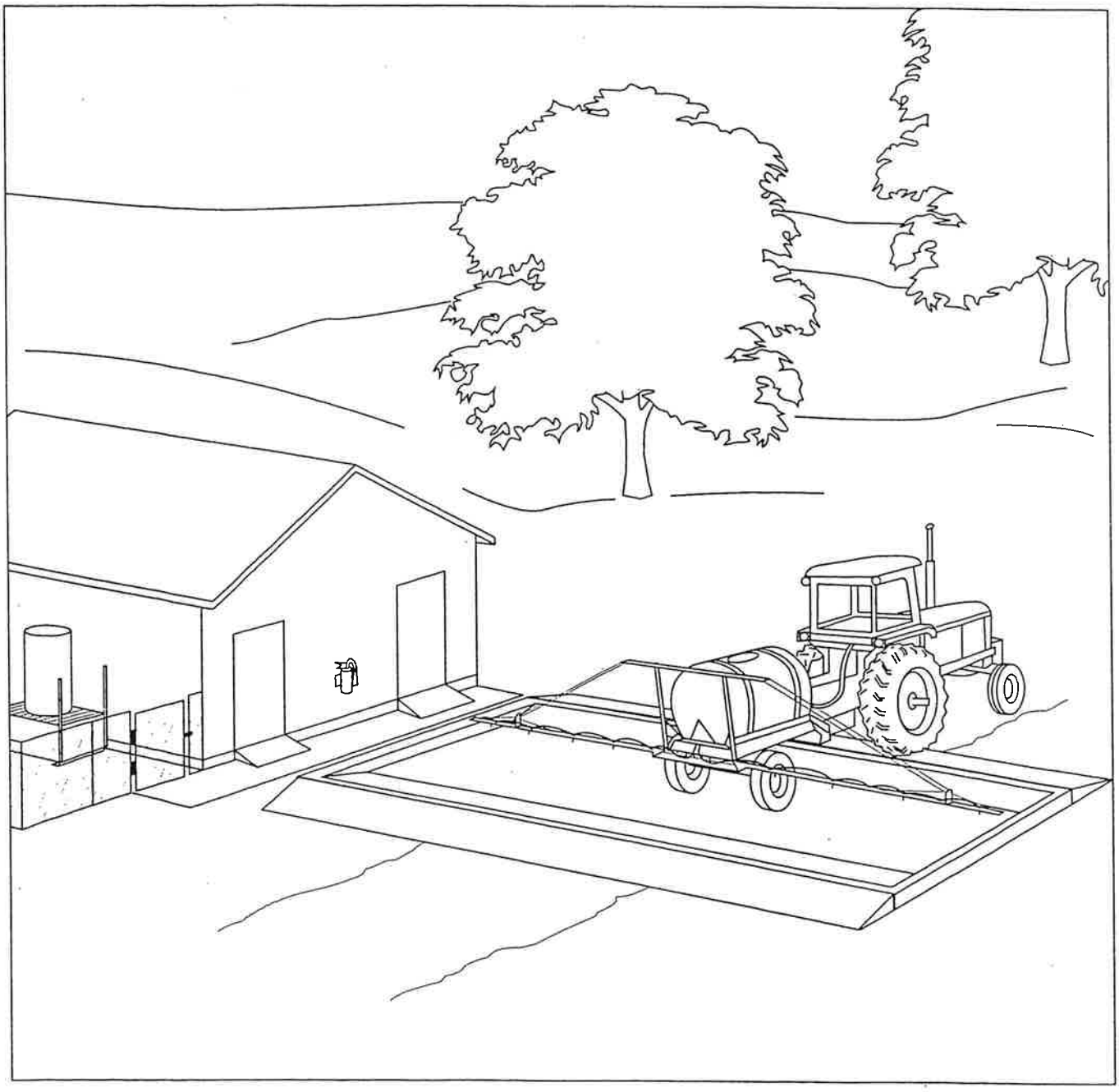
NRAES–78

On-Farm Agrichemical Handling Facilities



Natural Resource, Agriculture, and Engineering Service
Cooperative Extension

Table of Contents

List of Tables

List of Figures

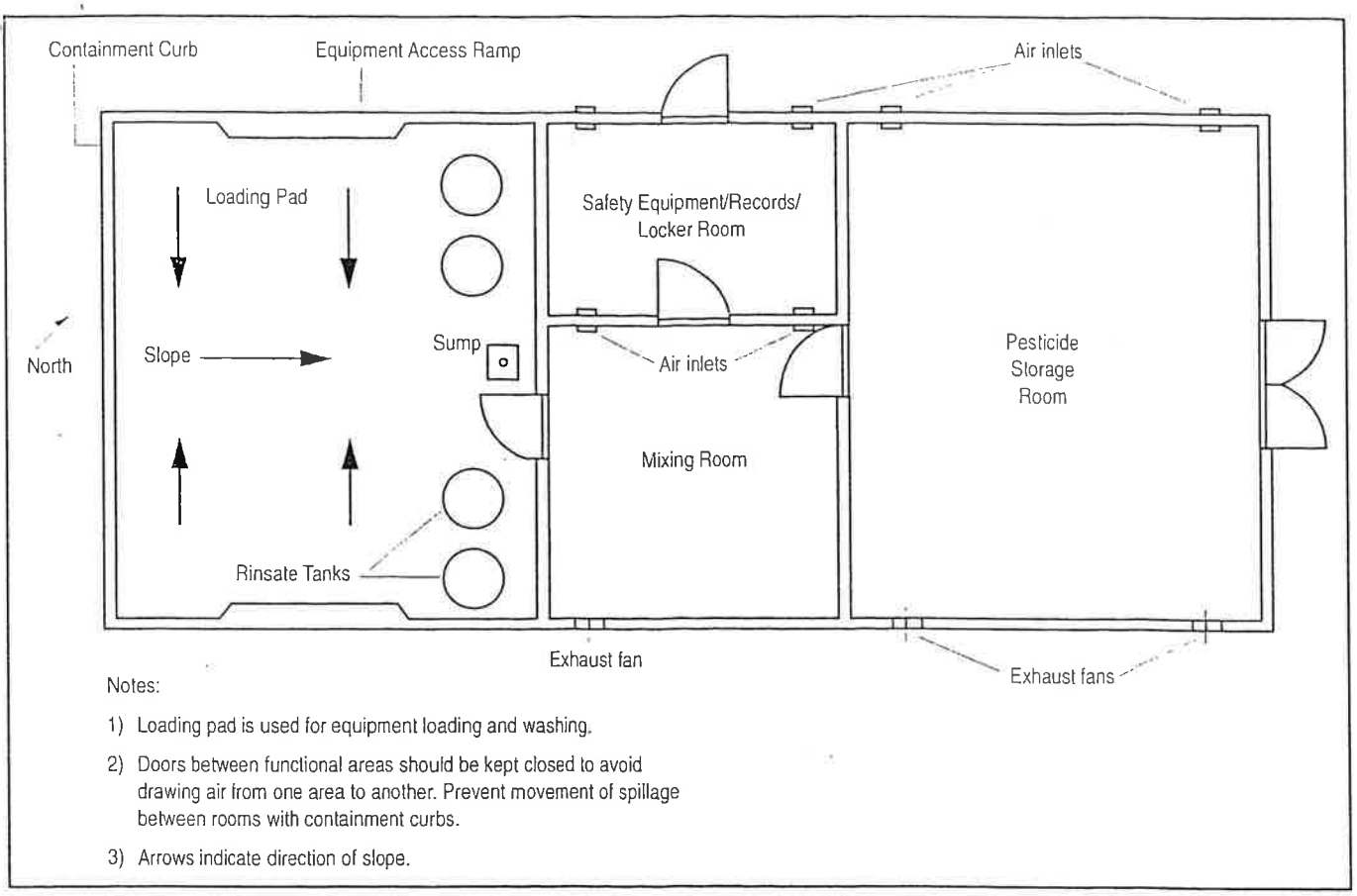


Figure 1. Components of a chemical handling facility.

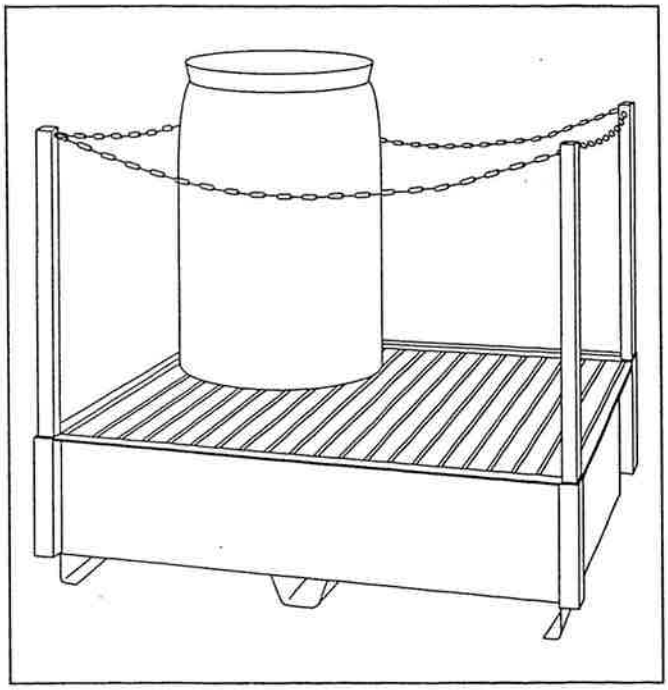


Figure 2. Spill containment pallet.

Mixing Room

The mixing room contains a work surface with scales, measuring cups and spoons, and buckets. A water supply and sink are needed for chemical preparation and cleanup. Even though protective gear will be worn, employees should wash their hands after handling pesticides. Cleaning agents should be available.

A backflow prevention device should be installed to protect the water supply. The sink drains to a sump where the contaminated water is collected and pumped into a tank where it is stored for use in subsequent spraying operations or for disposal as a hazardous waste. Pesticide recommendations and application records may be kept here but are better stored outside of the mixing room to avoid water damage or chemical contamination. The size and design of the facility will dictate where some procedures occur.

Continuous ventilation is necessary to avoid buildup of toxic gases. This can be provided by strategically placed openings to the outside or by a

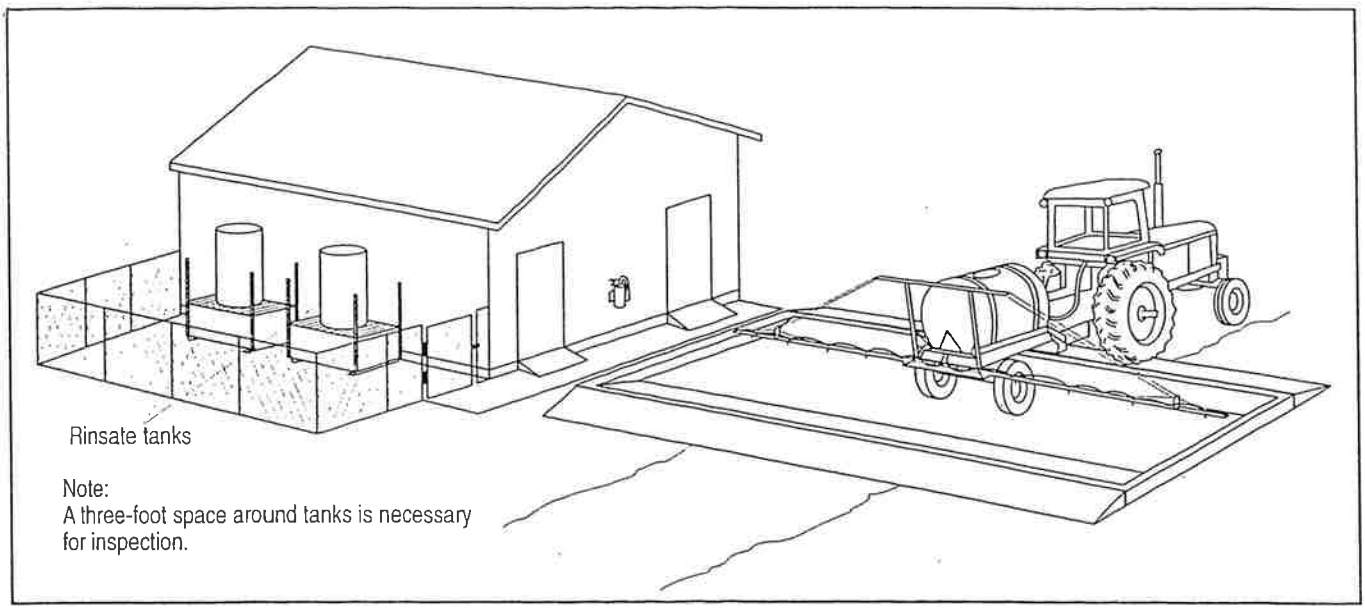


Figure 4. Storage building/containment pad with sprayer.

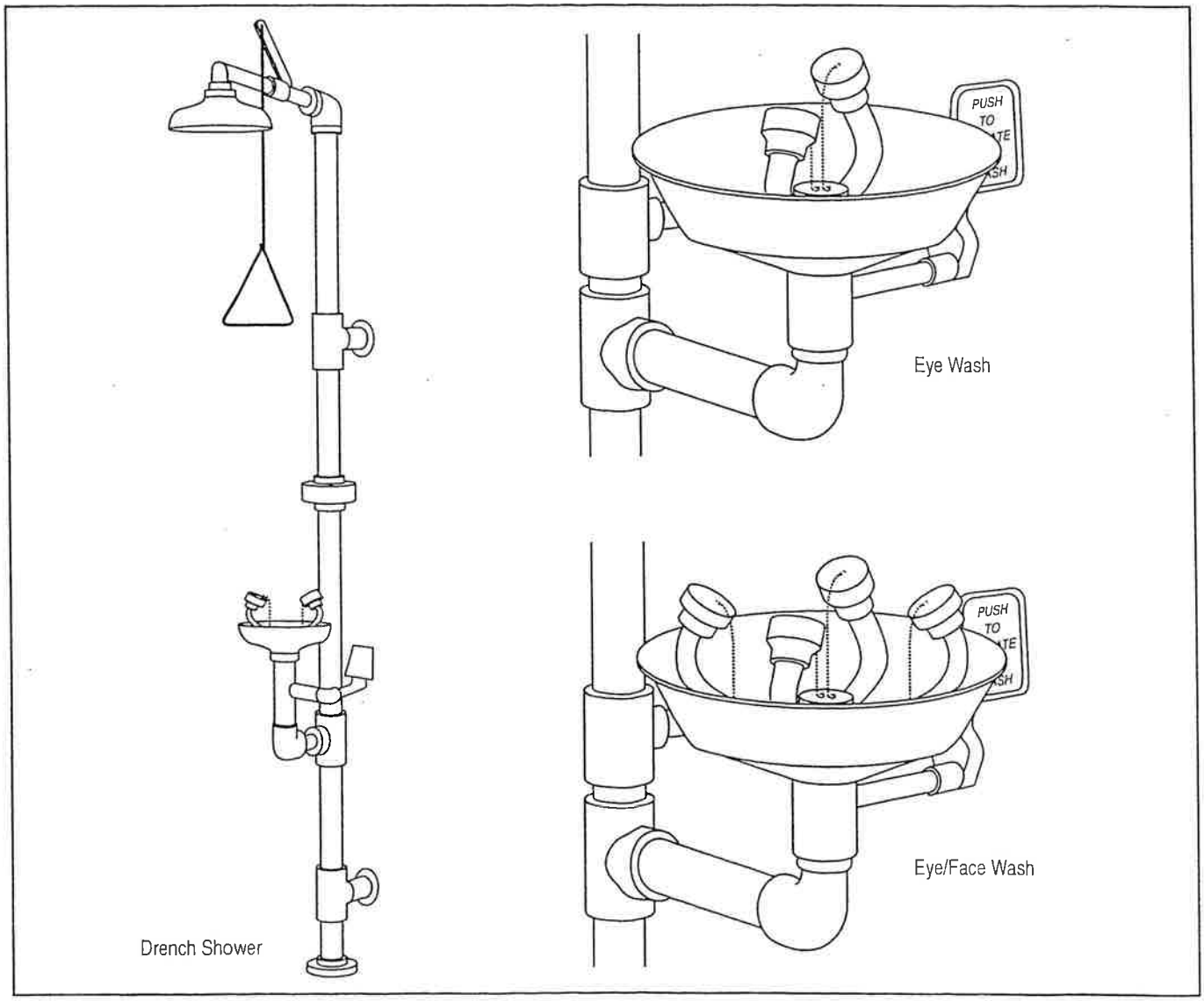


Figure 5. Drench shower and eye wash.

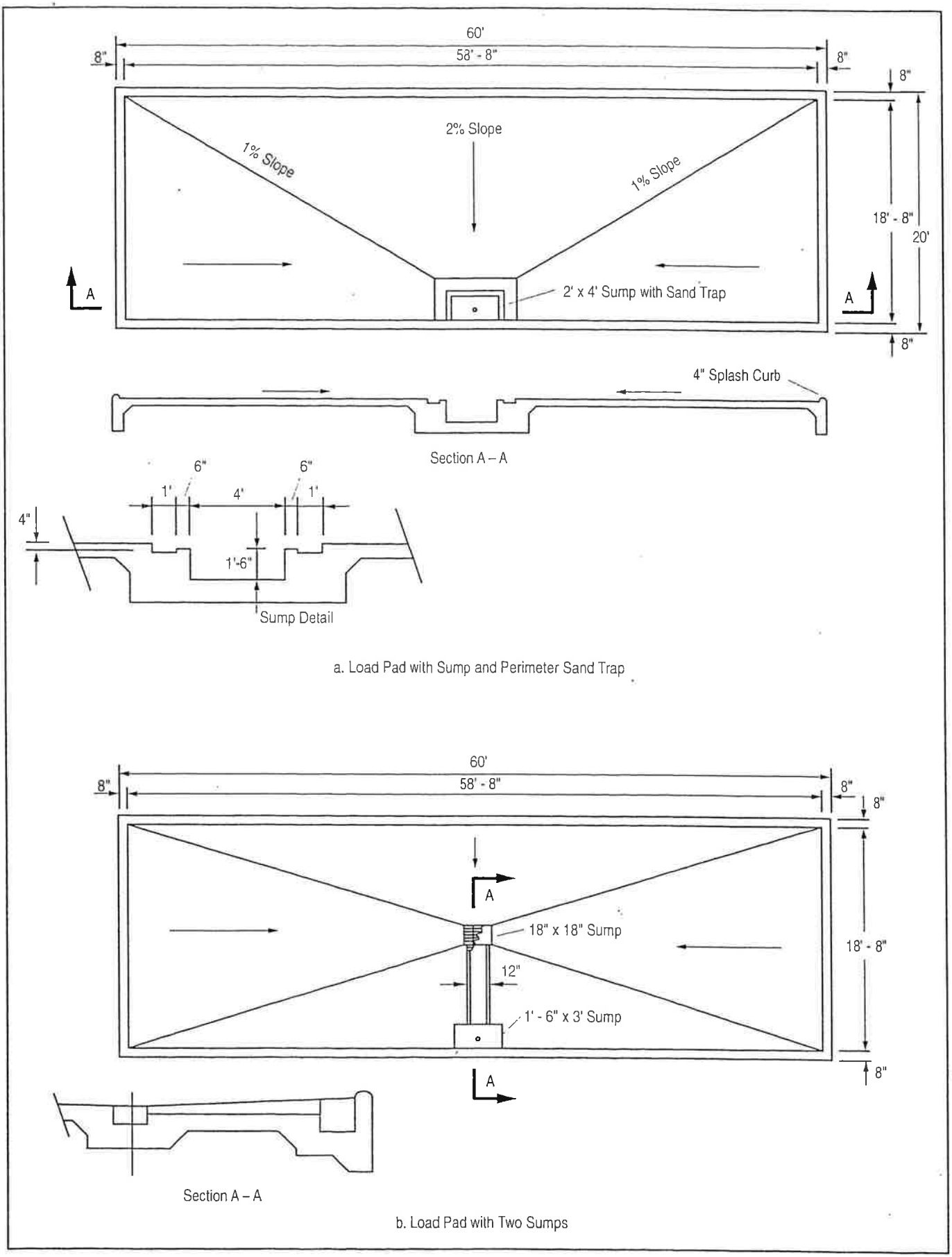


Figure 6. Slope of pad to sump.

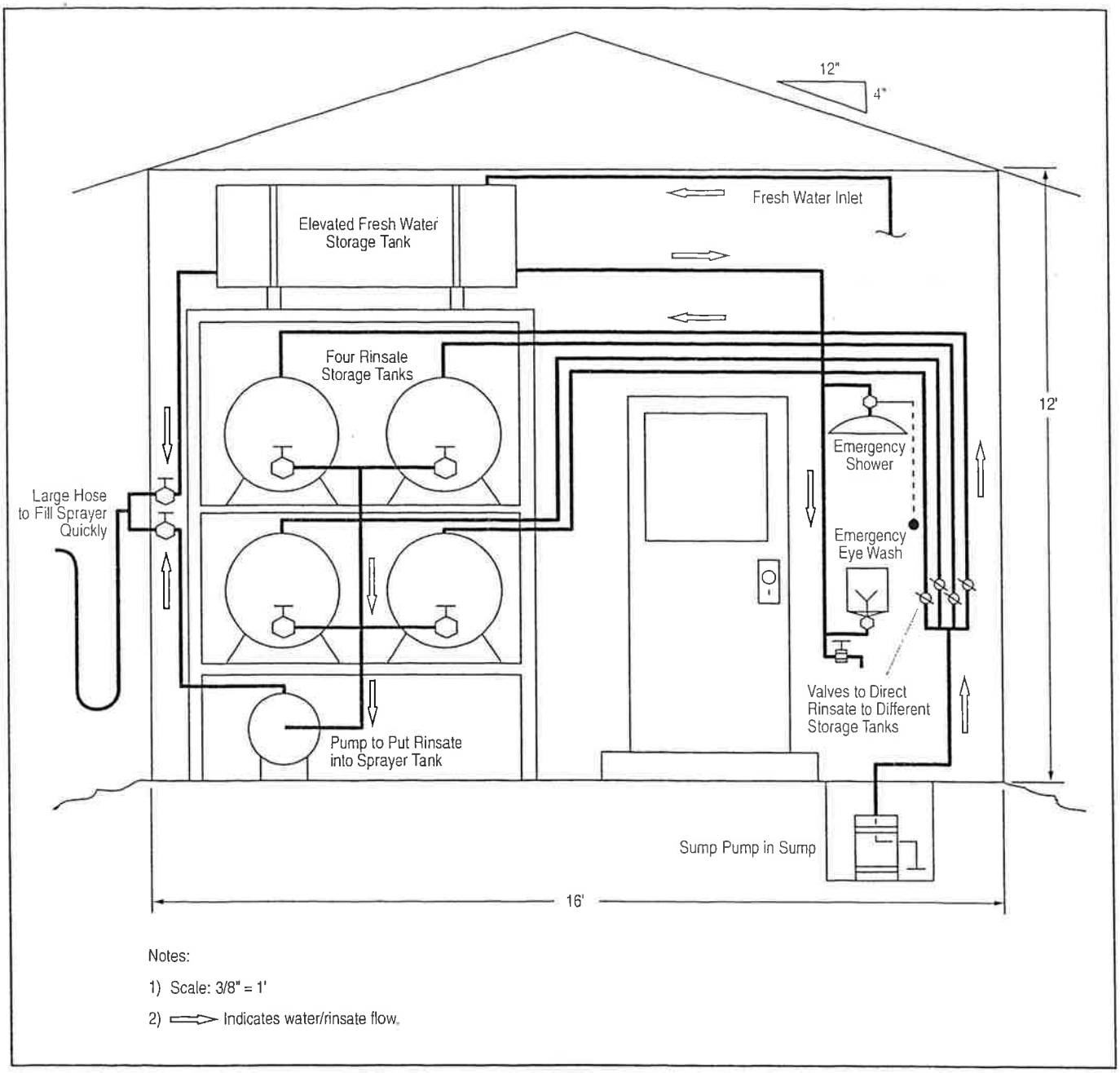


Figure 8. System to store rinsate and supply fresh water.

Figure 8 shows the plumbing system for directing rinsate water into separate tanks and for handling fresh water for tank filling and emergency wash purposes. All tanks are elevated on a heavy steel support frame so the floor can be cleaned easily. Allow a three-foot clearance for easy inspection. Fresh water in an elevated tank provides a large flow rate for fast filling of tanks and for emergency eye wash and drench shower equipment.

To reduce the volume of rainwater collected on the pad that subsequently has to be stored, a shelter over the pad is desirable. A pole building with open sides works well. A low-cost alternative is a greenhouse frame covered with a three-year copolymer film (figure 9). Greenhouse frames are available in widths up to 40 feet.

Portable Containment Pads

Several companies market portable or temporary containment pads. There are two types available: vinyl- or nylon-reinforced elastomer pad with an inflated berm and steel. Sizes vary from 4 x 8 feet to 34 x 74 feet.

Storage Environmental Requirements

The following environmental requirements should be considered when designing or building a pesticide storage.

Light and Temperature

Exposure to sunlight may cause chemical breakdown, reducing the effectiveness of the pesticide. Therefore, pesticide containers (especially glass and aerosols) should never be placed in front of windows. Be sure to provide adequate lighting in all parts of the storage so that chemical labels can be read easily and people can work safely.

High temperatures can cause liquid pesticides to expand, causing increased pressure within the container. Under these conditions, the pesticide may leak from the container, or an explosion could occur. Freezing temperatures should also be avoided. Some pesticides separate or break down chemically at lower temperatures; and containers may crack, as well.

Store pesticides at temperatures above 40°F and below 100°F. Follow the label directions for more specific requirements. Flammable (Class I) and combustible (Class II or III) liquids have special requirements for storage. Refer to National Fire Protection Association (NFPA) codes for more details.

Humidity

Locate the storage away from high-humidity areas or provide dehumidification. Excess moisture may cause caking or degradation of dry formulations, making them impossible to mix thoroughly or destroying their effectiveness. Metal containers will eventually rust and may develop leaks. The strength of paper bags may be reduced, causing spillage.

Contamination

Within the storage, the different groups of pesticides (herbicide, insecticide, fungicide, rodenticide, and so on) should be kept separate to prevent cross-contamination. In small storages this may be done by providing separate shelves. Where large quantities of materials are stored, a separate room for herbicides is desirable.

Special precautions must be taken when storing herbicides (weed killers), especially when containers have been opened and reclosed. The phenoxy herbicides, such as 2,4-D, are among the most volatile; and their fumes can temporarily contaminate soils, fertilizers, growing containers, and so on, thus injuring plants. Volatile fumes can build up in a closed area and follow air currents, so a well-designed ventilation system is required.

Metal shelves are preferable to wooden shelves for storing pesticides because they are much easier to decontaminate. Leakproof plastic trays work well to hold bottles and bags, as they will contain any spillage. Drums should be stored off the ground on spill containment pallets (see figure 2, page 2). The containment volume should be large enough to hold 125% of the largest drum. Shelves, pallets, and drums should be placed along the walls of the storage to keep the aisle clear. A three-foot clearance between the walls and pallets and drums is necessary for inspection.

Ventilation

Good ventilation removes excess heat, chemical vapors, and moisture from the facility and is very important for safety. Ventilation can be by natural and/or mechanical means. Two levels of ventilation are needed. A low, continuous rate in the storage room helps prevent a buildup of toxic fumes. An additional fan system should be engaged just before workers enter the storage and while they are in the storage. The mixing room and the records/locker room should be ventilated before and during occupation. At mixing tables, where toxic dust or fumes originate, special fume or dust hoods will move dust and fumes away from the worker (figure 11).

During cold weather, ventilation may be reduced or blocked off so heat can be added to maintain 40°F in the storage room. The additional fan system must be used to clear out toxic fumes before entering the room.

Natural ventilation may be used, particularly in unheated spaces, to remove fumes and heat when the space is closed up. Put at least two vents, each 8 x 8 inches in size or larger, on opposite sides of the building and within 12 inches of the floor. Provide one square foot of "free open vent area" per

The ventilation system used when workers are in the room and the interior lights should be controlled by a common ON/OFF switch located outside the building. Putting the lights and fans on the same switch helps to ensure that the fans are used. The storage and mixing rooms should be ventilated separately where possible. Use a switch with a built-in indicator light or use a light mounted on the side of the building to indicate that the ventilation system is on. This provides a safety factor in that it signifies that someone may be in the room.

Air inlets are necessary to admit makeup air and should be located on the opposite side of the room from exhaust fans. They should be sized to provide 20 square inches of free open area per 100 cfm of fan capacity. The required inlet louver free open area is calculated as follows:

$$\text{Inlet free open area (sq in)} = \frac{\text{ventilation rate (cfm)} \times 20 \text{ sq in}}{100 \text{ cfm}}$$

Inlet vents will generally have the free open area marked on them; or, if not, it should be available from the manufacturer. Inlet vents with motorized louvers are suggested. The louvered vent is usually slightly larger than the exhaust fan.

Exhaust hoods over the work area in the mixing room provide added worker protection. A fresh-air velocity of 80 to 100 fpm at face level pulls dust and fumes into the hood and away from the worker (figure 11, page 11).

Safety Requirements

While all aspects of the facility are directed toward safety, some specific safety requirements are as follows.

Signs

Storage doors and windows should be kept locked at all times. Weatherproof signs, stating "Danger – Pesticides – Keep Out!" or a similar warning should be posted on each door of the facility and over all windows (figure 12). In some cases, it may be advisable to post the signs in more than one language. "No Smoking" signs should be placed both outside and inside the facility. "EXIT" signs should be on all exits.

Figure 12. Sign to warn people.

Fire Safety

An emergency plan should be developed for the storage and should include response, actions, responsibilities, and training. If an incident occurs, the plan can reduce liability through the timely actions of knowledgeable responders.

The storage should be protected by strategically located fire, smoke, temperature, and power sensors. If possible, connect these to an existing alarm

- Plastic pails, drums, and heavy-duty plastic bags to hold waste material.
- Drum repair kit to stop leaks.
- Barricade tape to restrict access to the area.
- A source of clean water. An elevated clean water storage tank is suggested where the water supply is limited.

Personal Protective Equipment Storage

Items of protective clothing and protective equipment should be stored nearby (but not inside) the pesticide storage area. Provide each person with two lockers, one for street clothes and the other for work clothes to prevent cross contamination. If a separate office is not maintained, the storage records, including application data and MSDSs, can be stored in a file in this area.

Storage Alternatives

Storage inside Existing Buildings

Three methods are used for chemical storage in a building: a storage cabinet, a storage locker, or a room within a building. The chosen method should be large enough to hold the quantity of pesticides to be stored with additional space for access or expansion.

Storage Cabinet

One or more steel cabinets work well for storing the quantities used in small operations or by part-time farmers (figure 13). These are available in many sizes as wall-mounted, under-bench, or

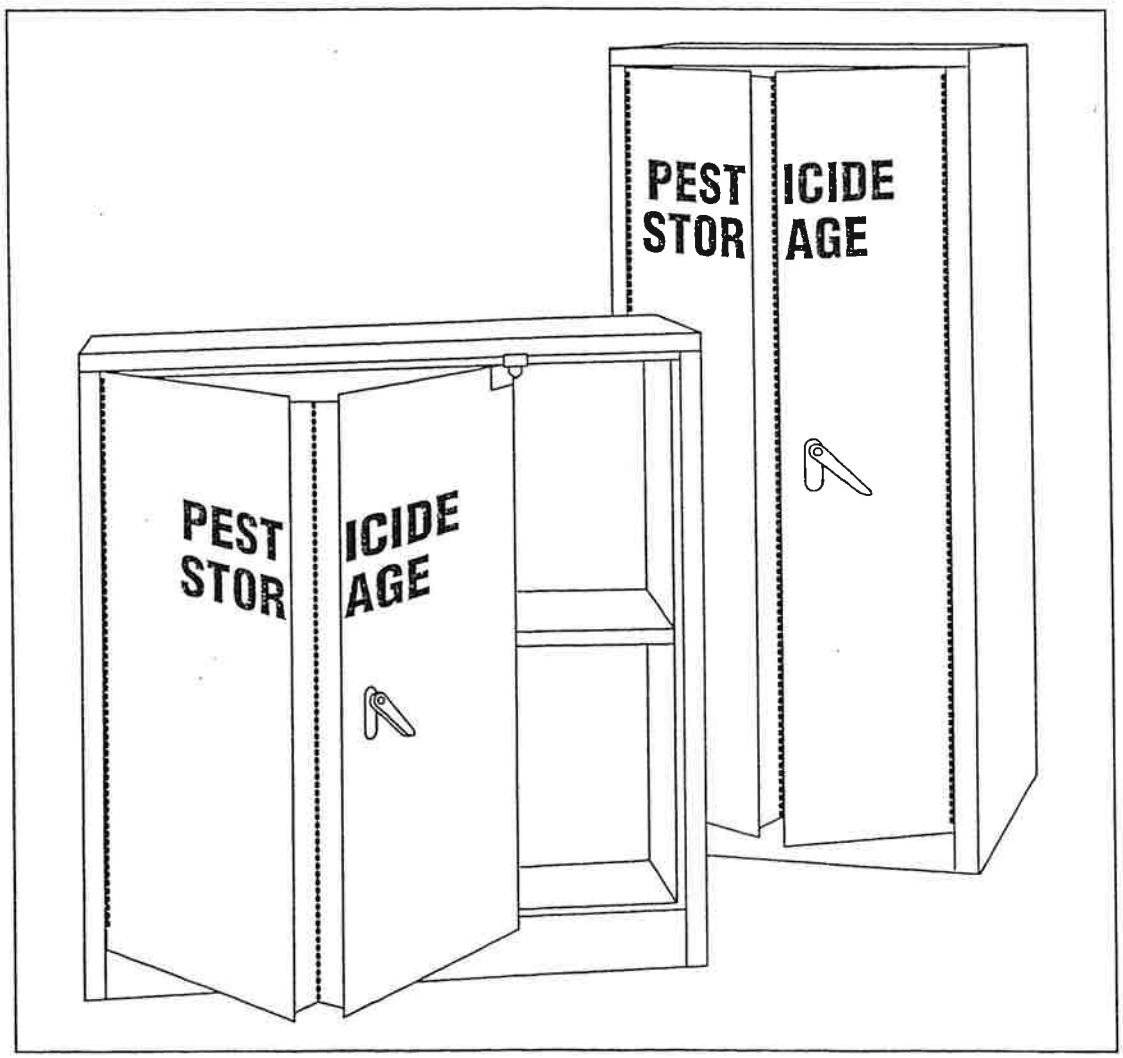


Figure 13. Small storage cabinets.

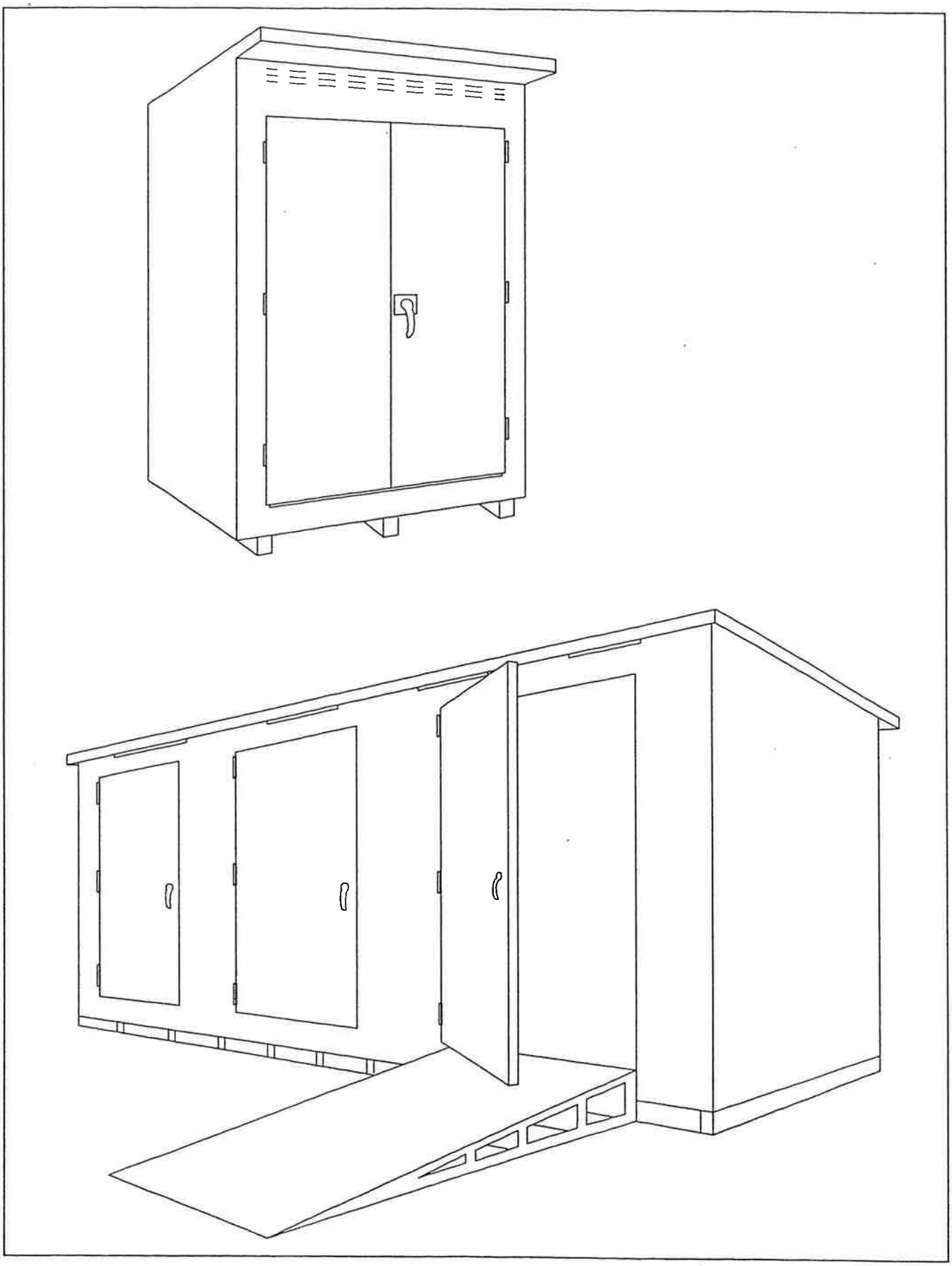
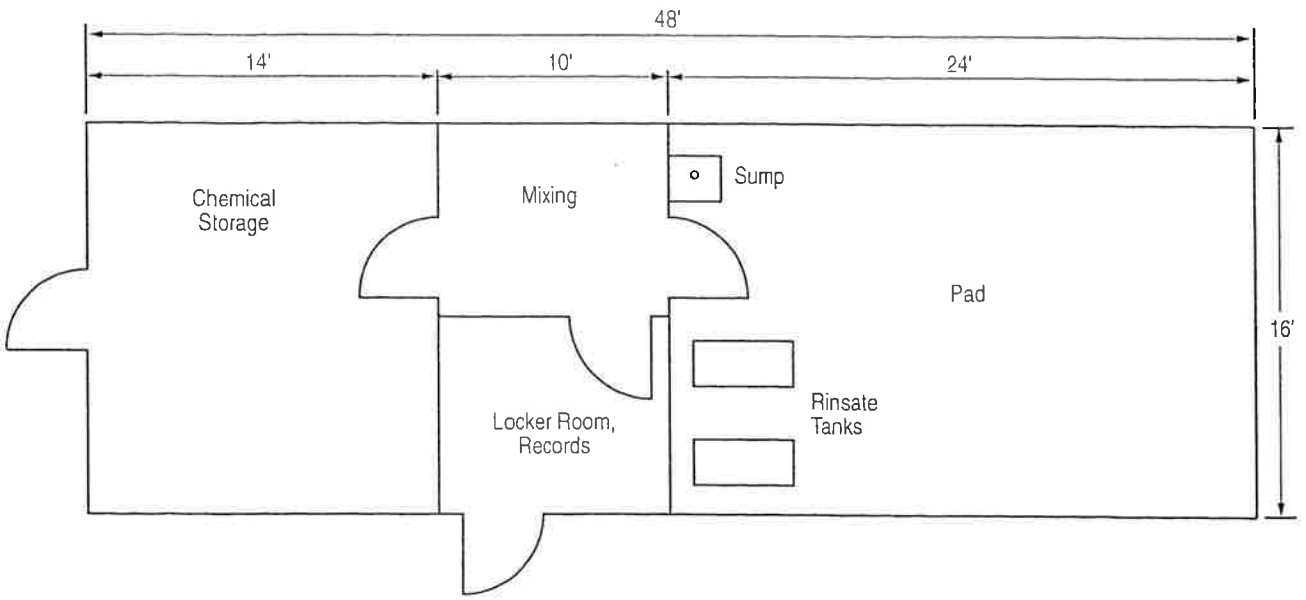
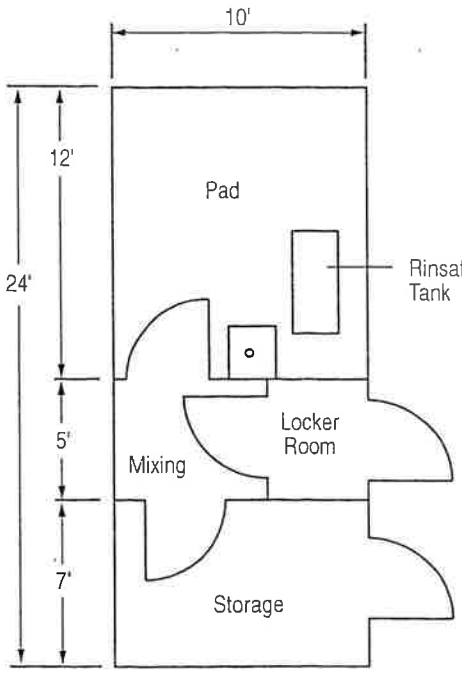


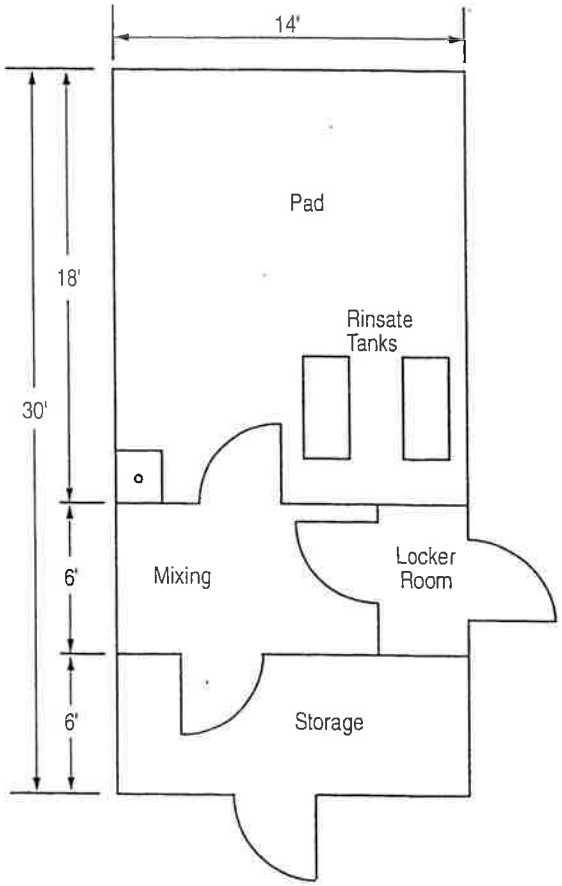
Figure 14. Steel storage locker – 4 x 6 feet or larger.



a. 48' x 16' Facility



b. 24' x 10' Facility



c. 30' x 14' Facility

Figure 16. Various layouts for agrichemical handling facilities.

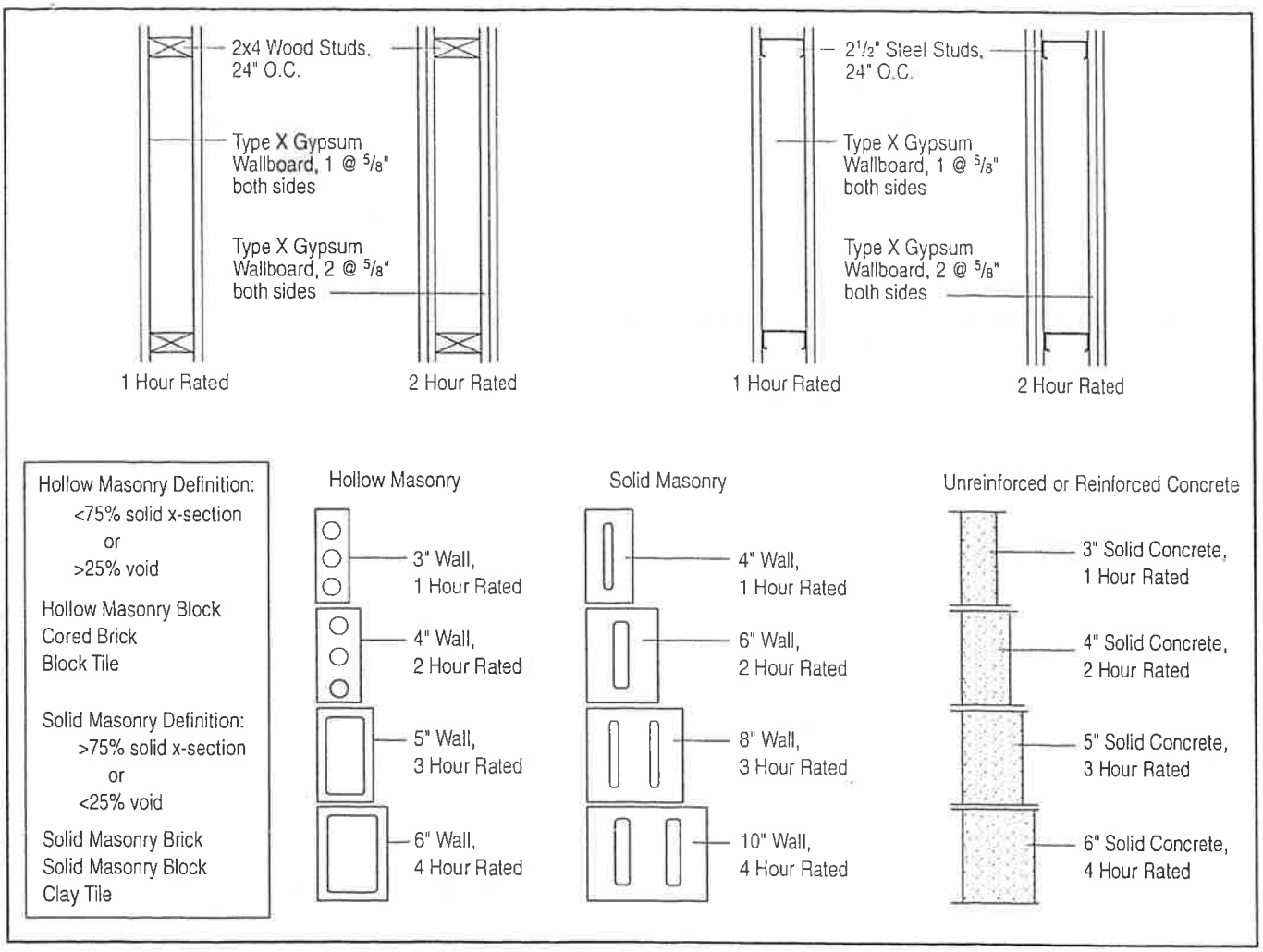


Figure 17. Fire ratings for various types and thicknesses of interior walls.

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A float switch in the water storage tank controls the pump in the well. A backflow prevention device is used where the water enters the building to prevent chemicals from flowing back into the water supply.

The water system and all storage tanks must be drained before freezing weather. Install all plumbing with proper slopes and drain plugs to ensure complete drainage. A frost hydrant might be used outside the building to prevent water in pipes from freezing. A frost hydrant has an on/off valve in the water pipe below the frost line. It includes an automatic drain to allow water above the on/off valve to drain away when the valve is in the off position.

Maintenance

Maintenance of the facility can extend its service life by many years, and its components will function much better with regular care. A plan for preventive maintenance to minimize factors that cause deterioration is important. Timely repair of small problems will prevent large problems from occurring.

Routine inspection and maintenance on a monthly, seasonal, or yearly basis for different components of the system will help to ensure proper functioning. Inspect all aspects of containment facilities, including protective coatings and paint; emergency and safety equipment; electrical systems; and pump, plumbing, and metering equipment.

Watch the exterior drainage for a few years after construction while the ground settles and the landscaping becomes established. Avoid ponding. Proper drainage helps to reduce frost heaving under the concrete structure. Keep burrowing rodents and animals away. Keep weeds under control.

Practice good housekeeping and keep the facility clean. Use a high pressure cleaner to clean the floors or pad after a spill. Wear protective gear for all

Appendix A

Post Frame Plan for a Chemical Storage

A post frame design of a farm chemical storage building is illustrated in figure A-1. The unit was designed for growers using primarily bulk storage of chemicals and provides rooms for mixing and storage. Rinsate storage may be contained under roof or not, as the producer desires. The rinsate storage area is surrounded by a one-foot high concrete curb forming a containment unit and, although open, is fenced.

The loading pad is roofed to reduce contaminated rainwater flow and is of sufficient height, with the half-monitor roof design to allow the egress of commercial chemical application equipment. In addition, for operators with boom sprayers, a rinse trough is provided on site for those not wishing to field rinse.

Before construction, an engineer should verify that the structure will withstand snow and wind loads at the building site.

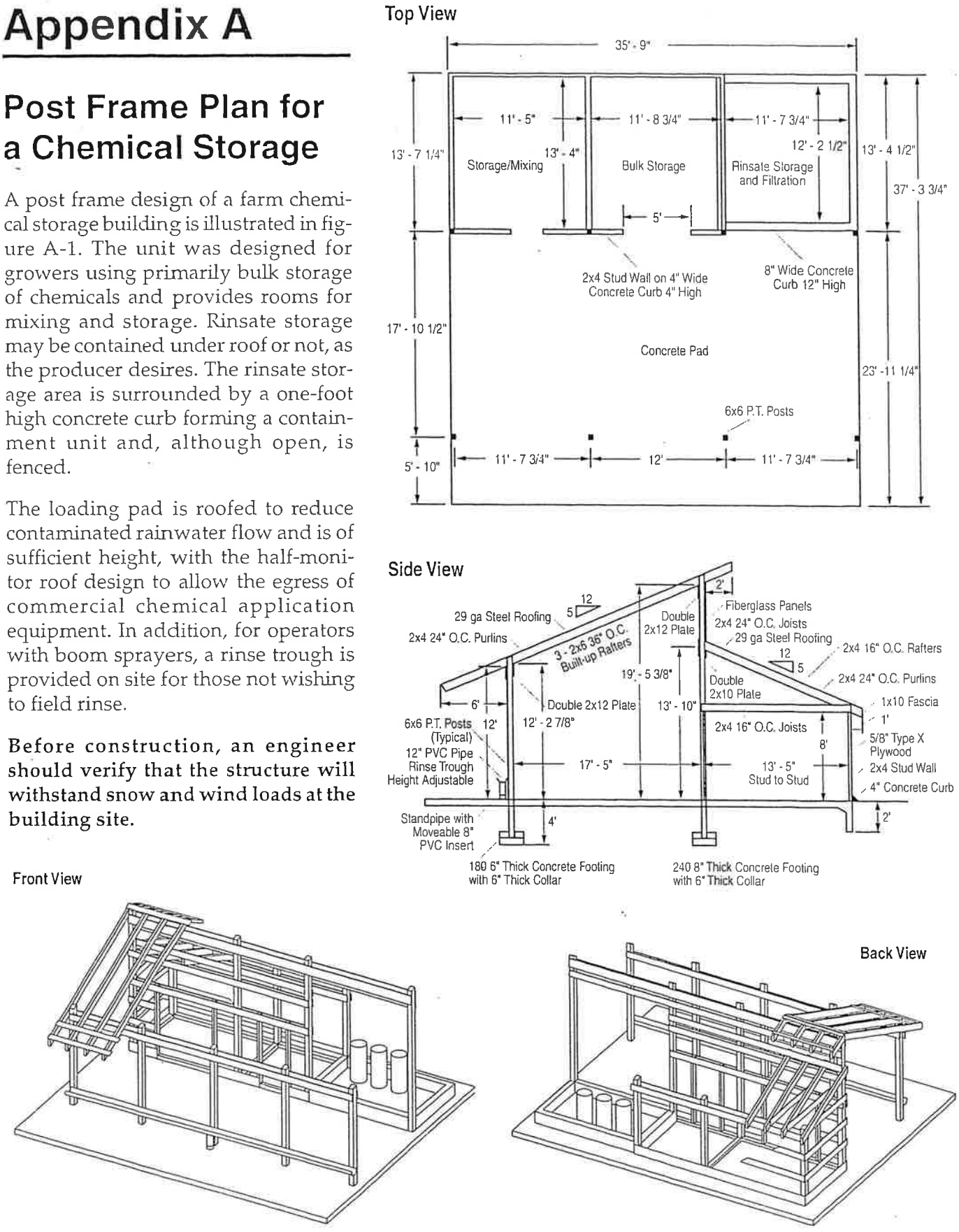

Figure A-1. Post frame design of farm chemical storage building.

Developed by James Scarborough, Associate Professor and Extension Specialist, Agricultural Engineering, University of Delaware. Before construction, an engineer should verify that the design will withstand snow and wind loads at the building site.

Acknowledgments

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- James Scarborough, Associate Professor and Extension Specialist, Agricultural Engineering, University of Delaware

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