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The Impact of Sanitation Reform on the Farm Landscape in U.S. Dairying, 1890–1950

In the late nineteenth and early twentieth centuries, spectacular advances in bacteriology brought profound responses in the United States ranging from the public level down to the personal.[1] Among the many American landscapes affected by the germ theory, perhaps none was more thoroughly transformed than the dairy farm. Progressive- and New Deal–era governments imposed milk sanitation regulations that reached far into the hinterland, reshaping the farm—and farm dwellers' spatial practices—to an unprecedented degree through state control.

The subject is significant partly for its sheer scale and landscape impact; this dairy version of a Great Rebuilding affected thousands of farms across the nation. To comply, dairying families rebuilt their barns, erected milk houses, and rearranged their farmsteads, but before long the role of architecture itself in securing clean and safe milk was called into question. Some scientists contended that other factors contributed far more to reducing bacteria counts: proper milking, handling, and cooling practices; animal-disease eradication campaigns; and above all, pasteurization. Yet architectural requirements persisted—as they do to this day. In the public mind visual cleanliness and modern appearance were still crucial indicators of proper sanitation. Located at the nexus between food production and consumption, the modern milk house and sanitary dairy barn functioned as key elements in a landscape discourse between country and city.[2]

The story appears through published sources such as dairy bacteriology texts and farm journals; archival materials such as completed dairy score cards and agricultural extension materials; and the landscape itself. Barns and milk houses reveal how milk producers interpreted the mandates and engaged in a dialogue with consumers. The broader landscape context suggests how the new spatial organization subtly reshaped daily experience. The examples discussed are mainly from Pennsylvania, but they well represent the nationwide range of landscape responses to the new imperatives.[3]

Producing milk for fluid consumption was tied to the rise of cows' milk as a popular substitute for human breast milk.[4] A new infrastructure developed to funnel milk from farm to city, starting when human workers milked from the cow into a pail and then emptied pails into metal cans. These were sent, in turn, by rail into the city. Over time, large corporations organized the milk supply across an ever wider geographic area. They built local plants where their "patrons" delivered milk to be pasteurized, bottled, cooled, and sent to market. Truck transport, via a developing highway system, expanded the "milk shed" (analogous to a watershed) beyond rail routes by the 1930s.[5]

Fluid milk consumption was growing just at the moment when it became apparent that cows' milk was an ideal growth medium for bacteria.[6] Soon, researchers expanded the list of suspected milk-borne human diseases to include tuberculosis, diphtheria, undulant fever, typhoid, infantile diarrhea, cholera infantum, scarlet fever, septic sore throat, and foot-and-mouth disease.[7] As epidemiologists began to piece together the processes by which disease reached humans through

milk, public officials devised multiple strategies to deal with the "Milk Question." Campaigns to eradicate bovine tuberculosis and other diseases focused on testing, culling, vaccinating, and certifying herds. Urban health departments formulated regulations designed to ensure a cleaner raw-milk supply by requiring producers to follow specific milk-handling practices in a clean environment.[8]

Dairy regulation typically blended thresholds for bacteria counts with evaluations of a farm's environment (barns, milk houses, water supply, and waste disposal) and handling practices (milking, straining, keeping cows and humans clean, cooling milk). They tied these standards to milk grades and, increasingly, to prices paid. Regulation developed over a half century and varied geographically; major cities led the way, while many smaller municipalities and rural districts were still not covered until as late as 1950. State and municipal regulations overlapped, and competing companies' milk-supply lines crisscrossed, leading to inconsistencies in expectations.[9] Yet where architecture was concerned, basic requirements varied little.

The laws affected multitudes of producers. A typical dairy herd in the early twentieth century numbered between five and ten generally low-producing cows, so city milk sheds were typically fed from thousands of small-scale dairying operations. In 1925, for example, over 82,000 New York State farms sent milk to New York City; the city also took in milk from five other states and Canada. In 1935, 14,000 farms supplied Detroit. And so on. Every one of these farms was eventually required to have barns and milk houses that met sanitation standards. Landscape change could take place rapidly as farmers scrambled to finish building before mandates went into effect. When statewide legislation was passed in Pennsylvania, state bureau of health official H. E. Shroat announced that "milk houses sprang up like magic and the month of August [1931] shall go down in dairy history in Pennsylvania as the month of two by fours and ten penny nails. Milk houses were erected by the thousand and construction not confined to lumber as a large percentage was made from concrete blocks."[10]

The earliest dairy regulations drew from prevailing understandings of how bacteria lived, multiplied, and traveled. At first, many believed that the cow's udder was sterile, so that all milk contamination must occur outside the animal. Therefore, the focus fell on handling and environment. Henry Ogden, author of *Rural Hygiene* (1911), confidently declared that "in the clean stable, where so few germs enter, disease germs could hardly find any opportunity for lodgment." He and other sanitarians proposed that disease germs got into milk from dust particles released through incompletely sealed surfaces and that pathogens multiplied in dark, humid conditions. Some critics proposed that inadequate ventilation led to dangerous stale air, leading somehow to disease. "Ventilation and sunlight," Ogden declared, "are both excellent antiseptics . . . the value of the window is in its disinfecting power on the bacterial life of the stable." Researchers discovered that cow manure teemed with bacteria and therefore called for regular manure removal and stringent fly control.[11]

In the harsh light of germ consciousness, traditional barn types underwent radical reevaluation. The famous Pennsylvania forebay barn, for example, had long been lauded as a model of efficient and productive design. Now, it seemed a veritable germ factory. E. Grant Lantz of the Pennsylvania State College proclaimed in 1926 that "sunshine and fresh air are two antagonistic foes of dirt and disease, yet both were sadly neglected in the original design of the Pennsylvania bank barn." No longer a clever space-extending device, the forebay was now a light-blocking impediment. The cellar stables had once been praised as warm, comfortable animal shelters; critics now depicted them as dark, dirty, dusty spaces harboring all manner of microbes. Wooden partitions and mangers came under fire for sheltering germs, and accumulated stable manure, once regarded as the *sine qua non* of the Pennsylvania barn, was recast as a sanitary horror. Neither did sanitarians spare from criticism other traditional barn types in New York State and the Midwest.[12]

The very construction techniques used in traditional barns came under criticism. Ernest

Kelly, author of the standard USDA Farmers' Bulletin on clean milk production (1914; revised 1931), maintained that barns "which have many exposed beams, braces, and ledges on which dust may lodge are undesirable."[13] His description fit any timber-frame barn and implicitly applied to most existing barns in the Northeast. Critics also faulted construction that left cracks for dust and dirt to collect. The influential 1909 publication *Milk and Its Relation to Public Health* featured a photograph of an unkempt stable with hay straggling through yawning ceiling cracks. The caption read, "This is the kitchen where baby's breakfast is prepared."[14] As sanitarians navigated this new, dangerous world, they proposed regulatory solutions that had a strong architectural component. The barn stable attracted considerable attention as the site where cows were milked daily and housed evenings and winters. By the mid-1930s most major milk markets required concrete stable floors on the assumption that impermeable surfaces would reduce bacterial contamination. For the same reason, reformers preferred easy-to-clean metal components like stanchions, feed troughs, and window frames. They urged barn builders to reduce dust-gathering surfaces, construct tight tongue-and-groove ceilings, and provide ventilation and light (Figure 1). Authorities often recommended a specific square footage of window space (most often four) per cow as a desirable standard. Many markets required twice-a-year whitewashing. Most ordinances also stipulated that horses, swine, and chickens must be physically separated from cows to minimize cross-species contamination. Laws generally mentioned well-drained barnyards with separate manure-storage facilities. Disposal of human waste also received greater scrutiny.[15]

Figure 1. Barn interior showing older (*far right*) and newer stabling (*left*). From A. M. Goodman, "Remodeling Barns for Better Dairy Stables," *Cornell University Extension Bulletin*, no. 742, revised version (November 1951): 16.

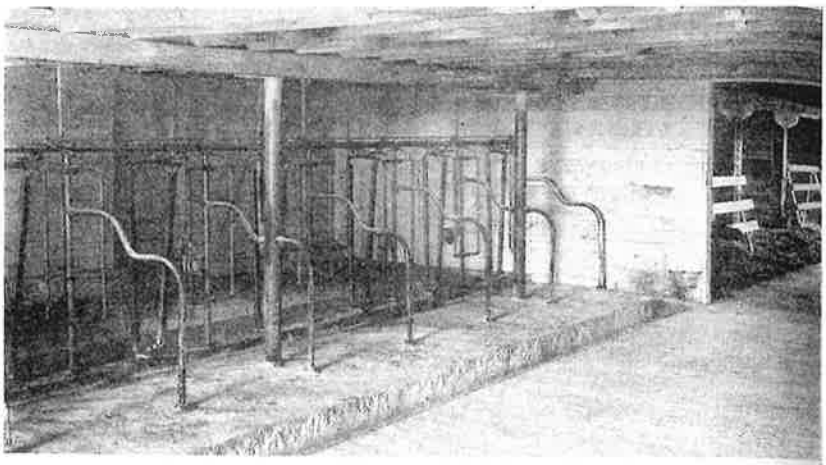


Figure 8. Interior of a partially remodeled barn. Note the large wooden posts and bolsters in the background. Note also how these have been replaced in the new stable with old, concrete-filled, boiler flues and steel bearing plates. See pages 49 to 55.

All milk markets required producers to build a milk house, a dedicated building where the milk would be cooled in cans and readied for transport. Utensils would often be washed and stored here. Milk house requirements generally demanded concrete block or other "impervious" material, sloping floors for drainage, adequate light, ventilation, screened openings to exclude flies, and space for equipment to cool milk, heat water, and clean utensils. Direct connection between the barn and the milk house was prohibited, as was siting near pigsties, poultry houses, or manure piles.[16]

Compliance with the new regulations was measured through various means, but the most popular was the dairy score card. By 1923 an estimated 240 cities in twenty-five states used a dairy score card.[17] These score cards were filled out by health department inspectors. Large milk distributors employed barn inspectors or field men who used the cards to monitor their suppliers in advance of the health inspector's visits.[18] Typically, the dairy score would derive from a combination of handling practices and building features. The score card system offered some flexibility by assigning partial scores and by deriving the total score from multiple separate factors. The USDA score card (a model for many markets) deducted for milk houses where flies were found, where walls and ceilings were unpainted wood, or where cooling facilities were absent. It gave points if the milk house had separate rooms for washing utensils and handling milk (Figure 2). Later on, score cards were updated to reflect electric-powered technology.[19]

The new architectural regulations brought significant departures from traditional farm building design practice. Farmers expecting to solve an agricultural problem did not devise specifications; public-health officials intending to solve a sanitation problem defined them. Ill-in-

Official Score Card.

United States Department of Agriculture, Bureau of Animal Industry.

Dairy Division.

Indorsed by the Official Dairy Instructors' Association.

EQUIPMENT.	SCORE. Perfect.	Allowed.
COWS.		
Health	6	
Apparently in good health	1	
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed	5	
(If tested within a year and reacting animals are found and removed, 2.)		
Food (clean and wholesome)	2	
Water	2	
Clean and fresh	1	
Convenient and abundant	1	
STABLES.		
Location of stable	2	
Well drained	1	
Free from contaminating surroundings	1	
Construction of stable	4	
Tight, sound floor and proper gutter	2	
Smooth, tight walls and ceiling	1	
Proper stall, tie, and manger	1	
Provision for light: Four sq. ft. of glass per cow	4	
(Three sq. ft., 3; 2 sq. ft., 2; 1 sq. ft., 1. Deduct for uneven distribution.)		
Bedding	1	
Ventilation	7	
Provision for fresh air, controllable flue system	3	
(Windows hinged at bottom, 1.50; sliding windows, 1; other openings, 0.50.)		
Cubic feet of space per cow, 500 ft.	3	
(Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.)		
Provision for controlling temperature	1	
UTENSILS.		
Construction and condition of utensils	1	
Water for cleaning	1	
(Clean, convenient, and abundant.)		
Small-top milking pail	3	
Facilities for steam	1	
(Hot water, 0.50.)		
(In milk house, not in kitchen.)		
Milk cooler	1	
Clean milking suits	1	
MILK ROOM OR MILK HOUSE.		
Location: free from contaminating surroundings	1	
Construction of milk room	2	
Floor, walls, and ceiling	1	
Light, ventilation, screens	1	
Separate rooms for washing utensils and handling milk	1	
Total	40	

METHODS.	SCORE. Perfect.	Allowed.
COWS.		
Cleanliness of cows	8	
(Free from coarse dirt, 6.)		
STABLES.		
Cleanliness of stables	6	
Floor	2	
Walls	1	
Ceiling and ledges	1	
Mangers and partitions	1	
Windows	1	
Stable air at milking time	6	
Freedom from dust	3	
Freedom from odors	2	
Cleanliness of bedding	1	
Barnyard	2	
Clean	1	
Well drained	1	
Removal of manure daily to field or proper pit	2	
(To 50 feet from stable, 1.)		
MILK ROOM OR MILK HOUSE.		
Cleanliness of milk room	3	
UTENSILS AND MILKING.		
Care and cleanliness of utensils	8	
Thoroughly washed	2	
Sterilized in live steam for 15 minutes	3	
(Placed over steam jet, or scalded with boiling water, 2.)		
Inverted in pure air	3	
Cleanliness of milking	9	
Clean, dry hands	3	
Udders washed and dried	6	
(Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.)		
HANDLING THE MILK.		
Cleanliness of attendants in milk room	2	
Milk removed immediately from stable without pouring from pail	2	
Cooled immediately after milking each cow	2	
Cooled below 50° F.	5	
(51° to 55°, 4; 56° to 60°, 2.)		
Stored below 50° F.	3	
(51° to 55°, 2; 56° to 60°, 1.)		
(If delivered twice a day, allow perfect score.)		
Transportation below 50° F.	2	
(51° to 55°, 1.50; 56° to 60°, 1.)		
Total	60	

Equipment ..... + Methods ..... = ... **Final Score.**

Note 1.—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

Note 2.—If the water is exposed to dangerous contamination, or there is evidence of the presence of a dangerous disease in animals or attendants, the score shall be 0.

Figure 2. U.S. Department of Agriculture, "Official Score Card," 1915. Published in James D. Brew, "Milk Quality as Determined by Present Dairy Score Cards," *New York Agricultural Experiment Station Bulletin*, no. 398 (March 1915): 111.

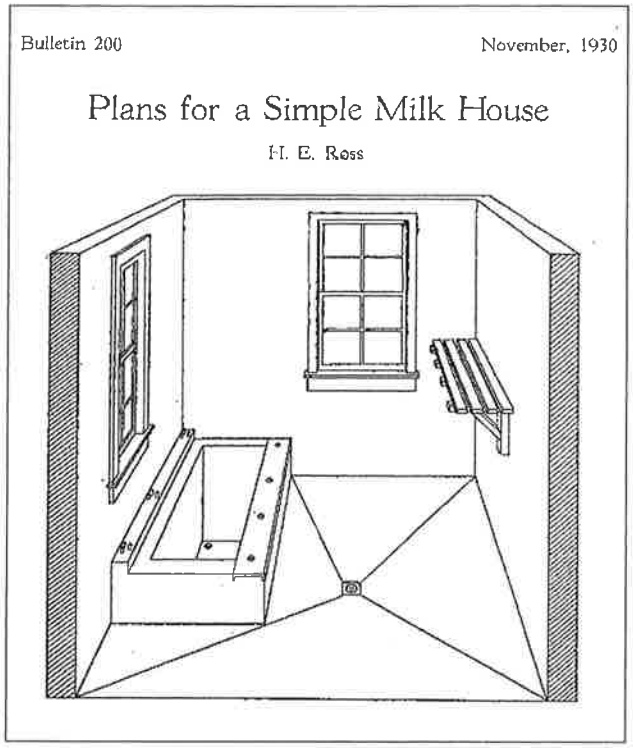


Figure 3. Interior view of a simple milk house. From H. E. Ross, "Plans for a Simple Milk House," *Cornell Extension Bulletin*, no. 200 (November 1930): front cover.

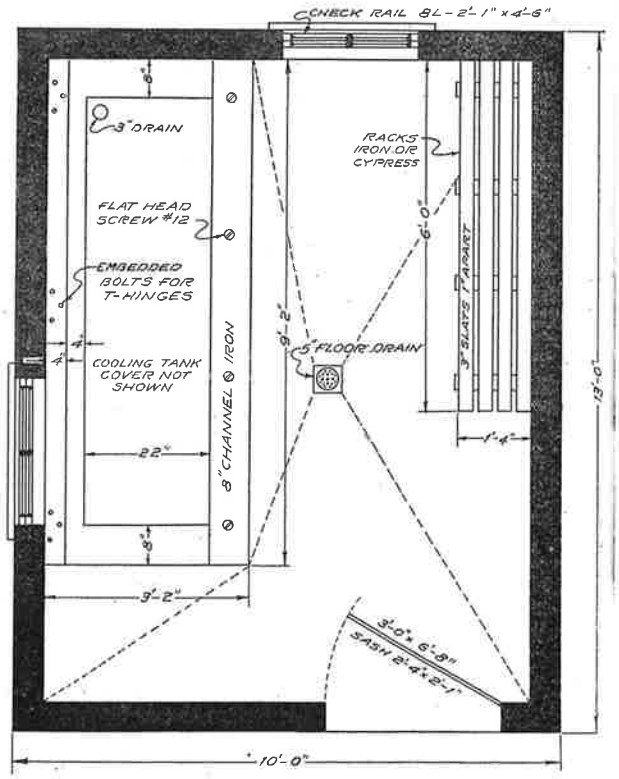


Figure 4. Plan for a small milk house. From H. E. Ross, "Plans for a Simple Milk House," *Cornell Extension Bulletin*, no. 200 (November 1930): 4.

formed farmers found to their chagrin that it was risky to build without first consulting experts who understood the regulations. Agricultural extension agents quickly stepped in, disseminating designs produced by trained agricultural engineers. The plans usually contained detailed instructions, photographs, bills of materials, and drawings showing layout and construction details (Figures 3 and 4).[20]

Commercial enterprises also moved to offer products tailored to new standards. The Portland Cement Company advertisements touted the supposed sanitary advantages of concrete and marketed designs for milk houses built of concrete block (Figure 5). Makers of hollow-tile blocks, metal windows, stanchions, and ventilators freely used "sanitary" as a watchword when marketing their wares (Figures 6 and 7). Popular architectural catalog companies featured milk house and barn designs.[21]

Dairy reforms swept through the barn basement with transforming force. Today, in Pennsylvania it is unusual to find a barn with its original lower-level configuration. Transverse wooden stalls, mangers, horse box stalls—all were ripped out. Then, the dirt floor was concreted over, with the floor organized into raised platforms, gutters, litter alleys, and feed alleys—as recommended. Most farmers installed mass-marketed metal stanchions, sometimes with integrated individual water cups.[22] A popular type of metal-framed window tilted inward on the theory that "fresh air is admitted above the cow's [*sic*] bodies," thus garnering points for both lighting and ventilation (Figure 8). Builders frequently enclosed the Pennsylvania barn forebay with an amply glazed wall (Figures 9 and 10) and sometimes pierced stone gable-end foundation walls with new openings (see Figure 9).[23]

Some farming families chose to build anew. Land-grant colleges and commercial concerns published plans for modern barns usually built on a single level (Figure 11). A gable-end door led to a longitudinal center aisle flanked by stanchions. The original flooring in these barns was concrete, with integral gutters and alleys. Large windows lined the long sidewalls. The upper level provided ample hay storage. These barns offered spatial or-

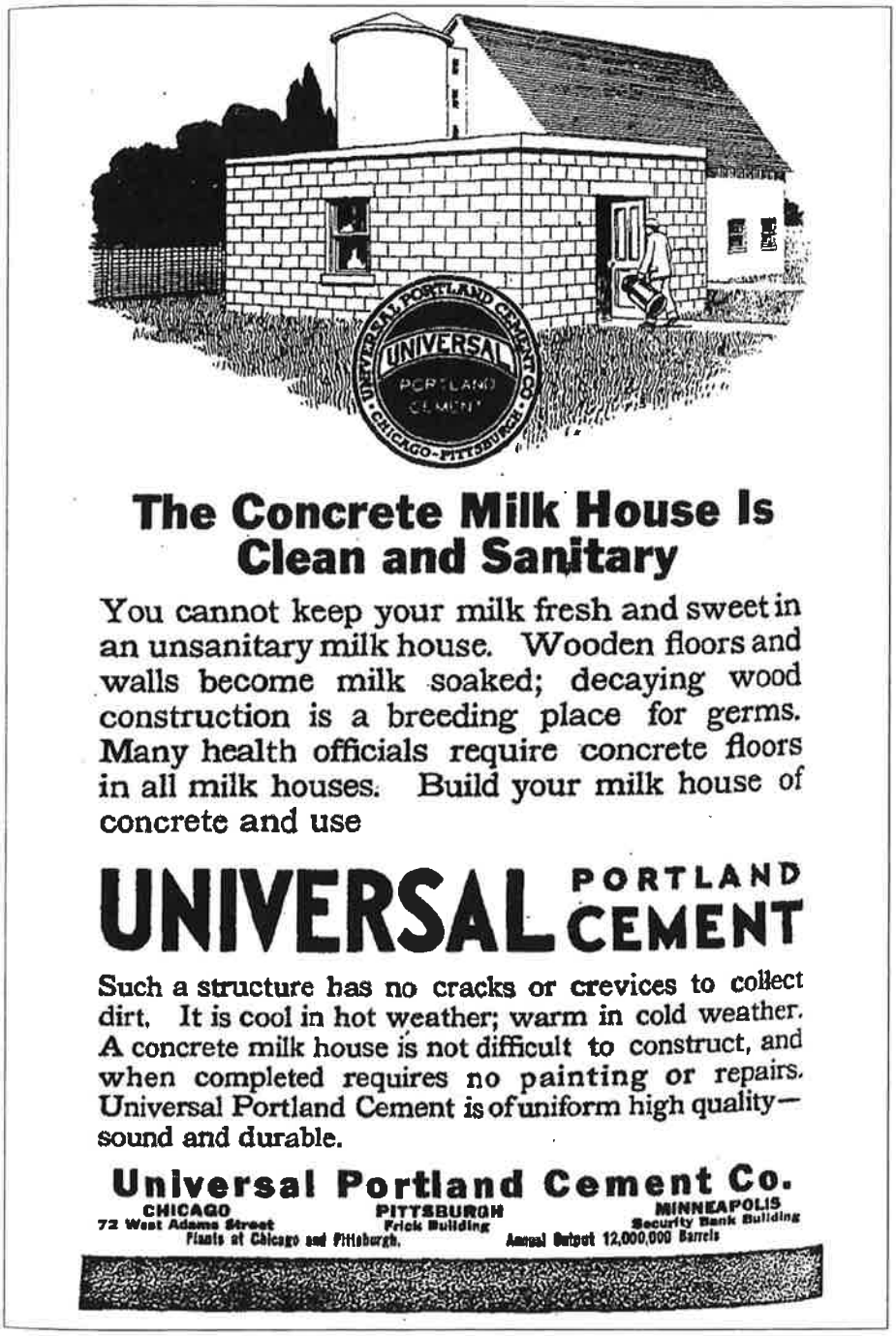


Figure 5. Advertisement for Universal Portland Cement and its uses in "sanitary" milk house construction. *Farmers' Review*, July 26, 1913, 16.

ganization for specialized, sanitation-conscious dairying.[24]

The milk house was a new building type even more closely regulated than the barn. We might therefore expect to find marked architectural uniformity in milk house examples, but field study shows that milk houses exhibit scarcely more standardization than do traditional forms like the Pennsylvania barn. Within a consistent set of design parameters, builders interpreted the milk house in varied forms, materials, and finishes. Average herd sizes between five and ten animals meant that most milk houses in Pennsylvania were small—as small as eight feet by ten feet, but usually around two hundred square feet. Milk houses were usually sited at the gable end

Figure 6. Advertisement promoting barn ventilator as an aid to disease prevention. From *Farm Mechanics* 2 (February 1920): 114.

of the barn, on the side nearest the house and lane. As the rules dictated, they lacked any direct connection into the barn, even if they abutted it. Roof styles ranged from gabled to shed, pyramid, and hipped versions. Plain concrete block was the most common milk house material, but rock-face block, refractory brick, hollow-tile block, and beaded board also appeared. Ventilation requirements were interpreted variously, from simple louvered openings in a gable peak to metal roof-ridge ventilators. Windows ranged from metal types that tilted or swung inward to wood-frame sash styles (Figures 12, 13, and 14).[25]

Most older Pennsylvania milk house interiors had a single room. Floors were always concrete and usually sloped. A concrete cooling tank was sometimes built into the milk house fabric. Water would have been hand-carried to the milk house, pumped by windmill, or fed by gravity power. Early sanitation requirements predated widespread rural electrification, so none assume electric power. Today, most milk houses stand unused, and many elements have been removed, but a few retain features such as racks for storing equipment, washing facilities, and cooling boxes. Some have been adapted to hold bulk tanks.

An example from Centre County, Pennsylvania, shows how builders invested great care and thought in milk house design (Figures 15 and 16). The concrete-block structure abuts the barn gable and is slightly banked to match the barn's slope. A raised poured concrete platform joins the milk house to a Dutch door under the barn forebay, allowing for efficient transfer of milk from barn stable to milk house without violating rules prohibiting direct connection. The milk house roof extends on the front side, conferring protection from the elements. The interior has a poured concrete floor with a drain and a roof opening for ventilation. A standpipe in

one corner brought water into the building. Probably, the cooling tank was on the blank rear wall. Two manufactured metal windows have hinged upper sections that open inward. The building's beveled poured-concrete windowsills, exposed rafters, and wooden gable fascia board add modest decorative touches.

As time went on, the state of knowledge about dairy bacteriology changed. New research suggested that the cow's udder was not sterile after all but could contain and thus transmit harmful bacteria. Sanitarians also realized that even milk with very low overall bacteria counts might still kill if it harbored pathogens.[26] At the same time,

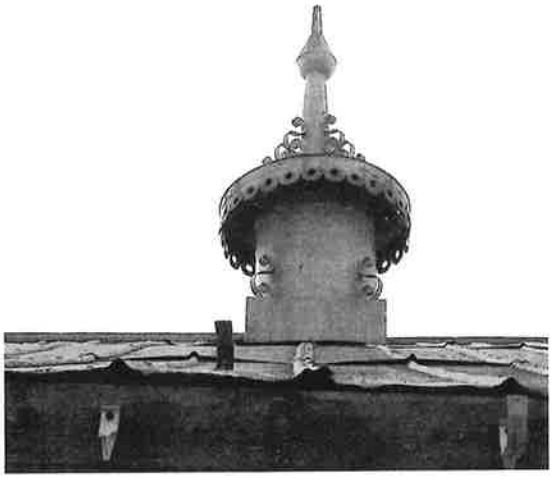


Figure 7. Barn roof ventilator, Franklin County, Pennsylvania, c. 1920. Photograph by the author, 2009.

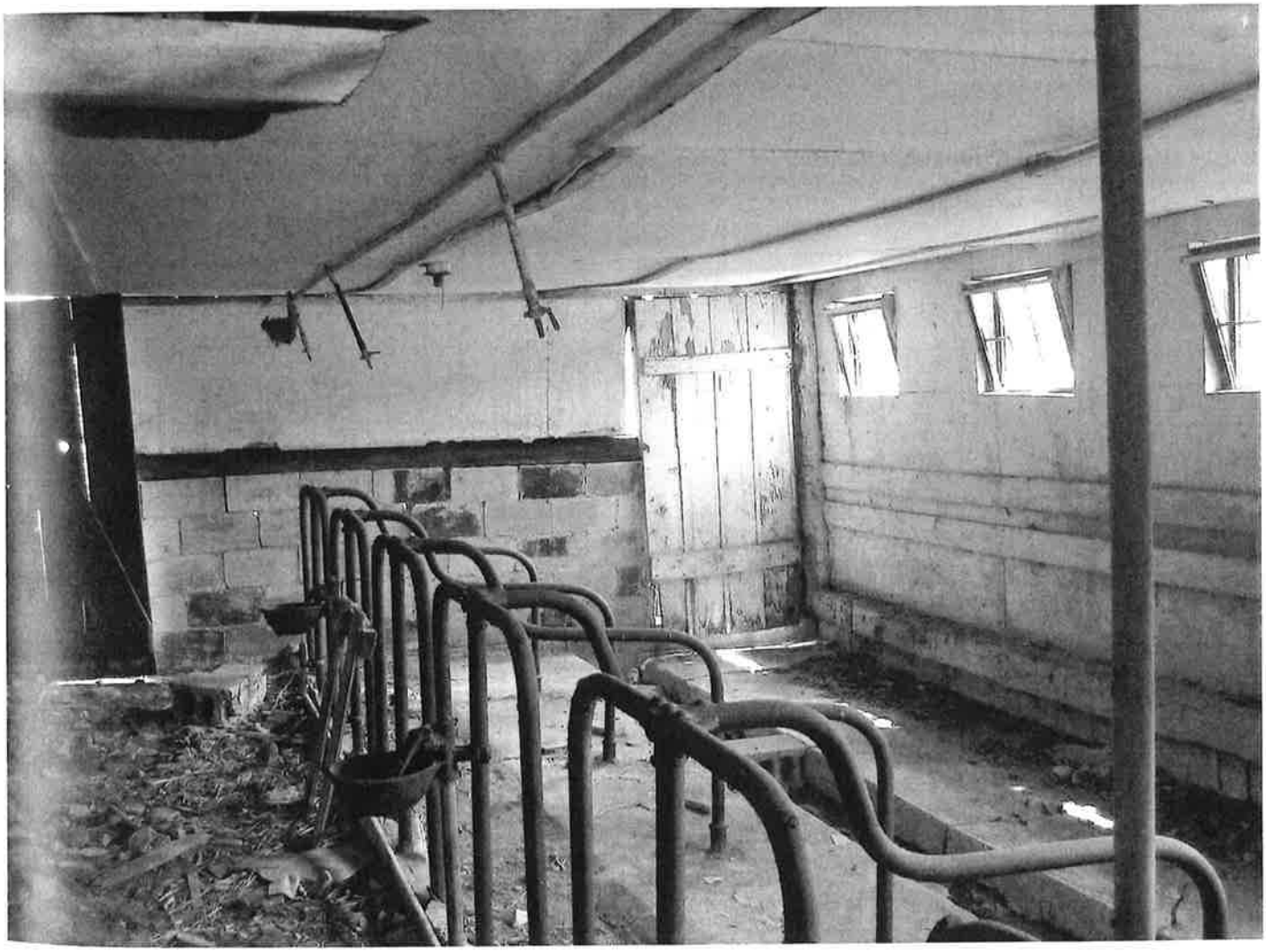


Figure 8. Interior barn renovation, Tioga County, Pennsylvania. This late nineteenth-century barn stable was renovated around 1930. Concrete floors and metal stanchions with water cups were installed, and tilting metal windows were inserted into the stable wall. Photograph by the author, 2008.

Figure 9. Renovated barn, Chester County, Pennsylvania. Originally, this nineteenth-century barn probably had the extended posted forebay characteristic of southeastern Pennsylvania. In the mid-twentieth century it was renovated for dairying. The forebay was enclosed with a concrete-block wall with windows inserted; stables were concreted; and tilting metal windows were inserted into the original stone foundation wall. Photograph by the author, 2010.

Figure 10. Renovated barn, Lebanon County, Pennsylvania. The original portion was built around 1850. About 1925 the forebay was enclosed with a stone wall with long strips of windows. Photograph by the author, 2009.

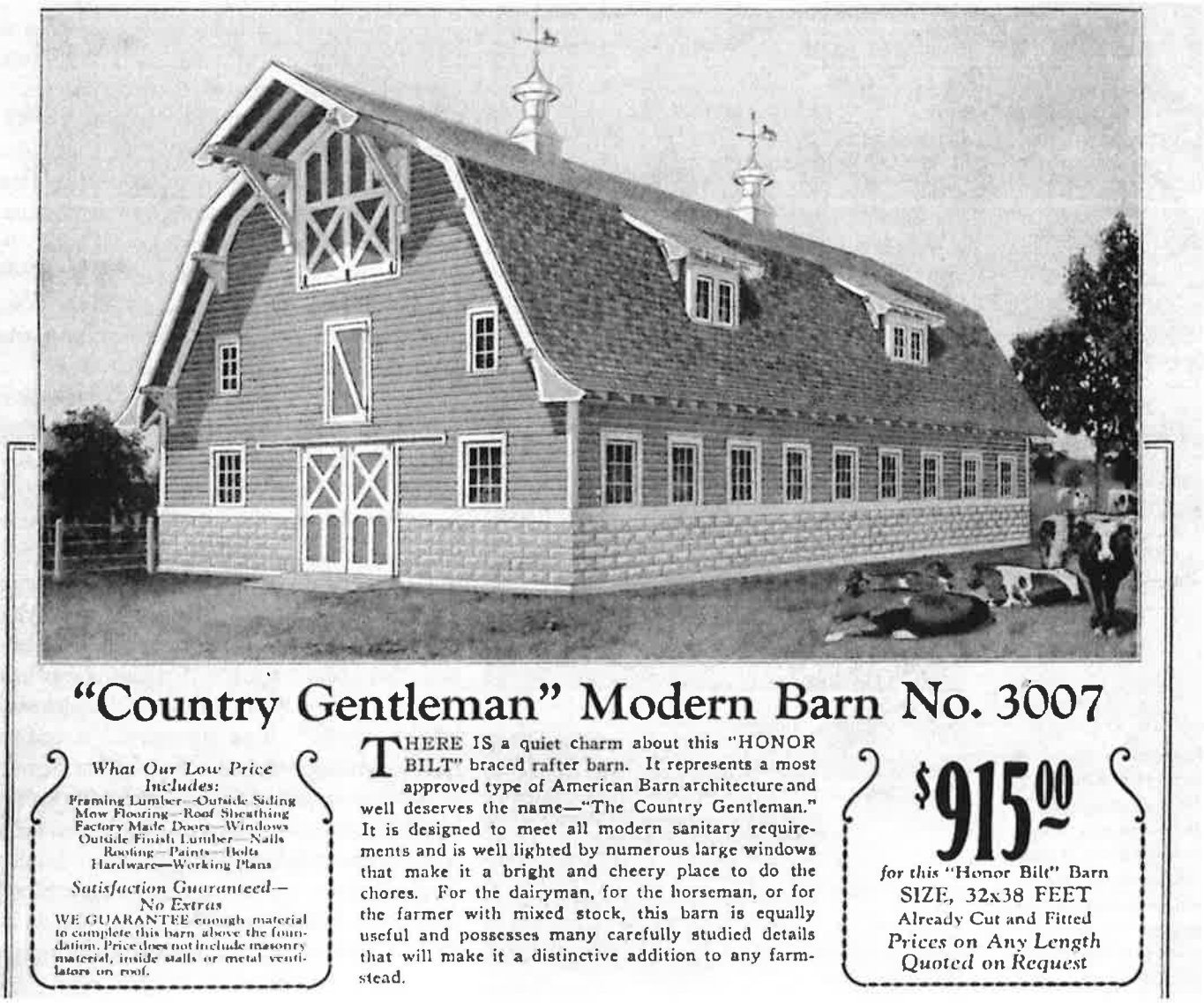


Figure 11. Sears "Modern Barn" design, 1927, billed as meeting "modern sanitary requirements." From Sears, Roebuck Company, *Modern Farm Buildings Already Cut and Fitted Barn Equipment Catalog*, 1927, 28.

researchers investigated the contribution of various factors to bacteria counts in milk. Studies challenged the notion that dust was a major contributor and questioned the germicidal impact of fresh air and sunlight. An important 1918 publication concluded that the three "Essential Factors in the Production of Milk of Low Bacterial Content" were

> first, the use of sterilized utensils; second, clean cows, particularly the udders and teats; third, the use of the small-top pail. By the use of these factors it has been possible to produce milk of a low bacterial count and practically free from visible dirt in an experimental barn which represents a poor type found in this country.[27]

Prominent dairy researcher Charles E. North inventoried the elements of "well constructed and sanitary barns" only to dismiss these "cow palaces" as irrelevant to sanitation. Indeed, a notorious milk-borne epidemic was traced to a dairy that had been held up as a model for its hygienic and modern stable design.[28] Dairy texts began to reflect the new science by the 1920s and 1930s.[29]

Given these developments, it would seem that

architectural requirements were irrelevant to the milk sanitation problem or, at most, marginally important. Yet they remained very much in force; farmers were compelled to invest money in buildings or lose access to markets. The continued presence of architectural requirements was due to powerful aesthetic and cultural factors.

The aesthetic factors included harmless but potentially offensive odors and appearances.[30] Farmers and sanitarians alike recognized that objectionable flavors and odors got into milk. The Sheffield Farms company newsletter warned suppliers: "I have had a woman who used a lot of milk ask me what made the milk taste like a barn and she at once left this dealer."[31] Situated away from barn, root cellar, and pigsty, the milk house seemed to provide an architectural solution to these aesthetic problems. Similarly, whitewash was supposed to "keep the barn sweet."[32]

Figure 12. Milk house, Chester County, Pennsylvania, c. 1940. This concrete-block milk house has projecting window sills, mullioned windows, and a triangular vent in the gable peak. It abuts a much earlier barn. Photograph by the author, 2010.

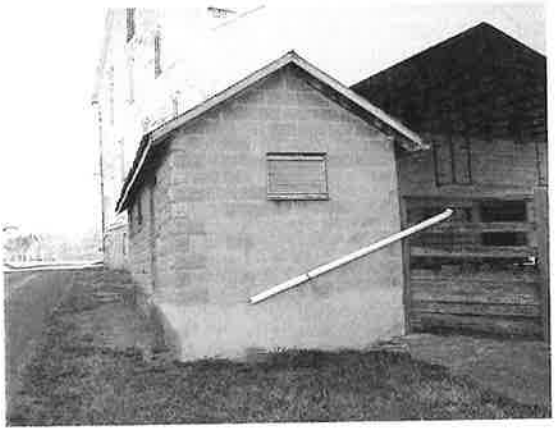


Figure 13. Milk house, Franklin County, Pennsylvania, c. 1935. This milk house has decorative rock-face concrete block on the side facing the road, while the remainder not visible to the public is made of simple concrete block. Photograph by the author, 2009.

Figure 14. Milk house, Lebanon County, Pennsylvania, c. 1920. This milk house is constructed of yellow hollow-tile block, and its hipped roof has decorative wood trim. Photograph by the author, 2009.

Dirt was another aesthetic problem. Workers strained the milk when pouring from pail to can, but sediment tests revealed that most milk still contained visible dirt. Although bacteriologist H. A. Harding found that dirt had little appreciable effect on bacterial counts ("a disappointment to those who hold that dirt is a large source of germ life in milk"), Milton Rosenau, professor of preventive medicine at Harvard, argued for an "aesthetic side . . . not to be ignored. . . . No one wants dirty milk even though it is not specifically dangerous."[33] Dirt control was linked to architectural features like easily cleaned or whitewashed surfaces, tight ceilings, and integral water supplies.

Still more potent forces for keeping architectural requirements in force were cultural factors. Despite the empirical evidence, the consuming public—and even the inspectors—continued to believe that if the farm buildings *looked* clean, then they must *be* clean, too, and that they must therefore contribute to the goal of safety. These older views of cleanliness persisted into the germ-theory era.[34] Dairy experts recognized the popular currency of this notion even as they validated current research. Rosenau explicitly acknowledged that low bacteria counts and clean-looking dairy environments were no guarantee of safe milk, yet he hopefully proclaimed that "clean-looking things are apt to be safe things."[35]

In "antisepticonscious America," even if milk houses and modernized dairy stables might be bacteriologically unimportant, they performed a crucial public-relations function because of their direct link to food preparation. Before universal pasteurization (after 1950), there was often no intermediary processing step between producer and consumer.[36] The milk house and barn stable

therefore functioned as food preparation sites and were (implicitly or explicitly) placed in the same category as a restaurant's kitchen or a butcher's shop. The 1922 textbook *Farm Buildings* compared the dairy barn to "a factory where human food is produced, and for this reason the sanitary requirements of light, ventilation, drainage and cleanliness cannot be over-emphasized. The barn should be and often is as clean as many kitchens."[37] In the raw-milk era, clean barns and milk houses provided evidence that the producer had taken all possible measures within his control.

Sustained dairy-building requirements were therefore guided by a strong impulse to remake the farm in an image more acceptable to the growing consuming public of town and city dwellers. Cement block, hollow-tile block, factory-milled wood, and metal architectural components represented industrially produced, standardized materials. In older dairy regions these often emphasized the message of modernity and sanitation through sheer contrast against a backdrop of more traditional architectural surroundings.

The milk house's siting was also significant as an element in its visual expression. Usually, it was located between the barn and the road or farm lane. To be sure, this location had a practical significance, yet it also allowed the milk house to serve as an architectural buffer between the farm and the city, a kind of filter that symbolically accomplished the transformation of a dirty, smelly farm product into a clean, safe, white drinkable substance free from odor or taste that might associate it with the country or even with an animal.[38]

Barn renovations also communicated the sanitation message. Mass-produced roof-ridge ventilators suggested an up-to-date interior. The Hershey Chocolate Company advertised its wares with photographs of a tidy row of very clean cows confined in stanchions, bordering an implausibly clean manure gutter (Figure 17). This interior would have received a top score: the floors were concrete; the stanchions, metal; the ceilings, smooth; and the windows, plentiful. In reality, milking machines were notoriously difficult to keep clean, and Hershey accepted milk for candy manufacturing that did not meet standards for fluid consumption. But the adman's phraseology of "pure country milk" and the image of clean cows and clean stables advanced a vivid counternarrative.[39]

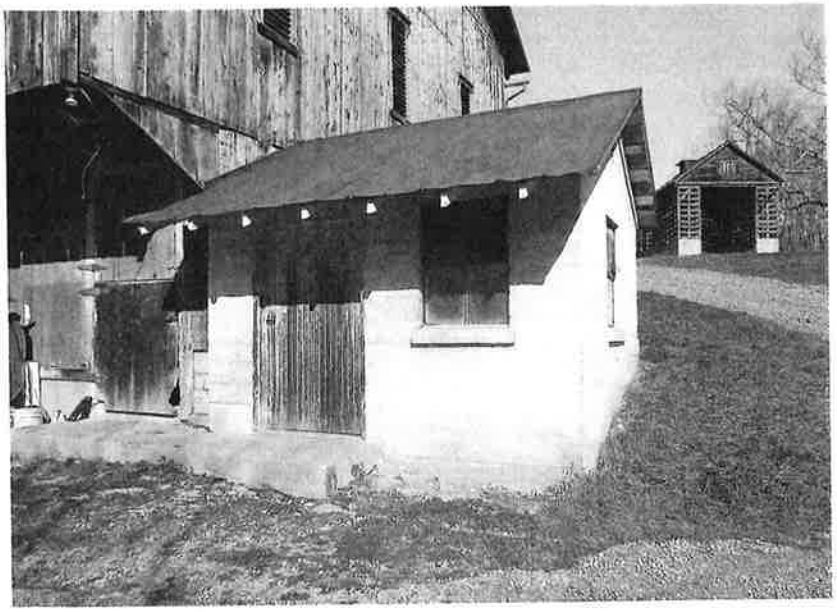


Figure 15. Milk house, Pine Creek Road, Centre County, Pennsylvania, c. 1945, south elevation. This concrete-block house has projecting window sills, exposed rafters, a board door, and mullioned windows. Photograph by the author, 2011.

This visual link between country and city wasn't always an imaginary one.[40] In 1930 a Philadelphia dairy inspector remarked:

> Our consumers in the cities today are travelling in the country in greater numbers than was ever the case heretofore. . . . The impression of such city consumers of the conditions surrounding the production of milk is largely gathered as they hastily drive through the rural districts. A neat dairy farm with a herd of healthy cattle in view, and a tidy milk house standing beside the barn creates a favorable impression in the mind of the consumer towards dairymen's products. We can therefore, safely assume that farm inspection is not only justified from the standpoint of improving the quality of milk, but also to some extent justified by the impression created upon our consumers.[41]

In the Los Angeles area, the 1930s Dairy Roadside Appearance Program even awarded plaques to farms whose buildings were painted and landscaped with flower beds.[42]

If we probe a little further into the rationales

for continued architectural requirements, we find arguments that posit the dairy farm's reformed architectural environment as a motivator to the people working in the refashioned spaces. If the buildings themselves didn't contribute directly to cleanliness, the reasoning went, they could still inspire workers to be cleaner. Here is the old notion about the psychological and moral influence of proper surroundings, reworked to address pervasive fears about germs among consumers. These fears now fastened upon the sloppy farmer or his slovenly hired hand.

Scientists, milk distributors, and sanitarians attacked the "intelligence of the average farmer."[43] The USDA proclaimed in its influential standard bulletin on clean milk production: "It may be possible by taking great pains to produce good milk in a dark or dirty stable, but it is extremely improbable that clean milk will be produced under such conditions by the average person."[44] As an anonymous writer in the Sheffield Farms Company bulletin more explicitly put it:

> There are certain so-called ethical standards which should be observed, not only for the protection of milk by a cleanly environment, but also for the psychological effect on milk producers. Nearly anyone will do more careful work if his surroundings are high class.[45]

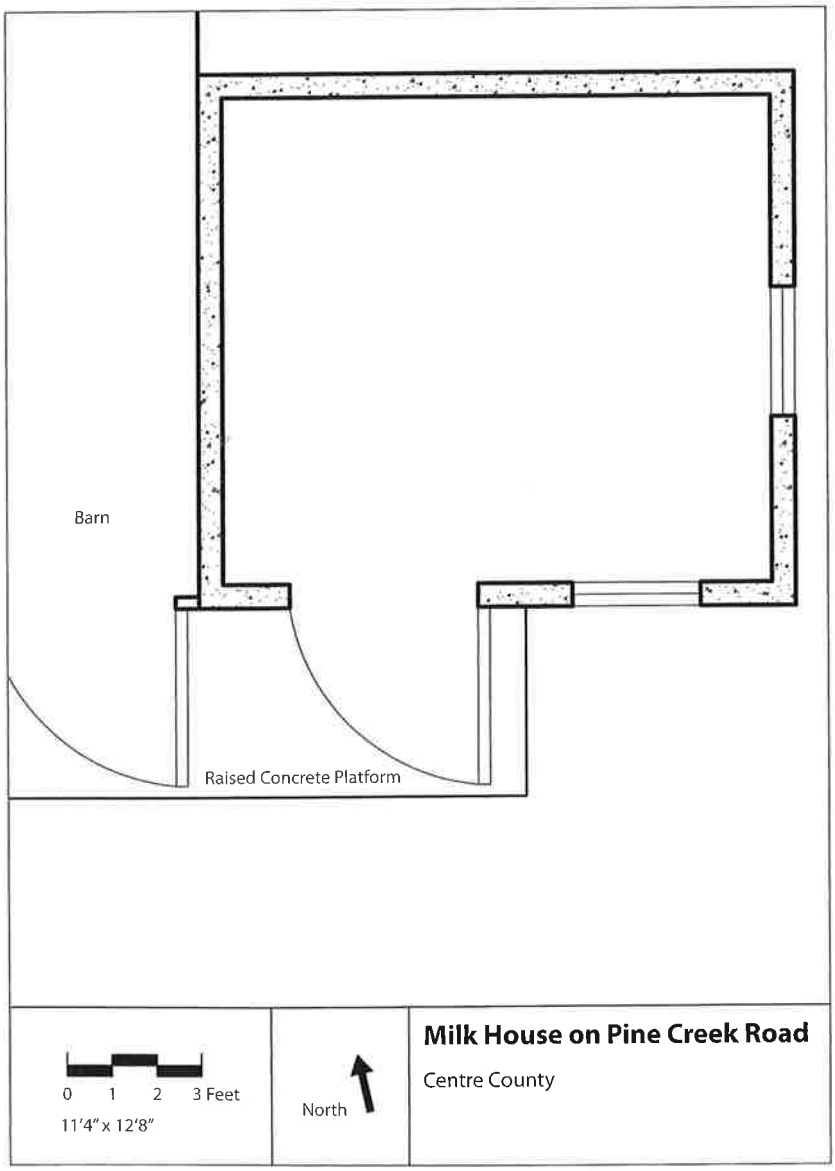


Figure 16. Milk house, Pine Creek Road, Centre County, Pennsylvania, c. 1945, plan. At eleven feet four inches by twelve feet nine inches, this milk house provided approximately 144 square feet of work space. Measured by the author and drawn by Aislynn Herbst, 2011.

These utterances were cast in coded language that tapped into deep social tensions. Some invoked class mistrust, targeting the hired man. Generally, however, criticisms referred to the "average person" or the "average farmer." These critiques reflected the growing cultural divide between rural and urban people. The popular image of the noble yeoman was giving way to the country hick or hayseed, notable above all for his ignorance.[46] Surely, an ignorant farmer could not be trusted to produce clean milk without external motivation. Thus, the milk house and renovated barn stable—presented as architectural containers for proper dairy spatial practices—sent a message not only to the consumer but to the farmer, as well.

Whether or not modern surroundings resulted in cleaner milk precisely in the way reformers hoped, the new buildings and regulations did have an impact on spatial practices and experiences. Perhaps most profoundly, the milk house and renovated barn stable became subject to inspection from outside. The inspector was empowered to enter the premises, and if access was refused, he could bar milk from the market. The Borden Company, for example, made contracts with its suppliers that explicitly stipulated: "The contract gives the company right and access to examine the cows, stable, milk house, feed, dairy utensils and place for keeping the same at all reasonable hours."[47] Often, one copy of the completed dairy score card was required to

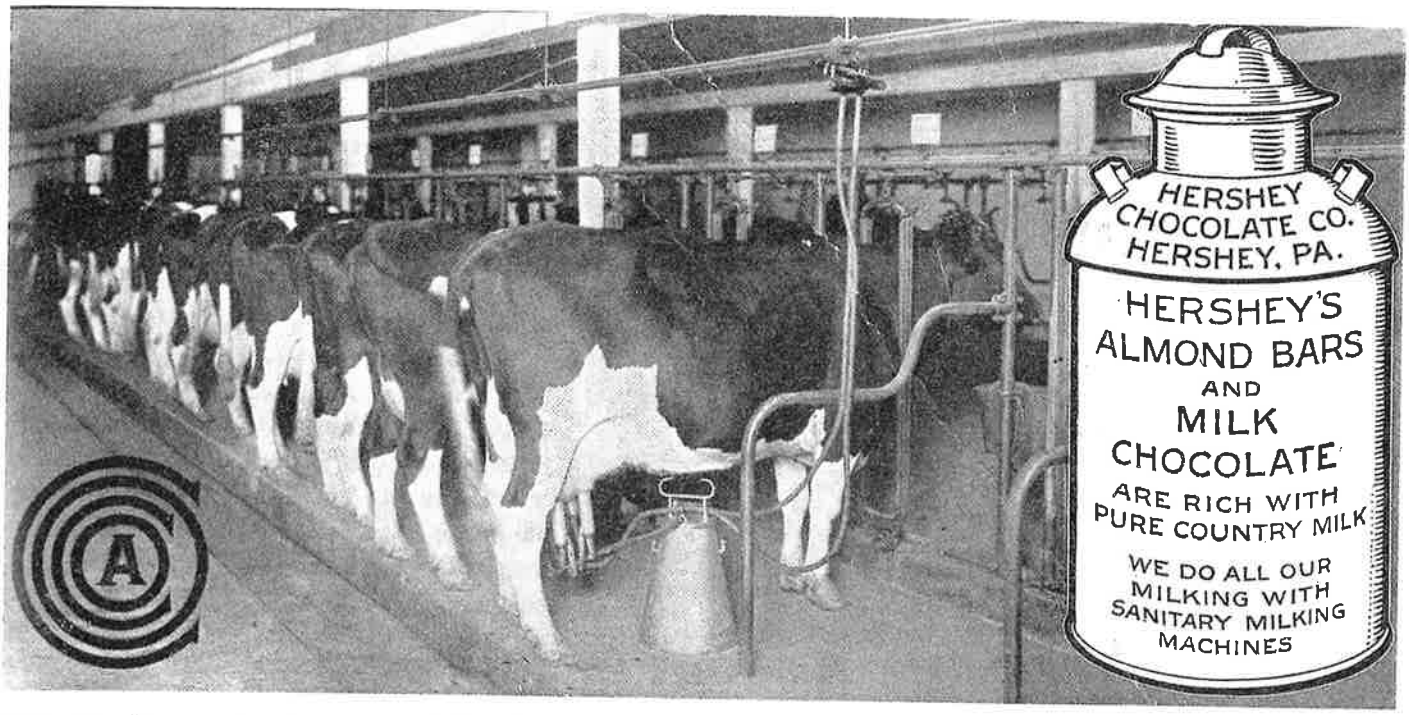
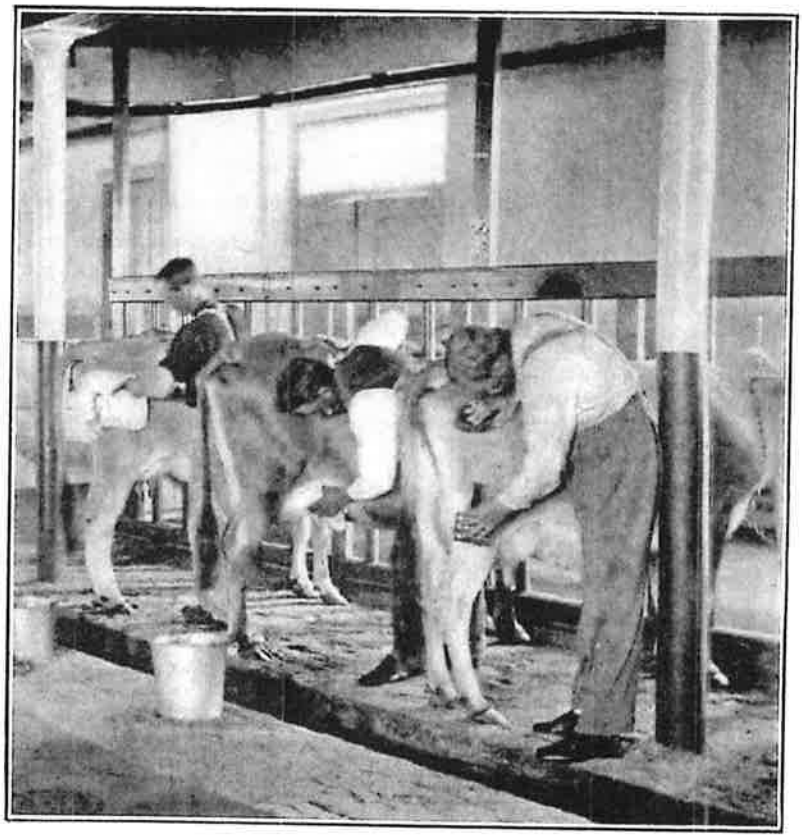


Figure 17. "Milking Cows," postcard, c. 1909–18. This advertisement from the Hershey Chocolate Company connects barn sanitation to the "pure country milk" used in its candy products. Courtesy of the Hershey Community Archives, Hershey, Pennsylvania.

be posted in the milk house to verify that inspection had taken place.

Inspection had a different meaning on farms than it did in other places (like restaurants or factories) where sanitarians entered equipped with score cards. The barn and milk house were within the farm family's home territory, conventionally understood as private space. Court decisions validated the legality of inspection, citing an overriding public interest and legitimate state police power.[48] By subjecting these spaces to inspection and their interior workings to public exposure, the state transformed them into quasi-public places. Not only the physical plant but the farm family's very bodies were scrutinized; doctors' certificates for all workers were required for a license to sell milk, and employers were expected to inform authorities of sickness.



30. CLEANING COWS PREPARATORY TO MILKING. A SIMPLE OPERATION REQUIRING NO OTHER OUTLAY THAN A LITTLE TIME.

Figure 18. Dairy employees cleaning cows in up-to-date surroundings, c. 1909. From U.S. Treasury Department, Public Health and Marine-Hospital Service of the United States, "Milk in Its Relation to Public Health," *Hygienic Laboratory Bulletin*, no. 56 (March 1909).

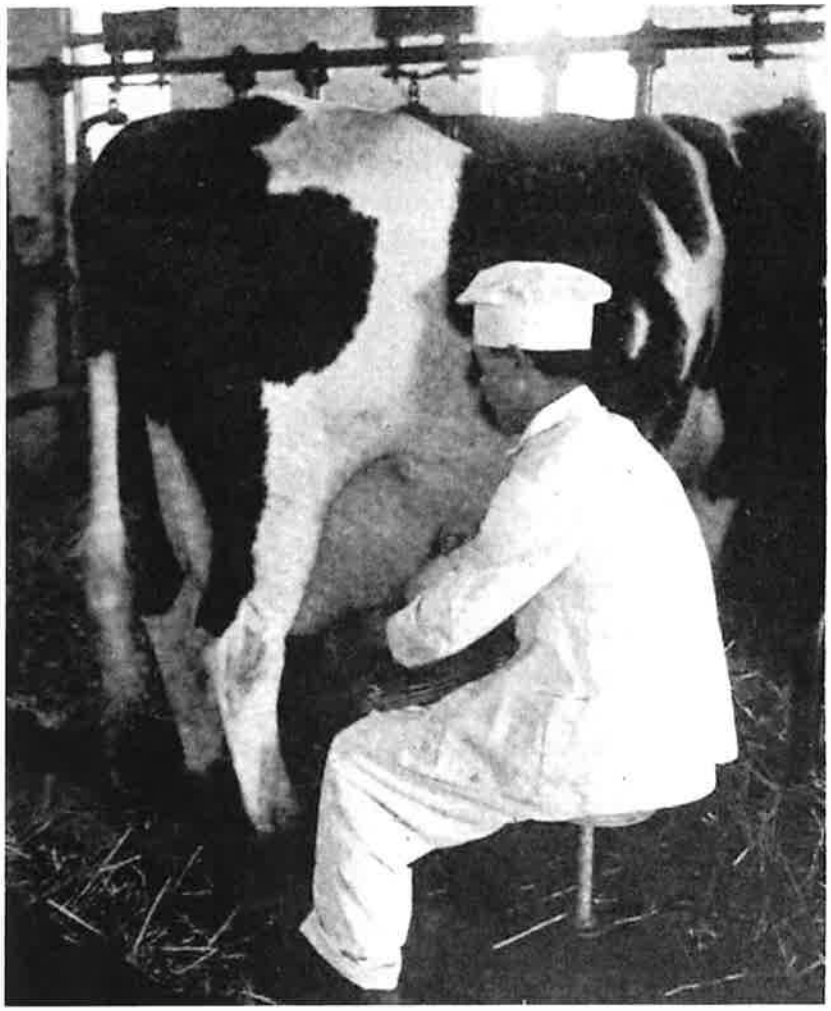


Figure 19. Dairy employee milking a cow, c. 1914. The milker is forced into an awkward position, perched on a one-legged stool and putting a foot in the manure gutter. From Ernest Kelly, "The Production of Clean Milk," *USDA Farmers' Bulletin*, no. 602 (August 21, 1914): front cover. The original caption for the cover image described the scene:

> Fig. 1.—A clean milker in a clean stable at milking time. Note the clean suit, sanitary milking stool, small-top pail, cow with clean flanks and udder, and sanitary stable construction. Under these conditions it is an easy matter to produce clean milk.
>
> Note.—This bulletin is intended to be of especial value to all persons engaged in the production of milk, and also to consumers who are interested in procuring clean, safe milk.
>
> 46669°—Bull. 602—14—1

Some boards of health used harsh tactics, including public shaming. In Lexington, Kentucky, and Waynesboro, Pennsylvania, for example, bacteria counts were published in local newspapers and board of health reports with the farmers' names attached.[49]

This unprecedented incursion of the state into the farmer's everyday life prompted considerable unease; the milk house and dairy barn stable could become contested spaces. Public health advocates advised dairy inspectors to expect resistance. Health board member J. W. Rice of Lewisburg, Pennsylvania, had the following testy exchange with farmer Walter Lilley in 1924: "From the manner in which you discussed the matter with our Officer, we felt that instead of having your co-operation in the production of good, clean milk, you were resentful of the conditions stipulated in the milk ordinance necessary for the production of a good, safe type of milk." Even as late as 1947, Harold Adams, author of a standard sanitation manual, noted that "in an area where little if any dairy farm sanitation work has been done, one cannot always expect a too cordial reception."[50]

In dealing with these conditions, experienced inspectors advocated an approach that stressed their roles as advisors and educators. Plant manager P. O. Pletcher, for example, advised field men to meet the farmer "on his own level. . . . Canvassers must be courteous and friendly and above all be able to control their tempers. . . . A smile will go very much further than a frown. . . . Get the interest of the farmer and explain tactfully the advantages he will gain by putting his buildings and surroundings in sanitary condition."[51] When inspector W. J. Lewis shifted his tactics to emphasize "education instead of prosecution," he found that "instead of dissatisfaction we have cooperation." Many believed that inspectors with farm backgrounds would not only have a better grasp of the issues but also be regarded less as outsiders than inspectors who were "discarded drug clerk[s]."[52]

This advice was practical on one level, but it could also be interpreted as a response to a delicate situation. If inspectors were educators, friends, colleagues, and advisors rather than "prosecu-

tors," their entry onto farm property would be legitimized and its impact softened. By calling themselves educators, for instance, they implicitly allied themselves with the popular agricultural extension agent or even the rural school teacher. By stressing a personal relationship, they made official inspections seem more like friendly visits, thus obscuring the reality that private space was being transgressed.

Available evidence suggests that very few farms failed inspection.[53] Farmers were frequently given opportunities to remedy defects.[54] Sometimes, informal collaboration took place so that the farmer knew in advance when the inspector would arrive. Resistance, coaching, and collusion helped to moderate the invasive potential of the new system. Kendra Smith-Howard has incisively analyzed a process of give-and-take between producers, reformers, and inspectors. Taking issue with interpretations that stress a binary pattern pitting small-producer resistance against large-producer accommodation, she argues for a more complex exchange. Regulators recognized small producers' difficulties, and farm people grasped the importance of disease-free milk and animals. The Pennsylvania experience confirms this give-and-take through both documentary and architectural evidence.[55]

Thus transformed, the farm environment altered mundane, everyday spatial experiences for both humans and animals. Consider the barn floor, with its concrete cow platform, integral metal stanchions, manure gutter, concrete feeding trough, and, sometimes, piped-in water supply attached to metal dishes. Compared with the earlier wood stall, the new setup was more spatially rigid. The concrete platform was just wide enough to prevent an animal's rear hooves from slipping back into the gutter. Head restraints, partitions between feed troughs, and wide-spaced aisles limited contact among animals.[56] Cows with water access at their stanchions walked less to drink. Even though the cows were bedded with straw, concrete floors were colder and harder than the old-style dirt.[57] The new spatial practices ambiguously combined the old cow-as-machine analogy with a renewed acknowledgment of the cow's status as a living organism.[58]

Figure 20. Dairy employee sweeping barn floor, 1939. "Floor of milking house is swept between each group of cows milked. Large dairy, Tom Green County, Texas." Courtesy of the Library of Congress, Farm Security Administration/Office of War Administration Photo Collection, photograph by Lee Russell, November 1939, digital ID fsa 8b23581.

Under the new spatial regime, cows less often had the company of other animals in the stable or barnyard. The mandate to segregate animal species had the potential to figuratively explode the barn and to accommodate the expelled species in separate, scattered outbuildings.[59] These changes are visible in the Pennsylvania farm landscape. Some families simply tore down the hog house. Others converted it to a machine shed, moved it away from the barn, or flipped it to face away from the barnyard. One farm family in Chester County, Pennsylvania, built a separate cow house in 1936 when regulations mandated that horses and cows be separated. The spatial separation of species mirrored the transformation taking place in agriculture toward greater specialization and less tendency to view the farm enterprise as an integrated whole.[60]

While cows had less contact with other animal species, they probably had more interaction with humans. Sanitation mandates considerably affected human spatial practices on the farm. Milking was still overwhelmingly done by hand, and new rules required more careful techniques. Before getting down to the actual business of milking, workers had to brush the cow, wash the udder, wash and dry their own hands, and sometimes clip the cow's hair (Figure 18). Even the type of milking stool and pail were sometimes prescribed (Figure 19).

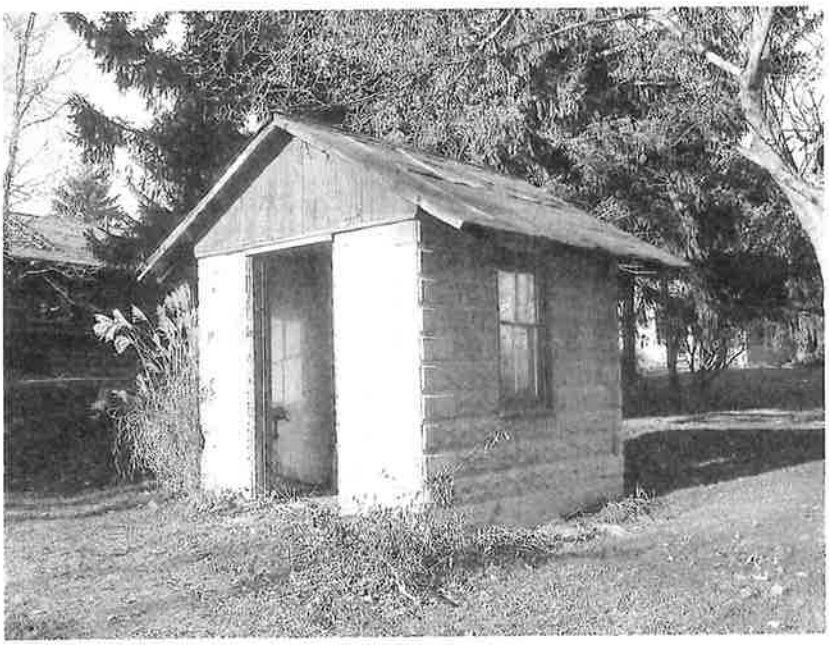
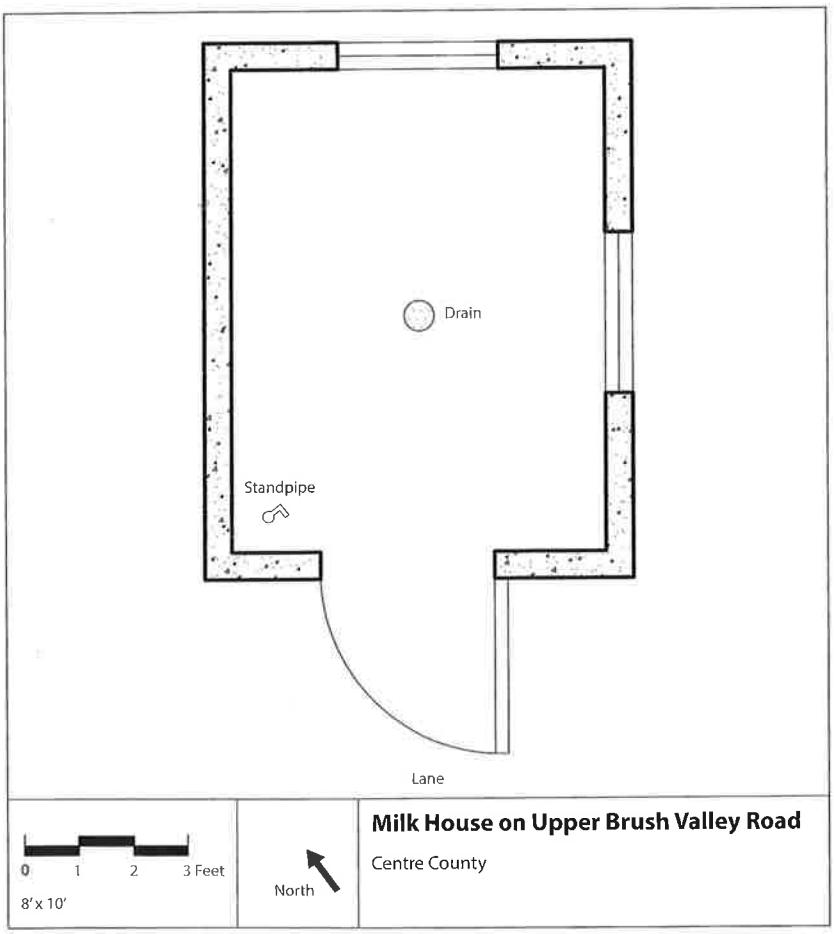


Figure 21. Milk house, Upper Brush Valley Road, Centre County, Pennsylvania, c. 1925, west and south elevations. This diminutive milk house was carefully built of rock-face concrete block with corner quoins. Photograph by the author, 2011.



Sanitary reform brought shifts in men's work that confused gender norms. Men on dairy farms found themselves in an unaccustomed housekeeping role. Not only did they have to pay more attention to grooming themselves and their cows, but they more often performed tasks like sweeping, washing floors or windows, and sometimes washing utensils (Figure 20). Regulations held farmers responsible for monitoring their employees' health and body habits. They had to make sure employees washed their hands and used the privy (apparently not a given).[61] The barn thus became more like the house, and the farmer, more like the farm wife and mother—at least where cleanliness standards were concerned.

A glimpse of how this shifting gendering of work played out becomes clearer when we see it against the backdrop of Progressive-era urban women's activism, sometimes characterized as "municipal housekeeping." In 1913, B. H. Rawl, chief of the USDA's Dairy Division, proudly showed a sanitation activist an up-to-date dairy farm, expecting she would be well impressed. To his dismay, she was "very much disgusted," expecting to "find the barns fitted up like a parlor." Rawl ruefully concluded that "the milk man feels it impossible to produce milk in the way in which it ought to be produced to please the ladies who are agitating the question."[62] The hope that well-appointed dairy buildings would motivate farmers to keep them clean must be interpreted in this gendered context. The masculine associations of modern, scientific, and industrial farming coexisted uneasily with the day-to-day reality of sweeping floors.[63]

The new spatial regime meant that farm workers traveled different pathways around the farm. As the importance of quick cooling came to be better understood, rapid transfer from cow to milk house took on great importance. A World War II–era illustration in the *Eastern Milk*

Figure 22. Milk house, Upper Brush Valley Road, Centre County, Pennsylvania, c. 1925, floor plan. Measured by the author and drawn by Aislynn Herbst, 2011.

Producer superimposed travel lines over barn floor plans—supposedly to demonstrate how rationalized planning reduced travel time and distances—yet even the more "efficient" plan required many steps.[64] Manure-removal requirements introduced another change to daily work routine, and one Pennsylvania farmer was praised for removing manure "as fast as it accumulate[d]." Even trips to the outhouse might be redirected.[65]

Meanwhile, farm women found themselves wearing a path between the milk house and the farm house. They were usually responsible for cleaning utensils such as pails, strainers, separators, and (later) milking machines and, sometimes, for carrying water to the milk house.[66] Score cards completed by inspector J. W. Rice of Lewisburg, Pennsylvania, frequently contain comments crediting women with good sanitation work; he notes that at one farm the milk house was "kept in good shape by Mrs. Gauger."[67] Most sources suggest that over time utensil washing shifted to the milk house from the farmhouse.[68]

In this light certain architectural features of milk houses take on added meaning because of women's gendered association with cleanliness. Many milk house builders took surprising care with exterior details. Pennsylvania examples exhibit contrasting brick windowsills, multipane sash windows, molded window frames, concrete window lintels, brick door lintels, scalloped wood eave trim, exposed rafters, triangular ventilation louvers framed in molding, board-and-batten gable fill, paneled doors with decorative knobs, corner quoins, and decorative roof coverings (Figures 21 and 23; see also Figures 12, 13, 14, and 15). These architectural niceties further illustrate the point that visual cues connected the milk house with domesticity and women and, implicitly, with cleanliness.[69]

Though the milk house might convey domestic cues from outside, inside, the story was dif-

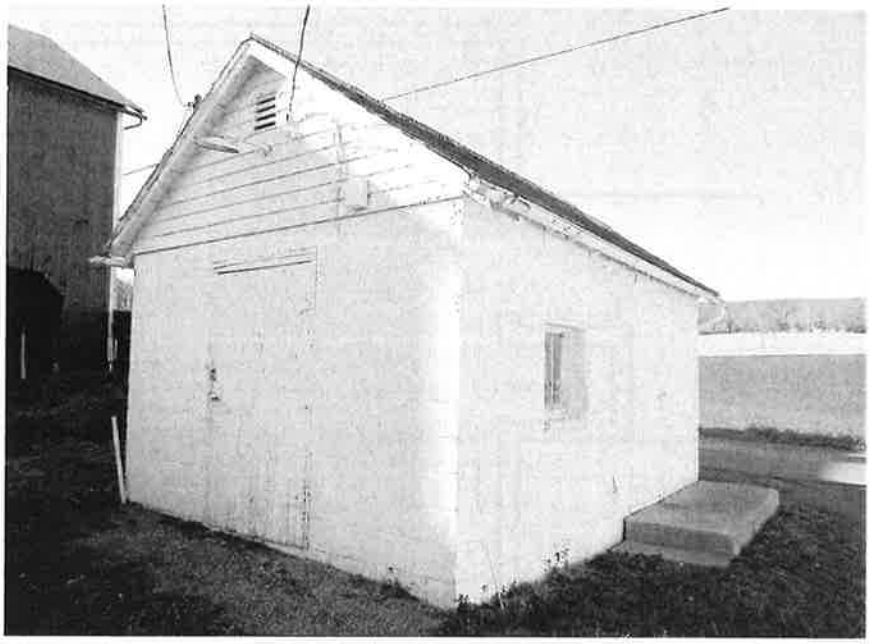


Figure 23. Milk house, Middle Road, Centre County, Pennsylvania, c. 1945, south and east sides. This concrete-block milk house had decorative roof covering and projecting window sills. Photograph by the author, 2011.

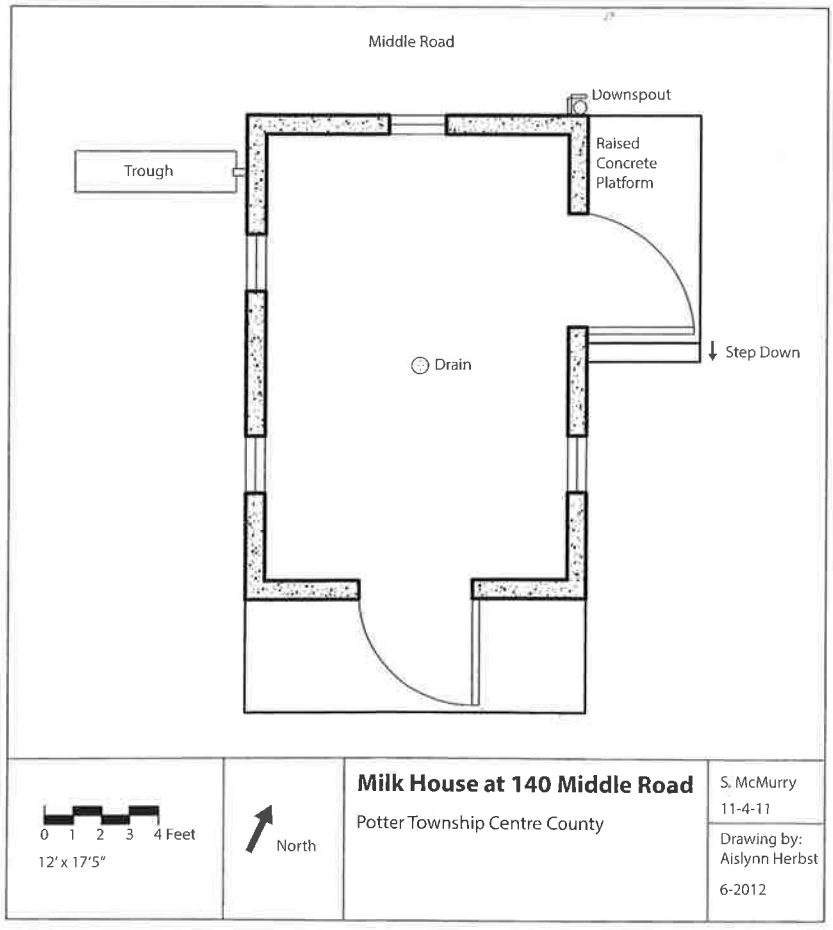


Figure 24. Milk house, Middle Road, Centre County, Pennsylvania, c. 1945, plan. Measured by the author, 2011, and drawn by Aislynn Herbst, 2012.

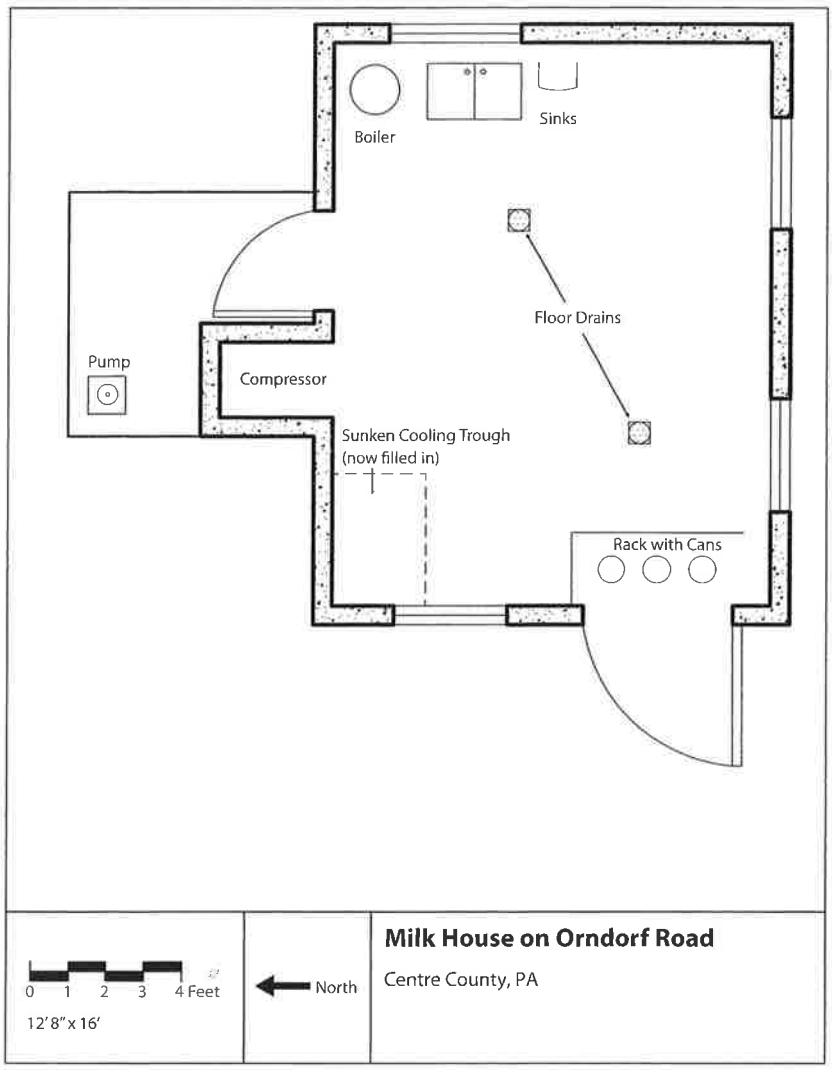


Figure 25. Milk house, Orndorf Road, Centre County, Pennsylvania, c. 1950, plan. This building retained many of its fixtures and equipment, and their location is shown here. Measured by the author, 2011, and drawn by Aislynn Herbst, 2012.

ferent (Figures 22, 24, and 25). The milk house was essentially a highly specialized one-person work space very different from the farm kitchen. The small size of the typical milk house suggests little room for maneuver once the cooling tank, sinks, perhaps a boiler, and drying racks were installed.[70] Moreover, washing the dairy utensils in the germ era was only partly analogous to ordinary housework; it was an exacting job that involved multiple steps of rinsing, scrubbing, applying chemical cleansers, and steam sterilizing. Fiction and opinion columns in farm women's magazines suggest that many dairying women faced guilt and anxiety in the germ-conscious era.[71]

In sum, sanitation regulations transformed many an early twentieth-century farmstead. On thousands of milk-producing farms, the barn basement received a thorough makeover; metal ventilators sprouted from the roof ridge; milk houses appeared; hog houses were demolished or moved; poultry houses were relocated; new privies were built; water systems were installed (at least at the barn and the milk house); and new horse stables were built. Added to the silos that also became common in the period, these changes had a cumulative impact in fundamentally altering the farm's appearance. Not only was the farmstead itself rearranged, but spatial practices changed for animals and humans alike. The new elements visually associated the dairy farm with modernity and tied it to the city in new ways. On an even larger scale, sanitation regulations contributed to broad agricultural shifts that took place between 1920 and 1950. Clean, modern-looking buildings and equipment were costly. They became a factor in dairy industry consolidation, helping to drive out those who had small herds and little more than labor to invest.[72]

By 1950 another significant shift was taking place. The refrigerated bulk tank replaced multiple small milk cans and thus reshaped the milk house. Milk was piped directly from the cow to the tank, thus sharply reducing handling. Around the same time, the freestall barn with accompanying milking "parlor" introduced another radical spatial change. Cows "loafed" unrestrained in a freestall barn with a simple floor plan, dirt floors, and open sides. At milking time they ambled to a small milking parlor separate from the barn.[73] The arrangement reduced human labor and improved cow comfort and health. These two innovations resulted from economic forces, research findings, and new circumstances. Once pasteurization was essentially complete and the milk supply thereby made much safer, architectural arrangements could shift to prioritize human labor efficiency and animal health. Gradually, health boards adapted their regulations to allow these arrangements.[74]

Yet regulatory language showed a remarkable consistency by continuing to invoke older aesthetic and cultural concepts of cleanliness. In the 2009 Pasteurized Milk Ordinance, the construction requirements and "Public Health Rea-

son" for barn standards echo language used in the early twentieth century:

> Floors constructed of concrete or other impervious materials can be kept clean more easily than floors constructed of wood, earth or similar materials and are; therefore, more apt to be kept clean. Painted or properly finished walls and ceilings encourage cleanliness. Tight ceilings reduce the likelihood of dust and extraneous material getting into the milk. Adequate lighting makes it more probable that the barn will be clean and that the lactating animals will be milked in a sanitary manner.[75]

Today, we can read this history of continuity and change in a layered dairy landscape: freestall barns, milking parlors, and bulk tank facilities coexist on many a farm along with older barns and milk houses. Together, they testify to the possibilities of ordinary buildings to tell a much larger story.

AUTHOR BIOGRAPHY

Sally McMurry is professor of history at Penn State University. She is coeditor of *Architecture and Landscape of the Pennsylvania Germans* (2011). Her book *Pennsylvania Farming: A History in Landscapes* is forthcoming. From 2003 to 2012, she served as principal investigator of the Pennsylvania Agricultural History Project, the 2013 VAF Buchanan Award winner.

NOTES

I would like to thank Cindy Falk, Ritchie Garrison, Kendra Smith-Howard, and two anonymous reviewers. This article is dedicated to the memory of my friend and mentor Pamela Simpson.

1. Maureen Ogle, *All the Modern Conveniences: American Household Plumbing, 1840–1890* (Baltimore, Md.: Johns Hopkins University Press, 1996); May N. Stone, "The Plumbing Paradox: American Attitudes toward Late Nineteenth-Century Domestic Sanitary Arrangements," *Winterthur Portfolio* 14, no. 3 (Autumn 1979): 283–309; Gwendolyn Wright, *Moralism and the Model Home: Domestic Architecture and Cultural Conflict in Chicago, 1873–1913* (Chicago: University of Chicago Press, 1980); Roy Lubove, *The Progressives and the Slums: Tenement House Reform in New York City, 1890–1917* (Pittsburgh, Penn.: University of Pittsburgh Press, 1963); Abigail Van Slyck, *A Manufactured Wilderness: Summer Camps and the Shaping of American Youth, 1890–1960* (Minneapolis: University of Minnesota Press, 2006).

2. As Kendra Smith-Howard nicely puts it, milk was a "white liquid that tied [farm and city] together." Kendra Smith-Howard, *Pure and Modern Milk: An Environmental History since 1900* (New York: Oxford University Press, 2013), 14. It is a revised version of her dissertation, "Perfecting Nature's Food: A Cultural and Environmental History of Milk in the United States, 1900–1970" (PhD diss., University of Wisconsin–Madison, 2007).

3. A large body of extant examples exists in the field documentation for the Pennsylvania Agricultural History Project at http://phmc.info/aghistory. Pennsylvania represents dairy changes well because dairying for eastern urban markets moved through multiple stages, from home cheese and butter production in the eighteenth and nineteenth centuries to fluid milk production in the twentieth.

4. E. Melanie Dupuis, *Nature's Perfect Food: How Milk Became America's Drink* (New York: New York University Press, 2002); Smith-Howard, "Perfecting Nature's Food"; Harvey Levenstein, "'Best for Babies' or 'Preventable Infanticide'? The Controversy over Artificial Feeding of Infants in America, 1880–1920," *Journal of American History* 70, no. 1 (June 1983): 75–94.

5. This description focuses on transportation and distribution for fluid milk consumption. The picture is more complicated, since processing plants collected milk to produce not only cheese and butter but other milk products, like evaporated milk, ice cream, cream, and the like.

6. W. T. Sedgwick, *Principles of Sanitary Science and the Public Health* (New York: MacMillan, 1905), 263.

7. Sedgwick, *Principles of Sanitary Science*, 1905 ed., 263–67; W. T. Sedgwick, *Principles of Sanitary Science and the Public Health*, rev ed. (1905; New York: MacMillan, 1935), 222; Milton Rosenau, *The Milk Question* (New York: Houghton Mifflin, 1912), 89; Harold Adams, *Milk and Food Sanitation Practice* (New York: The Commonwealth Fund, 1947), 34; Archibald R. Ward, *Pure Milk and the Public Health*,

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9. George Whitaker, "Milk Supply of Boston, New York, and Philadelphia," *USDA Bureau of Animal Industry Bulletin*, no. 81 (1905); *PADMI Annual Report* (1925), 115, fig.; "Report of the Committee on Statistics of Milk and Cream Regulations," *Journal of Dairy Science* 1 (May 1917): 54–63; "Basic Essentials of Milk Sanitation," *American Journal of Public Health* 35, no. 1 (January 1945): 50–52.

10. Ingolf Vogeler, in an essay on "Dairying and Dairy Barns in the Northern Midwest," in Alan Noble and H. G. Wilhelm, eds., *Barns of the Midwest* (Athens: Ohio University Press, 1995), 109–10, suggests that even by 1915 "no milk houses were being built" and that until about 1945 "milk rooms were inside barns." The landscape and documentary evidence all show that thousands of detached milk houses existed before 1940. Data appear in I. F. Hall, "An Economic Study of Farm Buildings in New York," *Cornell University Agricultural Experiment Station Bulletin*, no. 478 (May 1929): 8; Sedgwick, *Principles of Sanitary Science*, 1935 ed., 218; Adams, *Milk and Food Sanitation*, 18–19; R. M. Wellwood, "The Importance of the Right Kind of Personnel in our Country Creamery Plants," *Sheffield Farms Bulletin* 14 (May 1929): 7; Horatio Newton Parker, *City Milk Supply* (New York: McGraw-Hill, 1917), 179; Carl Edwin Ladd, *Dairy Farming Projects* (New York: Macmillan, 1923), 128; H. E. Shroat, "Experience of the Bureau of Milk Control in the Enforcement of Act No. 428," *PADMI Annual Report* (1931), 95.

11. Henry Ogden, *Rural Hygiene* (New York: Macmillan, 1911), 235, 237; Henry H. Wing, *Milk and Its Products* (New York: Macmillan, 1898), 67; Alfred Hopkins, *Modern Farm Buildings* (New York: R. M. McBride, 1913), 21; Ogden, *Rural Hygiene*, 68, 73, 243; George W. Pope, "Practical Methods for Disinfecting Stables," *USDA Farmers' Bulletin*, no. 480 (1912): 8; Ladd, *Dairy Farming Projects*, 110, 118; Ernest Kelly, "Production of Clean Milk," *USDA Farmers' Bulletin*, no. 602 (1931 revision): 4; Dr. C. I. Corbin, "Checking the Activities of Bacteria in the Cow Stable," *Sheffield Farms Bulletin* 9 (February 1924): 7; Corbin, "Source, Significance, and Control of B. Coli in Certified Milk," *Sheffield Farms Bulletin* 12, no. 3 (March 1927): 6; Edith Brown Kirkwood, "The Flyless Farm," *Farmer's Wife* 18 (February 1, 1916): 1.

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13. Ernest Kelly, "Production of Clean Milk," *USDA Farmers' Bulletin*, no. 602 (August 21, 1914): 9; Ernest Kelly and Clarence Clement, *Market Milk* (New York: John Wiley and Sons, 1923), 106; Parker, *City Milk Supply*, 116; W. A. Foster and Deane G. Carter, *Farm Buildings* (New York: John Wiley and Sons, 1922).

14. Treasury Department, Public Health and Marine-Hospital Service of the United States, *Milk and Its Relation to Public Health, Hygienic Laboratory Bulletin*, no. 56 (March 1909): fig. 33.

15. Ogden, *Rural Hygiene*, 63; Dr. J. E. Tompkins, "Interpretation of New York City Board of Health Score Card for Grade B Dairymen to Study and Heed," *Sheffield Farms Bulletin* 9 (June 1924): 10; Ladd, *Dairy Farming Projects*, 107; Foster and Deane, *Farm Buildings*, 102; *Journal of Dairy Science* 1 (May 1917): 62–63, summary table; see also Corbin, "Checking the Activity of Bacteria."

16. Ward, *Pure Milk and the Public Health*, 16;

Adams, *Milk and Food Sanitation Practice*, 44; Hall, "Study of Farm Buildings," 62–64; B. A. Jennings, "Milk-House Construction," *Cornell University Extension Bulletin*, no. 330 (August 1935): 4, 9; Kelly, "Production of Clean Milk" (1914 and 1931 versions); "Relations with the Milk Producer," *The Farmers' Voice*, n.s. no. 108 (November 15, 1910): 10; *Journal of Dairy Science* 1, no. 1 (May 1917): 67, summary table; D. A. Wallace, "Plan for a Sanitary, Convenient Dairy House," *Farmer's Wife* 19 (June 1916): 23; J. A. Gamble, "Cooling Milk and Cream on the Farm," *USDA Farmers' Bulletin*, no. 976 (May 1918); H. A. Ross, "Plans for a Simple Milk House," *New York State Extension Bulletin*, no. 200 (November 1930); Lewisburg Board of Health to potential producers, containing the wording of the new ordinance, March 5, 1924, binder vol. 29, John W. Rice Collection, Bucknell University Archives, Bucknell University Library Special Collections; "Farm Water Supplies," *PADMI Annual Report* (1937), 100–108.

17. Kelly, *Market Milk*, 101, 104; see also Rosenau, *The Milk Question*, 171; Ward, *Pure Milk and the Public Health*, 102; Ladd, *Dairy Farm Projects*, 128.

18. "Your Fieldmen's Suggestions on Building New Milk Houses," *Eastern Milk Producer* 25 (February 1949): 6; *Sheffield Farms Bulletin* 12 (May 1927): 3; C. R. Roberts, "The Importance of the Dairy Inspector's Work in the Field," producer's insert, *Sheffield Farms Bulletin* 3 (July 1929): 6; Dr. L. J. Tompkins, "Interpretation of New York City Board of Health Score Card for Grade B Dairymen to Study and Heed," *Sheffield Farms Bulletin* 9 (June 1924): 10; Elizabeth Frazer, "Drink It Down or Eat It Up," *Good Housekeeping* 100 (June 1935): 93; A. C. Dahlberg et al., *Sanitary Milk Control and Its Relation to the Sanitary, Nutritive, and Other Qualities of Milk* (Washington, D.C.: National Research Council, 1953), 46; Timothy Mojonnier, *The Technical Control of Dairy Products: A Treatise on the Testing, Analyzing, Standardizing and the Manufacture of Dairy Products* (Chicago: Mojonnier, 1922), chap. 20, esp. 772–77.

19. Henry F. Judkins and Merrill Mack, *The Principles of Dairying: Testing and Manufactures* (New York: John Wiley and Sons, 1941), appendix H; Adams, *Milk and Food Sanitation Practice*, 44–46; Dahlberg et al., *Sanitary Milk Control*, 96, 98.

20. "Dairymen's Meetings in Central Pennsylvania," *Sheffield Farms Bulletin* 17 (February 1931): 3. Sheffield Farms also published the titles and numbers of the relevant USDA and state extension bulletins in the *Sheffield Farms Bulletin* 9 (December 1924): 4–5. For an example of extension aid in building milk houses, see the Centre County Agricultural Extension Agent Report for 1924, Penn State University Archives.

21. N. S. Grubbs, "The Relation of Concrete to Clean Milk Production," *PADMI Annual Report* (1927), 140–42; *PADMI Annual Report* (1934), 220; H. Armstrong Roberts, *The Farmer His Own Builder* (1918 catalogue), 20–21; Sears, Roebuck Company, *Modern Farm Buildings Already Cut and Fitted Barn Equipment Catalog* (1927). These enterprises paralleled other commercial forays into selling products designed to meet sanitation concerns. For example, reformer George Waring established a plumbing supply company. See Tomes, *Gospel of Germs*, chap. 3.

22. Parker, *City Milk Supply*, 123; Louden Machinery Company of Iowa, advertisement, *Farm Mechanics* 2 (March 1920): 67; barn ventilator advertisement, *Farm Mechanics* 2 (February 1920): 14; Foster and Deane, *Farm Buildings*, 43; Hall, "A Study of Farm Buildings," 59; Betts and Kelley, "Suggestions for the Improvement of Old Bank Dairy Barns," 25; M. A. R. Kelley and George Edick, "Some Factors in Scientific Dairy Barn Design," *Agricultural Engineering* 4 (September 1923): 140.

23. Centre County Agricultural Extension Agent Report (1948); *PADMI Annual Report* (1927), 159; Hall, "Study of Farm Buildings," 75–76; *PADMI Annual Report* (1931), 151.

24. The University of Wisconsin Agricultural Experiment Station is often credited with an influential series that gave rise to the term "Wisconsin-Style dairy barn." All were published in the station's bulletin. See Frank M. White and Clyde I. Griffith, "Barns for Wisconsin Dairy Farms," *University of Wisconsin Agricultural Experiment Station Bulletin*, no. 266 (April 1916); O. R. Zeasman, G. C. Humphrey, and L. M. Schindler, "Dairy Barns," *University of Wisconsin Agricultural Experiment Station Bulletin*, no. 325 (January 1921); N. S. Fish, "Building the Dairy Barn," *University of Wisconsin Agricultural Experiment Station Bulletin*, no. 369 (August 1924). For a summary of the "modern" barn's attributes, see Glenn A. Harper and Steve Gordon, "The Modern Midwestern Barn, 1900–Present," in Noble and Wilhelm, eds., *Barns of the Midwest*, 213–37.

25. This information is compiled from Pennsyl-

vania Agricultural History Project field documentation of milk houses throughout Pennsylvania and selected detailed examinations of milk houses in Centre County, Pennsylvania.

26. Ward, *Pure Milk and the Public Health*, 2, 72; Leslie C. Frank, "A Statewide Milk Sanitation Program," *Public Health Reports* 39 (November 7, 1924): 2768; Leslie C. Frank, "Engineering Problems in Milk Sanitation," *Public Health Reports* 54 (March 31, 1939): 514.

27. S. H. Ayers et al., "Essential Factors in the Production of Milk of Low Bacterial Content," *USDA Bulletin*, no. 642 (April 30, 1918): 38.

28. Charles E. North, *The Farmers' Clean Milk Book* (New York: John Wiley and Sons, 1918), 37; Charles E. North, "The Dairyman versus the Dairy," *American Journal of Public Health* 5 (June 1915): 519–25; R. S. Breed and James Brew, "Control of Public Milk Supplies by the Use of the Microscopic Method," *Journal of Dairy Science* 1 (September 1918): 259–71; James Brew, "Milk Quality as Determined by Present Dairy Score Cards," *New York Agricultural Experiment Station Bulletin*, no. 398 (March 1915); "Editorial Comment: Germ Content and Barn Factors," *Creamery and Milk Plant Monthly* 6 (September 1917): 16–17; H. A. Harding et al., "What Is Meant by 'Quality' in Milk," *Journal of Dairy Science* 1 (September 1918): 199–218, esp. 209; Ernest Kelly, "Dairy Farm Score Card," *Journal of Dairy Science* 1 (January 1919): 400–409.

29. Bernard Hammer, *Dairy Bacteriology* (New York: John Wiley and Sons, 1938), 118; Dr. R. S. Breed, "Controlling Quality of Milk," *Sheffield Farms Bulletin* 13 (August 1928): 5; Parker, *City Milk Supply*, 179; Judkins and Mack, *Principles of Dairying*; L. A. Rogers, *Fundamentals of Dairy Science* (New York: Chemical Catalog Company, 1928).

30. Steven Murphy, *Sensory Evaluation of Milk Products* (Department of Food Science, Cornell University), http://foodscience.cornell.edu/cals/foodsci/extension/upload/CU-DFScience-Notes-Milk-Flavor-Defects-Sensory-Eval-04-10.pdf; Smith-Howard, "Perfecting Nature's Food," 38, 56.

31. "Receiving Milk," producer's insert, *Sheffield Farms Bulletin* 3 (July 1929): 7; Dr. J. F. Jansen, "Judging Milk on the Platform," *Sheffield Farms Bulletin* 20 (March 1934): 2; *Sheffield Farms Bulletin* 14 (March 1929): 4. This bulletin's volume number differed for the primary publication and the producer's insert.

32. Parker, *City Milk Supply*, 125, 158; Adams, *Milk and Food Sanitation Practice*, 75; Kelly, *Market Milk*, 11; Kelly, "Production of Clean Milk" (1914), 11; Ladd, *Dairy Farming Projects*, 130.

33. H. A. Harding, "In How Far Is the Bacterial Count of Milk Influenced by the Dirt Content?," *Journal of Dairy Science* 4 (September 1921): 433, 441, 446; Rosenau, *The Milk Question*, 162.

34. For an example of inspectors who continued to believe dust was "loaded" with bacteria, see Dr. C. I. Corbin, "Checking the Activities of Bacteria in the Cow Stable," *Sheffield Farms Bulletin* 9 (February 1924): 7; J. L. Strahan, "The Housing Factor in Milk Production," *Agricultural Engineering* 12 (June 1931): 222. On the persistence of older views, see Tomes, *Gospel of Germs*, 92–93. Architectural historians have also made the connection. See Thomas Visser, *Field Guide to New England Barns and Outbuildings*, 56, 97–98; Cynthia Falk, *Barns of New York* (Ithaca, N.Y.: Cornell University Press, 2012), 73–74; Ingolf Vogeler, "Dairying and Dairy Barns in the Northern Midwest," in Noble and Wilhelm, eds., *Barns of the Midwest*, 109–10.

35. Rosenau, *The Milk Question*, 244; Parker, *City Milk Supply*, 158, 179.

36. The phrase "antisepticonscious America" appears in Tomes, *Gospel of Germs*. The extent of pasteurization is discussed in Kelly, *Market Milk*, 288; Leslie C. Frank, "Disease Outbreaks Resulting from Faulty Environmental Sanitation," *Public Health Reports* 55 (August 2, 1940): 1378; "Basic Essentials of Milk Sanitation," *American Journal of Public Health* 35 (January 1945): 50–52.

37. Foster and Carter, *Farm Buildings*, 6.

38. For an incisive discussion of how cows' bodies were manipulated, see Smith-Howard, "Perfecting Nature's Food," chap. 1.

39. A. C. Berger, "Agricultural Production and Marketing in Lebanon County, Pennsylvania," *Pennsylvania Agricultural Experiment Station Bulletin*, no. 198 (September 1925). A letter from John W. Rice, June 30, 1924, notes that the Allendale dairy discontinued the use of milking machines because they were too hard to keep clean. Rice Collection, binder vol. 29.

40. "Relations with the Milk Producer," *The Farmers' Voice*, n.s. no. 108 (November 15, 1910): 10; Christopher Wells, "The Changing Nature of Country

Roads: Farmers, Reformers, and the Shifting Uses of Rural Space, 1880–1905," *Agricultural History* 80 (Spring 2006): 143–66.

41. C. I. Cohee, "Dairy Farm Inspections and Score Cards," *PADMI Annual Report* (1930), 134.

42. Dairy Roadside Appearance Program files, folder I/2/20, box 1, California Dairy Industry History Collection, California State Parks Archive, Sacramento, Calif. Thanks to Kendra Smith-Howard for this information.

43. Ogden, *Rural Hygiene*, 90–91; Kelly, "Production of Clean Milk" (1914), 13; Rosenau, *The Milk Question*, 58–59; H. E. Barnard, "Sanitary Food Law and the Use of the Score Card in Sanitary Inspection of Food Establishments," *American Food Journal* 8 (July 1913): 257.

44. Kelly, "Production of Clean Milk" (1914), 13. See *PADMI Annual Report* (1931), 125, for a satirical piece that makes fun of farmers who don't understand cooling and thermometers.

45. "The Dairy Score Card," *Sheffield Farms Bulletin* 9 (April 1925): 2.

46. James H. Shideler, "'Flappers and Philosophers,' and Farmers: Rural–Urban Tensions of the Twenties," *Agricultural History* 47, no. 4 (October 1973): 283–99; see also Rosenau, *The Milk Question*, 268–69; Hammer, *Dairy Science*, 118. Of course country–city tensions were long-standing, but a persuasive case can be made that as the nation tilted towards a majority of urbanites, they increased.

47. "Relations with the Milk Producer," *The Farmers' Voice*, n.s. no. 108 (November 15, 1910): 10; Adams, *Milk Sanitation and Food Practice*, 17.

48. James A. Tobey, *Legal Aspects of Milk Sanitation*, 2nd ed. (Washington, D.C.: Milk Industry Foundation, 1947), esp. chap. 6. The Fourteenth Amendment's due-process clause was often invoked; Tobey does not mention explicit issues of privacy. See also Ronald F. Wright and Paul Huck, "Counting Cases about Milk, Our 'Most Nearly Perfect' Food, 1860–1940," *Law and Society Review* 36, no. 1 (2002): 51–112.

49. Letter from Dewart Company, no date, Rice Collection, binder vol. 29; R. M. Allen, "Practical and Effective Methods for Milk Inspection," *American Food Journal* 8 (July 1913): 27; H. E. Erdman, *The Marketing of Whole Milk* (New York: Macmillan, 1921), 24; John J. Shank, "Publication of Municipal Milk Gradings," *PADMI Annual Report* (1936), 72. The Rice Collection also contains medical reports for farm family members.

50. J. W. Rice to Walter Lilley, July 21, 1924, Rice Collection, binder vol. 29; Adams, *Milk Sanitation and Food Practice*, 17.

51. L. O. Pletcher, "Some Observations on the Development of New Milk Producing Territory," *Sheffield Farms Bulletin* 14 (December 1929): 8. See also Kelly, *Market Milk*, 97; Adams, *Milk Sanitation and Food Practice*, 17.

52. W. J. Lewis, "A Short Course for Milk Inspectors," *PADMI Annual Report* (1928), 96; W. W. White, "The Producer's Viewpoint of Farm Inspection," *PADMI Annual Report* (1929), 69–72.

53. Roundtable discussion, *American Food Journal* 8 (July 1913): 238; Ogden, *Rural Hygiene*, 420; B. H. Rawl, "Milk Supply of Cities and Towns," *American Food Journal* 8 (July 1913): 239.

54. J. W. Rice to W. Dietrich, June 23, 1924, Rice Collection, binder vol. 29.

55. Smith-Howard, "Perfecting Nature's Food," 25. In informal conversations in the field with the author, older dairy farmers would joke about having been alerted before the inspector arrived.

56. N. S. Grubbs, "Arrangement and Remodeling of Dairy Barns," *PADMI Annual Report* (1929), 53.

57. J. D. Long, "Present Trends in Dairy Management and Structures," *Agricultural Engineering* 12 (November 1931): 399–405.

58. Thomas B. Harbison, *Milk and Its Distribution in Philadelphia*, pamphlet (Educational Committee of the Philadelphia Chamber of Commerce, 1917), 5; George A. Green, "Dairy Farm Inspection from the Standpoint of the Producer," *PADMI Annual Report* (1937), 57–58.

59. Scorecards for George B. Frederick, March 12, 1926, and Harry L. Heim, November 17, 1927, emphatically note that pigs in the cow stable must be removed. Rice Collection, binder vol. 29.

60. These alterations can be seen with special clarity at Pennsylvania Agricultural History Project sites 133-FV-001, 055-LU-004, 133-FV-002, and 029-UO-002. Project records show that on farms where there was no evidence of dairying, pigsties remained in place either in the barn or closely related to it. This was the case at sites 037-GR-004, 133-CO-005, and

133-CO-006. Some—for example, 133-WI-001 and 077-HE-004—have privies attached to the pig house.

61. Harry E. Shroat, "Milk Houses," *PADMI Annual Report* (1937), 148. Shroat thought hired men seldom "resorted" to the privy, instead just using the outdoors. Mildred Kalish, *Little Heathens: Hard Times and High Spirits on an Iowa Farm during the Great Depression* (New York: Bantam Books, 2007), chap. 16, concurred.

62. B. H. Rawl, "Milk Supply of Cities and Towns," *American Food Journal* 8 (July 1913): 23. For a case where city women's groups spurred reform, see "How Washington, PA Prepared and Passed a Milk Ordinance," *PADMI Annual Report* (1926), 111.

63. Daniel Block, "Saving Milk through Masculinity: Public Health Officers and Pure Milk, 1880–1930," *Food and Foodways* 13 (2005): 115–34; Sally McMurry, *Transforming Rural Life: Dairying Families and Agricultural Change, 1830–1885* (Baltimore, Md.: Johns Hopkins University Press, 1995), 197–201.

64. Whitaker, *Milk Supply*, 49; "Labor Saving through Job Analysis," *Eastern Milk Producer*, April 15, 1944, 9; Irwin, "However Small"; Gamble, "Cooling Milk."

65. H. B. White, "Dairy Barns from a Manufacturing Point of View," *Agricultural Engineering* 10 (April 1939): 117–20; Review of the milk supply of Hughesville, Penn., remarks on the farm of a Mr. Price, Rice Collection, binder vol. 30; Inspection records for Frank Erdly, February 1926, Rice Collection, binder vol. 29.

66. Elsie White Douglas, "My Daily Time-Schedule," *Farmer's Wife* 26 (March 1924): 427; Mrs. Frank Konczak, "Our Dairy Business," *Farmer's Wife* 29 (May 1926): 307; "I Glory in My Job!," *Farmer's Wife* 35 (April 1932): 24; Bernice H. Irwin, "In the Dairy: Sanitation of All Milk Utensils Is Required for Health and Profits," *Farmer's Wife* 19 (October 1, 1917): 22; Bernice H. Irwin, "In the Dairy: However Small the Plant, Cleanliness is a Stern Necessity," *Farmer's Wife* 19 (February 1917): 31; D. A. Wallace, "In the Dairy: A Stove and Running Water as Labor Savers," *Farmer's Wife* 17 (October 1914): 165. The Northampton County Agricultural and Home Economics Extension Agent Annual Report, 1944–45, "Home Economics Report," 32, noted that of twenty-five farm families in Mount Bethel, "only four homemakers take care of milk equipment in the kitchen. The other 20 have special milk houses." Penn State University Archives.

67. Survey of Northumberland, Penn., milk supply, April 1927, reference to the William Gauger Farm, Rice Collection, binder vol. 30. In the same volume the records for Ralph E. Musser show two women in the family (Clementine and Viola), who were listed as milkers and "washers."

68. Jennings, "Milk-House Construction," 5. On social surveys about farm women's work, see Ronald R. Kline, "Ideology and Social Surveys: Reinterpreting the Effects of 'Laborsaving' Technology on American Farm Women," *Technology and Culture* 38, no. 2 (April 1997): 355–85.

69. On the evolution of women's association with cleanliness, see Kathleen Brown, *Foul Bodies* (New Haven: Yale University Press, 2011).

70. D. A. Wallace, "Plans for a Sanitary, Convenient Dairy House," *Farmer's Wife* 19 (June 1916): 23; Parker, *City Milk Supply*, 135; Ayers, "Critical Factors," 58.

71. Kelly, "Production of Clean Milk" (1931), 10; advertisements for Bon Ami, *Farmer's Wife*, 30 (May 1927): 339; Irwin, "However Small"; Ayers et al., "Critical Factors," 58; Bernice Irwin, "Costly Bacteria," *Farmer's Wife* 23 (October 1920): 51. On women's work in milk dairying, see Nancy Grey Osterud, *Putting the Barn before the House* (Ithaca, N.Y.: Cornell University Press, 2012), esp. 55, 92, 118, 132–33, 148, 186.

72. For a good analysis of conflicts among political entities, large-scale dairy interests, and small-scale farmers, see Thomas R. Pegram, "Public Health and Progressive Dairying in Illinois," *Agricultural History* 65 (Winter 1991): 36–50. Figures on dairy-herd size are from Kuan-I Chen and Jerome Pasto, "Facts on a Century of Agriculture in Pennsylvania," *Pennsylvania Agricultural Experiment Station Bulletin*, no. 587 (January 1955). The definition of what counts as a milk cow varied over time, so these are not precise figures, but they do indicate scale well. Equipment prices can be found in *The Book of Barns: Honor-Bilt-Already Cut*, facsimile (1919; Chicago: Sears, Roebuck and Company, 2005); and *Modern Farm Buildings Already Cut and Fitted* (Chicago: Sears, Roebuck and Company, 1927). Smith-Howard, in "Perfecting Nature's Food," argues that Progressive reformers were not just pushing an urban agenda but wanted to improve country life; she cites the give-and-take and some evidence that regulators tried to accommodate small farms (27, 32–33). This observation is corroborated by many of

my sources, as well, but the financial issues appeared to still put great pressure on less-affluent farmers. See issues of *Eastern Milk Producer* throughout the 1950s, especially the year-end remarks in volume 30 (December 1954), 11.

73. "Bulk Handling of Farm Milk," *Eastern Milk Producer* 29 (February 1953): 11; Robert Decker, "Operating Studies on Bulk Tanks," *Eastern Milk Producer* 30 (August 1954): 10; R. P. March, "Boom in Bulk Tanks Expected," *Eastern Milk Producer* 30 (October 1954): 7; Long, "Present Trends"; Gray, *Farm Service Buildings*, 285; A. M. Goodman, "Remodeling Barns for Better Dairy Stables," *Cornell University Extension Bulletin*, no. 742 (November 1951), 5–6; K. B. Huff, "The Milking Parlor for Small Dairy Farms," *Agricultural Engineering* 20, no. 12 (December 1939): 462. The term "parlor" is noteworthy in this context. Although I have not researched its significance, it seems likely that it is related to the parlor's association with females (cows) and that it also continues the association of dairy spaces with human women's spaces and gender attributes. Smith-Howard, in "Perfecting Nature's Food," argues that "only after milk had been 'perfected' by technologies like pasteurization and the tuberculin test could technologies be understood to be adulterating nature" (13). Similarly, the architectural landscape could be reworked once it was no longer regarded as central to making milk safe.

74. "N.Y. Pen Stabling OK'd By Health Authorities," *Eastern Milk Producer* 28 (March 1952): 5.

75. USPHS/FDA, *Grade "A" Pasteurized Milk Ordinance* (Washington, D.C.: U.S. Department of Health and Human Services, 2009), 33, http://www.fda.gov/downloads/Food/FoodSafety/Product-SpecificInformation/MilkSafety/NationalConferenceonInterstateMilkShipmentsNCIMSModelDocuments/UCM209789.pdf. Punctuation is reproduced here as it appears in the document.