

CONCRETE CONTAINMENT - CRACK REPAIR AND MAINTENANCE

This fact sheet was prepared by the Minnesota Department of Agriculture to provide information for facilities who have constructed and have permitted concrete containment systems in Minnesota. This guidance is intended to supplement—not replace—Federal and State Laws and Rules

Since 1990, the Minnesota Department of Agriculture (MDA) has issued bulk liquid pesticide and fertilizer permits that include safeguards constructed of concrete. Minnesota Statutes define “safeguard” as “a facility, equipment, device, or system, or a combination of these, designed to prevent an incident as required by rule.” Over time safeguards constructed of concrete show various levels of cracking and/or deterioration—some anticipated, some not. Design specification, use, and installation all influence how well individual safeguards (dikes and load pads and dry bulk pesticide/fertilizer floors) perform. Agricultural chemical containment areas (including pads and floors in dry pesticide/fertilizer storage areas) with excessive cracking and/or deterioration may not prevent the escape or movement of pesticides and fertilizers as intended. MDA inspections of these concrete safeguard areas are showing compliance problems when cracks are present and no maintenance or repair work has been performed. Concrete safeguard systems showing maintenance and compliance problems may be ordered to cease storing bulk agrichemicals until these safeguards have been adequately repaired.

INSPECTION AND MAINTENANCE

Pesticide Storage Rules

Minnesota Rules, Part 1505.3110, Subpart. 2, specifies that a secondary containment area must be inspected for condition and leakage of the base, seams, and walls at least monthly while bulk pesticide is in storage. Loading area pads must be inspected for leakage at least monthly during the use season.

Maintenance of the bulk pesticide storage facility must be performed as necessary in order to ensure the integrity of the secondary containment areas and loading areas is maintained.

Liquid Commercial Fertilizer Rules

Minnesota Rules, Part 1510.0375, requires that safeguards

be maintained and operated in a manner which will prevent the escape of any liquid commercial fertilizer from the facility.

Proposed Rules for Above-Ground Liquid Bulk Fertilizer Storage

Section VI, Subpart 1(L) of the proposed rules require that a secondary safeguard be inspected at least monthly while liquid bulk fertilizer is in storage, and must be maintained to prevent leakage of liquid bulk fertilizer or any other stored or accumulated liquid from the secondary safeguard. All cracks and joints must be sealed with sealants that are compatible with liquid bulk fertilizer as verified through direct testing of the sealant for compatibility, durability, and performance for the application being proposed, by the manufacturer of the sealant using an independent laboratory.

Fertilizer Containment Requirements

Minnesota Statutes Chapter 18C.201 states that a person may not store a fertilizer in a manner that will cause unreasonable adverse effects on the environment. M.S. Ch.18C.305 states that a person must obtain a permit from the commissioner on forms provided by the commissioner before the person constructs or substantially alters an existing facility used for the bulk storage and handling of fertilizers. The commissioner may not grant a permit for a site without safeguards that are adequate to prevent the escape or movement of the fertilizers (liquid or dry) from the site.

Dry Commercial Fertilizer Rules

Minnesota Rules, Part 1510.0400-1510.0408 requires that safeguards, (storage containers) be maintained and operated in a manner which will prevent avoidable amounts of particulate matter from leaving the facility. This includes the concrete walls and floors in bin area or dry fertilizer tank concrete pads where dry bulk fertilizer is stored.

CONTAINMENT EVALUATION

When conducting inspections of the safeguard (dike or load pad) areas, pay special attention to the following:

- Joint movement (floor, wall and wall/floor joints)
- Cracks: If cracks are present, try and determine whether they are active/moving (additional movement can be expected) or dormant/non-moving (little or virtually no movement in the future can be expected)
- Concrete defects, damage or corrosion.

CONTAINMENT REPAIR TECHNIQUES

If joint movement and cracking is evident in the concrete floor or wall and dike integrity has been jeopardized, repairs must be made immediately.

Below are examples of repair techniques for a variety of concrete repair problems. Some manufacturers may have similar techniques and procedures specific to their products.

Dormant/Non-Moving Cracks

For very small non-moving hairline cracks, the required repair could be done by applying a pesticide/fertilizer compatible coating over the area creating a thin film or seal to prevent liquid movement through the area in question. The procedure of coating the entire secondary containment structure has also been recommended to help preserve concrete safeguards from deterioration from the substances they are intended to capture.

For small non-moving cracks that are larger than hairline cracks (1/4-inch or less), one possible solution is to apply a compatible coating on both sides of the crack and, while coating is still wet, work in a fiberglass-mesh cloth strip over the crack with a roller until the coating has soaked its way through the cloth. After the first coat is dry, apply a second coat on top of the first coat and fiberglass cloth.

Cracks that are non-moving but greater than 1/4 inch wide should be filled with a compatible sealant material first to properly seal the opening. Once the sealant has dried, a compatible coating can be applied over and extending beyond the filled crack area to ensure a liquid-tight seal.

Active/Moving Cracks

For small moving cracks (1/4 inch or less) a possible solution is to apply a compatible, flexible coating material in and around the cracked area. While coating is still wet, work in a fiberglass-mesh cloth strip over the crack with a roller until the coating has soaked its way through the cloth. Apply a second coat of the flexible coating material after the first coat has set.

For moving cracks/joints greater than 1/4 inch wide, insert a backer rod prior to sealing. In some cases, the crack or joint may need to be routed (widened and/or deepened) slightly to accommodate proper placement of the backer rod. After the backer rod is in place, apply a flexible joint or crack sealant on top of the backer rod and into the sides of the joint or crack. Flexible sealant should be capable of expanding or contracting without pulling away from the concrete. If the sealant is not flexible, a moving crack or joint will reopen, lessening the effectiveness of the repair. The flexible sealant must also be coated with a compatible material if the compatibility of the sealant is questionable or unknown.

Wall/Floor Joints

There are several repair techniques adequate for wall and floor joints that are suspect. Examples:

- Caulk and cove corner joint;
- Caulk the corner joint, then cover with two layers of compatible coating material working fiberglass-mesh cloth into the first coat while wet (see small moving crack repair above).

Voids and Bugholes

All voids and bugholes should also be filled and patched when present to ensure dike integrity. Though they may not be cause for immediate concern, they can become problems in the future. A patching material recommended by the coating manufacturer should be used if the area is to be coated following patchwork.

SELECTING A COATING OR SEALANT

It is important to note that there are many repair methods and techniques available for dealing with a variety of concrete damage or deterioration. When selecting a coating or sealant, the following must be considered:

- Chemical exposure;
- Type of exposure;
- Compatibility with the substrate; and Application conditions.

In most pesticide and fertilizer containment applications, the following coating and sealant types have been shown to provide satisfactory resistance to various agricultural chemicals:

Best Chemical Resistance

- Vinyl ester¹
- Epoxy phenolic resin¹
- Epoxy novalac resin¹
- Polysiloxane epoxy¹

Acceptable Chemical Resistance

- Polysulfide compounds² for sealing larger moving cracks/joints
- 100% solid polyamide cured epoxy¹
- Amido amine cured epoxy¹

Acceptable Fertilizer-Only Resistance

- Poly urethane
- Urea urethane
- Other urethane sealants compatible with fertilizer products

¹According to TVA Coating Performance Rating (*Circular Z-361*).

²According to information provided by several manufacturers.

The sealant types listed above are not inclusive and are provided solely to help readers get started in selecting products for containment repair. Before using specific products containing any of these or other coating types, it is best to check first with the coating's manufacturer for recommended applications. Choose a sealant or coating that has performed well in extended tests of continuous exposure.

In all cases, proper concrete preparation is critical to ensure a proper bond of sealant to concrete. The surface must be sound and free of contaminants (clean). In addition, all application instructions, including those regarding temperature range at which the product may be applied, should be followed carefully. Don't hesitate to call the manufacturer with application questions or problems. Attention to such details will help to ensure long-term performance.

New and improved products are continually being made available. If choosing a coating type different from above recommendations, have the manufacturer provide you with compatibility test results and forward a copy of these results to the MDA.

SELECTING A COMMERCIAL CONTRACTOR FOR CONCRETE CONTAINMENT REPAIR

Firms may opt to hire someone else to perform repair work on their concrete containment system. This may be necessary due to time limitations, lack of personnel qualified to do the repair(s), or severity of repairs needed (dike condition).

Quality concrete containment system installation/repair and coating/sealant pesticide and fertilizer compatibility are critical for ensuring effective, long-lasting repairs. When contracting someone else to complete repair(s) for you, make sure the company hired is aware of all the factors discussed in the previous section "Selecting a Coating or Sealant."

Screening commercial companies before you hire a contractor will help you to select the one most qualified. If you are not familiar with a potential contractor's workmanship, timeliness, and quality of materials, it is a good idea to thoroughly check references and ask to view similar repair projects completed for past customers. Other background checking might include contacting the Minnesota Department of Commerce to verify whether or not the potential contractor has a business license and carries workers' compensation insurance (in case any of their workers are injured while performing repairs at your site). You should also consider asking potential contractors about workmanship and sealant/coating performance warranties.

SUMMARY

Whatever your concrete repair problems are, it is important to ensure that the repair solution chosen addresses the problem through the use of proper technique and compatible sealant/coating for lasting results. Regular inspection and maintenance of your concrete containment system are required by law—compliance can help you keep repair costs down while preserving the life and integrity of the system.

Firms are strongly recommended to purchase and keep an inventory of enough sealant to do small crack repair jobs as they appear. For a typical pesticide dike and load pad area, you may want to have the manufacturer set you up with enough material to fix and repair a minimum of 25 linear feet. For larger fertilizer dike and load pad areas, you may want to double that amount.

Plan ahead by identifying your suppliers, the type of sealants available that meet your containment needs, and keep an inventory of enough sealant to repair small crack problems as they appear.

FURTHER INFORMATION

For questions contact Greg Harding at 651/201-6274 or e-mail: greg.harding@state.mn.us