AGRICHEMICAL HANDLING FACILITIES

BASIC PLANNING AND APPLICATION TRAINING MODULE

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PREFACE

This module has been written to provide basic planning, design, and construction training for agrichemical handling facilities (AHFs). This module is designed to be used for training of employees with experience in planning, design and construction of less complex NRCS practices. It may be used as a working reference by others.

The training module follows NRCS standard 309, Agrichemical Handling Facility, dated 12-2009. The module is designed to be used to help an instructor (experienced in agrichemical handling facilities) teach individual students or small groups of students. A basic understanding of basic structural design concepts for walls and slabs would be helpful for the student. This module may be used as a reference for planning.

References for this module are:

1) Michigan NRCS Standard 309, Agrichemical Handling Facility
2) Michigan NRCS Construction Specifications:
   - MI-152 Excavation
   - MI-154 Earthfill
   - MI-158 Reinforced Concrete
   - MI-159 Plain Concrete
   - MI-165 Geotextiles
   - MI-166 Seeding
   - MI-174 Timber Fabrication and Installation
   - MI-184 Flexible Membrane Liners
3) On Farm Agrichemical Storage and Handling, Michigan State University Extension, E-2335 (Revised) October 1996
4) Michigan Department of Agriculture Regulation 642, Farm Bulk Liquid Fertilizer Storage
5) Designing Facilities for Pesticide and Fertilizer Containment, Midwest Plan Service - 37, Revised First Edition 1995 (A significant portion of the structural recommendations in this publication are not appropriate for NRCS design of facilities. Do not use this as a guide for concrete mix or structural system design)
6) Concrete Inspection Training Module, NRCS Michigan, Dated, June 2009

OBJECTIVE

This module is intended to provide the student with a basic understanding of agrichemical handling facilities. The module follows NRCS standard 309, Agrichemical Handling Facilities. After completion of this module, the student should be able to, with assistance, plan, design, and provide quality assurance (inspection) for less complex AHFs.

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CONTENTS

SECTION 1 – PLANNING

Working with landowners in a comfortable, professional manner is a skill that is developed by each individual. As you progress through different training locations and trainers, you will be able to decide which techniques that best suit your individual style and personality.

In discussing an AHF with a landowner, keep the following topics in mind, and make sure that the landowner is aware of and understands them:

- What is the practicality of the type of AHF being considered?
- Does it fit the landowner's objectives? (Are lights needed for night application in an orchard? Is there access available for delivery of product when the ground is wet? Does it fit his anticipated equipment as well as his existing equipment?)
- Does it meet NRCS standards and specifications?
- Is it affordable?
- Discuss operation and maintenance for the AHF.
- Discuss other possible alternatives.

Your trainer will discuss the necessary information you need to collect from the landowner during the initial site visit. By filling out appropriate data collection sheets (located in the back of this module), you should be able to collect most of the necessary information.

AGENCY INVOLVEMENT

This practice involves the cooperation and involvement of other agencies

For example:

1. Michigan Department of Agriculture – the NRCS practice standard follows the rules of MDA for liquid fertilizer storage and operational areas.
2. Conservation Districts – Districts may have technicians that request help from NRCS.
3. MISS DIG – Utilities are identified by this entity.
4. Townships or other local units of government may have rules that govern the siting of the facility.

INVENTORY

Identify all data needed to provide and support inventory.

In the OFFICE:

a. Site location on plat map
b. Locate and outline work site on FSA aerial photo
c. Locate and outline work site on soil survey
d. Locate site on appropriate topographic map.
e. Find County Drain Maps (if available) to locate possible nearby drains.

In the FIELD:

a. Fill out data collection worksheet for facility as appropriate.
b. Verify 25-year flood elevation and 100-year flood elevation.
c. Make soil borings to determine at what depth the soil is mineral.
d. Verify water table location is at least 2 feet below the bottom of the facility.
e. Identify landowner objectives, both present and future.

SECTION 2 - DESIGN

The design phase consists of:

1) Determining if the planned site location is appropriate for water table, access, well isolation, setbacks, etc.
2) Determining if the planned size and layout are appropriate
3) Verifying that the soils are adequate for the expected loading
4) Final determination of details of facility (concrete thickness, wall heights, standard drawings to use, etc.)
5) Developing the drawings and assembling the specifications (drawings+specs=plans)
6) Developing a cost estimate.
7) Meeting with the landowner to review draft plans
8) Finalizing drawings and specifications

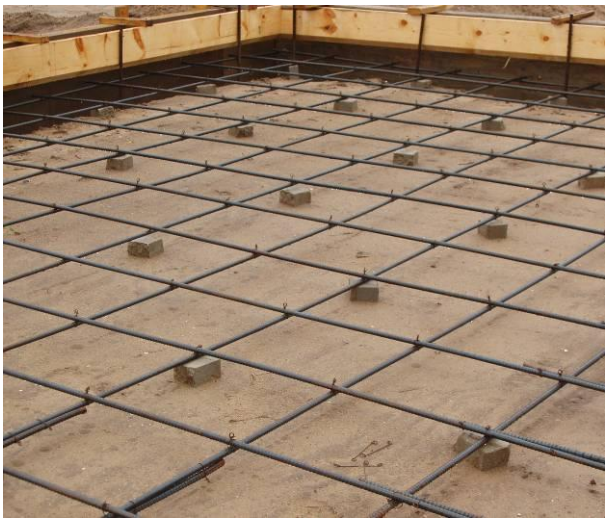
SECTION 3 - PRE-CONSTRUCTION ACTIVITIES

It is very important to schedule a preconstruction meeting with the landowner and the contractor prior to the installation of the practice. A preconstruction meeting allows the contractor and landowner to discuss items that are unclear to them in the approved construction drawings and specifications. It should be made clear that we have a contract with the landowner, and not the contractor. NRCS may not direct the work of the contractor. NRCS provides assistance to the landowner by assuring the contractor's work meets the resource protection needs through following the approved construction plans and meeting the requirements of AHF practice standard. The NRCS personnel are also on site to protect the government interest in funds being expended. A good working relationship between NRCS and the contractor can increase efficiency, as well as, reduce costs for the landowner.

A pre-construction conference with the landowner and contractor should be held with discussion of:

1) Safety requirements
2) Responsibilities for construction layout, quality assurance, and quality control
3) Specifications
4) Drawings
5) Items required in Concrete Inspection Training Module, where applicable
6) Coating and liner requirements
7) Timing of NRCS inspections
8) Requirements for cost share to be released to the landowner

SECTION 4 – SAFETY, CONSTRUCTION AND CHECKOUT



Safety requirements, both state and national, are contained in Part 503 of the National Engineering Manual at:

http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=18419.wba and ftp://ftp-fc.sc.egov.usda.gov/MI/technical/engineering/NEM_Amend_MI-18_503.pdf.

It is recommended that you review the safety requirements with the landowner and contractor at the preconstruction meeting.

An employee with the proper construction approval authority may need to be present during the construction of the facility. The amount of time for NRCS inspection is dependant on the complexity of the facility and trust in the contractor. Construction checkout sheets may be used where available. Photo documentation should document construction.

It is important to avoid giving direction to the contractors employees. Communication at the worksite should be kept between an NRCS representative, the contractor's foreman, and the landowner. This reduces the chance of multiple interpretations of plan requirements. Directing the work, beyond interpretation of specifications, may add liability to NRCS for improperly completed work.

As-built drawings must be completed and kept in the producer's case file.

Unsafe working conditions should be immediately brought to the attention of the contractor's foreman. If the unsafe conditions are not corrected by the contractor, you should explain to the landowner that the work does not meet NRCS standards and specifications. If the unsafe conditions are not then fixed, leave the site and inform your supervisor. Completely document the conversations and the safety violations in the Conservation 6 (Conservation Assistance Notes) or in some other permanent part of the landowner file as directed by your supervisor.

Lead by example. Wear your hardhat on all active construction sites. . Hard hats are required for everyone where overhead equipment is operating.

SECTION 5 - OPERATION AND MAINTENANCE PLAN

An operation and maintenance (O&M) plan is required for be developed for each AHF installed. Example O&M Plans are available on the eFOTG website for several types of facilities.

SECTION 6 – AGRICHEMICAL HANDLING FACILITY STANDARD (NO.) 309

The standard is in Times New Roman italics print in each of the sections. The commentary is in Arial regular print.

DEFINITION

A facility with an impervious surface to provide an environmentally safe area for the handling of on-farm agrichemicals.

This definition is meant to include 5 types of handling/storage: bulk liquid fertilizer storage, dry fertilizer storage, operational area for liquid fertilizer, permanent pesticide storage, and mix-load pad for pesticides. The facilities may be built as a stand alone or combination of any or all of these handling/ storage structures. The bulk liquid fertilizer storage and operational areas will always need to be located together to meet the requirements of state law.

The impervious surface is a relative term. Uncoated concrete is adequate for fertilizers, but not pesticides.

PURPOSE

To provide a safe environment on farm and ranch operations for the storage, mixing, loading and cleanup of agrichemicals, retain incidental spillage, retain leakage, and to reduce pollution to surface water, groundwater, air, and/or soil.

The safe environment is for soil, surface and groundwater, as well as, human health. Recommend adequate ventilation where needed.

CONDITION WHERE PRACTICE APPLIES

This practice applies where:

- *The handling of agrichemicals creates significant potential for pollution of surface water, groundwater, air or soil and a facility is needed to properly manage and handle the chemical operation;*

As with all NRCS standards, we should not provide assistance where a resource problem cannot be fixed, reduced, or prevented. NRCS program may require existing resource concerns be remedied for cost share eligibility.

- *An adequate water supply is available for filling application equipment tanks, rinsing application equipment and chemical containers as needed for the operation;*
- *Soils and topography are suitable for construction.*

This standard does not apply to the handling or storage of fuels. This standard does not apply to commercial or multi-landowner agrichemical handling operations.

Fuels are excluded from this standard by directive from the chief of NRCS. NRCS may not provide assistance for fuel storage facilities. Multi-landowner does not include partnerships where significant resources other than the AHF are shared.

Agrichemical handling facilities may include both pesticide and fertilizer storage, mixing, and loading only when the requirements stated in Michigan Department of Agriculture (MDA) Regulation 642, On Farm Fertilizer Bulk Storage, are followed in addition to the criteria in this standard.

Agrichemical handling facilities utilizing an individual storage container with a capacity of 100,000 gallons or more shall follow the requirements for secondary containment provisions of commercial fertilizer bulk storage as stated in MDA Regulation 641, Commercial Fertilizer Bulk Storage.

The AHF facility design and construction are only governed by state law where fluid fertilizer storage is more than 2,500 gallons in a single container or more than 7,500 gallons at a single location. Facilities with less storage capacity than stated above, still need to meet the requirements of Regulation 642 when combining fertilizer and pesticide storage in a single facility.

Soils and topography suitability is dependant on flood elevations, soil strengths and water tables as discussed later in the training module.

CRITERIA

General Criteria for Permanent Facilities Applicable to All Purposes

Agrichemical handling facilities shall be planned designed and installed to meet all federal, state, local, and tribal laws and regulations.

The walls and floors designed for the agrichemical handling facility shall be constructed of any of the following materials and shall be designed to withstand a full hydrostatic head of any discharged liquid and weight load of material: earth, steel, reinforced concrete, precast concrete blocks, or solid masonry.

Walls and floors are the support for the liner or are used in combination with a liner. Earth, for instance, is not an option as a liner material, but can support a flexible membrane liner.

Capacity for storage of equipment, other than that directly related to the agrichemical handling facility operation, shall not be included in an agrichemical handling facility. Office space, other than for agrichemical handling facility record keeping, shall not be included in an agrichemical handling facility. Since the building is part of the agrichemical handling facility-these restrictions include the entire building in which the agrichemical handling facility is housed.

This section accomplishes 2 purposes:

1) Reduces losses in case of fire. Fire departments will not put out fires in known chemical storage buildings

2) Human health concerns require us to not have people be in these buildings, with the chemical fumes, more than necessary.

Treated seed may not be stored in an agrichemical handling facility.

Treated seed is not a hazardous chemical by state regulations. Storage of treated seed has not been determined to be "agrichemical storage".

The agrichemical handling facility and access areas will be designed for the intended material, equipment and vehicle loads.

This is specific to each site. Design will need to include structural as well as liner requirements and traffic patterns

Primary storage containers placed in an agrichemical handling facility shall be limited to those that are designed specifically for the liquid they are storing/containing and for above-ground operation.

Do not allow use of storage tanks designed for underground installation to be used for above ground storage in NRCS approved facilities. Do not store material in containers that are not properly labeled. We should generally expect pesticides to be in their original containers. Any storage tank for wash water should be chemical resistant.

Secondary containment areas not protected from rainfall shall provide for a complete separation between bulk fertilizers and pesticides while maintaining their individual capacity.

Pesticides are rarely stored in facilities exposed to rainfall.

Prevent outside runoff water from entering the facility for storms up to the 25-year, 24-hour event.

We have had some facilities built that allowed drainage water from the roof to drain back into the building containment area. It is important to grade approaches away from the building. Consider that rain does not always fall straight down. Be sure to grade down from the garage door, and not just the building edge.

Restrict access to agrichemical storage by children, pets, livestock, wildlife, and unauthorized persons. Refer to pesticide labels and state regulations for controlled access requirements at agrichemical handling facilities with pesticide storage.

We expect locks on doors and buildings to be locked when we visit the site for status reviews. This does not keep the owner from opening the doors to let the building "air out" before use.

Year round storage facilities shall be heated, if required, to comply with agrichemical label requirements.

The heat is needed to keep pesticides from freezing. Many facilities have a small well insulated storage room within the facility that is heated by a light bulb. In some facilities, chest freezers or insulated crates (shown above) that are heated with a light bulbs and controlled by thermostats are used.

Primary containment piping shall be located above the ground and within the secondary containment. No posts, pipes, hoses, discharge valves, or other devices may pass through the floor, containment storage walls, or the sump.

"Through" means through from one side to the other. It is permissible to bury conduit in walls where the conduit enters from the outside of the containment and exits through the outside or top. It is important not to have posts and other things pass through the floor as they are discontinuities that may cause cracking of the concrete slab or sump.

Outlet drains are not permitted in the agrichemical collection, storage or handling areas.

This means outlet drains for the liner. Some mix-load pads are concrete bases with flexible membrane liners. Those may be have an outlet drains from the concrete slab. Those drains may not function with the flexible membrane liner in place.

Provide rinsate tanks of adequate number and size as needed for the type of operation, allowing for separation of non-compatible chemicals. The material type shall be suitable for the type of chemical to be contained in the tank.

During the season when the agrichemical handling facility will be used, provide a means of storing or field applying spills according to the agrichemical label within 72 hours following the spill event.

For agrichemical handling facilities exposed to rainfall, if the pad is not power-washed after daily use during the growing season, provide a means of storing or field applying accumulated rainfall according to the agrichemical label within 72 hours following the rainfall event.

Provide an adequate water supply for mixing agrichemicals, rinsing tanks and containers, and for emergency health and safety needs as appropriate for the facility. Provide all pipelines, hoses, backflow prevention and other hardware as needed.

Stabilize disturbed areas, as necessary, to prevent erosion, in accordance with the NRCS Critical Area Planting practice standard (342).

Location: Stationary agrichemical handling facilities (secondary containment and/or mix/load) are not to be located on sites where stationary pesticide storage, mixing, and loading has previously occurred over an extended period of time.

The question is what is an "extended period of time"? The probability of the soil to be already contaminated is the test. If you know they have been mixing or loading in a location that appears to have good soil, but won't grow grass, it is not a good location due to soil contamination even if they mixed there for only a few times. Some of the thought behind this is that we should be able to tell by testing if the facility has failed.

Locate the agrichemical handling facility above the 100-year flood elevation.

The lowest component shall be at least 2 feet above the seasonal high water table.

Locate the mix-load pad or operational pad adjacent to or as near the agrichemical storage facility as practical when chemical storage is not incorporated into the facility.

Tile drainage tubing that underlies the facility must be removed or broken in a manner to eliminate the risk of agrichemicals from entering the drainage system.

Agrichemical handling facility locations must meet the following minimum separation distances:

Wells (private)[1/]	*150 ft*
Wells (public Type I and IIa)[2/]	*2000 ft*
Wells (public Type IIb and III)[2/]	*150 ft*
Surface waters	*200 ft*
Fuel storage tank < 1100 gal	*40 ft*
Fuel storage tank > 1100 gal	*5 ft*

[1/] As defined by Part 127, 1978 PA 368, Michigan Public Health Code.

[2/] As defined by 1976 PA 399, Michigan Safe Drinking Water Act.

Public wells are those wells that supply water to the piping/bulk tank/other food contact surfaces or, for employee consumption through sinks/water fountains or other fixtures. A yard hydrant does not make a well "Public". Private wells include all water wells, including water wells for irrigation and livestock.

It is possible to obtain a variance for a separation distances as small as 75 feet from Type IIB and III public wells. **The facility must be located the maximum practical distance from the well to have a variance considered**. Variances have been granted to allow a mix/load pad to be placed adjacent to an existing storage facility and where the farmstead was so small that the facility would have needed to be placed a considerable distance into the crop field. It is not possible to get a variance to less than 150 feet from a private well. This may seem to be illogical, but state law on well construction is different for private and public wells.

Coatings and Liners: Coatings and liners shall be designed to withstand hydrostatic head and anticipated traffic loads. The coating or liner shall be flexible enough to bridge joints and provide watertightness.

An impervious coating or liner material which will prevent deterioration of the concrete and absorption of pesticide will be applied on all concrete surfaces, including mixing/loading areas and storage areas, exposed to pesticides.

Coating materials must be designed to remain flexible after curing, aging, cold weather, sunlight, and exposure to anticipated agrichemicals, loads and traffic. Coatings shall be epoxy, polyurea, or vinyl ester. Coatings shall be recommended by the manufacturer for secondary containment, continuous contact, immersion, or contact for 7 days or more for the chemicals mixed, loaded, and stored in the facility.

A review in 2009 indicated there is no industry standard for performance descriptions of coatings. The list above is meant to provide flexibility in determining whether a coating may be acceptable. Each facility will store, load and mix its own distinct chemicals and needs to be evaluated for that mix of chemicals. It would be appropriate for the coating supplier to respond by letter as to the expected performance of the proposed coatings in response to a list of pesticides provided by the facility operator.

The coatings or liner shall be installed in accordance with the manufacturer's specifications.

Exposed surfaces of fertilizer containment will be designed to resist penetration and absorption of fertilizer and fertilizer contaminated waters. An impervious coating or liner is required for secondary containment facilities constructed out of earth, concrete blocks or similar materials. For cast in place reinforced concrete walls and floors, an impervious coating or liner is not required for either liquid or dry fertilizers.

All coatings or liners shall be compatible with the materials being stored within the secondary containment area.

Minimum Thickness for Flexible Membrane Liners	
Type	*Minimum Thickness*
HDPE	*40 mil thickness*
LLDPE	*40 mil thickness*
PVC	*30 mil thickness*
RPE	*45 mil thickness*
EPDM	*45 mil thickness*

RPE = Reinforced Polypropylene

Flexible membrane liners shall be installed under the supervision of a qualified representative of the manufacturer and all field constructed seams shall be tested and repaired in accordance with the manufacturer's recommendations.

NRCS is not the expert on seaming different flexible membrane materials. The manufacturers have the appropriate seaming and testing equipment. The majority of liners will have some kind of seaming, if only for the corners and sumps.

Foundation Preparation: In order to provide for slab friction and drainage, concrete agrichemical handling facilities will be provided with a foundation of at least 4 inches of compacted sand on native mineral soil or compacted sub-base. The sand will have no more than 12 percent passing the No. 200 sieve (74 microns) and be free from clay lumps.

The majority of failures of AHFs are due to foundation problems. Some of the failures have been due to frost action where soils are clays and the water table was higher. Other failures have been due to the facility being placed on part cut and part fill. Where AHFs are placed on sloping ground, the foundation should be prepared to avoid a hinge point in the foundation. This can be accomplished through overexcavating the entire foundation to into a planer surface. The foundation can be either sloping or flat. If the foundation is sloping, a variable sand fill depth will be needed.

Flexible membrane liners will be placed on relatively smooth ground that is free of stumps, roots, rocks, sticks, or other items that could puncture the liner or interfere with the operation. Surface preparation will be provided as required by the manufacturer.

Of course, flexible membrane liners will be placed on smooth concrete or be padded as necessary. A common padding is nonwoven geotextile.

Structural Requirements: Concrete will be structurally designed for: 1) the wheel loads of the existing or anticipated loaded equipment; 2) the loads imposed by storage tanks and other equipment; and 3) temperature and shrinkage. If the containment is to serve as part of a foundation or support for a building or roof, consider the total load in the structural design of the concrete.

Design slabs for loads using ACI 360, Chapters A1 or A3, as appropriate. Chapter A3 is the Corps of Engineers method and is appropriate for semi loads and tire pressures. Chapter A1 is the Portland Cement Association method and is appropriate for the low pressure tires normally used on farm equipment.

Design raft (mat) foundations to accommodate frost/freeze conditions. Locate roof/building footings below the anticipated frost depth unless measures are designed to accommodate frost/freeze conditions. When vertical frost footings are used, there must be a smooth transition from the footing to the floor along the interface with the subgrade to reduce the stress from drying shrinkage, and expansion and contraction from temperature changes of the concrete.

Mat foundations are used to allow the concrete slab to shrink to the middle from all sides. Best performance has been obtained by providing a low friction concrete - soil interface and avoiding anchoring the slab edges. A sand base has roughly ½ the friction that a gravel or clay base has. Slabs may be anchored by any abrupt vertical changes in the concrete-foundation interface.

If the facility is to have a roof, snow and wind loads shall be as specified in the 2003 Michigan Building Code.

NRCS is not an expert in building design. NRCS is requiring that a qualified building designer/contractor certify the roof/building design. The following statement is suggested for the drawings:

The contractor shall provide roof/building construction data to the NRCS inspector a minimum of 5 days before construction of the facility is started. The data shall include:

1) Truss capacity, span and spacing
2) Truss to post/header connection details
3) Header wood type, span, and size
4) Post wood type, treatment, size, embedment depth, and spacing
5) Bracing plan

I certify the roof and roof support systems meet the requirements of the 2003 Michigan Building Code for wind and snow loads.

_____

Licensed Builder or P.E. ***Date***

NRCS is approving construction of this roof/building on the basis that they have been certified by a registered professional engineer or licensed builder. Based on the information provided, the roof/building appears to meet NRCS standards and specifications. Any deficiencies in the design or construction are the responsibility of the professional engineer or licensed builder whose signature appears on the construction drawings.

_____

NRCS Representative ***Date***

Use of specification NRCS-MI-158 Reinforced Concrete Construction is required for slab and structural reinforced concrete. Reinforced concrete slabs and walls shall have a minimum thickness of 6-inches.

Design of slabs this thin will normally assume no flexural (load carrying) strength of the steel. This is due to the relatively thin concrete section.

Specification 158 is referenced here to provide for appropriate concrete that is low in shrinkage. It is unusual to reference a construction specification in a standard. This is referenced because there is no appropriate industry standard that applies to slab concrete mix design.

Reinforced concrete will comply with the guidance in the current ACI-318, except for soil-supported slabs.

For soil-supported slabs 50 feet or less in length, the minimum steel reinforcement provided when the liner is dependent upon uncracked concrete is 0.18 percent of the concrete area. For slabs with a length or width over 50 feet the steel ratio in the direction of that length or width that is greater than 50 feet shall be increased to 0.18 percent times the length divided by 50 feet.

This requirement is from research of pavement design and experience with concrete in Michigan. A sand base is assumed. Subgrade drag theory assumes friction resists the slab expanding and contracting from a center point. Friction is measured by weight times friction factor. Simply put, as a slab contracts, the stress at the center of the slab increases proportionally to both the slab length and thickness. This explains the proportional increase in reinforcing steel as the slab is thicker or longer. Note that the steel reinforcement in slabs 8 inches thick and less should be located 1 ½ to 2 inches below the top of a slab

Where reinforced concrete construction is required and also requires contraction or expansion joints or other conditions where steel is not continuous through a joint, a waterstop is required.

We try to avoid joints in these structures. Joints are difficult to seal well, even with waterstops. Waterstops are normally located at least a few inches into the concrete, leaving more surface area exposed to chemicals.

When a flexible membrane liner is used over the concrete walls and/or floor, the slab may be plain (non-reinforced) concrete in accordance with Construction Specification MI-159, Plain Concrete.

The concrete needs to be smooth, or padding will be needed between the membrane and floor. Padding is normally a nonwoven geotextile.

Fabricated structures shall be designed according to the criteria in the following references as appropriate:

Timber - National Design Specifications for Wood Construction, American Forest and Paper Association;

Steel – Manual of Steel Construction, AISC, American Institute of Steel Construction;

Masonry - Building Code Requirements for Masonry Structures, ACI 530, American Concrete Institute;

Appurtenances: Sumps will be designed as shallow and small as practical while allowing sufficient size for cleaning. Construct sumps of corrosion and leak resistant material. If the sump will create a hazard to traffic, cover the sump opening with a corrosion resistant grating capable of supporting anticipated loads. A manually activated pump shall remove accumulated liquids. Underground outlets shall not be used.

Sumps should be small to force the operator to clean up spills when the happen. It is a concern that if the spills are not cleaned up:

1) The epoxy or other coating may be damaged by prolonged exposure.
2) The operator will end up with a "chemical cocktail" in the sump that must be disposed of in a hazardous waste landfill.

Manual operation of pumps will help reduce the chances that the chemicals are pumped to the wrong place or into already full temporary storage.

Sumps or low point shall be located within the containment area.

Design appurtenances to prevent damage from freezing and thawing.

Use hoses, pipes, valves, connectors, filters, tanks, and related plumbing material compatible with the agrichemicals being handled. Suction hoses shall be designed for vacuum operation.

Backflow prevention devices shall be provided on pipes supplying non-contaminated water. Design transfer piping to prevent backflow between the pump and the storage tank(s). Air gaps are acceptable backflow prevention measures. Check valves are not acceptable backflow prevention measures.

This is a state requirement to protect backflow of chemicals into the groundwater through wells.

Additional Criteria for Mix-Load Pads for Pesticides

The pad width shall be at least 2 feet wider than the widest piece of equipment (booms retracted) and the pad length at least 2 feet longer than the maximum length of the application equipment. Only the additional room necessary to accommodate entrance and exit ramps, worker access, tanks, pumps, power washers, hoses, temporary placement of agrichemical containers, storage of sprayers, and other necessary equipment shall be provided.

Ramps, rounded curbing, or other methods will be designed to provide a smooth transition for entrances and exits.

The floor of the facility shall slope to a watertight catch basin or sump.

Minimally sized sumps, shallow depressions, or cleanup channels must be provided to collect spills, rinsate, sediment, etc. in each containment area.

The mix load area shall provide the capacity to hold at least 750 gallons or the volume of the largest application equipment tank, whichever is less.

Additional Criteria for Permanent Pesticide Storage

When more than 60 gallons of Class I, II, or III flammable or combustible liquids or a single storage container larger than 5 gallons of Class I, II, or III flammable or combustible liquids are stored in an agrichemical handling facility, National Fire Protection Association (NFPA) 30, Flammable and Combustible Liquids Code, Chapter 4, shall be followed. Storage cabinets or other remedies must be installed.

Storage will be provided that will contain 110 percent of the largest container stored in the area.

Ventilate all enclosed areas while occupied. This may be accomplished by the use of door openings, removable walls or a forced air ventilation system.

The floor shall be graded to a low corner to collect concentrated liquids.

A sump is not allowed for pesticide storage facilities. Only low corners as stated above.

Additional Criteria for Secondary Containment of Bulk Liquid Fertilizers

Primary storage containers of bulk fertilizer shall be located within a walled or diked containment area.

Primary storage containers shall be anchored, elevated, or secured by some other means as necessary to prevent flotation or instability.

An option to this is to be sure to draw down all storage tanks to just above the floor before drawing any one tank below that level. At that point, a spill should not float an empty storage tank. Tanks may still need to be anchored to resist wind loads.

Primary storage containers and appurtenances shall be constructed of materials that are resistant to corrosion, puncture, or cracking.

Primary storage containers shall be labeled as fertilizer in order to identify the contents within. The storage container labeling shall be in a prominent location with lettering that is a minimum of 4 inches in height.

Primary storage containers and appurtenances shall be secured to provide reasonable protection from wildlife, vandalism, and unauthorized access at all times. The container and appurtenances may be secured using fencing, lighting or locks.

Some farm chemicals are used for drug making and fertilizers can be used in the making of explosives.

All storage containers shall have the capability to have the liquid level within the storage container measured readily and safely.

All storage containers shall be equipped with a shutoff valve that is located on the storage container or at a distance from the storage container dictated by standard engineering practice.

For multiple valves that are located on a single line, the valve closest to its storage container shall be securable.

Walls or dikes shall not be more than 4 feet in height above interior grade unless provision is made for safe access and exiting.

Most structures do not need to be deeper than 4 feet. Normally, stairways are used for access. Be sure the stairway does not damage the containment liner.

For earth embankment dikes, the minimum sum of the inside and outside slopes of the settled embankment shall not be less than five horizontal to one vertical with neither slope steeper than 2:1. Slopes shall be designed to be stable in all cases.

Avoid slopes steeper than 4:1 on the outside. Mowing is difficult on steeper slopes. Inside slopes steeper than 3:1 can be slippery when wet.

The minimum top width for an earthen embankment is 4 feet.

Secondary containment areas protected from rainfall shall contain a minimum of 110 percent of the volume of the largest storage container within the containment area, plus the displacement volume that is occupied by all other tanks within and below the height of the wall or dike.

Secondary containment areas not protected from rainfall shall contain a minimum of 110 percent of the volume of the largest storage container within the diked area, plus the volume that is occupied by all other tanks within and below the height of the dike, plus the volume of a 6-inch rainfall.

The floor shall be graded to a low corner or sump to collect concentrated liquids.

A sump is allowed fertilizer storage facilities.

Allow 2 feet minimum distance for inspection and maintenance between storage containers and, between storage containers and the secondary containment wall.

This also allows some space in case of a lower leak that is pressurized.

Additional Criteria for Operational Area for Bulk Liquid Fertilizer Storage

Operational areas shall be utilized for transferring, loading, unloading, and mixing fertilizers at farm storage facilities.

The operational area containment shall provide the capacity to hold at least 750 gallons or the volume of the largest application equipment tank, whichever is less.

The operational area shall have a minimum width of 10 feet and a minimum length of 20 feet and shall be sized with booms retracted.

Loading and unloading operations shall be supervised at all times by an attendant who is familiar and/or trained in the procedures that are used for the control and recovery of discharges.

Any fill or unloading point of the mobile container shall be positioned over the containment area during loading or unloading or assure retention of any discharge.

A portable operational area meeting the capacity and dimension criteria in this section and constructed of durable material compatible with the liquid fertilizer being stored within the secondary containment area will satisfy the requirements of an operational area.

Additional Criteria for Bulk Dry Fertilizer

A storage facility shall store non-fluid fertilizers in a sound structure that has a cover or roof, sidewalls, and a base sufficient to prevent contact with precipitation and surface waters. If the dry fertilizer is stored outdoors, the storage facility shall place the dry fertilizer on a ground cover that is sufficiently impermeable to prevent seepage or runoff and shall completely cover the dry fertilizer with a tarpaulin or other suitable covering to prevent contact with precipitation and surface water.

A storage facility shall allow that all loading, unloading, mixing, and handling of dry fertilizer is on an impermeable surface of a size and design that will contain the fertilizer and allow for the collection of spilled material to be recycled and applied at agronomic rates.

CONSIDERATIONS

The consideration section of the standard includes items that are generally good to do, but are not required. This section provides ideas to consider that may make the facility easier to operate or may be in conflict with some other important desired attribute of the facility. An example of this is the section on prevailing winds. It would be good to have all facilities downwind of residences. At a particular farmstead, you may need to choose between the prevailing winds in an undesirable direction, moving the rest of the farmstead, and reduced security due to placement of the AHF away from the farmstead. If prevailing wind was a criteria, you would need to make the prevailing wind the deciding factor. By placing it in "considerations" there is a chance to use professional judgment to best solve the resource concern.

Consider the potential effects of installation and operation of agrichemical handling facilities on the cultural, archeological, historic, and economic resources.

Consider the prevailing winds during the season when the agrichemical handling facility will be used. As much as practical, locate agrichemical handling facilities downwind and downhill from

sensitive areas such as waters of the state, wetlands, sensitive upland areas, houses, play areas, gardens, and livestock feedlots.

Consider including measures to reduce the accumulation of sediment transported by wind, vehicles, or other means.

For roofed agrichemical handling facilities, consider providing measures to prevent blown-in precipitation.

Consider installing an apron at the facility entrance to minimize sediment transport onto into the facility, mix/load pad or operational area.

Consider siting the facility to meet the following guidelines:

Farm buildings	*50 ft.*
Residential/business building	*200 ft.*
Public roads	*50 ft.*
Pressurized water lines (Domestic/livestock use)	*25ft.*
Property lines	*25 ft.*

Siting is a consideration in relation to farm buildings. The fire department is not likely to put out a fire in an AHF. The reason they will not generally put out the fire is that there is less potential pollution to surface and groundwater if they let the AHF burn. Therefore, any building of significant value should not be within 50 feet of the AHF. It may be reasonable to place an AHF adjacent to a low value building. The setback from farm buildings is left to the designer based on risk. The landowner should be informed that the fire department will most likely not put out a fire in an AHF. They will be on site to keep the fire from spreading to other buildings.

Other setbacks will be dictated by zoning or local laws.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use.

Support data documentation requirements are as follows:

- *Inventory and evaluation records*
  - *Assistance notes or special report*
- *Survey notes, where applicable*
  - *Design survey*
  - *Construction layout survey*
  - *Construction check survey*
- *Design records*
  - *Physical data, functional requirements and*

site constraints, where applicable
  - *Soils/subsurface investigation report, where applicable*
- *Design and quantity calculations*
- *Construction drawings/specifications with:*
  - *Location map*
  - *Designed by" and "Checked by" names or initials*
  - *Approval signature*
  - *Job class designation*
  - *Initials from preconstruction conference*
  - *As-built notes*
- *Construction inspection records*
  - *Assistance notes or separate inspection records*
  - *Construction approval signature*
- *Record of any variances approved, where applicable*
- *Record of approvals of in-field changes affecting function and/or job class, where applicable.*

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

Example O&M plans are available on the NRCS Michigan web site under technical resources/engineering.

REFERENCES

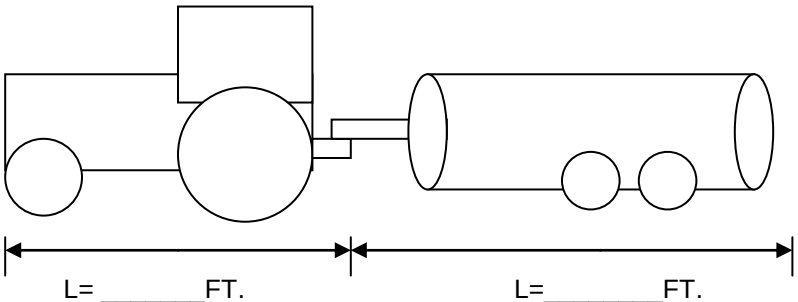
Michigan State University Extension Bulletin E-2335 "On-Farm Pesticide Storage and Handling"

MWPS - 37 may be used for items other than structural design. The structural section has several deficiencies causing it to be extremely conservative in its handling of reinforced slabs. Its information on concrete mixes is also deficient.

MIX LOAD PAD DATA COLLECTION

LANDOWNER:_____ DATE:_____

COUNTY:_____ BY:_____



L= _____FT. L=_____FT.

MAXIMUM WIDTH = _____FT. SPRAYER TANK =_____GAL.

SIZE:

MINIMUM PAD WIDTH = WIDEST PIECE OF EQUIPMENT + 2 FT.
(_____FT. + 2 FT.) = _____FT.

MINIMUM PAD LENGTH = LONGEST PIECE OF EQUIPMENT + 2 FT.
(_____FT. + 2 FT.) = _____FT.

MINIMUM RAMP WIDTH = WIDEST PIECE OF EQUIPMENT + 2 FT.
(_____FT. + 2 FT.) = _____FT.

LOCATION:

WELLS (PRIVATE)……	150 FT.
SURFACE WATERS……	200 FT.
FUEL STORAGE TANK(<1100 GAL.)……	40 FT.
PUBLIC WELLS……..See Standard	

CONSIDER THE FOLLOWING SETBACKS:

FARM BUILDINGS…….	50 FT.
RESIDENTIAL OR BUSINESS……	200 FT.
PUBLIC ROADS…….	50 FT.
PROPERTY LINES……	25 FT.
WATER LINES……	25 FT.

DO NOT LOCATE STATIONARY AHF'S ON EXISTING MIXING SITES!

PESTICIDE SECONDARY CONTAINMENT DATA COLLECTION

Landowner Name_____ County_____ Date _____

1. Type, size, and number of containers. List of chemicals stored.

2. Draw a site map indicating location of the facility in relation to other buildings, ditches, etc.

3. Type of material:
   ____ Building with concrete cast-in-place walls and floor
   ____ Shed building with flexible membrane liner
   ____ Other

4. Location of the facility must meet the following setbacks:
   Wells (Private)……..150 ft.
   Surface Waters including catch basin inlets…….200 ft.
   Fuel tanks < 1100 gallons…….40 ft.
   Fuel tanks > 1100 gallons……..5 ft.
   Public wells…….See Standard

5. Consider locating the facility to meet the following setbacks:
   Farm Buildings…….50 ft.
   Residential or Business…….200 ft.
   Public Roads…….50 ft.
   Pressurized Water lines for domestic or livestock use…..25 ft.
   Property Lines……25 ft.

Do not locate stationary containment facilities on existing mixing sites..

LIQUID BULK FERTILIZER SECONDARY CONTAINMENT DATA COLLECTION

Landowner Name_____ County_____ Date _____

1. Dimensions and orientation of all tanks that will be stored in the containment facility.

2. What will be stored in each tank?

3. Draw a site map indicating location of the facility in relation to other buildings, ditches, etc.

4. Type of material:
   ____ Wood Post and Plank Wall with synthetic liner
   ____ Large Concrete Block with synthetic liner
   ____ Earthen Berm with synthetic liner
   ____ Concrete cast-in-place walls and floor
   ____ Concrete cast-in-place walls, earth floor, with synthetic liner attached to wall
   ____ Other

5. Location of the facility must meet the following setbacks:
   Wells (Private)…….150 ft.
   Surface Waters including catch basin inlets…….200 ft.
   Fuel tanks < 1100 gallons…….40 ft.
   Fuel tanks > 1100 gallons……..5 ft.
   Public wells…….See Standard

6. Consider locating the facility to meet the following setbacks:
   Farm Buildings…….50 ft.
   Residential or Business…….200 ft.
   Public Roads…….50 ft.
   Pressurized Water lines for domestic or livestock use…..25 ft.
   Property Lines…….25 ft.

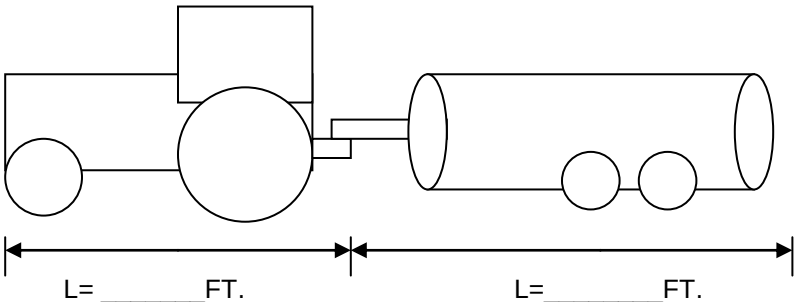
7. An operational area is required. Minimum 10 ft. x 20 ft.. Must store a minimum of 750 gallons.

Do not locate stationary containment facilities on existing mixing sites

OPERATIONAL AREA FOR LIQUID FERTILIZER DATA COLLECTION

LANDOWNER:_____ DATE:_____

COUNTY:_____ BY:_____



L= _____FT. L=_____FT.

MAXIMUM WIDTH = _____FT. FERTILIZER TANK =_____GAL.

SIZE:

MINIMUM PAD WIDTH = 10 FT. PROPOSED WIDTH = _____FT.

MINIMUM PAD LENGTH = 20 FT. PROPOSED LENGTH = _____FT.

LOCATION:

WELLS (PRIVATE)……	150 FT.
SURFACE WATERS……	200 FT.
FUEL STORAGE TANK(<1100 GAL.)……	40 FT.
PUBLIC WELLS……..See Standard	

CONSIDER THE FOLLOWING SETBACKS:

FARM BUILDINGS……	50 FT.
RESIDENTIAL OR BUSINESS……	200 FT.
PUBLIC ROADS……..	50 FT.
PROPERTY LINES……	25 FT.
WATER LINES……	25 FT.

Operational Areas are required for all Secondary Containment of Bulk Fertilizers

DO NOT LOCATE STATIONARY AHF'S ON EXISTING MIXING SITES!

DRY BULK FERTILIZER SECONDARY CONTAINMENT DATA COLLECTION

Landowner Name_____ County_____ Date _____

1. Tons of each type of dry fertilizer to be stored in the containment facility.

2. Note working area required for handling fertilizer.

3. Draw a site map indicating location of the facility in relation to other buildings, ditches, etc.

4. Type of material:
   - ____ Wood Post and Plank Wall with synthetic liner
   - ____ Large Concrete Block
   - ____ Concrete cast-in-place walls and floor
   - ____ Other

5. Location of the facility must meet the following setbacks:

   - ____ Wells (Private)……..150 ft.
   - ____ Surface Waters including catch basin inlets…….200 ft.
   - ____ Fuel tanks < 1100 gallons…….40 ft.
   - ____ Fuel tanks > 1100 gallons……..5 ft.
   - ____ Public wells…….150 ft. and maximum practical

6. Consider locating the facility to meet the following setbacks:

   - ____ Farm Buildings…….50 ft.
   - ____ Residential or Business…….200 ft.
   - ____ Public Roads…….50 ft.
   - ____ Pressurized Water lines for domestic or livestock use…..25 ft.
   - ____ Property Lines……25 ft.

Do not locate stationary containment facilities on existing mixing sites