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adequate air exchange during very cold weather.

Temperature is relatively easy to measure and monitor, but it isn't the best indicator of air quality. Other instruments are needed to more accurately measure air quality. Relative humidity can be measured with a hygrometer or psychrometer. Gas concentrations are measured using a detector tubes and a hand pump. The equipment required to measure dust levels is expensive, which makes is impractical to. Dust levels are difficult to measure, and the necessary equipment is expensive, therefore common sense comes in handy.

A ventilation system should provide good air quality and comfort during all seasons. Therefore, the system design and installation must allow the components to adjust and provide relatively consistent conditions and air quality for the animals.

Tunnel ventilation systems, for example, are excellent warm weather systems since they provide a rapid air exchange and breeze down the length of the building. However, the exchange rate is much too high for cold weather and the "breeze" can become a "draft". Even if the exchange rate and inlet opening are reduced, the air quality between one end of the building and the other can be significant.

A primary objective of a ventilation system is to provide good air quality to the occupants of a livestock shelter. Keeping moisture, gas concentrations and pollutant levels within acceptable ranges is the responsibility of the producer.

The ventilation system should be carefully selected and managed to meet the needs of the animals during all seasons. In addition, air quality should be regularly monitored, and necessary adjustments made to insure the animals have clean fresh air available at all times.

Penn State Cooperative Extension has a number of Fact Sheets available related to the design, evaluation and management of livestock housing ventilation systems. Contact your local PSCE county office for copies.

Feed System Expansion

John T. Tyson, Agricultural Engineer, Mifflin Co.

As cow numbers and production increase so does the need for increased quantity, quality, and variety of feed stuffs. Also, the methods for storing and handling feed may change. Many animals previously housed in tie stalls and fed by hand are now in freestalls and fed with a mobile TMR mixer.

This new system must be capable of handling large quantities of feed very quickly and very efficiently, both into and out of storage. More materials will be handled in bulk to save money and improve efficiency. This new system will also consume a large area. Often the area of the feed center equals that of the freestalls and parlor.

A dairy operation can grow into a well-planned feed center. The whole center must be laid out to match the final goal of where the dairy is heading. As cow numbers are increased, the feed center can be expanded as planned.

The goal at the end of expansion is to allow one person to conveniently feed the various groups of animals no matter where they are located on the farmstead.

At times during expansion, feed storage may be spread out and feeding may be less efficient, but remember that the extra time spent during one or two years of expansion is part of the cost of an efficient system which will be used for the life of the new dairy.

Incremental Expansion

Lay out the total system and then construct the pieces as they are needed. Complete system (operational) planning is the best approach.

System planning needs to consider cow housing, feed storage and delivery, parlor location, manure removal, possible manure storage, machine storage, and future expansion . Consider travel routes for vehicles bringing in or taking away feed. Provide for flexibility, farmsteads aren't and probably never will be static.

The most important part of expansion is planning. However, remember that a puzzle was a whole picture first, and then someone cut it up to make a puzzle. Therefore, if the picture wasn't right to begin with or a piece is missing, the puzzle will never fit together.

Planning a Feeding Center

When designing a feed center and feeding system, think FEEDS: Flexibility, Economy, Ease of operation, Dependability, and Safety.

Flexibility: A good system will allow easy changes in feeding practices or rations. Avoid getting locked into a system which allows only one feeding practice. Plan for expansion. An ideal system provides for alternative methods to keep feeding even though a part or component is out of service.

Economy: The lowest cost combination of components with effective performance and minimal wastage.

Ease of operation: The steps and machinery required to feed should be convenient and straightforward. A feeding system can be evaluated by asking, "How easy is it for me to explain to someone else how to feed my cows?"

Dependability: As mechanization increases so does the potential for breakdown and the cost to repair. Simplicity is a key consideration in any system development project.

Safety: A well-designed system will keep hazards and risks to a minimum. Work injuries result in loss of productivity, emotional trauma, and various unplanned costs.

A good feed center and feeding system are important parts of a successful dairy. High quality feed must be stored, mixed, and delivered each and every day. Investing time and resources in the design of an efficient feeding system will help ensure a profitable dairy farm.