Managing Worker Safety, Productivity, and Regulatory Issues

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Introduction

More and more milk in the US is produced on larger operations. Fifty percent of the US milk is produced by less than 3% of the dairies – those with 1,000 cows or larger. Expanding production has required a larger workforce, primarily comprised of non-English speaking Latino workers (>90%) with minimal experience in agriculture. Dairy farming is among the most dangerous occupations, with high rates of injury, illness, and employee turnover. Many dairy owners and managers have not had formal training in employee management or occupational health and safety. Complying with health and safety regulatory standards while simultaneously training a predominantly non-English speaking workforce is a daunting challenge. In a highly competitive global market it is critical that dairy owners and managers have the knowledge, tools, and support needed to effectively address these challenges and sustain a healthy, productive workforce.

Background and Scope of Challenge

Production and Technology Trends in US Dairy Industry

Dairy production in the US has steadily moved toward a large-herd, high-efficiency model due to associated economies of scale [Reinemann, 2001]. Currently the United States ranks second (behind EU-27) among major dairy countries, producing 14.6% of the world's milk supply with an estimated 9.2 million cows [International Dairy Federation, 2010]. Milk production in the US has essentially quadrupled since 1944, producing 59% more milk with only 36% of the cows [USDA, 2012b]. Average herd size in the US is currently around 246 cows and ranges from 122 cows per herd in Pennsylvania to 1,906 cows per herd in New Mexico [USDA, 2009]. Between 2005 and 2009, farms with 1,000 or more cows increased 20%, driven by significantly lower costs of production. In 2005, dairy farms with 1,000 cows or more had average costs of production of $13.59 per hundredweight of milk, 15% below the average for farms with 400-999 head and 35% below the cost for farms with 100-199 head. [MacDonald et al., 2009]. In 1998, nearly 70% of milk produced in the US came from small-herd operations (<500 head). By 2011, over 63% of milk produced in the US came from large herd operations (>500 head), and 34.6% came from operations of 2,000 head or more [NASS, 2012]. Combined, only 2.7% of dairies in the US, representing large herds of more than 1,000 head, produce 50.3% of US milk [NASS, 2012] Despite the increasing size, almost

all (94%) of the dairies in the US are family owned (79.1%) or in a partnership (14.8%), while only 6.1% are structured as a corporation and the remaining 0.5% is either in the form of a trust or an estate. The shift to large operations with many hired workers is a significant change for dairy operators. Larger dairies in the US typically employ one person for every 80-100 cows, not including farm labor needed to grow forage crops. Most of those hired workers are immigrants from Mexico, Central America and South America. Most have no experience in dairy and do not speak English. Recent technological advancements have led to the mechanization and automation of the entire milking process, including the utilization of milking robots. Dairy science research has led to significant advances in dairy practice, resulting in an optimization of cow milk production and efficiency. However, little research has addressed worker health and safety or worker productivity and efficiency.

Injury, Illness and Fatality in the Dairy Industry

The industrial sector of Agriculture, Forestry & Fishing (AgFF) consistently has among the highest fatality rate in the United States, about eight times the national average for all industries (26.0 per 100,000 full-time workers in 2009) [BLS 2010]. According to national estimates, the non-fatal injury rate for the AgFF sector was 5.1 per 100 workers in 2009 [BLS 2010]. The rates of non-fatal injuries are even higher on Dairy and cattle operations - 5.4 and 6.5 respectively [BLS 2010]. From 2003 through 2009, a total of 110 people were killed while working on US dairy farms [BLS 2009]. One of the most common causes of death and serious injury on farms is related to the heavy equipment required to run a dairy farm. A high number of farming fatalities are due to tractor turnovers. Other causes of fatalities include silage bunker collapse, manure pits, tractor power take offs (PTO) and large animals such as bulls. Recent studies show the two main causes of workers' injuries (fatal and non-fatal) are incidents with machinery and animals [Mitloehner 2008]. Machine-related accidents include tractor rollovers, being run over by tractors and being entangled in rotating shafts. Animal-related injuries include kicks, bites, and workers being pinned between animals and fixed objects. Researchers have identified dairy farming as having the second highest prevalence of injuries among all US agriculture groups [Boyle 1997, Crawford 1998, NIOSH 1993]. The majority of injuries originate from interactions with dairy cattle during milking activities [Pratt 1992, Boyle 1997, Waller 1992]. Other causes of injuries include chemical hazards, confined spaces, manure lagoons, use of power tools, and improper use or lack of personal protective equipment [Mitloehner].

Researchers at the High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) completed two analyses of workers' compensation data among Colorado dairy workers [Douphrate 2006, Douphrate 2009]. Results indicated dairy workers had an injury claim rate of 8.6 per 200,000 work hours, higher than the national injury rate (6.2 per 200,000 hours) as reported by the Bureau of Labor Statistics (BLS) for 2003 [Douphrate 2006]. The largest percentage of claims involved the upper extremity (33.5%), and was caused by the cow (28.9%) during animal-handling activities. A second study focused on livestock-handling injuries [Douphrate 2009]. Nearly 50% of livestock-handling injuries took place in the parlor while performing a milking task. The highest percentage (27%) of injuries was to the wrist, hand, and fingers. The majority of livestock-handling injuries involved large operations (more than 10 workers), male, young, and less experienced workers.

Recent studies focusing on respiratory disease among workers on larger modern dairies are consistent with historical studies providing evidence of an association between lung disease and both the extent and duration of exposure to aerosols in dairies [Chaudemanche 2003, Eastman 2013,

Basinas 2012, Reynolds 2012]. Dairy workers experience lung conditions such as asthma, chronic obstructive pulmonary disease, hypersensitivity pneumonitis, and chronic bronchitis. The increased scale of dairy production with significant changes in technology and work practices, have altered airborne exposure patterns among dairy workers. There is some evidence that occupational exposure to inhalation hazards and the rates of lung disease may have been reduced with modernization. There is also strong evidence that new, inexperienced workers are at greater risk for lung disease, just as they are for injuries [Reynolds 2012].

HICAHS researchers conducted one of the first studies to examine the relationships between exposures to microbial containing aerosols (e.g. endotoxin from Gram negative bacteria), cross-shift changes in pulmonary function, and potential intrinsic (genetic) and extrinsic (behavior) effect modifiers of the exposure-response relationships [Reynolds 2012]. Stronger effects were observed among dairy and beef cattle workers compared to grain handlers. Evidence of larger cross-shift reductions in lung function was observed among those more highly exposed. Current smoking and the use of pesticides or herbicides increased the effects of dust inhalation on reductions in lung function. There was also limited evidence of the potential modifying effects of obesity, preexisting respiratory conditions, and the presence of genetic polymorphisms related to inflammatory reactions. New workers, who had not been exposed to these types of microbial agents, were also at greater risk of decreased lung function. Further evaluation of data from a larger population of dairy workers is under way. The results suggest that interventions to reduce lung disease among dairy workers need to include more comprehensive wellness programs in addition to exposure reduction strategies [Reynolds 2012].

Stress has also been shown to be a major concern for both dairy workers and managers [Fetsch 2009]. Suicide is among the top causes of fatalities on CO farms and ranches, and this is a consistent problem throughout US, UK, Canada, and Australia [National Vital Statistics Reports 2008]. Western mountain states have some of the highest levels suicides. In addition to contributing factors such as economic pressure and isolation, farmers and ranchers have ready access to the means to commit suicide. This was highlighted in the mid 2000's when a review of U.S. poison center data found that close to half of the fatalities from Mycotil (an injectible drug for cattle) were determined to be suicides [Von Essen 2003, NIOSH 2003, Oakes 2008]
The human and economic impact of illness, injury, and fatalities on the dairy industry is significant. In an industry with low profit margins and highly volatile global markets, reducing employee turnover, and direct and indirect costs may make the difference in survival.

HICAHS and the NIOSH AgFF Centers

Programs and Approach

In 1990 the US Centers for Disease Control and Prevention – National Institute for Occupational Safety and Health (CDC/NIOSH) launched a national effort to address the high toll of occupational hazards in agriculture, forestry and fishing (AgFF). A key component was the creation of regional centers with the mission to conduct research into the causes and programs for prevention of injury, illness, and fatalities. These centers are funded through highly competitive scientific peer review grant process. The High Plains Intermountain Center for Agricultural Health and Safety (HICAHS) was one of the earliest, initially funded in 1991, and is responsible primarily for the states of Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming

[http://www.hicahs.colostate.edu]. The NIOSH AgFF Centers bring together a diverse range of expertise including occupational medicine, exposure assessment, agriculture, engineering, education, economics, anthropology, veterinary medicine, dairy science, and others to provide a multi-disciplinary approach to solving the challenges in AgFF. HICAHS has been particularly known for its partnerships and engagement with Cooperative Extension.

HICAHS Dairy Programs

Over the past decade and particularly in the last five years, HICAHS has worked closely with the dairy industry to understand the causes and impact of work-related injuries and illnesses, develop and evaluate effective education and engineering interventions, and build a network of partners with capacity to address the global health and safety needs of the dairy industry. At the core of all projects and interventions has been a focus on stakeholder engagement and partnership building. The HICAHS approach to address health and safety on dairy farms is to ***LISTEN*** to dairy stakeholders, and ***RESPOND*** to expressed needs and concerns with *sound and relevant* research and outreach efforts.

Network Capacity Building

HICAHS researchers have worked diligently to engage dairy industry stakeholders to form partnerships for research, outreach, and translation/dissemination efforts. Strategic partnerships have been formed with representatives of US dairies and producer organizations. HICAHS researchers have also engaged industry-leading service and equipment companies to address health and safety on the dairy farm. HICAHS has formed collaborative partnerships to address the health and safety needs in the US as well as internationally. We are working closely with industry partners to design milking tools that will enable workers to perform milking tasks more efficiently, productively, and with reduced risk for the development of musculoskeletal disorders.

Research partnerships have been formed with domestic and international dairy researchers with the goal of increasing research capacity, and optimizing resources. We have partnered with the University of Texas Health Science Center in Tyler, TX (Southwest Ag Center), University of Iowa (Great Plains Ag Center), University of California Davis (Western Center for Agricultural Health and Safety), University of Nebraska (Central States Center for Agricultural Safety and Health), Wisconsin National Farm Medicine Center (National Children's Center for Agricultural Health and Safety) and University of Minnesota (Upper Midwest Agricultural Safety and Health Center) and with Dairy Extension programs in a number of states including New Mexico. Additionally, we have partnered with researchers at the Swedish University of Agriculture Sciences in Alnarp, Sweden, to form an International Dairy Research Consortium to address health and safety on dairy farms in the US, Europe and other dairy producing countries. New members of the consortium represent Italy, Germany, Denmark, Australia, Canada, Brazil, New Zealand, and Ireland.

Outreach to the Dairy Industry has been directed through the development and integration of three groups with expertise to assist HICAHS with research, prevention efforts and dissemination of materials. Multiple workshops have assisted with this process.

HICAHS partnered with the Southwest Ag Center to host two High Plains and Mountain Region Dairy Health and Safety Workshops in 2009 and 2011 in Denver, Colorado. Attendees included faculty from US and Swedish universities, dairy extension specialists (CO, TX, NM, SD, ND, IA,

and UT); dairy owners and managers (CO, TX, NM, and SD); dairy equipment manufacturers, workers' compensation providers, and dairy producer organizations (CO, TX, and NM). The workshop enabled the identification and prioritization of dairy worker health and safety issues, and generated recommendations and strategies for dealing with the challenges of addressing worker health and safety.

Through stakeholder engagement, the HICAHS Dairy Advisory Board has been formed. Made up of dairy producers, extension specialists, and equipment manufacturers, the Board guides and directs all HICAHS dairy-related projects, as well as serves as a medium for dissemination of findings.

In response to these workshops and in concert with the HICAHS Dairy Advisory board, a major effort is to develop a regional Dairy Health and Safety Network. Goals include: 1. Creating mechanisms for improved multi-directional communication between researchers and producers, and 2) Development of a structure to efficiently disseminate information on evidence-based practices (Research To Practice - R2P) to improve health on dairies. The Network to date consists of numerous producers and extension specialists in 10 states, equipment manufacturers, collaborating researchers at other Ag Centers, and producer organizations.

Established partnerships such as those listed above have provided opportunities for outreach efforts with dairy owners, managers and workers, enhanced HICAHS research opportunities and enabled the successful execution of R2P and dissemination efforts.

Needs Assessment

Feedback from the two regional workshops, advisory board meetings, and surveys of Dairy managers and workers has identified a number of key priority issues or needs including:

- Resources for developing health/wellness programs (e.g. immunizations).
- Community integration and acceptance.
- Communication, awareness and training in relation to chemical and drug exposures.
- Owner and worker awareness about hazards of equipment and animal handling.
- Awareness and training regarding personal hygiene.
- Awareness of transmission of infectious agents from animals to people.

Heading the list of concerns are four major areas:

- Stress affecting both managers and workers
- The need for effective worker training
- Immigration issues
- The need for management training and tools

HICAHS has refocused research and programs to address these issues, including bringing on new faculty expertise (cultural anthropology, occupational health psychology) and building new partnerships. Short term efforts have included providing training for producers on the Occupational Safety and Health Administration (OSHA) and on management approaches such as Lean Six Sigma. Longer term efforts to develop Occupational Health and Safety Management Systems and effective worker training programs are in progress. HICAHS continues to focus on building partnerships to facilitate the sharing of knowledge and resources.

A few examples of current HICAHS programs are described below. Further information, including links to resources can be found at www.HICAHS.colostate.edu

Research

Current projects focus on better understanding of risk factors associated with adverse health outcomes, and development and testing of effective interventions for prevention and control. One current intervention effort concentrates on specific milking tasks and how to most cost-effectively reduce their associated ergonomic exposures. Researchers have partnered with dairy producers, equipment manufacturers and extension specialists to identify specific ergonomic interventions (i.e. lightweight milking cluster, udder preparation tool, varying pit heights) to reduce risk factors in the milking parlor that are associated with the development of musculoskeletal disorders.

Dissemination of Knowledge

HICAHS has worked with industry partners to implement a more immediate response to the need for management training and information about regulatory activities of the Occupational Safety and Health Administration (OSHA). HICAHS partnered with the I-29 Dairy Consortium to sponsor five health and safety workshops for the regional dairy industry entitled *What You Need to Know About OSHA Before OSHA Needs to Know About You*. HICAHS enabled a partnership with Utah State University and Utah Dairy Extension to offer a two-day workshop entitled *Agriculture Safety Management Using Lean Six Sigma.* HICAHS also partnered with a leading manufacturer of dairy equipment, to offer a one-day workshop entitled *Worker Safety on Dairy Farms: How Does OSHA Apply?*

HICAHS researchers have disseminated relevant dairy-related health and safety information to producers via extension newsletters (e.g. New Mexico State University Dairy Extension Newsletter, Utah State University Dairy Extension Newsletter), Ag Center newsletters (e.g. AgConnections), and producer trade publications (e.g. DeLaval Environmental, Health & Safety Newsletter). Additionally, HICAHS researchers have published dairy-related research findings in several high-impact, peer-reviewed academic journals.

HICAHS has also collaborated with the Southwest Ag Center and New Mexico State Dairy Extension to develop and evaluate a safety training DVD (in English and Spanish) entitled *Considering Human and Animal Safety—Dairy Safety Training for New Mexico Dairy Producers.* HICAHS provided funding and personnel to collaborate with the Colorado Livestock Association to develop and evaluate the DVD *Creating Safety Culture in Livestock Operations*, English and Spanish Versions. Another effort of importance for the dairy industry is the development and implementation of training programs and materials for agricultural users of ATVs in partnership with Montana Extension.

These programs have been informed by HICAHS research into effective training methods and their impact on injury reduction. A key study of workers interviewed on 15 volunteer large dairies found that safety information presented within the context of task-related training, rather than provided as a separate training experience had an apparent protective effect against injury [Roman-Muniz 2006]. Safety information seen as valuable, meaningful and relevant to everyday experiences should enhance adult learner motivation, and aid with the processes of memorization and recollection in

older students. This study also suggests that incorporating appropriately trained co-workers into training efforts could be very beneficial to training programs. The effectiveness of these interventions should be assessed by conventional objective data (injury rates and the severity of work-related injury pre- and post-intervention) as well as by querying participant workers and dairy operators on such parameters as scope and depth of training, continuation of training, language of delivery, and the cultural sensitivity of delivery.

Worker training programs, OSHA awareness and compliance are important steps to managing occupational health and safety risks, but they are only components of a more systematic approach that is needed to sustain a healthy, productive workforce at the same time that cow health and productivity are addressed.

Risk Management

Occupational Safety and Health Regulation – OSHA

The Occupational Safety and Health Administration (OSHA) was created by the US Congress with the OSHA Act in 1970. The agency is part of the US Department of Labor and is tasked with helping to sustain a healthy U.S. workforce through development and enforcement of occupational health and safety regulations, and through provision of consultation services. About half of U.S. states operate their own OSHA programs, and state programs may go beyond the basic federal program. The OSHA Consultation programs are not as well known as the regulatory aspects of programs, but have become a valued asset in many states. The OSHA Voluntary Protection Program (VPP) provides recognition of companies where management, labor and OSHA work cooperatively and proactively to prevent fatalities, injuries and illnesses through a systematic program.

VPP participants are exempt from OSHA programmed inspections while they maintain their VPP status. While there has been a widespread belief that OSHA does not regulate agriculture, that perception is certainly changing as farms and ranches grow into operations with large workforces.

The California Occupational Safety and Health Administration has been particularly active in engaging the Dairy industry for more than a decade. Nationally OSHA (both federal and state agencies) has become much more active in the past few years, particularly following fatalities. A recent article in the Hoard's Dairyman (March 2012) summarized the most common dairy violations in California, based on inspection reports from CAL-OSHA:

1. Not having a written and active Injury Illness Prevention Program that workers are aware of, trained for, and kept informed about.
2. Not having a written and active Heat Illness Prevention Program that workers are aware of, trained for, and kept informed about.
3. Not having employee washing and toilet facilities that are in good working order.
4. Open electrical boxes and circuit breakers, missing wire insulation, or circuits not properly labeled.
5. Not having adequate sanitary and accessible first aid supplies.

6. Not immediately (within eight hours) reporting any serious worker injury or death to the district OSHA office.
7. Failing to provide hazardous materials training and protection devices to employees or not maintaining material safety data sheet (MSDS) binders.
8. Failing to have and display a copy of the Permit to Operate Air Compressor sheet at each permanent and portable pressurized vessel on the farm.
9. Not having a written and active Control of Hazardous Energy Program that workers are aware of, trained for, and kept informed about.
10. Failing to operate and maintain equipment safety. Typical violations include not having PTO guards, rollover protective structures, or seat belts; jumping off equipment; and having extra riders on equipment.

These are similar to violations on dairies in other states. Prevention of most of these violations is straightforward. Fines can be costly – in some cases exceeding five figures. Fatalities related to manure handling in California dairies gained national attention through a series of article in the NY Times in 2004. In an extreme example one dairy farmer was charged with involuntary manslaughter in the 2001 deaths of two workers, based upon alleged violations of California's permit-required confined space regulations. After a 3 year trial the dairy farmer was acquitted. The Times showcased this prosecution in a three-part front page series in 2004. Although this scenario is rare, it does demonstrate the extreme emotional and financial impact that severe injury or fatality has on a dairy operation and its people.

OSHA attention to the dairy industry nationally is accelerating and it is important for the Dairy industry to not only understand how OSHA operates, but to become proactively involved in helping craft regulations that are appropriate and applicable to dairy operations. It is important note that compliance with OSHA is setting the risk management bar low.

Comprehensive/Integrated OHS Management Systems

Occupational Health and Safety Management Systems (OHSMS) have gained wide acceptance in many industries, and are becoming mandated on a global level. OHSMS programs share characteristics and should be integrated with other accepted management systems such quality and environmental management. The goal of OHSMS programs is to achieve safety and health excellence including continuous quality improvement. They are driven by management commitment and employee involvement, and must be a part of every task so that health and safety becomes a way of doing business. Health and safety management ***systems*** are different from S&H ***programs***. Systems are performance-based, programs focus on compliance. Systems have an evaluation feedback loop to improve performance. OHSMS follow the Plan-Do-Check-Act (PDCA) model of continual improvement. PDCA, as defined by the EPA includes:

- Plan: Planning, including identifying environmental aspects and establishing goals
- Do: Implementing, including training and operational controls
- Check: Checking, including monitoring and corrective action
- Act: Reviewing, including progress reviews and acting to make needed changes to the system.

A successful OHSMS depends on full management commitment to achieving S&H excellence and relies on the creation of a culture of safety and health encompassing beliefs, norms, values, and work practices of managers and employees.

There is evidence that OHSMS or Environmental Health and Safety Systems make good business sense, although there is little critical evaluation in the peer reviewed literature and no published evaluation of OHSMS in Dairies [Linhard 2005]. Effective management and implementation of workplace safety and health programs add significant value to individuals and companies by reducing the extent, severity and consequences of work-related injury and illness. Workplaces that establish safety and health management systems reduce their injury and illness costs by 20 to 40 percent. Businesses spend $171 billion a year on costs associated with occupational injuries and illness, expenditures that come straight out of company profits and can comprise as much as 5 percent of a company's total costs. Achievements of a successful OHSMS include: Lowering injury and illness rates; Decreasing workers' compensation costs; Reducing lost workdays; Limiting equipment damage and product losses; Increased productivity; Higher quality products; Increased morale; Better labor/management relations; Reduced turnover; Better use of human resources.

A number of tools developed for other industries allow an employer to calculate the average cost of an injury or illness and project the number of sales the organization would have to make to cover the indirect cost of an injury or illness, and to determine the impact and profitability to her/his organization. In addition, there is software available to organizations that also includes environmental aspects that can be used to show how ES&H affects the bottom line. On resource is OSHA's $afety Pays Program that can be found at www.osha.gov. This site also allows the employer to download and use OSHA's "$afety Pays" Expert System. This program was not designed for the dairy industry, but the basic components should be useful.

Federal OSHA has indicated that their top priority for the near future is to pass regulations requiring all U.S. establishments to develop and implement an OHSMS. CAL OSHA has required a version called the Injury and Illness Prevention Program (I2P2) since 1991. The OSHA OHSMS will likely be based on the American Industrial Hygiene Association (AIHA) and the American National Standards Institute (ANSI) voluntary standard Z10-2005 and OSHA's 1989 guidelines. From a risk management standpoint OSHA is a minimum "bar" – international competition and the challenges facing the dairy industry will require a higher bar. Worker health/productivity must be an essential component of Animal health/productivity, Food Safety, Environmental compliance, Profitability and Sustainability of the business.

Conclusion

As modern dairy operations around the world expand, farmers have become increasingly reliant upon immigrant workers to milk cows and perform other essential tasks on the farm. Optimal dairy farming management should address milk production that is sustainable and responsible from the animal welfare, social, economic and environmental perspectives (*Guide to Good Dairy Farming Practice*) [FAO and IDF 2011]. Each of these aspects is interdependent with each other and with a sustainable, healthy, productive workforce. Physical health and well-being of owners, managers or hired labor are not often proactively addressed on modern dairy farms. There are very few studies addressing effective risk management in the dairy industry. Managers on expanding dairy farms struggle with the transition to human resource management, expressing difficulty and low

satisfaction with this aspect of farm management. There have been a few limited studies suggesting that labor management practices are a potential competitive advantage for dairy farms, but the connection with productivity and profitability has not been clearly demonstrated. The Transformational leadership style (exhibiting: idealized influence, inspirational motivation, intellectual stimulation and individualized consideration) has been associated with improved safety climate and reduced incidence of injury. On the contrary, non-positive or passive leadership styles have opposite effects on safety climate and safety consciousness, and are associated with increased safety events and injuries. Lower education levels, illiteracy and limited language proficiency increase the possibility of injury or death associated with higher risk occupations such as dairy. There is a need to develop and evaluate the effectiveness of safety-specific transformational leadership among dairy managers and supervisors. A systematic approach to risk management should address worker health and safety as an integral component of production, food safety, and animal welfare. A successful program must address the cultural and linguistic barriers associated with immigrant workers. The U.S. Dairy industry needs to be proactively involved with OSHA to help craft standards and approaches that make sense for the industry.

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