Assessing Environmental Quality for the Bovine from Medical and Engineering Viewpoints

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Programs dealing with animal care and disease prevention often employ medication, antibiotics, and vaccines as substitutes for suitable building design, construction and maintenance of proper environments. Design errors which lead to varying levels of economic loss for producers are common. Animal death losses are often used to evaluate building success or failure. Permanent lung damage however is a common sequelae following clinical or subclinical bouts of pneumonia. Limitations on genetic potential are incurred by lung damage with a resulting decrease in milk and/or beef production. A reliable evaluation of an animals environment may be performed using the senses of site, smell, hearing, and touch.

Initially, a rapid tour of the building should be conducted "sniffing" the air periodically. A rapid pace during this tour is necessary to prevent coating of the olfactory apparatus thereby giving a false impression that all parts of the building smell alike. This procedure identifies microenvironments with high manure gas concentration within the structure and also will identify their probable causes. Concurrent with this procedure, note that ages of animals housed and their location relative to identified microenvironments. A further observation should reveal direction of air flow within the total structure. This air movement should always be from the younger toward the older animals.

Manure handling systems should be noted i.e. liquid manure (pits) versus solid manure (bedded) versus flush to outside pits or lagoons. Each method produces specific gases which if improperly vented may be respiratory irritants. In liquid manure (pit) systems, one-half of the total ventilation air should be removed from the pit by rated fans before wall fans ever start. With solid manure (bedded) pack systems (usually used in naturally ventilated units), continuous tip out ventilation doors around the building periphery and an open ridge system are required. Flush systems to outside holding tanks require venting of the tank to prevent gases of decomposition from reentering the animal housing compartment.

Disease patterns within a structure must be considered. Introduction of younger non-immune individuals should always be on the "up wind" end of a structure. This locaton must be considered in both mechanically and naturally ventilated units. In a mechanically ventilated unit, air flow is controlled by the location of the air intake and exhaust fan systems. Naturally ventilated systems should house the youngest animals on the prevailing wind end of the unit. In each case (mechanically or natural ventilation) these young animals should always be separated from their older counterparts by a seven foot high barrier wall, constructed of either dry oak or elm lumber. If the lumber is not dry, wide cracks soon appear which defeats the purpose of the barrier wall.

Observations to detect environmental communication within attached building and between adjacent units must be considered. Connected building often present problems because of improperly designed ventilation systems and communicating door (which are usually left open). Separate housing structures often intercommunicate environments when the exhaust fans from one building discharge air into the air intakes of adjacent units. Fan and intake locations must always be planned giving special consideration to building placement. Conversely, in order to insure exposure to the organisms in a milking herd provided that the vaccination program is properly planned and executed) pregnant heifers should be located adjacent to the dry cow lot separated only by a fence. Naturally ventilated units should be located at least 50 feet apart to allow air access to adjacent structures. Further, this separation allows a gravitational effect of microorganisms to occur between the units. Never locate calf hutches on the exhaust fan side of a barn.

Uniform air distribution in a mechanically ventilated structure is accomplished with a properly designed and installed intake system. For purposes the air intake system is estimated to be 51% of the total system. Air removal is achieved through the use of exhaust fans. These fans create a negative pressure within the structure, allowing atmospheric pressure to force air into the unit through the air intakes.

Air flow rates in any mechanically ventilated unit should be calculated on the basis of air changes per hour. A minimum *continuous* exhaust rate of four air changes per hour is recommended. Remove this air at a point about 15 inches above the floor, through a duct built around the continuous fan or fans when more than one is used to conserve heat. In summer, an exhaust capacity of 40 air changes per hour is necessary to prevent the temperature in the building from rising more than about five degrees above the outside temperature. About one-half of this total capacity should be considered the fall and spring part of the system.

Paper presented at the Fall Conference for Veterinarians, University of Minnesota, St. Paul, MN, Oct. 30, 1986.

Control all fans with thermostats, except those providing the minimum continuous capacity.

The barn door can give an indication of fresh air intake adequacy. If the door opens outward it will be difficult to open when there is insufficient air entering. If entry doors open inward, in rushing air opens them quickly when air intake is inadequate. The sound of the exhaust fans is another indication of air intake adequacy. When the fans speed up or there is a change in sound when the doors are opened, insufficient air is entering through the intake system.

Moisture within a structure migrates from the warm toward the cold areas. Shifting animal populations in free stall barns typify this principle because fog and condensation occur in the unoccupied areas during cold weather. In tie stall or stanchion barns the calf pens or maternity pen walls are often wet in winter because of this physical principle. The microbiological problem with this moisture migration is the movement of aerosols within the building. When young animals are housed in the same structure as old animals, this principle becomes very important. Aerosol movement is also enhanced by air movement from the ventilation process, therefore if young animals are housed in buildings with older animals, air intakes in mechanically ventilated structures should be over the calf or maternity pens with properly constructed barrier walls separating older and young animals.

Further observations should include general building and animal hygiene. Following parturition, the calf should have a navel clip affixed, it should be administered prescribed medications by the attending veterinarian and the calf should then be given two quarts of clean colostrum collected from all four quarters of the dams udder. To minimize exposure to microorganisms the calf should then be immediately placed in a calf dryer unit, developed at the University of Minnesota for that purpose. The calf should receive 3 subsequent feedings of colostrum, 2 quarts per feeding at six hour intervals, after it is placed in a clean, disinfected calf hutch.

Following weaning the calf is placed in a super hutch with no more than 7 other calves of the same age.

The milking cow barn environment should be clean, dry and properly ventilated. Stalls should be properly bedded and maintained in free stall barns twice daily to ensure minimal build up of chloroform organisms from accumulation of urine or manure on either saw dust or chopped straw. Agricultural lime should be added to bedding to change the pH. High humidity and high environmental temperatures (approaching 37°C) are times when these procedures are absolutely essential to prevent coliform mastitis. If the milking machine is properly installed, serviced and maintained, and milking procedures are correct, the cow must also be properly prepared for milking. Washing the udder with a proven effective udder wash is necessary in preparation. Adequate drying of the udder before attachment of the milking machine is equally necessary. This is best accomplished by the use of a small terry washcloths or towel. Use a clean cloth for each cow. These towels should then be **washed** and **sanitized** in a washing machine, and be dryed in a clothes dryer. An approved non-irritating teat dip should be applied with a dipper following milking. This dipper should be thoroughly washed each time the milk machine is washed. It may be necessary to discontinue the use of teat dips during cold weather to prevent freezing.