A Global Perspective On Automatic Milking Systems Rules And Regulations

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Introduction

There are a variety of rules and regulations in the many milk-producing countries of the world governing the production of raw milk, including the general areas of:

- Milk Quality and Safety
- Milking Machine Performance, and
- Worker and Animal Welfare.

The existing rules and regulations for milk production have been developed over many years and are meant to apply to the types milking equipment and management practices commonly used in the field. Automatic milking (AM), particularly when it is unattended by a person (as is the common implementation), has required that these regulatory structures be re-examined to clarify the desired end goal and determine how they might be best applied to this new technology and management situation. This paper will present an overview of the challenges in adapting existing rules and regulations to the situations in which AM is employed.

The Regulatory Process in the European Union

EEC Directive 92/46/EEC defines the requirements for animal health and the milk quality parameters of Somatic Cell Count and Bacteria Count in the EU (EEC, 1992). EEC Directive 89/362/EEC establishes the general conditions for hygiene on dairy farms (EEC, 1989). This directive states that:

> *Before the milking of the individual cow, the milker must inspect the appearance of the milk. If any physical abnormality is detected, milk from the cow must be withheld from deliver.*
>
> *Milk from cows with clinical udder disease must be milked last or by a separate machine or hand-stripped and the milk withheld from delivery.*
>
> *Before milking of a cow is started, the teats, udder and if necessary adjacent parts of the groin, thigh and abdomen of the cow must be clean.*

Two proposals to change of 89/362/EEC were made to exempt AM from the requirement to examine foremilk before putting milk from any cow into the bulk milk storage tank. Neither proposal obtained a qualified majority in preliminary voting at the May 2001 meeting of the Commission resulting in no formal vote and no action on the proposals. The current Directives, therefore, are still active, and individual national authorities must decide how to apply the

Directive to AM in their countries. Some examples of how individual countries are adapting rules and regulations for AM installations follow.

In the Netherlands, issues of milk quality assurance for automatic milking systems are under discussion. Efforts are underway to develop standard test methods for AM systems to be incorporated into the KKM rules for the dairy industry. In Switzerland, study is underway to determine how AM will be treated under existing animal welfare Swiss legislation. Farms in Denmark using AM have been exempted from the national requirement for visual inspection of foremilk only if they are enrolled in a self-monitoring program being carried out in cooperation with milk plants, regulatory agencies and research institutions.

The Regulatory Process in the USA

The rules that prescribe the minimum requirements for the production of milk that will be sold across state lines are established in the Pasteurized Milk Ordinance (PMO), which is issued by the United States Food and Drug Administration (USFDA). Changes in the PMO are proposed, debated and voted on at the National Conference of Interstate Milk Shippers (NCIMS). This organization meets every other year. Each state has voting delegates to this conference and the USFDA has veto power over any proposals.

The PMO has no provision for the operation of AM and these systems are currently being installed as "experimental" units in the USA. A group of regulatory officials from the Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP) and the USFDA, faculty from the University of Wisconsin and equipment manufacturers have begun to address AM regulatory issues. While much of the current regulatory language will apply to AM, there will be some parts of the PMO that will require expansion or revision as the current regulatory structure is based on the assumption that a person would be present during milking and cleaning of the milking machine. The NCIMS approved a proposal at their May 2001 meeting for a nationally approved pilot project to study AM and to develop regulatory language to incorporate into the PMO. A self-monitoring program, similar to the Danish program, is being implemented. If the performance of AM technology is satisfactory during this pilot project, a proposal for a general approval and modifications to the PMO would be presented at the 2003 NCIMS.

The Regulatory Process in Canada

Although there is a National Dairy Code for Canada , and also a National Quality Assurance Program initiative, both are in development and lack the legislative enactment needed on the provincial level for proper authority. Provincial regulations in each of the 10 provinces regulate the production and marketing of milk. By way of example, in the province of Ontario, the Milk Act, RSO 1990 c M-12, provides authority to the provincial government to regulate the production, processing and marketing of cows milk and its products. Among many other components, regulation 761 of the Act defines and limits health standards for cows, milking management practices, facilities standards for livestock housing and milk houses, milk storage and cooling and system cleaning. Although there are areas where the regulations are very specific, many of the rules which would impact on robotic milking are non-specific and reflect

broad principles of good raw milk handling. Neither the Act, nor the proposed National Code include specific provisions for the operation of robotic milking systems.

As examples of areas where the Milk Act is open to interpretation, article 5 (1)(c) states that no producer shall offer for sale, milk or cream that shows evidence of being watery, flaky, stringy, bloody, thick, or adulterated. While this may imply an examination foremilk, no specific management practice is spelled out. Milk cooling requirements call for milk to be more than 1^{o} C and less than 4^{o} C "within two hours of milking". When this regulation was written it may well have been intended to relate to the end of milking chores. Both farms with longer milking times and robotic milking systems have led to the current interpretation that milk must be at this temperature at all times except within the first two hours after starting the process of filling a clean empty bulk tank. Regulations concerning two bulk tanks in section 12 (7) are designed to address the need for additional milk storage and not use of bulk tanks as buffer tanks. These rules require minimum tank sizes and do not permit transfer between the tanks. While in Ontario, government holds the regulatory authority, responsibility for day to day management of milk quality regulation has been delegated to the producer run marketing board, Dairy Farmers of Ontario (DFO). Last year, this organization initiated a cooperative process involving government, producer representation via DFO staff, and manufacturers of robotic milking systems in a process to develop industry guidelines for robotic milking facilities. Now completed, these guidelines are not incorporated into law, but all manufacturers are committed to voluntary compliance until new legislation is enacted.

Quebec, the other province with many robotic milking herds has adopted similar guidelines. This province also considers approvals for robotic systems as "experimental" and reserves the right to limit installations. To date, other provinces have not addressed the need for provisions for AMS.

Milk Quality and Safety

The overall goal of the rules and regulations regarding milk quality and safety are to ensure that 'abnormal milk' does not enter the raw milk supply system. The normal screen for abnormal milk is visual inspection of the cow and/or the foremilk by a human being while performing the tasks of udder and teat preparation and milking unit attachment. Automatic milking systems typically rely on some form of sensor to measure various aspects of milk quality. This has created the need for a better definition of 'abnormal milk'.

Visual inspection is capable of detecting gross abnormalities in milk composition (clots, flakes, or 'wateriness') and some substantial change in color due to blood in the milk or other gross changes due to changes in lactation physiology. The primary emphasis in the development of AM systems has been on mastitis detection. At a recent meeting of the International Dairy Federation Standing Committee on Farm Management (IDF-SCFM), a group of experts indicated that the present methods of monitoring state of udder health and milk quality in AM are not reliable enough to be used as basis for diverting abnormal milk on-line. More research on the subject was encouraged. The practical implementation in the field results in a cow being 'flagged' at one milking using a combination of data from milk quality sensors and deviations in yield and behavior. Human inspection of the cow, foremilk, or milk quality data is generally

required to make the final decision to divert the milk from this cow at the next milking and until the milk quality problem is resolved.

Biosensing systems, in general, respond to some change in the chemical composition, or changes in the visible or non-visible light transmission or reflection of the milk. The basis for detecting abnormal milk with biosensors is thus quite different than for visual inspection. Biosensors have the ability to detect smaller changes in the visible light spectrum than the human eye. Visual inspection cannot be used to detect changes in chemical composition or the non-visible light spectra. Biosensors thus have the capacity to be a much more sensitive detection system for milk quality than human visual inspection. At present we do not have a well-developed set of criteria for identifying 'abnormal' milk using biosensors. An EU project to study various aspects of automatic milking was initiated in December 2000 (EU, 2000). This project includes elements to develop a definition of acceptable milk quality at the time of milking and to develop the criteria for systems to detect and separate abnormal milk.

The definition of abnormal milk will likely evolve as biosensor technology develops and offers the possibility of on-line measurement of more aspects of milk quality. This is an area of rapid technological development. These developments are fueled by the prospect of a commercially viable product (providing the market with management information at a price justified by the benefits) and are also highly influenced by the regulatory climate (what types of technology are allowable and/or mandatory). The challenge to regulatory agencies will be to ensure the quality and safety of the raw milk supplied from automatic milking systems while not stifling the development of new technologies that could significantly improve milk quality and safety.

Milking Machine Performance

Aspects of milking machine design and performance are addressed in standards issued by the International Standards Organization (ISO) and nationally based standards authorities. These standards deal primarily with the process of harvesting milk from the cow, although mention of certain aspects of milk quality, particularly related to cleaning and sanitation of the milking equipment are also addressed. The IDF-SCFM sponsored a workshop on the performance requirements and testing of AM machines in June of 2001 (Lind, 2001). The objective of this workshop was to identify important issues that should be addressed in a new ISO standard: Automatic Milking Systems - Performance Requirements and Testing. The first meeting of the ISO standards committee will have taken place at the time of this conference (February 2002).

There was general agreement among the group of experts that standards should emphasize the desired performance criteria of assuring milk quality and animal welfare and that all testing and performance requirements be based on sound scientific evidence. It was also generally agreed that references to specific technological requirements should be avoided as much as possible so as not to impede further technical developments, which are occurring at a very rapid pace. The items considered important in an ISO standard included:

- Maximum time interval between milkings of individual cows
- Requirements for cleaning teatcups between individual milkings
- Performance requirements for milking vacuum, airflow and pulsation similar to those for conventional milking machines

- Methods for automatically diverting abnormal milk
- Test methods to determine the adequacy of an AM machine

A number of performance related items were deemed important for day-to-day management of AM but not considered appropriate for incorporation into standards. It was recommended that these aspects be included in a clear set of Good Management Practices (GMP).

Good Management Practices

The many questions regarding the regulation of AM have not been encoded in rules and regulations, and there are already more than 1000 machines in operation on commercial farms. It is likely that it will take some considerable time to arrive at appropriate rules and regulations as this new technology is developed and deployed. Recognizing the need for some interim measures, experts from Denmark, Sweden, England, and the Netherlands have drafted a set of GMPs for AM as a supplement to existing EU regulations. A similar process is underway in Canada and the US. These GMPs apply to the following aspects of automatic milking:

- Food safety
- Hygienic milk production
- Animal welfare, safety and health
- Labour welfare and safety
- Construction, installation and performance of milking equipment

These GMPs will be an invaluable aid to producers considering, as well as those already using, AM machines to identify the critical management tasks required to produce quality milk. They will also serve as an educational tool for the variety of farm advisors helping solve milk quality problems. These GMPs also serve to help meet the demand for Hazard Analysis Critical Control Point (HACCP) type systems to ensure that food is safe and suitable for its intended use. According to its strict definition, HACCP is very difficult to perform precisely enough in a farm environment, as there are no microbiologically clear critical control points. GMPs have been used with success in other areas of agricultural production systems and strike a workable compromise between rigid regulations and lack of guidelines in areas of rapidly evolving practice.

Worker and Animal Welfare

Many countries have rules and regulations related to worker safety but these are generally not applied to the situation of milking. There is currently no EU legislation nor regulations in the US or Canada governing animal welfare in dairy production systems although some European countries do have animal welfare requirements. There is increasing public interest in developing regulations for both worker and animal welfare on dairy farms both in Europe and North America.

Automatic milking has obvious advantages to worker health and welfare. The job of milking, particularly on large farms, poses risks for both repetitive stress and traumatic injuries. Care must be taken in the design of the machine, as with any piece of farm machinery, to protect both

the people working around the machine and cows being milked from physical injury due to entanglement, crushing or cutting.

There is growing evidence that dairy cows milked automatically, especially when movement is voluntary, show no signs of increased stress and are perhaps under less stress. This is contradictory to the conception of many people unfamiliar with dairy farming in general and automatic milking in particular that cows will react negatively to being milked by a "robot".

Conclusion

The experience of AM clearly indicates that it is possible to produce milk of the same or better quality than conventional methods of milk harvesting. AM systems relieve the dairy farmer from the physical labour of milking and also provide a wealth of information for herd management. These systems use a higher level of technology than conventional milk harvesting techniques and, therefore, will require a higher level of management skill to use this technology successfully.

A major public education effort will be required to ensure that AM users clearly understand the management skills and practices required for its successful implementation and that legislative bodies clearly understand both dairy production systems in general and AM in particular so that the resulting rules and regulations achieve their desired goals and reflect informed reality rather than perceptions.

References

EU, 2000. Project on Automatic Milking. www.pv.agro.nl.

EEC, 1992. Council Directive 92/46/EEC of 16 June 1992 laying down the health rules for the production and placing on the market of raw milk, heat-treated milk and milk-based products. Official Journal of the European Communities. No. L 268, 1-32.

EEC, 1989. Commission Directive of 89/362/EEC of 26 May 1989 on general conditions of hygiene in milk production holdings. Official Journal of the European Communities. No. L 156, 30-32.

FDA, 1999. Grade "A" Pasteurized Milk Ordinance. Public Health Service /Food and Drug Administration Publication No. 229. U.S. Department of Health and Human Services, Public Health Service Food and Drug Administration.

Jepsen, L. B. Everitt, C. Cook, R.H. Oost, H. Hogeveen, and J.B. Rasmussen, 2001. Good Management Practice Code for Milking with Automatic Milking Systems. Draft Documents March 2001.

Lind, O., 2001. Proceedings from the Workshop on Performance Requirements and Testing of Automatic Milking Systems. Publication of the International Dairy Federation, Standing Committee on Farm Management. IDF, Brussels. 11 pp.