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On-Farm Agrichemical Storage and Handling

MSU Extension

Robert H. Wilkinson, Agricultural Engineering Department

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ON-FARM AGRICHEMICAL STORAGE AND HANDLING



Michigan State University Extension
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Robert H. Wilkinson
Agricultural Engineering Department

Pesticides 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.

Current Michigan laws that apply to private applicators are quite general. Regulation 637, "Pesticide Use," requires that all applicators follow the label instructions when using pesticides and that applicators are accountable to clean up any spills and contamination for which they are responsible. All applicators are required to calibrate their equipment at least once a year and to have a "spill kit" readily available in the event of an accident. Compliance will provide a measure of liability protection under the Right-to-Farm Act. The specifics or details on how to meet these general goals are left to the judgment and discretion of the private applicator.

On the other hand, commercial applicators and dealers are subject to many additional specific requirements in Regulation 637 and in Regulation 640, "Commercial Pesticide Bulk Storage," and Regulation 641, "Commercial Fertilizer Bulk Storage."

In general, when there are no laws or regulations specifically written for private pesticide users, following the recommendations and requirements that

are written for commercial users will usually put a grower on "safe ground" and be more than satisfactory.

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.

Components of a Chemical Handling Facility

A typical farm chemical handling facility will usually provide four specific areas or functions:

- A chemical storage area.
- An area for measuring and mixing chemicals.
- A locker-washroom for personnel and safety equipment storage.
- A loading-rinsing apron with spill containment and a sump for cleanup and rinsate recovery.

The size and arrangement of the components are decisions of the farmer-grower. In many cases, the mixing and loading areas overlap or are combined.

Some farmers with a modest use of chemicals may prefer to hire a custom applicator and have no on-farm storage. Others may elect to use a portable loading pad and/or a small storage building or truck box. The grower who uses many chemicals and sprays will be more interested in a well developed chemical handling facility, complete with a shower and locker room for workers. The decisions about size and extent of the storage handling facility are left to the farmer-grower.

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 and a sealed well casing into a deep aquifer — should be used. Public water supply wells 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

pesticide fires 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 as 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 protection (i.e., smoke detectors or alarms) as needed. Outside shutoffs for all electrical and water systems are recommended. Although agricultural buildings are exempt from

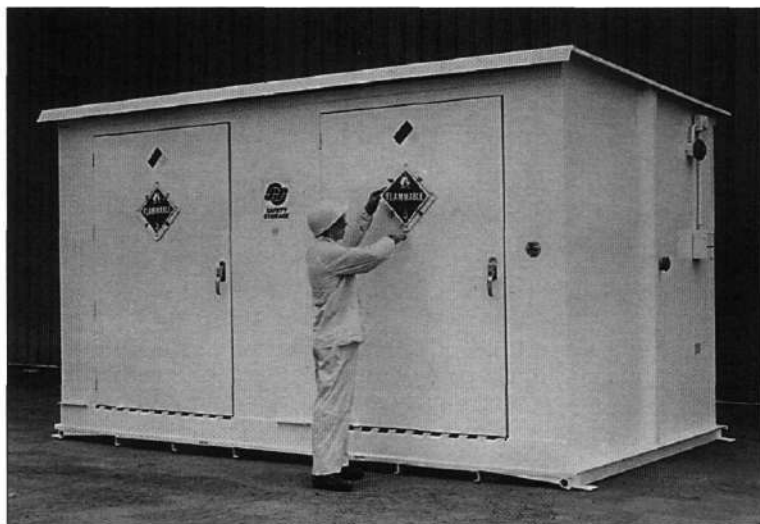


Figure 1. A portable storage structure.

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 of sources for these sealants is included in Appendix B.

Wastewater

Water is needed for mixing, rinsing and cleanup, so a waste handling system is necessary. Waste should flow to a sump and be pumped directly to a holding tank until waste can be used as a dilutant or disposed of properly. Floor drains are discouraged. If floor drains are present, they must never be connected to the wastewater sewer or septic tank.

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 (cfm) 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 to 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 or are positioned with a high opening and a low opening for good air flow. Large door openings may provide sufficient ventilation so that fans may not be needed for fume and odor removal.

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 more information on storage temperatures.

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: 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; the National Electrical Code, Article 500, for details on hazardous locations; and 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 marshal'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 alternative 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, a container designed for ready handling and transport and filled by the chemical manufacturer or licensed repackager. 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.

Secondary containment for on-farm bulk storage is highly recommended. It is required for commercial storage by

Regulations 640-641. The containment should be constructed to prevent the absorption or loss of spilled chemicals. The containment should have the holding capacity of the greatest of the following three options plus the displacement of all contained tanks:

1. Ten percent of the total volume of all tanks or containers.
2. 125 percent of the largest tank.
3. The volume of a 25-year/24-hour rain (where the containment is not covered with a roof).

Pesticide storage may not use an earthen secondary containment. Although the use of earth dikes is not preferred for any secondary containment, it is acceptable 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. Earthen 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 surface or groundwater. 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).

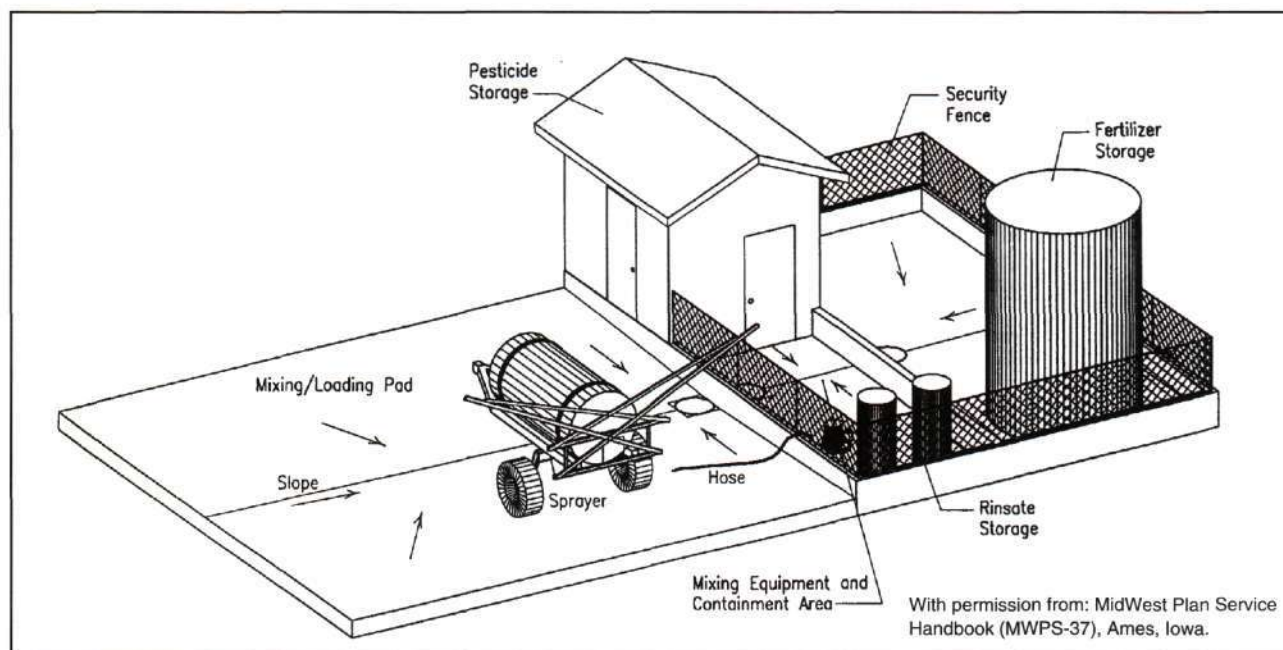


Figure 2. Medium-sized pesticide/fertilizer storage, containment, mixing/loading pad.

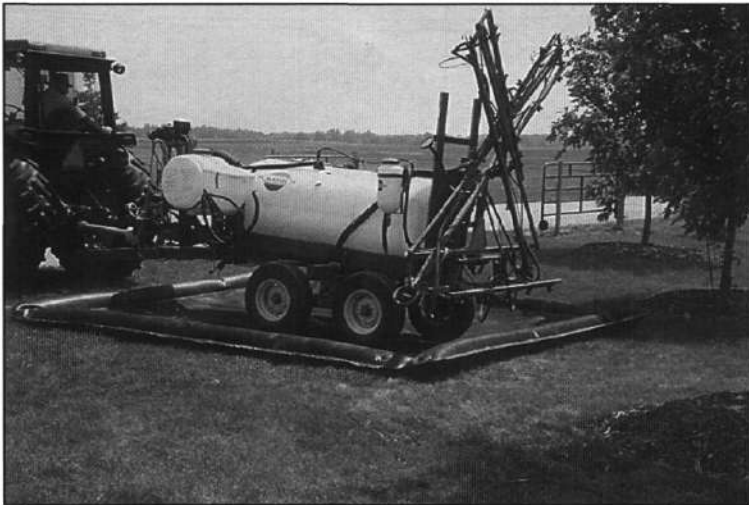


Figure 3. Portable loading pad.

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 buildup 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 (Fig. 4).

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.

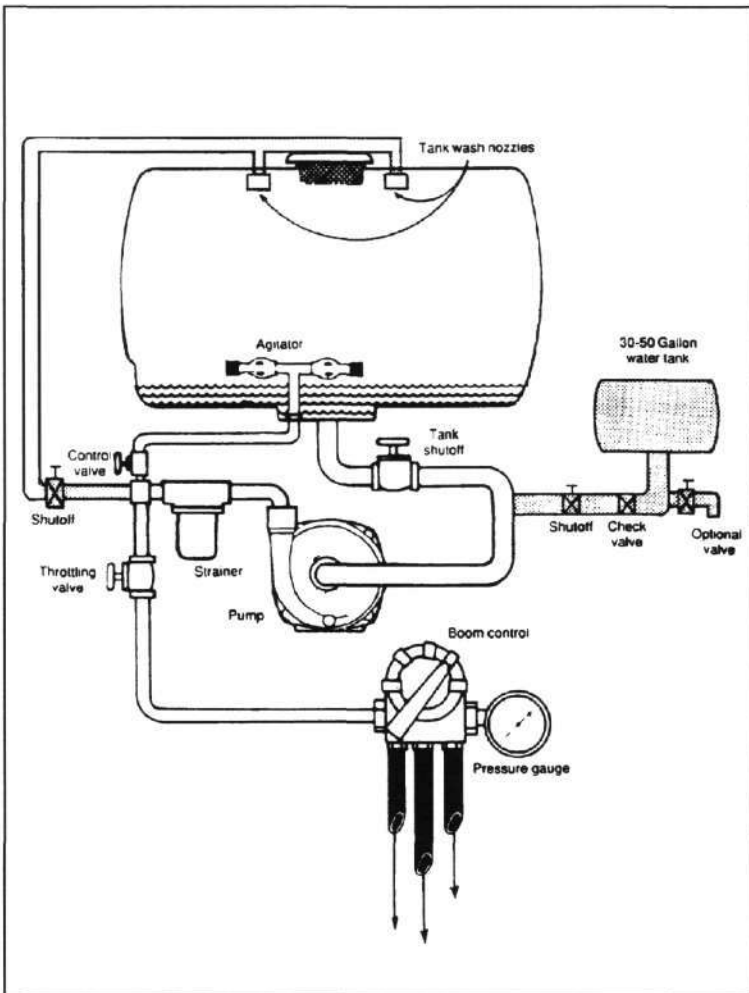
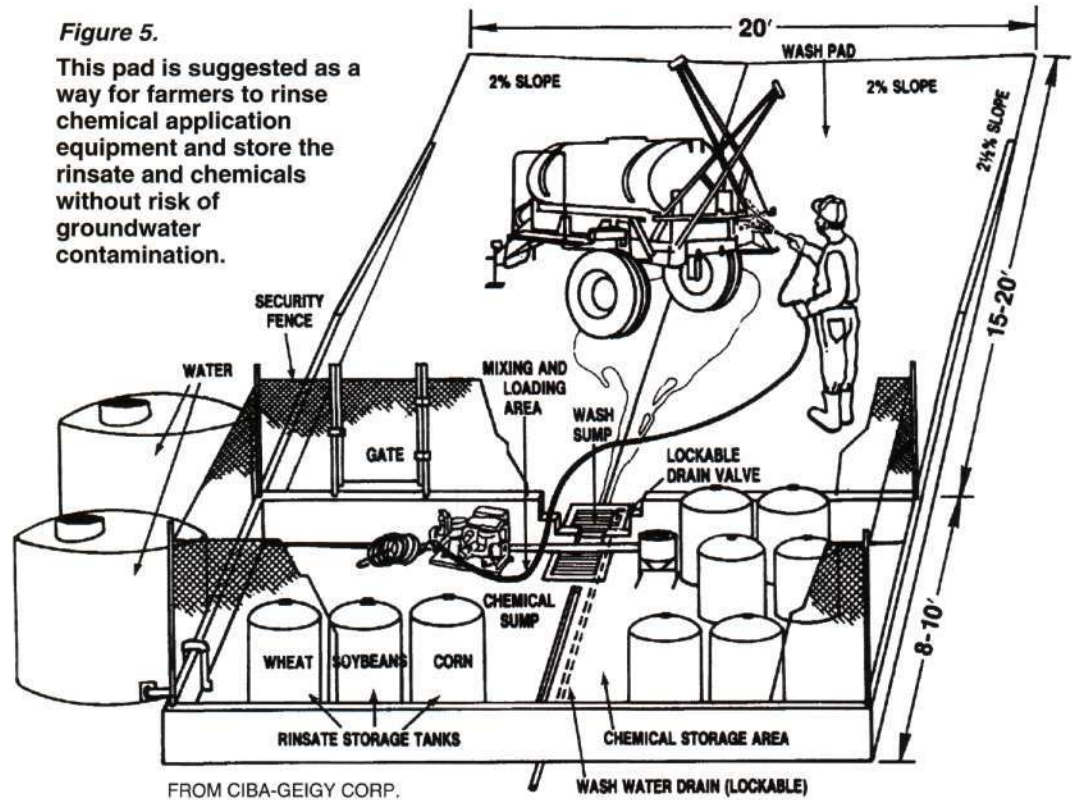


Figure 4. Sprayer field wash system.

Figure 5.

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.



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 have a capacity to hold 125 percent of the contents of the largest spray tank used (Fig. 5) or a 6-inch rainfall if the pad is not covered.

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., a labeled site, 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 add 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.

A management system to consider for a non-covered pad is to contain and reuse runoff when the pad is in use. At the end of the use period, clean the pad by triple rinsing or power washing with biodegradable detergent and dispose of the rinsate by one of the methods described above.

With the pad now clean, the discharge can be handled as clean water and freely released. The key to the success of this system is to pay particular attention to the cleaning of the pad and sump so that the subsequent rainfall and runoff discharge from the pad does not become contaminated.

Sump Design

The sump is designed to be the lowest point in the liquid collection system. Typically, concrete aprons of the mix-and-load pad are sloped 2 percent toward the sump. This allows liquid to flow to the sump and then be pumped to rinsate holding tanks for later spray mixing or disposal.

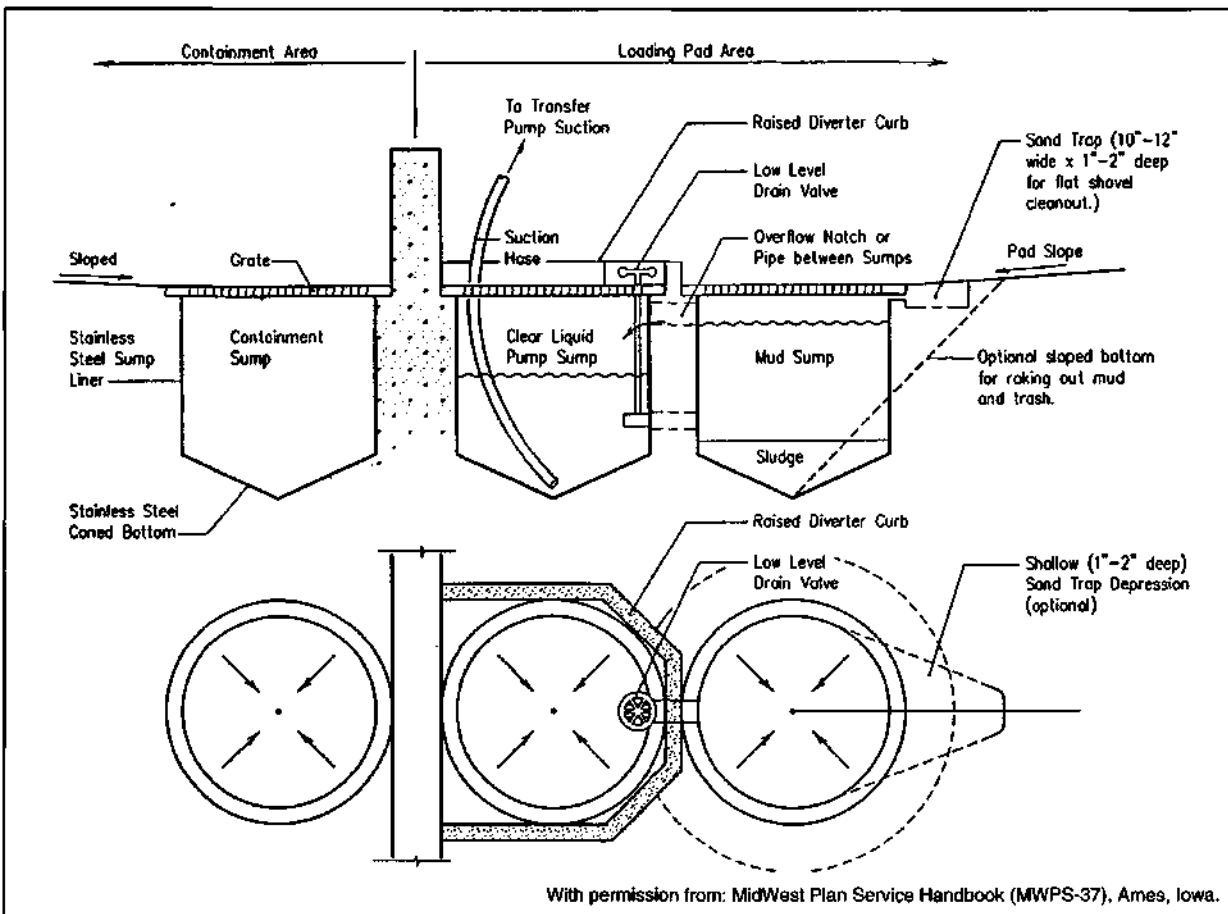
The sump should be big enough to easily accommodate the sump pump but not overly large. Large sumps tend to become "holding areas" and are more difficult to manage and clean.

Several sump designs can be used. Examples are shown in Fig. 6. Sumps can be cast-in-place, prefabricated concrete, stainless steel or plastic. Single sumps are the simplest but, where excessive amounts of sand and sludge are expected, a double sump design may be preferred. Refer to

Midwest Plan Service Handbook 37 for additional information on sump construction.

As an alternative to installing a traditional sump, there is a trend to construct the mix-load pad with a shallow trench at the low side to collect the runoff. This provides the depth of liquid for the pump to operate properly without having the hole and grate in the pad. It is easier to clean than the deeper sump and reduces stress on the concrete from freezing liquids.

The pumping capacity of the sump should be sized to match the maximum expected rate of fill from the pad— at least as large as that of the wash-down pump used to clean the spray equipment. Suitable plumbing and valves will allow sump discharge to be directed to one of several holding tanks.



With permission from: Midwest Plan Service Handbook (MWPS-37), Ames, Iowa.

Figure 6. Multiple mixing/loading sump detail for sediment control.

Emergency Preparedness for Pesticide Handling

The Spill Kit

All pesticide applicators in Michigan are required to have a spill kit readily available. Although the contents of the spill kit are not defined, experience suggests a few items that it is wise to include. A 5-gallon, sealable plastic pail makes a reasonable container. In the bucket, keep a quantity of pet litter ready to absorb liquid spills, a dust pan and brush, several heavy plastic trash bags to hold material, rubber gloves and boots. A broom and shovel will help with the cleanup. Other items can be included, depending on individual needs. If you travel through urban areas with storm drains and sewer systems, you may need different materials than if you work only in field areas.

The Storage Area

Protective equipment and clothing, including disposable clothing, should be kept in a nearby location that provides immediate access but is 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).
 - Local Emergency Pollution Control.
 - MDEQ (Michigan Department of Environmental Quality) Pollution Emergency Alerting System (1-800-292-4706).
 - MDA (Michigan Department of Agriculture) Emergency Hotline (1-800-405-0101).
- 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 and nearby sensitive areas.

Appendix A

Location Requirements or Recommendations for Pesticide and Fertilizer Storage

- (1) The location of a pesticide or fertilizer storage facility shall comply with applicable local, state and federal regulations. The Natural Resources Conservation Service (NRCS) 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 or facilities:

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)	2,000 ft. (minimum)
Public supply wells Type IIb & III, FOOD SERVICE, CAMPGROUNDS, SCHOOLS, SMALL BUSINESS, GAS STATIONS	75 ft. (minimum)	800 ft. (minimum)
Private well	50 ft. (minimum)	150 ft. (minimum)
Farm building		50 ft.
Residential/business bldg.		200 ft.
Pressurized water lines		50 ft.
Fuel storage tank		40 ft. – under 1,100 gal. 5 ft. – over 1,100 gal.
Property lines		25 ft.

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

- (4) Most storage facilities do not require special provisions. However, all storage facilities should have 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 by the Michigan Department of Agriculture.
- (5) Assistance in the design and layout of agrichemical storage facilities can be obtained from:
 - Michigan State University County Extension offices. Check with your local county Extension director.
 - Michigan State University Agricultural Engineering Department, MSU, East Lansing, MI 48824, (517) 355-4720.
 - Natural Resources Conservation Service, 1405 S. Harrison Road, East Lansing, MI 48823, (517) 337-6701.

Agrichemical Containment Reference Information

The appended list of companies associated with chemical containment presented here as a convenience may be incomplete. Inclusion on or omission from this list should not be construed in any way as an endorsement, either positive or negative.

Appendix B

Coatings and Sealants:

- Ameron Protective Coatings**
2452 Cedar Crest Dr., NE
Grand Rapids, MI 49505
616-365-3090
- Ascot Products Inc.**
44585 Telegraph Road
Elyria, OH 44035
216-323-5410
- Boichot Concrete Corp.**
1800 Turner Street
Lansing, MI 48906
517-482-9066
- Carboline Company**
350 Hanley Industrial Court
St. Louis, MO 63144
314-644-1000
- Courtaulds Coatings**
400 S. 13th Street
Louisville, KY 40203
502-588-9200
- Darling Builder Supply**
1600 Turner Street
Lansing, MI 48906
517-484-5700
- Dayton Superior Corp.**
402 South First Street
Oregon, IL 61061-1836
800-745-3707
- Euclid Chemical Company**
19218 Redwood Road
Cleveland, OH 44110
800-321-7628
- Freda Inc.**
1864 Austin
Troy, MI 48083
810-680-0213
- Greenstreak**
3400 Tree Court Industrial Blvd.
St. Louis, MO 63122
800-793-7832
- Integrated Polymer Industries, Inc.**
29734 Avenida de Las Banderas
Rancho Santa Margarita, CA 92688
714-858-4047
- Lifeliner Corporation**
1535 North Seventh Street
St. Louis, MO 63102
800-444-8143
- Master Builders Technologies**
3543 Winston Court
Marietta, GA 30066
800-545-2590
- W. R. Meadows Inc.**
P.O. Box 543
Elgin, IL 60121
708-683-4500
- Morton International**
100 North Riverside Plaza
Chicago, IL 60606-1598
312-807-3478
- Murray Equipment**
2515 Charleston Place
Fort Wayne, IN 46808
800-348-4753

17. **Restoration Technology**
109 Logan Street, SW
Grand Rapids, MI 49503
616-774-0377
18. **S. G. Pinney & Associates, Inc.**
2500 SE Midport Rd.,
P.O. Box 9220
Port St. Lucie, FL 34985-9220
407-337-3080
19. **Precision Laboratories/
AGmaster Coatings**
P.O. Box 127
Northbrook, IL 60065
800-323-6280
20. **Gustave Renner & Sons**
1625 Hampton Road
Grosse Pointe Woods, MI 48236
313-886-1646
21. **R.N.R. Systems, Inc.**
1009 S. Henry
Bay City, MI 48706
800-722-2641
22. **Seven's Paint & Wallpaper Co.**
2452 Cedar Crest, NE
Grand Rapids, MI 49505
800-220-9630
23. **Sonneborn/Chemrez**
415 East Sixteenth
Chicago Heights, IL 60411
800-243-6739
24. **Spatz Paints**
675 Hanley Industrial Court
St. Louis, MO 63144
314-282-6061
25. **Steelcote Manufacturing Co.**
One Steelcote Square
St. Louis, MO 63103-2990
314-625-2932
26. **Thoro System Products**
7800 NW 38th Street
Miami, FL 33166
800-327-1570 (Kalamazoo, MI)
27. **United Paint**
23361 Telegraph Road
Southfield, MI 48034
810-353-6967
28. **Willamette Valley Company**
P.O. Box 2280
Eugene, OR 97402
800-333-9826
29. **Wisconsin Protective Coatings**
614 Elizabeth St - PO Box 8147
Green Bay, WI 54308
414-437-6561

Appendix C

Liners:

1. **Ascot Products Inc.**
44585 Telegraph Road
Elyria, OH 44035
216-323-5410
2. **Beckman Environmental**
3687 Beebe Road
Kalkaska, MI 49646
616-258-9524
3. **Duro-Last, Inc.**
525 Morley Drive
Saginaw, MI 48601
800-248-0280
4. **Environetics, Inc.**
1201 Commerce Street
Lockport, IL 60441
815-838-8331
5. **GSE Lining
Technology Inc.**
19103 Gundle Road
Houston, TX 77073
800-435-2008
6. **Hunter Agri-Sales**
Box 2
Coatesville, IN 46121
800-536-4131
7. **MPC Containment
Systems, Inc.**
4834 South Oakley
Chicago, IL 60609
800-621-0146
8. **National Seal Company**
1245 Corporate Blvd.
Aurora, IL 60504
800-323-3820
9. **Octa Aqua Flex
Environmental Systems**
P.O. Box 367
Timber Lake, SD 57656
800-768-3316
10. **Price and Company, Inc.**
425 36th Street, SW
Wyoming, MI 49548
800-248-8230
11. **R.N.R. Systems, Inc.**
1009 S. Henry
Bay City, MI 48706
800-722-2641
12. **Seaman Corporation**
1000 Venture Blvd
Wooster, OH 44691
216-262-1111
13. **Sioux Steel Company**
196.5 E. 6th Street
P.O. Box 1265
Sioux Falls, SD 57101
605-336-1750
14. **Thoro System Products**
7800 NW 38th Street
Miami, FL 33166
616-344-7737
(Kalamazoo, MI)
15. **The White Group**
2300 Riverside Drive
Tulsa, OK 74114
800-583-0404
16. **Willamette Valley
Company**
P.O. Box 2280
Eugene, OR 97402
800-333-9826

Appendix D

Self-Contained Storage Buildings:

1. **Eagle Container
Corporation**
4214 Rome West Road
Chillicothe, IL 61523
309-274-5273
2. **Environmental
Products, Inc.**
P.O. Box 900
Orville, OH 44667-0900
216-683-0880
3. **The Haz*Stor Company**
2454 Dempster Street
Des Plaines, IL 60016
810-348-0300
4. **Jennings of Michigan**
2764 Armstrong
Lake Orion, MI 48360
800-632-4153
5. **N.B.T. Ltd. Distributors**
P.O. Box 1000
1123 North Street S.
Dresden, Ontario NOP 1M0
Canada
519-683-2181
6. **P & D Systemtechnic**
P.O. Box 11118
Louisville, KY 40251
502-776-7776
7. **Petro-Chem Equipment/
Safety Storage**
2300 W. Big Beaver,
Suite 12
Troy, MI 48084
810-643-6050
8. **Shields Mfg. Co. Inc.**
624 Maulhardt Avenue
Oxnard, CA 93030
800-552-8783
9. **Turfgrass Inc.**
P.O. Box T
South Lyon, MI 48178
800-521-8873

Appendix E

Portable Containment:

1. **Beckman Environmental**
3687 Beebe Road
Kalkaska, MI 49646
616-258-9524
2. **Compliance Concepts**
24800 N. Industrial Drive
Farmington Hills, MI 48335
800-482-6520
3. **Eagle Container Corporation**
4214 Rome West Road
Chillicothe, IL 61523
309-274-5273
4. **Friend Manufacturing**
Prospect Street, P.O. Box 385
Gasport, NY 14067-0385
800-777-2936
5. **Hunter Agri-Sales**
Box 2
Coatesville, IN 46121
800-536-4131
6. **Murray Equipment Co.**
2515 Charleston Place
Fort Wayne, IN 46808
800-348-4753
7. **Portable Containment Inc.**
P.O. Box 400
Antigo, WI 54409
715-627-4826
8. **R.N.R. Systems, Inc.**
1009 S. Henry
Bay City, MI 48706
800-722-2641
9. **Stoen Farm Supply**
Box 155
Lowry, MN 56349
800-323-5769
10. **Turfgrass Inc.**
P.O. Box T
South Lyon, MI 48178
800-521-8873

Appendix F

Storage/Pads/Containment - Design and Build Services - Technical Services:

1. **Card Construction Company**
1931 Commercial Drive
Mt. Pleasant, MI 48804
517-772-5995
2. **Environmental Structures**
P.O. Box 0218
Hudsonville, MI 49426
800-968-9670
3. **Gregory Construction Co.**
1009 S. Henry
Bay City, MI 48706
800-722-2641
4. **Gustave Rener and Sons**
1625 Hampton Road
Grosse Pointe Woods, MI 48236
313-886-1646
5. **Restoration Technology**
109 Logan St., SW
Grand Rapids, MI 49503
616-774-0377
6. **River City Specialty Products**
902 47th Street, SW
Wyoming, MI 49509
616-249-9440
7. **Tailored Building Systems**
11335 Apple Drive
Nunica, MI 49448
800-955-7005
8. **Turf Maintenance Facility Planners**
2990 Pontiac Trail
Walled Lake, MI 48390
313-960-0061
9. **The White Group**
2300 Riverside Drive
Tulsa, OK 74114
800-583-0404

Appendix G

State, University and Organization Contacts:

- | | |
|--|--------------|
| 1. Agrichemical Retailers Association | 314-256-4900 |
| 2. Alliance for a Clean Rural Environment (ACRE) | 800-545-5410 |
| 3. American Crop Protection Association | 202-296-1585 |
| 4. Michigan Agri-Business Association | 517-336-0223 |
| 5. Michigan Department of Agriculture – Ben Darling | 517-335-6544 |
| 6. Midwest Agricultural Chemicals Association | 712-277-7380 |
| 7. MSU Ag Engineering – Bob Wilkinson | 517-353-3784 |
| 8. MSU Ag Engineering – Midwest Plan Service | 517-353-3297 |
| 9. MSU Crop and Soil Sciences – Greg Lyman (turf) | 517-353-0860 |
| 10. MSU Extension – Dan Rossman | 517-875-5233 |
| 11. MSU Pesticide Education Office | 517-432-2203 |
| 12. Natural Resource Conservation Service – Steve Davis | 517-337-6701 |
| 13. Tennessee Valley Authority National Fertilizer and
Environmental Research Center (NFERC) – Michael Broder | 205-386-2475 |
| 14. U.S. EPA, Office of Pesticide Programs | 703-557-5288 |

Appendix H

Containment/Construction Information:

1. **American Association of Nurserymen**

1250 I Street NW, Suite 500, Washington, DC 20005; 202-789-2900

- Water Quality Action Manual for Greenhouse & Nursery Operators

2. **American Concrete Institute**

Box 19150, Redford Station, Detroit, MI 48219-0150; 313-532-2600

- Catalog of publications available free
- ACI 515.1R-79 — Guide for Waterproofing/Protective Systems for Concrete
- ACI 350R-89 — Environmental Engineering Concrete Structures
- ACI 504R-90 — Guide to Sealing Joints and Concrete Structures

3. **Midwest Agricultural Chemicals Association**

P.O. Box 2125, Northside Station, Sioux City, IA 51104-0125; 712-277-7380

- The "How To's" of Agricultural Chemical Storage
- Fundamental Principles for Agricultural Chemical Storage

4. **Midwest Plan Service**

Agricultural Engineering Department, 216 Farrall Hall, Michigan State University, East Lansing, MI 48824-1323; 517-353-3297

- MWPS-37 Designing Facilities for Pesticide & Fertilizer Containment (1991) (\$15)
- MWPS-C1 Conference Proceedings: Pesticide & Fertilizer Containment (2/92) (\$15)
- MWPS-C2 Conference Proceedings: Pesticide & Fertilizer Containment (2/94) (\$15)
- MWPS-35 Farm and Home Concrete Handbook (1989)
- Plan Numbers 74401, 74402, 74403: Fertilizer Storage Structures

5. **Portland Cement Association**

P.O. Box 726, Skokie, IL 60076-0726; 708-966-6200, ext. 564

- Publications covering concrete, mixtures, resurfacing, reinforcement, designs, subgrades

6. **Tennessee Valley Authority**

National Fertilizer & Environmental Research Center, Muscle Shoals, AL 35660-1010; 205-386-3924 (Technical Library)

- TVA/NFERC-91/3 CIRCULAR Z-291, February 1991 (\$6) — Containment of Fertilizers and Pesticides at Retail Operations
- TVA/NFERC-91/10 BULLETIN Y-223, October 1991 (\$35) — Environmental Handbook for Fertilizer & Agrichemical Dealers

Appendix I

On-farm Storage and Handling:

1. **Michigan State University – county Extension office or campus Bulletin Office (517-355-0240)**
 - Extension bulletin E-2335: *On-Farm Agrichemical Storage and Handling* (Revised 1996)
 - Extension bulletin E-2349: *Protect Your Water Supply From Agrichemical Backflow* (February '93)
2. NCR-522: *Fifty Ways Farmers Can Protect Their Groundwater*. University of Illinois Extension (217-333-2007)
3. *Agrichemical Containment Facility and Michigan Concrete Standards –* Natural Resource Conservation Service
4. *Farmstead Assessment – Work Sheets/Fact Sheets/Standards –* MSU Extension and Michigan Department of Agriculture

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.

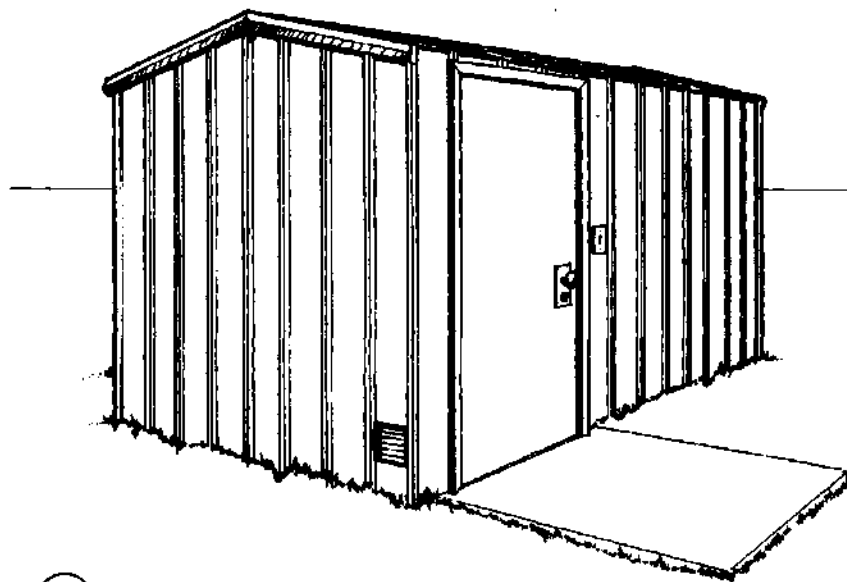
This bulletin is not intended to be all-inclusive, but rather to present a few examples of typical facilities and construction ideas that may be suitable for a variety of sizes and needs. For a more complete treatment of ideas and construction techniques, refer to the Midwest Plan Service Handbook *Designing 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, IA 50011.

Plans and illustrations included

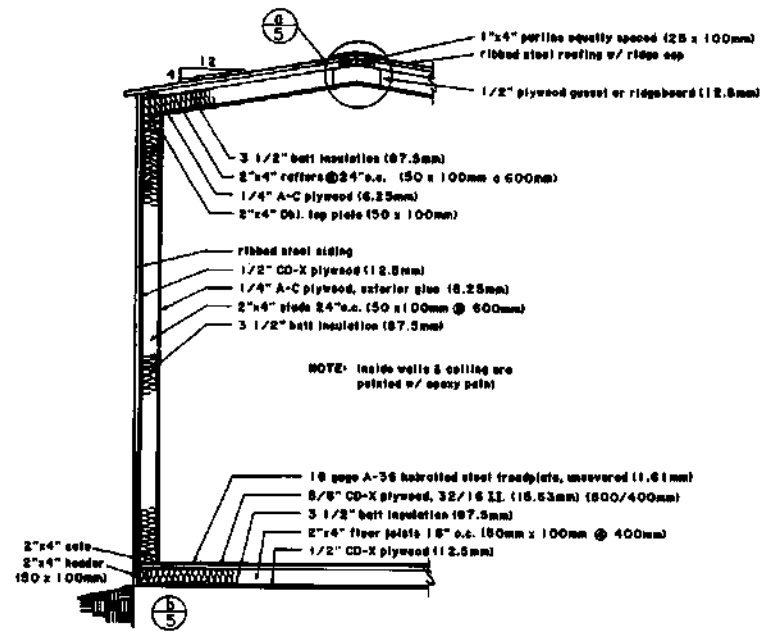
1. Small to medium-sized farm pesticide storage—movable or permanent (Kansas State University).
2. Medium-sized farm pesticide storage—covered mixing/loading pad (Carl Huhn design, DeWitt, Mich.).
3. Medium- to large-sized pesticide storage—open or covered loading pad.
4. Mixing/loading pad and chemical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

SMALL PESTICIDE STORAGE FACILITY

MOVABLE OR PERMANENT

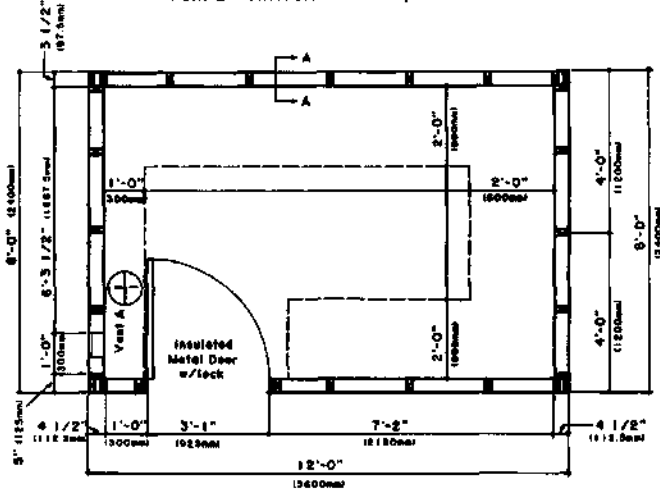


1
1 AGRICULTURAL PESTICIDE STORAGE BUILDING

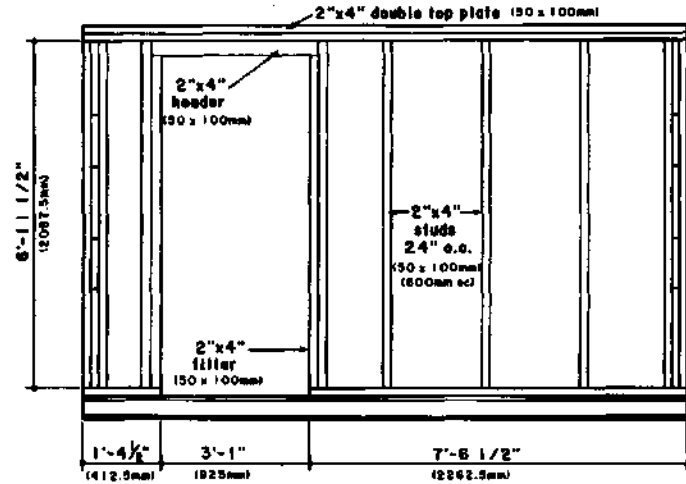


1
3 WALL SECTION A-A

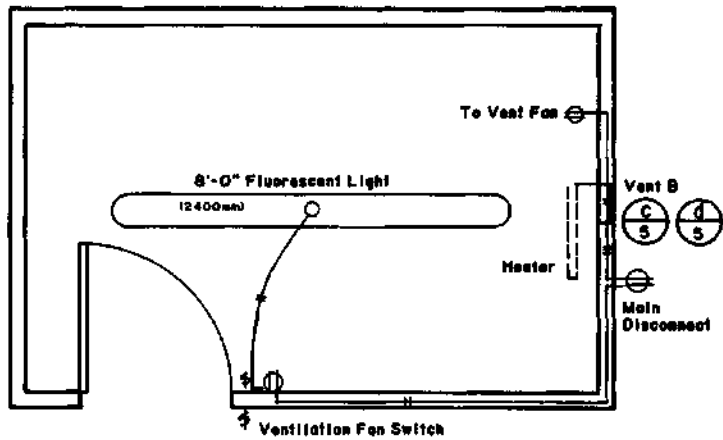
Vent A intake vent-bottom of wall
 Vent B ventilation fan-top of wall



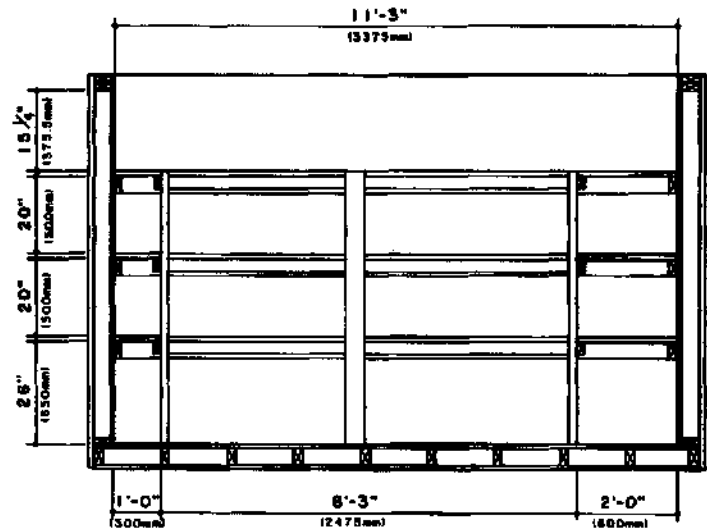
1
2 FLOOR PLAN



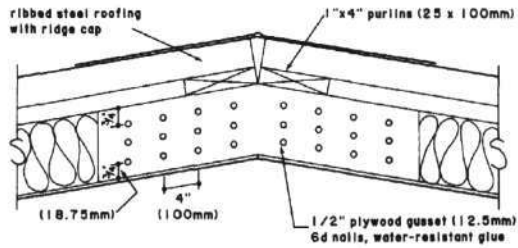
1
4 FRAMING DETAIL



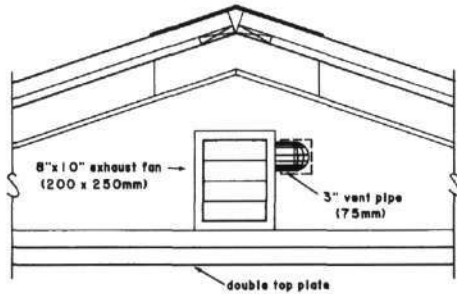
2
2 ELECTRICAL PLAN



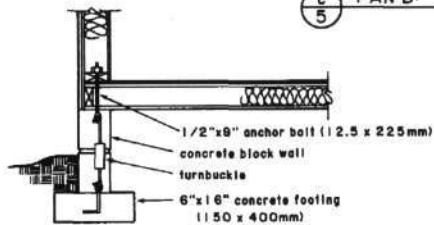
2
4 SHELVING DETAIL



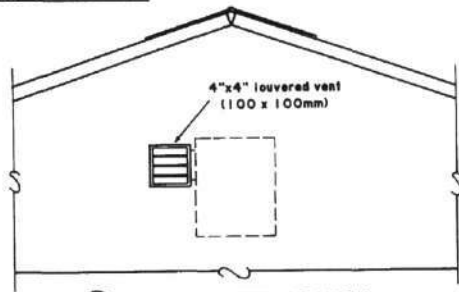
a ROOF DETAIL



c FAN B: INTERIOR VIEW



b FOUNDATION DETAIL

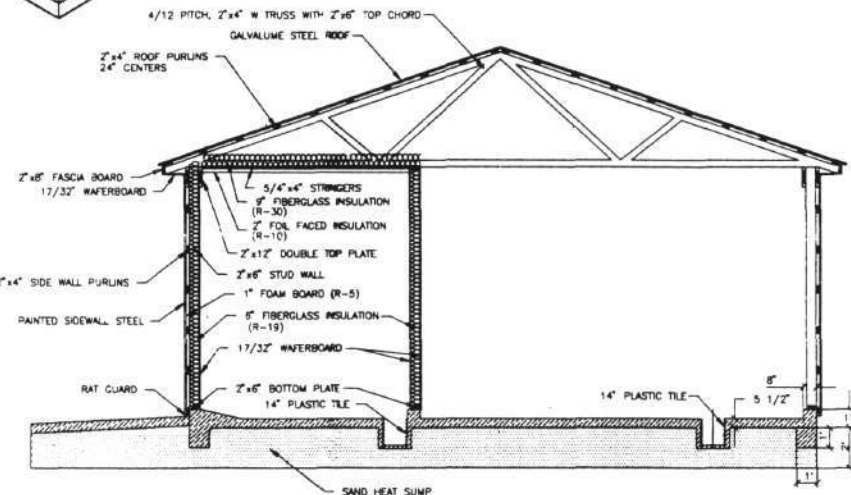
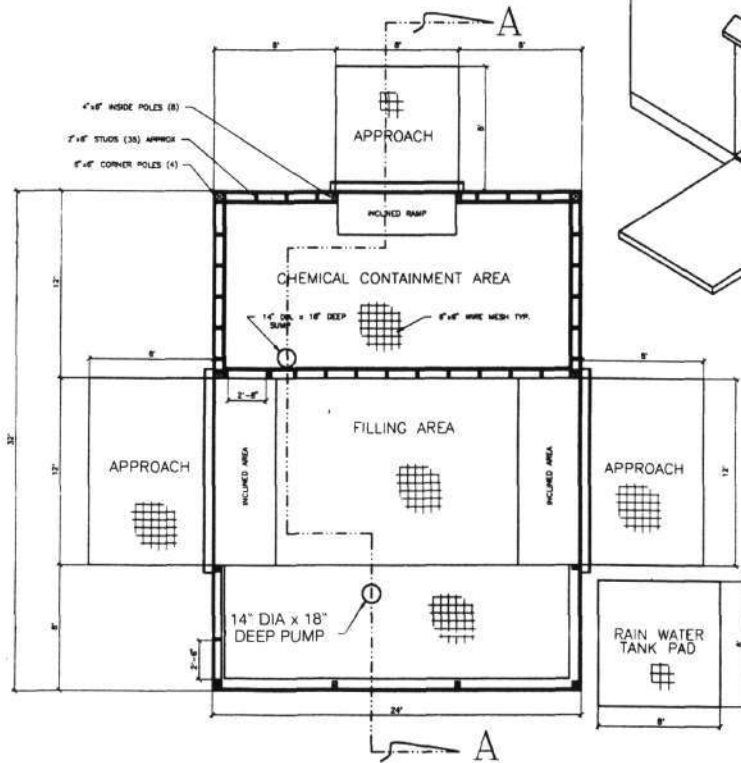
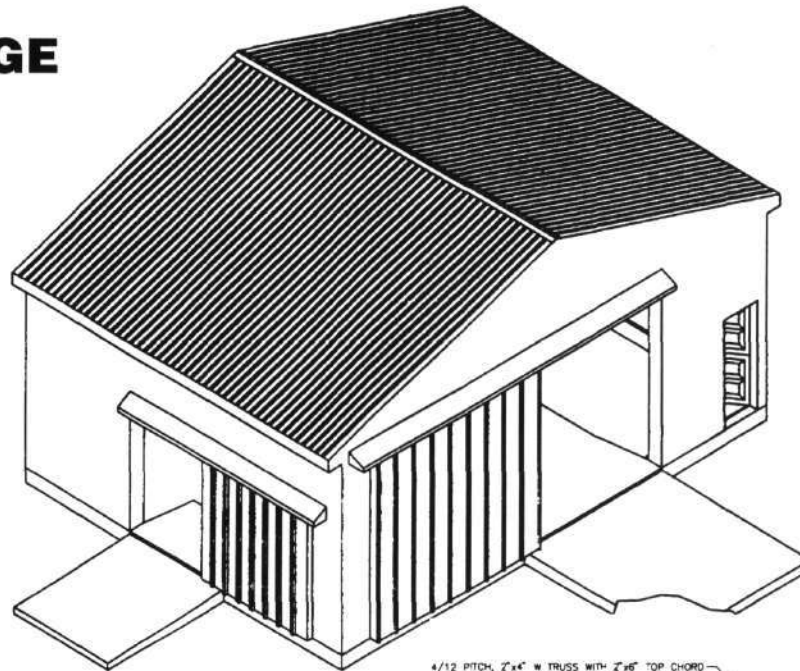


d FAN B: EXTERIOR VIEW

PESTICIDE STORAGE FACILITY BILL OF MATERIALS

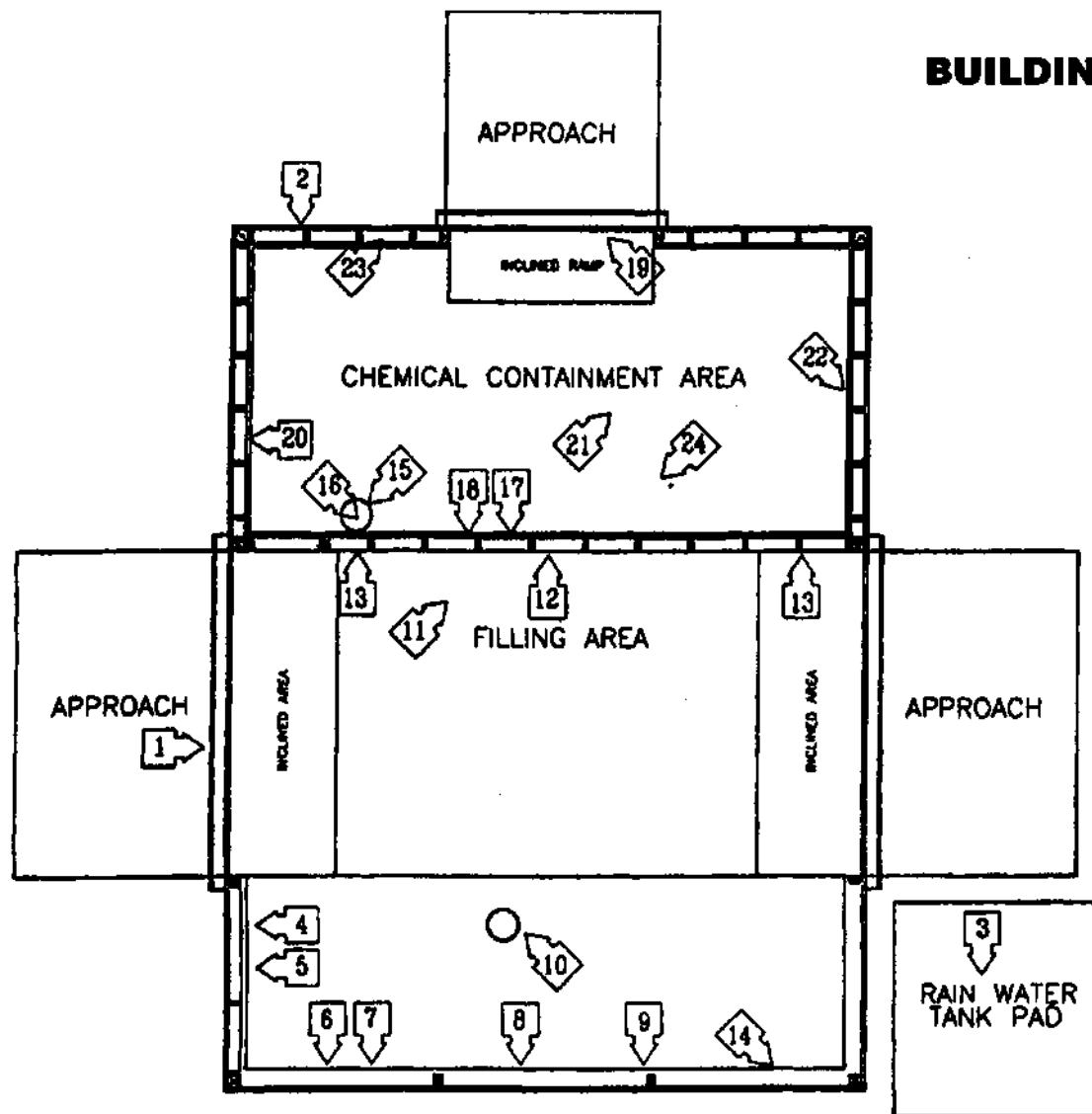
No. Pieces	T	x W	x L	Description	Grade
14	1/2"	x 4'	x 8'	Plywood	CDX
10	2"	x 4"	x 7'	Floor Joists	Construction
2	2"	x 4"	x 12'	Floor Joists Headers	Construction
3	3/4"	x 4'	x 8'	Plywood	CDX
173 ft ²	3 1/2"	x 24"		Floor & Ceiling Batt Insulation	R19
28	2"	x 4"	x 83 1/2"	Studs	Construction
6	2"	x 4"	x 12'	Sole & Top Plates	Construction
6	2"	x 4"	x 6' 5"	Sole & Top Plates	Construction
258 ft ²	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
Dewitt, Michigan

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.

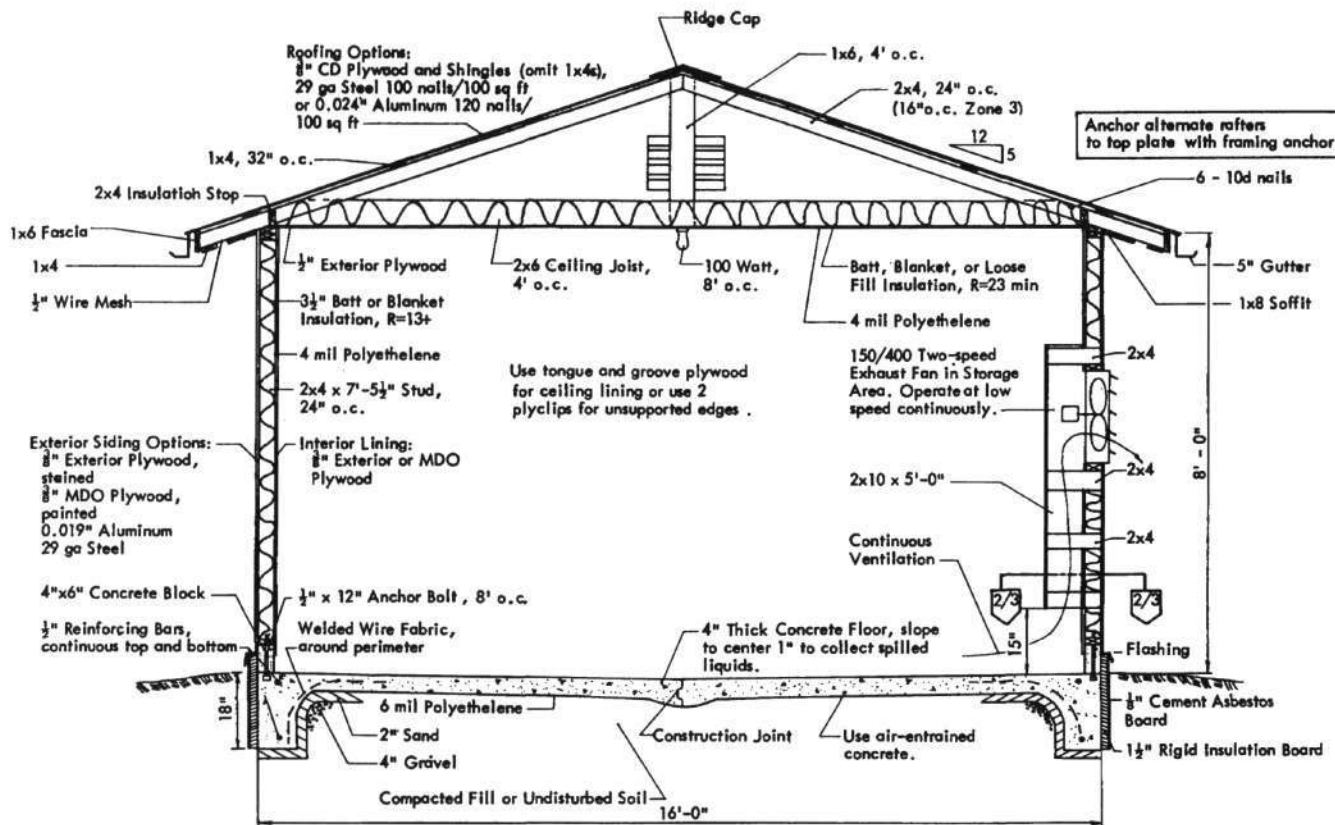
SPRAYER LOADING AND RINSING AREA

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.

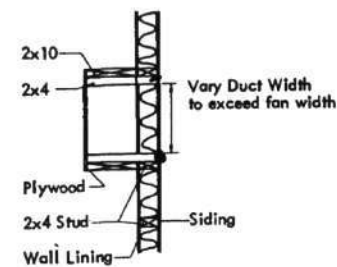
CHEMICAL STORAGE ROOM

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.

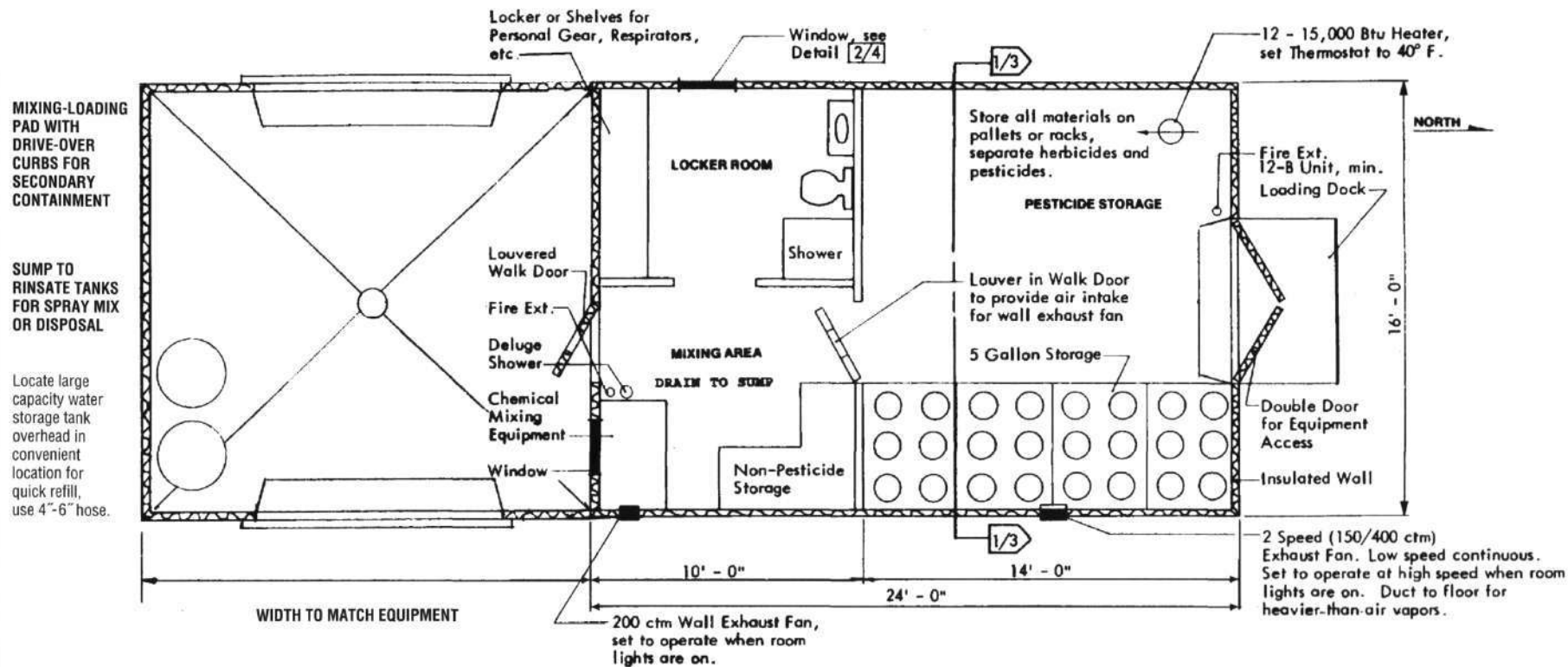
MEDIUM-SIZED TO LARGE PESTICIDE STORAGE STRUCTURE



CROSS SECTION—1/3



FAN DUCT CROSS SECTION—2/3



FLOOR PLAN

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.

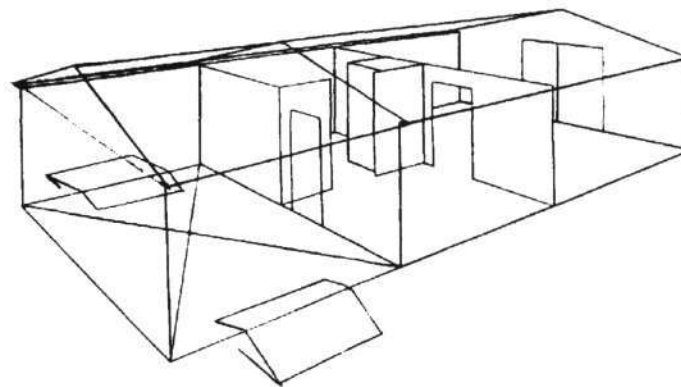
Precise calculations and care in mixing can greatly reduce leftover pesticides. Consult with state and local officials for approved disposal methods.

Consider direct-load mixing equipment for increased safety.

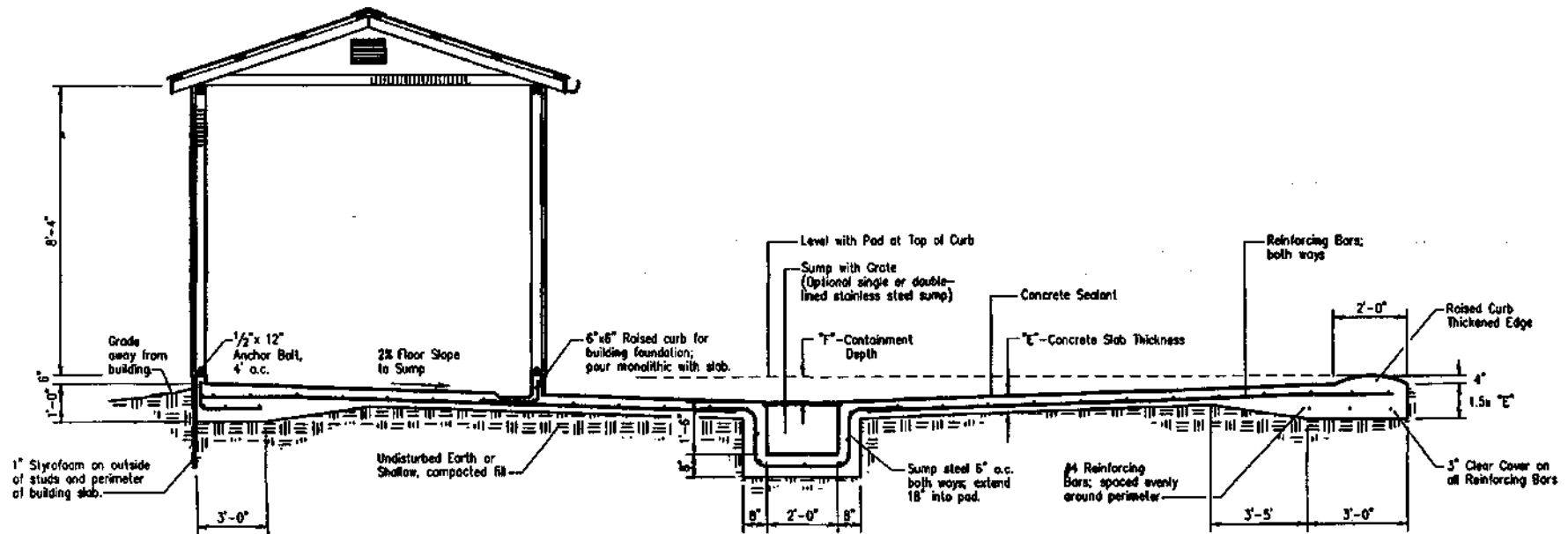
Install vacuum breakers on water lines used for filling rigs to prevent chemicals from entering the water supply system. Install stop and waste valves on all water lines entering unheated areas.

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

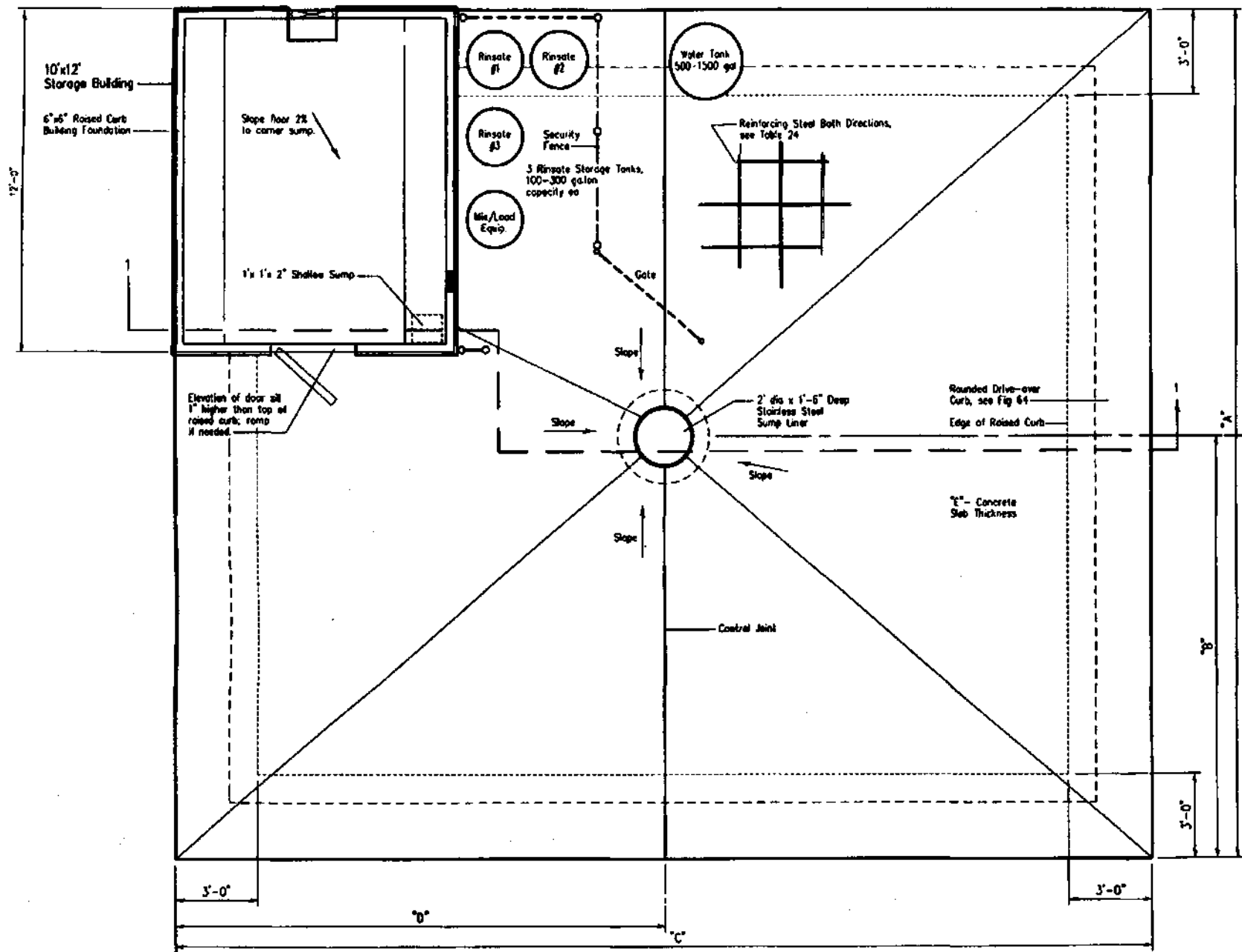
Locate the building on a site where flooding is unlikely. Choose an area such that natural runoff from the storage area, seepage through the soil or runoff from fire fighting will not contaminate residential areas, livestock feeding areas, streams or ponds.



ROOF (OPTIONAL) OVER MIXING-LOADING PAD REDUCES STORM AND WASTE WATER DISPOSAL



MIXING/LOADING PAD CROSS-SECTION



PLAN VIEW OF MIXING/LOADING PAD

MICHIGAN STATE
UNIVERSITY
EXTENSION

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