

Cal Poly Dairy:
Safety and Procedures

A Senior Project

presented to

the Faculty of the Agricultural Education and Communication Department

California Polytechnic State University, San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science

By

Christine Woodman
December 2011

© 2011 Christine Woodman

Abstract

The purpose of this project was to create a safety program that was designed specifically for the milkers at the Cal Pol Dairy. It was designed as an orientation program for all new employees at the Dairy. By creating an orientation program that delivers a consistent message time after time, it is hoped that all student employees will be able to maintain a high level of safety while employed at the Dairy. It includes an instructional video as well as a written safety test.

Table of Contents

Abstract.....	II
List of Figures	IV
Chapter One.....	1
Statement of the Problem	2
Importance of the Project.....	3
Purpose of the Project	4
Objectives of the Project.....	4
Definitions of Important Terms.....	5
Summary	7
Chapter Two	9
Aging Workforce	9
Purpose of University Dairies	10
Dairy Safety Hazards.....	11
Animal Hazards	12
Chemical Hazards	13
Employee Safety Features	15
Personal Protective Equipment	16
Fire Safety Equipment	16
Milk House	16
Backroom	17
Milking Procedures	18
Cow Handling	18
Video Production	19
Chapter Three.....	21
Choosing Media.....	21
Topical Outline.....	23
Writing the Safety Test	25
Chapter Four.....	27
Cal Poly Dairy: Safety and Procedures Video Script and Selected Still Frames	27
Safety Test.....	41
Safety Test.....	43
Chapter Five	46
Summary	46
Conclusion	46
Recommendations.....	46
Bibliography	48

List of Figures

Figure 1. Cross Section of Common Milking Parlor Design.....	12
--	----

Chapter One

Introduction

A university dairy provides a crucial laboratory for future dairy industry leaders to gain practical knowledge of the mechanics of running a dairy. Students in dairy science programs as well as students in other related fields of study are able to work at the campus dairy as a means of income while gaining a more intimate understanding of the processes involved in milking. It also provides an understanding of the fundamental in operating a milking barn and dairy operation. The experience with difficult physical labor may also help the students to become more empathetic supervisors later in life. The university dairy also provides a key location for dairy outreach to the general public. Most private dairies are not open to the public because of obvious safety hazards. Without university dairies, many people would never have the opportunity to see first hand what takes place in a dairy. These educational benefits do, however, come at a certain price.

More hazardous working conditions are simply a fact on dairies as with many other agricultural operations. Workers on a standard dairy farm will be in close contact with large dairy cattle who, while docile in general, can be unpredictable at times. If workers are not cautious, they can become injured by being kicked, stepped on, rammed, or trampled by the cattle. Many of the chemicals used on dairies can also pose health hazards if proper precautions are not taken. Whenever an employee is injured, they must miss work and go to doctor appointments. This results in lowered ability for the employee to be productive. Injuries also result in worker's compensation

claims. Every time a worker's compensation claim is filed, the employer's workers compensation costs also increase. Because of the negative consequences associated with worker injuries, it is clear that preventing injury all together is the most beneficial solution. To this end, it is essential that employees receive proper safety training.

Statement of the Problem

Because of the inherent risks associated with working with large animals and potentially hazardous chemicals in a production setting, it is essential that dairy employees receive proper training. At this point however, there is no comprehensive training program available specifically for use at the California Polytechnic State University Dairy. Currently, employees are trained in proper backroom set-up, milking procedures, and safety measures by the Herd Manager or a senior employee. Due to human error and inconsistency between trainers, the training each new employee receives may be varied, and important safety precautions may accidentally be left out. There is also no method for evaluating how much of the training each employee understands or the amount of information retained. It is difficult to determine conceptual understanding among a large group of students without a formal evaluation, so currently there is no way of knowing whether new employees really grasp the concepts necessary to work safely within the milking parlor and backroom. This leaves employees at increased risk of injury and the Cal Poly Corporation at risk of increased worker's compensation costs and potential law suits.

Importance of the Project

The safety of workers and cattle is of the utmost importance on any dairy. If workers are not working in a safe manner, injuries will occur at higher rates and workers' compensation costs will skyrocket for the employer. Additionally, if cattle are not handled properly, production will decrease and profitability will decline. It is therefore essential that all dairy employees be properly trained in procedures to ensure the health and safety of themselves, their fellow workers, and the production animals.

Because of the nature of the dairy environment, however, it is inconvenient to train large numbers of new employees at once. Large numbers of people being in the milking parlor at one time often results in excess noise, lack of concentration among milkers, decreased efficiency and safety hazards. Additionally, large numbers of unfamiliar people accompanied by increased noise will cause the cattle to stress and, in many cases, not let their milk down properly. It is also difficult for the trainer to give proper attention to each trainee and ensure that they are getting adequate instruction in each step of the milking process.

A training video will be able to more effectively convey all of the pertinent safety information and techniques to a new employee. By using a training video before taking a new employee into the parlor, the Herd Manager will be able to ensure consistency in the information provided to new employees and will guarantee that all employees are able to see how the milking process should work in a standardized way. Showing how to properly use the equipment in the Cal Poly Milking Parlor will also provide greater benefit than the current training videos. These videos show a generic milking parlor,

which does not demonstrate many of the proper operations and procedures specific to the Cal Poly Dairy. The new employees will also have knowledge of necessary safety precautions before they ever enter the milking parlor, thus increasing their ability to work safely from the start. A knowledge test following the showing of the video will be given. This test will check employee information retention and provide written proof that the employee has received training for record keeping and legal purposes.

Purpose of the Project

The purpose of this project is to create a comprehensive training video for the backroom and milking parlor at the Cal Poly Dairy. This instructional video will provide information on pertinent safety features, proper use of personal protective equipment when handling chemicals, the set up and tear down of the backroom, proper milking procedures, and proper cow handling technique. A coordinated test will be developed to check for employee understanding of important milking procedures and safety precautions.

Objectives of the Project

The objectives of this project are:

- To research and understand the safety hazards associated with the dairy environment.
- To acquire more intimate knowledge of the importance of best management practices used on dairies.

- To gain further knowledge of video production techniques.
- To develop a script for instructional video production.
- To create an instructional video that encompasses all aspects of the operation of the milking parlor and backroom area at the Cal Poly Dairy.
- To author a test to determine the information retention of the trainees after watching the instructional video.

Definitions of Important Terms

- Backroom: the area in which the bulk tanks, CIP system, heat exchangers, and other essential equipment are located
- Bulk Tanks: high capacity storage tanks used to store the collected milk between pick-ups by the processing plant. Modern bulk tanks are highly insulated and refrigerated to maintain milk at the legally required temperatures to prevent bacterial proliferation
- CIP: Clean-in-place. A system commonly used in dairies and processing plants to clean permanent equipment that would be impractical to clean manually such as milk lines, bulk tanks, heat exchangers, etc. The CIP process uses acid and chlorine based cleaners to break down any contaminants or residual milk left in the lines and on the equipment.
- HAACP: Hazard Analysis and Critical Control Points. A method of reducing the possibility of food borne illness transmission

- Holding pen: the area where the cattle wait before entering the milking parlor.
This area contains the crowd gate
- Mastitis: the inflammation of mammary tissue. Usually mastitis is associated with an infection or some sort of trauma inflicted upon the mammary tissue.
- Milk House: The collective term for the milking parlor and backroom areas
- Milk Letdown: The physical and hormonal process by which a cow is stimulated to release her milk
- Milker: the employee who is executing the milking process
- Milking: the act of removing milk from the mammary glands of the cow
- Milking Machine (claw): the device used to collect the milk from the mammary gland in a semi-automated milking parlor.
- Milking Parlor: the location of milking. Contains the milking machines and all associated equipment.
- OSHA: Occupational Safety and Health Administration. The organization that enforces worker safety and health regulations and issues fines and penalties to those who violate the laws
- Pasteurized Milk Ordinance (PMO): an ordinance issued by the United States Department of Agriculture that mandates every aspect of milk production including facility design, employee conduct, etc.
- Pit: the area within the milking parlor where the milker stands. In the Cal Poly milking parlor, the pit is set approximately three and a half feet below the level of the cow platform

- Pulsator: the portion of the milking machine that squeezes and releases the teat in a rhythmic cycle to help aid the collection of milk
- PVC: Polyvinyl chlorate. A waterproof plastic that is resistant to some common chemicals used on dairies
- Teat: the portion of the cow's udder from which milk is drawn out
- Teat Dip: A liquid used before and after milking to kill bacteria on the teats, clean the teats, insure good milk quality, and prevent mastitis
- Udder: Contains the cow's mammary glands. The location of milk production within the cow and the focus of most of the activities of the milking process

Summary

The California dairy industry is extremely important to the physical and economic health of California. With the current generation of farmers aging quickly, it is essential that a new generation of progressive farmers be educated in order to gain the practical, theoretical, and technical knowledge necessary to step in and take over the industry. In order to gain that knowledge, students need to be able to obtain hands on experience working with dairy cattle and industry standard equipment. That is the purpose of a dairy on a university campus.

Like any regular dairy, a university dairy comes with health and safety risks associated with its operation. Without proper safety training, employees may injure themselves, their fellow workers, or the production animals. It is therefore essential that

all dairy employees receive comprehensive safety and procedural training to work safely and effectively.

It is impractical to train large numbers of new employees at once while in the parlor due to the constraint of the dairy environment. Therefore, a training video is necessary to communicate safety features and proper techniques to new employees. A training video also provides consistent information to all new employees. A knowledge test given after the training video will gauge employee understanding and will provide proof of safety training.

Chapter Two

Review of Literature

The dairy industry is extremely important to California in a variety of capacities. Milk and cream was the highest valued commodity produced in California in 2008, bringing in nearly seven billion dollars (California Department of Food and Agriculture, 2010). As such, it is of great importance to the California economy that the dairy industry continues to thrive. The health of California's population is also highly dependent on the success of the dairy industry. Milk provides nine essential nutrients, which contribute to healthy bones, skin, and eyes and help maintain optimum immune function (National Dairy Council, 2011). Milk also contributes to healthy sleep patterns (Markus, Jonkman, Lammers, Deutz, Messer, & Rigtering, 2005) and may help people maintain a healthy weight (Capretto, 2010). Overall, it is vital to the physical and economic health of Californians that the dairy industry continues to thrive.

Aging Workforce

The only way the dairy industry will continue to thrive, however, is if a new generation of farmers steps in to take over. Currently, the average American farmer is 57.1 years old. This number is up from 55.3 in the 2002 Census of Agriculture report. The number of farmers over the age of 75 has grown 20 percent since 2002 and the number of farmers under 25 has decreased by 30 percent since the same time (National Agricultural Statistics Service, 2008). For the dairy industry to continue to remain competitive, a new generation of farmers will need to gain the technical, theoretical, and

practical knowledge necessary to run a successful dairy. To accomplish those ends, future farmers must be educated. That is the purpose of a dairy science program at the university level.

Purpose of University Dairies

Dairy science programs provide the much-needed education that will help to shape a new generation of successful dairy farmers. The mission statement for the Dairy Science Department at California Polytechnic State University reads as follows, “Have a positive and important impact on society and the dairy industry by: developing a critically thinking workforce of proactive future leaders, excellence in applied scholarly achievement, and outstanding outreach and service” (2010). In order to further these goals, it is essential that California Polytechnic State University and other universities with dairy science programs provide students with the opportunity to gain hands on experience in their intended career field through a campus dairy.

Although learning the theories behind basic dairy practices such as feeding, milking, and artificial insemination are important, there is no substitute for practical experience. Hands-on learning activities increase students’ cognitive learning and retention because they activate more of the students’ senses. Hands-on learning incorporates greater use of visual, auditory, tactile, and motor memory storage areas of the brain. This increases both long and short-term retention of information (Korwin, 1990). As such, experience working with live animals and industry standard equipment is essential for students to retain the maximum amount of information. The only way to

have live animals and industry standard equipment readily available for teaching purposes is to incorporate a campus dairy into any comprehensive dairy science program.

Incorporating a campus dairy is essential for educational purposes, but can also be very dangerous if proper precautions are not taken. According to data compiled by the Census of Fatal Occupational Injuries, four people were killed in dairy accidents during 2008 alone (2011). Although risks are an inherent part of dairy work, steps can be taken to decrease the risk of serious injuries and fatalities. One of the most important steps that can be taken is to educate employees about the risks associated with their jobs.

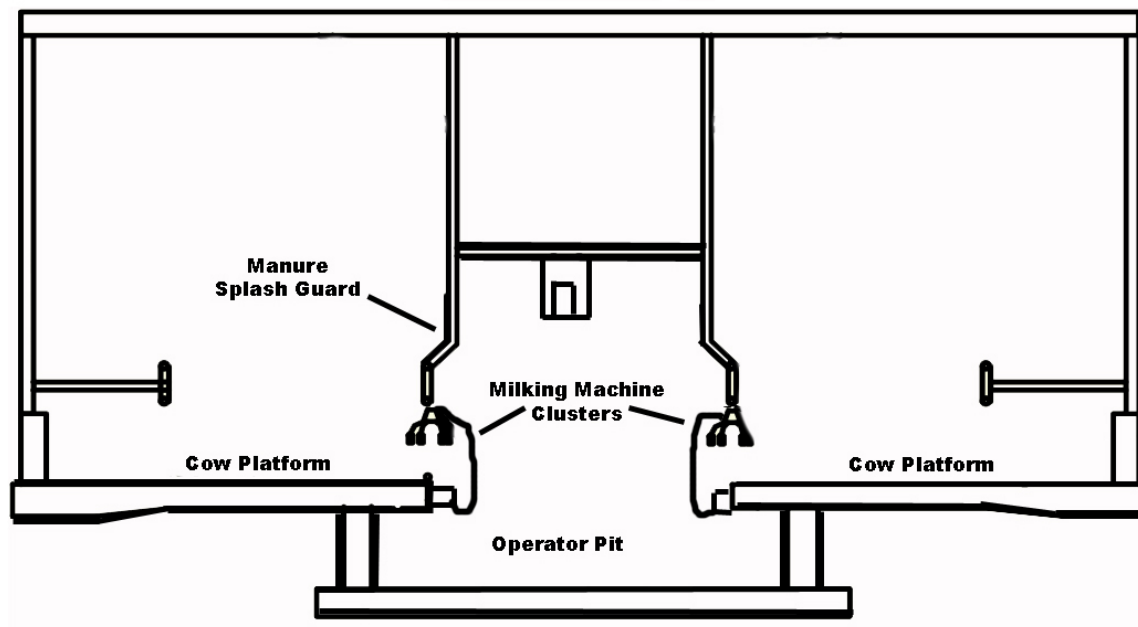
Dairy Safety Hazards

Although dairies are extremely important educational facilities, they can also be very dangerous places to work if proper precautions are not taken. According to data compiled by the Census of Fatal Occupational Injuries, four people were killed in dairy accidents during 2008 (2011). Although risks are an inherent part of dairy work, steps can be taken to decrease the risk of serious injuries and fatalities. The Occupational Safety and Health Administration (OSHA) has many guidelines that employers and employees are required by law to follow in order to decrease the risk associated with employment activities.

Animal Hazards

Because dairy farming involves extensive animal handling, it is associated with higher risk of injuries and fatalities (Von Essen & McCurdy, 1998). It is easy for cattle to be spooked by unfamiliar sights, startling sounds, and new people (Raussi, 2003). It is therefore extremely important for handlers to be cautious when working in close proximity to dairy cattle, even if the cattle seem docile. Cows typically injure a human handler when the handler is: kicked, bitten, pinned, rammed, stepped on, or pushed (Andrews, Dairy Safety Training Guide, 2010). When moving cattle, workers have to be continually aware of their location within the barn and should always know where the easiest escape is located. This can prevent accidents. Handlers should also handle the cattle calmly and patiently as a stressed animal is more likely to push, kick or attack (Andrews, Dairy Safety Training Guide, 2010).

Figure 1. Cross Section of Common Milking Parlor Design



Cows also pose risks to human handlers while in the milking parlor. In many of the most common parlor types, as shown in Figure 1, workers stand in an operator pit that is below the level of the cow platform (Reinemann, 2003). This enables workers to have easier access to the cows' udders during milking, but also puts the cows' powerful feet and legs closer to the worker's head and chest. This increases the potential risk of injury from kicking due to the sensitive nature of the head and core areas of the human body. Workers should, therefore, be very cautious when milking to avoid injury. For instance, a worker should never put his or her head or upper body in the cow platform area while cows are present. Only the arms should cross the demarcation between the operator pit and the cow platform to prevent serious and potentially fatal injuries. Workers should also be cautious of where they put their hands. Cows often shift unexpectedly during milking and a worker's hand laid on the cow platform may be inadvertently crushed.

Chemical Hazards

Certain chemicals are vital for use on dairies to maintain cow health. These chemicals can pose human health risks, however. Copper sulfate is a common ingredient used in dairy footbaths to prevent and treat foot rot (AGRI-BASICS Inc., 2005). Copper sulfate, which typically comes in a bright blue crystal or powder, is toxic if swallowed in high enough concentration and can cause upper respiratory irritation if the dust is inhaled (Goldschmid, 2008). Copper sulfate is also corrosive to eyes and eye protection should be worn when handling (Goldschmid, 2008). In the event of

accidental swallowing, the victim should be given large amounts of water or milk and vomiting should be induced. In the event of eye exposure, the eye should be immediately flushed with water for at least fifteen minutes. If inhalation occurs, the victim should be removed to a well-ventilated area. If exposure of any kind occurs, a physician should be contacted (Goldschmid, 2008).

Another common chemical used in footbaths is an inorganic liquid acid such as sulfuric acid. This, in combination with copper sulfate, maximizes foot rot prevention. As a class 8 corrosive liquid, sulfuric acid poses serious risks to human workers. Eye protection and PVC gloves should be used to prevent accidental exposure. If skin contact occurs, the skin should be immediately flushed with large amounts of water and contaminated clothing should be removed. Eyes should also be flushed immediately with large amounts of water (Vanco Industries LLC, 2011).

Dairy teat dips are also essential for maintaining overall cow health and preventing mastitis. However, they too can pose health risks. A typical pre-dip will contain hydrogen peroxide, benzoic acid, and glycerin (IBA Inc., 2011). These ingredients can cause eye irritation due to the corrosive nature of the compounds and can cause illness if ingested. If ingestion occurs, the victim should drink two large glasses of water and consult a physician. If eye contact occurs, the eyes should be immediately flushed with water (IBA Inc., 2011). Post-dips generally contain active iodine making them more hazardous than pre-dips. If eye contact occurs, the eyes should be immediately flushed with water. If ingestion occurs, large amounts of water

should be given and vomiting should not be induced. The victim should seek immediate medical attention (IBA Inc., 2011).

Other chemicals present in the milking parlor and backroom area are intended for use in the CIP system. Normally, at least one liquid chlorinated CIP cleaner, and one CIP acid cleaner are used, but never at the same time because such a mixture will release toxic fumes (TetraDyne, 2011). The chlorine must be included to peptize milk proteins for easier removal (Melrose Chemicals Ltd., 2010). The acid is used to avoid milkstone and mineral deposits and to neutralize alkaline CIP residues (IBA Inc., 2011). Both chemicals are extremely corrosive and may be harmful or fatal if swallowed. They are also hazardous to the skin and eyes, so if contact occurs the effected are should be thoroughly flushed with large quantities of water.

Employee Safety Features

The California Division of Occupational Safety and Health, better know as Cal-OSHA, and the U.S. Occupational Safety and Health Administration (OSHA) protect the public and workers from safety hazards that may be present in various locations and occupations (Department of Industrial Relations, 2010). As such, there are certain regulations that all employers and employees must follow in order to maintain employee health and safety.

Personal Protective Equipment

OSHA regulation 1910.133(a)(1) requires that all employees who will be handling caustic and corrosive chemicals be provided with appropriate eye and face protection to reduce risks. This applies to employees handling the aforementioned footbath and CIP chemicals (Occupational Safety and Health Administration).

Fire Safety Equipment

Dairies are filled with electrical equipment that could potentially cause fires. OSHA regulation 1910.157(c) requires that all employers provide portable fire extinguishers that are mounted and clearly labeled in locations that would be easily accessible in the event of a fire. These fire extinguishers are required to be in good working order and free from corrosion and other factors that may cause them to fail. Regulation 1910.157(d) dictates that these fire extinguishers must be placed so that the travel distance to a fire extinguisher does not exceed 75 feet. Section 1910.157(g) dictates that all employees must be trained in the proper use of portable fire extinguisher upon hiring and must be retrained at least annually (Occupational Safety and Health Administration).

Milk House

The Pasteurized Milk Ordinance dictates almost every feature of the milking facility. It has regulations about the materials the parlor can be constructed of, where restrooms can be located, how equipment should be stored and sanitized and how milk

should be handled to prevent contamination (United States Food and Drug Administration, 2007). Every dairy will have its own unique combination of milking parlor design, backroom equipment, and milking systems that meet Pasteurized Milk Ordinance (PMO) guidelines and allow for the production of a wholesome, healthy product.

Backroom

The backroom is the portion of the dairy that houses the milk storage tanks, filtration equipment, and heat exchanger. Most modern dairies use bulk milk tanks for storage between milk pick-ups because the high volume of milk produced on an average dairy makes other methods of storage highly impractical. Most bulk tanks are equipped with insulation and refrigeration units that first cool, then maintain milk temperature. By law, milk must be cooled to a maximum of 50° F within four hours of the start of milking and must be at 45°F or less by two hours after milking is completed to prevent the growth of harmful microorganism and bacteria that may be present (United States Food and Drug Administration, 2007). The bulk tanks are often aided in the milk cooling process by one or more heat exchanging devices. When milking, it is essential that employees monitor the temperature of the tanks to insure that everything is functioning properly. The milk is not allowed to spike above 50°F at any point after the first milking into the tank or it must be discarded (United States Food and Drug Administration, 2007). Employees should be trained to monitor milk temperature to maintain product quality and minimize economic loss potential.

Milking Procedures

The PMO outlines proper milking procedures to minimize the risk of milk contamination by foreign microorganisms. By mandate of the PMO, each teat must be dipped in a sanitizing solution and thoroughly dried before the milking machine can be attached (2007). Common practice also involves stripping the teat between the dipping and wiping steps. Stripping helps with the milk let down process by stimulation the release of the milk let down hormone oxytocin (Berning, 2009).

Cow Handling

The milking parlor should be a pleasant place for the cows. A positive environment helps to encourage cow cooperation and proper milk let down. A stressed cow will release epinephrine and adrenaline, which are direct competitors with oxytocin. If oxytocin is prevented from binding because of competition with adrenaline and epinephrine, proper milk let down cannot take place (Berning, 2009). This will lead to decreased production and profitability. Additionally, if a cow is mistreated in the parlor, it will begin to associate the parlor with negative experiences and will be less cooperative at subsequent milkings. Milkers should also avoid loud noises and abrupt movements in the parlor as this may startle the cows causing increased stress. A startled cow may also inadvertently injure itself, another cow, or an employee in its reaction to the stressor.

Video Production

The production of instructional videos, and all videos for that matter, has three stages: pre-production, production, and post-production (Millerson, 2001). During pre-production, the production team writes the script and devises a storyboard. The storyboard provides a map of what shots and scenes the production team needs to capture to create an effective video. It is important that the script and storyboard are well thought out in advance of production (Bernard, 1990).

During the production stage, the production crew actually captures the video and dialog needed to create the video. It is essential during this stage that the production crew takes the time to compose the shots, set up lighting, and manage sound capture in a way that will create high quality images and sound. If the image and sound quality is not high enough quality, portions of the video may have to be reshot at a later time wasting both time and resources. Filming things properly the first time is essential for efficiency. It is also essential that the crew captures enough content, or there may be weak areas when it comes time for post-production. The general rule is to always overshoot scenes. It is much easier to sort through a large amount of content than to have to go back and create more content at a later time (Gates, 1999).

Post-production involves editing the raw video. This may include removing unneeded content, adding music and special effects, and incorporating text into the scenes. During post-production, attention to detail is essential. Spelling mistakes in text or abrupt endings to music can detract from the professionalism of any video. Scenes should be spliced neatly, and voice-overs should match the volume of the rest

of the video in order to create a professional final product (Gates, 1999). Special care should also be taken not to over edit. Although special effects and odd fonts may be tempting, they can also be distracting from the main purpose of the work. When editing any video besides a big budget action film, more is often less when it comes to special effects.

Chapter Three

Methods and Materials

This project was originally devised based upon the observations of the author and the Herd Manager that the University is not currently providing enough safety training to ensure the safe work habits of Cal Poly Dairy employees. This leaves student employees vulnerable to injury because there is no means of determining whether or not they fully understand how to work safely. This lack of a formal safety program could also leave the University liable if a student were to be injured. This observation, along with others about the efficient operation of the Cal Poly Dairy, led to an initiative to create a better employee-training program. This program would include a training/safety video and written test to be administered to student employees upon hiring before beginning work.

Main Collaborator

The main collaborator for this project was Richard Silacci, Herd Manager at the Cal Poly Dairy.

Choosing Media

Before beginning the actual filming and test writing aspect of the project, the author met with Herd Manager Richard Silacci to determine what medium and format would best serve new employees. Based upon the author's own experience as a new employee, and Silacci's advice, it was determined that a video would be the most

effective medium for instruction in this particular case. A video production was chosen because:

- It provides the greatest flexibility by allowing the incorporation of video clips, still images, and audio. Some procedures do not lend themselves well to still images.
- It allows for a stand-alone presentation. The video can be shown to new employees in a large group setting without the necessity of a trained presenter being present. The video can also be loaned to new employees who are unable to attend large training sessions. The new employee can watch it on their own time and come in to take the safety test at a time that is convenient for both the Herd Manager and new employee. This prevents the Herd Manager or Milking Manager from having to present the same material over and over again. New employees will also be able to learn at their own place because they will have the ability to pause and rewind specific sections for greater clarification.
- It ensures that the same messages and information are delivered to every new employee every time. Every presenter has his or her own style and may choose to highlight one aspect of the training more than another. Video format ensures that the proper information is given in the best way every time while eliminating the variability that comes with a live presenter.

After determining that video would be the best presentation medium, the author and Herd Manager then devised an outline of the most important topics that needed to be covered in the video. The Herd Manager and the author drew upon their own experiences and observations to come up with an outline of the areas of most crucial

importance to the safety and well being of the new employees and dairy cattle. The topic outline determined was as follows:

Topical Outline

1. Safety equipment/hazards
 - a. Chemical hazards
 - i. Footbath chemicals
 1. Personal protective equipment
 2. Proper handling and procedures
 - ii. Wash chemicals
 1. Personal protective equipment
 - iii. What to do in case of exposure
 1. Skin
 2. Ingestion
 3. Eyes
 - a. Eye wash station
 - b. First Aid Kit
 - i. Locations
 - ii. Contents
 - iii. Emergency procedures
 - c. Fire
 - i. Alarm locations and procedures
 - ii. Proper fire extinguisher usages and procedure

- d. Cow hazards
 - i. Enclosed spaces
 - ii. Herds
 - iii. Kick hazards
- 2. Parlor/backroom set-up
 - a. Pump area
 - b. Backroom
- 3. Milking procedures
 - a. Step by-step demonstration of milking procedures.
 - i. Dip
 - ii. Strip
 - iii. Wipe
 - iv. Attach
 - 1. How to know if machine is properly attached
 - 2. Attaching dry quarter cows
 - v. Dip again
 - b. Explanation of the importance of each step
- 4. Proper cow handling
 - a. How to properly move cows in the parlor
 - b. Safe operation of the crowd gate
 - c. Unacceptable methods
- 5. Clean-up procedures

- a. Milking machines
 - b. Back room break down
 - c. Proper recording procedures
6. Conclusion and credits

Writing the Safety Test

After devising the above topic outline, the author wrote a safety test to be administered to all new employees before beginning work. By writing the safety test first, the author was able to ensure that all relevant information would be presented in the video. The safety test consists of twenty questions including short answer and multiple-choice. These questions were designed to test the milkers' knowledge of the main safety features and work habits necessary while working at the Dairy. After the safety test was revised and approved by the Herd Manager, the author began to write a script for the video. The script incorporated all of the necessary narration for the video based on the research the author had completed, the approved safety test, input by the Herd manager, and her own experiences as a milker. She then brought the script to the Herd Manager for revisions, corrections, and comments.

The author used a Canon Powershot SX 130IS camera for all of the filming. The camera shoots HD video, which allowed the author to capture the maximum amount of detail in many of the procedures. The author also owned the camera, which from a logistical standpoint made filming much easier because she did not have to schedule specific times to borrow camera equipment. The author borrowed a Manfrotto tripod from Cal Poly's Media Distribution Services. The tripod allowed for more steady shots

and less camera shake during filming. Filming took place at the Cal Poly Dairy with the assistance of several Dairy employees, the Herd Manager, and a few close friends of the author.

After filming was completed, the author began editing the footage. The author used iMovie to edit the footage including scene modification, voice-overs, incorporation of still images, incorporating transitions, adding music and adding credits. After editing was complete, the author took the finished product to the Herd Manager for approval. Once the Herd Manager's approval had been given, the author submitted the completed project to her senior project advisor for revisions. After the project was approved, the video was put on a flash drive and given to the Herd Manager. The original intention was to burn the video to a DVD, but the Herd Manager requested a digital copy of the video on a flash drive instead for convenience. The video was also loaded onto YouTube and can be found at <http://www.youtube.com/watch?v=Dhy0TQDbGLc>. The Herd Manager was also provided with both a hard copy and digital copy of the safety test to enable easy reproduction and enable any changes to the test that may become necessary in the future.

Chapter Four

Video Production

Because of the tangible nature of this project, the results are the training video and the safety test. The safety video can be viewed on YouTube at <http://www.youtube.com/watch?v=Dhy0TQDbGLc>. The safety test can be found at the end of this section. The written result of the filming process is the script used to narrate the training video. Because of the extremely variable nature of working with large animals and a wet, dirty environment, no storyboard was created for this project. Instead, the author took the topical outline presented in Chapter Three to the Dairy during the filming days to act as a guide and experimented with a variety of different camera angles and lighting types. The topical outline served as a scene list to be used during the filming process. Then, during post production the author went through all of the footage to determine which views and ways of portraying instructions were most effective. The video script can be found on the following pages. The left hand column contains still frames from the filming process as well as captions to provide a better visual image of the project.

Cal Poly Dairy: Safety and Procedures Video Script and Selected Still Frames



A view of the Cal Poly Dairy

Working at the Cal Poly Dairy can be a fun and rewarding experience. It's hard work, but at the end of the day you can go home knowing you have done

something worth while. In order to make the most of your time at the dairy however, safety has to be your number one priority. It is essential that you maintain a safe work environment for yourself, your cow workers, and for the cows. So lets begin.

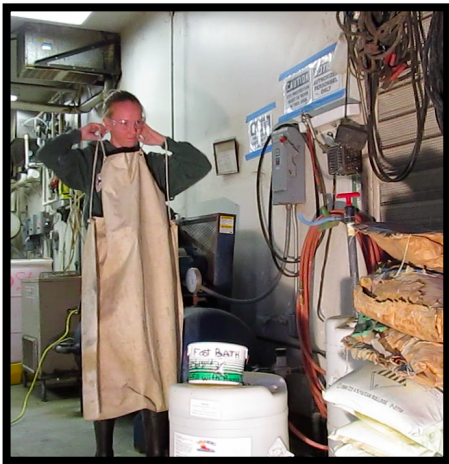
The Cal Poly Milking Parlor is equipped with a variety of safety features and equipment that help to ensure a safe workplace. Lets have a look.

One of the first places you will encounter an opportunity to practice safe work habits are with the footbath chemicals.

At the start of your shift, the footbaths need to be set up to help keep the cows feet healthy. The chemicals necessary for the footbath can be

hazardous, however, particularly the acid which can burn through clothing and skin. Therefore, when handling the chemicals, it is important that you wear the proper personal protective equipment provided.

That includes an apron and safety glasses. First, measure out the proper amount of the dry copper sulfate, and then add two pumps of the acid. Take special care not to breathe in any of the dust from the



A milker prepares to handle the footbath chemicals by putting on the proper personal protective



A milker dispenses tank wash chemicals while wearing the correct personal protective equipment

copper sulfate, and not to allow the acid to splash you.

Add the chemicals to each footbath.

Working with the wash chemicals is another area where personal protective equipment is necessary.

When working with the wash acid and detergents, you should always wear a face shield and rubber gloves.

A few more notes on chemical exposure. In the event that you or a coworker accidentally ingest any of the chemicals present on the dairy, you should contact the poison control center at 1 800-222-1222 for instructions. If your eyes or skin are exposed to copper sulfate, you should flush those areas with water immediately. If you are accidentally splashed with footbath acid, you should remove any

contaminated clothing and flush the affected area with water immediately. If the acid gets in your eyes, you should flush them with large amounts of water. You may be wondering, what is the most effective way to flush my eyes. The answer is use the eye wash station.



Removing the protective caps from the eye wash station to demonstrate proper use.

In the event of a chemical splash in the eye, it is extremely important to wash your eyes out as quickly

as possible in order to minimize any negative effects.

In order to operate the eye wash station, remove the caps, press the lever, and insert face. You should flush your eyes for a minimum of 15 minutes and if irritation persists, you should seek medical attention.

All incidents of chemical exposure should be reported to the herd manager.



A view of the inside of one of the first aid kits at the Cal Poly Dairy.

The dairy is also equipped with several first aid kits. These kits are located in the office, in the compressor room, and in the wash chemical room. These kits contain, Band-Aids, instant ice packs, tweezers, antiseptic, burn cream etc. Any injury, no matter how minor, should be reported to the herd manager. In the event of a life-threatening emergency, you should call 911 first, then contact campus authorities and the herd manager.



An expert displays a fire extinguisher.

Another potential emergency at the dairy would be a fire. There are several fire extinguishers located throughout the dairy and also several fire alarm stations. The locations are as shown. In the event of a large fire, lift the protective covering, and pull down on the handle. If a small fire breaks out and you feel

comfortable doing so, use one of the fire extinguishers located in the parlor area. When extinguishing a fire remember the acronym PASS. First, pull the pin, aim the extinguisher, squeeze the handle, then sweep across the base of the fire as you approach.



Proper fire extinguisher technique.

To properly use a fire extinguisher, you should first grasp the extinguisher firmly by the top of the tank, not by the handle. Twist the pin to break the plastic retainer then, pull the pin. Before approaching a fire, you should always double check that the extinguisher works by squeezing the handle for a few seconds. Once you are sure the extinguisher works, you should move upwind of the fire. Never approach a fire from downwind. Now, approach the fire, squeeze the handle, and sweep the extinguishing agent across the base of the flames.

In addition to proper technique, it is extremely important that you use the proper type of fire extinguisher for the kind of fire you are trying to put out. As you can see here this pressurized water fire extinguisher is completely ineffective at putting out the gasoline and diesel based flames you see. Now for a



Cows in the holding pen at the Cal Poly Dairy's Milking Parlor

few notes on animal handling safety. When working with cattle, even dairy cattle, which are typically very tame, it is important to remember that you are still working with large animals that outweigh you by several times and can be very unpredictable especially when frightened. Whenever you are in a pen or another enclosed area with the cattle, be aware of your surroundings. Make sure that you always have an escape route available in case something goes wrong. Avoid entering the holding pen at the parlor wherever possible and try to stay out of dense bunches of cattle. If you get knocked to the ground in the middle of a herd, you could be easily trampled. Avoid putting yourself in a position where you might become pinned between a wall, fence, or gate and a cow. Also remember that cows can kick in almost every direction, so you should always try to stay out of their reach. This is especially true when you are in the pit and the cows are on the milking platform. Avoid letting your head cross the threshold of the milking platform wherever possible to decrease the possibility of injury. Also avoid putting your hands

and arms in places that they might become pinned between an animal and a hard surface such as the butt plates.

Now that you know how to remain safe while working at the dairy, lets move on to setting up the milking parlor at the start of your shift.



A milker prepares to drain the lines of wash water.

When you walk into the parlor to start your shift, begin by draining the lines of the wash water. Unscrew the caps, switch the levers into milking position, and activate the pump to help drain the water more quickly. Deactivate the pump once there is no water remaining in the balance tank. After completing this procedure on both sides, head to the back room.

Start by draining the wash water from these lines as well. Unscrew all of the caps, and partially unscrew the clamps on the filter tubes. Completely detach the wash hose to enable faster drainage. Be sure not to lose the black gasket. Once all of the water has drained from the lines, remove the clamps from the filter assembly and slide out the inner portion. Remove the black caps from the top and place them in a safe location. Next, grab a filter sock and slide it



A milker puts the filter socks on the inner filter assemblies

over the inner assembly. Make sure that the gasket at the bottom goes over the filter sock. Replace the black cap at the top of the filter sock and then repeat with the other side. Properly assembling these filters is essential because they prevent any foreign materials that may have accidentally gotten sucked into the milk lines from entering the tank. Once both filters have socks, reinsert the filter assembly into the tubes. When doing this step, you need to be sure that the black gasket is seated properly. If it isn't properly seated, the filters will leak throughout the rest of the shift. Here is another view of this process. Next, go to the sink and find the plate shown here. Use the plate to cover the wash line hook up. Also make sure that the lever on the wash hook up is parallel to the milk lines. The last step for this area is to make sure you recap all of the pipes.

Now it's time to hook up the milk tanks. Retrieve the milk pipe from the sink and take it to the tank. Unscrew the elbow. You may need the wrench, which is typically found on top of one of the tanks. Insert the milk pipe and make sure it is secured. Before you

leave the back room, check all of the orifices and follow the pipes. If you can't identify anywhere that the milk can escape, you are ready to go.

Now, flip on the milking system and grab the basket of dip cups. As you make your way back to the parlor, don't forget to turn on the machines. Now, you need to put the safety balls into the vacuum canisters. Push in the plungers, release the valve at the bottom of the canister, wait for the vacuum to release, and then insert the safety ball into the canister. Rehang the canister, and pull the lever out to reactivate the vacuum. Repeat on the other side. Also, be sure to recap the pipes, or this will happen. The last step before you are ready to milk is to make sure that you are wearing rubber gloves. Wearing gloves is extremely important for sanitation purposes and to keep the cows healthy. Bacteria can get trapped in the crack and lines of your hands and then be transmitted from cow to cow. By wearing gloves, you create a smooth surface that bacteria can not stick to which reduces the chance of passing harmful bacteria from one cow to another.



A milker applies pre-dip to a cow's teats



A milker strips a cow to stimulate milk let down



A milker wipes a cow's teats to remove moisture and contaminants

Now that the parlor is set up, its time to milk!

Preparing a cow to be milked may be one of the simplest and most repetitive things you do during your shift, but it is also one of the most important. There are 5 steps in the milking process. Lets have a look at them. The steps are dip, strip, wipe attach, then dip again. The first dip is called a pre-dip and is designed to help clean and sanitize the teat before milking.

Next comes stripping which helps start the milk flow by stimulating the release of the milk let down hormone oxytocin. The third step is wiping which removes any dirt or moisture from the teats that may contaminate the milk. And finally, you are ready to attach the machine. Press the start button on the console to start the suction then apply the teat cups to each teat. If the previous steps were completed correctly, the milk should be flowing freely and the machine should hang with the hose parallel to the cows underline. This is an example of a cow that has been improperly hooked up. Some cows may also have what is known as a dry quarter. That means that only three of the four teats give milk. In that case,



A milker attaches the milking machine to the cow



A milker moves cows through the parlor



A milker properly moves back the crowd gate.

only hook up the working teats as shown. The machines will pop off automatically, and when they do, make sure to post-dip each teat to help keep the cow's udder healthy.

Now let's take a moment to talk about cow handling. While milking, you should handle the cows slowly and quietly. Cows that are happy and relaxed will be much easier to handle, will milk faster, and will be more willing to cooperate during future milkings. It only takes one bad experience in the parlor to sour a cow. It is never acceptable to beat a cow or to use any kind of excessive force, especially on the udder.

It is acceptable to apply gentle pressure to the hock of a cow to encourage her to move forward. Whistling and gentle verbal encouragement are allowed, but never yell at a cow or make excessive noise. Walking past a cow's point of balance may also encourage forward movement.

When attempting to move cows into the milking area, the crowd gate can be a useful tool as well when used properly. Never use the crowd gate to squish cows. They can easily become stressed, lose

their balance and go down in the holding pen.

Typically, the sound of the crowd gate alone is enough to encourage the cows to move forward.

When dropping the crowd gate, or moving it back behind a pen, you should get up onto the milking platform and watch the gates progress, this will prevent you from accidentally injuring a cow.



Milkers begin the process of cleaning the parlor.

At the end of your shift, it is crucial that you get the barn spotlessly clean. This involves hand washing all of the claws, hoses and machines, as well as ensuring that all of the manure is flushed from the barn. Each person has a different technique for cleaning the parlor, and so long as the parlor gets clean, your technique is entirely up to you. Always make sure that you rinse the dip cups and place them back in the basket. Also remember that if you decide to start cleaning up early, the cows should still be your number one priority.



A milker breaking down the pump area at the end of the milking.

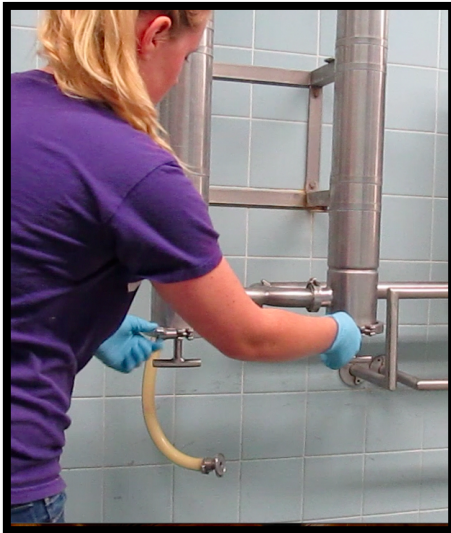
When tearing down the backroom, follow the same steps that you did for set up. First, push in the lever and use the valve to release the vacuum. Then remove the safety balls and put them in the wash

basket. Before reactivating the vacuum, drain and wash the balance tanks. Do not uncap the pipes, or milk will spray everywhere. Activate the pump to drain the milk, and then take the hose and wash the inside of the tank to help remove any milk residue.

Deactivate the pump once the balance tank is empty. Then, replace the balance tank lid, move the levers into the wash position, and reactivate the vacuum by pulling the lever back out. Repeat on the other side.

Now, take your wash basket with you as you head to the back room. On the way, shut off the machines.

Once in the backroom, loosen the clamps on the filter assemblies to help drain the milk. Also, uncap the wash hookup and turn the lever so that it is perpendicular to the milk lines. Uncap the pipe as well. It is also a good idea to turn on the hose at this time. Milk on a tile floor can be extremely slippery, and the water can help minimize the risk of falls.



A milker breaking down the backroom area.

While the milk drains from the pipes, go and remove the milk pipe from the tank. Reattach the elbow, and make sure that it is tight. Also replace the black cap on the tank opening. Place the milk pipe in

the wash sink. Now, go back to the filter assemblies. Remove the clamps, remove the black caps, and then remove the filter sock. Repeat on both sides. Before reinserting the inner filter assembly, it is a good idea to wash the entire set-up down to prevent any build up of milk residues. Reinsert the inner assemblies on both sides and attach the clamps. You also need to be sure to hook up the wash line and make sure the lever is perpendicular to the milk lines. If this step is not completely properly, the wash won't work. Also remember to recap the pipe. Next, you should rinse the floor and mat below the filter. If you don't mildew will start to grow which is extremely unsanitary and in violation of health codes.



A milker unscrewing the plunger on the milk outlet

Finally, its time to see how much milk you collected for the day! Go to the sink and collect the parts shown. Screw them onto the milk outlet and attach the hose. Carefully unscrew the plunger on the milk outlet and pull it out all the way. See how high the milk rises on the gauge at right. Look up the number on the milk charts to see how many gallons are in the tank. Record that number on the clipboard. Next, reinsert

the plunger and make sure it is screwed in all the way.

Unhook the hose and rinse it out a few times to remove milk residue. Then, unscrew the parts and wash out the milk outlet. Put the parts back in the sink. Then, flip the milking system to wash and head back into the parlor. If you have done everything correctly, the parlor will be spotlessly clean, and wash water will be flowing fully through the machines.



The clean milking parlor.

So now you are prepared to work at the Cal Poly Dairy. This video was designed to give you a basic understanding of safety precautions and parlor operations. It doesn't tell you everything you need to know, but it gives you a good basis on which to build. Don't hesitate to ask your fellow milkers or the herd manager if you have any questions. Safety is our number one priority and it is better to ask questions than to guess and end up hurt. Enjoy your time at the dairy.

Safety Test

The following safety test was designed to evaluate the milkers' knowledge retention and understanding of the safety features of the parlor and of safe work

practices to observe while working at the Cal Poly Dairy. The test will be given to all perspective milkers after watching the safety video and before they are allowed to begin work at the Dairy. Milkens who miss more than three questions will be required to watch the safety video again. The milker must also correct any incorrect answers, give a written explanation of why their original answer was wrong and why the correct answer is correct, and initial the incorrect questions to certify that they understand the correct answer. The purpose of this evaluation is to make sure than all milkers have a thorough understanding of Dairy safety.

Safety Test

1. What personal protective equipment is NOT necessary when handling the footbath chemicals?
 - a. Face shield
 - b. Goggles/safety glasses
 - c. Apron
 - d. Rubber gloves
2. What personal protective equipment is necessary when handling the wash chemicals?
 - a. Tyvek chemical suit
 - b. Respirator
 - c. Face shield and rubber gloves
 - d. Cotton clothing
3. What should you do first in case of a life-threatening emergency?
 - a. Call your mom
 - b. Call 911
 - c. Call the Herd Manager
 - d. Run home
4. Which is not a location where a first aid kit can be found in the parlor area?
 - a. The holding pen
 - b. The office
 - c. The compressor room
 - d. The wash chemical room
5. Which of the following is not an appropriate reaction in case of a parlor fire?
 - a. Pull the fire alarm
 - b. Stop drop and roll
 - c. Use the fire extinguisher
 - d. None of the above
6. What kinds of injuries need to be reported to the herd manager?
 - a. Broken bones
 - b. Minor abrasions
 - c. Chipped teeth
 - d. All of the above

7. What should you do if you, or a fellow employee accidentally ingests dairy chemicals?
 - a. Call the Herd Manager
 - b. Call Poison Control
 - c. Induce vomiting
 - d. Drink at least 8 glasses of water
8. How long should you flush your eyes in case of chemical exposure?
 - a. 2-3 minutes
 - b. 15 minutes
 - c. 45 seconds
 - d. 45 minutes
9. Which of the following is not true in regards to using a fire extinguisher?
 - a. You should test the extinguisher before approaching a fire
 - b. You should approach the fire from down wind to make sure the flames get a full blast of extinguishing agent
 - c. You should grab the extinguisher by the top of the tank instead of the handle
 - d. You should sweep the extinguishing agent back and forth across the base of the flames
10. When are cows most unpredictable?
 - a. When they are in love
 - b. When they smell death
 - c. When they are in the parlor
 - d. When they are frightened
11. Which direction are cows capable of kicking?
 - a. Forwards
 - b. Backwards
 - c. Sideways
 - d. All of the above
12. What should you always have when entering a pen or other enclosed space with cattle?
 - a. A cattle prod
 - b. An escape route
 - c. A lead rope
 - d. A rake
13. What is the purpose of the filter sock?
 - a. To prevent foreign material from entering the milk tanks
 - b. To keep the filter assembly warm between milkings

- c. To protect the filters from impacts
- d. To soak up excess milk that might leak out of the filters

14. What are the steps in the milking process? (List in the proper order)

15. What is the purpose of post dip? (Short answer)

16. Why is it important to properly attach the milking machine? (Short answer)

17. Which if the following is NOT an approved method of moving cattle forward?

- a. Whistling
- b. Gentle prods to the udder
- c. Soft pressure on the hocks
- d. All are approved methods

18. Where should you stand when sending the crowd gate backwards?

- a. On your partners shoulders
- b. On cow platform
- c. On the railings in the parlor
- d. You should sit down not stand

19. What is one way to reduce slip hazards while breaking down the back room?
(Short answer)

20. Why must you wash the mats and floor below the filters in the back room? (Short answer)

Chapter Five

Summary, Conclusions, and Recommendations

Summary

Overall, this project has addressed all of the problems that prompted its inception. In the future, as the program is implemented, it will help student employees work and handle the cattle more safely which will benefit them, their fellow employees, the cattle, and the University. This program should be continually updated to encompass any new equipment, altered procedures, and other new findings.

Conclusion

Based upon the feedback from the Herd Manager, it is concluded that the safety program is ready for implementation. Although the Herd Manager's feedback has been helpful, the training program would have been more effective had it been implemented during the training and scheduling meeting that took place at the beginning of Fall Quarter. That would have allowed for student feedback on the program so that revisions could have been made where necessary. Implementing it at the beginning of Fall Quarter would also have allowed the program to impact the largest number of new employees, as most of the new hires start work in the fall.

Recommendations

It is recommended that this safety program be implemented immediately to train newly hired employees. It is also recommended that all current employees be given the

safety test to determine whether they need to go through further training to maximize their ability to work safely. All current employees who pass the test should be exempt from further training while current employees who fail the test should go through the same training program as the new hires.

It is further recommended that a similar project be undertaken to train employees on safe practices outside of the milking parlor. This should include training for milkers on safe practices in the milk cow barns, training for calf feeders on best practices for animal welfare, and training for Dairy visitors on how to interact safely with the Cal Poly Dairy environment. The training program for using the equipment at the Dairy should also be updated in order to maximize its effectiveness. Creating and implementing further safety programs will help to increase safe work habits, and will limit the University's liability in the event of a preventable accident. This will benefit all parties involved.

Bibliography

- AGRI-BASICS Inc. (2005, May). Footbaths control infectious diseases. *Focus of the month* . (S. A. Bunting, Ed.)
- Andrews, T. (2010). Dairy Safety Training Guide. Commission on Health and Safety and Workers' Compensation.
- Bernard, R. (1990). *Practical Videography: Field Systems and Troubleshooting*. Burlington: Focal Press.
- Berning, L. (2009). General Dairy Husbandry Course Notes. 06. El Corral Publications.
- Blake-Beard, S., O'Neill, R., Ingols, C., & Shapiro, M. (2010). Social sustainability, flexible work arrangements, and diverse women. *Gender in Management: An International Journal* , 25 (5), 408-425.
- California Department of Food and Agriculture. (2010). *California Agriculture Highlights*.
- California Polytechnic State University Dairy Science Department. (2010, May 12). *Welcome to Dairy Science*. Retrieved February 1, 2011, from Dairy Science: <http://dsci.calpoly.edu/>
- Capretto, L. (2010, March 25). *The Health Benefits of Milk*. Retrieved March 5, 2011, from Oprah.com: <http://www.oprah.com/food/The-Health-Benefits-of-Milk>
- Census of Fatal Occupational Injuries. (2011). *California Department of Industrial Relations*. Retrieved February 2, 2011, from http://www.dir.ca.gov/dosh/cfoi/CFOI_2008/CFOI2008_Table1.pdf
- Department of Industrial Relations. (2010, September 27). Leadership through Innovation: California's Occupational Safety and Health Program.
- Division of Occupational Safety and Health. (2008). *2008 Fatal Occupational Injuries in California*. Retrieved January 25, 2010, from California Department of Labor Relations: http://www.dir.ca.gov/dosh/cfoi/CFOI_2008/CFOI2008_Table1.pdf
- Gates, R. (1999). *Production Management for Film and Video*. (3rd, Ed.) Amsterdam: Focal Press.
- Goldschmid, J. L. (2008, October 28). Copper Sulfate. *Material Safety Data Sheet* .
- IBA Inc. (2011). *Assure-M Sanitizing Teat Dip*. Product safety label.

- IBA Inc. (2011). *Dura-Sheild Sanitizing 1% Iodine Barrier Teat Dip*. Product safety label.
- IBA Inc. (2011). *FC-298 CIP Acid Cleaner*. Product safety label.
- Henderson, E., Mandelbaum, R., Mendieta, O., & Sligh, M. (2007). *The Agriculture Justice Project: Social Stewardship Standards for Organic and Sustainable Agriculture*. Agriculture Justice Project.
- Kira, M., & van Eijnatten, F. M. (2010). Socially Sustainable Work Organizations and Systems Thinking. *Systems Research and Behavioral Sciences* (27), 713-721.
- National Agricultural Statistics Service. (2008). *Demographics*. Retrieved February 27, 2011, from 2007 Census of Agriculture: http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/demographics.pdf
- National Dairy Council. (2011). *Dairy's Unique Nutrient Combination*. Retrieved March 5, 2011, from The Dairy Connection: <http://www.nationaldairycouncil.org/HealthandWellness/Pages/DairysUniqueNutrientCombination.aspx>
- Markus, C. R., Jonkman, L. M., Lammers, J. H., Deutz, N. E., Messer, M. H., & Rigtering, N. (2005, May 1). Evening intake of {alpha}-lactalbumin increases plasma tryptophan availability and improves morning alertness and brain measures of attention. *The American Journal of Clinical Nutrition* , 85 , 5.
- Melrose Chemicals Ltd. (2010). *C.I.P. Cleaning*. Application pamphlet.
- Merlo, C. (2010, May). OSHA Gets Tough Top 10 Dairy Citations. *Dairy Today* .
- Millerson, G. (2001). *Video Production Handbook* (3rd ed.). Amsterdam: Focal Press.
- Occupational Safety and Health Administration. (n.d.). *General Industry Regulations*. Retrieved March 6, 2011, from United States Department of Labor Website: http://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910
- Old Bridge Chemicals. (2008, October 28). Copper Sulfate. *Material Safety Data Sheet* .
- Raussi, S. (2003). Human-cattle interactions in group housing. *Applied Animal Behavior Science*, 80 (3), 245-262.

- Reinemann, D. J. (2003). *Milking Parlor Types*. Instructional Lab, University of Wisconsin at Madison.
- TetraDyne. (2011). *TetraBase-150 liquid chlorinated C.I.P cleaner*. Product safety label.
- United States Food and Drug Administration. (2007). Pasteurized Milk Ordinance 2007.
- Vanco Industries LLC. (2011). *Advantage Foot Bath Concentrate*. Product safety label.
- Von Essen, S. G., & McCurdy, S. A. (1998). Health and safety risks in production agriculture. *Western Journal of Medicine* , 169 (4), 214-220.
- Western Center for Agricultural Health and Safety. (2010). Dairy Safety Training Guide. Commission on Health and Safety and Workers' Compensation.