

**NIOSH**

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**RESIDENTIAL  
WASTE  
COLLECTION:**

**Hazard Recognition & Prevention**

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

**RESIDENTIAL WASTE COLLECTION**

*HAZARD RECOGNITION & PREVENTION*

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**Public Health Service**  
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**National Institute for Occupational Safety and Health**

March 1982

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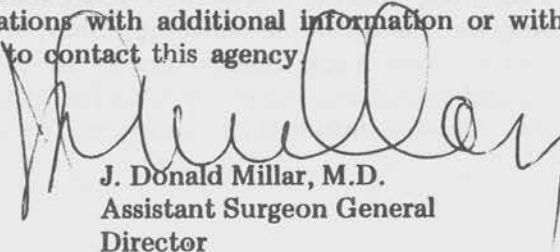
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## PREFACE

*Residential Waste Collection* was undertaken to assist employers, workers, and worker representatives with the task of improving the health and safety record of this occupation, which experiences an injury rate seven times as great as the average for all industries.

The text that follows attempts to provide basic hazard recognition and prevention information for the residential waste collection industry. Individuals or organizations with additional information or with suggestions are encouraged to contact this agency



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## CONTENTS

PREFACE . . . . .	III
ACKNOWLEDGMENTS . . . . .	IV
INTRODUCTION . . . . .	1
MINIMIZING THE HAZARDS OF WASTE COLLECTION	
Nature of the Work Environment . . . . .	2
Load Limitations . . . . .	2
Equipment Maintenance . . . . .	2
Engineering Controls . . . . .	3
Personal Protective Equipment and Clothing . . . . .	5
Curbside vs. Backyard Pickup . . . . .	6
Driver Training . . . . .	6
Work Pace . . . . .	7
Job Satisfaction . . . . .	7
Riding Position . . . . .	7
Personal Hygiene . . . . .	8
Preplacement Physical . . . . .	9
Scientific Studies of Health Hazards . . . . .	9
SPECIFIC ON-THE-JOB HAZARDS	
Traveling . . . . .	11
Safety Check . . . . .	11
Truck Handling Characteristics . . . . .	14
Riding Position . . . . .	14
Parking on Hills . . . . .	16
Curbside Driving Controls . . . . .	16
Backing a Rear-Loader . . . . .	16
Backup Safety Devices . . . . .	19

Sizing Up the Load . . . . .	20
Tagging . . . . .	20
Hidden Chemical Hazards . . . . .	21
Defective Containers . . . . .	21
Hidden Lifting Hazards . . . . .	21
Wet Boxes . . . . .	21
Protruding Trash . . . . .	23
Drums . . . . .	26
Loading . . . . .	26
Hand Protection . . . . .	26
Lifting Bags . . . . .	27
Carrying Several Loaded Containers . . . . .	27
Transfer Tubs . . . . .	27
Hand Trucks for Moving Tubs . . . . .	27
Collecting from the Left Side . . . . .	29
High-Visibility Clothing . . . . .	30
Lifting Over an Obstruction . . . . .	30
Lifting Position . . . . .	31
Loading Sill Height . . . . .	32
Twisting While Lifting . . . . .	34
Team Lifting . . . . .	35
Bulk Pickups . . . . .	36
Dusty Loads . . . . .	38
Animals, Rodents, Stinging Insects . . . . .	38
Tossing Cans . . . . .	40
Throwing Bags . . . . .	41
Riding Steps . . . . .	42
Foot on Loading Sill . . . . .	42
Step Extensions . . . . .	42
Children at Play . . . . .	44
Foot Protection . . . . .	44
Slippery Surfaces . . . . .	44
Street Hazards . . . . .	46
Deep Puddles . . . . .	46
Jumping to or from the Riding Step . . . . .	47
Jumping from the Cab Step . . . . .	48
Pace of Work . . . . .	48

Compacting and Unloading .....	50
Split-Cycle Packing Controls .....	50
Hands on Hopper Sill, and Side Walls .....	53
Constant-Pressure Two-Hand Controls .....	54
Guard Doors .....	54
Recessed and Nonrecessed Buttons .....	58
Placement of Controls .....	59
Elevating Hoppers .....	60
Signal Buzzer .....	61
Repositioning the Load .....	62
Scavenging .....	63
Eye Protection .....	64
Ejections .....	65
Oversized Lumber .....	66
Oversized Garden Waste .....	66
Exhaust Fumes .....	66
Fluorescent Lights, Picture Tubes .....	69
Overfilling the Compactor .....	70
Auxiliary Engine Access .....	71
Entering the Compactor .....	72
Truck and Body Fires .....	72
Visibility in the Landfill .....	74
Weather Extremes .....	75
Sources of Additional Information .....	77



## INTRODUCTION

Every day in the U.S., 400 million pounds of residential waste are collected from 23.4 million single family residences and 1.4 million duplexes.\* Waste collected from apartment buildings utilizing residential waste collection services adds additional millions of pounds to this figure. In the course of collecting those hundreds of millions of pounds of solid waste, collectors incur injuries at a rate 7 times higher than the average for all other industries. Collectors may also risk serious short- and long-term illnesses.

This publication is intended to assist residential waste collection employers, collectors, and worker representatives in identifying, evaluating, and eliminating the major hazards of refuse collection.

The text consists of two sections. The first discusses residential waste collection hazards, and makes general recommendations. The second section, "Specific On-the-Job Hazards", uses photographs and brief explanations to illustrate hazards encountered during refuse collection. In many cases both desirable and undesirable work practices are shown to allow comparison. NIOSH's specific recommendations for protecting collectors and drivers are found in this part.

Few Federal health and safety standards apply *specifically* to residential waste collection work (at least outside the truck garage). However, Section 5(a)(1) of the Occupational Safety and Health Act of 1970, known as the General Duty Clause, requires employers to protect their employees against generally recognized hazards that are "causing or likely to cause death or serious physical harm" but

which are not already covered by specific standards.

Although specific recommendations are made here, NIOSH does not intend thereby to discourage employers, collectors, or worker representatives from minimizing or eliminating hazards by other methods. Questions on whether specific preventive measures meet OSHA standards or General Duty Clause requirements should be directed to the local or regional OSHA office. Phone numbers and address of each local office appear in the NIOSH publication, "Occupational Safety and Health Directory," and are also listed in the white pages of the phone directory under "U.S. Government—Department of Labor." Note that assistance in hazard identification and evaluation can be obtained from NIOSH regional offices or from OSHA-sponsored state consultation programs.

No distinction is made in the text between public and private collection operations. While technically the only municipal workers covered by OSHA rules are those employed in states with approved public employee plans, municipal workers in other states face the same hazards.

The recommendations in this publication are made exclusively to prevent injury, disease, or illness arising from work in the residential waste collection industry. Employee protection, however, isn't the only predictable result of these recommendations. Injury, disease, and illness that is prevented also means lower insured and uninsured costs. The uninsured costs of on-the-job injury, disease, and illness—estimated to be at least as much as the insured costs\*\*—include downtime, accident investigation, equipment repair,

extra overtime, claims processing, dislocation of schedules, training of replacement workers, injury reporting, etc. To these already substantial insured and uninsured costs must be added the uncompensated costs, both monetary and intangible, "paid" by injured employees. In light of these considerations, it should be clear that by preventing occupational injury, disease, and illness, employers and collectors can realize significant economic as well as social dividends.

The criteria used to determine which hazards would be discussed in this publication were:

1. The hazard is applicable to most of the industry.
2. The hazard has the potential for causing injury, disease, or illness.
3. There are sufficient data to support a recommendation for a possible solution.
4. The hazard is one that the employer can do something about.

Some recommendations, such as those for icy surfaces, obviously don't apply in certain regions. On the other hand, some collection organizations may face significant hazards *not* covered by this publication. The fact that this text doesn't cover such hazards, in no way, diminishes the employer's legal obligation to protect employees against the dangers they face on the job.

\*National Solid Wastes Management Assoc., Washington, D.C.: Geographic characteristics of the refuse collection industry. Technical Bulletin 5:3, 1974.

\*\*Grimaldi, J. V., and Simonds, R. H.: *Safety Management*, (Homewood, Ill.: Richard D. Irwin, 1975 3rd ed.), p. 491.

# MINIMIZING THE HAZARDS OF WASTE COLLECTION

## NATURE OF THE WORK ENVIRONMENT

One of the critical differences between residential waste collection and most other jobs is that *the collector does most of his or her work in a workplace that is constantly changing*. Consider the following factors:

- variations in solid waste composition, weight, size, and toxicity
- differences in container size, structure, and condition
- changing weather
- children in the work area
- street repairs
- irregular and/or slippery walking surfaces
- parked vehicles
- vehicles in motion (including the collection vehicle itself)
- loose dogs
- stinging insects
- rodents

Waste collection employees themselves differ from many other workers in that they do most of their work with only minimal supervision. At the same time, their efforts—again unlike those of most other workers—are particularly subject to direct scrutiny by customers.

Taken together, a constantly changing work environment, minimal supervision, and high public visibility raise important considerations, several of which are discussed.

## LOAD LIMITATIONS

If a supervisor followed each truck constantly to make instant judgments on refuse acceptability, formal load limitations might not be necessary. But since this isn't practical or desirable, customers need to be made aware of acceptability criteria, preferably in advance. To inform them, plus protect the collector, the employer should provide a concise written list of load limitations, such as on tags or labels, that can be marked to indicate the particular limitation violated and attached to the container or item. Throughout this publication it is assumed that a tag-type notification method is used, although alternative methods are utilized in some localities.

Tags (or labels, brochures, etc.) should contain information regarding:

- acceptable container types and condition
- maximum gross weight per container
- maximum load dimensions
- unusually heavy items or debris
- hazardous chemical or biological materials

The purpose of specifying such limitations *in writing* is to take some of the burden off the collector. Collectors should not have to spend time justifying the decision to leave a load behind when a printed tag would be sufficient in most cases. The tag transfers much of the acceptability judgment to management, while helping to assure customers that they are getting equal treatment. It typically gives a phone number to call for further information.

By lessening the opportunity for collector-customer antagonism, work practices such as tagging can save the employee considerable stress. Note that elevated job stress is generally associated with an increased number of sick days, higher injury rates, earlier fatigue, and lower morale. In short, the more sources of unnecessary job stress that are eliminated, the better employees are likely to perform.

A gross weight limit no greater than 50 lbs. is recommended for cans and other *rigid containers*. Except where exceptionally cut- and puncture-resistant gloves with long gauntlets (cuffs) are used, the practice of lifting *bags* with one hand on the bottom is discouraged. When such gloves *aren't* used for bag handling, NIOSH recommends that the weight limit be that weight (no more than 50 lbs.) which allows lifting from the top *without* one hand on the bottom. Actual bag weight limits will depend on whether an area has bag strength requirements. Weight and other load limitations are discussed in greater detail in the second section of the text. Specific On-the-Job Hazards.

## EQUIPMENT MAINTENANCE

*One very tangible result of inadequate maintenance is that employees may be forced to improvise, sometimes with disastrous consequences.* A good rule of thumb is this: if the equipment isn't in safe operating condition, it doesn't leave the garage; if it leaves in good shape but develops problems on the route, the vehicle is put out of service until the problem is solved. This simple rule will help prevent employees from having to divide their attention between doing their jobs and coping with vehicle defects.

### TRUCK SAFETY CHECKLIST

- \_\_\_ Signals work
- \_\_\_ Service brakes OK
- \_\_\_ Parking brakes OK
- \_\_\_ Tire condition OK
- \_\_\_ Wipers and window washer OK
- \_\_\_ Collectors' buzzer works
- \_\_\_ Backup alarm/ safety bar OK
- \_\_\_ Exhaust system OK
- \_\_\_ Fuel system, lines OK
- \_\_\_ Compactor hydraulics OK
- \_\_\_ Engine oil level OK
- \_\_\_ Radiator water level OK
- \_\_\_ Riding steps level, secure
- \_\_\_ Spare clothing in cab
- \_\_\_ Cycling controls, stops, OK
- \_\_\_ Mirrors, light lenses clean
- \_\_\_ Emergency equipment OK  
(flags, reflectors, fire extinguisher, eye wash bottle and water, first aid kit)
- \_\_\_ steering OK
- \_\_\_ defroster (if cold season) OK

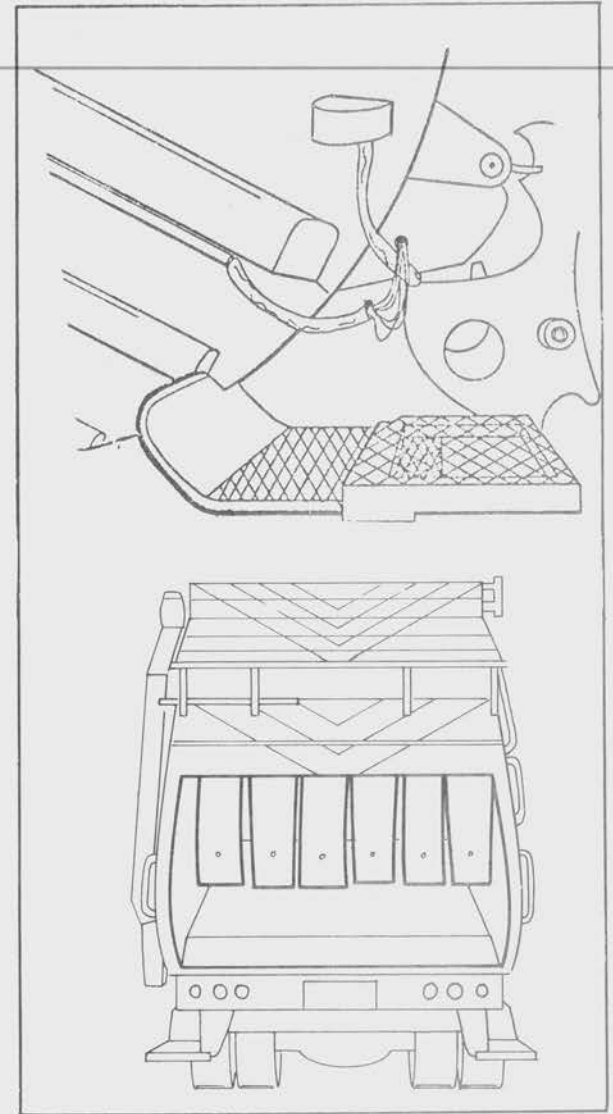
Diminished morale is one of the less tangible but entirely predictable results when equipment is not maintained in good and safe operating condition. To minimize the hazards caused by vehicle failures occurring on the route (and direct and indirect maintenance costs as well), a thorough program of preventive maintenance is strongly recommended.

### ENGINEERING CONTROLS

Some of the hazards faced by residential waste collectors can be "engineered out" by appropriate equipment design. Continuous-pressure controls, moving barriers, split-cycle controls, or elevating hoppers are recommended for pinch point protection (panel-to-loading-sill) in ANSI Standard Z245.1 (1975).\* This voluntary standard, developed by the waste collection industry, also recommends an automatic neutral interlock for trucks with automatic transmissions that use one engine for both moving the vehicle and for hydraulic power. In addition, the standard suggests that a warning light or bell be used to signal the driver whenever the tailgate is up.

Municipalities participating in the Injury Reporting and Information System (IRIS), sponsored by the National Science Foundation, have reported success with several innovative engineering controls. Among these are:

1. Extendable and/or split-level riding steps, to help keep feet off the hopper sill by providing a more comfortable riding platform;
2. Rubber flaps hung in the hopper, to deflect ejected refuse back into the hopper;



\*ANSI stands for American National Standards Institute, a private standards-setting organization not affiliated with the U.S. Government. For further information, see page 77.

3. Windows installed in the lower door panels of the cab, plus fixed side windows at eye level behind the doorposts;

4. Rapid-rail mechanical loading devices, to eliminate manual lifting of refuse containers (typically in areas where on-street parking is minimal and containers can be readily standardized);

5. Pressure-sensitive backup devices that apply the brakes automatically whenever the vehicle is operated in reverse and the tailgate-mounted sensor strikes anything (only used on side loaders);

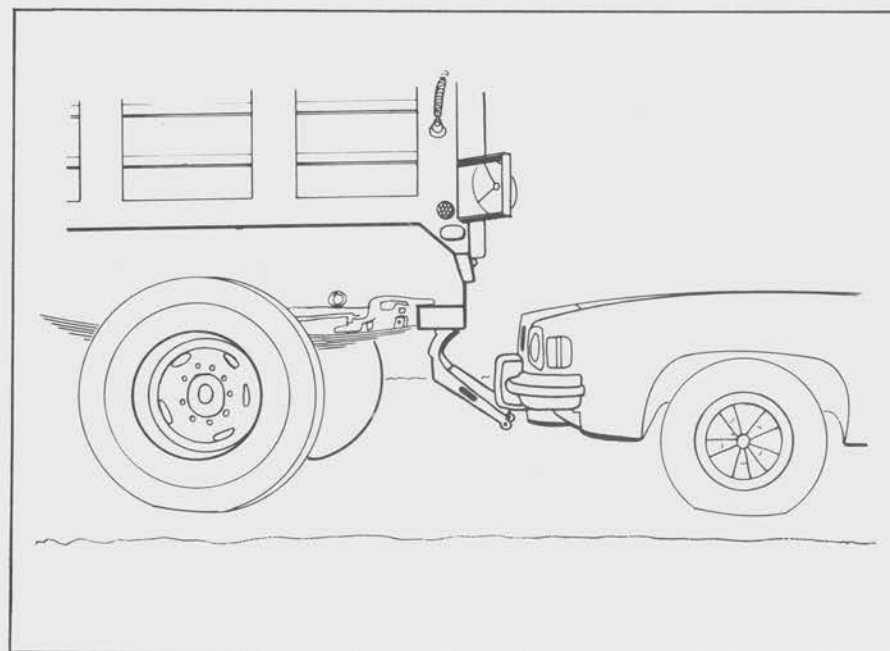
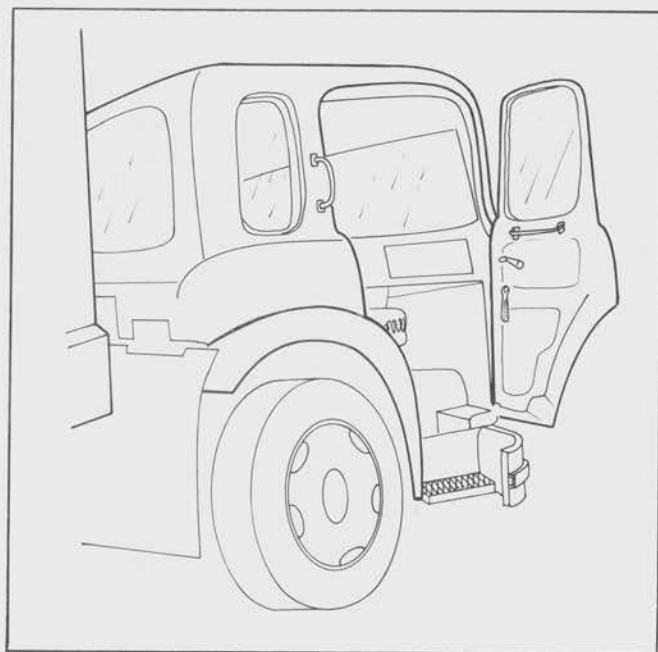
6. Self-cleaning riding and cab steps, and extended, slip-resistant handholds;

7. A rotating top light on the compactor; a second set of rear signal lights mounted high enough that collectors don't block them from the view of approaching motorists; truck-mounted work area illumination if collection work is performed before sunrise or after sunset;

8. Hard rubber padding on the hopper sill, to protect the collector's hands when cans are rested or bumped on the sill for dumping; and

9. A windshield and weather cover over the controls for side-driving vehicles.

SINCE THE EXPENSE INVOLVED IN RETROFITTING EXISTING VEHICLES WITH SUCH CONTROLS CAN BE CONSIDERABLY GREATER THAN THE COST OF GETTING THE CONTROLS AS ORIGINAL EQUIPMENT, NIOSH RECOMMENDS THAT SERIOUS CONSIDERATION BE GIVEN TO INCORPORATING THE FEATURES DESIRED INTO BID SPECIFICATIONS. CLOSE ATTENTION SHOULD BE GIVEN TO THE RECOMMENDATIONS IN ANSI STANDARDS Z245.1 (1975) (see page 77 for details), AND TO THE DISCUSSION OF SILL HEIGHT IN THE SECOND SECTION OF THIS PUBLICATION.



## PERSONAL PROTECTIVE EQUIPMENT AND CLOTHING

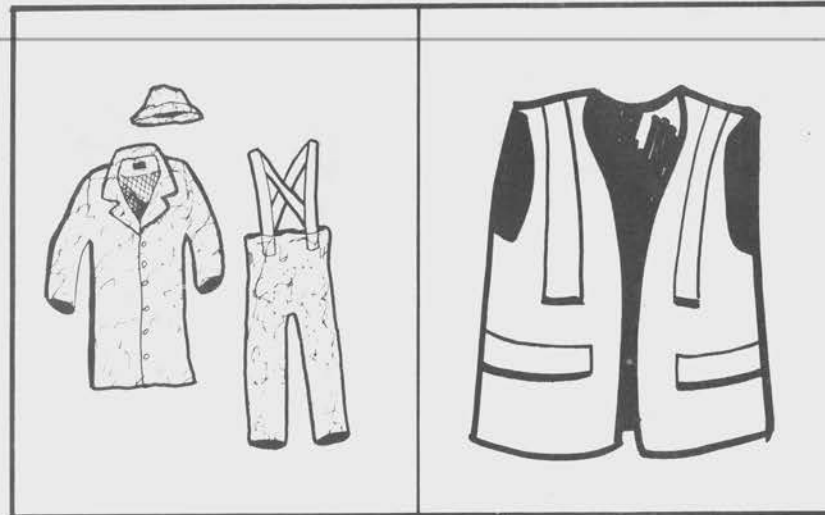
Residential waste collectors cannot be entirely protected against job hazards by engineering controls and work rules.

During foul weather, collectors need high visibility outer gear. A bright yellow or orange raincoat or safety vest is necessary under such conditions to ensure that collectors can be easily seen by motorists.

The high frequency of "foreign object in eye" injuries in this industry indicates a definite need for eye protection. Ejections during the compacting cycle—broken glass, acid from storage batteries, and various other refuse fragments—are only part of the problem. Aerosol cans may explode when packed, as may explosives, ammunition, flammable liquids, and picture tubes. To protect the eyes (while avoiding significant discomfort), safety glasses with cable temples or holding straps, plus wire screen side shields, should be used. For employees whose vision does not require correction, "plano" safety glasses are recommended (not plastic goggles, which usually distort the view, scratch more readily, and are hotter to wear). Where equipment with a descending hopper guard door or an elevating hopper is used, a hard hat with chin strap is recommended.

The skin should be covered during collection work to the greatest extent possible (but still consistent with reasonable comfort). Full-body coveralls, gauntlet gloves, and safety glasses will substantially cover all exposed areas. Care should be taken (especially where heat stress could be a problem) to select a coverall fabric that is comfortable.

Hand protection is especially important for residential waste collection. The glove



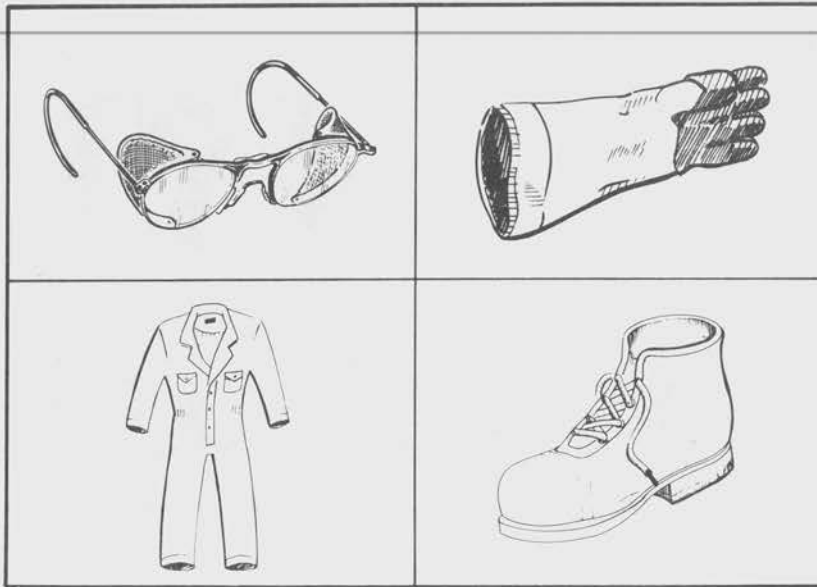
selected would ideally protect against punctures and lacerations, chemical hazards (such as caustics, acids, pesticides), and biological hazards (such as animal waste). Choosing a glove that would best protect a collector from one particular hazard would make glove selection relatively simple. But the "unknowns" that collectors face daily require that the glove selected protect, to the extent possible, against *all* of the major hazards cited. In addition, the ideal glove would: resist water, provide a good grip under both wet and dry conditions, be reasonably comfortable and flexible over the range of local temperatures, be washable, and have a reasonable wear life.

Ordinary cotton or latex gloves can generally be ruled out. Gloves that do not "breathe" at all (natural rubber, neoprene, or plastic, either unsupported or fully-coated), gloves that do not protect against punctures and lacerations (cotton, latex), gloves that

have poor wet grip (smooth nitrile butyl rubber), and gloves that are not relatively impervious to common hazardous chemicals (cotton) are *not* recommended. In a survey of 60 municipalities providing gloves to collectors, 46 preferred a canvas gauntlet glove with a suede or leather palm plus leather on the fingertips and across the knuckles.\*

Whatever the type of glove selected, current interpretations of Federal safety legislation indicate that personal protective equipment necessary to protect the employee must be provided by the employer, and that the employer must ensure it is properly used and maintained. Glove selection is discussed further under Specific On-the-Job Hazards.

\*IRIS News, Volume 1, No. 9, December 1977, Safety Sciences/Division WSA, Inc., San Diego, California.



### CURBSIDE VS. BACKYARD PICKUP

In 1970, 9.8 million single family residences received backyard pickup, and 13.6 million had curbside waste collection service.\* (In this publication, curbside and alley collection are both treated as "curbside" methods.) Those firms and departments providing *backyard* pickup should consider these factors:

1. Getting to and from the customer's backyard adds hurdles to the collector's

\*National Solid Wastes Management Association, Washington, D.C.: Geographic characteristics of the refuse collection industry. Technical Bulletin 5:3, 1974.

work. Access may be impeded by vehicles, toys, uncleared snow or ice, mud, locked gates, and fenced-in animals. When conditions on the customer's property prevent safe refuse collection, collectors should be instructed to either leave a tag or contact their supervisor.

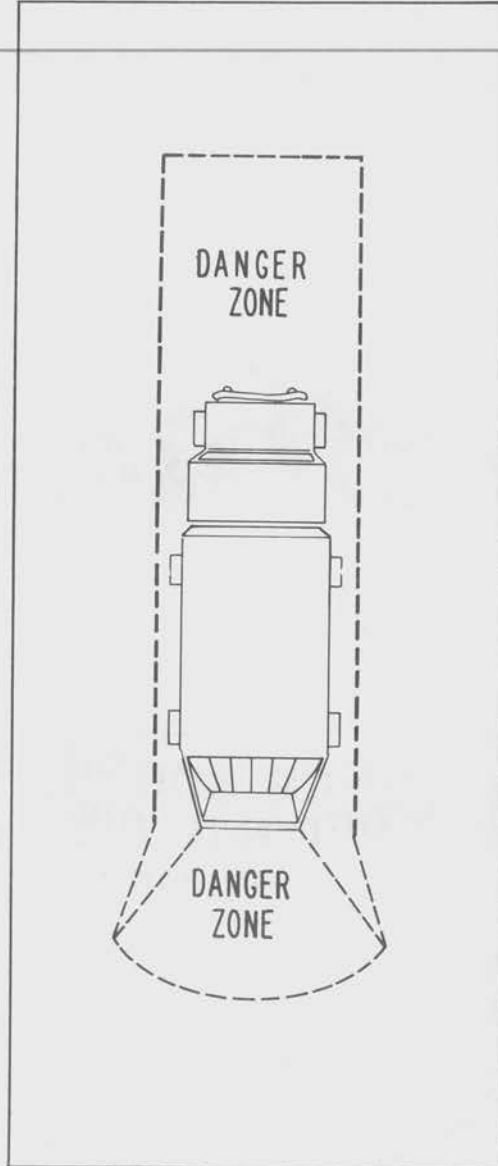
2. Getting the refuse to the street often requires the use of a transfer container (tub). Wheeling this load is considerably safer than carrying it. If tubs are not equipped with wheels, or terrain includes slopes or steps, hand trucks should be

used. Note that large-volume transfer tubs allow for unsafe (overweight) loads to be assembled rather easily. The overloading problem can be reduced by requiring the collector to rock the tub (to estimate the weight and stability of its contents) before adding each additional container of waste.

### DRIVER TRAINING

Many employers put their vehicle operators through a defensive driving course before assigning them to a truck. Note, however, that adequate driver training in this industry requires special instruction on waste collection work, if not included in the general defensive driving program.

One way that drivers and collectors can visualize some truck and compactor hazards found in residential waste collection is to mark out, during training, a "zone of danger" extending in front and behind (and sometimes besides) the truck. In front, the zone extends as far as it takes for the truck to stop without hitting anything and without stopping so short as to throw a step rider to the pavement. To the rear of a rearloading compactor, the zone extends as far as ejected refuse can travel during the packing cycle, as far as the driver's rear blind spot extends, or an arm's length from the loading sill, *whichever is longest*. To the rear of a sideloading compactor, the zone extends as far as the side-driver's blind spot extends. To the side of the sideloader, the zone extends an arm's length from the loading sill or as far as ejected refuse can travel, whichever is longer. Keep in mind that under different conditions (example: slick pavement), one or more of these zones may change size.



### WORK PACE

Factors that may lead to a dangerously fast work pace include:

- collectors' desire to finish the day's work early
- peer pressure exerted by faster collectors
- possible advantage to the employer of having trucks return early
- increased risk-taking behavior of new employees (such as taking shortcuts)

Because too fast a work pace does not allow muscles adequate time to rest between exertions, the body tires earlier. Fatigue can diminish alertness, and thereby increase the risk of injury. Too fast a work pace can adversely affect the heart. During hot weather, it can also increase the risk of heat cramps, heat exhaustion, and heat stroke. These weather-related illnesses are discussed in greater detail under Specific On-the-Job Hazards.

Firms or departments selecting the task system should be sensitive to the incentives it provides for rushed work, and should establish appropriate safeguards.

### JOB SATISFACTION

Improving job satisfaction may help reduce turnover rates and some risk-taking behavior. Some measures the employer can take to develop and maintain job satisfaction (and improve safety) include:

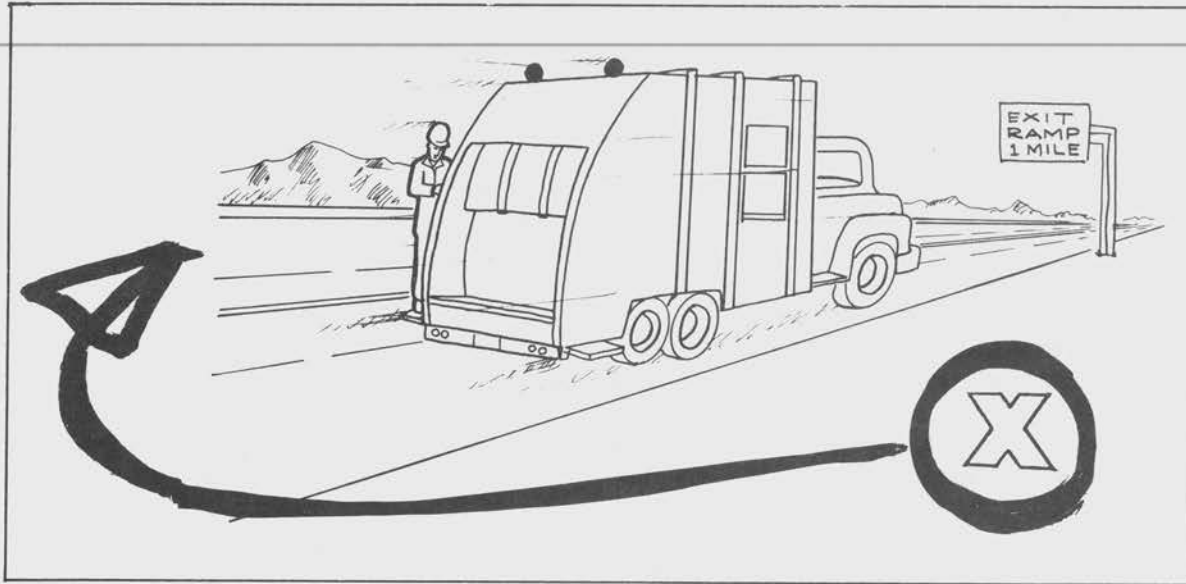
- keeping the vehicle and equipment in good working order
- promptly fixing broken signal devices, window glass, lenses, gauges, etc.

- prohibiting containers that are likely to cause spills, such as bags that are too weak for the load
- providing the equipment needed for cleaning up ejected or spilled refuse safely
- regularly cleaning the truck exterior and keeping it well-painted
- providing a clean uniform daily
- providing spare uniforms and gloves in the cab for use when needed for on-the-route changes
- supporting employees who properly tag out unacceptable refuse, through strict enforcement of rules and by followup with customers
- providing customers with written explanations of pertinent collector work rules, and of the local requirements for disposal of regular as well as hazardous waste.

### RIDING POSITION

Collectors should ride in the cab, except when moving short distances at slow speeds; then the riding steps may be used. Poorly designed steps or handholds, however, can make even this limited use of riding steps hazardous. Steps that are too narrow or too short (and handholds that are poorly placed) may encourage collectors to ride with one foot on the loading sill and/or with a hand on the side of the hopper. Either practice can result in a permanent disability, such as a crushed hand or foot. Some employers have found extendable steps, wraparound steps, or split-level steps to be valuable modifications.

In some cases cab space is too small for the crew. Do not allow lack of space to force



employees to ride on cab steps, riding steps, the loading sill, or in the hopper. Transport collectors lacking cab seating to and from the collection route in another vehicle.

#### PERSONAL HYGIENE

Because of the disease-spreading potential inherent in the handling of largely unrestricted residential solid waste, personal hygiene is a health matter of considerable importance to the well-being of the collector. Hygiene is particularly important due to the opportunity for contact of waste with broken skin (lacerations, cuts, and punctures).

In industries with comparable exposure risks, employees are required to wash their hands and face before eating, drinking, smoking, or chewing gum or tobacco, and they are often required to shower before leaving work.

Collectors should be urged to (1) wash before eating during the workday, (2) wash before leaving work, and (3) bathe daily for protection against infection and skin disease. They should also be shown techniques for properly cleaning and covering wounds. *Note that wearing clothes or gloves (including underclothes and shoes) that have been previously contaminated defeats good personal hygiene.* Skin ailments are more likely to occur as a result. In addition, if the *insides* of gloves or garments are contaminated, certain chemicals, such as pesticides, may come into contact with the skin and be absorbed without warning, especially after the skin becomes moist with sweat. For the above reasons, the employer should provide clean coveralls and gloves daily, plus keep spares in the cab. To ensure that hazardous contaminants are not

inadvertently taken home, where family members may be exposed to them, laundering of protective clothing should be handled by the employer.





## PREPLACEMENT PHYSICAL

Before a new collector is assigned to a crew, NIOSH recommends that a medical examination be performed that includes:

1. visual acuity
2. depth perception
3. hearing acuity
4. field of vision
5. motor defects
6. cardiovascular system
7. date of last tetanus booster
8. medications or drugs used that could affect perception, coordination, or judgment
9. lifting strength
10. chest x-ray
11. pulmonary function (FEV and FEV<sub>1</sub>).

Item 8 on this list includes alcoholic beverages. An executive who has a desk job and drinks excessively may fall asleep. However, a collector—like anyone else who operates potentially hazardous machinery—runs a significant risk of self-injury or of injuring others if under the influence of alcohol. This is one area where fellow employees can be influential in persuading a person who needs help to get it.

## SCIENTIFIC STUDIES OF HEALTH HAZARDS

Few studies have been performed that examine the impact of residential waste collection work on the health of collectors. Six investigations specific to waste collection are summarized below.

In a 1952 report, Sliepevich analyzed the medical records of New York City sanitation workers. [1] Collectors, drivers, and sweep-

ers, taken as a group, appeared to experience a greater incidence of arthritis, cardiovascular disease, and hernia than a comparison group of active workers of similar ages.

Cimino also examined the New York City Sanitation Department's medical records, but his study, reported in 1975, covered employees working during 1968–1969. [2] Activity limitations for collectors, due to arthritis, occurred four times as often as the average for a comparison group of "general laborers." Incidence of coronary heart disease (a type of cardiovascular disease) in New York City sanitation workers, ages 35–64, was nearly double the rate of a comparison group of active workers of similar ages.

Gellin and Zavon examined 97 residential waste collectors, employed by the City of Cincinnati, for skin disorders during January and February of 1968. [3] Disorders frequently observed included abrasions or lacerations (especially on the front of the legs); folliculitis (a skin inflammation) of either the thighs, buttocks, or torso; bacterial or fungal infections (not necessarily occupational in origin); and dermatitis of the lower limbs (dry, cracked, scaly skin, occasionally inflamed).

Rufener-Press and coworkers reported in 1975 that trash collectors in Geneva, Switzerland developed chronic bronchitis 2-1/2 times as frequently as did a comparison group of active working Swiss men in the same age group. [4] Ducel and coworkers (1976) examined the levels and types of microorganisms in the breathing air of collectors working at or near the hopper, and compared them with the normal background level in outdoor air. [5] From the small number of samples analyzed in their 1976 report, it ap-

peared that concentrations of such microbes in air were considerably greater near the hopper.

In 1974, Peterson characterized viruses found in samples of disposable diapers taken from residential waste. [6] Potentially hazardous viruses were found in 9 of 84 samples.

On the basis of these studies, the following conclusions may be drawn:

1. Methods for minimizing lifting injuries should be given serious consideration. Load weight limitations should be established. Collectors should be trained in safe lifting practices, and in recognizing approximate load weights by rocking the container. Collectors should be provided a convenient way to indicate that a load is overweight and uncollectable. In addition, loading sill height and other related

<sup>1</sup>Sliepevich, EM: Effect of Work Conditions Upon the Health of the Uniformed Sanitationmen of New York City, Doctoral dissertation, Springfield College, Springfield, Mass., June 1955.

<sup>2</sup>Cimino, JA: Health and safety in the solid waste industry. *Am. J. Public Health* 65:1, 1975.

<sup>3</sup>Gellin, GA, and Zavon, MR: Occupational dermatoses of solid waste workers. *Arch. Environ. Health* 20:510–515, 1970.

<sup>4</sup>Rufener-Press, C., Bahy, M., and Rey, R: Chronic bronchitis and risk factors among trash collectors in Geneva—research studies, *Occupational Medicine Unit No. 5*, 1975.

<sup>5</sup>Ducel, G, Pitteloud, JJ, Rufener-Press, C, Bahy, M, and Rey, R: Exposure of trash collectors to bacteria. *Soz. Praventivmed.* 21(4):136–138, 1976 (French).

<sup>6</sup>Peterson, ML: Soiled disposable diapers: A potential source of viruses. *Am. J. Public Health* 64(9):912–914, 1974.

engineering considerations should be carefully examined when new equipment is procured.

2. The reason for the elevated cardiovascular disease rate reported in the Slipevich and Cimino studies is unknown. It is an unusual finding, since persons with strenuous jobs generally experience a *lower* than average incidence of cardiovascular disease. Exposure to elevated carbon monoxide levels significantly increases the effort required for supplying the body with oxygen; good preventive practice would require that steps be taken to eliminate unnecessary exposure. Modifying horizontal exhaust systems to vertical discharge configurations will significantly reduce exposure in most cases.

3. The high incidence of folliculitis in the Gellin and Zavon study suggests that increased emphasis needs to be placed on personal hygiene, and on use of garments that "breathe." Daily laundering of uni-

forms by the employer would ensure that the garments most likely to be contaminated during collection work will not be put on dirty. Spares should be kept in the cab for use when uniforms or gloves become excessively contaminated on the route. During training, collectors should be made aware of the importance of changing undergarments and bathing daily to help prevent skin ailments.

4. The cause of the elevated chronic bronchitis rate in the Rufener-Press study is not known. The Lucel study of microbes in collector breathing air is insufficient by itself to demonstrate a role of elevated levels of breathing air microbes in the initiation or development of chronic bronchitis or other chronic respiratory diseases.

5. Disposable diapers are not the only source of fecal matter in residential solid waste. They are, however, one of the few sources of *human* fecal matter in collected household waste. The World

Health Organization stated in 1972 that solid waste (in contrast to sewage) should contain no feces or urine, and that mixing of these with household wastes should be prohibited by law. [7] Collection of feces-contaminated materials raises several problems. First, collectors cannot be practically protected against feces-borne disease by the methods that protect employees who work, for example, in diaper cleaning plants or hospital laundries. Second, some concern has been raised about the potential for contamination of ground water when soiled disposable diapers are buried in landfills. However, the alternative of flushing the diaper (minus the plastic liner) in a toilet can present problems for sewage treatment plants (clogged screens).

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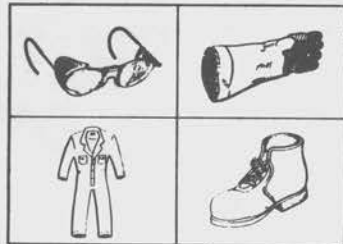
<sup>7</sup>World Health Organization: Solid waste disposal and control. WHO Chronicle 24:147, 1972.

## SPECIFIC ON-THE-JOB HAZARDS

This section treats the hazards specific to each phase of residential waste collection. The discussion is divided into five parts:

1. Traveling p 11
2. Sizing up the load p 20
3. Loading p 26
4. Compacting and unloading p 50
5. Weather extremes p 75

Many of the photos taken during actual collection operations do not show the use of the safety gear recommended in the text—gloves, bright vests, eye protection, etc. Our choice of relying primarily on real-life photos, despite this shortcoming, in no manner indicates indifference on our part to the widespread problem of inadequate availability and/or utilization of personal protective equipment. To make it clear that we don't approve of inadequate personal protection, a symbol appears next to each picture where a piece of protective equipment should have been used. Here are the four possible symbols:



Note also that some pictures in this section contain an "x" or "√" mark. The "x" is used to indicate that an activity should not be permitted. The "√" is used to label an activity as recommended.

### TRAVELING

#### SAFETY CHECK

At the start of each shift, a truck safety check should be performed. The following items should be examined (as applicable to type of truck):

1. Signal and other exterior lighting (switches, bulbs, fixtures, lenses, and wiring intact and operable);
2. Brakes (pedal travel not excessive, brakes don't grab, proper brake fluid level or adequate air pressure);
3. Parking brakes (hold on a grade);

4. Tire condition (no cuts or gouges; adequate tread depth);

5. Wipers (wipers function properly, window washer works, washer tank filled);

6. Collectors' signal buzzer works;

7. Backup alarm or pressure-sensitive safety bar works;

8. Exhaust system (no holes or leaks; assembly secure);

9. Fuel system (fuel lines intact; metal tubing not excessively corroded, rubber tubing not cracked or broken; no leaks);



Figure 1. All lights must work.

10. Compactor hydraulics (no oil leaks, hydraulic lines not deteriorated; oil level adequate);

11. Engine oil (level adequate);

12. Radiator coolant (level adequate);

13. Riding steps (not bent, broken, or loose);

14. Spare gloves and clothing in cab;

15. Cycling controls, emergency stop and interlocks or pauses all in good working order;

16. Mirrors and light lenses (clean, with no cracks);

17. Emergency equipment (flags, reflectors, charged fire extinguisher, eye wash

bottle with clean water, first-aid kit);

18. Steering (tight; no wheel shimmy); and

19. Defroster, if applicable, works.

If a defect is found, it should be reported immediately. If it can't be fixed on the spot, the employer should remove the truck from service until repairs are completed.



Figure 2. Checking tires for cuts, gouges, underinflation.

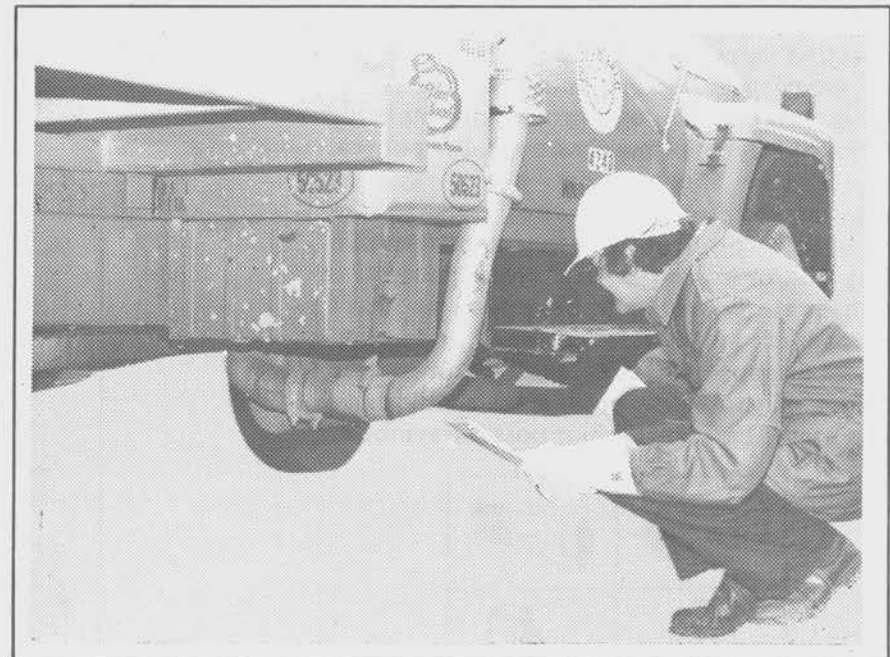


Figure 3. Checking for exhaust leaks.

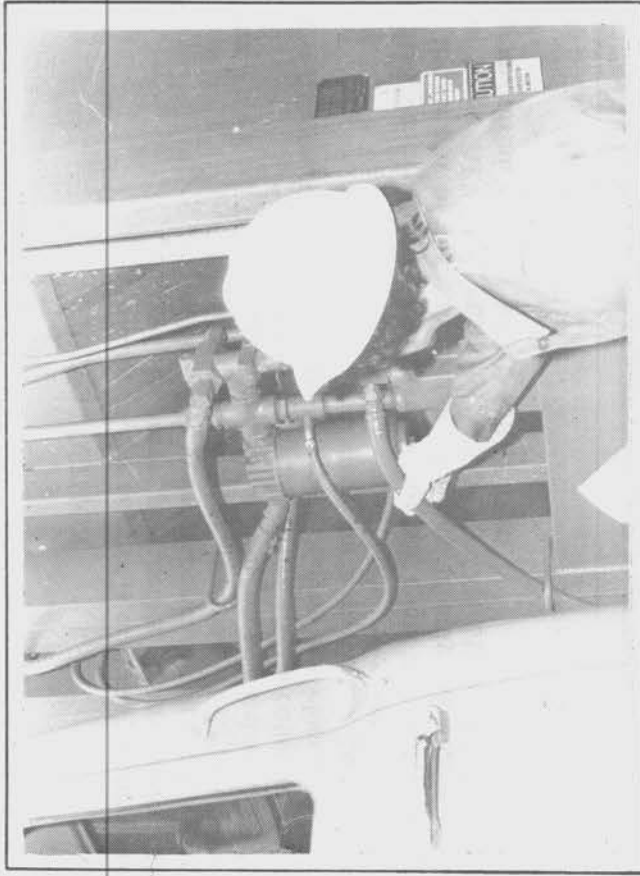


Figure 4. Checking compactor hydraulic lines and fittings for deterioration, leaks.



Figure 6. Riding steps (here bent) must be level, secure, slip-resistant.

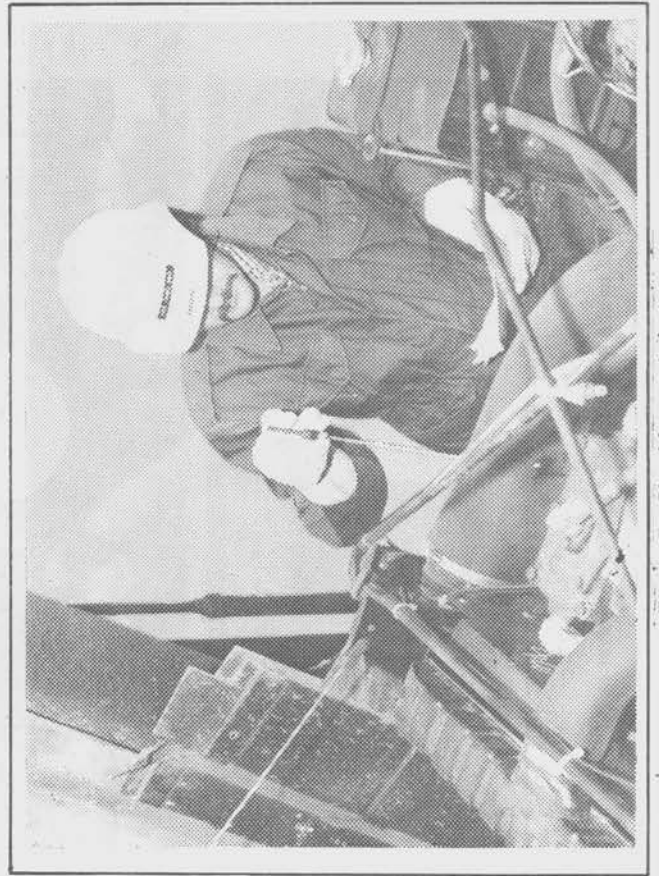


Figure 5. Checking engine oil level.

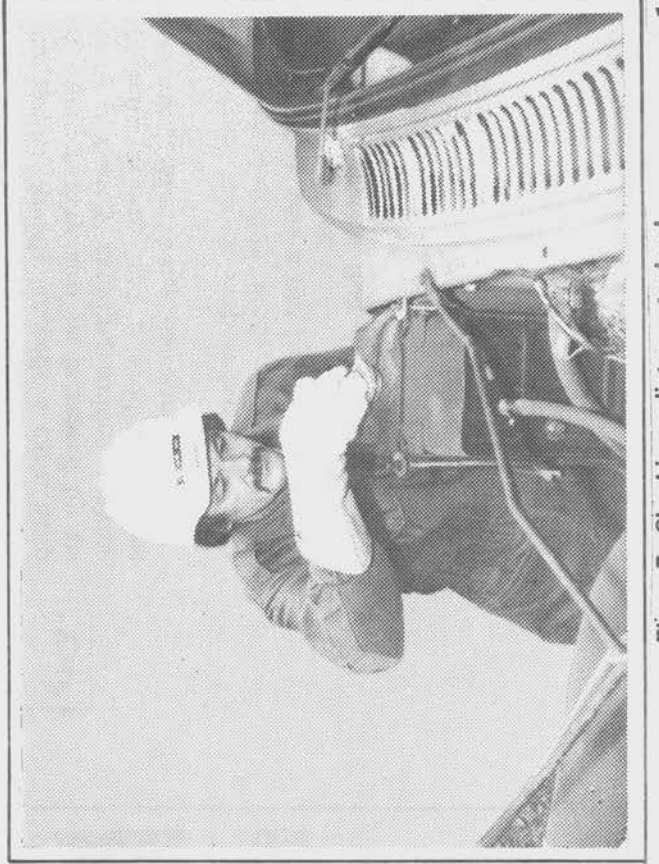


Figure 7. Checking radiator water level.



## TRUCK HANDLING CHARACTERISTICS

Most experienced truck drivers recognize that *collection trucks handle quite a bit differently than cars*. They are far more *topheavy*, and thus more likely to roll over. Factors increasing the chances for a rollover include irregular terrain, driving with the tailgate raised, and abrupt steering or braking. Combinations of two or more of these factors (example: abrupt steering over irregular terrain while the tailgate is raised) greatly increase the likelihood of a rollover.

Another difference between cars and collection vehicles that affects their handling concerns *visibility*. Collection vehicles have no back window for rear visibility, and visibility to the right of a left-hand drive truck (to the left of a side-driven truck) is often poor.

Collection trucks differ also in that they are far *heavier* than cars, particularly when loaded. Their panic-stop distance, especially when loaded, greatly exceeds a car's. Stopping distance may also be increased by the driver's purposely avoiding sudden braking, since most realize that a sudden stop can throw a step rider to the pavement.

Experienced drivers also realize that moving from stop to stop as fast as possible, rather than smoothly, moderately, and under control, rarely gets a run finished more than a few minutes faster.

NIOSH suggests that drivers give a brief honk or other signal each time they are about to move the vehicle.

The distance it takes a truck to "panic stop" depends on:

- road surface
- road condition
- road grade

- tire size
- tire condition
- tire inflation
- weight of the load
- air temperature
- driver's reaction time
- truck speed
- condition of brakes (shoes, drums, cylinders, lines)

The key fact to remember regarding braking is that increasing the *weight* of the load or the *speed* of the truck ALWAYS increases the minimum stopping distance.

## RIDING POSITION

*Riding in the hopper is extremely dangerous and is never permissible.* Many collectors with a few years' experience can recall a time when the packer double-cycled—they activated it once, but it packed twice. What if the extra cycle occurs after a collector steps into the hopper? Maybe the chance of this type of tragedy on a particular occasion is *statistically* small, but over the years the average collector will cycle the packer tens of thousands of times. It only takes once for a tragedy, AND IT COULD HAPPEN THE VERY FIRST TIME.



Figure 8. Never ride in the hopper, and never seek shelter in it.

The alternative is to ride in the cab. Collectors should use the riding step only when the ride is short and slow. If cab room is inadequate, alternate transportation should be

provided to and from the route.

#### PERMANENT OBSTRUCTIONS

Drivers and collectors need to be on the

alert for obstructions (such as trees and poles) that could injure step riders, especially when steering the vehicle clear of pedestrians or road hazards.

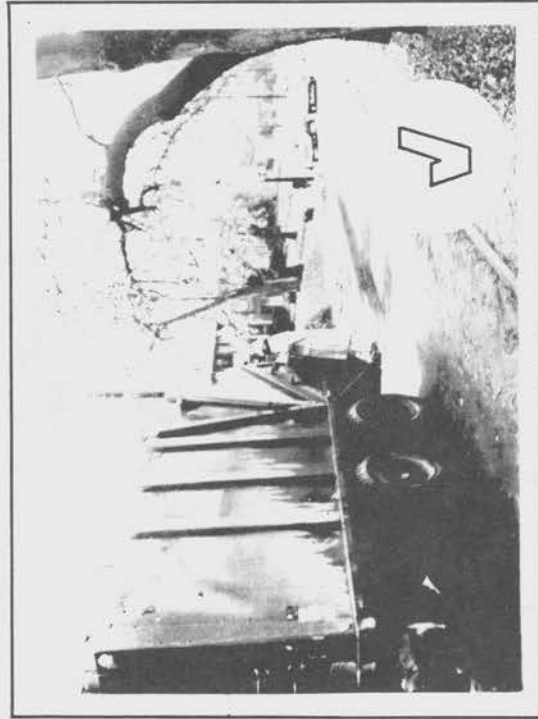


Figure 9. Steer clear of overhanging branches.

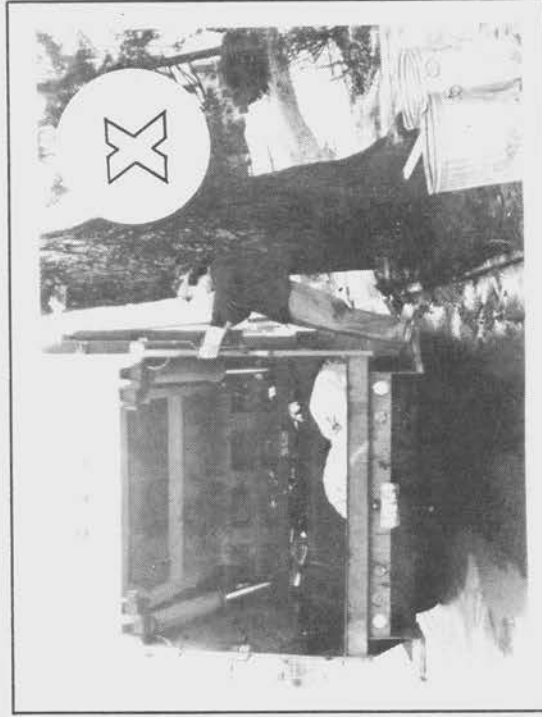


Figure 10. Trees, poles, and lampposts on narrow streets can injure the unwary step rider.

## PARKING ON HILLS

Before leaving the cab of a truck that is parked on a hill, the driver should apply the parking brake, turn the wheels toward the curb, and put the manual transmission in gear or automatic transmission in "park". In addition, on steep hills chocks should be placed against the rear wheels. Note that chocks should never be used to routinely compensate for service or parking brakes in poor condition. If brakes are not in good working order at the start of the day, the truck should be retired for repair.

## CURBSIDE DRIVING CONTROLS

One-person side-loaders often have a second set of driving controls on the curb side. *These controls are only for use when traveling short distances at very low speeds.* Even though the operator using these controls stands while driving, the driver's eye level is still considerably lower than it would be from the cab seat. This means reduced visibility in front and to the left of the vehicle. Convex mirrors on the street side can help eliminate the resulting blind spots. Because of the reduced visibility—even with mirrors—and the possibility of road defects or vehicle maneuvers throwing the driver, side-driving speed should not exceed 10 mph.

## BACKING A REAR-LOADER

As a rule, collectors near the back of the vehicle must remain visible in the driver's mirrors at all times when a truck is backing. If the collector(s) can't be seen in a mirror, or disappear from view, backing should stop immediately. The driver should then leave the cab to determine whether continued backing is safe. Note that collectors should not stand

on the rear step during the backing—otherwise they may slip off and risk being run over, or they may collide with a utility pole or other object.



Figure 11. Chocks should be used when parking on a street this steep.

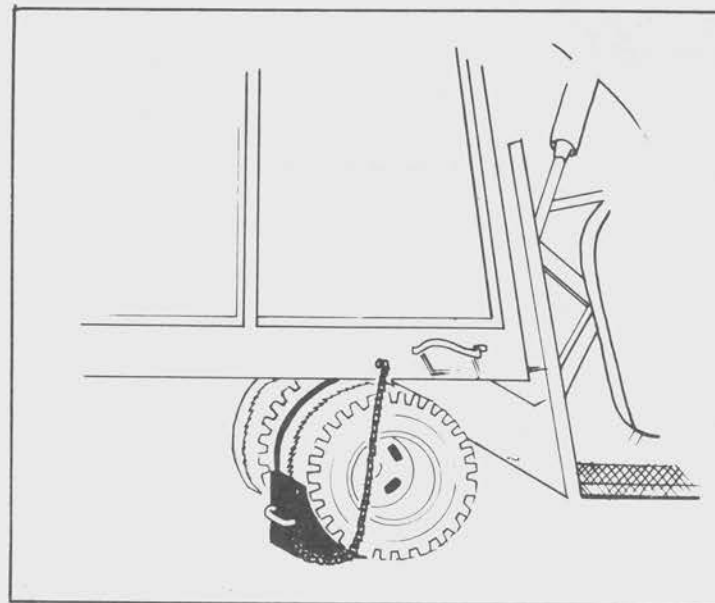
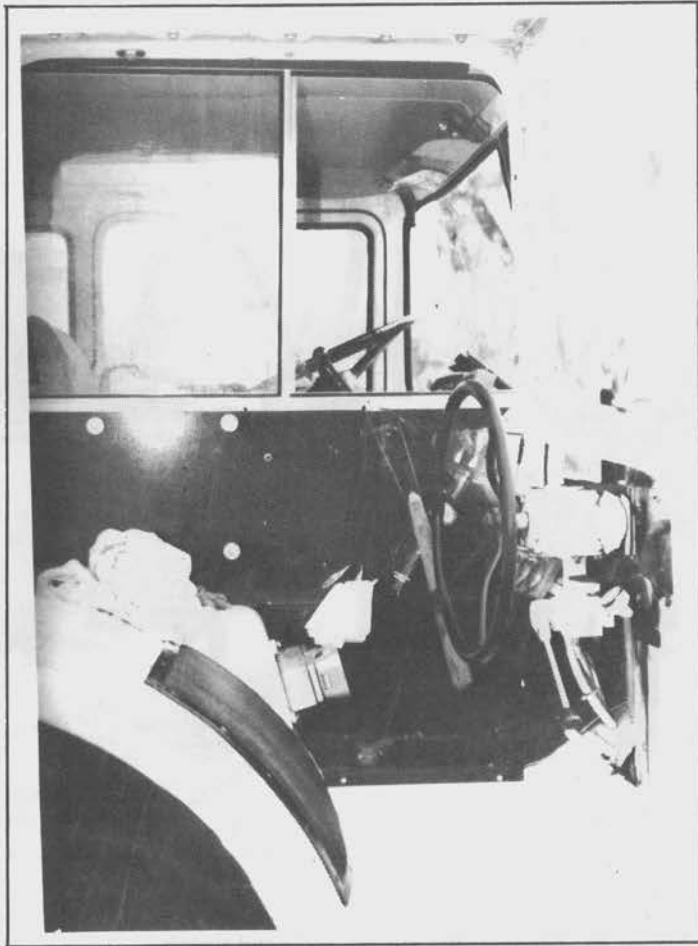


Figure 12. Chocked wheel (truck facing downhill).





**Figure 13.** Side wheel and controls for traveling short distances at very slow speeds.



**Figure 14.** Rain canopy on side-driving controls.

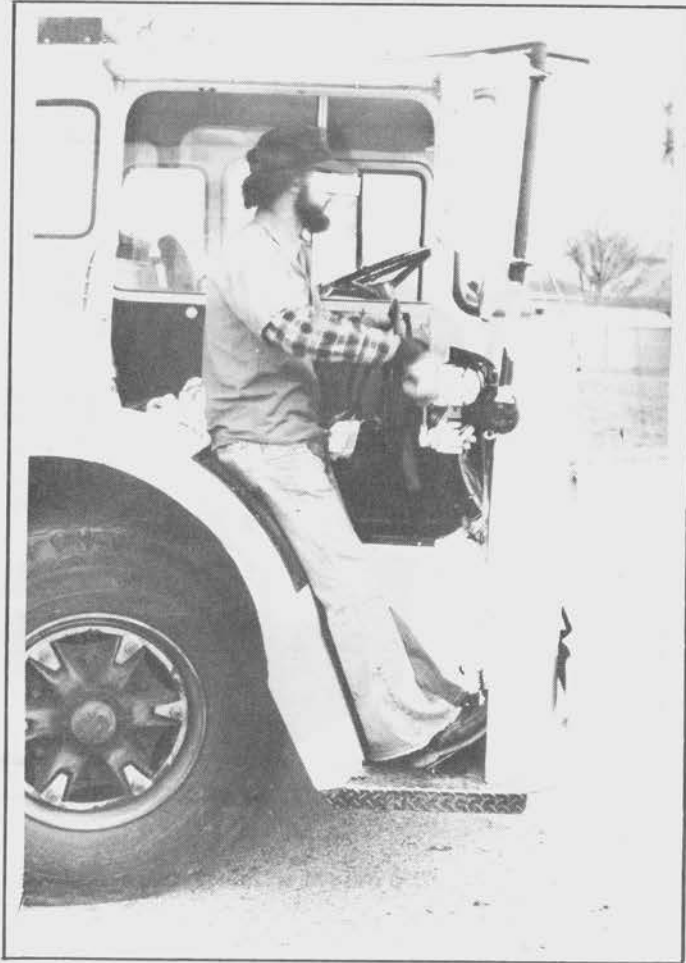


Figure 15. Driver in side-driving position.

Figure 16. Backing—use mirrors and hand signals.

## BACKUP SAFETY DEVICES

To reduce backup accidents, some collection vehicles—particularly side-loaders—are equipped with pressure-sensitive backup bars or feelers on the tailgate. When the truck

transmission is in reverse, anything contacting the sensor activates the brakes. Units are being developed with a “runaway” feature that would apply the brakes if the sensor contacts anything, regardless of whether the transmission was in reverse (for example, an

unattended truck left in neutral on a slope rolls backwards into a fire hydrant). It is important that drivers *not* rely on such pressure-sensitive safety devices to stop the vehicle; *they need to drive almost as if the device weren't there.*



Figure 17. Pressure-sensitive backup safety device.

## SIZING UP THE LOAD

### TAGGING

Many refuse collection organizations provide their staff with printed tags that explain why a load couldn't be collected. Others use a phone call or have a supervisor visit the customer instead of tagging. Listed below are some typical reasons for not accepting a load:

- maximum length exceeded
- tree or brush trimmings not bundled
- wet box
- overweight load
- hazardous container
- construction waste
- menacing dog
- hazardous chemical or material
- improper container
- bees or other stinging insects
- rats or other vermin
- unshoveled snow
- illegal racks or enclosures
- cover attached to can (must be completely removable)

### HAZARDOUS WASTE

Common types of waste that can be hazardous to the collector include:

- liquid chemicals
- dry chemicals
- containers of gasoline or solvents
- refuse that contains asbestos (example: old pipe wrapping)
- broken glass



Figure 18. Sample tag for unacceptable load.

- sharp metal (examples: razor blades, hypodermic needles, sheet metal scraps)
- building materials
- fluorescent light tubes and TV picture tubes
- aerosol cans
- feces-contaminated items (example: soiled disposable diapers)
- dead animals (collection by residential waste collectors prohibited in most areas)

Collectors should never pour chemical wastes into sewers. Some may ignite and cause a sewer explosion. Others could contaminate downstream water or water treatment facilities. If there are any doubts about the safety of the material being collected, it should be tagged and left behind. Collectors should alert a supervisor or contact the customer or a neighbor directly if a dangerous item is rejected that could readily fall into the hands of children.

Many chemical, animal, and human wastes are potential health hazards when breathed, when brought in contact with skin, or when ingested on foodstuffs. Contact with open wounds is especially dangerous. The employer should instruct collectors to tag loads containing such wastes as unacceptable. Hazardous chemical wastes that are allowed should only be handled by collectors who have eye protection (safety glasses with side shields, a face shield, or goggles; impervious full-body coveralls (or foul-weather gear); and rubber, synthetic rubber (neoprene, NBR, etc.), plastic-coated, or other impervious gloves.

Despite the measures recommended above, some waste that is potentially hazardous to the collector's health will still be inadvertently handled. For example, dangerous items may be hidden from view by nonhazardous refuse. For this reason, it is important that the hands, arms and face be washed before eating, and that wounds be promptly cleaned and covered.

#### HIDDEN CHEMICAL HAZARDS

Looking over a pile of refuse may give clues to potential hidden dangers. This pile of discarded paint cans could hide containers of leftover paint or stripping solvents, which could splash on the body or ignite when packed. Loads like this make eye protection all the more important.

#### DEFECTIVE CONTAINERS

Containers with jagged metal edges, rusted-out bottoms, or with loose or missing handles or covers are dangerous. Loose or missing handles force the collector to lift in an awkward manner. Containers without snug-fitting covers are an invitation for dogs, rats, bees, and flies. Rats scared during collection work may bite. Dogs often topple open containers—and loading spilled refuse is far more hazardous than dumping cans. Many collection organizations attach a warning tag to a defective container.

#### HIDDEN LIFTING HAZARDS

Rocking the container before lifting it helps collectors determine whether heavy items are concealed. Examples are construction waste and rain-soaked refuse. Some work rules (and many local ordinances) require that con-



Figure 19. Paint cans here may hide chemical hazards.

tainers have tight lids, primarily to keep pets, flies, and rodents out; the cover requirement is also valuable for keeping out rain. Many rules do not allow loads containing construction debris.

Another good reason for rocking the container before lifting it is that it may be stuck in dried mud, packed snow, or ice.

Rocking may also warn that an animal is in the container, or that the bottom is rusted out.

#### WET BOXES

Wet cardboard boxes of refuse are extra heavy, and fall apart readily. The collector may be injured when a wet box bursts that



Figure 20. Tag a can with a jagged edge as unacceptable.



Figure 21. Rock the load to estimate its weight.

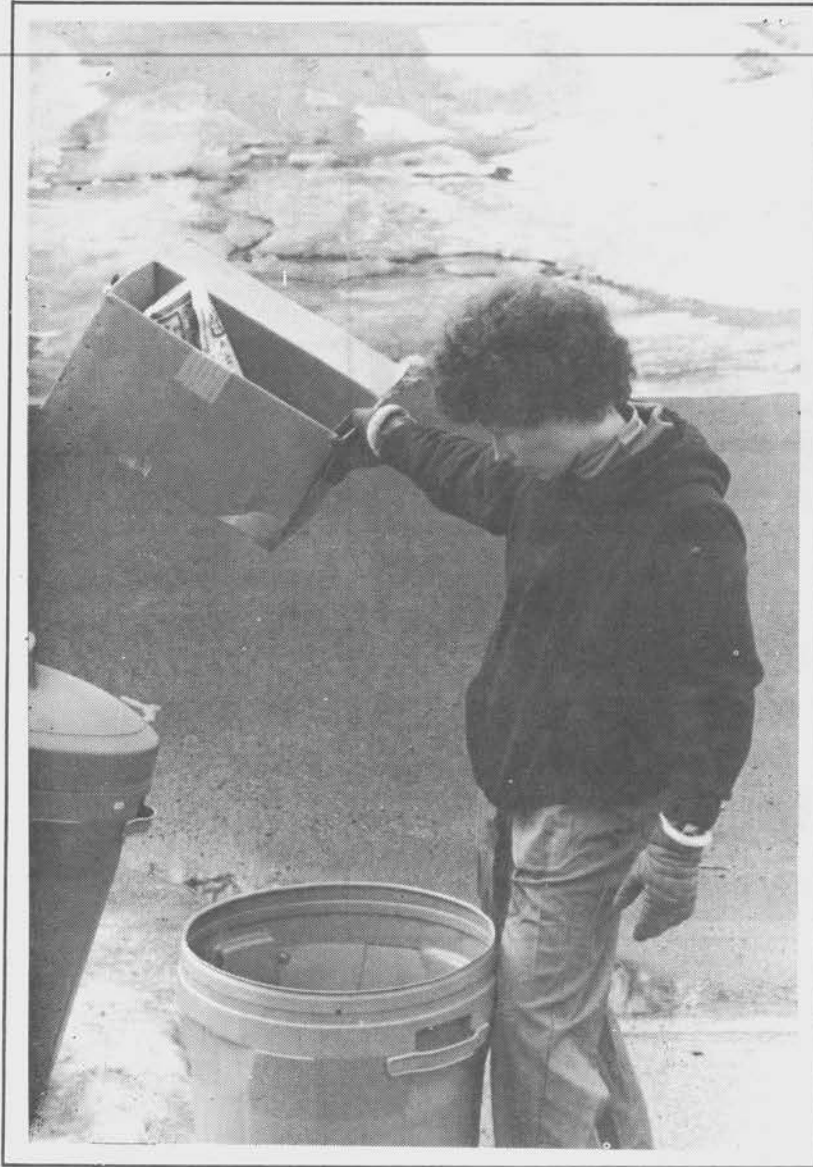


Figure 22. Checking a heavy load for unacceptable waste.



Figure 23. This block was under the box in Figure 22.



contains heavy, sharp, or otherwise hazardous objects. Some operators will not accept refuse in wet boxes. If allowed, use caution—a broad, flat shovel may be helpful. If wet boxes aren't allowed, they should be tagged.

#### PROTRUDING TRASH

Wood and metal scrap sticking out of cans requires special handling. If such items are accepted, collectors should watch out for nails when lifting, and should be sure to use handles rather than grabbing the rim. Collection workers should place one hand on the bottom rim of the container so the materials point away from the body.

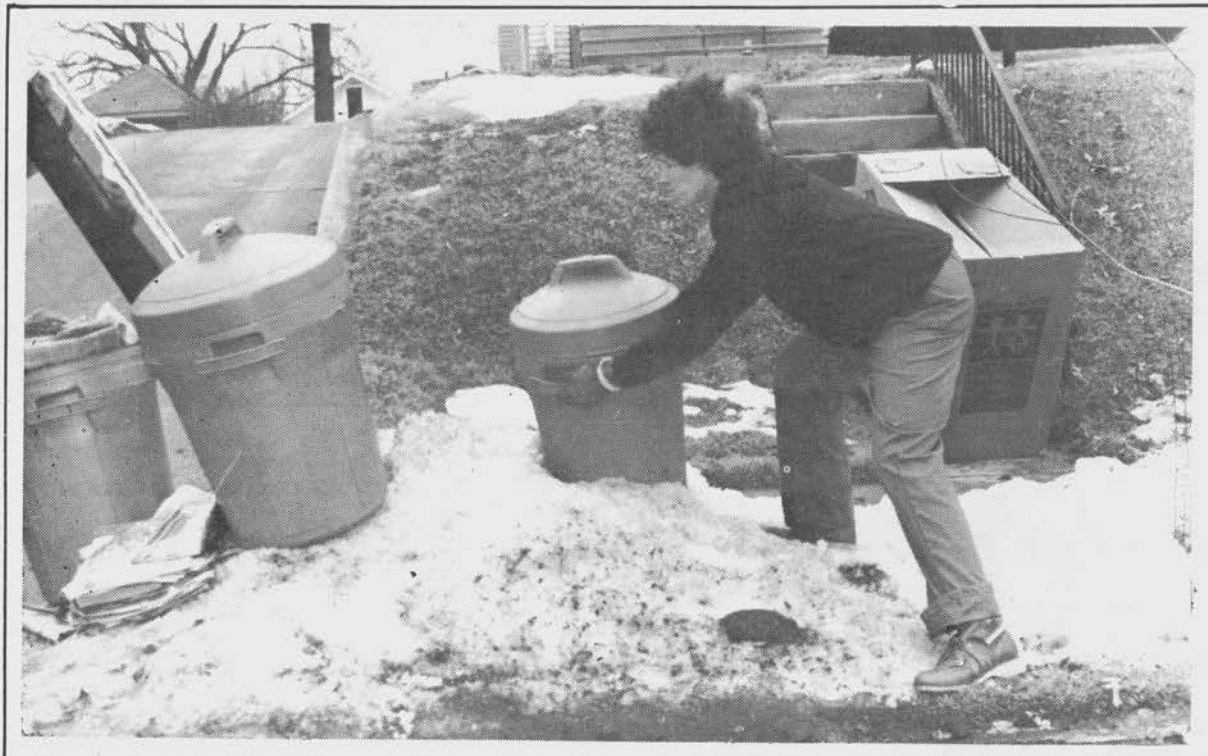


Figure 24. Rocking will tell the collector when a can is stuck in snow or ice.



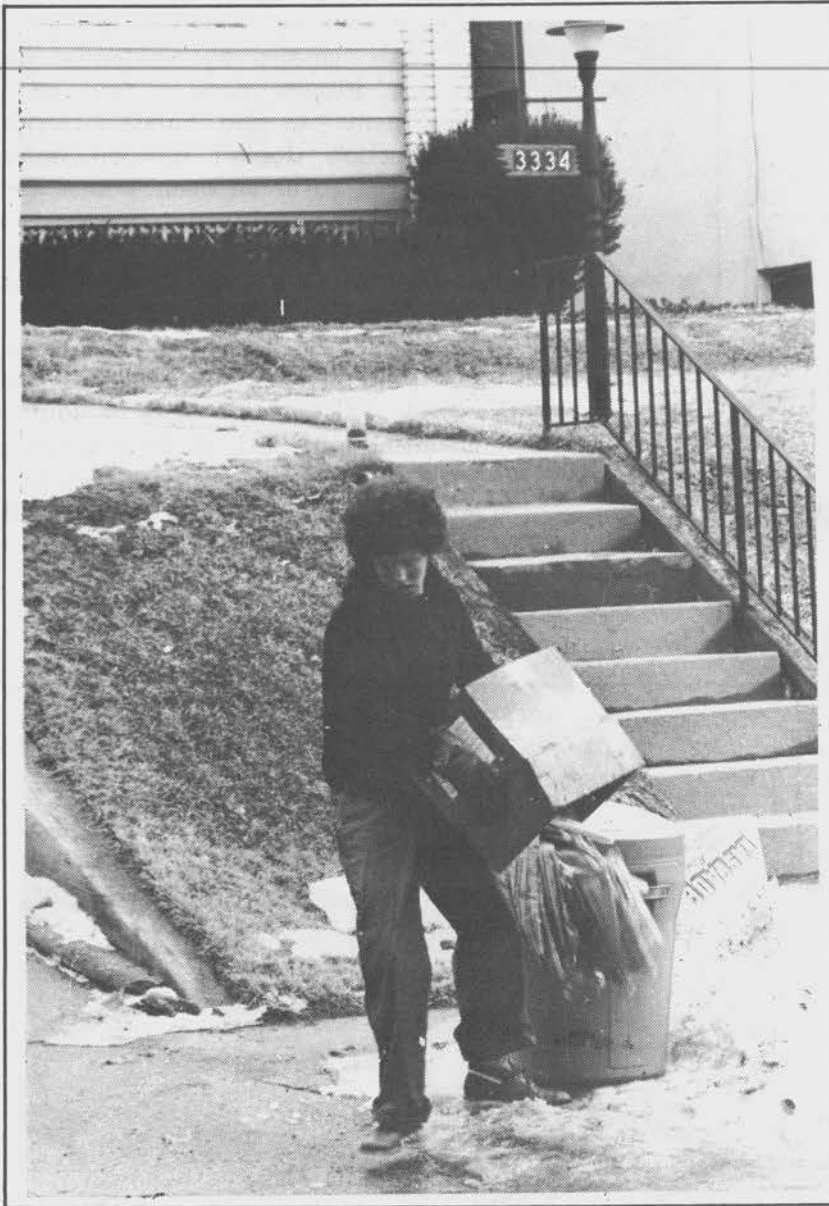


Figure 25. Wet boxes are heavy, and break open readily.



Figure 26. Either remove scrap first, or point the can away from you.



Figure 27. See a board?  
Think nails.

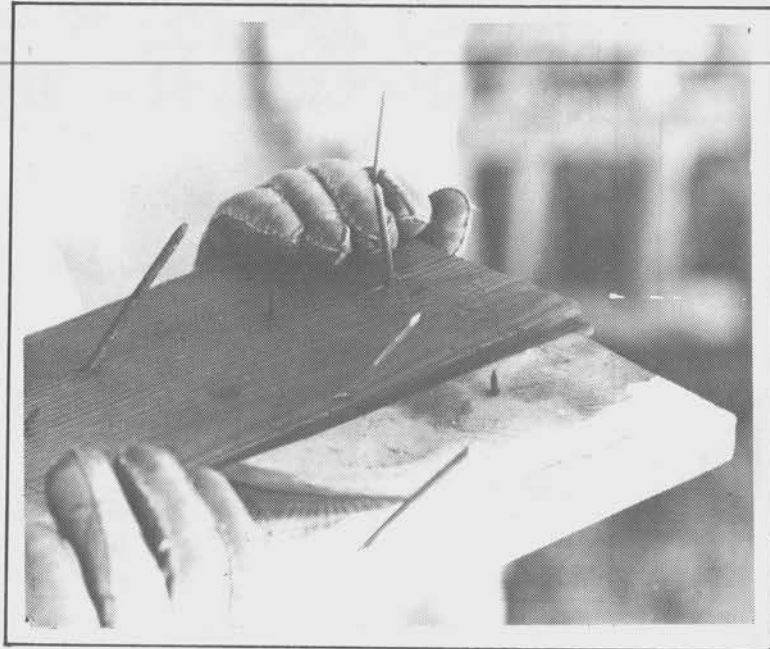


Figure 28. Most gloves are no match for a nail.

## DRUMS

Many public and private operators who use conventional collection methods prohibit the use of 55-gallon drums as refuse containers. This is due primarily to the excessive weight of the container itself; the lack of handles makes the situation even worse. If neither the employer nor the locality prohibits drums, collectors should be especially careful to rock them before lifting to determine whether the local gross weight limitation is met.

## LOADING

### HAND PROTECTION

Bare skin is obviously no match for glass, nails, sheet metal, can lids, razor blades,

jagged container edges, and other sharp materials handled by residential waste collectors. Besides causing frequent injuries, these items can also initiate infections. Even if infection doesn't develop immediately, failure to cover an open wound and to use adequate hand protection may lead to serious infection later. Jersey gloves (uncoated cotton), latex household gloves, and similar light duty gloves are not adequate.

The ideal glove for collectors would: (1) protect against cutting or puncturing objects; (2) be impervious to liquid and dry chemicals; (3) be both flexible and comfortable in hot and cold weather; (4) provide good wet as well as dry grip; (5) allow adequate dexterity; (6) be washable; and (7) not absorb water.

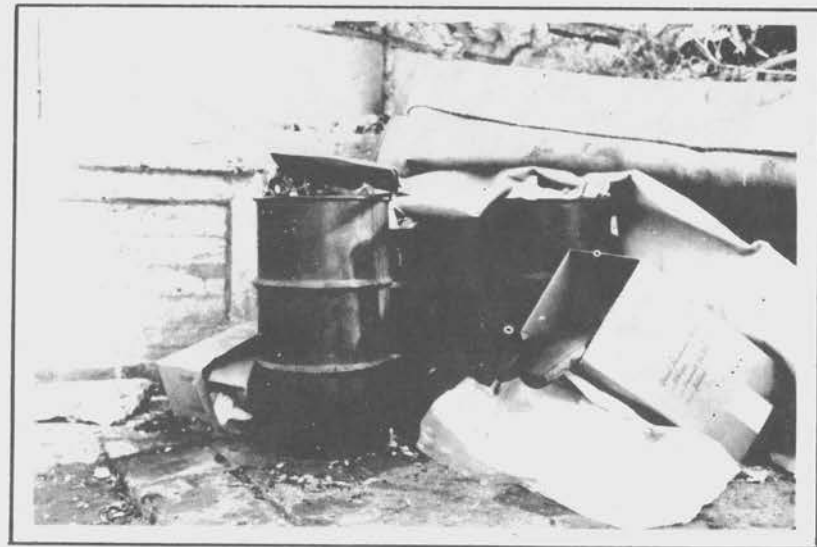


Figure 29. Drums are too heavy for use as conventional waste containers.



Innovations in glove design (such as those made by NIOSH for fire fighters) may provide significant improvements over gloves now available to waste collectors. Since cut and puncture resistance are often the most critical factors, gloves should have: (1) a strong supporting fabric such as duck, nylon, or aramid fiber; or (2) split leather throughout (although not necessarily for the gauntlet); or (3) split leather on at least the palms, fingers, and knuckles.

Geographical variations in weather make it hard to recommend one glove for all areas. It may be necessary to try different types to find one that satisfies as many requirements as possible. Since some gloves perform well in dry weather but poorly in the rain, it may be necessary to have more than one type of glove, with spares of each kind in the cab.

Note that when an employee's safety requires special protective items (such as gloves), Federal law requires the employer to provide them, and to replace them when necessary.

### LIFTING BAGS

Unless gauntlet gloves with exceptional cut and puncture resistance are worn, plastic bags should only be lifted from the top. Serious hand and forearm cuts and punctures have occurred when a collector has lifted a bag with one hand on the bottom, since nails, glass, and other sharp materials tend to settle. Some localities specify a minimum bag strength to reduce the need for putting a hand on the bottom of a bag, and for frequently handling broken bag spills.

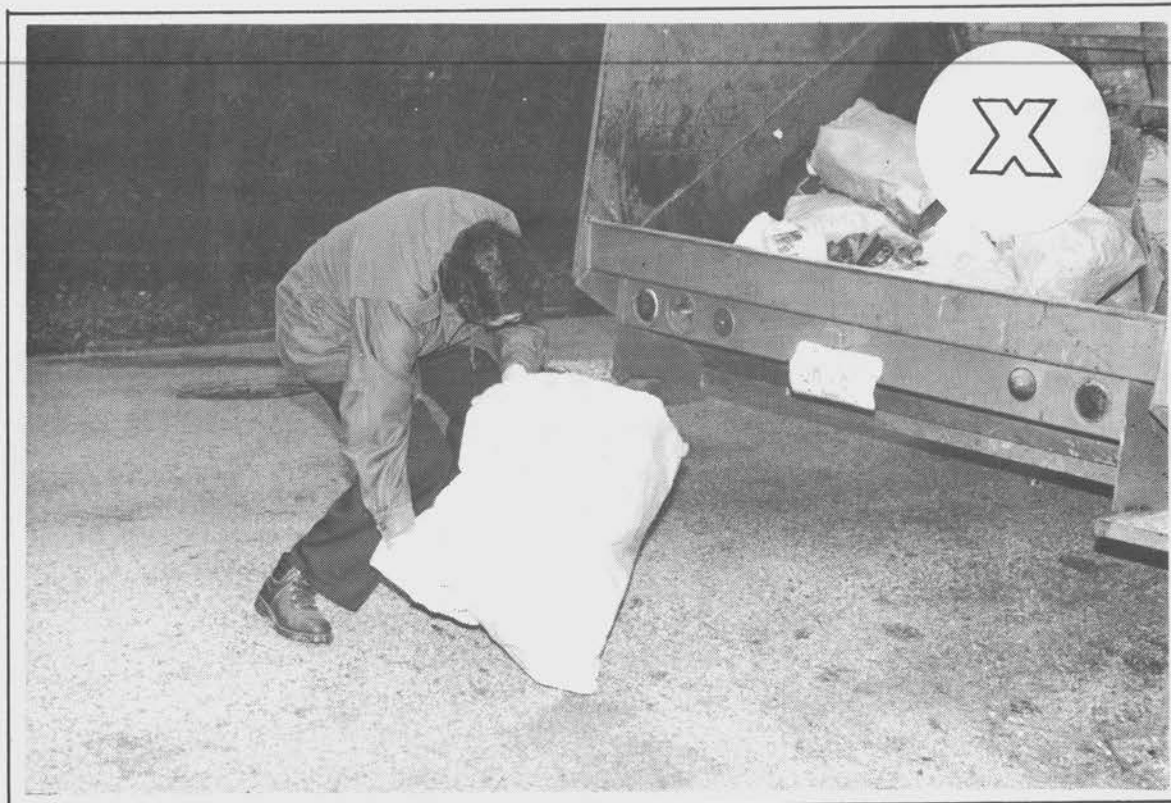


Figure 30. Lift bags from the top.

### CARRYING SEVERAL LOADED CONTAINERS

To speed up the job, a collector may try to carry several containers at a time. In this picture, the collector is off-balance, and has reduced visibility of the ground in front of him. Slipping or stumbling under these conditions is a lot more likely.

### TRANSFER TUBS

Backyard collection often involves the use of a large transfer tub to minimize the number

of trips back and forth to the truck. Since tub loads are often too heavy to carry by hand, tubs should either have wheels or should be moved with hand trucks.

Since the tub in most cases is manually lifted from the dump into the hopper, its filled weight should not be too heavy for the number of people lifting it. A limit of 50 lbs. for one person (90 for two) is recommended.

### HAND TRUCKS FOR MOVING TUBS

When moving a loaded tub on a flight of



Figure 31. Too much for one trip.

stairs or steep hill, or when moving a tub that has no wheels, a hand truck should be used. In such situations, the load should always be kept *below* the collector, whether going up or down—that way a load that breaks loose won't strike the person moving it. The hand truck should have a latch to secure the tub so the collector can use both hands to maintain balance or grab a rail.

When wheeled tubs are put on a hand truck, the truck platform should support the tub base, not its wheels—otherwise the tub may be unstable. In areas where snow or mud is prevalent, one way of keeping it from caking up around the hand truck wheels is for the employer to attach a scraping arm that clears the wheels by about 1/4 to 1/2 inch.

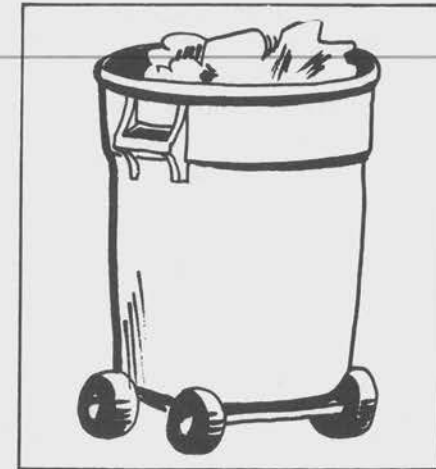


Figure 32. Transfer container with wheels.



Figure 33. Use hand truck to get tub up or down stairs or slopes, or for tubs lacking wheels.

### COLLECTING FROM THE LEFT SIDE

To collect refuse from the left side of the street, after several stops on the right side, the driver should pull to the left. This way collectors don't have to walk into the traffic

with the bundled brush. However, the bulky refuse reduced one collector's view of his path—he is about to step off the curb without knowing it, and may suffer a foot or ankle sprain.

If the packer must be operated before a truck collects refuse from the left side of the street and returns to the right lane, the collector must be very careful of traffic (packing controls are on the right side).



Figure 34. When truck is on left side of street, packer controls are on the traffic side.

## HIGH-VISIBILITY CLOTHING

Because collectors are on the street during pre-dawn hours, during bad weather, and during morning rush hours, measures must be taken to ensure that they are seen by motorists. Bright orange, yellow, red, or green outer clothing is suggested for ensuring high visibility. If uniforms with these colors aren't used, a bright safety vest, jacket, or shirt is recommended. During hours of darkness, outer clothing should include reflective stripes or patches.

## LIFTING OVER AN OBSTRUCTION

Reaching over a fence to lift a container can put severe strain on the collector's back. If



a gate is locked, or a dog is menacing, a tag should be left that explains why the load couldn't be taken.

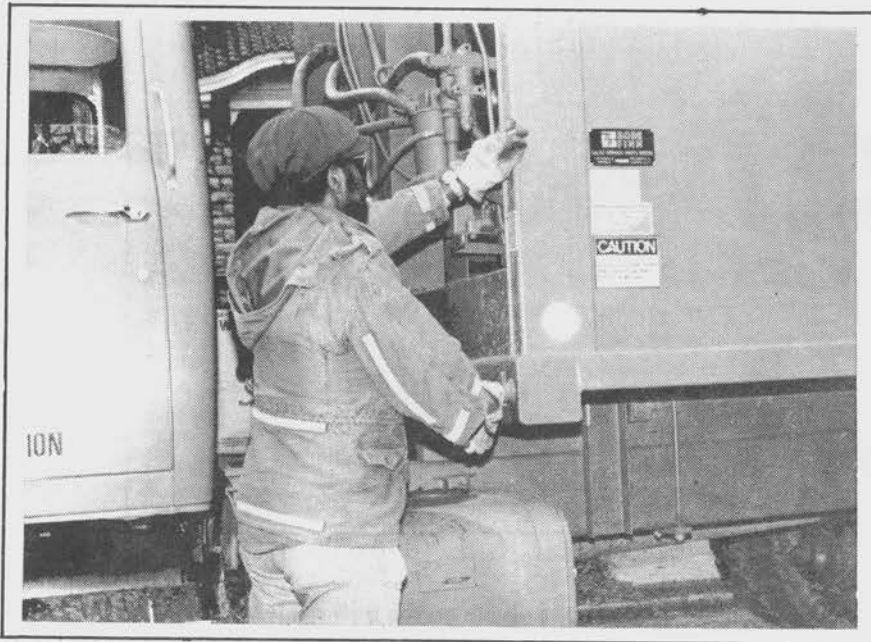


Figure 35. Worker wearing a jacket with reflective stripes.



Figure 36. Lifting over a fence.

## LIFTING POSITION

Lifting the load with one hand while standing on the riding step may injure muscles, ten-

dons, and ligaments. More severe injury can result if balance is lost. Note that heavier loads should be lifted with the knees bent, back straight, and the load kept close to the

body *if* the load fits between the knees. If it doesn't fit, then the knees-bent position isn't recommended (except for team lifting)



Figure 37. Don't lift or load from riding step.

## LOADING SILL HEIGHT

The easiest and safest lifting heights are between knee and hip level. Above or below these points the collector is forced to use

much more energy to move the same load, and strain on the body is significantly greater.

For this reason, containers manually handled should never be recessed below ground level, and loading sill height should be

as low as practical (preferably at or below the hip level of the shorter collectors). If sill height *must* be higher than this level, consideration should be given to reducing the permissible load weight.



Figure 38. Lifting from the step level.





Figure 39. Lifting to dump from ground level.

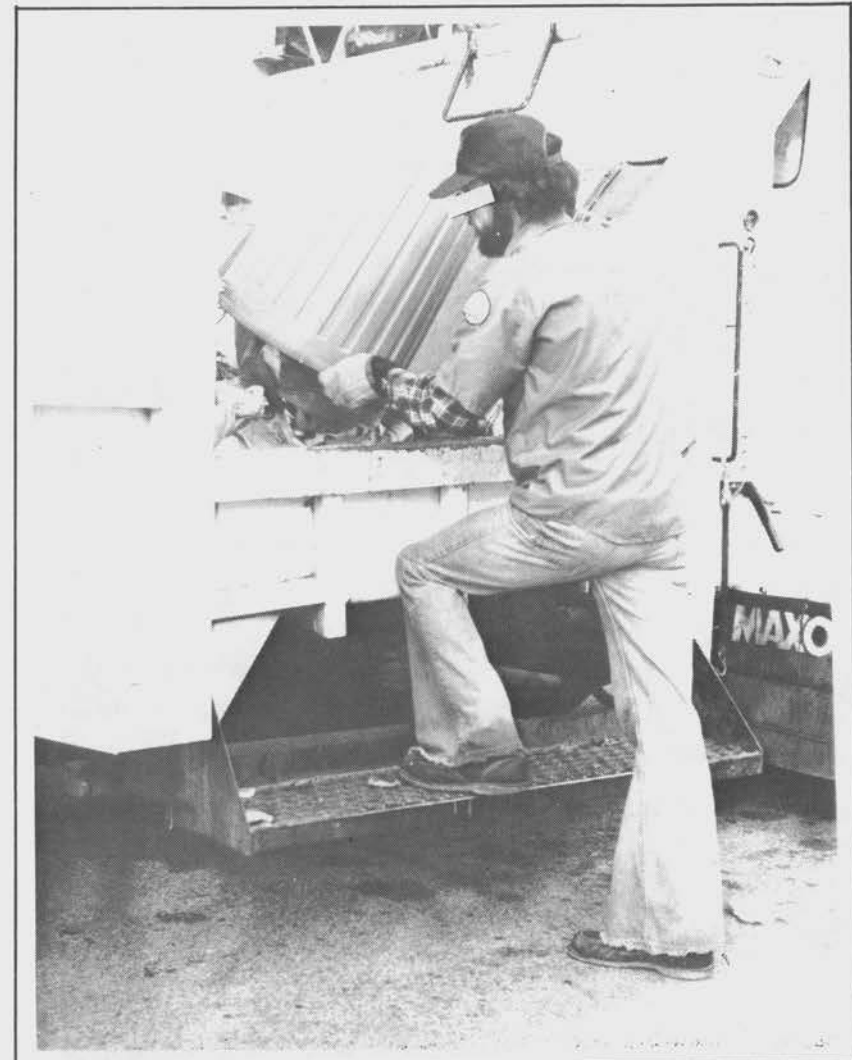


Figure 40. One foot on the step, helps collector keep steady.

## TWISTING WHILE LIFTING

Twisting during a lift (exaggerated for emphasis) puts severe strains on the body. The solution is simple—lift from a position that makes twisting unnecessary.



Figure 41. Twisting while lifting.

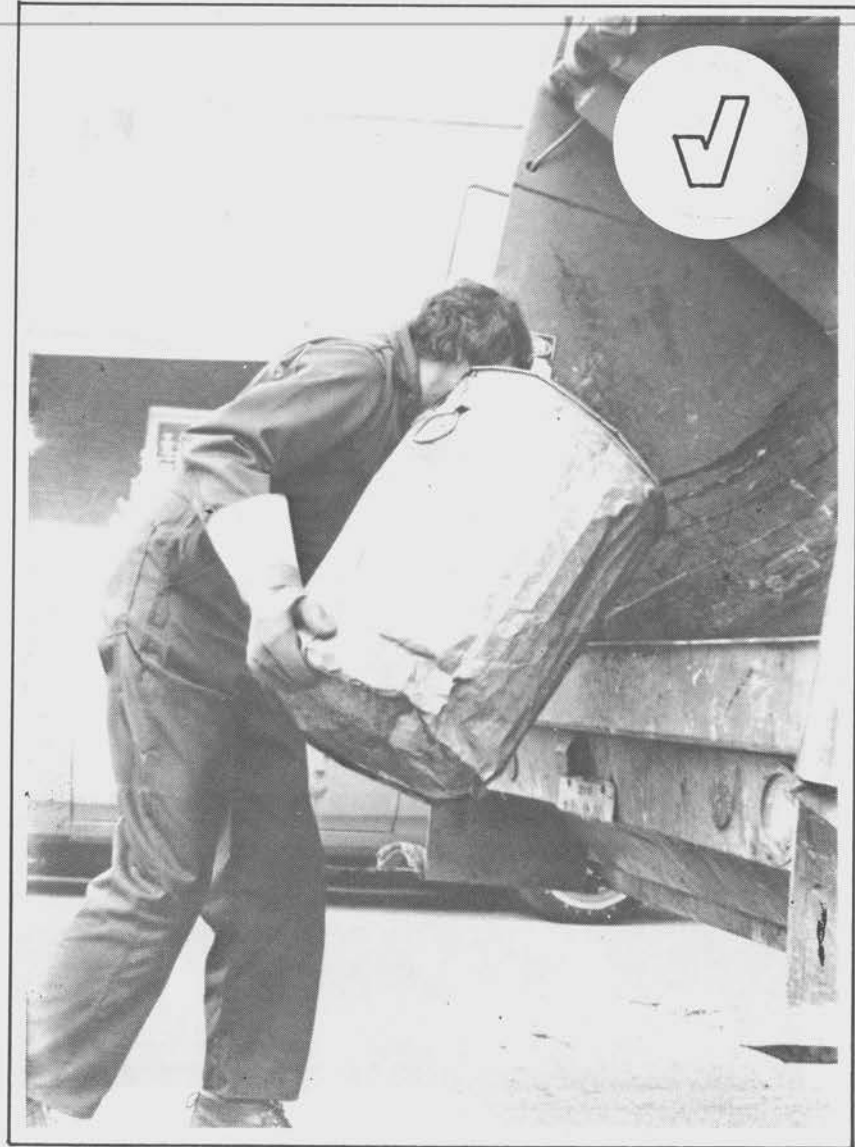


Figure 42. Lifting without twisting.

## TEAM LIFTING

When a load is too heavy for one person, the item may often be handled through team lifting. The key point to remember is to do the lifting in unison. One of the pair should call out the lift command after both are in position. Team lifting, however, doesn't mean that *any* weight load can be handled (NIOSH recommends a limit of 90 lbs. for two persons). Since team lifters must stay in step with each other, teams should try to avoid carrying heavy items over rough, hilly, or slippery terrain.



Figure 44. One lifter calls the lift signals.



Figure 43. Getting in place for a team lift.



Figure 45. Team lift and dump.

## BULK PICKUPS

Bulk collections, due to the greater weight and size of the waste, present special hazards for the employee. In most cases a hydraulic lift-gate is a necessity—but operating a gate isn't without potential hazards. The gate shown here created a “shear point” as it was raised. In other words, if fingers or hands had gotten caught in the lift arms while the gate was rising, they would have been cut, smashed, or severed with a scissor-like action. Clothing that became caught could also have drawn a hand or arm into the danger area.

With this type of lift, the operator must make sure that the lift arms at both ends are clear.

Regardless of the type of lift gate, the load should always be kept as stable as possible. Any persons who ride the lift with a load should position themselves so that if the load shifts it won't strike them. When loading on a hill, the truck should always be parked facing downgrade—this prevents items being loaded (or already loaded) from sliding back off the tailgate. This may require parking temporarily facing in the wrong direction in order to load, since it is undesirable to move heavy items across a street. When load-

ing, collectors should use the emergency flasher to help alert traffic to their presence.

If local laws prohibit a vehicle from racing the wrong direction on a public street, the supervisor should inquire whether loading heavy or bulky items is an exception. To move a heavy item such as a refrigerator over to the lift-gate, a dolly or hand truck should be used. Heavy items that *must* be hand-carried to the truck (items that are too bulky for a dolly and can't be dragged) should be moved by collectors specially trained in team lifting.

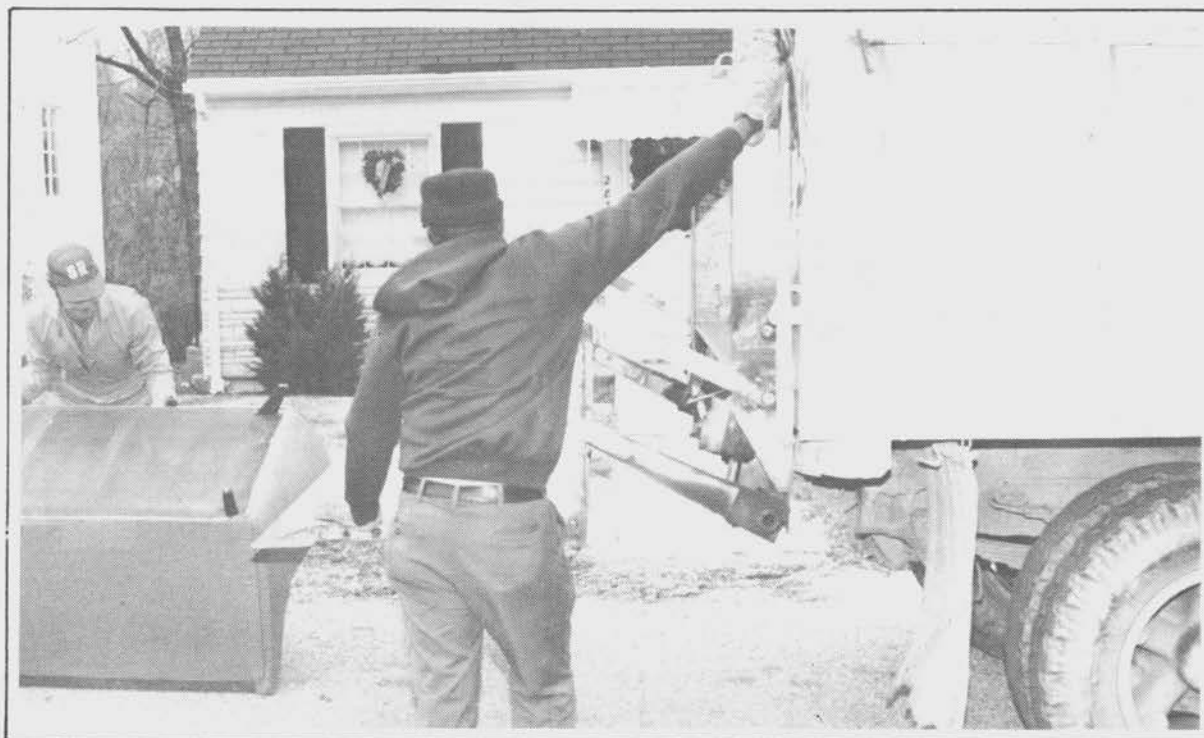


Figure 46. Lowering the gate for bulk collection.



**Figure 47. Keep clear of shear point (lift arms) as gate is raised.**



**Figure 48. Park truck facing downhill for bulk pickup.**

## DUSTY LOADS

From time to time, loads will include various dusts or powders. None are healthy to breathe. Some, such as granular or dust forms of pesticides, herbicides, lye, or scrap asbestos, can be hazardous. Collectors should be trained to recognize common forms of asbestos waste, and should have the health hazards caused by asbestos inhalation explained. (See NIOSH publication 77-188 for a nontechnical discussion of asbestos hazards.)

Standing to the sidewalk side of rearloading vehicles during the packing cycle will keep collectors clear of dust clouds caused by bursting bags or boxes. If dusts rise during loading, collectors should similarly avoid breathing them. If clothing is contaminated by unknown dusts or by known hazardous dusts, collectors should change into fresh coveralls and seal the contaminated items in a plastic bag for laundering.

## ANIMALS, RODENTS, STINGING INSECTS

When threatened by a loose dog, a rat, or by a stinging insect, a collector (like anyone else) will be distracted. Whether or not the animal or bug actually bites or stings may be irrelevant, since the *apprehension* of being bitten or stung can lead to an accident as the collector retreats or otherwise attempts to avoid the hazard.

If containers lack tight lids, a tag should be attached to warn the customer (even if the waste is taken). The same applies to loose dogs—the customer may not be the dog's owner, but may help correct the situation once notified by the tag that collection may be (or has unavoidably been) interrupted.



Figure 49 If dust kicks up, step to curbside until it settles.



Figure 50. Uncovered cans attract bees and other stinging insects.

Collectors working in areas where menacing by loose dogs is a recurrent problem should be provided with a spray repellent or an equivalent means of protection.



Figure 51. Cans without tight covers (or no cover at all) attract rodents and dogs.

## TOSSING CANS

Residential waste collectors spend a large portion of their workday walking. To save

steps, some collectors get in the habit of throwing empty containers to a curbside coworker. If the container has a jagged edge, the receiver may be injured. Tossing

full containers (such as curb to hopper) is even more dangerous. And in either case the can may take the receiver by surprise.



Figure 52. Throwing cans.



## THROWING BAGS

Throwing bagged refuse into the hopper from a distance can create four problems. First, if the bag strikes a leg as it is swung up to the hopper, a sharp object may pierce the bag and

cause a leg laceration. Second, the bag may burst on the swing—cleaning up the resulting mess can result in hand and forearm lacerations, or exposure to spilled chemicals. Third, if the bag doesn't land far enough into the

hopper, it will need to be repositioned to prevent ejections (and the less repositioning, the better). Fourth, the bag may miss the hopper entirely, endangering fellow workers or pedestrians.



Figure 53. Swinging a bag to toss it in the hopper.



Figure 54. Keep bag clear of leg to prevent cuts from protruding glass or metal.



Figure 55. This bag is about to bounce out of the hopper and burst.



### RIDING STEPS

The riding step in Figure 56 is designed to be self-cleaning when the ground is muddy or snow-covered. If riding steps are bent, loose, or broken, the problem should be reported at once, and they shouldn't be used again until they are fixed. *Secure, level, slip-resistant steps of adequate size are an essential element of collector safety, not a luxury.*

### FOOT ON LOADING SILL

Riding with one foot on the loading sill may be more comfortable than riding with both feet at the same level on the riding step, but it is dangerous. A foot on loading sill can be amputated if refuse is packed on the run (never recommended) or the packer double-cycles when a foot is on the sill.

### STEP EXTENSIONS

Some trucks are equipped with riding step extensions. These add-on sections are flipped up (or slid in) when not needed, or when they could be damaged (examples: entering landfills or narrow alleys; backing up to a dock). Step extensions offer a safer ride by allowing a wider and more comfortable stance.



Figure 56. Self-cleaning riding step.

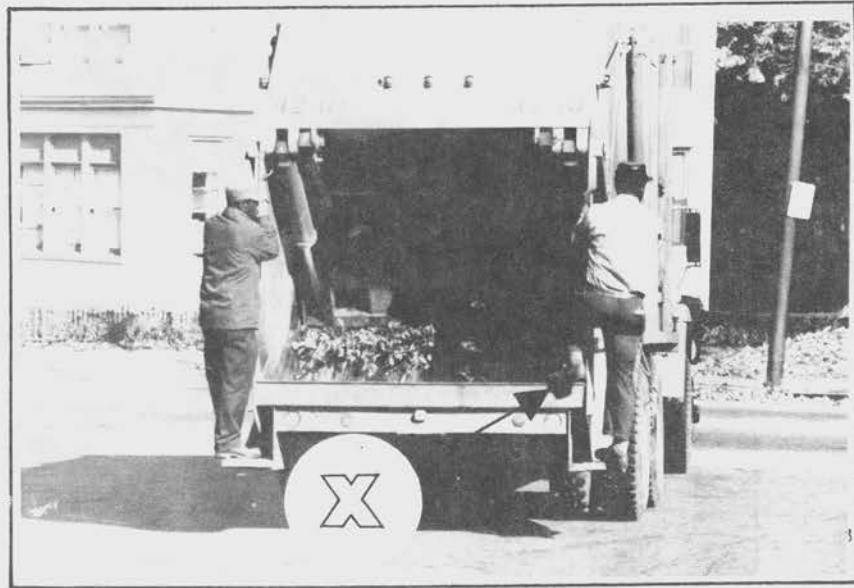


Figure 57. Foot on loading sill.

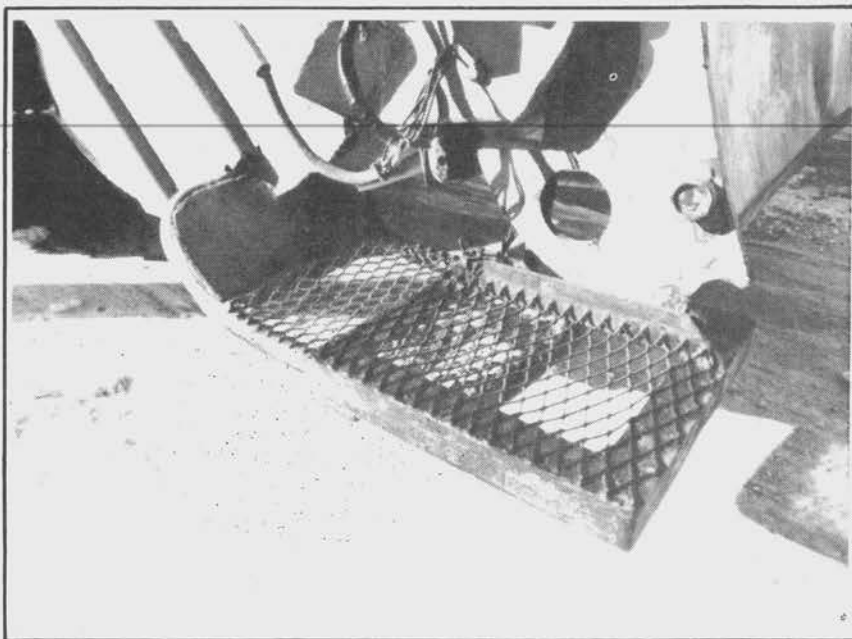


Figure 58. Riding step extension, open.

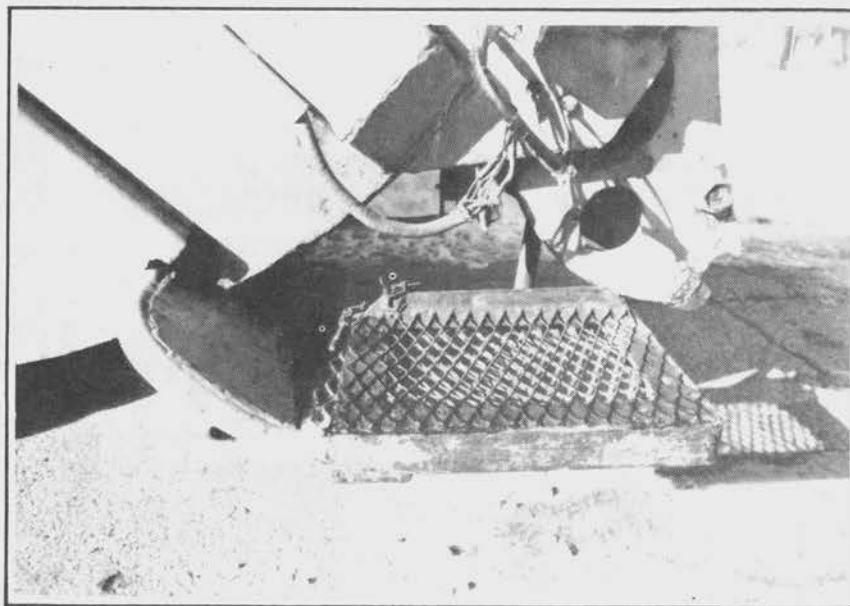


Figure 59. Riding step extension, closed.

### CHILDREN AT PLAY

Special attention must be given to children when they are in the area. In the case shown here the child was supervised. In other situations they may not be. The main point to remember is that *children are unpredictable*. They may run in front of a moving truck, behind a backing truck, play with controls (if they can reach them), or hide in boxes. Children must be asked to move from the immediate collection area if they aren't closely supervised.

### FOOT PROTECTION

The day this shoe was photographed in Figure 61, conditions were muddy. Shoes with cleated soles offer better traction under such conditions. When snow is on the ground they are essential. Note that shoes with pins or very narrow cleats, such as spiked shoes, are often *undesirable*, because they may get caught in open-mesh riding steps, and also can make walking on paved surfaces tricky.

Regardless of the weather, collectors should wear shoes with puncture-resistant soles. Sneakers and similar types of footwear are too easily penetrated by nails, glass, and other sharp objects. Most safety-toe shoes provide adequate puncture resistance.

### SLIPPERY SURFACES

When snow or ice makes walking difficult, it is often possible to increase traction by walking on *uneven* surfaces, such as grass, gravel, soft snow, or a road shoulder. On especially slippery surfaces, collectors should carry (or slide) only small loads, and should take short steps. Changes in direction under such conditions should be done gradually.



Figure 60. Children on the route.



Figure 61. Cleated shoe.



Figure 62. Shoes with puncture-resistant soles.



Figure 63. Poor choice of footwear.

Where subfreezing temperatures are common, some waste collection employers provide collectors with ice creepers.

#### **STREET HAZARDS**

Factory workers rarely have to deal with as great a variety of unpredictable walking surfaces as collectors. In Figures 64 and 65, the curb had been dug up for repair work. Sewer covers had been raised for a new layer of asphalt. Both created tripping hazards.

#### **DEEP PUDDLES**

Here is a close-up of the curb work done on the street shown in Figure 66. The hole was more than a foot deep, and there were 6 holes on this side of the block alone. When filled

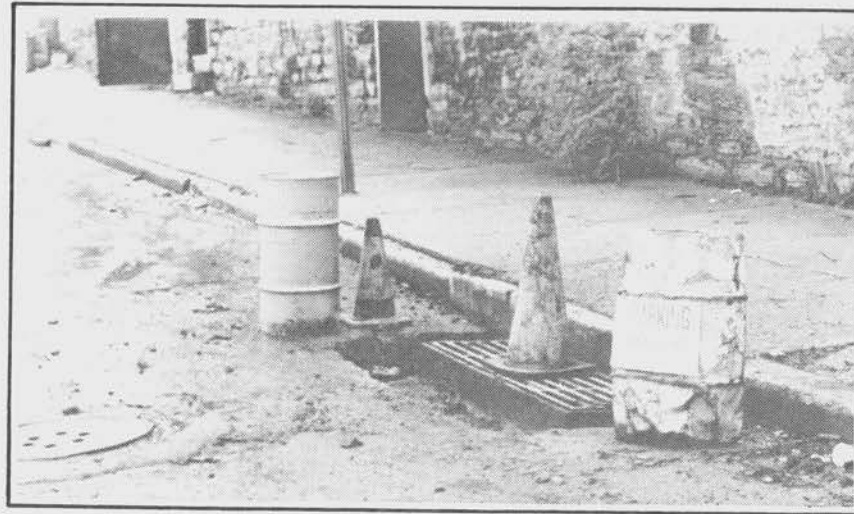


Figure 64. Street repair, marked.



Figure 65. Street repair, unmarked.



with rainwater, they could have been mistaken for shallow puddles. In a factory, work traffic would typically be diverted to other corridors in the event of comparable floor defects. In waste collection, it rarely can be.

#### JUMPING TO OR FROM THE RIDING STEP

Jumping off the riding step puts tremendous strains on the bones of the foot, and risks a painful and persistent injury, especially if the collector lands on the heel, or if the ankle twists. Stepping off should be just that, not jumping off. Additional handholds or better placed handholds may be necessary on some vehicles if jumping is to be avoided.

Several fatalities have occurred when collectors jumped *onto* the riding step of a *moving* vehicle, fell off, and were run over by the rear wheels. Drivers should wait for the proper signal before moving. Collectors

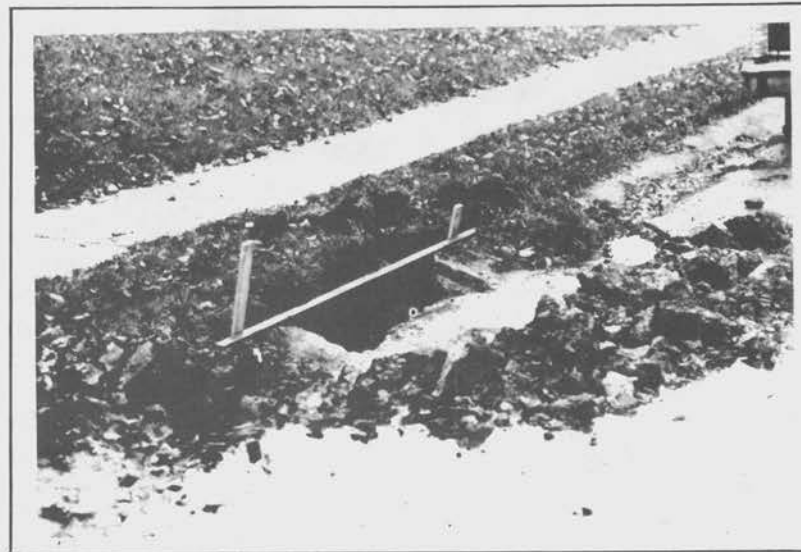


Figure 66. Before it was drained for this picture, this hole had a foot of water in it.



Figure 67. Jumping from the riding step.

should make sure others (on a multiperson crew) are in the proper position to ride before giving the signal. It is likewise important to wait for the truck to stop before dismounting. The collector riding on a truck at 10 mph is also traveling at 10 mph. Stepping off at that speed typically causes the body to tumble to a stop—obviously a rather painful experience.

#### JUMPING FROM THE CAB STEP

Jumping from the cab can be just as hazardous as jumping from the riding step. Collectors and drivers must be careful not to use the exhaust pipe as a handhold. The exhaust pipe in Figure 68 had a protective screen to guard against fires from paper trash (the box sitting on the fuel tank in this picture, however, was an invitation for a fire). The screen also protected the collector against burns to the hands and arms, or to clothing. To enable collectors to face the cab while stepping down—the preferred method—a handhold on the rear doorpost plus well-placed cab steps are recommended.

#### PACE OF WORK

Collectors and drivers who work faster than is reasonably comfortable for the body should understand that speeding up an operation involving repeated (and often strenuous) lifting, especially while operating potentially dangerous machinery, invites increased stress, fatigue, and injuries. Studies of workers under high job stress show that their health can suffer as a result. Studies of fatigue show that the shorter the rest interval between exertions (lifts), the less chance the body has to recover, and the quicker fatigue sets in. Rest breaks should be taken at least every 2 hours (unless riding in the cab between areas allows





for an adequate rest break). Task systems, where the collector's workday is over when the run is finished, can readily lead to rushed work. On the other hand, this system often eliminates the need for working for an extended period during extremes of weather, since collection runs can often be completed by midday or shortly thereafter. If the task system is used, adequate safeguards against rushing are essential.

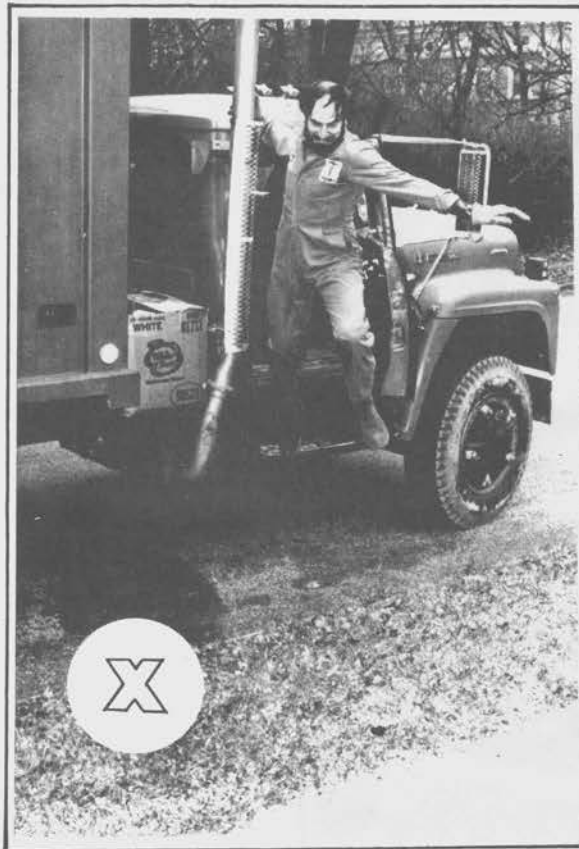


Figure 68. Jumping from the cab.



Figure 69. Rest breaks are needed to prevent early muscle fatigue.

## COMPACTING AND UNLOADING

### SPLIT-CYCLE PACKING CONTROLS

Many newer trucks have either split-cycle or continuous-pressure packer controls. The split-cycle feature means the control has to be released and reapplied, after the first part of the cycle, to complete the packing process.

At the split point in the cycle, the packer panel stops, about a foot from the hopper sill. This allows the operator to check to make sure that nobody's hands or feet are endangered. *This doesn't mean that the first part of the split packing cycle may be safely started before the hopper pinch points are clear.* The split-cycle is a valuable safety feature, but it does not allow collectors to wait

until the mid-cycle stopping point to clear the packer panel pinch points.

The problem with most split cycle controls is that they leave one hand free—that can be crushed. Examples of situations where a hand (or leg) could have been crushed appear in the pictures that follow. Adding a continuous pressure control for the other hand, would increase hand protection substantially.

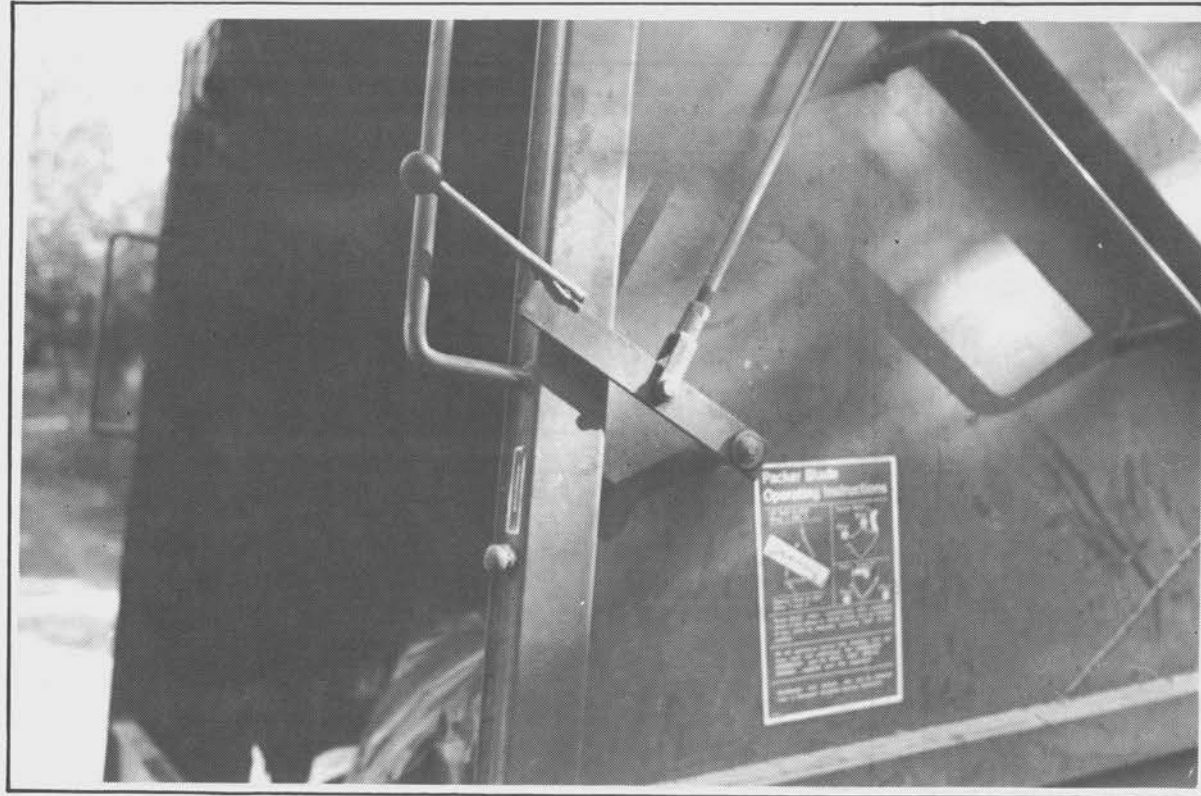


Figure 70. Split-cycle packing control.



**Figure 71. Operating packer with right hand, pushing bulging bags with left.**



Figure 72. Operating packer with right hand, positioning oversized refuse with left.



Figure 73. Operating packer with right hand, dumping load with left.

### HANDS ON HOPPER SILL, AND SIDE WALLS

Cycling the packer with hands on the loading sill is asking for trouble. When the packing panel descends to the sill it creates a very-high-pressure pinch point. Hands on the side walls of the hopper can similarly be crushed by the overwhelming pressure exerted by the panel.



Figure 74. Panel-to-side-wall shear point.



Figure 75. Cycling with hands on loading sill.

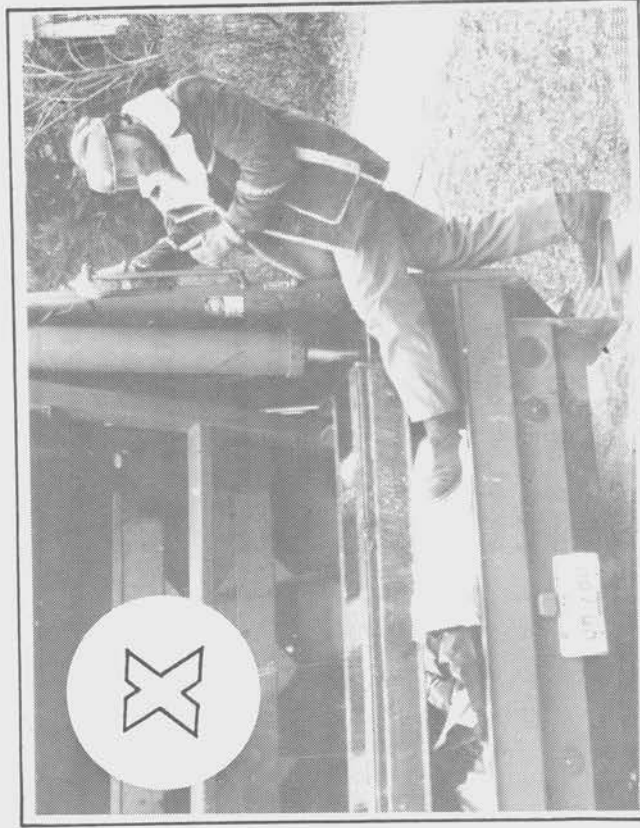


Figure 76. Operating the packer on the run with foot for a pusher.

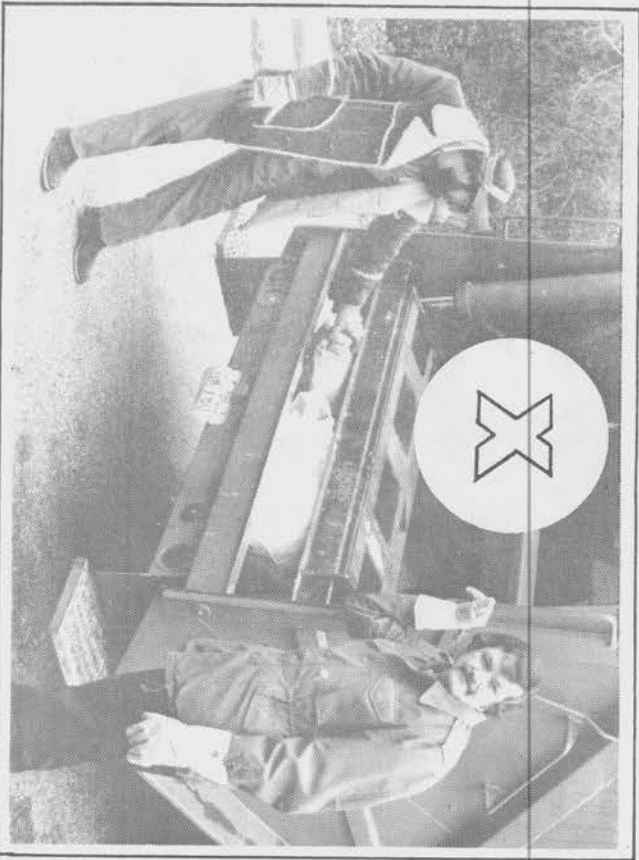


Figure 77. Split-cycle control doesn't protect if operator doesn't watch.

### CONSTANT-PRESSURE TWO-HAND CONTROLS

The crusher panel on this side-loader requires constant pressure on two separate levers, or it will stop. Note also that the panel is edged with flexible flaps to offer an additional margin of safety.

### GUARD DOORS

Some rear-loader designs include a rolling guard door that descends before the packer panel reaches the loading sill, and opens once the packing panel has cleared the sill. When properly designed and maintained, such guarding arrangements can provide significant protection against packer panel injuries. Ejections, however, remain a problem, since many occur when the panel crests the raised



Figure 78. Constant-pressure two-hand controls.



Figure 79. Crusher panel.

portion of the hopper floor; at this point the guard door is already partly reopened. On this type of equipment, it is important to keep clear of the guard door rails and wheel tracks.

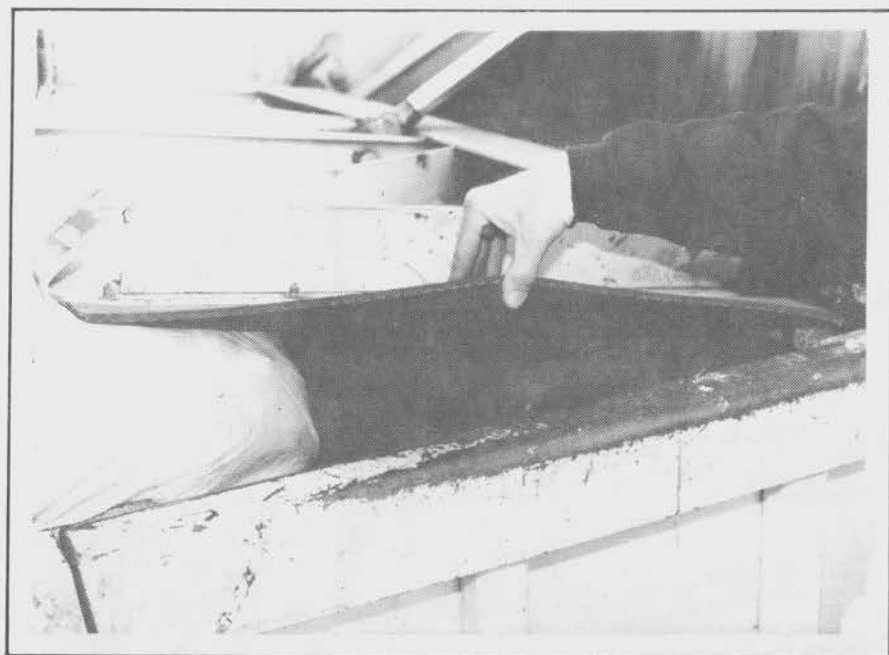


Figure 80. Rubber edging on crusher panel.

It is also important to keep the door mechanism well-maintained. A door that dropped uncontrollably, for example, would create rather than prevent—a hazard.



Figure 81. Rolling guard door. open.



Figure 82. Guard door, nearly closed.



Figure 83. Guard door reopens after packer panel clears loading sill.



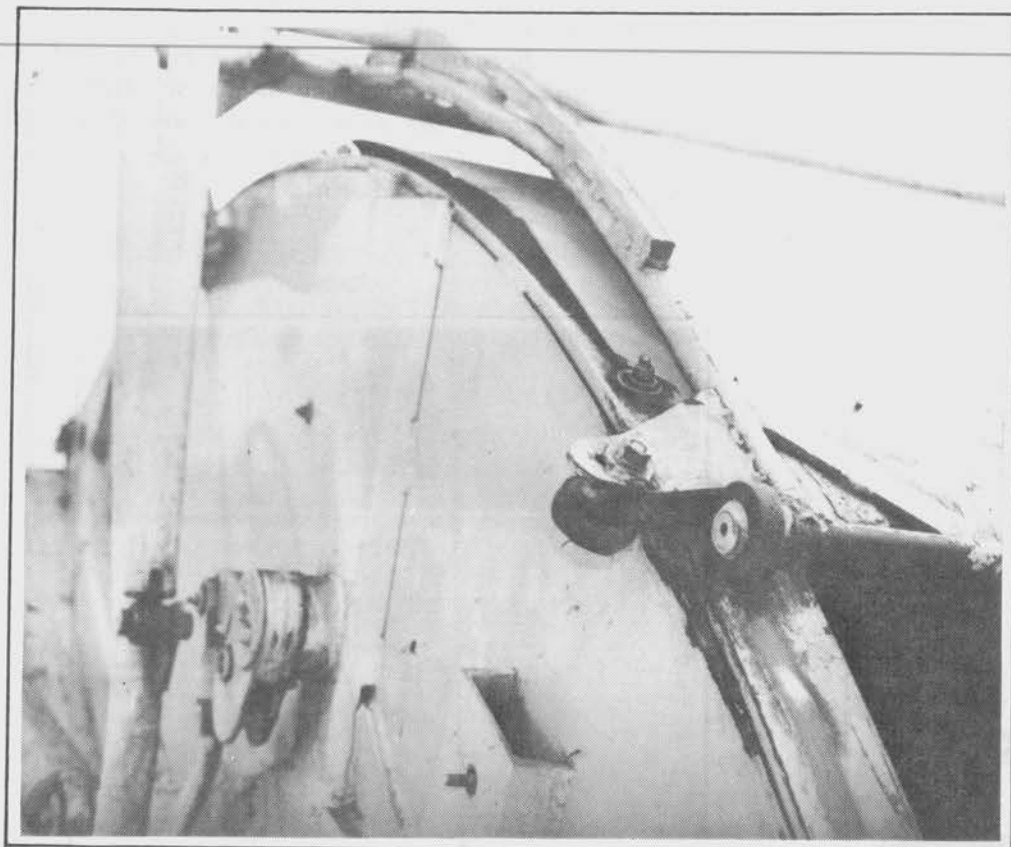


Figure 84. Guard door wheels and rail.

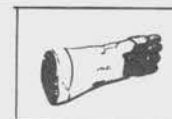


Figure 85. Keep hands clear of guard door wheel rail.

## RECESSED AND NONRECESSED BUTTONS

With some ingenuity, most engineering controls can be defeated. Here the collar around the *start* button on a side-loader was designed to prevent unintentional actuation of the packing ram. The rag tied to the start button

collar in this picture allowed the collector to start the cycle with his knee, while pushing the refuse with the container or with his hands—a highly dangerous practice. If necessary, collectors should pack more often, *but should never adjust the load during the cycle*. It may seem overly obvious, but to a packing

panel a hand might just as well be another piece of rubbish.

*Because an emergency may arise where the packing cycle needs to be interrupted instantly, the stop button must always be VERY accessible—never recessed or otherwise hard to find or hit.*

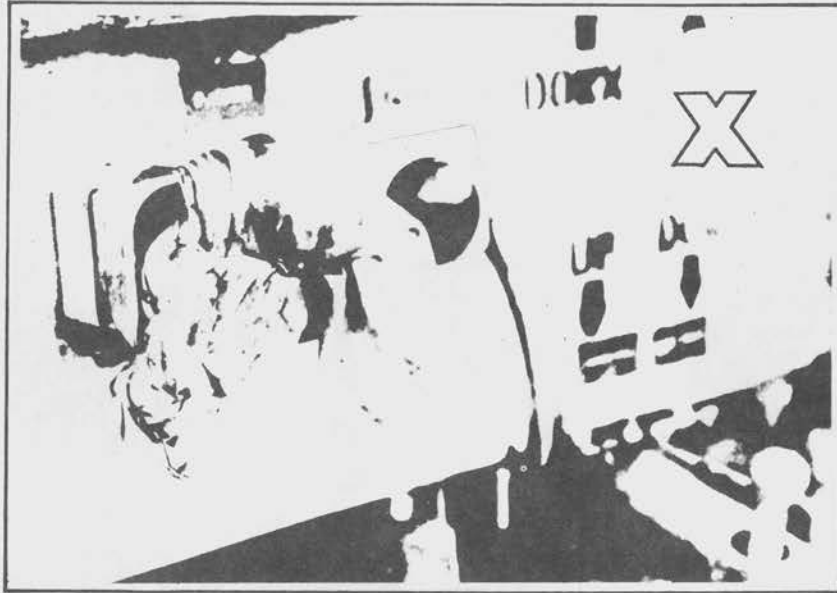


Figure 86. Rag tied over recessed start button defeated this safety feature.

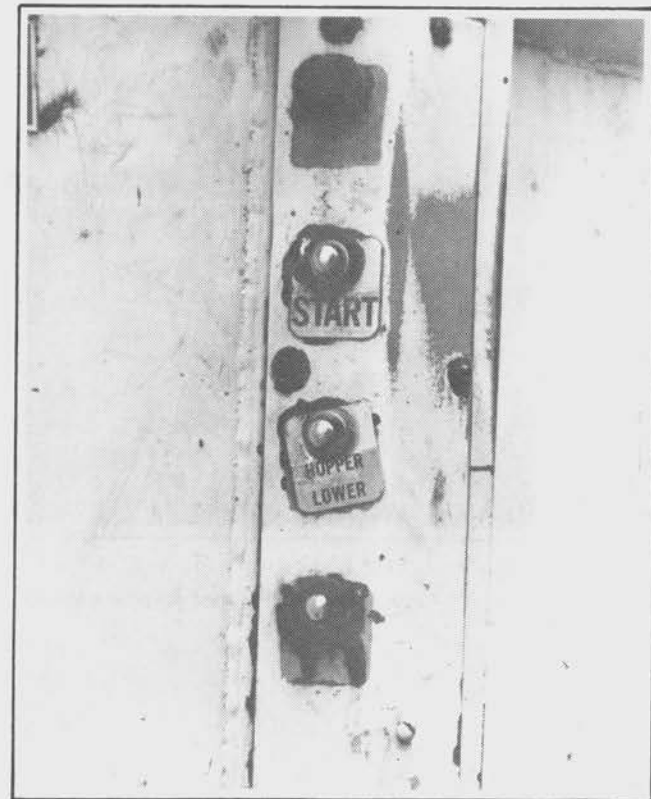


Figure 87. "Start" and "lower" buttons should be recessed here.

## PLACEMENT OF CONTROLS

This older rear-loader doesn't require the collector to hold the start button in to continue

the packing cycle. In addition, the control panel is low enough that youngsters could reach it. A collector was fatally injured in one city when a child pressed the start button.

These controls can be modified to require continuous two-handed operation, preferably with the second control high enough to be out of the reach of children.



Figure 88. Control panel is too low if children can reach it.

## ELEVATING HOPPERS

Elevating hoppers eliminate one hazard but create another. The danger eliminated is the packer-to-loading-sill pinch, which is now out of reach of collectors. The danger is the pinch created when the hopper comes back down. Reaching or falling in under the elevated hopper during a cycle could result in serious injury.



Figure 89. Elevating hopper, closing.



Figure 90. Elevating hopper, closed and packing.

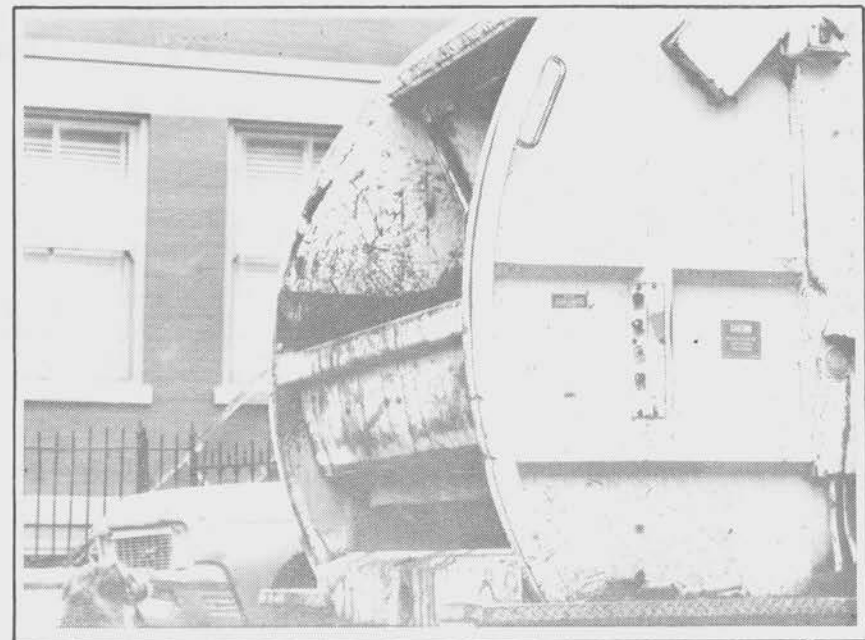


Figure 91. Elevating hopper, reopening.

### SIGNAL BUZZER

A signal buzzer mounted on the tailgate can be very useful in preventing accidents, since it provides a reliable means of communication with the driver. Yelling or whistling may work

when the cab window is open, but it doesn't under poor weather conditions—when clear signals are needed most. For this reason, voice signals are not recommended for routine collector-driver signals. Whatever the signal

used, it should be consistent throughout the department or firm to avoid confusion (example: when someone fills in for an absent crew member). Drivers should not proceed without the proper signal.

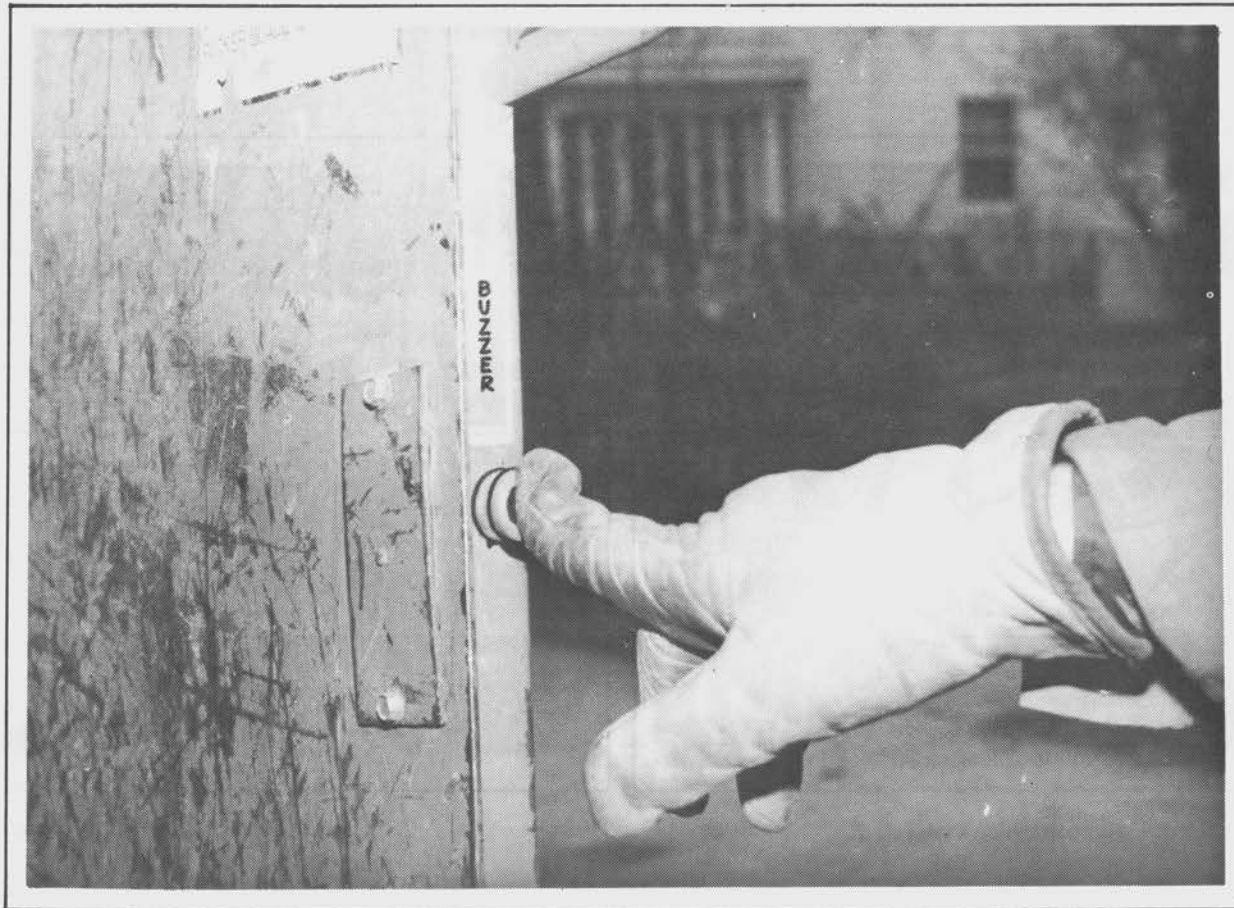


Figure 92. Buzzer for signaling driver.

### REPOSITIONING THE LOAD

A hopper that is routinely overfilled will require excessive repositioning of refuse. (Even if the hopper *isn't* overfilled, there are still occasions when some repositioning is necessary.) For these occasions, a shovel,

or container lid or other shield, should be used rather than the hands. Note that the shovel or shield is only intended to prevent punctures, cuts, and lacerations—it won't protect against the crushing force of the packing panel. *There is no safe way to reposition*

*refuse once the packing cycle is started.* The instinct to push in trash that will otherwise eject is strong, but it must be resisted. Even a truck that has a split packing cycle (where the packing panel stops in mid-cycle about a foot above the sill) is not foolproof.

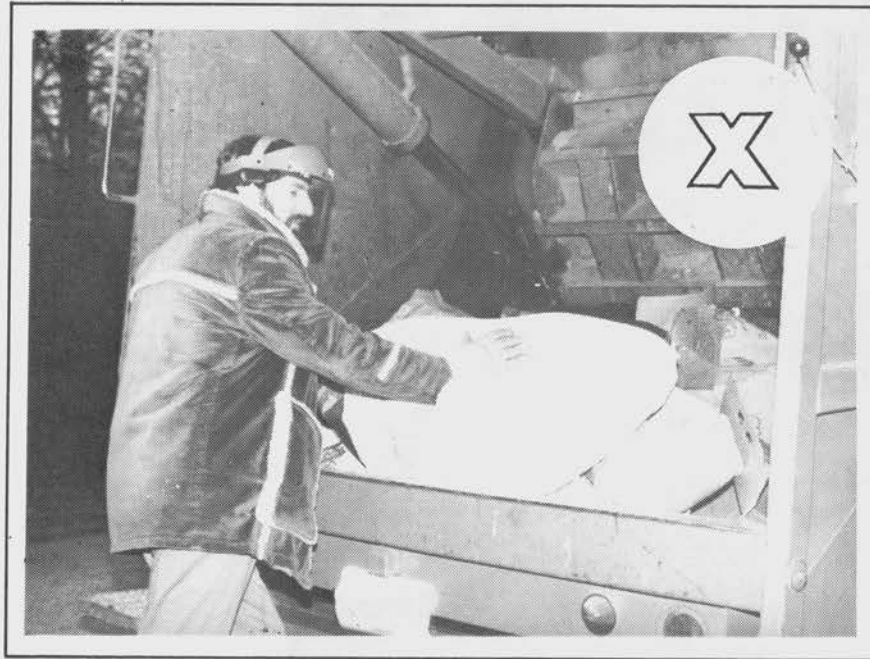


Figure 93. Repositioning with hands.

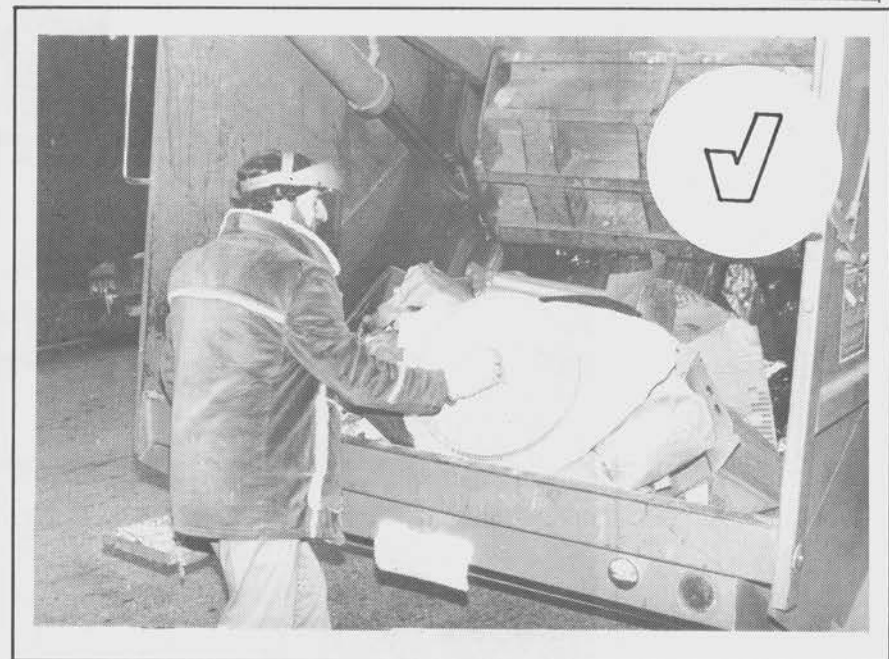


Figure 94. Repositioning with can lid.

## SCAVENGING

Reaching into the hopper to grab a valuable item is asking for trouble. While it could have been relatively safe here if the engine on this

rear loader were shut off, and there were no sharp or toxic refuse present, the problem is this: once the habit develops, a collector may *automatically* scavenge, even when the packing panel is in motion. A collector may beat

the panel 1,000 times, but lose a hand on the 1,001st try, or on the very first try. What the panel did to the pumpkin in the picture below (it had been sitting on the loading sill) it can just as readily do to a human limb.

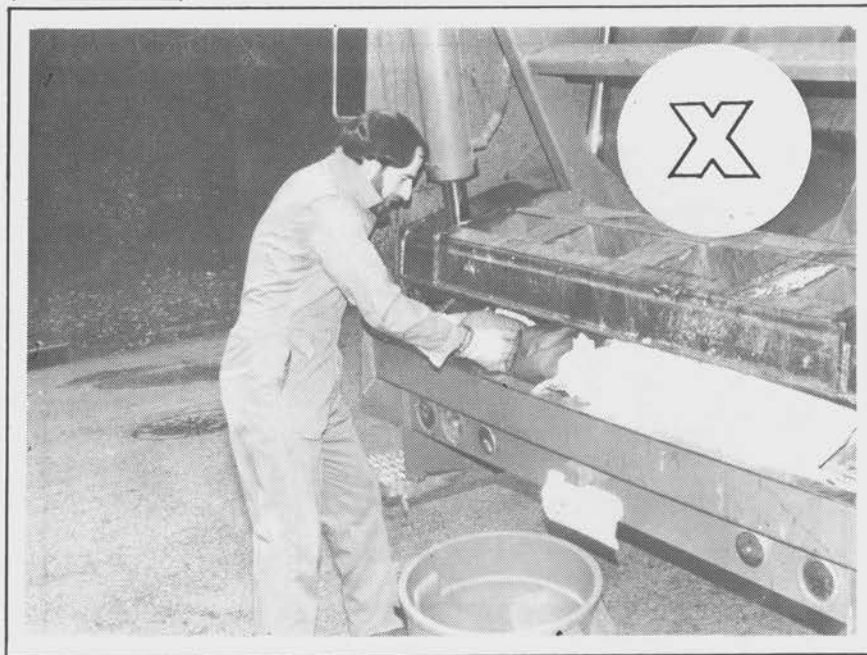


Figure 95. Scavenging



Figure 96. In this demonstration, we put a pumpkin on the loading sill and hit the emergency stop button just as the packer panel hit it. Here are the results.

## EYE PROTECTION

Eye protection is one of the most important items of personal protective equipment for collectors. For this reason, it must be (1) effective, (2) comfortable, and (3) usable under all weather conditions—especially adverse

ones. Safety glasses (prescription or plano type) with screen-type side shields are recommended for optimum protection with minimum discomfort. Such glasses should be equipped with cable temples to keep them from slipping off. If cable temples are unavailable, eyeglass straps are recommended.



Figure 97. Eye protection needed here.



Figure 98. Safety glasses with side shields offer good eye protection.



## EJECTIONS

Some “popouts” are inevitable. In any event, hands must be kept clear of the hopper during the packing cycle. The collector can avoid eye injury from ejections by standing to the side of the truck during the packing cycle (use of the left hand on the packing control encourages this).



Figure 99. Too many bags to pack at once.



Figure 100. Truck should have carried broom and shovel for popouts.

## OVERSIZED LUMBER

Many collectors will make special efforts to pack all the waste they find, including items that should properly be left behind. Long lumber is an example. Some collectors try to use the packer to break it up by feeding it straight in and packing repeatedly. The problem with this is that the portion hanging over the sill may whip around with great force and strike persons standing in the area, or it can shoot out of the hopper. It can also

damage the equipment. Outsized lumber should be tagged and left behind.

## OVERSIZED GARDEN WASTE

Garden waste that is oversized (that won't fit in the hopper without sticking out over the sill) should be tagged and left behind. Tying the garden waste into a manageable bundle reduces the need for handling, which is especially important for garden waste that has thorns. For these reasons, many areas require customers to bundle garden waste.

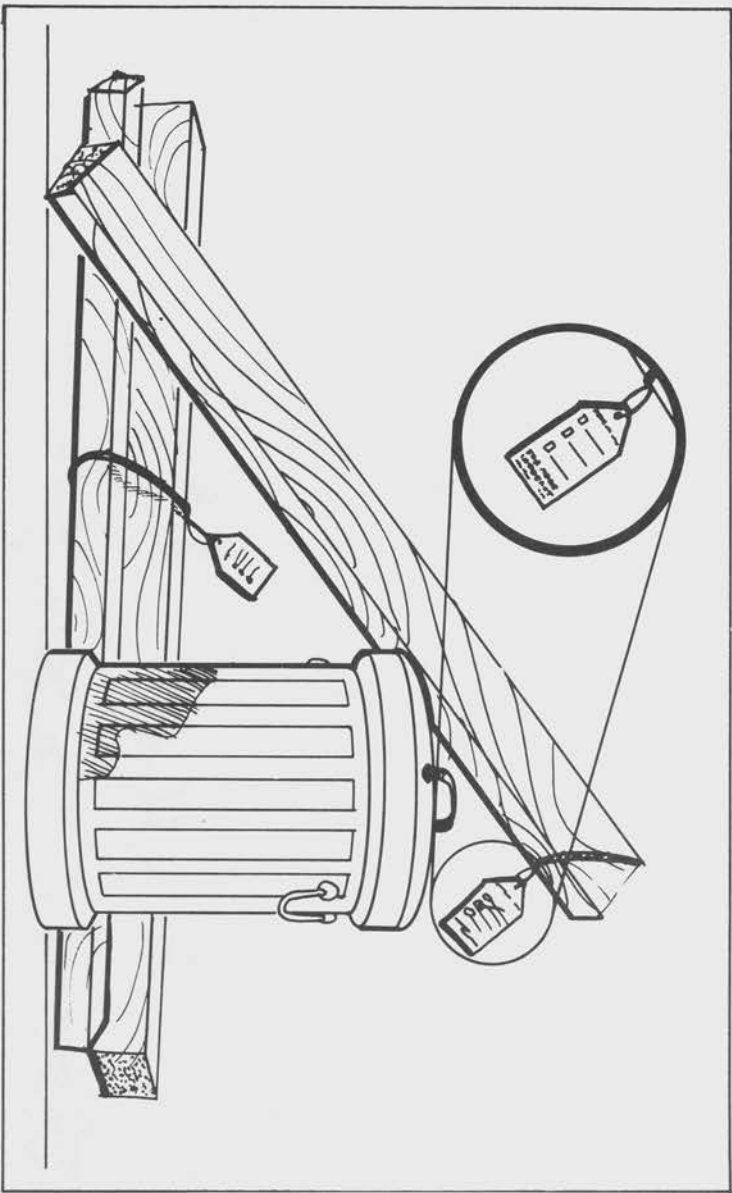


Figure 101. Tagged lumber, oversized.

## EXHAUST FUMES

Overexposure to exhaust fumes can cause dizziness, nausea, sleepiness, and confusion. If levels are high enough, such as in a poorly ventilated enclosed area, overexposure can be fatal. The position of the exhaust pipe on a collection vehicle has a lot to do with the amount of exhaust gases inhaled. Vertical pipes are recommended in preference to horizontal ones, since the gases are discharged above the breathing zone. Many older trucks were equipped with exhaust pipes running halfway or all the way to the rear, where gases were discharged either near collectors or under the body. Pipes discharging under the body near the cab allow exhaust gases to enter the cab through floor holes or door seals. Collectors and drivers are already exposed to elevated levels of combustion products because they work in or near motor vehicle traffic. For this reason, it is important not to add to this exposure by allowing exhaust systems to discharge into the breathing zone. If equipment has a horizontal exhaust discharge, the employer may be able to modify it to the vertical type, or at least to a horizontal type that directs fumes to the street side of the truck away from the hopper, the packer control, and the cab floor.

Regardless of the exhaust system configuration, it is advisable to minimize the amount of time a truck idles indoors, such as at the garage. Trucks that have to be run indoors for more than a minute or so should have special local exhaust ventilation at the tailpipe to remove exhaust gases. Even with such ventilation devices, attention must be given to leaks in the exhaust system which might allow gases to escape into the work area. Note that the major toxic exhaust com-

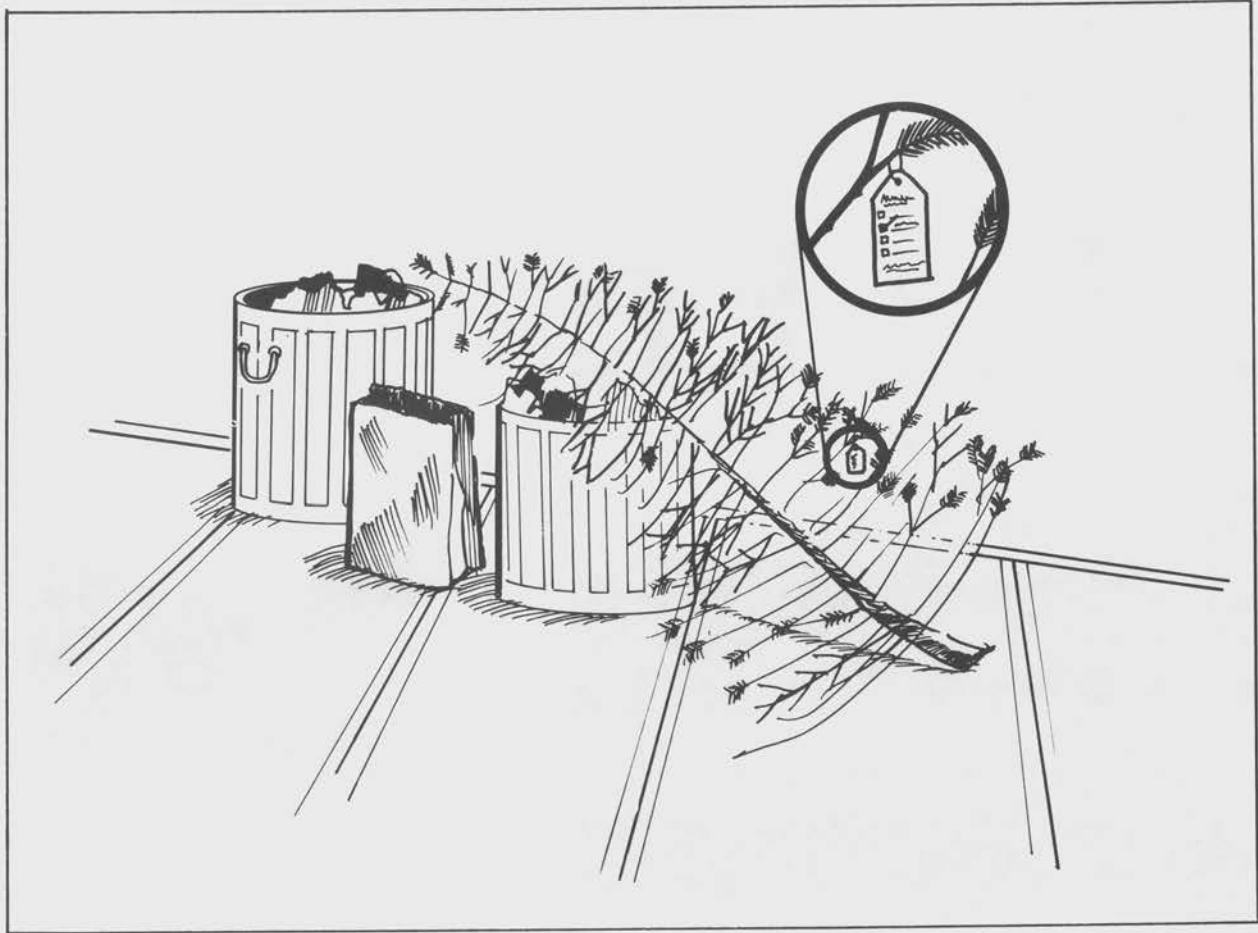


Figure 102. Tagged shrubbery (oversized).

ponent\*—carbon monoxide—is *not* detectable by the human senses. This chemical does not have any taste, smell, or color. It can be measured, but only with special equipment.

\*Diesel exhaust contains toxic chemicals that are absorbed during combustion onto smoke particles. Long-term health effects, if any, of breathing diesel exhaust are currently under study by NIOSH and other Federal agencies.

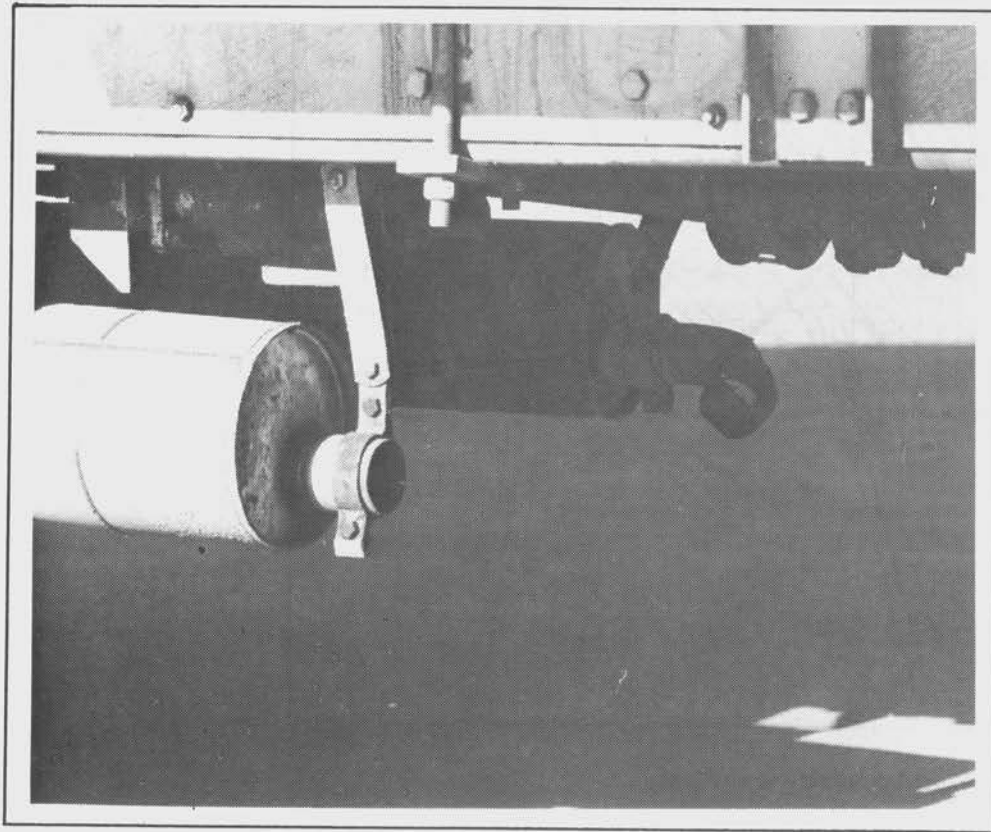


Figure 103. Horizontal exhaust outlets may expose collectors and drivers to excessive amounts of exhaust gases.



Figure 104. Vertical exhaust outlet (preferred).

## FLUORESCENT LIGHTS, PICTURE TUBES

Fluorescent lights, TV picture tubes, and similar items require special handling. The collector should "cushion" them by placing them in the hopper with some other refuse above and below. For rearloading vehicles, the rear danger zone (ejection area) should be cleared of all persons, and the load packed with the packer operator well to the side of the vehicle. Picture tubes "explode inward" (implode) when broken due to the high vacuum inside. The pieces bounce back with explosive force.



Figure 105. Tubes here fell out of the can when the can was carried.



Figure 106. Take lighting tubes out before dumping.

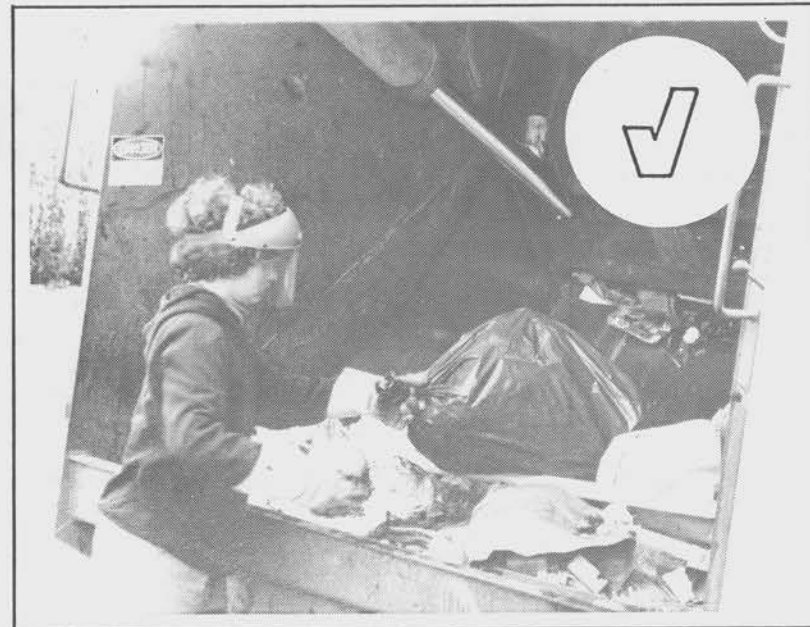


Figure 107. Place some refuse under tubes and some over them before packing.

## OVERFILLING THE COMPACTOR

Loosening the turnbuckles on a rear-loader to pack just a bit more refuse may save a trip to

the landfill, but it is extremely dangerous (pressure on the turnbuckles can exceed 50,000 lbs per square inch). The tailgate

might pop open with explosive force and slam into persons standing to the rear, risking serious, even fatal, injury.



Figure 108. Loosening turnbuckle to overload can have deadly results.

## AUXILIARY ENGINE ACCESS

The auxiliary engine shown here is practically inaccessible for minor on-the-run adjustments or servicing. Other compactor models include a permanently mounted ladder for considerably safer access. In some cases a ladder can be retrofitted to a compactor lacking one.

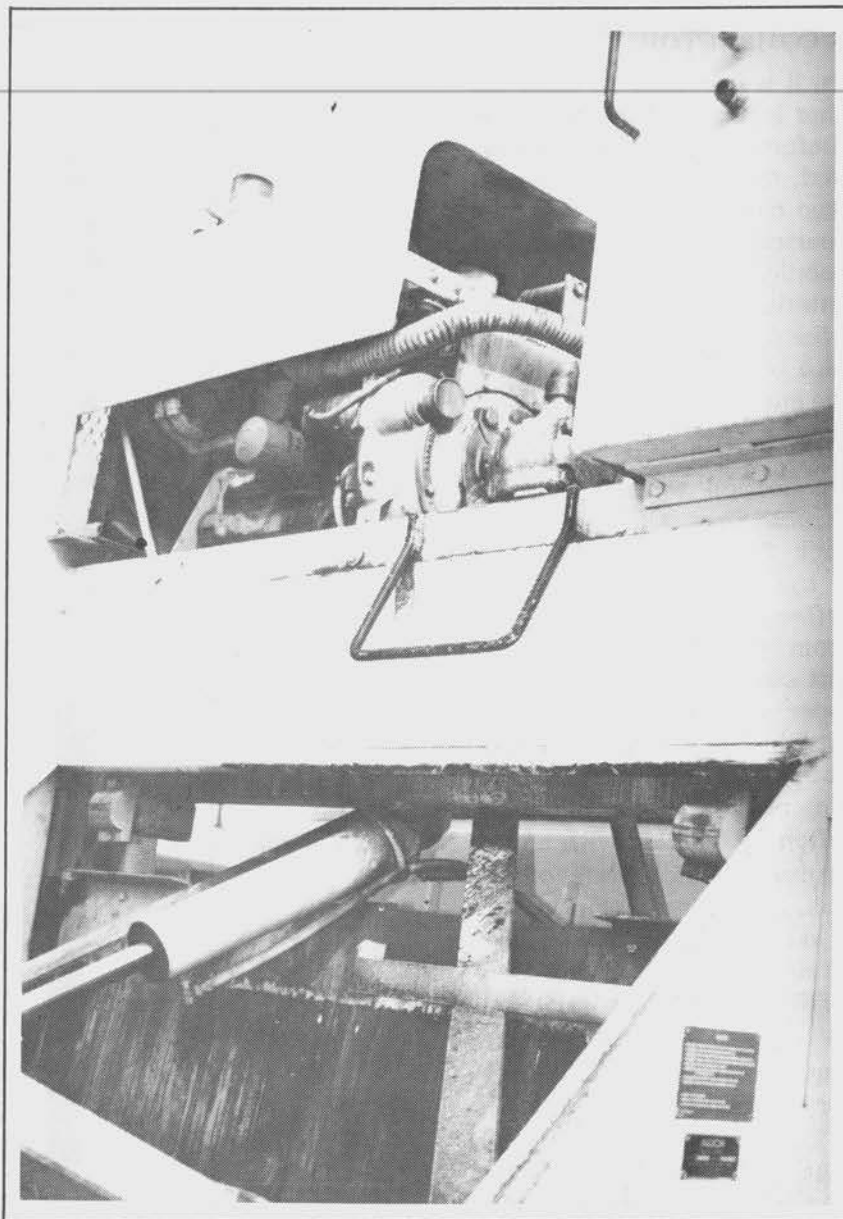


Figure 109. Auxiliary engine with poor access (better design includes a fixed ladder).

## ENTERING THE COMPACTOR

In some instances, it is necessary to enter the packer body (either in front of or behind the ejection panel). Before entering, ignition keys should be removed, the ignition lock should be tagged or locked out, and the keys should be kept by the person entering the body. A second person should stand watch over the truck until the entering employee emerges. If a person enters the body through an access door, it should also be tagged with a suitable warning during the entry.

## TRUCK AND BODY FIRES

Fires on refuse collection vehicles fall into two categories—truck fires and compactor (body) fires. Truck fires can be started by: fuel line failure; hydraulic line leaks, if the oil is hot and deflectors are not attached to prevent leaks from spraying onto exhaust system parts; short circuits in the presence of grease, oil, or paper, or of combustible wire insulation, in either the cab or engine housing; and by contact of hot exhaust system parts with combustible or flammable materials. Truck fires can often be handled with appropriate fire extinguishers—but beware of the fire restarting if oil, grease, or wire insulation is involved. The vehicle should not be used after a truck fire until a mechanic has thoroughly checked and released it.

Fires in the compactor *body* require different handling. Employers should have definite rules for handling such hot loads. For example:

Once a hot load is observed, quickly scout the area for an appropriate dump site—never near fallen leaves, under trees, or near storm drains or sanitary

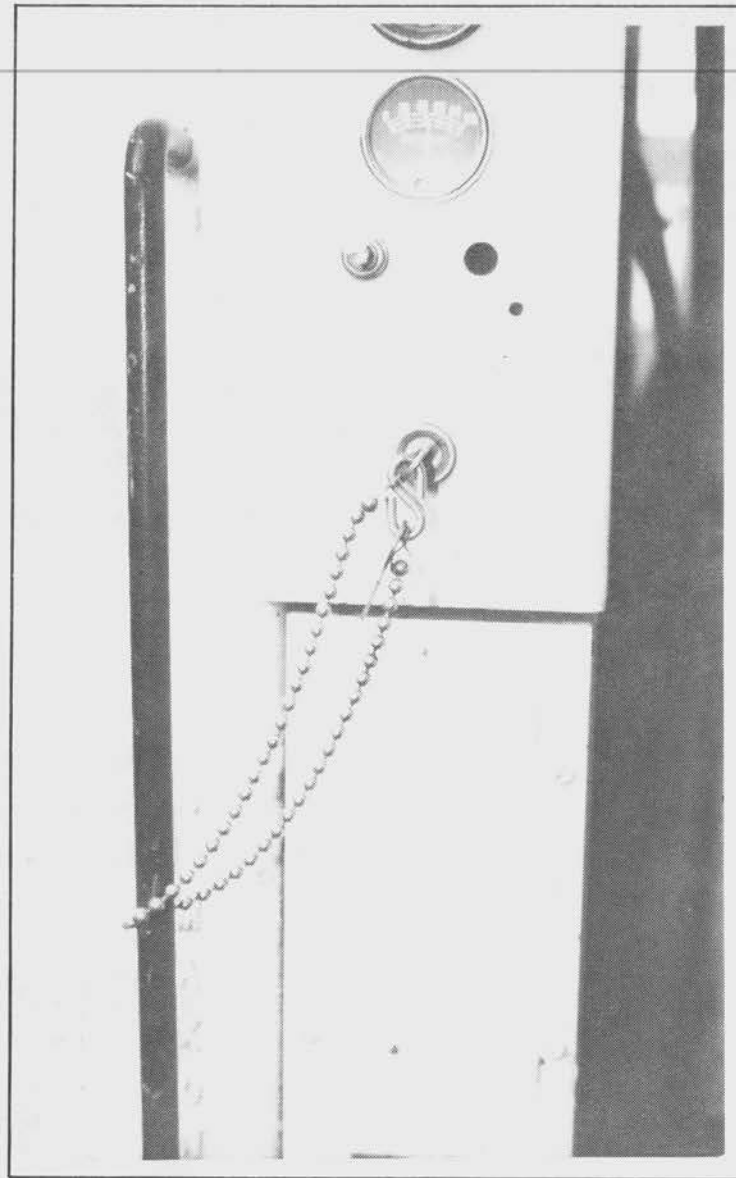


Figure 110. Before entering the compactor body, remove the key to whatever engine provides hydraulic power and put it in *your* pocket.



sewers, and *never* in front of a firehouse or gas station. Empty areas of a parking lot or clear street areas are examples of some more desirable emergency dump sites. Once the hot load is dumped, move the truck away, if possible, to prevent a truck fire. Do not leave the area until the burning refuse is cool. A call to the fire

department is always recommended, but consideration should be given to dumping first if a suitable site is available.

If the dumped load is reloaded after extinguishing, it should be taken to the landfill, incinerator, or separation plant immediately. Due to the possibility of the fire

restarting, the collection route should *not* be resumed until the problem load is disposed of.

Whatever the procedure followed for fires, it is recommended that one or more possible hot load dump sites be picked out along the run as soon as the run is assigned. This saves time and mistakes in the event of a body fire or truck fire.



Figure 111. Calling fire department to report hot load or truck fire.

## VISIBILITY IN THE LANDFILL

One of the hazards present in sanitary landfills is the problem of workers on foot not being clearly visible to truck drivers and equipment operators. Generally, the number of people on foot in a landfill should be kept to a minimum. Such a limit not only

reduces the visibility problem, but also minimizes several potential dangers, such as rodent bites, contact with various biohazards, burns from landfill fires, and foot injuries from sharp debris. Limiting the number of persons on foot means that scavenging for useful items cannot be allowed. The landfill spotter in Figure 112 should have worn a

bright outer garment, such as a traffic vest, on this heavily overcast day. NIOSH also recommends that spotters be provided with a gas-powered horn (or a similar warning device) to alert equipment operators to a dangerous situation, such as an injured worker or a potential collision.



Figure 112. Landfill spotter without high-visibility clothing.



Figure 113. Landfill spotter with high-visibility vest (drawn in).

## WEATHER EXTREMES

Both cold and hot weather can adversely affect a collector's health. In extremely hot (especially hot and humid) weather, a worker can develop heat cramps, heat exhaustion, or, in particularly severe cases, heat stroke.

*Heat cramps* are painful and often incapacitating cramps or spasms of those muscles used most frequently during manual work. They are caused by excessive loss of body salts (also called "electrolytes") due to sweating. Heat cramps generally occur after several hours of very heavy sweating where salt intake has been insufficient to make up the loss. By drinking a balanced electrolyte drink (such as Gatorade) or lightly salted water and resting in a cool place, the cramps usually disappear in a few hours.

*Heat exhaustion* is the most frequent type of heat illness. It usually results from working in temperatures much higher than the person is used to, or from not drinking enough water while heavily sweating. Heat exhaustion is characterized by pale and clammy skin, weakness, nausea, faintness, and rapid pulse. Body temperature, on the other hand, is typically normal. Resting in a cool place plus drinking a balanced electrolyte drink or lightly salted water usually leads to a complete recovery in 1-4 hours.

*Heat stroke* is a serious medical emergency. It usually occurs when a person who is not used to working under hot conditions, or who is very heavy, or who is in poor physical condition, is exposed to extremely hot conditions. The skin of the heat stroke victim is hot, flushed, and typically dry. Body temperature may rise to 105°F and above. As the fever develops, the victim

typically feels weak, hot, sick, and fearful. If treatment isn't started immediately, unconsciousness, coma, and death can occur.

*Treatment of heat stroke consists of immediate cooling of the body as rapidly as possible.* Removing outer clothing, pouring water on the victim, and getting the victim into a cold bath or shower are just a few of the methods that will cool the body quickly. Remember that heat stroke is a serious medical emergency—cool the victim and call a physician or ambulance at once.

*If a choice must be made, the collector or supervisor should start cooling the victim first—and then call for medical help.*

*Most heat illnesses are preventable.* Here are some suggestions:

1. During hot weather, meals should include adequate salt (better still are the balanced electrolyte drinks familiar to athletes) to make up for sweat loss.

2. The body's adjustment (acclimatization) to elevated heat on the job generally takes a full week. This acclimatization is lost after a 1- or 2-week absence. For this reason, a person returning to work after an absence of about 10 days or more must be especially careful to take precautions against heat illness. Returning to work during hot weather *in poor physical condition* would increase the risk of heat illness.

3. The signs and symptoms of heat illness cited should be memorized.

4. Be sure that a phone number for a physician and ambulance is in the cab at all times (such as on the ignition key ring) in case either needs to be contacted in a hurry.

5. Adequate rest breaks should be taken.

Cold weather can also contribute to job illness or injuries. A combination of low temperatures with high winds is especially hazardous. In cases of mild tissue freezing, only blistering of the skin or minor tissue damage occurs. In cases of severe cold injury, however, deep tissue freezing can result in death of all the frozen tissue, which may include the entire finger, toe, or even an entire foot.

"Chilblains" are inflammations of the fingers, toes, or feet caused by prolonged exposure to cold, damp conditions. They may occur when the hands or feet are wet for long periods, such as several days in a row, typically at temperatures slightly above freezing. Chilblains can be very painful, and may take weeks to cure. They usually can be prevented by keeping gloves and socks dry during cold weather. Spare gloves and socks should be kept in the cab to allow for changes while on the route.

Frostbite occurs at temperatures below freezing, most often on exposed skin (such as the face) or on fingers and toes. In sub-freezing weather, coworkers should check each other's faces periodically for grayish-white spots, an early sign of frostbite. Collectors should look for similar spots on fingers or toes if any indications of impending frostbite appear. The area of skin that is starting to freeze frequently develops a sharp stinging sensation. Note that frostbitten skin should not be massaged and should not be rubbed with snow. If frostbite occurs, workers should take the steps listed below.

1. If feet are frostbitten, carry the victim;

2. Get the victim out of the cold;

3. Rewarm the frostbitten part *slowly*  
with lukewarm water (never with a stove,

heater, fire, or hot water)—use water at  
body temperature;

4. Separate frostbitten fingers or toes

with sterile gauze from a first-aid kit;

5. Give victim a warm drink; and

6. Get medical attention.

## SOURCES OF ADDITIONAL INFORMATION\*

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Educational Research Institute Suite 206 10920 N. 56th Street Tampa, FL 33617	filmstrip and audio tape audiovisual training materials: Series 1. Residential Collector Series 2. Driver Improvement Series 3. Interpersonal Relations
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Governmental Refuse Collection and Disposal Association 1629 -K- Street, N.W. Suite 701 Washington, D.C. 20006	
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U.S. Environmental Protection Agency 401 -M- Street, S.W. Washington, D.C. 20036	slides, movie, and training manual: “Operation Responsible: Safe Refuse Collection (1972).”

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