



## Construction Quality Assurance for CAFO Livestock Waste Control Facilities

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# Construction QA for CAFO LWCF

## A. General considerations

A detailed **Construction Quality Assurance (CQA) plan** is required to be included in applications for a Construction and Operating Permit for all **Large Concentrated Animal Feeding Operations (CAFO)**.

Quality assurance is a planned system of activities with the purpose to provide assurance that the overall construction quality is being effectively implemented. Quality assurance activities involve verification and evaluation of the quality factors that affect the specification, production, inspection, and use of the **livestock waste control facility (LWCF)**.

For **Large CAFOs**, a written **CQA plan** must be included in applications for a Construction and Operating Permit under [Title 130 – Livestock Waste Control Regulations, Chapter 4](#).

The definition of a “livestock waste control facility” can be found in [Title 130, Chapter 1](#).

**LWCF** structures include, but are not limited to:

- holding ponds,
- debris basins,
- liquid manure storage pits,
- lagoons,
- shallow and deep underfloor pits, and
- other devices utilized to control livestock waste.

The **CQA plan** should address all items to be included in the application.

For example, inlet and outlet elevations of piping, pipe size and type, pipe placement requirements, debris basin dimensions and grades, holding pond dimensions and grades, soil liner permeability and thickness, concrete construction (including specifications, placement, and joint sealing), reinforcement bar specification and spacing, recycle flush systems, lift stations, and any other facility structures used to control livestock waste should be documented in the CQA.

The **CQA plan** must be signed and sealed by a Nebraska registered professional engineer and should include the following general information:

- 1) A clear statement of the authority and lines of authority between contractors, CQA personnel, design engineer, and the owner.
- 2) A description of any specialized skill and or work qualifications required for CQA personnel.
- 3) A description of observation and oversight duties, and critical work times when CQA personnel must be on-site.
- 4) A description of test procedures, frequencies, reporting and acceptance/rejection criteria, as well as descriptions of methods to determine and document corrective work.

The following sections address some of the specific information needed for construction of an earthen liner or **Flexible Membrane Liner (FML)**.

Before the liner is installed, the excavation should be evaluated structurally and to make sure the dimensions are correct. The sub-grade acceptability should be documented prior to the installation of the liner.

## B. Earthen liner

For earthen liner design, the CQA plan should include a description of the soil materials to be utilized, the location of the material, an estimate of the amount of material available, and a description of the soil properties.

Specifications for placement of the materials to meet the percolation requirements of [Title 130](#) must also be included.

Much of this information can be obtained from soil samples obtained during the site evaluation with the use of test pits and/or soil borings. Tests such as Atterberg limits (ASTM D4318), gradation (ASTM D6913) to determine standard soil classification (ASTM D2487), and laboratory compaction tests (ASTM D698) can be utilized to select material for further testing and to develop methods to ensure proper materials are utilized during liner construction. Moisture/density tests and hydraulic conductivity tests are used to quantify material to design the appropriate liner.

The **CQA Plan** should include:

- 1) A description of the methods used to select earthen material for construction and any testing required of borrow material.
- 2) A description of the placement of the liner material. Generally, loose lifts of 8 to 9 inches are placed and then compacted to approximately 6 inches. For clay soils, compacted lifts generally should be less than the working depth of the compaction equipment. Previously compacted lifts are scarified 1 to 2 inches in depth prior to placement of the next lift to ensure bonding between lifts. This type of information and appropriate documentation should be included in the CQA Plan.
- 3) When confirming the constructed liner using moisture and density testing several items should be included in the CQA. The test frequency, test method, and acceptance/rejection criteria should be specified. A limited number of tests may fall outside the acceptable range; but generally, is limited to 3% of the total number of tests. The test must not be more than a limited amount outside the specified moisture/density range (i.e., -2% to +3% of the acceptable moisture and no more than 5 pcf below acceptable dry density). Additional laboratory hydraulic permeability testing will be required by the Department.
- 4) Any corrective action for an unacceptable moisture/density test. A re-test should consist of three consecutive passing tests in the vicinity of a questionable or unacceptable test, or the area should be re-worked or replaced with suitable material, then retested. The corrective action and retest should be documented.
- 5) Submission of record drawings showing dimensions and tests locations. A statement that the construction was completed in accordance with the approved construction tolerances, and/or record drawings, should be submitted as part of the Certification of Completion.

## C. Flexible membrane liners (FML)

Many installers, vendors, or manufacturers have written their own quality assurance plans. These may be submitted to the Department as the **CQA plan**, or part of the **CQA plan**, for installation of an **FML**.

The plan should include the following specified items:

- 1) Specification of the material properties of the FML documentation that the material received on-site meets the design requirements.

- 2) A description of methods to resolve any conflicts or outstanding issues and to coordinate installation. Resolution of design and installation issues generally involve CQA personnel, the installer, other contractors, owner or operator of the animal feeding operation, and the designer.
- 3) A description of acceptable means of seaming, and seaming materials, such as chemical seaming compounds or extrusion welding of HDPE liners.
- 4) Verification methods for the seaming and a clear statement of any seam testing. FML should have 100% of the seams non-destructively tested, and randomly tested by destruction test. Clearly describe test acceptance/rejection criteria, and corrective actions for failed seams.
- 5) Submission of record drawings, showing panel locations, panel dimensions, panel and seam identification, location of destructive test samples, and patch-and-repair locations.

## D. Elevations and locations

Information on dimensions, elevations, and locations may be included on the application drawings. If the construction is to vary more than specified in the approved application, prior approval of the change will be necessary from the Department of Environment and Energy.

Spatial locations should be specified with normal construction tolerances for variations, such as:

“The northwest corner of lagoon number 1 will be located within 10 feet of the location shown on drawing 1; the floor elevation will be 1501 feet, + or - .5 ft., top dimensions will be as shown on drawing 1, + or - 5 ft.,” etc.

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## Questions?

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