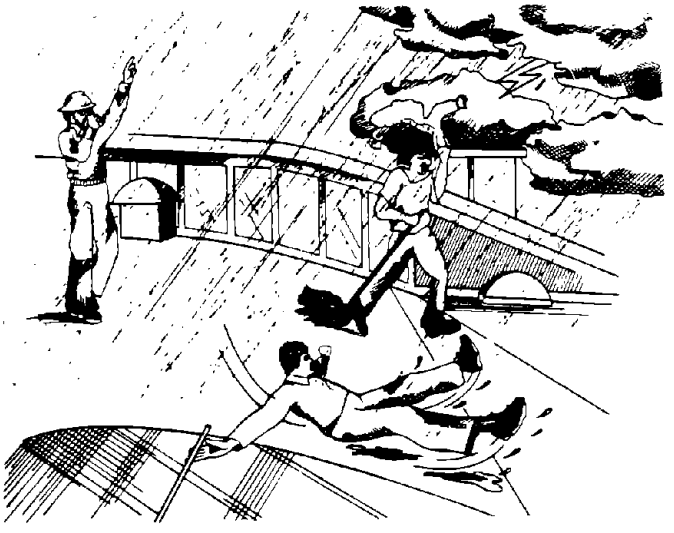


WIND LOAD ON LARGE BOARD

Working on a snow-, ice-, or frost-covered roof presents similarly predictable hazards. It is recommended that sufficient paths be cleared, spreading salt where necessary, before repair or other work begins. Until paths are created, the number of employees topside should be minimized. Slip-resistant shoes, boots, or rubbers should be worn to help provide adequate traction.

The employer is, of course, responsible for seeing that his or her employees are protected under all weather conditions.

FIG. 37



SUDDEN WEATHER CHANGE

Another climatic condition that presents work hazards to roofers is the sudden change (Figure 37)--the beginning of a thunderstorm, for example. When bad weather is approaching, there may be incentives to speed the work in order to reach a convenient stopping point or to protect a building's contents,

working right up until the storm hits if necessary. Once a severe storm arrives the rush to seek cover may create safety hazards, such as more than one person on a ladder at the same time, slips and falls on slippery surfaces, etc. Awareness of the potential dangers once a sudden change in weather occurs should enable the crew leader to anticipate the problem and figure out how best to deal with it.

Note the increased significance of good industrial housekeeping during extremes of climate. Weaknesses in this area create hazards for ground workers and even greater risks for workers on the deck.

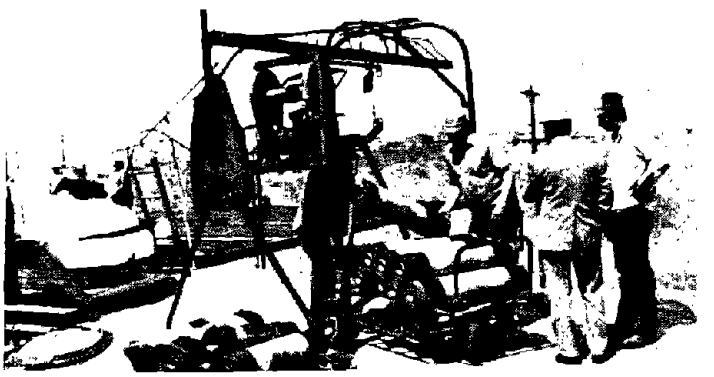
LIFTING APPARATUS of several types are used to raise equipment and materials onto a roof. Although high-lift fork trucks, truck bed scissors lifts, and conveyors are being used more frequently than in the past, much of the roofing industry still relies on hoists, especially for jobs on multistory buildings where a hoist may be the only practical lifting device. Figure 38 shows a fixed beam hoist counterweighted by felt rolls. Swing beam hoists are preferred to the fixed type, however, since the beam and load can be swung over the roof for unloading. Figure 39 shows a monorail type hoist; here the operator slides the entire lift mechanism plus load along an overhead rail until it is far enough from the roof edge to be safely unloaded. A section of guardrail should be erected on both sides of this

FIG. 38

FIXED BEAM HOIST

hoist along the roof edge. Note that the use of felt rolls or other roofing materials as ballast (Figures 38 and 39) is not recommended, since there may be some temptation to use them while the hoist is still in use.

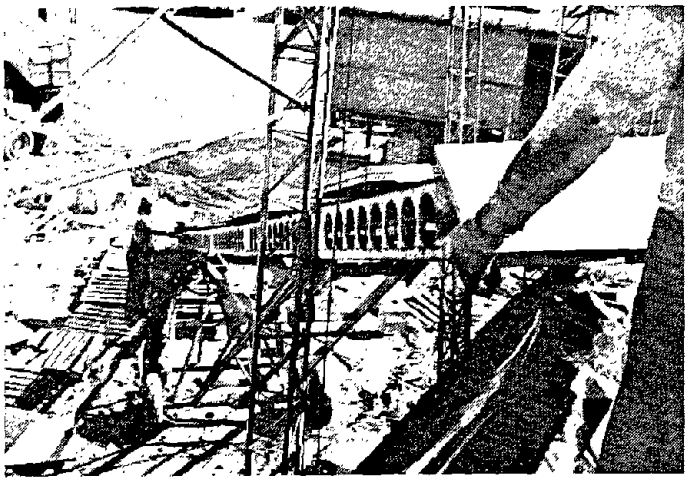
FIG. 39



MONORAIL HOIST

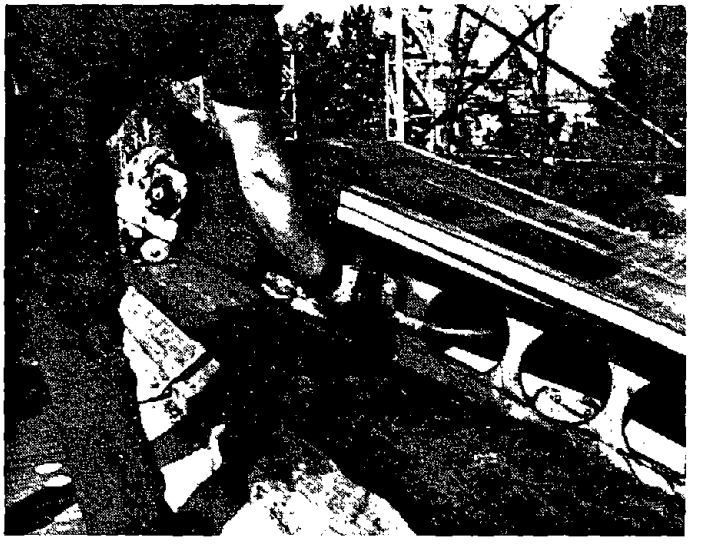
Figure 40 shows a self-supported portable conveyor being used to move insulation boards to the roof level. Both the loader and unloader have controls that can stop or start the belt (Figure 41). Whenever conveyors are in use, the area below them should be roped off for 10 feet on either side, and signs warning of overhead work should be attached to the rope, since materials may be knocked off, blown off, or simply slide off the belt and fall on unsuspecting workers. This is particularly likely to happen if the materials and belt are mismatched. Different conveyor and belt designs are intended for different types of loads. In Figure 42 a piece of insulation board that shifted on a mismatched belt was knocked off by an obstruction. Where possible, locate the conveyor well away from obstructions and power lines.

FIG. 40



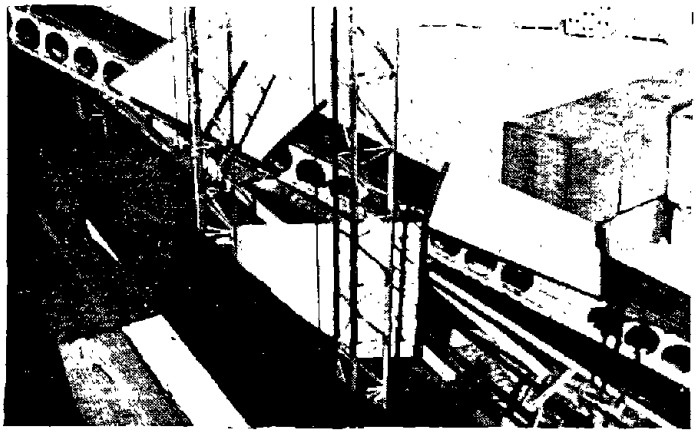
CONVEYOR

FIG. 41



TOPSIDE STOP/RESTART CONTROL
ON CONVEYOR

FIG. 42



MISMATCHED LOAD AND BELT

Figure 43 shows one method of getting equipment onto a roof that should NEVER be used. Five workers could have been seriously injured in this situation--the two on the ground if the machine slid off or broke through the ramp, the three on the roof (at left) if they tried to hold onto the two cables in the event that the machine had toppled.

FIG. 43

FIND A BETTER WAY
(CABLES DARKENED FOR EMPHASIS)

PERIMETER GUARDING is a subject of current controversy in the roofing industry. While edge guarding around the entire roof is accepted for "sloped" or "steep" roofs, it is not readily accepted by many contractors where "flat" roofs are involved. Note that the convention in the roofing industry is to consider all roofs that rise in slope more than 3" for every 12" horizontal to be "sloped" or "steep," and those that rise 3 in 12 or less to be "flat."

Figure 44 shows one extreme situation where a patching job is being performed on a leak near the center of a large, flat roof. Although this roof had a two-foot parapet, which provided significant edge protection, many roofs of this type have nothing more than a gravel stop along the perimeter. When work is performed near the edge of a flat roof without parapet, perimeter protection is necessary.

FIG. 44

SMALL REPAIR JOB ON A LARGE ROOF

The employer should erect guardrails at the hoisting area, and around the hot pipe if hot is pumped up from below. Figure 45 shows heavy cast iron base plates being used to support plumbing pipe assembled in guardrail style. Figure 46 shows a welded guardrail unit supporting a hot pipe. To prevent movement of the rail base in Figure 46, the legs of this rail should have been weighted down, such as with sand bags. While neither of these self-supporting guardrails is "tipover-proof," they can, if properly designed, be sufficiently stable to prevent many perimeter falls.

FIG. 45

HEAVY BASEPLATE FOR PERIMETER GUARD

FIG. 46

WELDED PERIMETER GUARD

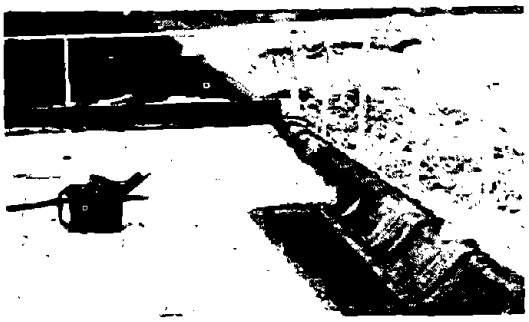
The roof shown in Figure 47 would require considerably more extensive perimeter protection--tethering of employees, use of safety nets or catch platforms, standard guardrails attached to the edge, or some similarly effective fall protection method. Since configurations, conditions, type of work performed, etc., vary from roof to roof, any effective means of perimeter protection will likely meet with OSHA approval. Check with your area office to see if a variance is required.

FIG. 47

STEEP ROOF

In 1978 OSHA's Construction Safety and Health Advisory Committee proposed changes in the construction standards that would allow roofers to use a warning line system for reducing the risk of falls from "flat" roofs. Under the system proposed by the industry, a rope and stanchion line would be erected 5-10 feet from the roof edge. No mechanized work would be allowed outside the line, since accidents have occured both with machines that are pulled backwards (operator falls off) and with machines that are pushed (operator falls off while trying to keep the machine from falling). The line would have flags attached for increased visibility, and would be sufficiently strong and taut to warn a person wearing cold-weather or foul-weather gear who made contact with it.

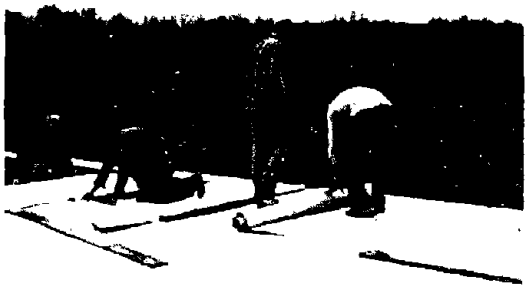
FIG. 48



PERIMETER GUARD LACKING MIDRAIL (NEW WORK)

Where a warning line system is used as part of a perimeter protection effort, it is recommended that the number of employees allowed outside the line be limited to the smallest number possible--two are all that are needed in Figure 49. Since inexperienced employees have considerably more than their share of roofing accidents, especially during the first few months of work, employees working outside the line should have at least a year's roofing experience topside and have no health impairments that could increase perimeter work hazards, such as deficient eyesight, hearing, etc.

FIG. 49



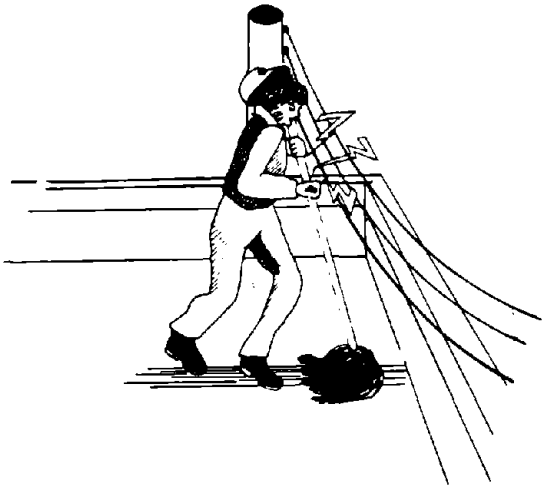
INSTALLING PVC ROOF

Note that since a warning line can only warn and does not actually serve as a perimeter guard, it is unsuitable for flat roof perimeter protection when the roof is slippery from ice, frost, water, or an uncured cold-process bitumen coating, especially when the slope of the "flat" roof is between 2 and 3 in 12 inches. Under such slippery conditions, a mere

warning that the edge is near does not provide sufficient fall protection. Since new construction work (as opposed to reroofing work) allows for conventional perimeter guarding, and such guarding provides considerably greater fall protection than a warning line, the use of a warning line is not recommended for work on new construction.

POWER LINES near ladders or feeding to roof attachment points, unless shut off, pose a significant hazard to roofers. An aluminum ladder, wet wooden ladder, or a mop handle accidentally contacting power lines (or coming close enough to power lines to arc) can lead to severe injury or death. The worker who backs into live lines or contacts them with machines or hand-held metal equipment is similarly endangered. If at all possible, have power cut off in the work area and ground the line. In some localities power companies will cover uninsulated wires upon request. If neither solution is practical, place the ladder in an area remote from the lines, point out to each topside crew member the location of the lines, and closely supervise all work performed near them. If equipment contacts the lines, cut off the power before touching it. Note that work should never be performed near live lines when the roof near the lines is wet.

FIG. 50



CONTACTING LIVE LINES

LADDER SAFETY is an often neglected aspect of roofing operations. Ladders should be long enough to extend above the roof level at least three feet (Figure 51), while maintaining a distance from the base to the wall of 1/4 the building height, and must be tied off to prevent shifting. Deteriorated ladders should be destroyed immmediately, never used "just one day more."

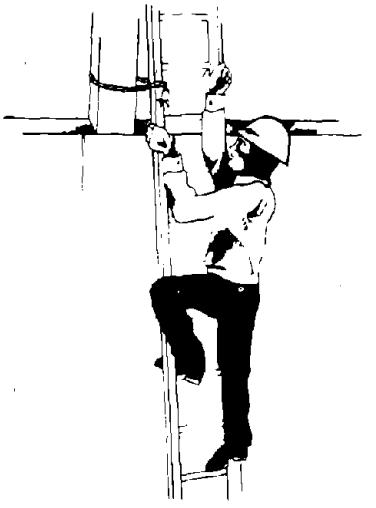
FIG. 51

LADDER EXTENDING ABOVE ROOF LEVEL

Use of ladders should be limited to getting roofers onto and off of the roof. Only one person at a time should be allowed to use a ladder. A comparison of the situations shown in Figures 52 and 53 shows the danger of trying to use a ladder beyond its legitimate capabilities. Materials, including hot, should never be carried up or down a ladder. Nor should tools, food, beverages, etc. Special attention must be taken in choosing the location for

the ladder to ensure that workers using it are not endangered by live power lines. Note: aluminum ladders should never be used on jobs where the only practical ladder location is near live power lines.

FIG. 52



LADDER'S INTENDED PURPOSE
(NOTE PROPERLY TIED OFF)

FIG. 53

LADDER'S UNINTENDED PURPOSE

DRIVING TANKERS AND TOWING KETTLES requires special care to avoid mishaps. Driving a tanker is not at all like driving a car; the differences have led to some disastrous accidents, typically rollovers. The center of gravity on a loaded or partially loaded tanker is high. The load is dense, and, since most tankers do not have sufficient baffles to dampen load shifts, it is mobile. A turn taken too fast on the highway, or rapid travel over irregular or steep terrain, can result in a rollover. The outcome of a tanker rollover can be death or severe burns for the cab occupants and for people in nearby vehicles. For these reasons, it is important that tanker driving be limited to seasoned or specially trained employees who know the hazards of hauling hot bitumen in bulk and who understand the very significant differences between driving a car and driving an over-the-road or day tanker.

When pulling a kettle on a trailer it is necessary to check the following items each time the rig is taken onto a street:

1. Hitch secure.
2. Safety chains attached.
3. Trailer in good working condition.
4. Brakes and brake lights working.
5. Outside mirrors on both sides of truck.

MATERIALS HANDLING injuries occur frequently in the roofing industry. An asphalt keg in Figure 54 could slide off the pile when another is moved, resulting in a crushed toe or foot. The weight of roofing materials is a problem for other reasons as well. The coal tar pitch drums in Figure 55 each weigh 500 lbs. Mechanical aids, such as hydraulic lift gates or powered lift trucks, should be used to load and unload such heavy items. For some loads, such as powered equipment and luggers, a dockboard or simple ramp sufficiently strong and securely attached to the tailgate may be adequate for making a safe transfer into or out of the truck. Note that it is important to secure any material or equipment transported in trucks that could shift dangerously in transit.

FIG. 54

ASPHALT KEGS

Loads exceeding 60 lbs. should not be handled without a mechanical aid. Sometimes another employee assisting can substitute for the mechanical device. If 100 lb. kegs are manually lifted, two employees should handle each keg to avoid the strains, sprains, and hernias common to this industry. When handling

roofing felt and bundles of insulation, this 60 pound per person limit should also be observed. Rather than increase the number of persons carrying a load, however, it is recommended instead that loads be lightened, such as through use of 50 lb. kegs of asphalt.

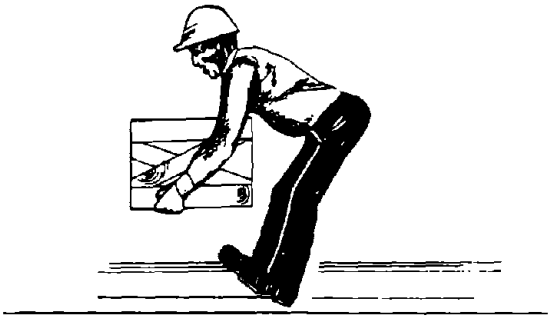
FIG. 55

PITCH KEGS

The way in which a load is lifted is also significant. Figure 56 shows an improper lifting technique. The back is being overloaded. In Figure 57, however, the back is erect and the knees bent--the far more powerful leg muscles do the work instead of the back. However, for lifting lighter but bulky materials, a bent knee posture may be inappropriate, and a bent back posture acceptable.

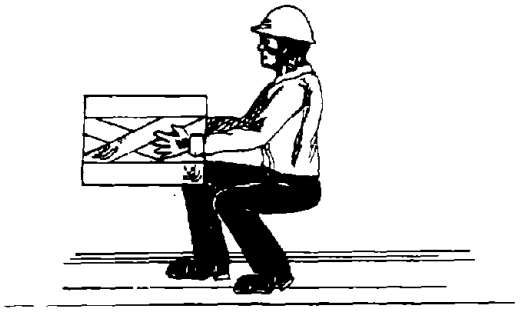
Note that many accidents caused by dropping felt, kegs, and cylinders may reflect a combination of carrying heavy and unwieldy items plus fatigue brought about by high heat, previous heavy work that day, etc. When such environmental and work conditions are taken into consideration, the need for a 60-lb. limitation becomes clearer.

FIG. 56



POOR LIFTING PRACTICE

FIG. 57



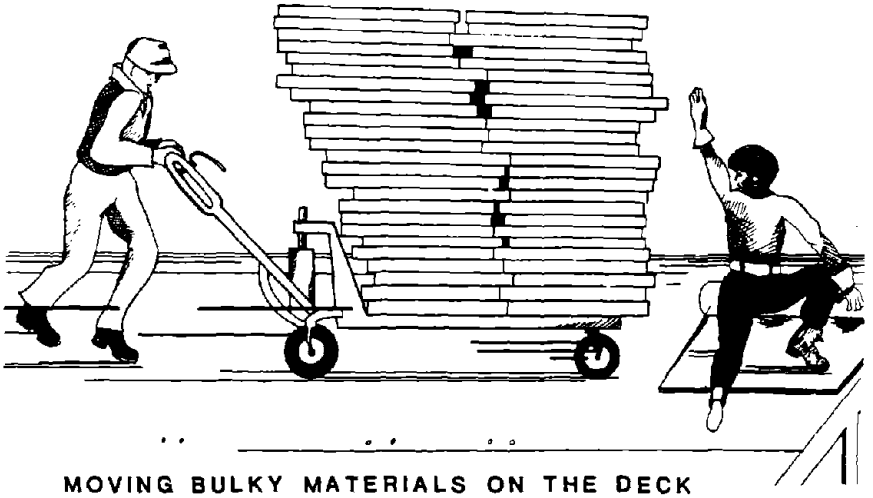
SAFE LIFTING PRACTICE

Persons handling heavy materials or equipment should be required to wear steel-toe safety shoes. Those loading and unloading pitch, asphalt, heavy equipment, cylinders, etc. from trucks by hand should be provided with safety shoes that have a metatarsal (instep) guard. Leather or similarly slip-resistant gloves should be provided for employees who perform materials handling work to help prevent drops onto the feet and strains.

When bulky materials are moved on the roof, a second worker should spot the mover to make sure the situation shown in Figure 58, or one involving spilled hot, doesn't occur. One of the reasons a spotter is needed is to allow the mover to follow the load. A person pulling a heavy load who slips or

otherwise looses control of it could be pushed over the edge or into a roof opening. An alternative to using a spotter would be to limit load size so that the vision of the pushing employee isn't obstructed. Trucks such as the one illustrated should have a wheel brake set or a wheel chocked when parked.

FIG. 58



MOVING BULKY MATERIALS ON THE DECK

Note that head protection (hard hats, not bump hats) is necessary whenever roofers work in positions where falling or flying objects present head injury hazards.

SAFE CLEANING OF KETTLES, TANKERS, OR OTHER EQUIPMENT THAT HAS HELD HOT PITCH OR ASPHALT requires an understanding of the potential hazards. When the persons doing the cleaning are positioned inside the kettle or tanker, they are working in a confined area. Airborne contaminant levels in confined areas run considerably higher than those in better ventilated areas, since there is comparatively little air available to dilute the contaminant. In such situations the employer must provide respiratory protection suitable for providing clean breathing air.

Working in a tanker will frequently require a NIOSH-approved supplied-air respirator, properly fitted and maintained, PLUS a second supplied air unit near the access hole. This second unit is for emergency use in the event that someone needs to enter the tanker to rescue the employee inside. A second employee must be stationed on the outside of the tanker or kettle to (1) watch that the worker inside does not become incapacitated, (2) ensure that nobody forgets that someone is inside, and (3) to stay in communication with the employee inside. Before an employee enters a tanker for cleaning, the oxygen level in the tank must be tested by a qualified person, unless the tank has sufficient side and top access panels to allow thorough ventilation.

Since kettle cleaning is typically performed with covers and firing tubes removed, a well-fitted disposable respirator should be sufficient to protect employees in this situation, and oxygen tests should be unnecessary.

TRAINING

Much of the information this publication contains is directly applicable to roofing employees. To ensure that this information does help prevent occupational injury and disease, it is important that it reach the rank and file roofer.

The need for training roofers to recognize and seek remedies for the hazards discussed in the previous section is well-supported by existing injury data. However, the pivotal role of training in the protection of roofers from job hazards arises not only by the nature of the hazards but also by two additional factors. First, a study performed in 1975 for NIOSH [1] found that roofing crew leaders were most often responsible for ensuring the health and safety of the crew, for setting the work pace, and, on many jobs, for performing part of the work. In such situations, the leader has little opportunity for close supervision of crew members. Most of their work crew members must rely on their own training and experience. Second, the potential hazards facing roofers vary from job to job, depending on the roof configuration, the prevalence and position of roof openings, the roof slope, roofing materials, ambient weather conditions, escape routes, etc. The roofer whose job site changes fairly often needs to be especially alert to unfamiliar surroundings and changed conditions. For this reason, safe work practices must become habitual. Effective training can be of significant assistance in developing such habits.

While training can be developed for each of the high-risk situations described in the previous section, several areas merit special emphasis. These include:

1. The purpose for and proper operation of kettle load insertion devices, plus risks from defeating the controls.
2. The purpose for and proper operation of kettle or tanker temperature regulating devices (or proper manual measuring/regulating procedures), including calibration protocol.
3. Special hazards presented by perimeter work.
4. When and how to properly use a respirator.[8]
5. Safe lifting procedures and load weight limits.
6. How to recognize common safety defects in equipment.
7. Proper fire control procedures (see fire extinguisher fold-out in back pages).
8. Safe tanker driving and kettle towing procedures.

MEDICAL AND FIRST AID CONSIDERATIONS

On every roofing job there should be at least one person trained in first aid techniques. An appropriately stocked first aid kit should be readily available at each roofing job. If "hot" is handled on the roof and ground, chemical cold packs should be kept both on the ground and on the deck.

In general, health impairments can increase the risk of accidents and of developing certain occupational diseases. Some employees cannot safely wear respirators. Some cannot safely lift heavy loads. Others taking medications that impair judgment or coordination should not perform work topside. The following is a list of health factors useful for identifying health problems that can affect the occupational health or safety of roofers:

1. Visual acuity
2. Hearing acuity
3. Neurological disorders (e.g., fainting, dizziness)
4. Motor defects
5. Field of vision
6. Depth perception
7. Ability to wear a respirator (if job requires one)
8. Cardiovascular sufficiency
9. Medications being used (effects on perceptual or motor abilities)
10. Ability to safely lift typical loads

On some regular basis, such as annually, it is advisable that employees whose work requires frequent respirator use be medically examined to (1) help

ensure the adequacy of the respiratory protection program, and (2) ensure that the employee is still able to safely wear the particular respirator.

Future recommendations from NIOSH in its roofing criteria document will likely include more specific medical information.

MAJOR OSHA STANDARDS APPLICABLE TO ROOFING

The following are the subjects and locations of OSHA standards applicable generally to roofing operations. Serious hazards not covered by the standards are included in the scope of the General Duty clause of the Occupational Safety and Health Act. This clause requires the employer to protect employees "from recognized hazards that are causing or are likely to cause death or serious physical harm." The text of the standards mentioned below is available through your area OSHA office or in the Code of Federal Regulations, Title 29 Part 1926. Note that as this guide went to press OSHA was considering recommended changes to subparts L and M of these regulations (29 CFR 1926.450-451 and 29 CFR 1926.500-502).

Breathing hazards	1926.55
Chains	1926.251(b)
Chicken ladders	1926.451(v)
Conveyors	1926.555
Dust control	1926.57
Dusts, breathing hazards	1926.55
Eye protection	1926.102
Face protection	1926.151
Fire prevention	1926.151
Fire protection	1926.150
First aid	1926.50
Flammable and combustible liquids	1926.152
Fumes, breathing hazards	1926.55
Gasoline, storage and use	1926.152
Grounding	1926.401
Guardrails	1926.500
Hand tools	1926.301
Head protection	1926.100
Hearing protection	1926.101

Hoists, general	1926.552
Hoists, overhead type	1926.554
Hooks	1926.251(f)
Ladders	1926.450
Lanyards	1926.104
Lifelines	1926.104
Lighting	1926.56
LP-gas	1926.153
Materials handling, storage, use, disposal (general)	1926.250
Medical services	1926.50
Noise	1926.52
Power lines, working near	1926.400(c)
Power-operated hand tools	1926.302
Respirators	1926.103
Respiratory protection	1926.103
Rigging equipment for materials handling, general	1926.251(a)
Roof openings and holes	1926.500
Roofing brackets	1926.451
Rope, natural	1926.251(d)
Rope, synthetic	1926.251(d)
Rope, wire	1926.251(d)
Safety belts	1926.104
Safety nets	1926.105
Sanitation	1926.51
Scaffolding	1926.451
Signs and tags, accident prevention type	1926.200
Tools, hand and power (general)	1926.300
Ventilation	1926.57
Waste materials, disposal	1926.252
Webbing, synthetic	1926.251(e)

SOURCES OF ADDITIONAL INFORMATION

SERVICES

Health Hazard Evaluation, a survey performed on-site at the request of the employer, employees, or employee representative at no cost. Results are given to the employer and employees. No citations are made. Contact your NIOSH regional office.

NIOSH consultative services, such as identifying contents of trade name products. Contact your NIOSH regional office.

OSHA consultative services (in certain states). Contact your area OSHA office.

PUBLICATIONS AND REPORTS CITED IN TEXT

1. Behavioral analysis of workers and job hazards in the roofing industry, DHEW (NIOSH) Pub. #75-176, Cincinnati, Oh., June 1975.

2. Criteria for a recommended standard . . . occupational exposure to COAL TAR PRODUCTS, DHEW (NIOSH) Pub. #78-107, Rockville, Md., September 1977.

3. Criteria for a recommended standard . . . Occupational exposure to ASPHALT FUMES, DHEW (NIOSH) Pub. #78-106, Rockville, Md., September 1977.

4. Brown, J.: Preliminary Report--Occupational Exposure to Polynuclear Aromatic Hydrocarbons (PNA's) in the Roofing Industry, Industry-wide Studies Branch, Division of Surveillance, Hazard Evaluations, and Field Studies, NIOSH, Cincinnati, Oh., 1978.

5. Hammond et al: Inhalation of Benzpyrene and Cancer in Man, Ann. N.Y. Acad. Sci. 271: 116-124, 1976.

6. Thomas, JF: Control of Air Pollution Emissions from Roofing Equipment, National Roofers Air Pollution Board (A Joint Board of the United Slate, Tile, Composition Roofers, Damp, and Waterproof Workers Association and the National Roofing Contractors Association), November 1973.

7. Field Information Memorandum #74-64, "Coal Tar Pitch Interpretation," Occupational Safety and Health Administration, August 9, 1974.

8. Respiratory Protection: An Employer's Manual, DHEW (NIOSH) Pub. #78-193, Cincinnati, Oh., September 1978.

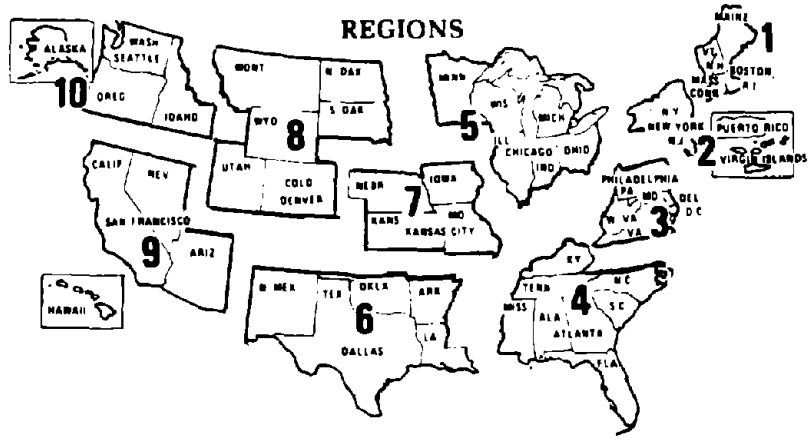
Single copies of the NIOSH publications on the above list are available to the public free. When NIOSH supplies of a publication are exhausted, they may be purchased from the U.S. Government Printing Office. Addresses appear below:

NIOSH
Publications Dissemination
4676 Columbia Parkway
Cincinnati, OH 45226

Superintendent of Documents
U.S. Government Printing
Office
Washington, D.C. 20402

NIOSH AND OSHA REGIONAL OFFICES

The following pages list NIOSH and OSHA regional offices. Either of these facilities serving the state can provide information on the Occupational Safety and Health Act including questions on standards interpretations, voluntary compliance information, copies of the OSHA Standards, OSH Act, Employee Rights Posting Notice, and other OSHA publications.



NIOSH REGIONAL OFFICES

DHEW, Region I
JFK Federal Bldg.
Room 1401
Boston, Massachusetts 02203
617/223-6668

DHEW, Region II
26 Federal Plaza, Room 3300
New York, New York 10007
212/264-2485

DHEW, Region III
P. O. Box 13716
Philadelphia, PA 19101
215/596-6716

DHEW, Region IV
101 Marietta Tower
Atlanta, GA 30323
404/221-2396

DHEW, Region V
300 South Wacker Dr.
33rd Floor
Chicago, IL 60606
312/886-3651

DHEW, Region VI
1200 Main Tower Bldg.
Dallas, Texas 75202
214/655-3081

DHEW, Region VII
601 E. 12th St.
5th Floor West
Kansas City, Missouri 64106
816/374-5332

DHEW, Region VIII
11037 Federal Bldg.
Denver, Colorado 80294
303/837-3979

DHEW, Region IX
50 United Nation Plaza, Rm. 231
San Francisco, CA 94102
415/556-3781

DHEW, Region X
1321 Second Ave., Mail Stop 502
Seattle, Washington 98101
206/442-0530

OSHA REGIONAL AND AREA OFFICES

REGION I

U.S. Department of Labor
Occupational Safety and Health Administration
JFK Building, Room 1804
Boston, Massachusetts 02203..... 617/223-6712

Area Offices

Boston, MA	617/894-2400	Hartford, CT	203/244-2294
Springfield, MA	413/781-2420	Providence, RI	401/528-4466
Concord, NH	603/224-1995		

REGION II

U.S. Department of Labor
Occupational Safety and Health Administration
1515 Broadway (1 Astor Plaza), Room 3445
New York, New York 10036..... 212/399-5941

Area Offices

Manhattan, NY	212/264-9840	Buffalo, NY	716/842-3333
Brooklyn, NY	212/330-7667	Newark, NJ	201/645-5930
White Plains, NY	914/761-4250	Belle Mead, NJ	201/359-2777
Long Island, NY	516/294-0400	Camden, NJ	609/757-5181
Queens, NY	212/445-5005	Dover, NJ	201/361-4050
Albany, NY	518/472-6085	Hasbrouck Hts., NJ	201/288-1700
Rochester, NY	716/263-6755	San Juan, PR	809/753-4457
Syracuse, NY	315/473-2700		

REGION III

U.S. Department of Labor
Occupational Safety and Health Administration
15220 Gateway Center, 3535 Market Street
Philadelphia, Pennsylvania 19104 ... 215/596-1202

Area Offices

Philadelphia, PA	215/597-4955	Wheeling, WV	304/232-8044
Pittsburgh, PA	412/644-2905	Elkins, WV	304/636-6224
Johnstown, PA	814/535-3504	Charleston, WV	304/343-6181
Meadville, PA	814/724-8031	Richmond, VA	804/782-2864
Allentown, PA	215/434-0181	Falls Church, VA	703/557-1330
Harrisburg, PA	717/657-0100	Roanoke, VA	703/982-6342
Lancaster, PA	717/394-0681	Norfolk, VA	804/441-8381
State College, PA	814/234-6695	Washington, DC	202/523-5224
Wilkes-Barre, PA	717/825-6811	Baltimore, MD	301/962-2840
Wilmington, DE	302/571-6115		

REGION IV

U.S. Department of Labor
Occupational Safety and Health Administration
1375 Peachtree Street, N.E., Suite 587
Atlanta, Georgia 30309..... 404/881-3575

Area Offices

Atlanta, GA	404/939-8987	Jackson, MS	601/969-4606
Macon, GA	912/746-5143	Pensacola, FL	904/438-2543
Savannah, GA	912/354-0733	Tampa, FL	813/228-2821
Louisville, KY	502/582-6111	Ft. Lauderdale, FL	305/566-6547
Anniston, AL	205/237-4212	Jacksonville, FL	904/791-2895
Mobile, AL	205/690-2131	Tallahassee, FL	904/877-3215
Montgomery, AL	205/832-7159	Raleigh, NC	919/755-4770
Huntsville, AL	205/895-5268	Columbia, SC	803/765-5904
Birmingham, AL	205/822-7100	Charleston, SC	803/577-2423
Sheffield/ Florence, AL	205/383-0010	Nashville, TN	615/749-5313
		Memphis, TN	901/534-4179

REGION V

U.S. Department of Labor
Occupational Safety and Health Administration
230 S. Dearborn, 32nd Floor
Chicago, Illinois 60604 ..... 312/353-4716

Area Office

Calumet City, IL	312/891-3800	Wausau, WI	715/842-8004
Niles, IL	312/631-8535	Milwaukee, WI	414/224-3315
Aurora, IL	312/896-8700	Madison, WI	608/252-5388
Peoria, IL	306/673-9515	Appleton, WI	414/231-1406
Belleville, IL	618/277-5300	Eau Claire, WI	715/832-9019
Cincinnati, OH	513/684-2354	Detroit, MI	313/226-6720
Cleveland, OH	216/522-3818	Indianapolis, IN	317/269-7290
Columbus, OH	614/469-5582	Minneapolis, MN	612/725-2571
Toledo, OH	419/259-7542		

REGION VI

U.S. Department of Labor
Occupational Safety and Health Administration
555 Griffin Square Building, Room 602
Dallas, Texas 75202 ..... 214/749-2477

Area Offices

Dallas/Ft. Worth, TX	214/749-7555	El Paso, TX	914/543-7828
Tyler, TX	214/595-1404	Albuquerque, NM	505/766-3411
Austin, TX	512/397-5783	Little Rock, AR	501/378-6291
San Antonio, TX	512/225-4569	Oklahoma City, OK	405/231-5351
Beaumont, TX	713/838-0271	Tulsa, OK	918/589-2451
Lubbock, TX	806/762-7681	Baton Rouge, LA	504/387-0181
Harlingen, TX	512/425-6811	Shreveport, LA	318/226-5360
Corpus Christi, TX	512/888-3257	New Orleans, LA	504/589-2451
Houston, TX	713/226-5431		

REGION VII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 3000, 911 Walnut Street
Kansas City, Missouri 64106..... 816/374-5861

Area Offices

Kansas City, MO	816/374-2756
St. Louis, MO	314/425-5461
Des Moines, IA	515/284-4794
North Platte, NE	308/534-9450
Omaha, NE	402/221-9341
Wichita, KA	316/267-6311

REGION VIII

U.S. Department of Labor
Occupational Safety and Health Administration
Federal Building, Room 15010, 1961 Stout Street
Denver, Colorado 80202..... 303/837-3883

Area Offices

Lakewood, CO	303/234-4471
Salt Lake City, UT	801/524-5080
Billings, MT	406/245-6711
Bismarck, ND	701/255-4011
Sioux Falls, SD	605/336-2980

REGION IX

U.S. Department of Labor
Occupational Safety and Health Administration
9470 Federal Building, 450 Golden Gate Avenue
Post Office Box 36017
San Francisco, California 94102..... 415/556-0586

Area Offices

San Francisco, CA	415/556-7260
Fresno, CA	209/487-5454
Sacramento, CA	916/484-4363
Long Beach, CA	213/432-3434
Carson City, NV	702/883-1226
Las Vegas, NV	702/385-6570
Honolulu, HI	808/546-3157
Phoenix, AZ	602/261-4858
Tucson, AZ	602/792-6286

REGION X

U.S. Department of Labor
Occupational Safety and Health Administration
6048 Federal Office Building, 909 First Avenue
Seattle, Washington 98174..... 206/442-5930

Area Offices

Bellevue, WA	206/442-7520
Spokane, WA	509/624-5235
Portland, OR	503/221-2251
Boise, ID	208/342-2711
Pocatello, ID	208/233-6374
Anchorage, AL	907/265-5341

Employee Chemical Protection Chart (Job Analysis)

Employees, first-line supervisors, and others need to know what hazards are presented by workplace chemicals, and what protective measures are required to guard against overexposure. The accompanying chart is suggested as a format for analyzing the specific chemical hazards employees face. Column headings are explained in the sections below.

Item

If the contents of chemical products are not listed by technical chemical names, those names should be requested from the supplier (for example, by requesting Material Safety Data Sheets). Both common and technical names should be included in the job analysis. Note that regulations being drafted when this guide went to press are expected to improve the usefulness both of chemical labeling and of Material Safety Data Sheets. Assistance in identifying chemical components can also be obtained by contacting NIOSH

Use

Indicating the use for each chemical product helps employees who handle several chemicals determine which personal protective equipment is required for which chemicals. Frequently, employees may recognize the chemical by its use far more readily than by its technical name. This information should likewise be valuable for supervisors.

Form(s) Found, Route(s) Of Exposure

Selection of appropriate engineering and administrative controls, and personal protective equipment and clothing depends on the physical forms of the substance present in the workplace--dust, liquid, vapor,

fume, gas, etc. The forms in which a chemical is present in a particular application plus the nature of the required handling together determine the routes of exposure--skin, inhalation, eye contact, or swallowing.

Controls and/or Protective Clothing and Equipment Required

Controls are recorded in this column so that in those situations where controls are necessary, supervisors and employees will be aware of what they are, and will take action when such controls require repair, adjustment, or routine maintenance.

To determine the adequacy of engineering or administrative controls, and of personal protective equipment or clothing, the concentration of an air contaminant may have to be measured.

Possible Results of Overexposure

This column is for the health effects of the hazard presented by overexposure (or by any exposure where a chemical is cancer-causing), as well as the basic symptoms of overexposure, if known. This information should be available from the supplier. If not, contact NIOSH

Effects due to short-term overexposure and those due to long-term overexposure should be separately identified. This should encourage the use of required protective equipment and the adoption of necessary work practices where long-latency health effects are involved and the need for protective measures is not immediately apparent--as well as where overexposure can produce serious acute effects.

U.S. GOVERNMENT PRINTING OFFICE 1979 - 760-577/27

Stock No: 017-033-00324-6

Title: Health and Safety Guide for the Commerical Roofing Industry
DHEW(NIOSH) Publication No. 78-194

Price: $2.50

MAIL ORDER FORM TO:
Superintendent of Documents,
Government Printing Office,
Washington, D.C. 20402.

NOTICE:
Prices of Government publications are subject to change without notice. Prices charged on your order may differ from prices printed in the publications.

Enclosed is $_____ ☐ check, ☐ money order, or

Charge to my Deposit Account No. ☐☐☐☐☐☐☐☐ Order No _____

Name _____

Street address _____

City and State _____ ZIP Code _____

79

FOR OFFICE USE ONLY

Quantity	Charges
____ Enclosed	
____ To be mailed	
____ Subscriptions	
Postage ____	
Foreign handling ____	
MMOB ____	
OPNR ____	
____ UPNS	
____ Discount	
____ Refund	

For prompt shipment, please print or type address on mailing label below

---

Government Printing Office
Superintendent of Documents
Washington, D.C. 20402

OFFICIAL BUSINESS

Penalty for private use, $300

Name _____

Street address _____

City and State _____ Zip Code _____

POSTAGE AND FEES PAID
U.S. GOVERNMENT
PRINTING OFFICE
375

PRINTED MATTER

KIND OF FIRE

DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .

. . .THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS

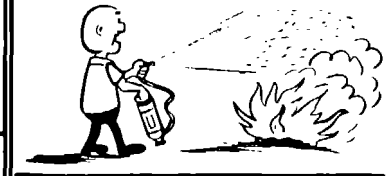
APPROVED TYPE OF EXTINGUISHER

MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT

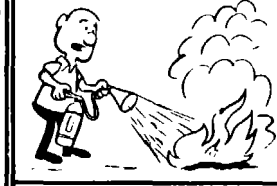
	FOAM Solution of Aluminum Sulphate and Bicarbonate of Soda	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	SODA ACID Bicarbonate of Soda Solution and Sulphuric Acid	PUMP TANK Plain Water	GAS CARTRIDGE Water Expelled by Carbon Dioxide Gas	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL
CLASS A FIRES — USE THESE EXTINGUISHERS — ORDINARY COMBUSTIBLES • WOOD • PAPER • CLOTH ETC.	✓	✗	✓	✓	✓	✓	✗
CLASS B FIRES — USE THESE EXTINGUISHERS — FLAMMABLE LIQUIDS, GREASE • GASOLINE • PAINTS • OILS, ETC.	✓	✓	✗	✗	✗	✓	✓
CLASS C FIRES — USE THESE EXTINGUISHERS — ELECTRICAL EQUIPMENT • MOTORS • SWITCHES ETC.	✗	✓	✗	✗	✗	✓	✓

HOW TO OPERATE

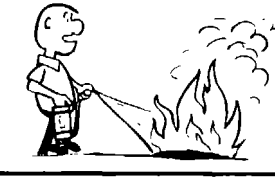
FOAM: Don't Play Stream into the Burning Liquid. Allow Foam to Fall Lightly on Fire.



CARBON DIOXIDE: Direct Discharge as Close to Fire as Possible. First at Edge of Flames and Gradually Forward and Upward

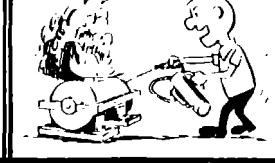


SODA-ACID, GAS CARTRIDGE: Direct Stream at Base of Flame



PUMP TANK: Place Foot on Footrest and Direct Stream at Base of Flames

DRY CHEMICAL: Direct at the Base of the Flames In the Case of Class A Fires, Follow Up by Directing the Dry Chemicals at Remaining Material That is Burning



EMPLOYEE CHEMICAL PROTECTION CHART

date

position title

initials

ITEM	USE	FORM(S) FOUND IN THIS OPERATION	ROUTE(S) OF EXPOSURE	CONTROLS and/or PERSONAL PROTECTIVE CLOTHING and EQUIPMENT REQUIRED	POSSIBLE RESULTS OF OVEREXPOSURE

EMERGENCY INFORMATION

FIRE

Telephone Fire Department _____

Nearest Alarm Box at _____

CRIME

Telephone Police _____

INJURY/ILLNESSES

Avoid infection of minor injuries; always get medical attention or skilled first aid.

Doctor _____

Office _____ Tel. _____

Residence _____ Tel. _____

_____

_____

Hospital _____

Address _____ Tel. _____

Ambulance _____

Address _____ Tel. _____

(In emergencies, get medical attention and transportation elsewhere if necessary.)

In all cases of Fire, Crime, Accident, or Sickness, promptly notify:

1. Name _____ Office Tel. _____
   Address _____ Res. Tel. _____

or

2. Name _____ Office Tel. _____
   Address _____ Res. Tel. _____