

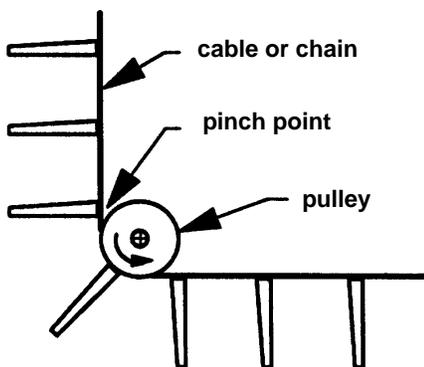
Safety considerations for manure handling

Mark A. Purschwitz

Handling manure is an important operation on Wisconsin dairy and livestock enterprises. Farm operators must make careful decisions about options for collecting, storing, transporting and applying manure.

Manure handling presents hazards, and Wisconsin farmers, employees and family members have suffered serious and fatal injuries related to this task. This bulletin discusses hazards, potential injuries and preventive measures involved in handling manure. Because particular machines and facilities may create unique hazards, farm operators may encounter situations not covered here.

Pinch point at corner pulley.



Collecting manure

Manure is collected by either: (1) a gutter cleaner; (2) an alley scraper; (3) mechanical scraping of an alley or lot with a tractor or skid-steer loader; (4) a flushing system; or (5) a slatted floor with a pit beneath. In some cases, a combination of these methods is used. All require proper management to avoid injuries.

Gutter cleaners and alley scrapers

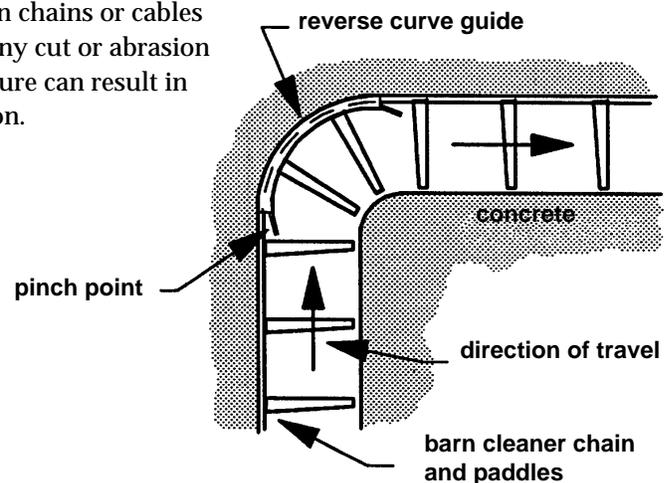
Hazards and potential injuries:

- A pinch point exists where the chain or cable of a gutter cleaner or alley scraper meets a corner pulley, reverse curve guide rail, drive sprocket, gutter wall or floor. A finger, hand or foot that gets caught in a pinch point will most likely be amputated. This is also the case with extremities caught between chains or cables and pulleys. Any cut or abrasion involving manure can result in serious infection.

- Children can fall into reception pits or pump hoppers, or be carried in by moving paddles, which could result in potentially fatal injuries.

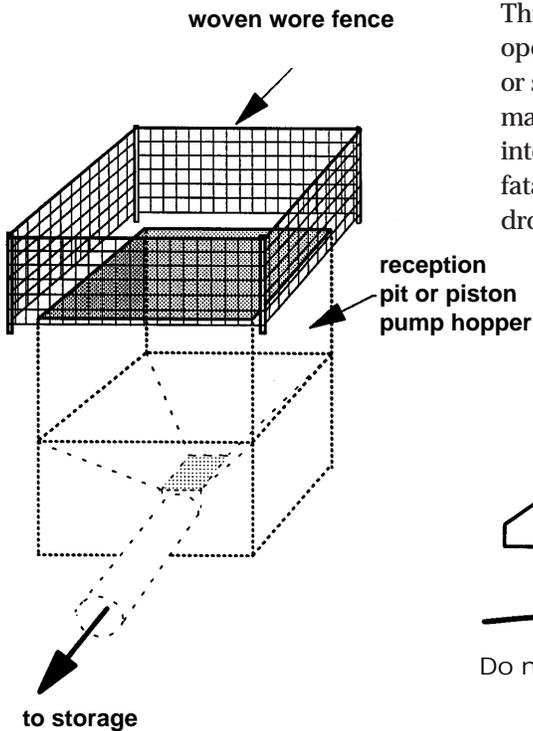
Prevention:

- Keep all shields or guards provided by the manufacturer in place. These include guards on reverse curve guide rails as well as drive gears, chains, cables and belts. Operators should check older equipment and add guards as necessary. Contact your dealer or manufacturer about retrofits.
- Do not allow young children near the gutter when a gutter cleaner is operating.
- Do not permit children to ride pulleys, paddles, chains or cables.



Pinch point at reverse curve.

- Fence or guard reception pits and pump hoppers. Woven wire fence is recommended when small children are present.

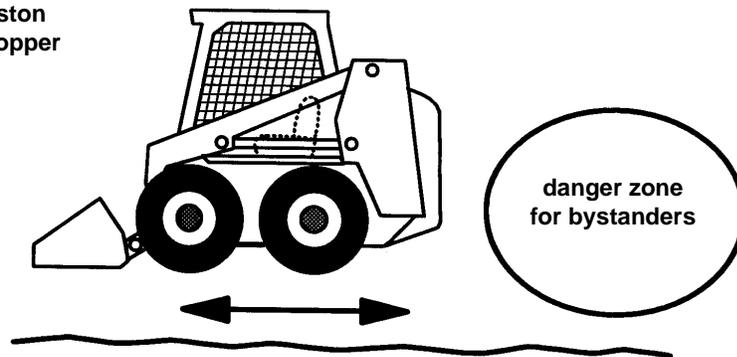


Install guard or fence around reception pits and pump hoppers.

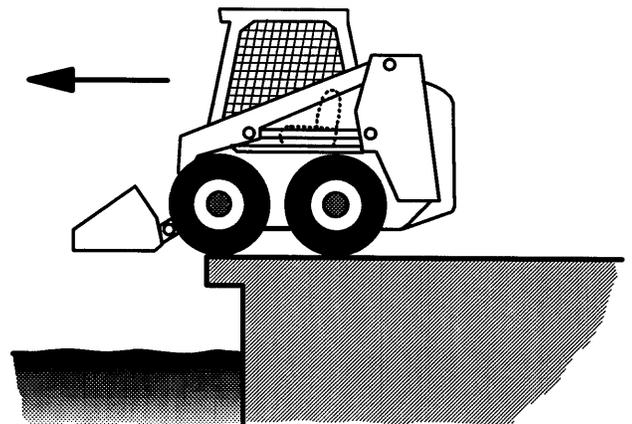
Tractor/loader operations

Hazards and potential injuries:

- The forward-reverse motion of skid-steer loaders or tractors makes it difficult for operators of these machines to see bystanders coming from behind—especially children. A bystander could easily be run over or struck by the bucket when a machine backs or turns.
- Extra riders can fall off the tractor or loader.
- A tractor or loader scraping or dumping at a push-off ramp could slide over the edge of the ramp. This might happen because of operator error, mechanical failure, or simply a too-slick surface. A machine that goes over the edge into a pit or storage can result in fatal crushing, entrapment or drowning of the operator.



Do not allow bystanders during loader operation.



Loaders can slide over the edge.

- Skid-steer loader buckets can drop down on an operator if the operator enters or exits the loader when the arms are up, or is thrown from the operator's station when the loader bounces. An operator can sometimes inadvertently activate a control and be caught off guard by the lowering of the loader. Skid-steer loader buckets coming down unexpectedly have resulted in fatal crushing injuries and asphyxiation.
- Reaching or leaning out of a skid-steer loader operator station while the loader arms are lowering has resulted in arm amputations and fatal head injuries.
- Tractors and loaders can overturn, causing serious or fatal crushing injuries.

Prevention:

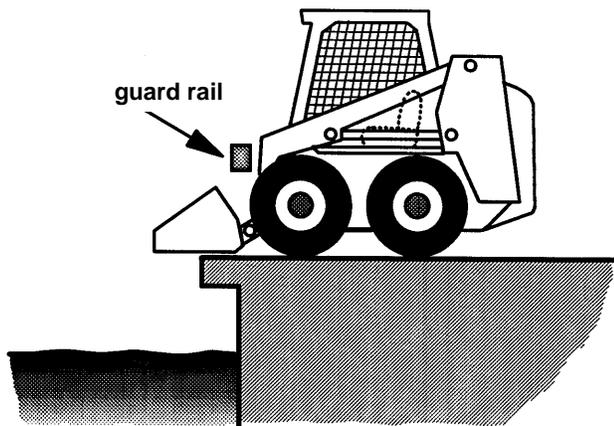
- Do not allow bystanders, particularly children, in the work area.
- Never permit extra riders.
- Install a guardrail or safety bar at the push-off point to prevent the tractor or skid-steer loader from sliding over the edge.
- Always make sure that skid-steer loaders have rollover protective structures (ROPS), side screens, and operator restraint systems such as restraint bars or seat belts. The ROPS protects the operator in case of overturn, and the restraint system and side screens keep the operator safely in the operator's station.
- Never exit or lean out of a skid-steer loader while the bucket or attachment is raised; always lower it first.
- Carry loader buckets low to minimize the chance of overturns. Tractors with tricycle front ends are the least stable and are not recommended for loader operations. Tractors with ROPS are much preferred because they protect the operator in case of an overturn.

Storing liquid manure

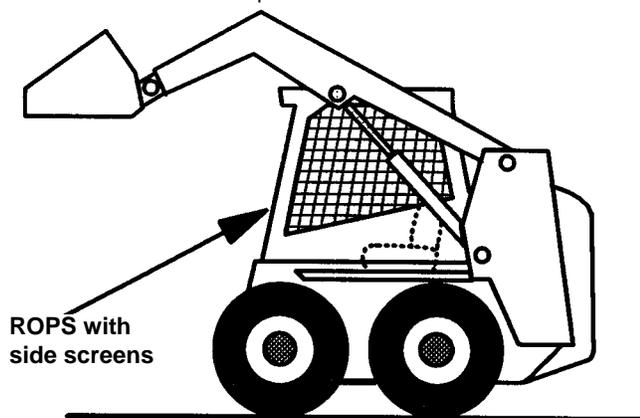
Increasing numbers of farm operators are storing manure in liquid form. This method of storage creates conditions for potentially fatal hazards that must be addressed.

Many liquid manure storage facilities are confined spaces, such as pits under buildings, including those with slatted floors, and covered or open outdoor tanks. The atmosphere inside these areas is dangerous and not designed for continuous human occupancy. Many offer limited access for personnel to enter or exit.

Install guardrail at push-off point.



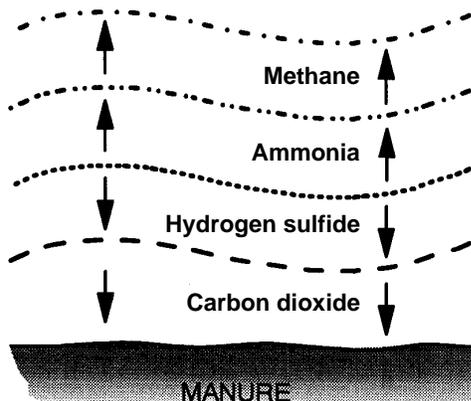
To prevent crushing injuries, never exit or lean out of a skid-steer loader with the bucket up.



Hazards and potential injuries:

- Gases produced by decomposing manure in storage can be fatal. The following four primary gases are produced:

1. Hydrogen sulfide—A highly toxic gas that is heavier than air. This gas can cause dizziness, unconsciousness, convulsions, respiratory paralysis and death at relatively low concentrations. Hydrogen sulfide also produces a cyanide-like effect which inhibits the body's use of oxygen, and can inflame the cornea. The Occupational Safety and Health Administration (OSHA) has established a short-term exposure limit (STEL) of 15 ppm (parts per million), and a level immediately dangerous to life or health (IDLH) of 300 ppm. Fatal levels can easily be reached in manure pits, especially during or after agitation of the manure. At low concentrations, hydrogen sulfide smells like rotten eggs, but as concentrations increase the sense of smell is overwhelmed, and cannot be relied upon to indicate the gas's presence.

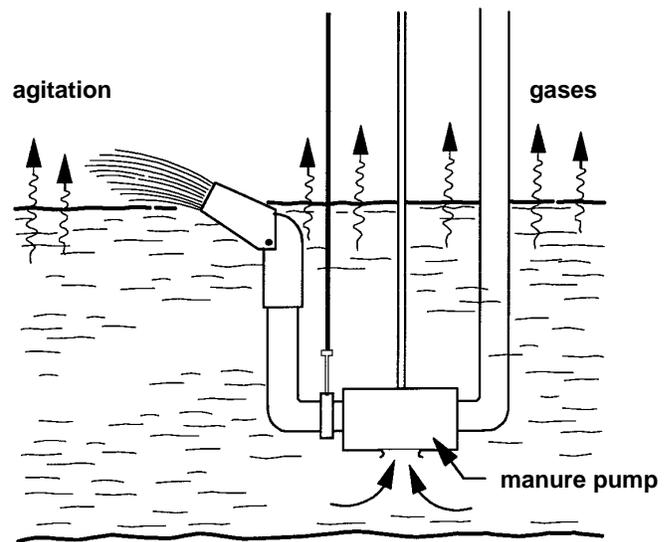


Manure gases.

2. Carbon dioxide—An odorless, heavier-than-air gas which displaces oxygen and can cause unconsciousness and death by asphyxiation. Carbon dioxide is even heavier than hydrogen sulfide.
 3. Ammonia—A pungent, lighter-than-air gas which can irritate eyes and lungs, displace oxygen and contribute to asphyxiation.
 4. Methane—An odorless, lighter-than-air gas which is explosive at certain concentrations. Smoking should never be allowed around liquid manure pits. Welding or cutting without proper ventilation can also cause an explosion. Methane displaces oxygen and can contribute to asphyxiation.
- Release of gases is greatly increased when the manure is agitated.
 - Children and animals can drown if they attempt to walk on the crust that forms over liquid manure.

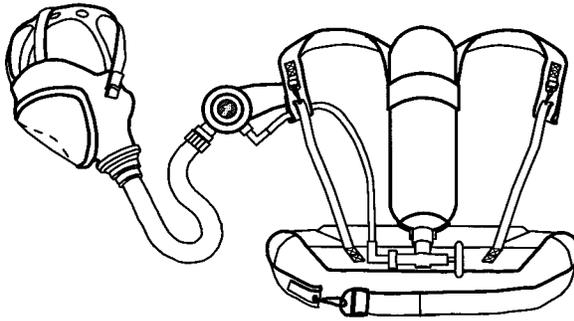
Prevention:

- Provide adequate ventilation to manure storage pits and reception/transfer pits.
- Remove all animals and people from buildings prior to agitating the manure. Do not return until buildings have been properly ventilated.

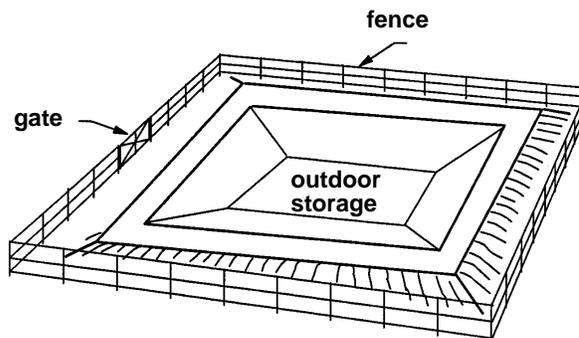


Agitation greatly increases release of manure gases.

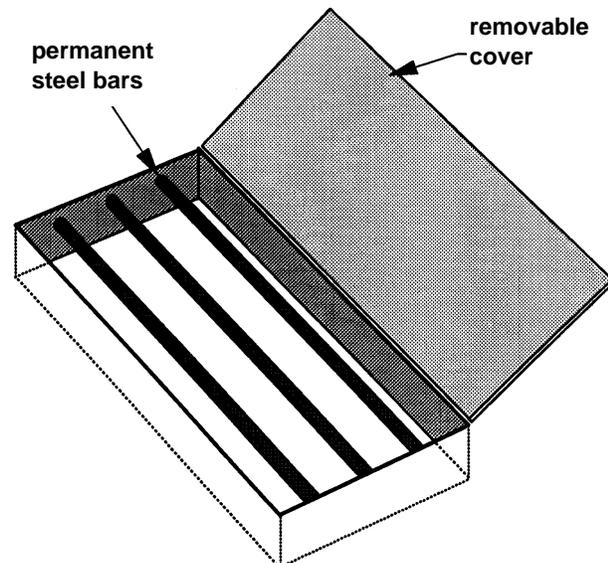
- Never enter a manure pit without proper breathing apparatus unless the air has been proven safe by proper testing for oxygen and all hazardous gases. Unless the air is proven safe, only a person wearing a supplied-air respirator, such as a self-contained breathing apparatus (SCBA) used by fire fighters, should enter. A cartridge respirator is not adequate—the breathing apparatus must supply air as well as seal out toxic gases. Never enter without an SCBA even to rescue someone who has become incapacitated. Safe entry also requires use of a lifeline and another adult standing by. Note that using SCBAs calls for special training.
- Place ladders on above-ground tanks out of children’s reach, or guard them to prevent use by unauthorized persons.
- Fence below-ground outdoor storages to keep out children and animals.
- Cover ports properly to prevent children and others from entering. Bars or grates under the covers of scrape-in or inspection ports provide additional protection.
- Post warning signs.



Self-contained breathing apparatus (SCBA) is required for entry into manure pits.



Install fence around outdoor storages.



Guard scrape-in ports.



Post warning signs.

Transporting and applying manure

You must follow some basic safety practices to prevent injuring yourself or others when you transport and apply manure.

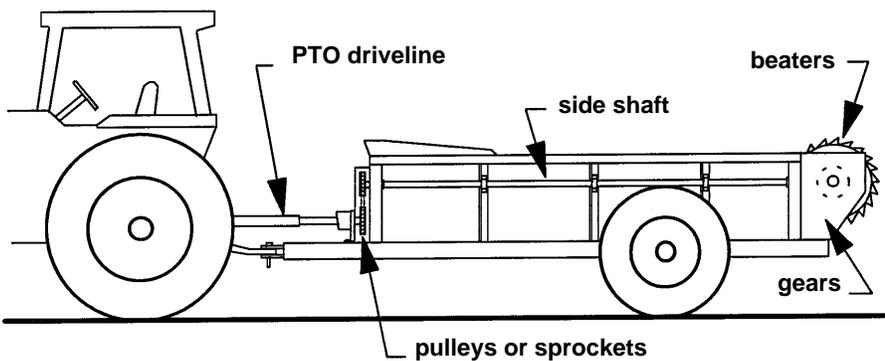
Hazards and potential injuries:

- Moving parts on manure spreaders, such as power take-off drivelines, side shafts, pulleys and sprockets are hazardous if not shielded. Becoming entangled in unshielded rotating shafts has resulted in amputations, spinal injuries and death.

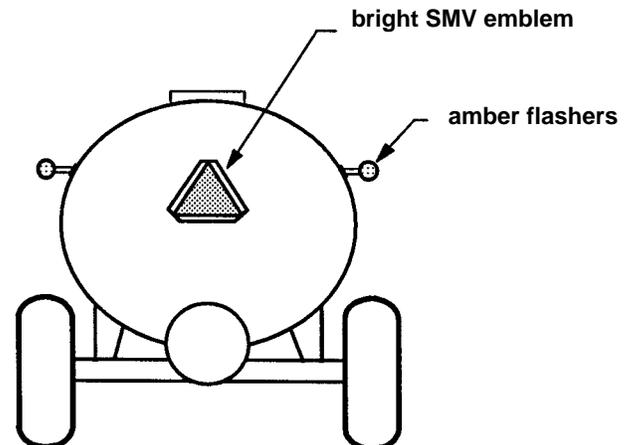
- Motor vehicle collisions can involve tractors and spreaders on public roads. Collisions can occur when vehicles overtake tractors quickly or when tractors turn unexpectedly. Collision-related injuries or fatalities can involve both tractor operators and motorists.
- Manure or wet soil left on the roadway by your tractor and spreader is a hazard to other vehicles. Drivers may swerve to avoid it, or hit it and lose control, possibly resulting in serious or fatal injuries or property damage for which you could be held liable.
- Loss of control can occur from towing a spreader larger than the tractor can safely handle, resulting in tractor overturns or collisions with other vehicles.

Prevention:

- Shield all rotating shafts and moving parts properly. Repair or replace any broken or missing shields.
- Always shut off the tractor engine before making adjustments or repairs.
- Use proper lighting and marking when you transport manure spreaders on public roads. A bright, unfaded slow moving vehicle (SMV) emblem must be visible either on the tractor or the rear of the spreader. Almost two-thirds of all fatal traffic accidents occur on rural roads. The SMV emblem plays an important role in warning drivers that farm equipment travels much slower than the rest of the traffic. Amber flashing lights and turn signals should also be used if available. Retrofitting lights on large spreaders is recommended, as these spreaders block the visibility of tractor lights.



Entanglement hazards.



Proper lighting and marking must be used and visible.

- Make sure that operators of manure application equipment are mature enough to make proper judgments regarding the safe transport and application of manure.
- Do not allow extra riders during transport or spreading.
- Use locking hitch pin and safety chains.
- Always remove loose manure or soil from tires and other parts of the equipment before entering the roadway. If you leave material on the road, clean it off.
- Use a tractor that is heavy enough to safely tow and control the loaded spreader. A 5,000 gallon liquid manure tanker can carry 40,000 lbs of manure plus the weight of the tanker itself. The tractor must have the braking power to handle the loaded spreader.

The following towing guidelines have been adopted by the American Society of Agricultural Engineers for transport on public roads (ASAE S318.11 MAR95, Safety for Agricultural Field Equipment). Guidelines vary depending on whether or not the towed equipment is equipped with brakes.

Acceptable:

1. Equipment *without* brakes: the ratio of the total weight of the towed load to the weight of the tractor should be 1.5 or less for towing. Such equipment may be towed up to 20 mph.
2. Equipment *with* brakes: the ratio of the total weight of the towed load to the weight of the tractor should be 4.5 or less for towing. It may be towed up to 25 mph.

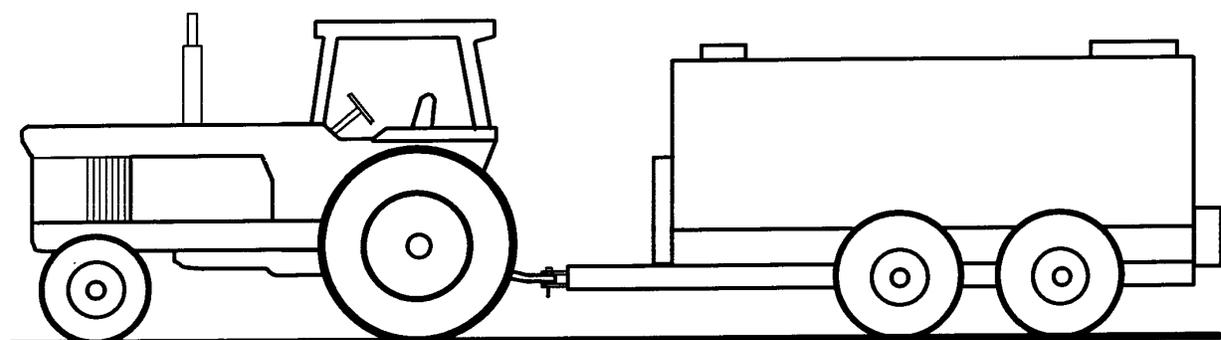
Not acceptable:

1. Equipment without brakes: if the ratio of the total weight of the towed load to the weight of the tractor is greater than 1.5, do not tow.
2. Equipment with brakes: if the ratio of the total weight of the towed load to the weight of the tractor is greater than 4.5, do not tow.

Summary

Collecting, storing, transporting and applying manure involve serious hazards for which you must take precautions. Wisconsin farmers, employees, and family members, including young children, have been injured and killed during manure handling operations. Treat machinery, storage structures, and toxic gases with the utmost respect, and require that safety practices be followed at all times.

Use a tractor large enough to safely handle the load on public roads.



Tractor

Towed load (with or without brakes)

Ratio =	$\frac{\text{Total weight of towed load}}{\text{Total weight of tractor}}$
OK	Without brakes: ratio \leq 1.5 with brakes: ratio \leq 4.5
Not OK	Without brakes: ratio $>$ 1.5 with brakes: ratio $>$ 4.5



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