

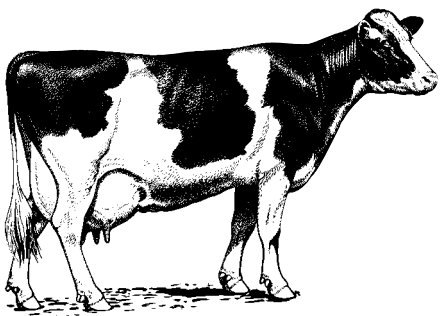
Special Needs Facilities

Recommendations for housing pregnant, lactating and sick cows

J.F. Smith
Animal Sciences & Industry
Kansas State University

J.P. Harner III
Biological & Agricultural Engineering
Kansas State University

M.J. Brouk
Animal Sciences & Industry Kansas State
University



When planning new dairy facilities, a lot of time is spent selecting and sizing the milking parlor and cow housing. Often, not enough effort is put into designing facilities to meet the special needs of lactating, pregnant or sick cows. From a cow health and milk production standpoint, there are an overwhelming number of reasons for providing such facilities. This publication offers tips on planning and design using examples based on a 2,400 lactating cow dairy with freestall housing configured in 4-row barns.

The transition from a pregnant cow to a lactating cow represents the period of greatest challenge to the health and productivity of the dairy cow. Most of the metabolic and infectious disease the cow will experience will occur in the first weeks of lactation. The sudden onset of milk production in early lactation outpaces the animal's ability to increase nutrient intake and places the animal in negative balance for such vital nutrients as energy, protein and calcium. Cows failing this metabolic challenge can develop milk fever, ketosis and displaced abomasum.

Hormonal changes associated with the act of calving suppress the immune system of the animal and increase susceptibility to infectious diseases such as mastitis and Salmonellosis. Negative energy balance and environmental stresses can have an additive effect on immune cells further suppressing the animal's resistance to infection. To reduce disease and improve productivity, facilities and strategies must be designed to maximize feed intake and reduce stress on the transition cow. Stress can take many forms, but generally results in increased cortisol release by the cow, which tends to reduce immune cell function.

Definitions

First, it is important to define some terms:

Special needs facility — The facility and equipment needed to manage cows and heifers from 21 days before calving (close-ups) to 16 days after calving (fresh cows) may house sick cows and high-risk lactating cows. This facility must ensure the safety and well-being of employees and minimize the stress on a dairy animal(s) due to additional interactions between the employee and dairy animal.

Close-up — Cows and heifers that are from 4 to 28 days prepartum up to but not including calving.

Maternity — The area provided for cows and heifers to give birth.

Fresh cows and heifers — Cows and heifers from calving to 16 days postpartum.

Transition period — 28 days prepartum to 16 days postpartum.

High-risk lactating cows — Cows that produce milk that can be sold, but that need special attention—for example, lame cows, older cows, slow milkers and cows that had just been released from the sick pen.

Mastitis and sick cows — Lactating and sick cows

that have been treated with antibiotics.

Activities to be Completed in Special Needs Facilities

A number of activities must be carried out in the special needs facilities. Much has been written on restraining and treating cows. Table 1 lists

these activities and possible locations for carrying them out. The decision to use or not to use headlocks should be made early in the design process. If headlocks are installed along the feed barrier, many of these activities may be carried out in headlocks. The planning team must deter-

mine how activities will be performed by the management team.

Grouping Strategies and Building Requirements

The size and number of cow groups on a dairy are critical planning factors. Fac-

Table 1. Possible areas activities can be completed in the special needs facilities.

Activity	Lockups	Chute	Palpation Rail	Shipping Area	Parlor/ Equipment Room	Maternity	Table
Drenching	X	X					
Injections	X	X	X				
Rectal Temperatures	X	X	X				
Urine pH	X	X					
I.V.'s	X	X					
Sorting	X	X	X				
Palpations	X	X	X				
Insemination	X	X	X				
Postmortem Exams				X			
Hoof Trimming		X					X
Surgery	X	X					
Milk Pasteurization					X		
Pulling Calves						X	
Process Calves						X	
Shipping				X			
Drying Off					X		
Treat Mastitis					X		

tors affecting the number and types of groups are largely associated with parlor size, maximizing cow comfort, feeding strategies, reproduction and increasing labor efficiency. Lactating cows fit one of seven classifications:

1. Healthy lactating heifers
2. Healthy lactating cows
3. Fresh cows and heifers with non-sellable milk (0 to 2 days postpartum)
4. Fresh cows with sellable milk (3 to 16 days postpartum)
5. Fresh heifers with sellable milk (3 to 16 days postpartum)

6. Sick cows with non-sellable milk

7. High risk cows with sellable milk

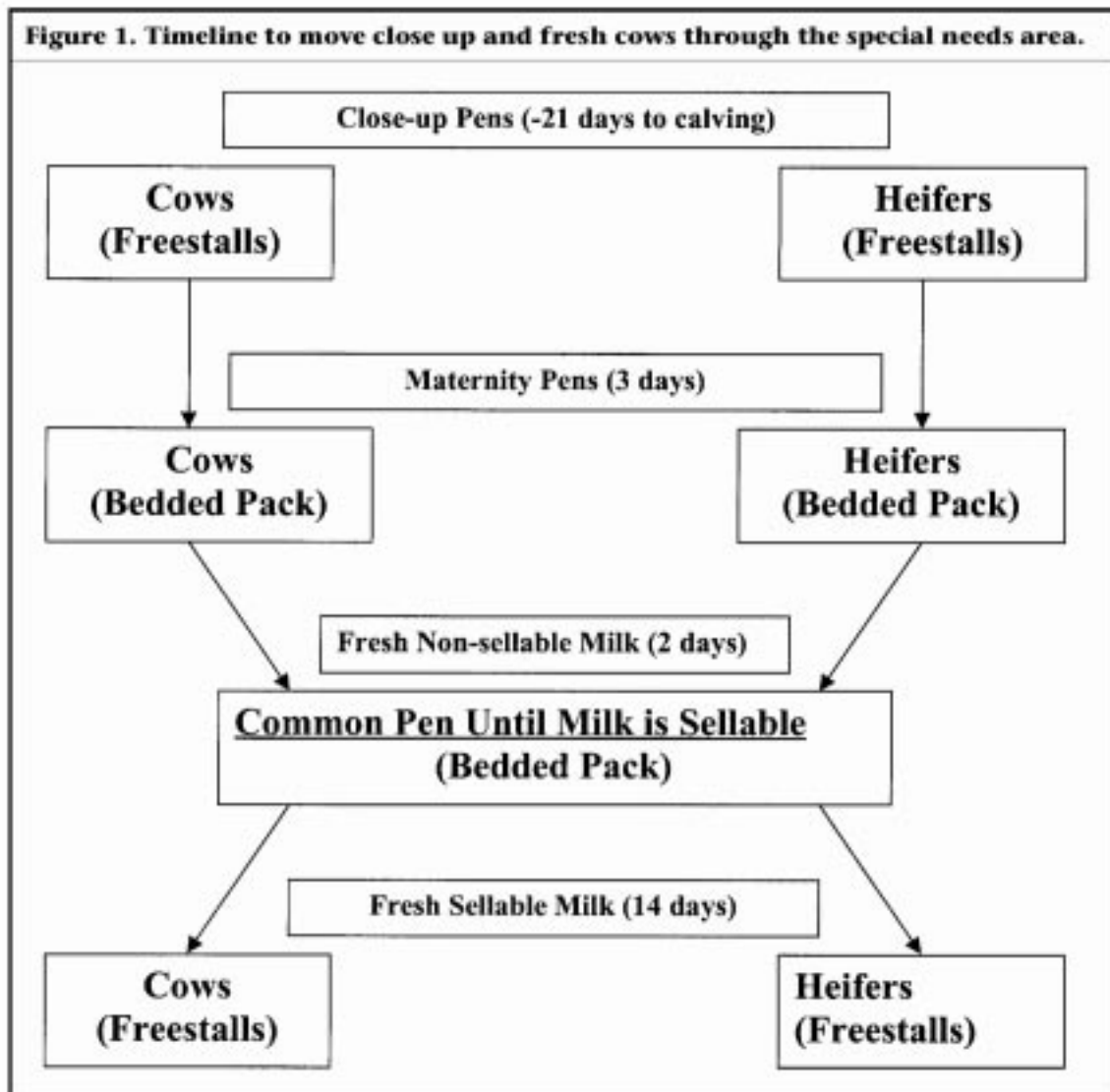
Cows in classifications 3 to 7 are typically housed in the special needs area along with close-up cows and heifers. Figure 1 illustrates how cows and heifers would move through the special needs area, beginning 21 days prepartum. Some may choose to move heifers into this facility 28 to 35 days prepartum.

Heifers respond favorably when grouped separately from older cows. Heifers have lower dry matter intakes and

greater growth requirements than older cattle. In addition, mixing heifers with older cattle increases social pressure resulting in less than optimal heifer performance.

Isolating heifers from mature cows immediately after calving is difficult on most dairies due to the small number of cows and heifers that will be two days postpartum at any given time. In Figure 1, cows and heifers are commingled for two days after calving.

Close-up dry cows and springing heifers differ in nutritional requirements. Close-



up cows have greater intakes and are more likely to develop milk fever than heifers. Springing heifers may also benefit from a longer transition period than normally allowed for cows. Thus, heifers and dry cows should be separated.

Close-up cows should be moved into a close-up pen 21 days before calving. The diet in this pen typically has greater concentrations of protein and energy than the far-off dry cow diet. In addition, the diet should be low in calcium and potassium or contain anionic salts with appropriate amounts of calcium and

potassium to prevent milk fever.

Milk fever is generally not a problem with heifers, but heifers may benefit from receiving the typical transition diet for five weeks rather than three weeks. Feeding a diet with higher levels of protein and energy without anionic salts for five weeks before freshening would be beneficial for heifers.

If heifers are to be housed 28 to 35 days prepartum rather than 21 days, this should be addressed during the planning process. Immediately before calving (24 to 48 hours), close-up cows and

heifers would be moved into a maternity pen with a bedded pack. Following calving, cows and heifers may be commingled or kept separate until the milk can be sold. This is the only place in the special needs area where cows and heifers may be housed together. If the facilities allow, keeping the cows and heifers separated during this period is recommended. Cows and heifers can be segregated when they move out of the fresh non-sellable pen into the fresh pens. Cows and heifers would be housed in the fresh pens for 14 days where rectal temperatures, dry matter intakes and general appearance

Table 2. Recommended Groups and Facilities for Cows Housed in the Special Needs Area in a 2,880 Cow Dairy (2,400 lactating cows).

Group	Average Time in Facility	% of Lactating Herd	# of Cows	Housing System
Close-up cows	21 days	6%	144	Freestalls or loose housing
Close-up heifers	21 days	3%	72	Freestalls or loose housing
Maternity cows	3 days	.33%	8	Loose housing
Maternity heifers	3 days	.33%	8	Loose housing
Maternity overflow	3 days	.33%	8	Loose housing
Fresh cows & heifers, non-sellable milk	2 days	1%	24	Freestalls or loose housing
Fresh cows	14 days	3.5%	84	Freestalls
Fresh heifers	14 days	1.5%	36	Freestalls
Mastitis & sick cows, non-sellable milk	N/A	2%	48	Freestalls or loose housing
High risk sellable milk	N/A	2-6%	48-144	Freestalls or loose housing
Cull and dry cows	N/A	1.5%	40	Loose housing
Calf housing	24 hours		1 2	Hutches or small pens

can be monitored on a daily basis.

Other pens for mature cows and heifers in the special needs area might include a sick pen used to house cows treated with antibiotics and a high-risk pen for lame cows and slow-milkers producing sellable milk. Another pen could be used as a holding area for cows to be culled, dried off or moved to another group of cows.

Generally, this is a drylot pen, conveniently located near the shipping area. Space near the maternity area is needed to process and house calves after calving. Calf housing should be provided for the number of calves that will be born in a 24-hour period or sized according to calf grower pick-up arrangements.

Table 2 shows recommended groups, group sizes and typical housing requirements for cows, heifers and calves. It is important to realize these group sizes have been increased to account for fluctuations in calvings and cow and heifer numbers. If pens are sized only for static or average numbers, special needs facilities will be overstocked for a considerable amount of time.

Selection of Cow Housing

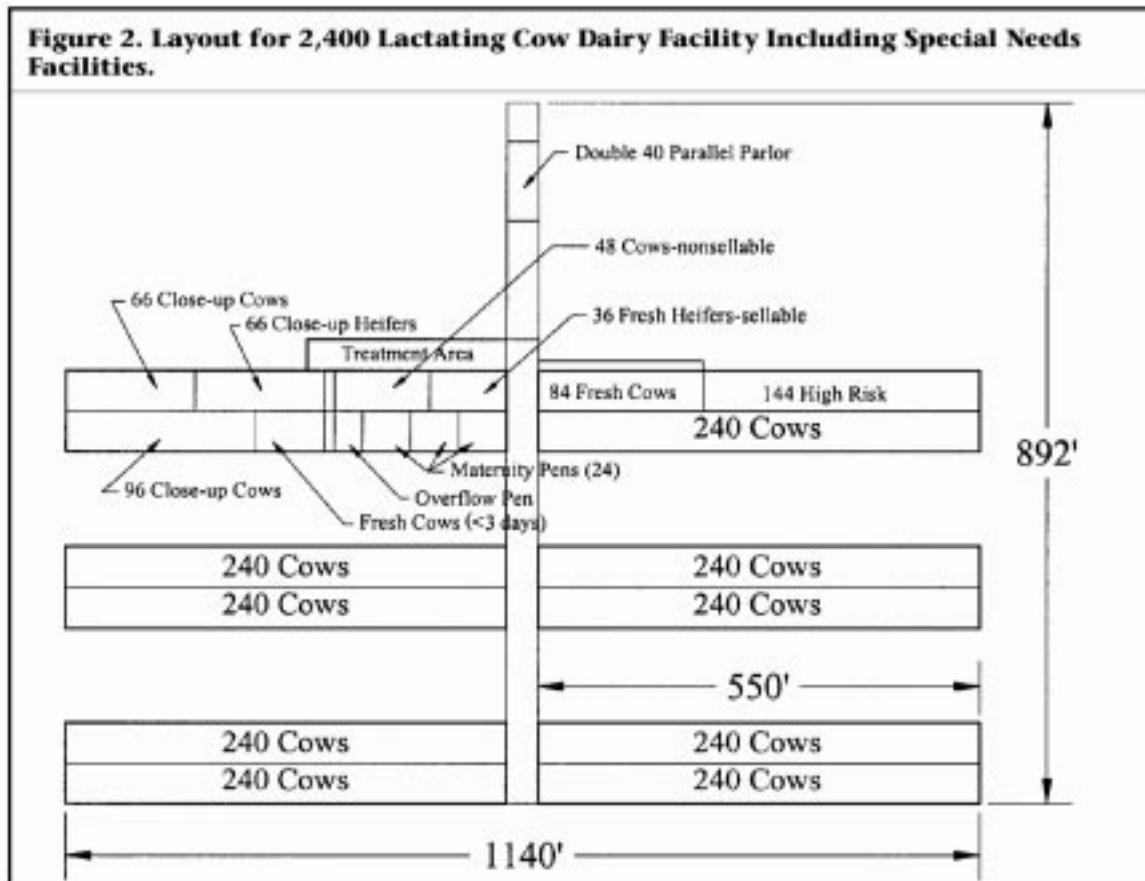
In a freestall dairy, cows and heifers in special needs facilities are housed in either freestalls or loose housing. There are advantages and disadvantages to the two housing systems. Loose housing maximizes cow comfort but requires additional space, bedding material and labor to maintain a sanitary environment.

This is particularly true when organic bedding is used. Freestalls reduce the labor cost of maintaining the resting area. Stalls may intimidate certain groups of cows and, therefore, should not be used. Housing options that can be used for different groups of cows are listed in Table 2.

The drawing in Figure 2, page 5, is based on the recommended group sizes.

Transition Cow Cooling

Heat stress in the transition cow may impair health, decrease milk yield and lengthen time to peak milk production and feed intake. Transition cows are particularly susceptible to infectious diseases and metabolic disorders. Cost estimates of impaired health in the fresh cow range from \$145 per case of



clinical ketosis to \$340 per case for displaced abomasum. Perhaps the biggest challenge in managing the fresh cow is to get her on feed the first few weeks postpartum. Aggressive postpartum appetites minimize time spent in negative energy balance and are necessary to support high levels of milk production.

Research reports that prepartum cooling consistently decreases rectal temperature, lowers respiration rate, and increases calf birth weight. While milk production responses have been somewhat variable, these variations may be explained by differences in duration and extent of prepartum cooling across trials.

One study reported higher peak milk production (up to 5 percent) in cows cooled prepartum compared to those not cooled prepartum (88.4 versus 84.2 pounds milk per cow per day for cooled and control cows, respectively). Another study reported trends for higher milk production due to prepartum cooling (either as shades or evaporative cooling systems). Field trials have demonstrated increased peak milk yield and earlier days to peak production in fresh cows cooled with evaporative cooling compared to non-cooled cows.

Likewise, cooled cows showed greater lactation persistency compared to non-cooled control cows.

The endocrine system is perhaps more sensitive to moderate heat stress during the dry period than during lactation. Prepartum heat stress affects growth of maternal tissues (mammary gland, placental, or fetal tissue), in-

fluences postpartum mammary function, decreases calf birth weight by as much as 10 percent, reduces immunoglobulin content, and lowers nutrient (fat, protein, and lactose) concentration in colostrum. Calves born during the summer suck their dams less vigorously and may have impaired absorption efficiency caused by heat stress. This lowered absorption efficiency, coupled with the lowered content of colostrum, may increase the incidence of health complications and mortality in calves born during the summer and early fall.

Heat stress in cows before breeding and during the implantation phase may influence fertility. A 1988 study reported an increase in both conception rate (59 vs 17 percent) and 90-day pregnancy rate (44 vs 14 percent) of cooled cows compared to non-cooled cows. Additionally, estrous behavior lasted longer in cooled cows (16 hours) than non-cooled cows (11.5 hours) having low body condition scores (average 2.6). Others have demonstrated a 15 percent decrease in services per conception and a reduction in the number of cows culled for reproductive failure (19 vs 7.7 percent) in response to prepartum cooling. A 1971 study reported heifers exposed to heat stress the first 72 hours after artificial insemination did not conceive at all. Postpartum production benefits of cooling dry cows may depend on the length of the cooling period.

Initial research in this area involved shade as the cooling method. While adequate shade is recommended for the far-off dry cow (first 4 to 6 weeks of the dry pe-

riod), recent work suggests that more extensive cooling systems may be justified for close-up dry cows. Much of the immune and endocrine responses reported with transition cows may be applicable to other immune-compromised groups, such as high-risk, mastitis, and sick pens.

Cooling should be provided for all cows housed in the special needs area. Low-pressure sprinklers or soakers should be placed on the feed lines. Mechanical ventilation or fans should be provided both on the feed lines and the housing area. The sprinklers should provide .03 gallons of water per square foot of wetted area per cycle. A common cycle would be 3 minutes on and 12 off. Typically 6 to 8 feet is wetted behind the feed lines.

Fans should be placed on the feed lines and the cow housing areas to provide 800 to 1000 cfm per cow. Typically, a single row of fans over the feed lines and a single row of fans over the freestalls will accomplish the desired airflow. Thirty-six inch fans should be spaced a maximum of every 30 feet and 48-inch fans should be spaced every 40 feet. Fans over loose housing should be placed in banks with fans 10 feet on center with the banks of fans being spaced according to the diameter of the fans being used.

Dairy Layout

One of the issues with special needs facilities is their location on the dairy. They will either be located near the milking parlor or at the back of the dairy. Locating these facilities near the milking parlor reduces walking distance to and from the milking parlor.

It also allows employees working near the parlor to observe close-up cows. The advantage of locating these facilities at the back of the dairy is to allow for easy movement to and from the special needs facilities of far-off dry cows, beef cows and cows that have been dried off.

Locating these facilities away from the main parlor may create the need for a hospital parlor. If the dairy has two main parlors in a head-to-head configuration, special needs facilities can be split into two barns directly behind the parlors.

Figure 2 shows a 2,400 lactating cow dairy with special needs facilities incorpo-

rated. Notice that the special needs facility requires space equivalent to three pens of healthy lactating cows. Figures 3 and 4 include detailed drawings of the freestall buildings that would include the special needs facility.

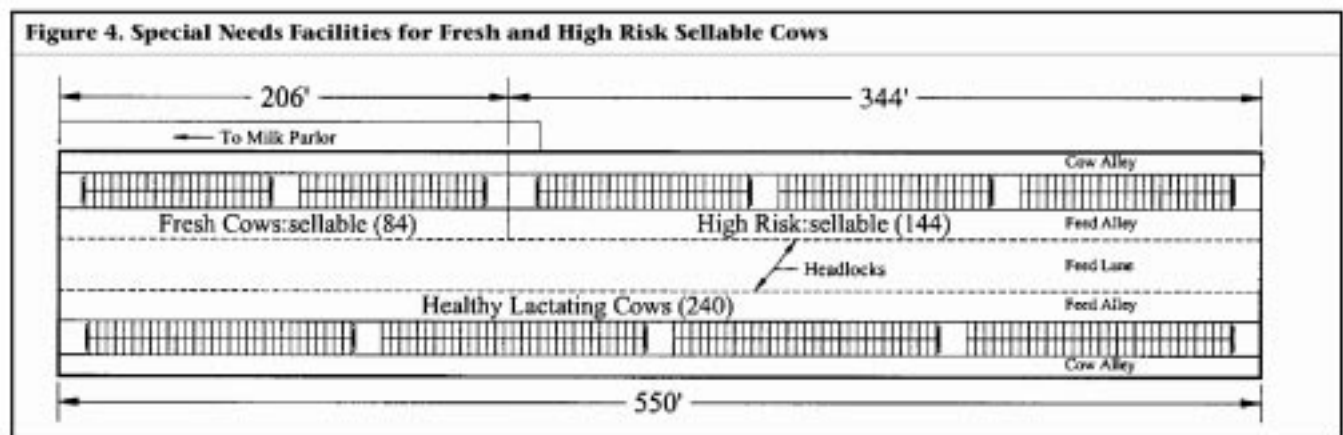
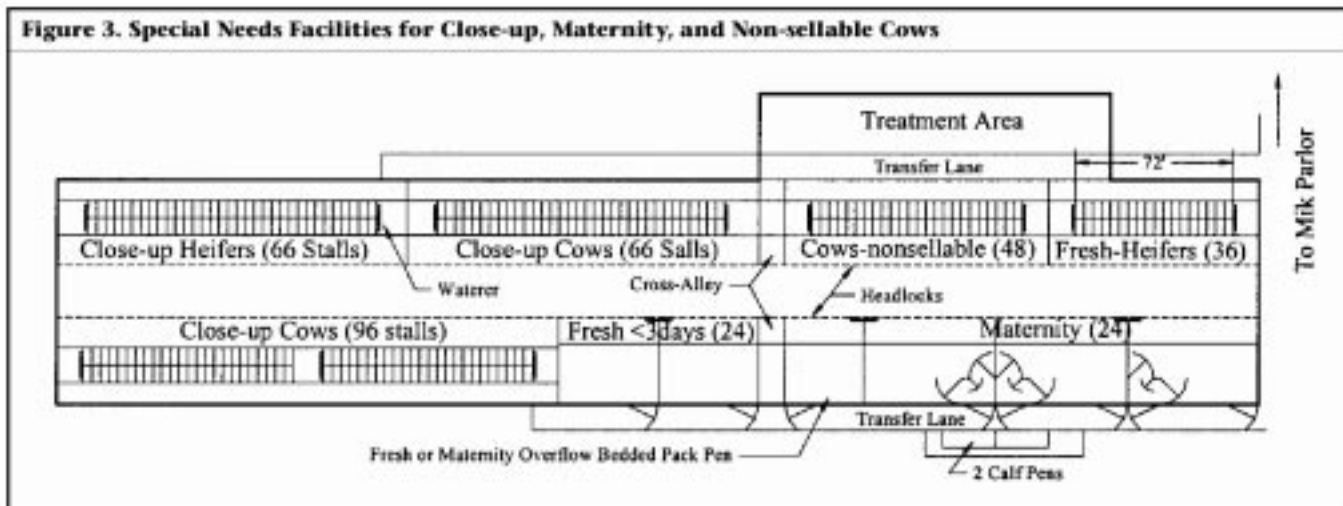
Special Needs Facilities Economic Impact

Generally, special needs facilities require additional capital investments by the dairy producer. These investments must be recovered in the form of additional milk sales from reduced culling, better health, etc. Unfortunately, the economic impact of special needs facilities is case specific and generalization

can be dangerous. The objective here is to estimate the additional investments and expenses required, and additional milk production required to cover such costs.

The following points are important for this analysis:

1. Cash-flow issues are not considered. It is assumed that the dairy has access to additional capital and that additional cash reserves are in place to ensure cash coverage in the short and medium term.
2. All capitalization projects are assumed to be financed at an annual rate of 8 percent for 10 years. No differentiation is made on



the source of such capital. So any additional equity capital has an implicit 8percent annual rate of return built into it.

3. Because cash-flow issues are not considered, it makes no difference from a profitability standpoint whether the annual capital cost is in the form of interest or depreciation. The depreciation used for tax purpose could be different depending on previous fiscal decisions, current tax liabilities, future tax expectations, and changes in tax laws. Tax implications could change cost figures significantly.
4. Repairs and maintenance as an annual cost percentage of initial capital cost was set at 2 percent for buildings and 5 percent for equipment.

The additional capital investment assumed for each component of the special needs facilities are reported in Table 3 along with a percentage of the milking herd for which they should be designed. Depending on the specific conditions of a herd, there are two views that can be taken with regard to these investments. The first is that — with the exception of the free-stalls for close-up cows and heifers and the hospital parlor if constructed — facilities would have to be secured for the different classes of cows whether these animals are housed separately from the milking herd or not. For example, mastitic and sick cows would require 48 stalls in the freestall barns if special facilities were not built.

An alternate view looks at all special needs facilities as a single investment project. With this view, all special needs facilities are considered additional investments. In this document, results are reported for both ends of this spectrum. So additional capital for special needs facilities would range between \$288,000 and \$1,056,400 in a 2,400 milking-cow dairy, or an additional \$120 to \$440 of capital investment per milking cow.

The costs of capital expenses (building and equipment) are reported in Table 3 both on a total annual basis and on a per-cow-per-year basis. At the low end, facilities for close-up cows and close-up heifers incur an additional capital cost of \$18 per milking cow per year. At the high end, these costs would amount to \$66 per cow per year, including the cost of a small double-10 parlor to milk an average of 48 mastitic and sick cows and 24 cows with non-sellable milk. Table 3 also presents the bedding cost expected from these specialized facilities. These costs are based on bedding cost of \$50 per stall per year, and \$0.75 per cow per day on a bedded pack. Total bedding costs in the special needs facilities amount to \$17 per cow per year.

This figure overestimates the real net cost because it assumes that alternatives to dedicated special needs facilities would incur no bedding cost. Total expenses for special needs facilities are estimated at \$23 per cow per year at the low end, and \$83.25 per cow per year at the high end.

Special needs facilities may result in additional oper-

ating costs or savings depending on the conditions. The efficiency of cleaning animal facilities may or may not be improved. Parlor efficiency would likely improve if a small parlor were built to handle cows with non-sellable milk. Assuming that additional cows with sellable milk can be milked through the large herd parlor(s). The dairy could theoretically milk an additional 100 to 200 cows through the large parlor without additional fixed costs and little additional labor cost.

Assuming gross milk revenues of \$12 per cwt and net marginal revenues (income minus variable costs) of \$6 per cwt, special needs facilities require, at the minimum, an additional 383 pounds of milk per cow per year to break even or roughly 1 pound of milk per cow per day. Using the high estimate for costs, special needs facilities require an additional 2,770 pounds of milk per cow per year, or roughly 7.5 pounds per cow per day. Because, in general, a great proportion of the capital and bedding cost would be incurred regardless of whether separate special needs facilities are built, a figure equivalent to 2 pounds of milk cow per day is a good benchmark for the situation where a small parlor is not included.

Because large parlors are more capital and labor efficient than small parlors, new facilities should be designed where all cows are milked in one large milking center. The large milking parlor would be used to milk the nine groups of healthy lactating cows and high-risk sellable cows three times per day in 6.5 hours per shift, allowing 1.5 hours per

Table 3. Additional capital investments for each component of the special needs facilities for 2,400 lactating cow dairy.

% of Herd	Category	Capital Expense ¹			Bedding Expenses ²		Total Expenses ³	
		Add. Capital	\$/year	\$/cow/year	\$/year	\$/cow/year	\$/year	\$/cow/year
	Close-up cows and close-up heifers							
10	240 stalls @ \$1200	\$288,000	\$43,200	\$18.00	\$12,000	\$5.00	\$55,200	\$23.00
1	Calving area (120 × 40) @ \$10/ft ²	48,000	7,200	3.00	6,500	2.70	13,700	5.70
1	Fresh cows —non sellable milk pen 24 stalls @ \$1200	28,800	4,320	1.80	1,200	0.50	5,520	2.30
5	Fresh cows —sellable milk pens 120 stalls @ \$1200	144,000	21,600	9.00	6,000	2.50	27,600	11.50
2	Mastitis and sick cows, non-sellable 48 stalls @ \$1200	57,600	8,640	3.60	2,400	1.00	11,040	4.60
6	High-risk, sellable milk pen 144 stalls @ \$1200	172,800	25,920	10.80	7,200	3.00	33,120	13.80
3	Hospital parlor Double shell-building Equipment	80,000 140,000	12,000 21,000	5.00 8.75	— —	— —	12,000 21,000	5.00 8.75
1.5	Beef and calves shipping area 90 sq. ft/cow x \$10/ft ²	32,400	4,860	2.00	5,000	2.10	9,860	4.10
	Treatment area 2500 sq. ft.: \$25,000 Equipment: \$25,000	50,000	7,500	3.10	—	—	7,500	3.10
	Calves area 800 ft ² : \$8,000 Equipment: \$1,800	9,800	1,470	0.60	1,200	0.50	2,670	1.10
	Office 200 ft ² @ \$25/ft ²	5,000	7500	.30	—	—	750	0.30
	Total	\$1,056,400	\$158,460	\$65.95	\$41,500	\$17.30	\$199,960	\$83.25

¹Capital expenses are based on 8% interest rate over 10 years and include depreciation, interest, taxes and insurance.

²Bedding expenses are based on \$50 per/stall/year or \$0.75 per cow/day on bedded pack.

³Total expenses are the sum of capital and bedding expenses.

shift to milk sick cows, fresh cows non-sellable and to clean the parlor facilities. During planning, allowances should be made to construct a hospital parlor in the future. This way, a dairy can increase the number of cows with sellable milk being milked in the large dairy parlor by 5 to 10 percent.

Risk Management and Biosecurity

The special needs area provides a dairy an opportunity to manage risk through disease control measures. Manageable risks include both human and animal disease, financial loss, marketability of milk, and animals and poten-

tial liability. Animals housed in these facilities are particularly vulnerable to contracting new infections. This is especially true for fresh cows, which have suppressed immunity around the time of calving. The newborn calf is at risk to contract Johne's disease, *Mycobacterium paratuberculosis*. Cleanliness and daily

maintenance of the calving area and the special needs facilities are critical. This area also provides an excellent opportunity to reduce the risk of antibiotic contamination of milk, as treated animals can be effectively isolated from the lactating herd.

It is important to identify and prioritize potential risks and develop appropriate control measures. The manager needs to gather information and advice from the herd veterinarian and others to properly assess exposure to these various diseases and develop a plan.

Some pathogens generally regarded as high risk for dairy herds include *Staphylococcus aureus*, *Mycobacterium paratuberculosis* (Johne's disease), bovine viral diarrhea (BVD) and Salmonella species. In addition diseases such as mycoplasma, foot warts, Chlamydia and other pathogens for which there is not an effective vaccine could jeopardize individual cows as well as herd health.

The highest risk for introduction of new disease into the herd comes from purchased cattle. Therefore, an effective program of prescreening and isolation of new arrivals is a key element of an effective biosecurity program. A location for accepting, processing and quarantining new arrivals should be located at least one-half mile from the closest animal facility. An additional risk exists with movement of animals in multiple site operations. Consideration should also be given to cattle movement, people movement, vehicles and equipment, feedstuffs, birds, rodents and

wild ruminants, water and manure management.

To be effective, a biosecurity program should be written and clearly communicated to employees, consultants and visitors. Dairies should display appropriate signage to alert and remind people of the dairy's policies.

The biosecurity plan should include a drawing depicting the traffic flow plan for all activities on the dairy. Access to special needs facilities should be limited to those personnel necessary to carry out daily activities. This minimizes the transfer in or out of organic material or contaminated equipment that could spread infectious disease.

Veterinarians, hoof trimmers, service persons, sales people and other visitors to the dairy should have easy access and a defined area where they are to perform their service to the dairy. This minimizes unnecessary traffic around the dairy.

A place to disinfect equipment should be provided near working areas. Professional, delivery, service and sales personnel need to be aware of the dairy's policy on disease containment. Equipment and vehicles should be clean and/or disinfected. Clothing should also be clean, and footwear should be of the type that can easily be disinfected. In some cases, on-site disposable coveralls and shoe covers may be provided.

Vehicles entering the dairy to deliver new arrivals should be provided an entry point that bypasses the majority of the dairy and allows easy access to the isolation/

quarantine area. Vehicles arriving to remove dead or cull animals should have a designated location where easy loading is available and away from the special needs area.

This area could also double as a location where the herd veterinarian could perform post mortem examinations on dead animals. A provision for cleaning and disinfection should be considered. After carcass removal and rinsing of the area, a final disinfection should occur. Examples of disinfectant solutions include chlorhexidine diacetate (Nolvasan®-S), sodium hypochlorite (bleach), quaternary ammonium chloride (Spectrosol®), and quaternary ammoniums with bisntributylin oxide (Roccal®-D Plus).

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Contributing authors:

N. St.-Pierre—Department of Animal Science, The Ohio State University

S.R. Stokes—Department of Animal Science, Texas A&M University

D.V. Armstrong—Department of Animal Science, University of Arizona

M.J. Gamroth—Department of Animal Science, Oregon State University

W. J. Cole—Monsanto Dairy Business

J.P. Goff—National Animal Disease Center

G. Boomer—Monsanto Dairy Business

G. Bethard—G & R Dairy Consulting

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