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On-Farm Agrichemical Storage and Handling

MSU Extension

Robert H. Wilkinson, Agricultural Engineering Department

June 1992

20 pages

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# **ON-FARM AGRICHEMICAL STORAGE AND HANDLING**

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**Cooperative Extension Service • Michigan State University  
Extension Bulletin E-2335 • (New) June 1992**

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**Robert H. Wilkinson**  
**Agricultural Engineering Department**

**P**esticides and fertilizers should be stored in a manner that protects the environment, ensures human and animal safety, and preserves the product and container integrity. To accomplish this effectively, farmers need to consider a number of items and observe certain precautions. First, always consult the current pesticide label for specific storage information for that product. Purchase only the amounts of chemicals required for a single application season to minimize the necessity for off-season storage. When agrichemical storage does occur on the farm, consider the following information and guidelines in designing and managing a storage facility.

At present in Michigan, no pesticide or fertilizer storage and handling regulations other than "label requirements" and "the polluter pays for his cleanup" are specifically directed to farmers. On the other hand, commercial applicators and dealers are subject to regulations 637, 640 and 641 (pending), which specify procedures for using, storing and handling pesticides and fertilizers.

The following guidelines and plans are based upon "good practice" that should reduce the potential for agrichemical problems. As new laws and regulations are developed that relate to pesticide and fertilizer use, growers are advised to stay informed and in compliance.

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## **Storage and Loading Area Considerations**

### **Location of a Storage Building**

When locating a chemical storage area, you need to consider the soil and land surface characteristics to prevent contamination of surface and groundwater by runoff, leaching and drainage. As much as possible, locate the storage area downwind and downhill from adjacent occupied areas. Existing pesticide and fertilizer storage areas should be located a minimum of 50 feet from any private water well and a minimum of 200 feet from surface water. New pesticide and fertilizer storage areas should be located a minimum of 150 feet from any private water well and a minimum of 200 feet from surface

water. Where these minimum distances cannot be effectively maintained, appropriate water source protection measures, such as runoff diversions, a covered well head, a sealed well casing into a deep aquifer, and so forth, should be used. Public water supply wells will require greater setback distances. (Refer to Appendix A, excerpt from Michigan Safe Drinking Water Act, Act No. 399, Part 325.1001, P.A. of 1976, amended.) Chemical storage areas should be at least 2 feet above the water table and should not be located in areas with a high probability of flooding.

## Buildings

It is preferable to have a separate, dedicated building for pesticide storage. We recommend that firefighters do not put out fires in structures containing pesticides with a high volume of water because chemicals may be washed away in runoff water. Usually a building containing pesticides will be allowed to burn. In such a case, the loss would be limited to the chemical building if it is separate, rather than to a whole barn and its contents if pesticides were stored in part of a general purpose building.

When pesticides must be stored in a general purpose building, they should be on the ground floor. They should not be stored in a building that contains office space unless pesticides are well separated and good ventilation is maintained.

When the amount of pesticide to be stored is modest or small, a portable storage unit may be acceptable. A portable unit is shown in Fig. 1. Other portable units might be developed from a closed trailer or truck box. However, any unit used for a pesticide storage should meet the criteria discussed below. Planning for security, ventilation, containment and spill cleanup will help ensure a safe storage.

*Basements of homes are not good storage places for most pesticides, and restricted use chemicals should never be stored here. If limited amounts of home-use pesticides need to be stored in the basement, obtain and use a locked storage chest. This will prevent children and pets from getting into them and possibly being poisoned.*

## Construction Considerations

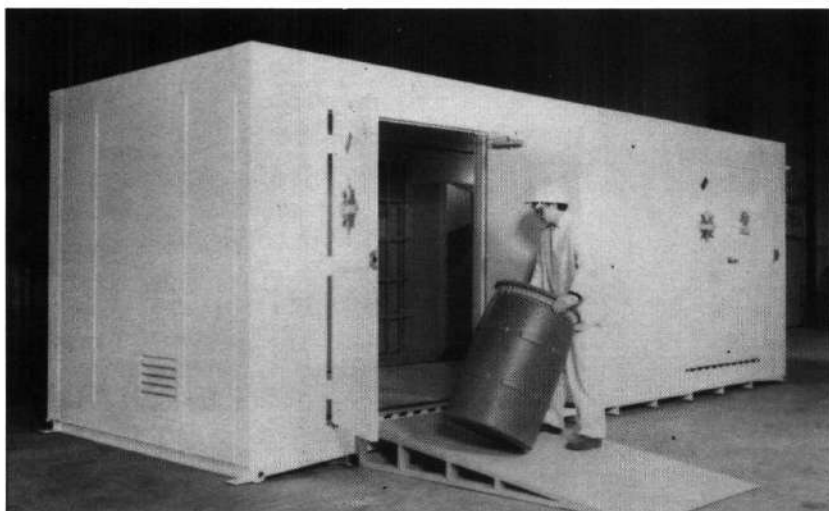
### Fire Resistance

The building material and design should be selected with fire resistance in mind. Locate a chemical type fire extinguisher near the door where it is accessible and provide fire warning (i.e., smoke detectors or alarms) as needed. Outside shutoffs for all electrical and water systems are recommended. Although agricultural buildings are exempt from many building codes, be sure to obtain all the required permits and to check with local inspectors to be sure your structure meets local requirements for plumbing, electricity, fire, etc.

### Floors and Walls

A sealed concrete floor with curbing to contain spills is best. Walls and floor material should be sealed with epoxy, enamel or a similar coating to prevent

absorption and facilitate cleanup. A number of commercial products are specifically intended for sealing containment floors. A partial list is included in Appendix B.



**Fig.1. A portable storage structure.**



### **Floor Drains**

Water is needed for mixing, rinsing and cleanup, so a waste handling system is necessary. Floor drains must not be connected to the wastewater sewer or septic tank, however. Sump drains must direct water to a holding tank until water can be used as a dilutant or disposed of properly.

### **Ventilation of Pesticide Storage**

Pesticide storage areas should be ventilated to reduce fumes and dust. Temperature variation and humidity should be kept to a minimum in pesticide storage areas.

Fans to provide three to six air changes per hour are usually adequate, with a minimum ventilation rate of 150 cubic feet per minute recommended for any size facility. An air flow of 100 cfm per each 1,000 cubic feet of storage volume will provide approximately six air changes per hour. An 8- or 10-inch wall-mounted exhaust/ventilation fan typically has a capacity of 200 to 400 cfm. With an air flow of 400 cfm, this fan would ventilate 4,000 cubic feet of storage. Assuming an 8-foot ceiling height, this is equivalent to a 20- by 25-foot storage building.

Fans may be wired to go on with the lights, or a fan may operate continuously on low speed and shift to high speed when lights are turned on and the room is occupied.

Ventilation may be provided by natural means (i.e., no fans) if the air intake and exhaust openings are on opposite sides of the building and of sufficient size to permit removal of fumes and odors.

Pesticides should not be stored in basements or significantly below grade level where vapors may accumulate.

### **Temperature Control of Pesticide Storage**

When storage areas are heated to prevent pesticides from freezing, pesticides should be stored away from the heat source. The building should be insulated, and temperature control devices should be used to maintain a minimum temperature of 40 degrees F. A summer maximum temperature of 100 degrees F is suggested for the storage. Extension bulletin E-2155, "Storing Pesticides," provides information on storage temperatures for specific pesticides.

### **Electrical Service**

Explosion-proof lights, switches and wiring are required by code where flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures (class 1). Most farm pesticide storages will not require this level of electrical service. If there is any question, consult: (1) the specifications for the pesticide being considered to determine its flash point; Extension bulletin E-2155, "Storing Pesticides," which also suggests some maximum storage temperatures; (2) the National Electrical Code, Article 500, for details on hazardous locations; and (3) your local building inspector. Provide outside shutoffs for all electrical power.

### **Security for Pesticide Storage Area**

The pesticide storage building must be locked when not in use and posted with pesticide warning signs. Bulk storage areas, valves and containers should be secured when not in use or when unsupervised, to prevent access by unauthorized persons, children or animals. Security can be enhanced with the use of fencing, lighting and/or separate securable structures.

## **Internal Storage Considerations**

### **Shelving**

Provide steel shelving or shelves sealed with epoxy or enamel to prevent absorption of spills. Storing containers on trays or shelves with a lip provides a degree of secondary containment and makes for easier cleanup. For farmers with very little pesticide to store, placing containers on trays or in pans may be all the secondary containment that is needed.

### **Organization**

Always consult pesticide labels for special storage instructions. Pesticides labeled as flammable or combustible liquids should be stored according to the label and pertinent local, state and federal fire protection codes (NFPA-395, NFPA-30—available from the fire marshall's office).

Separate pesticides by type (i.e., herbicides, fungicides and insecticides) to prevent accidental misuse or contamination. Keep food, feed, seed, veterinary supplies, protective equipment and clothing out of the pesticide storage area to prevent contamination by pesticide fumes, dust or spills.

Store glass containers and the most toxic chemicals on lower shelves near the floor. This minimizes exposure in the event they are broken or begin to leak. Metal containers should be stored off the floor in an upright position to minimize spillage or leakage from a ruptured top in the event of a fire.

Do not store any chemicals in front of windows, where they are vulnerable to damage from exposure to heat and light; nor in the direct presence of fuel products or fertilizers, because of the potential for explosions.

Store pesticides only in their original labeled containers to minimize the potential for accidents. If the original

container becomes unsuitable for pesticide storage, an appropriate alternate container may be used to store the pesticide temporarily if a label for that pesticide is prominently affixed to the container. Mark pesticide containers with the date of purchase to ensure that the oldest material is used up first.

Keep the storage area clean. Have clean-up materials and equipment (cat litter box filler, sawdust or other absorbent material, plastic-lined containers, small shovel, broom, dustpan, etc.) available to clean up any spill immediately.

## **Storing and Handling Pesticides and Fertilizers**

### **Packaged Materials**

A dry pesticide, packaged material or fertilizer is considered packaged if it is in an individual container with a maximum net weight of 100 pounds. A liquid pesticide or fertilizer is considered packaged if it is in an individual container with a maximum volume of 55 gallons.

### **Minibulk Pesticides and Fertilizers**

Liquid pesticide or fertilizer is considered a minibulk quantity if it is in an individual container with a volume greater than 55 gallons but not exceeding 300 gallons, which is designed for ready handling and transport and has been filled by the chemical manufacturer or licensed repackager. Minibulk chemicals should be stored or transported in minibulk containers designed and approved for that purpose and must be labeled with the registered product label. Minibulk pesticide or fertilizer containers should not be located within 200 feet of surface water or private water wells during temporary or permanent storage. Minibulk chemical containers used for off-season storage should be located on an impermeable surface.



## **Bulk Liquid Pesticides and Fertilizers**

A liquid pesticide or fertilizer is considered bulk if it is in an individual container that has a volume greater than 55 gallons and the container is used for permanent or temporary storage. Bulk liquid materials should be stored in containers approved for and compatible with the product being stored. Containers, valves, gauges and piping should be made of non-corrosive materials. Containers should be anchored or elevated to prevent flotation and instability.

Storage containers should not be filled to more than 95 percent of capacity to allow for product expansion. Bulk liquid chemical storage containers should be equipped with vents to relieve pressure buildup. Backflow and cross-contamination protection devices should be used when appropriate. All containers should have a liquid level gauging device. External sight gauges may not be used to determine the level of liquid pesticide in a storage container.

Secondary containment for bulk storage is required. It should be constructed to prevent the absorption or loss of spilled chemicals. It should be able to contain 110 percent of the volume of the largest tank in use plus the volume of other tanks within the containment area when the area is protected from rainfall. If the secondary containment area is not roofed, the storage capacity must be increased to handle a 25-year/24-hour rainfall in addition to the tank volume.

Pesticide storage may not use an earthen secondary containment. Although the use of earth dikes is not preferred for any secondary containment, it is allowed for bulk fertilizers. The large size of some fertilizer storage facilities makes the cost for containment prohibitive when concrete, steel or similar materials are used for containment walls. Earth construction requires additional

maintenance and clean-up measures in the event of a spill.

Liquid pesticides may not be stored in any underground storage container.

The last valve, within the secondary containment and closest to the delivery nozzle, should be locked when not in use.

Bulk liquid pesticide storage containers must be labeled with the registered product label. Bulk fertilizer containers must be labeled to show capacity and content.

## **Pesticide Loading and Rinse Pad**

Good practice does not allow concentrations of pesticides to be discharged onto the ground or into ground- or surface water. A properly constructed and managed loading and rinse pad will help achieve the goal of containing and handling pesticide rinsate, surpluses and accidental spills. A reinforced concrete pad with sealed joints, drive-over curbs and floor sumps works well (Fig. 2).

A portable mixing-loading pad is an alternative to a permanent facility. The portable pad may appeal to the applicator who has only occasional need of a pad or who must have a pad available in several locations. Portable pads are relatively low-cost and durable. They contain a spill until it can be cleaned up, are easily cleaned and can be rolled up for transport or stored until the next season (Fig. 3).

## **Wash-off in the Field**

Rather than returning the sprayer to the loading pad for cleaning and rinsing, a practice that is encouraged and gaining acceptance is to carry an auxiliary tank of water on the sprayer that can be used to wash down and rinse the sprayer in the field. This leaves the chemical in dilute form in the target area and prevents the build-

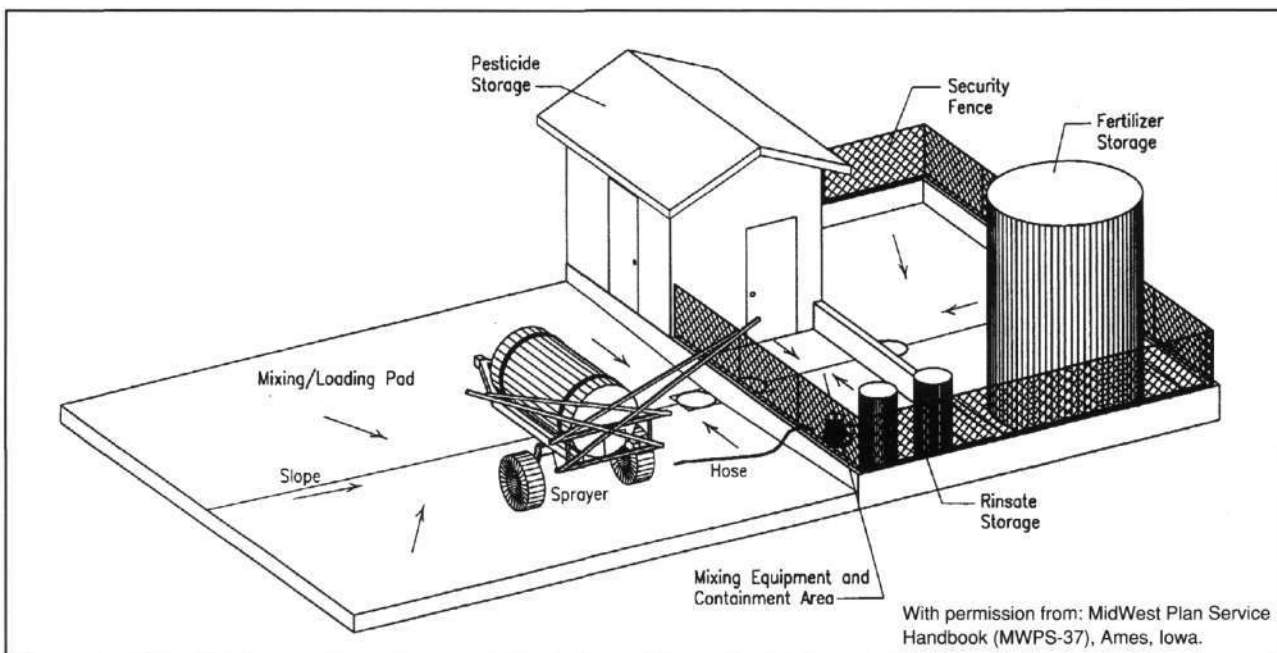
up of chemicals at the loading pad. The auxiliary water tank may contain its own pump for washing and rinsing or, with proper valving, the spray pump itself may be used to pump the clean-up water to a special tank flushing nozzle and to a hose for rinsing the exterior.

Even though in-field wash-downs produce very dilute solutions, cleaning should be done at different locations in the field each time to prevent chemical buildup from subsequent wash-downs. The very dilute tank rinsate can be applied to the

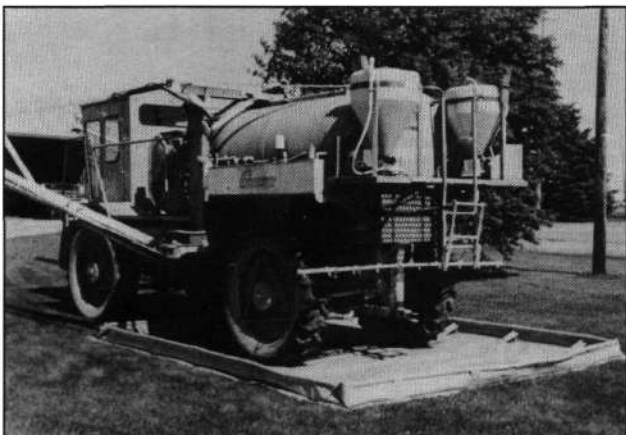
headlands or field edges and the flushing repeated to ensure a clean sprayer.

### Loading and Rinse Pad

When the loading and rinse pad is expected to serve as a spill containment for loading and a wash-down area, it should be constructed with curbs and slopes to the sump and drain valve and have a capacity to hold 125 percent of the contents of the largest spray tank used (Fig. 4).



**Fig. 2. Medium-sized pesticide/fertilizer storage, containment, mixing/loading pad.**

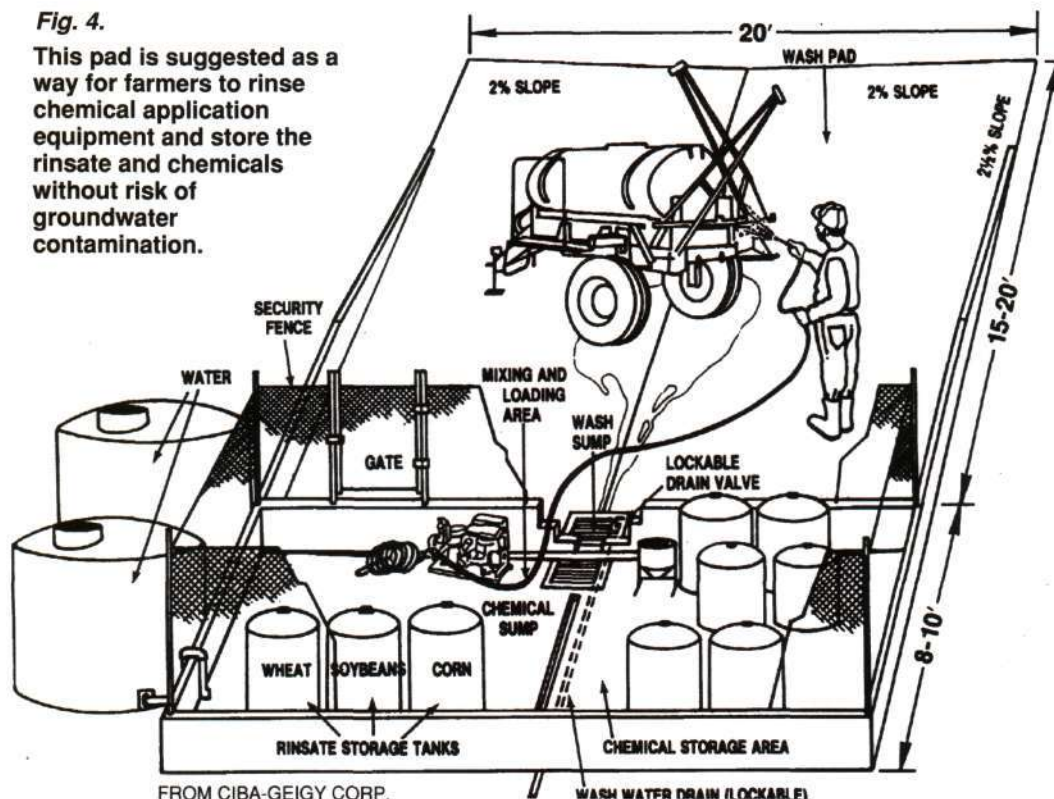


**Fig. 3. Portable loading pad.**



Fig. 4.

This pad is suggested as a way for farmers to rinse chemical application equipment and store the rinsate and chemicals without risk of groundwater contamination.



Farmers have several options for disposing of pesticides washed off or rinsed out of a sprayer. Rinsate may be:

- Pumped into a holding tank and used as a dilutant for a future spray mix that is legal on the crop and compatible with chemicals being applied.
- Held in an applicator (sprayer) and applied to suitable land (e.g., idle field, same crop, etc.) in a very dilute form.
- Trucked away by a licensed hazardous waste hauler.
- Applied to a degradation soil tank or an evaporation pond. Although these methods are experimental, they are promising as future disposal methods.

A major concern in managing a rinse pad is how to handle rainwater. A modest-sized rinse pad can collect many hundreds of gallons of rainwater which, if contained, just adds that

much more to the "hazardous waste" to be disposed of. A covered and walled rinse pad will eliminate the collection and disposal of the rainwater but will add to the cost of the structure.

An alternative management system to consider is to keep the discharge valve closed (as normal) when the pad is in use and contain all rinsate. At the end of the use period, clean the pad by triple rinsing or power washing with biodegradable detergent and pump the rinsate into a holding tank for disposal by one of the methods described above.

With the pad now clean, the discharge valve from the pad (or sump) can be left open and any rainwater that falls on the clean pad allowed to freely discharge to a grassed waterway.

The key to the success of this system is to pay particular attention to the cleaning of the pad and sump so that any discharge from the pad is not contaminated.

## Emergency Preparedness for Pesticide Storage Area

Protective equipment and clothing, including disposable clothing, should be kept in a nearby location that provides immediate access but away from pesticides and their fumes, dusts or spills. Clean-up and containment materials or kits, a fire extinguisher approved for chemical fires and first aid equipment should be readily available. Highly visible signs should be posted to notify persons entering the facility that pesticides are stored there and that smoking is not permitted. A water source for emergency washing and cleaning

should be available. Local emergency response agencies should be notified of the presence and maximum quantities of pesticides expected in the storage area during the season. The following information should be kept at the storage area and in the home or office:

- Emergency phone numbers:
  - Police, fire, poison control center (Extension bulletin AM-37).
  - DNR Pollution Emergency Alerting System (1-800-292-4706).
- Inventory of types and amounts of pesticides being stored.
- Site plan showing drains, runoff paths, wells and electrical service wires.
- Location of the storage area.

## Appendix A

### Location Requirements for Pesticide and Fertilizer Storage

- (1) The location of a pesticide or fertilizer storage facility shall comply with applicable local, state and federal regulations. A.S.C.S. may have additional requirements for cost sharing.
- (2) New storage facilities and their respective containment areas shall be located above a 100-year flood plain.
- (3) New and existing storage facilities and their respective containment areas shall be located specific minimum distances from water sources as follows:

Distance From*	Existing Storage	New Storage
Surface Water	Not Specified	200 ft. (minimum)
Public Water Supply Wells Type I & IIa, Communities (25 or more persons) & Large Resorts	200 ft. (minimum)	2000 ft. (minimum)
Public Supply Wells Type IIb & III (Food Service, Campgrounds, Schools, Small Business, Gas)	75 ft. (minimum)	800 ft. (minimum)
Private Well	50 ft. (minimum)	150 ft. (minimum)

\*Act No. 399 of Public Act of 1976 as Amended to 325.1001

- (4) All storage facilities shall demonstrate appropriate engineering safeguards to prevent water supply contamination if flood plain, surface water or water supply setback requirements cannot be met. These engineering safeguards shall be demonstrated prior to initial approval of a facility registration by the Michigan Department of Agriculture.

## Appendix B

### Impervious Sealing Compounds for Chemical Containment Structures (A Partial List)\*

COMPOUND	COMPANY
Chemglaze	Lord Corporation
Thiokote	Morton International
Steelcote	Steelcote Manufacturing Company
Phenoline (Thin Film)	Carboline Company
Starglaze (Epoxy)	Carboline Company
Carboline 1327 (Polyurethane Elastomer)	Carboline Company

\*Additional references are available through the Midwest Plan Service, Conference Proceedings, "National Symposium on Pesticide and Fertilizer Containment Design and Management," February 1992, p. 73.

## Example Plans for Pesticide Storage and Handling Facilities

Because the need for pesticide handling varies with the individual farmer, several plans from various sources are included here. These cover a spectrum of sizes from small to medium and large facilities.

This bulletin is not intended to be all-inclusive, but rather to present a few examples of typical facilities and construction ideas that may be suitable for a variety of sizes and needs. For a more complete treatment of ideas and construction techniques, refer to the Midwest Plan Service Handbook Designing Facilities for Pesticide and Fertilizer Containment (MWPS-37), available from the Plan Service Secretary, Agricultural

Engineering Department, Michigan State University, East Lansing, MI 48824, or from the Midwest Plan Service, 122 Davidson Hall, Iowa State University, Ames, Iowa 50011.

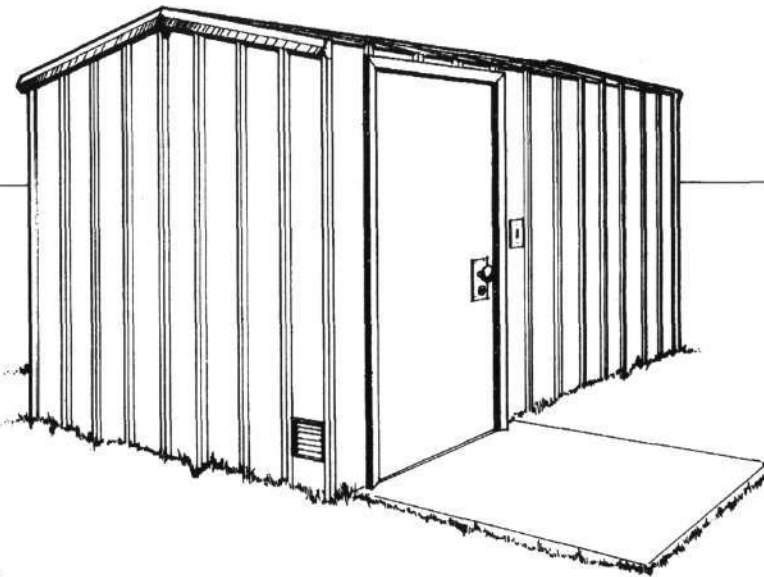
### Plans and Illustrations Included

1. Small-sized farm pesticide storage—movable or permanent (Kansas State University).
2. Medium-sized farm pesticide storage—covered mixing/loading pad (Carl Huhn design, DeWitt, MI).
3. Medium-to large-sized pesticide storage—open or covered loading pad.
4. Mixing/loading pad and chemical storage—plan view (from MWPS 37).
5. Mixing/loading pad—cross-section (from MWPS 37).

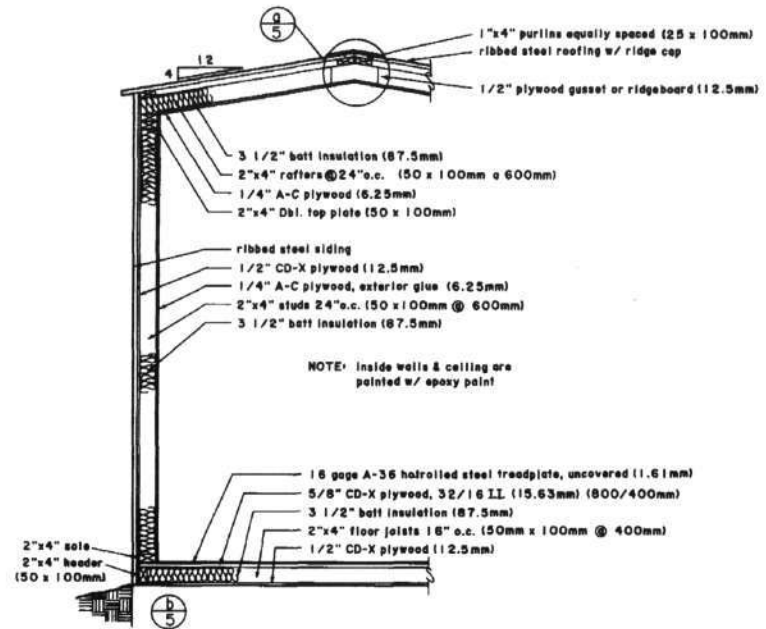


# SMALL SIZE PESTICIDE STORAGE FACILITY

## MOVABLE OR PERMANENT



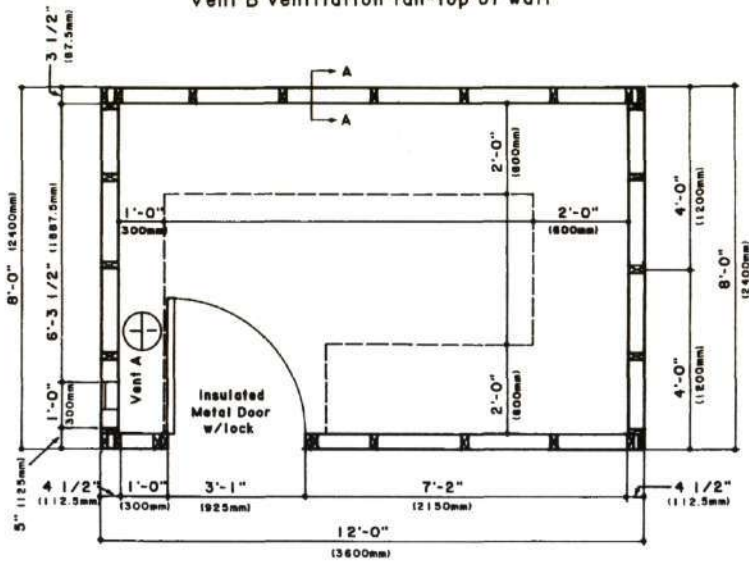
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1  
AGRICULTURAL PESTICIDE STORAGE BUILDING



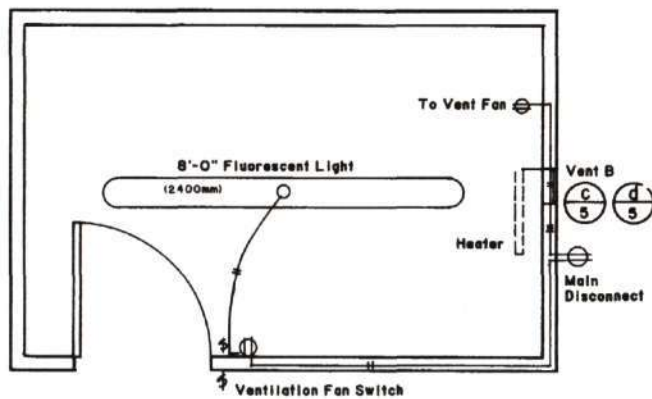
1  
3  
WALL SECTION A-A

(KANSAS STATE DESIGN)

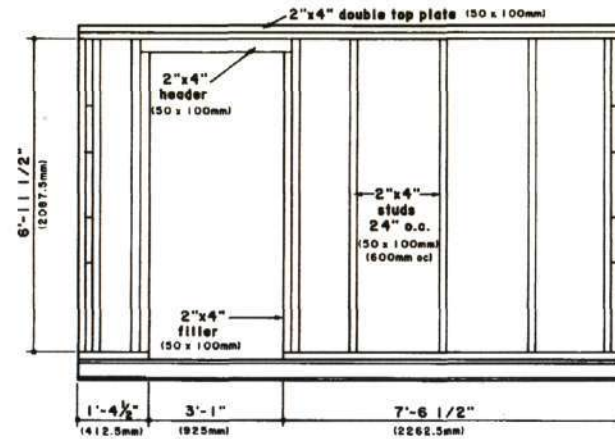
Vent A intake vent-bottom of wall  
 Vent B ventilation fan-top of wall



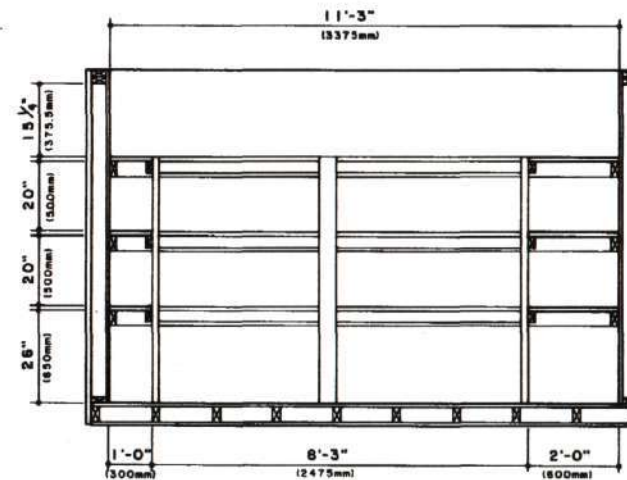
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 2 FLOOR PLAN



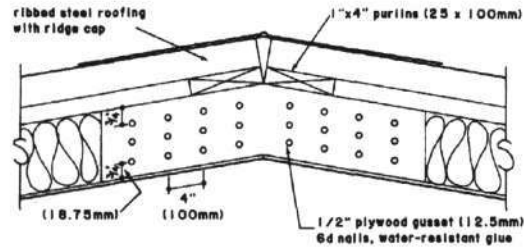
2  
 2 ELECTRICAL PLAN



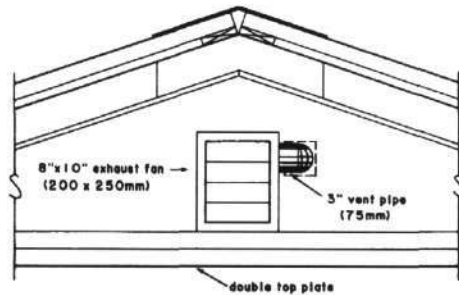
1  
 4 FRAMING DETAIL



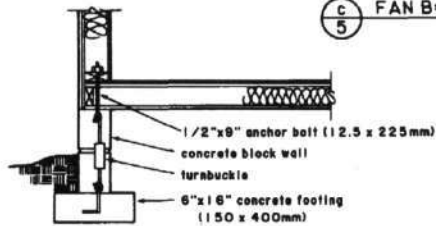
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 4 SHELVING DETAIL



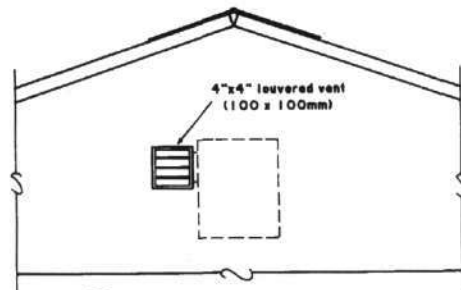
5 ROOF DETAIL



5 FAN B: INTERIOR VIEW



5 FOUNDATION DETAIL



5 FAN B: EXTERIOR VIEW

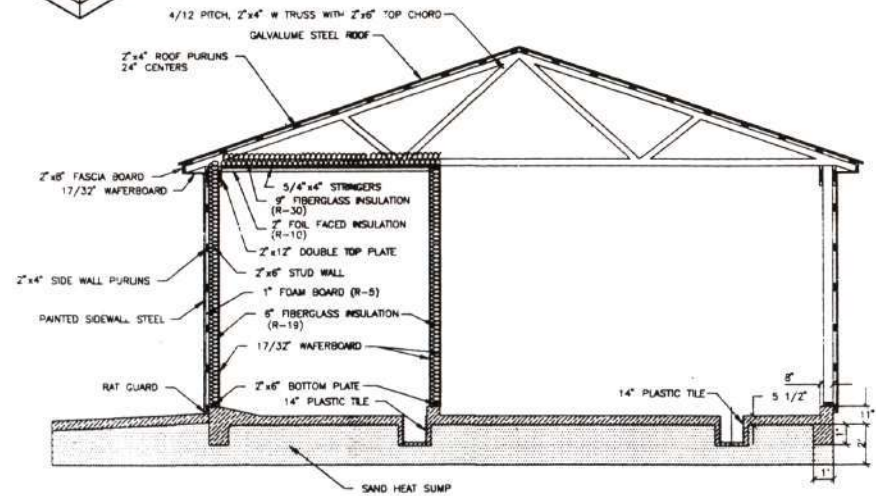
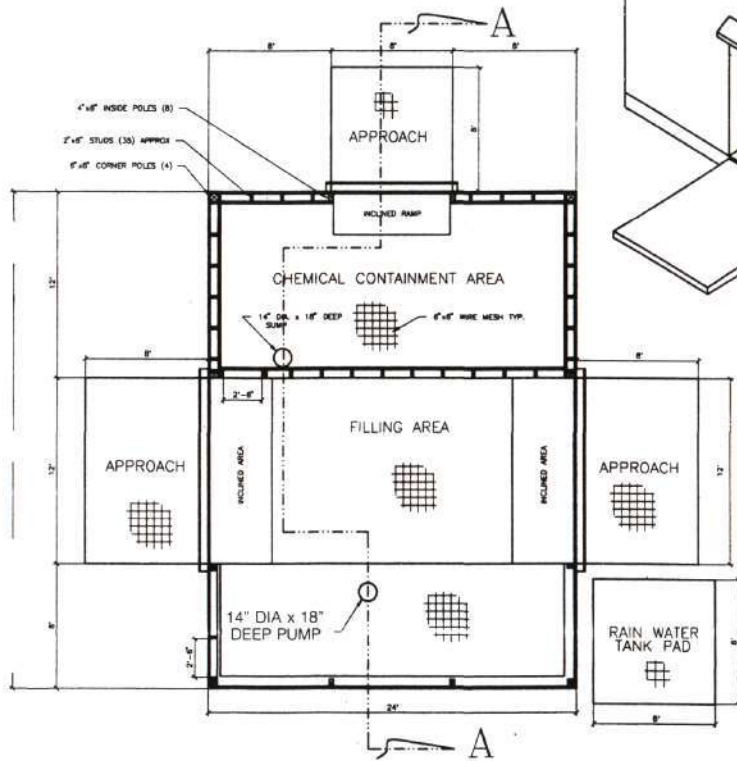
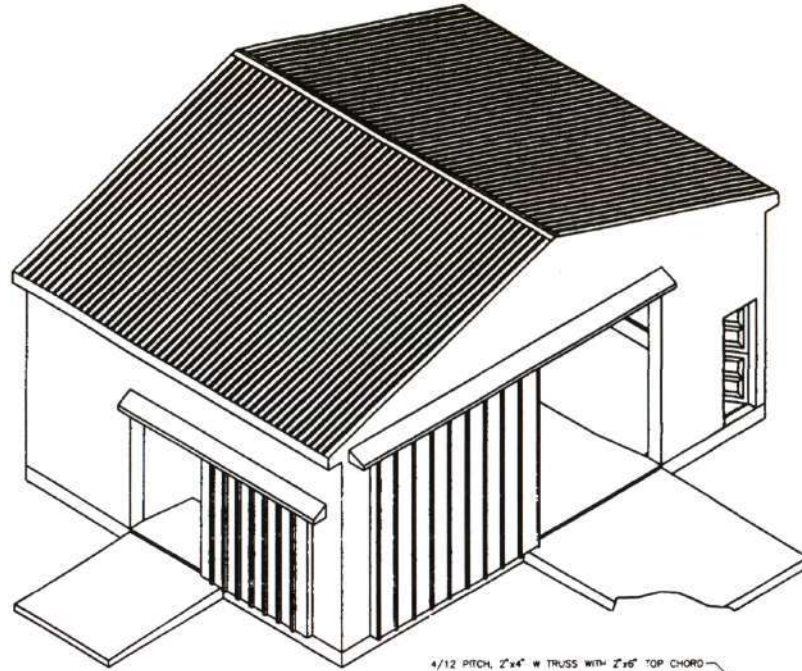
## PESTICIDE STORAGE FACILITY BILL OF MATERIALS

No. Pieces	T	x W	x L	Description	Grade
14	1/2"	x 4'	x 8'	Plywood	CDX
10	2"	x 4"	x 7'	Floor Joists	Construction
2	2"	x 4"	x 12'	Floor Joists Headers	Construction
3	3/4"	x 4'	x 8'	Plywood	CDX
173 ft <sup>2</sup>	3 1/2"	x 24"		Floor & Ceiling Batt Insulation	R19
28	2"	x 4"	x 83 1/2"	Studs	Construction
6	2"	x 4"	x 12'	Sole & Top Plates	Construction
6	2"	x 4"	x 6' 5"	Sole & Top Plates	Construction
258 ft <sup>2</sup>	3 1/2"	x 16"		Side Wall Batt Insulation	R19
13	1/4"	x 4'	x 8'	Plywood	A-C
4	1"	x 4"	x 12'	Purlins	Construction
4	2"	x 4"	x 16'	Rafters	Construction
1	16 ga.	x 7'	x 12'	Steel Treadplate	
8	28 ga.	x 3'	x 8' 3/4"	Steel Ribbed Siding	
6	28 ga.	x 3'	x 8' 11"	Steel Ribbed Siding	
8	28 ga.	x 3'	x 3' 8"	Steel Ribbed Roofing	
1		3'	x 6' 8"	Insulated Metal Door	
1				Ventilation Fan	100 CFM
1				Ventilation Vent	
1				Weatherproof Electrical Disconnect	30A
4				Electrical Circuit Breakers	
1			8'	2-Bulb Fluorescent Light	
2				SPST Switch	120V, 15A
1				Weatherproof Switch Box	
2				Electrical Gang Box	
1				Duplex Receptacle	120V, 20A
1				Electric Heater	
1 gal.				Marine Enamel Paint	

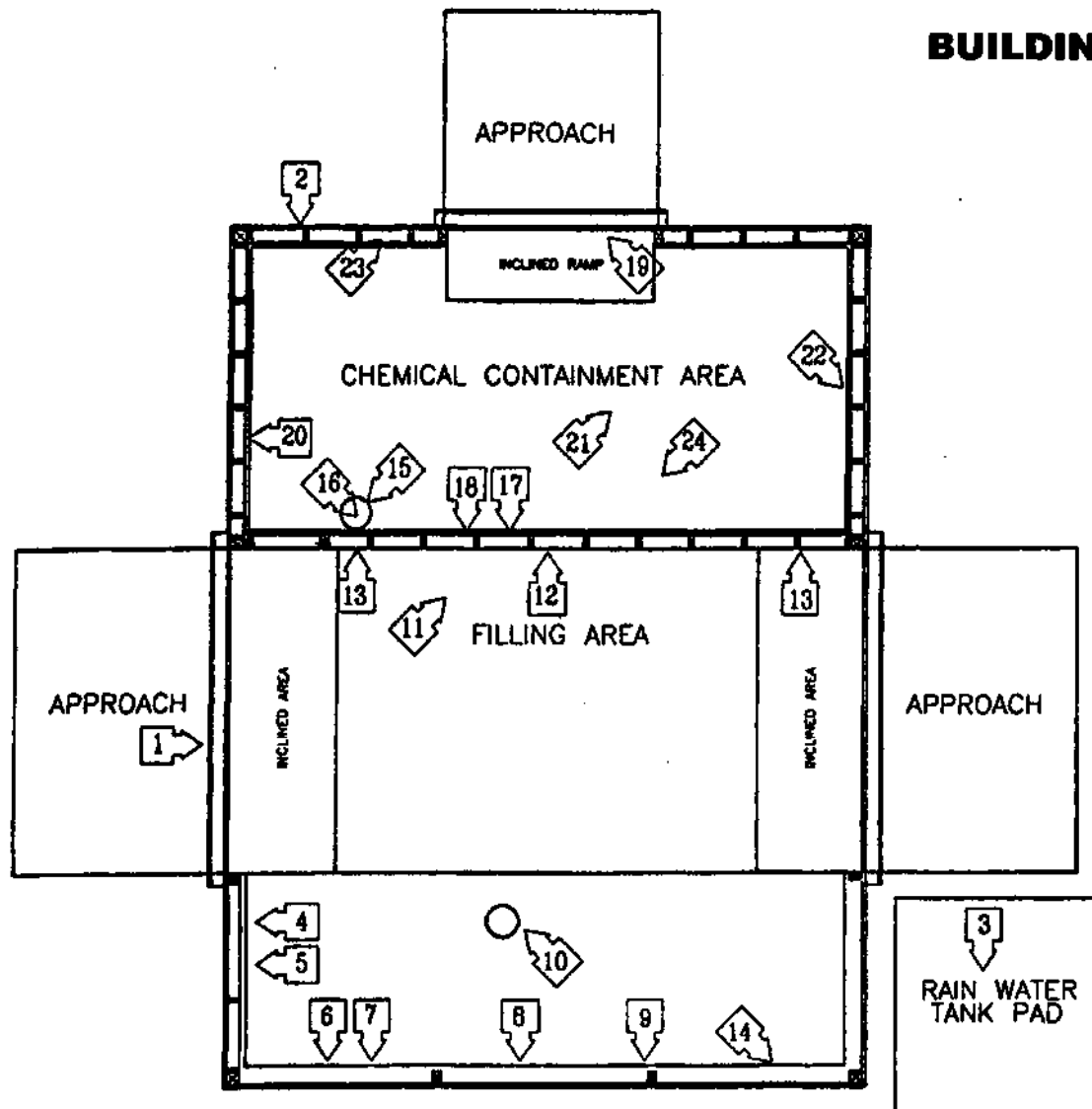


# MEDIUM-SIZED PESTICIDE STORAGE STRUCTURE

(CARL HUHN DESIGN)



## BUILDING FEATURES



### BUILDING EXTERIOR

1. Motion sensor halogen light.
2. Externally mounted 30 watt alarm siren.
3. 4" rainfall, taken from roof, to fill 2,000-gallon water tank.

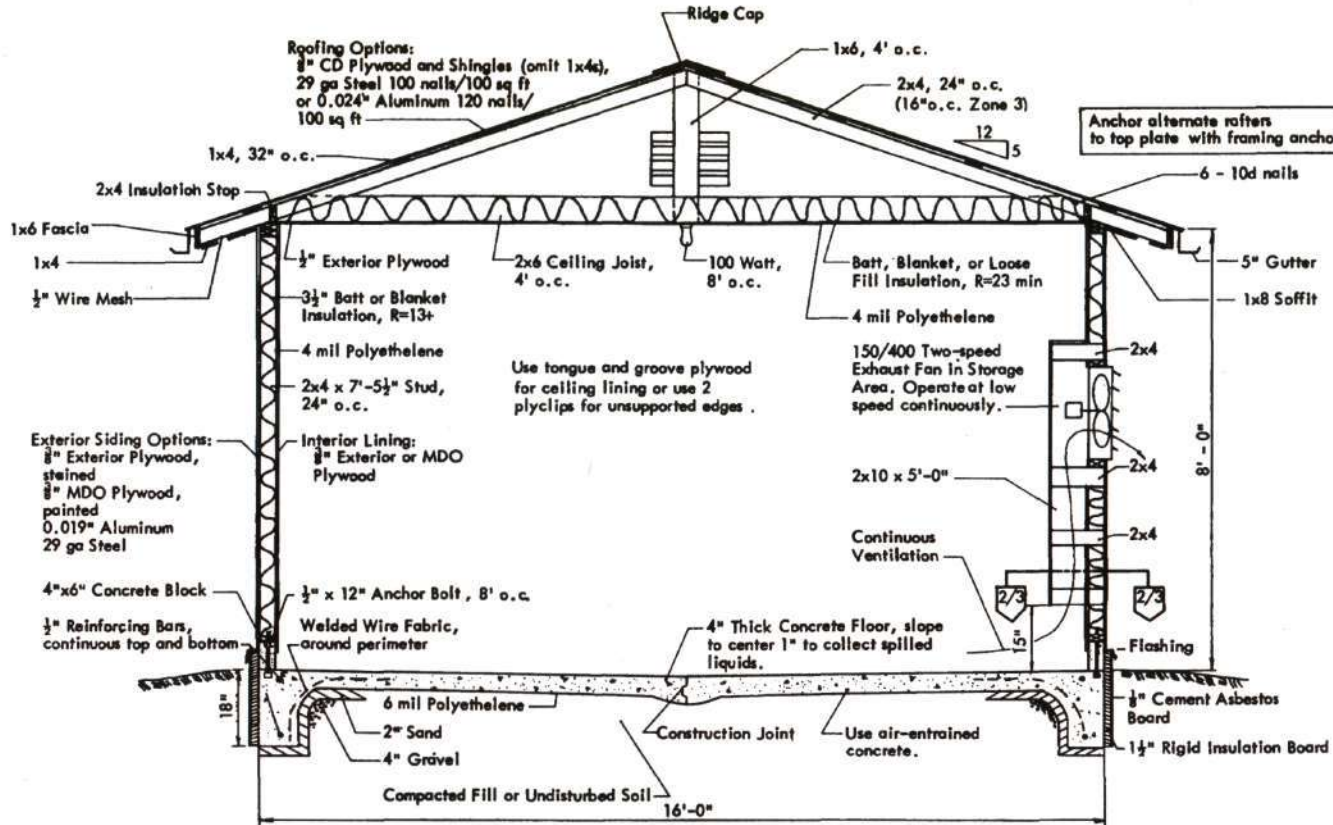
### SPRAYER LOADING AND RINSING AREA

4. Full function alarm system.
5. 60 amp electrical service.
6. Fire extinguisher, 20 lb. ABC.
7. Chemical safety equipment storage cabinet.
8. Low volume rinsate transfer pump.
9. Coned bottom rinsate holding tank.
10. Floor sump sprayer loading area.
11. Color-coded access doors.
12. Orange material access door.
13. Green ventilation doors.
14. 6" high concrete containment walls.

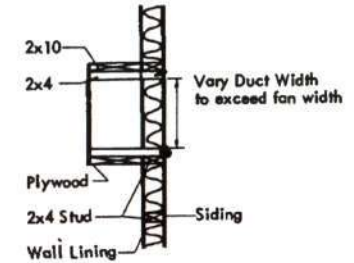
### CHEMICAL STORAGE ROOM

15. Floor sump for containment.
16. Chemical leak detector.
17. Low and high temperature sensor.
18. Remote "mini-bulk" pump switch.
19. Dual insulated sliding doors.
20. Thermostatically controlled electric heat.
21. 36" sand heat sink under floor.
22. 6" high concrete containment walls.
23. R-24 insulated side walls.
24. R-40 insulated ceiling.

# MEDIUM TO LARGE SIZED PESTICIDE STORAGE STRUCTURE (MODEL DESIGN)

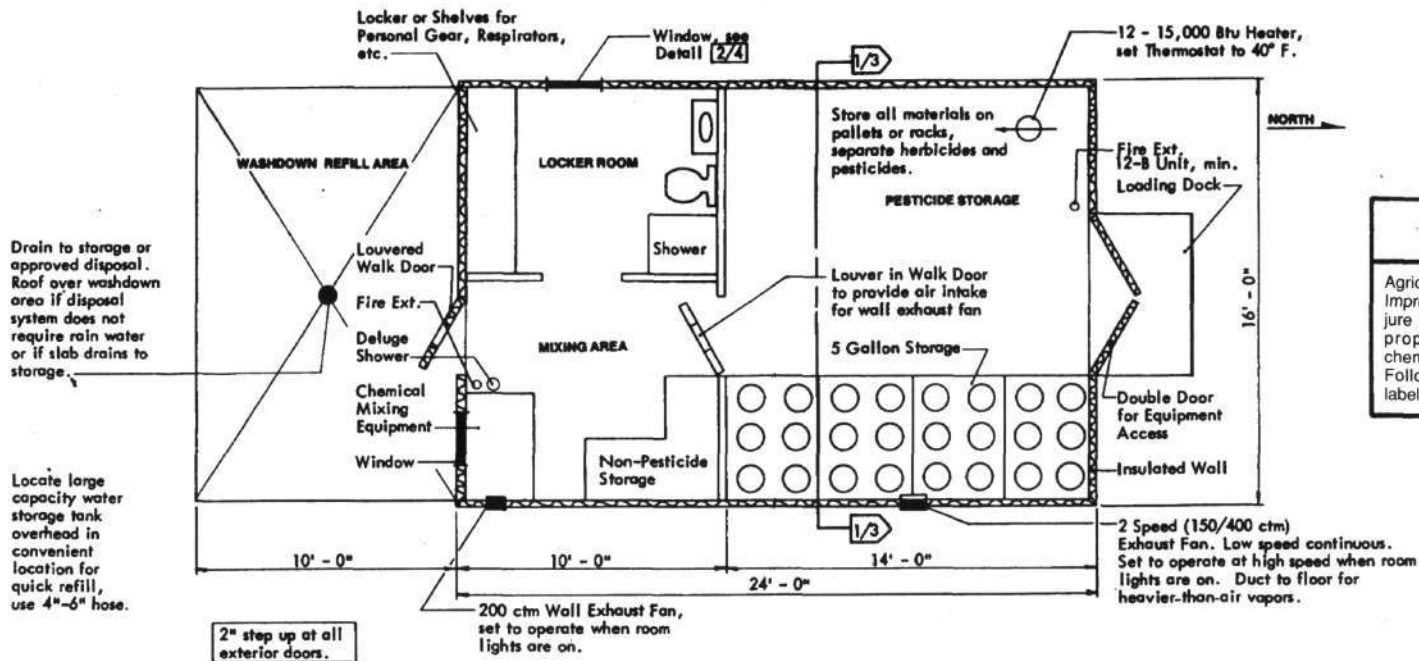


CROSS SECTION—1/3



FAN DUCT CROSS SECTION—2/3





**CAUTION**

Agricultural chemicals can be dangerous. Improper selection or use can seriously injure persons, animals, plants, soil or other property. **Be Safe:** Select the right chemical for the job. Handle it with care. Follow the instructions on the container label and of the equipment manufacturer.

FLOOR PLAN—1/1

**NOTES:**

With prevailing winds from the west, orient the building ridge north-south with the storage area to the north. With this orientation, prevailing winds will blow across the entrances instead of into them carrying toxic fumes (from mixing and filling operation) away from the building.

Surround the area with a security fence, provide locks for exterior doors. Place signs to warn of dangerous chemicals. Chemicals marked with a skull and crossbones are highly toxic. Solids are usually handled as granules, dusts and powders. This presents a dust explosion hazard when these materials are dispersed into the air.

Precise calculations and care in mixing can greatly reduce leftover pesticides. Consult with state and local officials for approved disposal methods.

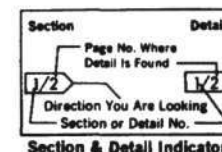
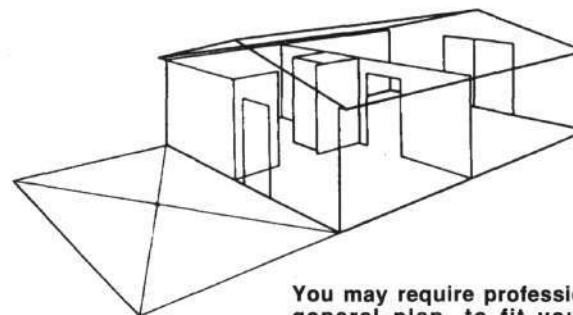
Consider direct-load mixing equipment for increased safety.

Install vacuum breakers on water lines used for filling rigs to prevent chemicals from entering the water supply system. Install stop and waste valves on all water lines entering unheated areas.

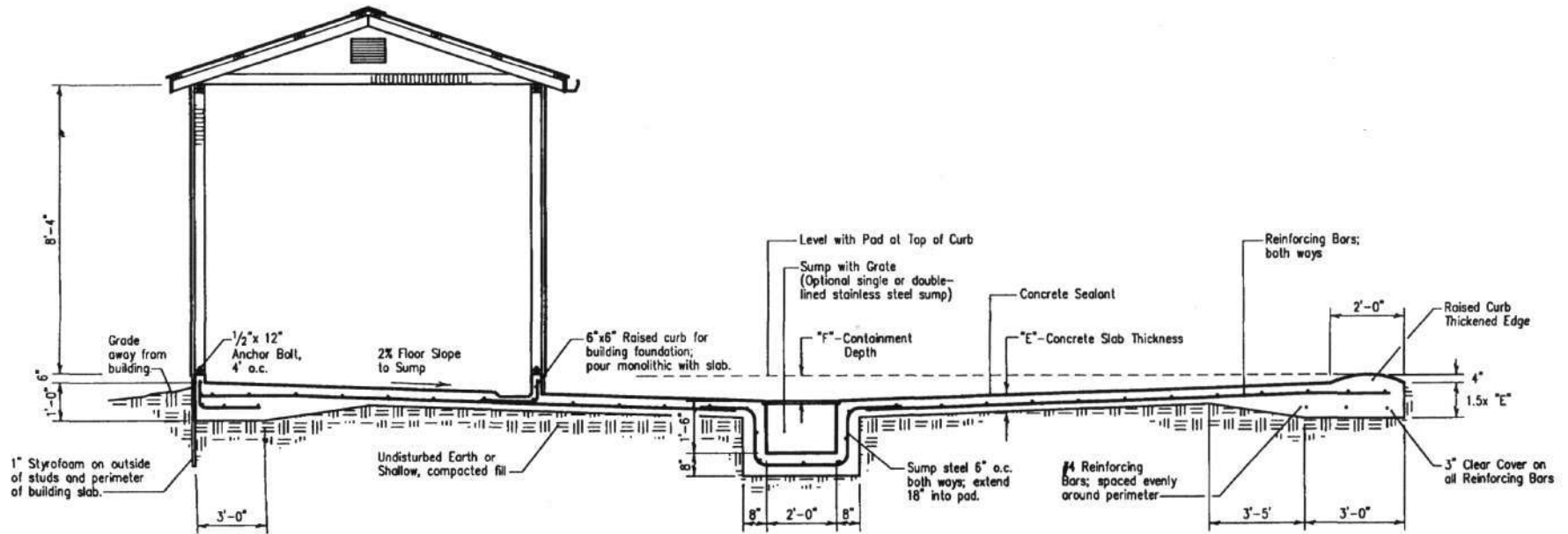
Contact state and local officials to verify compliance with all current regulations in your area.

Locate the building on a site where flooding is unlikely. Choose an area such that natural runoff from the storage area, seepage through the soil or runoff from fire fighting will not contaminate residential areas, livestock feeding areas, streams or ponds.

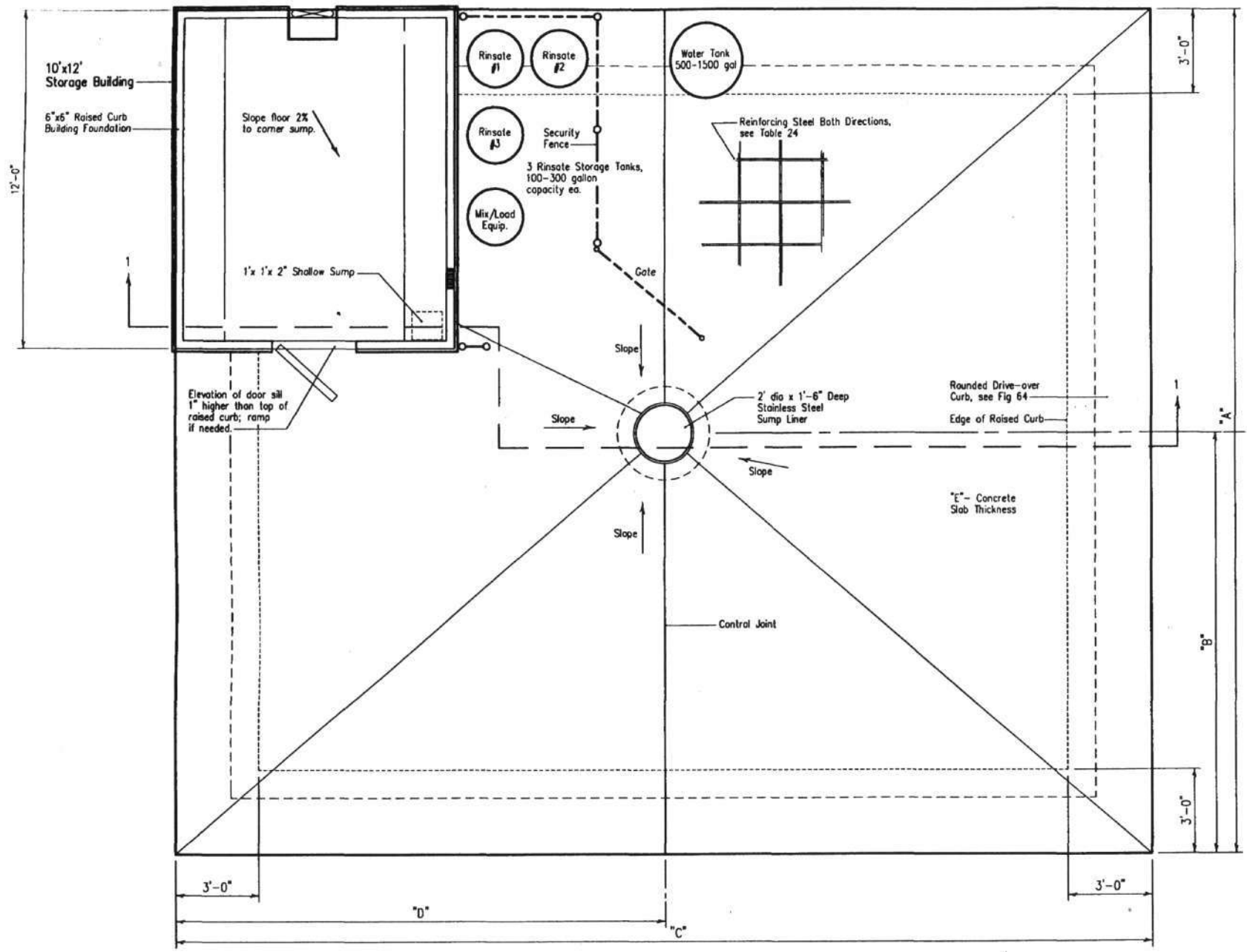
Use a mechanical can crusher to properly dispose of 5-gallon cans.



You may require professional services to complete this general plan, to fit your situation, and to include consideration of: site selection and preparation; provisions for utilities, waste management, and roads or other accesses; assurance of compliance with codes and regulations; specifications for some materials and equipment; and supervision of bid letting and construction.



## MIXING/LOADING PAD CROSS-SECTION



**PLAN VIEW OF MIXING/LOADING PAD**



# MICHIGAN STATE UNIVERSITY EXTENSION

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Issued in furtherance of Cooperative Extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Gail L. Imig, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

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