Wisconsin Minimum Design and Construction Standards for Concrete Mixing and Loading Pads and Secondary Containment Structures

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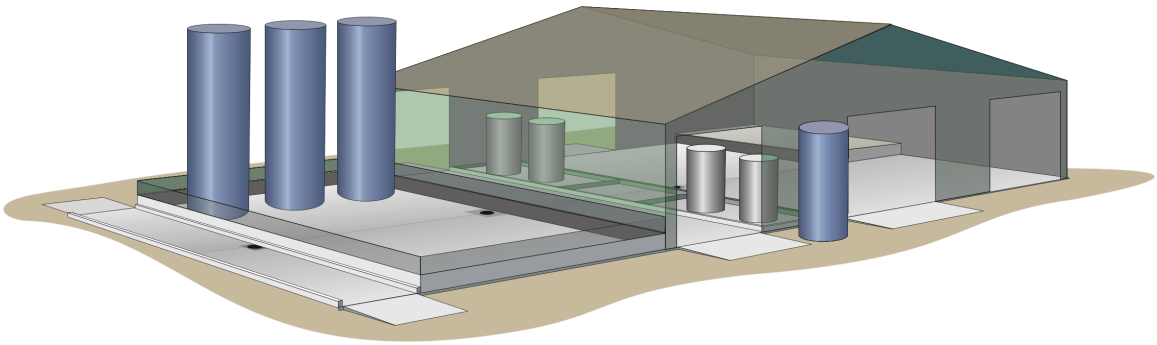

Chapter 1. Functional System Design

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Functional system design of pesticide and fertilizer facilities is best addressed as part of the site plan when developing new facilities or remodeling existing ones. A well-planned and designed facility is necessary for human safety and environmental protection. The facility design provides for several distinct and separate functions:

Worker safety

Storage of:
- Packaged pesticides
- Solid wastes

Secondary Containment for:
- Bulk pesticides
- Bulk fertilizers
- Rinsates
- Sludge

Operational Area for:
- Transferring and handling pesticides and fertilizers
- Mixing batches of pesticide and fertilizer solutions
- Loading application equipment
- Unloading transport vehicles
- Unloading and cleaning out application equipment
- External washing of application equipment (Not recommended)

Facility Planning

When designing the facility, consider current and planned production levels that can affect the size and scale of the facility. Trends within the agricultural industry continue to see consolidation and centralization to fewer and larger-scale facilities.

Plan a storage facility as an isolated, secured area with a single use, separate from other activities and storage areas (such as feed, seed, and fuel). Design the facility to protect pesticides and fertilizers from possible theft, unauthorized use by untrained personnel, and temperature extremes. Provide security with a properly designed chain link fence or a building with lockable doors. Proper storage protects workers, visitors, children, and animals from unknown or accidental exposure to pesticides and fertilizers. In a properly designed storage facility, the environment, including soil, surface water, and groundwater, is also protected from accidental release by containing a spill within the secondary containment designed integrally into the building until the spill can be properly recovered.

The most critical tools in the long-term effectiveness of a facility are the workers that manage the site. The facility design should accommodate efficient workflow and easy and safe operator movement between functional areas. Workers must have convenient and safe access to bulk tank valves and controls, package product storage, and the related emptying, cleaning, and waste management areas. The facility design should also accommodate regular, safe, and convenient cleaning of the equipment, mixing and loading pad, and related work areas where spills may occur.

Vehicle traffic flow must be planned to accommodate the increased sizes and turning radiuses of the larger tanker trucks bringing products in and the large-scale application equipment and tender vehicles taking product out. When possible, consider a drive-through facility design with one-way traffic to increase traffic flow and safety.

Plumbing and tanks

The design of the plumbing system from the pesticide and fertilizer storage tanks to the mixing and loading pad should also be considered in the overall facility design. Pumps, valves, and quick couplings need to be located within secondary containment to accommodate recovery of small leaks. Loads from the weight and vibration of overhead plumbing lines must be considered in the building design. Tanks that are under-roof and protected from direct sunlight and weather usually have a longer service life than those stored in the open.

When selecting storage tanks, check with both the pesticide manufacturer and tank manufacturer to be sure the tank is resistant to corrosion from the pesticide being stored. Cross-linked, high-density polyethylene or fiberglass tanks of 200 to 600 gallon volumes are usually a good economical selection for rinsate storage. The ability to view liquid levels through plastic or fiberglass tank walls improves management. Polyethylene tanks need to be inspected annually for signs of aging, cracking, or deterioration.

Galvanized or standard, mild steel tanks are not recommended because they corrode quickly causing rust and metal scaling which can plug strainers and plumbing. Type 304 or 306 stainless steel tanks are suitable but are expensive. Rinsate storage tanks should be supported 3 to 6 inches above the concrete floor for easy observation of leaks. Mount the tanks high enough to allow full operation of valves and other equipment. Some operators elevate rinsate holding tanks so they can gravity flow into mix tanks or sprayer tanks.

Use adhesive tank labels to identify pesticide, fertilizer, and rinsate storage tanks, and supplement these with placards or signs at valves and connections.

Mechanical systems

Ventilate storage buildings to prevent fumes from concentrating in the building. Connect smoke or fire detectors to an external site away from the storage building or to the local fire department. For some pesticides, a heating system may be required to maintain safe storage temperatures to prevent product degradation. All wiring and electrical equipment (lights, heating, ventilation) must meet local and national electrical codes.

Worker Safety

The worker safety area should be designed to have all the emergency equipment necessary to prevent harm or provide emergency aid to the workers. Provide an eyewash and/or deluge shower to rinse spilled pesticide and fertilizer from the eyes, face, and body. Also, provide a first aid kit and spill response kit to deal with accidents in a timely manner. Install fire extinguishers and telephones or another two-way communications system. Locate a telephone or other two-way communication system in or near the pesticide storage area for communication with fire, police, and health authorities.

Emergency response plan

Have an Emergency Response Plan (ERP) easily accessible to all employees. The Emergency Response Plan contains valuable emergency information for responding immediately to any emergency including a poisoning, spill, or fire. A pesticide label for each pesticide and a Material Safety Data Sheet (MSDS) for each fertilizer must be included in the plan. Inform all employees where the ERP is filed, and train them to be familiar with these documents at the beginning of employment as well as during annual training reviews and when a new pesticide or fertilizer is added.

Protection standards for agricultural worker

Federal law requires protection of persons that handle and/or apply pesticides used in agricultural production. These rules are primarily implemented through label-specific safety equipment requirements for pesticide handlers. Posting and information requirements along with worker training are implemented to protect agricultural workers and the public who may come into contact with a sprayed crop. Equip the worker safety area in a manner that is consistent with protecting the workers. This includes providing required safety and personal hygiene equipment and having information areas describing pesticides stored and handled at the facility.

Storage for Packaged Pesticides and Solid Wastes

Packaged pesticide (nonbulk container) storage should be considered as it affects the mixing and loading activity and/or the transport of packages to field locations or satellite sales points. Several separate access points to this storage area may be required to allow efficient movement of containers from storage to the mixing and loading pad or from storage to and from delivery vehicles at a different point.

Solid wastes and sometimes hazardous wastes are unavoidable byproducts of fertilizer and pesticide storage and handling practices. At its best, the only solid waste products will be empty triple or pressure rinsed plastic containers, corrugated boxes, paper bags, label booklets, and other packaging materials. The solid waste storage area holds empty containers until they can be disposed of properly.

Poor management of wastes, such as burn piles and outside unroofed areas used to store empty containers, has caused areas to become contaminated over years of use. These areas have been identified as major contamination sources requiring cleanups.

Store empty, triple or pressure rinsed containers, minibulks, metal drums, cardboard cartons, and paper packaging materials in a roofed, curbed, and secured area. Since pesticide residues may occur in any of these materials (especially empty containers), they should be stored under cover and over a secondary containment surface. Security of this area is required to prevent unlawful and unsafe reuse of empty pesticide containers by unauthorized personnel.

Segregate packaging wastes according to their ultimate recycling or disposal method. The facility design should accommodate this in a manner that assures this happens as part of the normal mixing and loading operations. The accumulation of unrinsed containers exacerbates rinsate management problems.

Secondary Containment Structures

Secondary containment structures protect the environment from accidental leaks and spills of the primary liquid storage by preventing the spills from entering the soil and possibly surface water or groundwater. Secondary containment is designed to temporarily hold a release of the fertilizer, pesticide, or rinsate. The spilled product (rinsate) can then be more easily recovered and used in a spray solution instead of being disposed of or leaching into the soil or draining into surface and groundwater. Secondary containment is designed to hold liquid for a short time period, long enough for the owner to manage the release in an appropriate manner. Secondary containment is not designed to hold liquid for an extended time; that is the job for the primary tank. Designing a secondary containment to be totally liquid tight under a long period of hydrostatic pressure would be very expensive and impractical.

Secondary containment is usually designed as an integral part of the storage facility. It should accommodate the storage of bulk liquid fertilizer, bulk liquid pesticides, rinsate, and sludge in separate and segregated areas. Storage of bulk pesticides and bulk fertilizer in a common secondary containment is not recommended but is allowed if the secondary containment is in a fully enclosed building. In the overall facility design, the storage areas for these products are usually placed adjacent to each other to minimize transfer distances and improve operational efficiency.

Fertilizer secondary containment

Large fertilizer tanks are usually stored in a secondary containment structure constructed from concrete, a synthetic liner system, or a relatively impervious soil (bentonite, attapulgite, and natural clay). Fertilizer secondary containment usually covers the largest area because of the size of the tanks used to store fertilizer solutions.

Pesticide secondary containment

Pesticide storage tanks are usually stored in a secondary containment structure constructed from concrete or a synthetic liner system (such as a plastic or fiberglass tub). Secondary containment for storage of bulk pesticides must be separate from fertilizer storage secondary containment. Cross contamination of fertilizer by pesticides results in a rinsate that would be considered a pesticide (which may be more difficult to handle) compared to a rinsate containing only fertilizer (which may be easier to handle).

Rinsate secondary containment

Rinsate storage tanks containing a pesticide rinsate are treated the same as pesticide storage tanks. They must be placed within a secondary containment structure similar to a pesticide secondary containment. If the facility design is such that rinsate containing only fertilizer is generated, that rinsate may be stored and managed as a fertilizer, allowing greater flexibility in its use.

Rinsate tanks should be located close to and adjacent to the mixing and loading pad to allow the operator to conveniently monitor and manage the rinsate accumulation and reuse on a daily basis. If not carefully managed, the rinsates that contain combinations and/or concentrations of pesticides that cannot be safely applied to a target site may be classified as hazardous waste. Segregation and prompt reuse of rinsate according to label directions to the intended target crop is the best method of managing rinsates. Preventing any waste from becoming a hazardous waste because of cross contamination with other products is the best management strategy to allow legal use versus disposal as a waste.

Sludge secondary containment

Sludge is created when application equipment tracks dirt and mud onto the mixing and loading pad. This mud and dirt is then washed into the sump with other pesticide and fertilizer liquids. The mud and dirt become contaminated with these products and must be containerized when removed from the sump. Sludge that is generated from mixing and handling bulk pesticides and fertilizers should also be stored in secondary containment. This sludge must be handled and disposed of based upon the products that are in the sludge. The sludge should be placed in a container made of polyethylene or other suitable material and stored within a secondary containment structure (minibulk storage area, mixing and loading pad, etc.) until properly disposed of.

Operational Area

Secondary containment is sometimes thought of only in the context of the storage of the pesticide, fertilizer, or rinsate; however, the primary component of a facility is the mixing and loading pad, which provides secondary containment for the normal operations performed at a pesticide and fertilizer facility. The mixing and loading pad is within the operational area and provides containment while pesticides and fertilizers are being transferred from storage tanks to

application equipment and tender vehicles. The mixing and loading pad is exposed to wash water and to the small spills and drips occurring during the normal daily routine of transferring pesticides and fertilizers from storage containers into application equipment. The daily leaks from hose connections, spills, or leaking nozzles are contained on the mixing and loading pad.

The mixing and loading pad is a curbed and ramped sloped concrete slab (or other impermeable material). The mixing and loading pad typically houses pumps, valves, hoses, and batch mixing equipment and is central to all the other operations of a fertilizer and pesticide handling facility. Because the pad is where most solid wastes and rinsates will be generated, the design of the pad will determine the productivity of the facility and the amounts of rinsates or wastes generated. Operations in this area present the greatest day-to-day environmental risk of the operation.

Fertilizers and pesticides are mixed and loaded into the application equipment parked on the mixing and loading pad. Operations are typically managed from plumbing controls and associated mixing equipment adjacent to the pad. Batch mixing tanks, temporary storage of pesticide containers, minibulk storage tanks, and the pumps, valves, hoses, and meters used to transfer pesticides and fertilizers from bulk storage are located on the mixing and loading pad. Elevate valves, pump motors, and other electrical equipment on platforms above secondary containment liquid levels.

The mixing and loading pad is sloped to a collection point called a sump. The rinsate can then be transferred from the sump to rinsate storage tanks and used as makeup water for subsequent sprayer loads. Rinsate storage tanks might include several separate storage tanks for pesticide rinsate or fertilizer-only rinsate tanks.

If unroofed, the mixing and loading pad also collects precipitation. To minimize the volume of contaminated precipitation that would have to be handled as a rinsate, the mixing and loading pad should be roofed. Roofing the mixing and loading pads may be an economically viable alternative compared to the cost of storing and using the large volumes of rinsate collected on an unroofed area.

When mixing and loading pads were first designed, many designers thought that they would be a convenient place to wash the exterior contamination of application equipment. Many in the industry may still call the mixing and loading pad a “wash pad.” Mixing and loading pads were originally developed because mixing and loading sites were becoming contaminated from the practice of routinely mixing, loading, and washing application equipment on the soil or gravel drive areas adjacent to a pesticide or fertilizer secondary containment. In addition, application equipment was commonly parked on unroofed areas. Rain washed the contaminated exterior of equipment and caused pesticide and fertilizer residues to build up in the soil over time.

Discharge of rinsate from the mixing and loading pad onto an adjacent area is not allowed. The only option is to collect, store, and use the rinsate in the approved manner, or dispose of it in an approved manner. Discharge of rinsate containing pesticide residues (including precipitation from an area that has not been properly cleaned) can lead to fines and expensive site cleanup liability. Repairing application equipment on the pad allows the collection of any liquid that leaks or is drained from the tanks or booms of the application equipment. When cleaning or repairing equipment on a mixing and loading pad, do not use solvents or degreasers or allow lubricants to drain onto the pad. Mixing these materials with pesticides may result in a rinsate that cannot be

used in an appropriate application and can lead to costly waste disposal problems. The mixing and loading pad must be segregated and separate from the pesticide or fertilizer storage areas.

Decide early in the planning process if some of the functions performed in the operational area should be separated into more than one separate and segregated operational areas (mixing and loading pads). For example, to accommodate semi and tanker traffic needs bulk fertilizer loading and unloading might be separated and located away from the mixing and loading of application equipment. Facilities that manage minibulks or other refillable containers may want a separate pad in the facility design to conduct that activity without affecting the daily routine of loading application equipment. Triple- or pressure-rinsing of plastic containers may also be done on a separate pad to allow routine daily cleaning of containers and reduce problems of cleaning dried residue from containers.

Example Facilities

To demonstrate planning and design of facilities, the following sections describe several example facilities. Regardless of the size of the operation, incorporate each of the functional areas into the total system facility plan for all operations. The size or scale of the functional areas of any facility design depends on the type of operation, amount of product stored and handled at the facility, and the number of employees.

As the size of the facility increases, the space needed for each functional area becomes larger and better defined, and it is better to keep the areas separated and segregated. Locate functional areas adjacent to but separate from each other to provide for ease of material handling, efficient traffic flow, easy access from one area to another, and worker safety.

Small-scale facility

Figures 1.1 and 1.2 show a small-scale facility. The mixing and loading pad is designed as a sloped concrete floating slab and combines several functional areas to minimize and optimize the use of the space. Application equipment drives onto the pad from the service road. This design allows driving across the pad from three directions. Worker safety equipment is near the mixing and loading pad. The curbed and sloped mixing and loading pad provides secondary containment for the loading of application equipment. A separate curbed area provides secondary containment for pesticide and rinsate storage tanks and mixing equipment. Secondary containment of minibulks could be on the mixing and loading pad or in a separate secondary containment area. Precipitation that falls onto the pad and becomes contaminated with pesticides or fertilizers is collected and stored as rinsate until it can be used as makeup water for subsequent loads and applied to the appropriate target crop (at, or below, label rates).

A small building located on a raised curb provides security and secondary containment of stored small containers of pesticides. A fence should be used to provide security around the minibulk storage area. Another option would be to build a roof over the entire area including the mixing and loading pad, pesticide storage, and mixing equipment and minibulk storage areas. The size of the mixing and loading pad depends on the size of the application equipment and storage space needed.

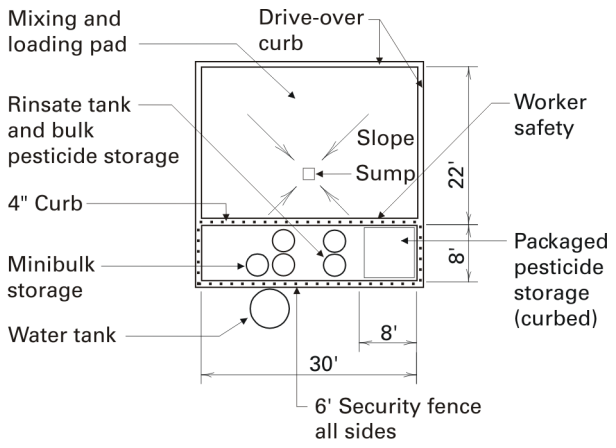

Figure 1.1. Small-scale facility, plan view. Optional roof over entire facility.

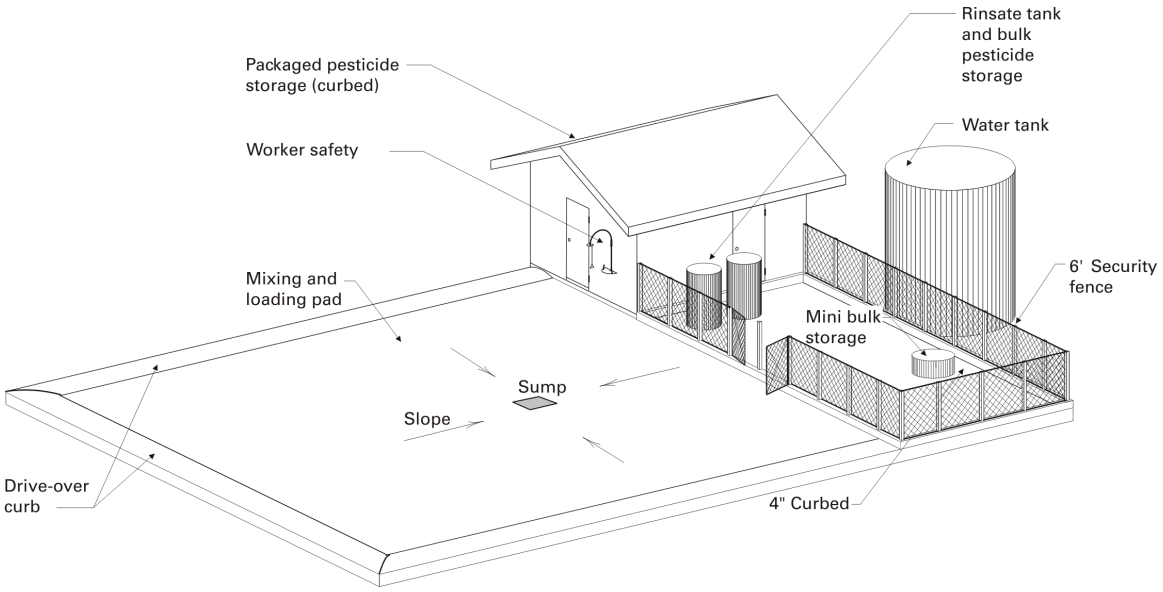

Figure 1.2. Small-scale facility, perspective view. Optional roof over entire facility.

Medium-scale facility

In the medium-scale facility shown in Figures 1.3 and 1.4, a mixing and loading pad is separate from the pesticide secondary containment and packaged pesticide storage. The fertilizer secondary containment is near the mixing and loading pad to reduce plumbing transfer distances. The fertilizer secondary containment can be expanded in the future and is commonly fenced off for security if the tanks are too tall to fit under a roof. Precipitation collected in an open (unroofed) fertilizer secondary containment is collected and stored in a tank within containment. Packaged pesticides are stored in a small room with a curbed secondary containment area adjacent to the mixing and loading pad. A worker safety area would be included in the mixing and loading pad.

An optional building covering the mixing and loading pad and packaged pesticide storage area eliminates precipitation from entering these areas and provides security. In some cases, the fertilizer secondary containment is placed under a roof as well.

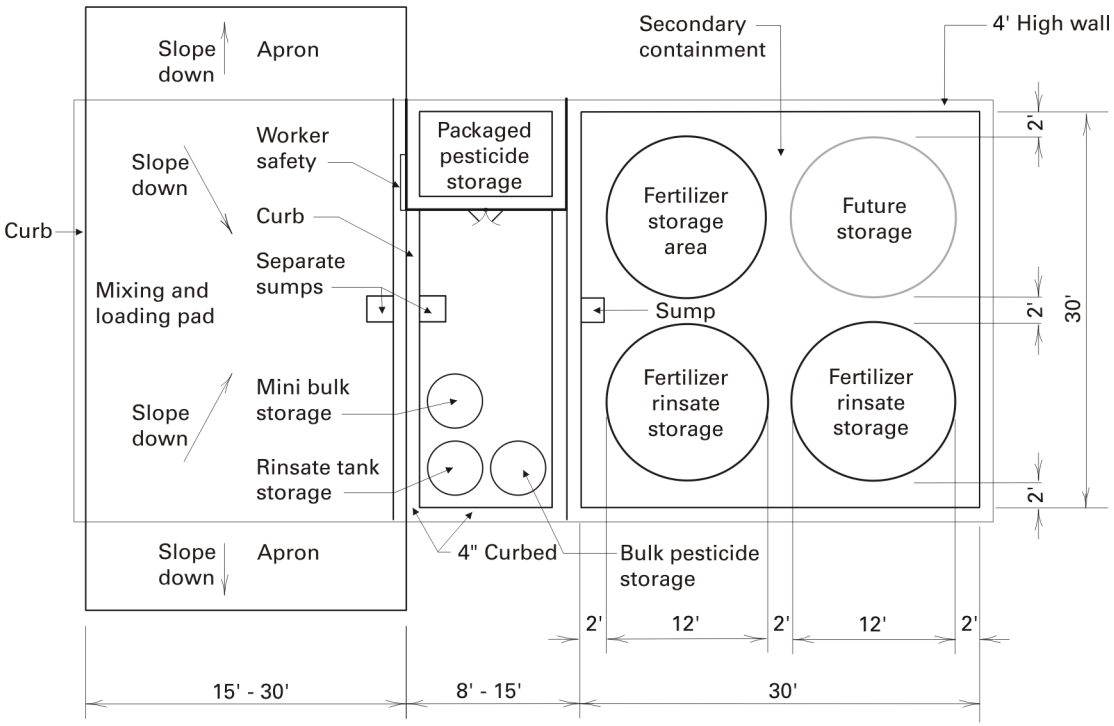

Figure 1.3. Medium-scale facility, plan view. Optional roof over entire facility.

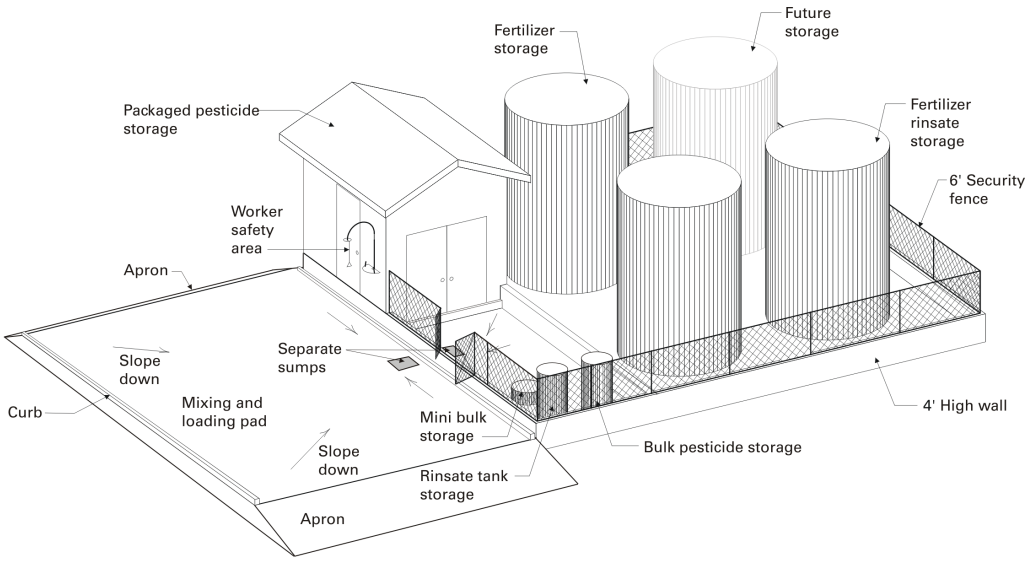

Figure 1.4. Medium-scale facility, perspective view. Optional roof over entire facility.

Large-scale facility

Figures 1.5 and 1.6 show a large-scale facility. For large-scale facilities, the design and layout should allow for future expansion. As the scale for the operations increases, the size of the spaces needed for the functional areas also increases. If the spaces are unroofed, the volume of rinsate from contaminated precipitation falling onto these areas can become a rinsate management problem. To minimize that problem, large facilities should use a building shell to provide a roof and walls to cover the functional areas. The building shell also provides security for the facility. The functional areas in the facility are separated but are placed adjacent to one another to facilitate access by employees and to provide for the efficient transfer and handling of material and loading of application equipment. Worker safety areas would be placed adjacent to the mixing and loading pads and the packaged pesticide warehouse. Offices and worker locker room are provided to accommodate the larger number of employees working in a large-scale facility.

If needed, an additional and separate drive-through mixing and loading pad could be placed adjacent to the central pesticide secondary containment. This allows more than one sprayer to be loaded at a time. The pesticide secondary containment is kept separate, and both mixing and loading pads can share the equipment and storage tanks. Pesticides in minibulks and rinsate storage tanks are placed in a curbed area to provide secondary containment.

The fertilizer secondary containment is adjacent to one of the mixing and loading pads to reduce plumbing transfer distances. A separate bulk fertilizer unloading/loading pad prevents tankers from blocking the main mixing and loading pad(s). The fertilizer secondary containment can be expanded in the future and is commonly fenced off for security if the tanks are too tall to fit under a roof. Precipitation collected in an open (unroofed) fertilizer secondary containment is collected and stored in a tank within containment. In some cases, if the tanks are not too tall, the fertilizer secondary containment is placed under a roof as well. Small packaged pesticides are stored in a warehouse with a curbed secondary containment adjacent to a mixing and loading pad.

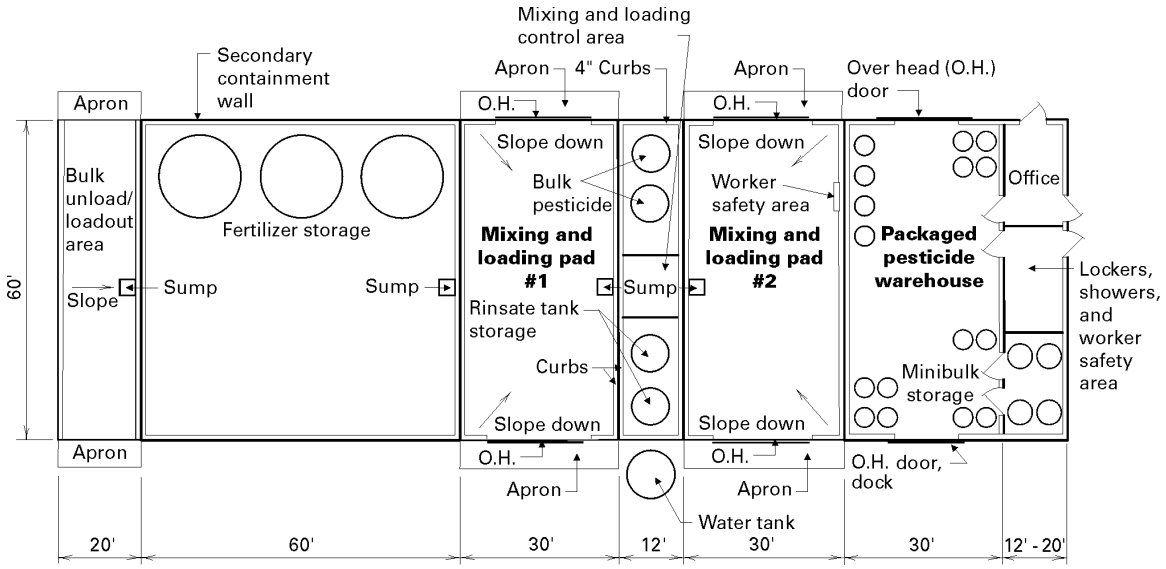

Figure 1.5. Large-scale facility, plan view. Optional roof over entire facility except fertilizer secondary containment and bulk unload pad.

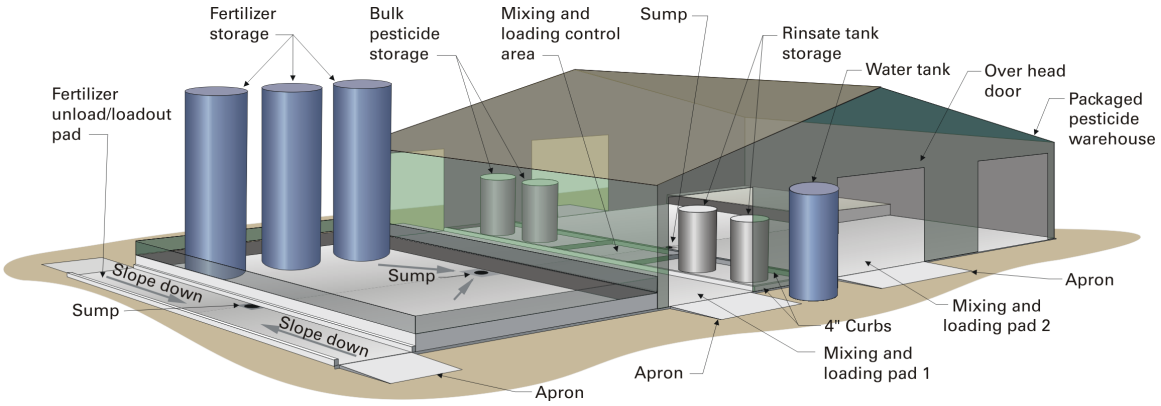

Figure 1.6. Large-scale facility, perspective view. Optional roof over entire facility except fertilizer secondary containment and bulk unload pad.