

THESIS

REVIEW, ASSESSMENT AND PRIORITIZATION FOR AN OCCUPATIONAL HEALTH AND SAFETY  
MANAGEMENT SYSTEM IN A VETERINARY TEACHING HOSPITAL  
USING THE ANSI/AIHA Z10 STANDARD

Submitted by

Miriam Koesterich

Department of Environmental and Radiological Health Sciences

In partial fulfillment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Spring 2011

Master's Committee:

Advisor: William Brazile

Kenneth Blehm  
Dean Hendrickson

## ABSTRACT

### REVIEW, ASSESSMENT AND PRIORITIZATION FOR AN OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM IN A VETERINARY TEACHING HOSPITAL USING THE ANSI/AIHA Z10 STANDARD

There are many hazards that could cause employee injuries and illnesses in veterinary hospitals. An effective way to control hazards in any organization is the implementation of an Occupational Health and Safety Management System (OHSMS). However, there are no published reports of any veterinary hospital that has successfully implemented an OHSMS using the ANSI/AIHA Z10 Standard. In 2005, the voluntary standard, Occupational Health and Safety Management Systems (ANSI/AIHA Standard Z10-2005) was published to assist organizations in implementing an OHSMS. This research was focused on the development of the initial stage of an OHSMS at Colorado State University (CSU)'s Veterinary Teaching Hospital (VTH), following the ANSI/AIHA Standard. The VTH was audited in 2003 and 2009 revealing significant health and safety hazards, yet there was little improvement in health and safety performance between the two audits. The rationale for this study was to improve the health and safety performance at the VTH as well as provide a template that other veterinary hospitals may use to develop and implement an OHSMS. Through a health and safety assessment and employee interviews at the VTH, the researcher identified hazards; conducted a comprehensive hazard analysis and risk

assessment of the service areas; identified applicable regulations, standards, and requirements; prioritized health and safety issues based on risk; and recommended protective strategies for each service area to lower the health and safety risk. Per the risk assessment and prioritization strategy of the 20 service areas that were evaluated, Large Animal Surgery was the number one service area priority followed by Livestock and Small Animal Surgery. Identified issues in these service areas were related to confined spaces, lack of lock-out tag-out procedures, chemical storage, and zoonotic disease. The service area with the lowest priority rating was Reception/Call Center/Business Office/Medical Records. Except for the Maintenance Service Area risks, all other serious health and safety risks affected all or the majority of the hospital and included violent patients, anesthetic waste gas, zoonotic disease, formalin, and lasers.

## ACKNOWLEDGEMENTS

I owe my deepest gratitude to my advisor, Dr. William Brazile, whose guidance, support, and encouragement from beginning to end has enabled me to produce this document that I am proud to put my name upon. This thesis would not have been possible without my committee members, Dr. Kenneth Blehm and Dr. Dean Hendrickson, who created such a unique opportunity and helped me along the way.

I am grateful to the Colorado State University Veterinary Teaching Hospital personnel who were so helpful and even enthusiastic with this research. Last, I would like to thank the College of Veterinary Medicine and Biomedical Sciences (CVMBS) for funding and the National Institute for Occupational Safety and Health (NIOSH) Mountain and Plains Education and Research Center (MAP ERC) training grant for supporting my graduate education.

## DEDICATION

I would like to dedicate this work to my loving family. A special thanks to my mother who has offered me unconditional love, patience, and guidance throughout my life.

## TABLE OF CONTENTS

CHAPTER 1 – INTRODUCTION .....	1
CHAPTER 2 – LITERATURE REVIEW AND BACKGROUND.....	5
CHAPTER 3 – PURPOSE AND SCOPE.....	13
CHAPTER 4 – METHODOLOGY .....	15
CHAPTER 5 – RESULTS AND DISCUSSION.....	29
CHAPTER 6 – RECOMMENDATIONS AND CONCLUSIONS .....	83
REFERENCES.....	107
APPENDICES .....	114

## LIST OF FIGURES AND TABLES

Figure 1: Structure of the Victoria, Australia Hospital OHSMS.....	9
Figure 2: Risk Assessment Matrix .....	61
Table 1: The Code and Definition for Hazards Noted in Walkthrough. ....	17
Table 2: The Score and Definition for Noteworthy Practices. ....	17
Table 3: Severity Terms and Associated Definitions.....	27
Table 4: Probability Terms and Associated Definitions. ....	27
Table 5: Management Decision Levels and their Associated Meaning. ....	28
Table 6: Definitions for Priority Ratings.....	28
Table 7: Number of Interviewees by Type per Service Area. ....	33
Table 8: A Comparison of Hazards Identified by VTH Personnel to Researcher Observations. ....	36
Table 9: Training Type Reported and Corresponding Number of Service Areas that Reported it.	37
Table 10: Controls Reported by the Interviewees. ....	38
Table 11: Top Risk Respondents Identified.....	40
Table 12: Respondents Perceptions of Protection and Continual Improvement at the VTH.....	41
Table 13: Respondent Answers to their Involvement in Health and Safety at the VTH.....	41
Table 14: The Number of Hazards Found per Service Area out of a Possible 19. ....	43
Table 15: The Percentage of Noteworthy Practices Present per Service Area.....	45
Table 16: Average Quality of Noteworthy Practices per Service Area. ....	46
Table 17: Summary of Risk for Each Service Area*.....	62

## CHAPTER 1 – INTRODUCTION

Close to 24,000 workers are injured every eight hour work day and almost 17 workers are killed on the job each day in the United States (OSHA, 2007). In 2009 there were 3,277,700 recordable nonfatal injuries and 4,340 fatalities (Bureau of Labor Statistics, 2009). Hospitals had a rate of 7.3 recordable injury and illness cases per 100 full-time workers in 2009 and specialty hospitals had 168,700 injury and illness cases (Bureau of Labor Statistics, 2009). These incidents not only cause immense pain and suffering to friends and families, but these injuries, illnesses and fatalities are estimated to cost \$170 billion dollars per year (OSHA, 2008). The National Safety Council estimated \$1,330,000 per death and \$53,000 per disabling injury (National Safety Council, 2009).

Veterinary Hospitals have a greater than average risk for injuries and illnesses than many other occupations (Jeyaretnam & Jones, 2000; Blair & Hayes, 1982). Injury rates for veterinarians are at least 10 per 100 cases per year (Landercasper, Cogbill, Strutt, & Landercasper, 1988; Langley, Pryor, & O'Brien, 1995; Hashemi, Brown, & Buckley, 1990; Poole, 1998) and 23 per 100 shown in another case (Gabel, 2000). These numbers do not include the many medical doctors who self treat and do not report their injuries and/or illnesses (Landercasper, Cogbill, Strutt, & Landercasper, 1988). Most of the risk is due to animal-related injuries and the most costly injuries are strain and back injuries (Landercasper, Cogbill, Strutt, & Landercasper, 1988). Researchers conducted a study of all the veterinarians in North Carolina which showed injury rates for major animal-related trauma were 67.8% (474/701)



(Langley, Pryor, & O'Brien, 1995). Landecasper, et. al., reported most severe animal-related career injury from kicks 35.5% (279/785) and bites 34% (267/785). A 2007 survey of registered practicing veterinarians found that 28% of veterinarians (105/371) experienced zoonotic illnesses during their career (Lipton, Hopkins, Koehler, & DiGiacomo, 2008). Although literature has been found on the subject, the area is relatively unexplored (Gabel & Gerberich, 2002).

There is an even greater risk for injuries and illnesses in Veterinary Teaching Hospitals. This is due to high referral case load, relative inexperience, naïveté due to student populations, and constant research and use of emerging techniques and technologies. Researchers found in a study that included 28 veterinary schools in the United States (U.S.) and Canada that veterinary teaching hospitals have a higher number of injuries and illnesses. (Morrow & Langley, 1996). Furthermore, the Bureau of Labor Statistics (BLS) reported that 40% of workers injured on the job had been there for less than one year, indicating that if one is new at their job (students, volunteers, or new hires); they are more likely to be injured. The reason reported for this, however, was not naïveté per se, but lack of information or experience. In 2003, a study was conducted that included 27 U.S. veterinary schools (all that were in operation at that time) to determine improvement of nontechnical skills, knowledge, aptitudes, and attitudes of veterinary students. The article was not detailed, but the authors suggested changes to admissions, orientation, curriculum, co-curricular activities, and other programs to improve the veterinary profession. However, the authors did not address health and safety knowledge, attitudes, or culture (Lloyd & King, 2004). The Healthy People Report of 2010 focused on veterinary medicine opportunities, but it was aimed at food safety, disease prevention, and the benefits of being a pet owner. It was more focused on the pet owner rather than the veterinarian and did not address many important health and safety issues (Hendrix, McClelland, Kahn, Thompson, & Pence, 2002).

Occupational Health and Safety Management Systems (OHSMS) are an effective way to reduce injuries, illnesses, fatalities, and costs. The costs saved from a functional OHSMS are greater than the costs of implementing it, and the final result is decreased injuries, illnesses, and fatalities; billions of dollars saved, improved productivity, and increased employee morale (OSHA, 2008).

There are many tools and various OHSMS that are available for use (Bovornsuppasri, 2005). However, few studies have been done on the analysis, comparison, and use of these systems. A study conducted in Canada described methods to implement data systems in order to assist occupational health programs in hospitals (Yassi, 1998). In an unpublished study (master's thesis) written in 2010, the author compared the OSHA Consultation Form 33 (a safety and health assessment form used to assess OHSMS) with the ANSI/AIHA Z10 - 2005 Standard and concluded there were many elements in the ANSI Z10 Standard that were not covered in the OSHA Form 33. In addition, an OSHA Consultant must be trained and certified to use Form 33 which is defined as 'tool' whereas ANSI Z10 is a 'standard' designed so that non-trained and non-certified employees can implement it (Henk, 2010). In another comparative study conducted in Australia, the researchers compared 10 OHSMS including both Australian and international systems. The ANSI Z10 Standard was concluded to be by far the most comprehensive system with 48 of the 57 elements used for analysis. Only one of the systems stressed the importance of task hazard analysis, which was an attribute that the ANSI Z10 Standard did not address. The ANSI Z10 Standard was said to be direct and confronted problems with reporting injuries and illnesses and included details such as cautioning against incentive schemes for decreasing incidence rates (Makin & Winder, 2009).

There are many hazards that could cause injuries and illnesses in veterinary hospitals and the risks have been shown to be greater, yet there are no published reports of any veterinary hospital in the U.S. of successfully implementing an OHSMS. A [human] hospital in Victoria, Australia implemented an OHSMS, but it was not based on the ANSI Z10 Standard and the effectiveness has not been published (Department of Human Services-Public Hospital Sector, 2003). Another study addressed an occupational health system in a hospital in Romania, but it was not nearly as comprehensive as the Australian 2003 OHSMS or the ANSI Z10 Standard (Rapas, Predut, Mocanu, & Popescu, 2000).

Based on a current literature review, no veterinary hospital in the world has successfully implemented an OHSMS using the ANSI/AIHA Z10 Standard. The purpose of this study was to complete the initial steps toward the goal of implementing a successful OHSMS using the ANSI Z10 Standard as a guideline. The Veterinary Teaching Hospital (VTH) at Colorado State University (CSU) was chosen as the site of this research project. The framework of this study could assist veterinary hospitals across the U.S. and even the world in implementing the initial stages of an OHSMS. Veterinary hospitals world-wide that have similar hazards could benefit from the documented process to implement an OHSMS in their own hospitals.

## CHAPTER 2 – LITERATURE REVIEW AND BACKGROUND

### **Management Systems**

A management system is a proactive process with an organized set of components which enable an organization to accomplish a set of goals. Management systems usually focus on continuous improvement using the plan-do-check-act model. A goal could be anything from facilitating the flow of information to improving quality to minimizing losses from accidents and injuries (Pascal, 1997). There are many types of management systems; environmental (Saad, 2003; International Organization for Standardization), hazardous waste (Massoomi, Neff, Pick, & Danekas, 2008), infectious disease (Tomiczek, Stumpo, & Downey, 2006) and many more. When implementing a management system, it is important to note how multiple management systems will work together. In 2004, a study was conducted on two different methods to implement an integrated management system (IMS), which combined quality (ISO 9000), environment (ISO 14000), and health and safety. One method was to implement separate management systems and then create an IMS. Alternatively, the management systems could be implemented as a single system that encompasses all three from the beginning. The researchers successfully implemented an IMS in two different companies using the two different methods (Labodová, 2004). The International Organization for Standardization (ISO) creates all its standards to be compatible for just this reason. The ANSI Z10 Standard is ISO compatible as well.

## **Occupational Health and Safety Management Systems**

A management system specific to occupational health and safety is comprised of four interrelated components. These include management leadership and employee involvement; worksite analysis; hazard prevention and control; and safety and health training (OSHA, 2008). OHSMS are performance oriented as opposed to compliance oriented. They use risk management to evaluate success as opposed to “body count” data (Doidge, 1997). For an OHSMS to be successful there must be emphasis on management leadership, management-employee communication, and human behavior factors. Management must lead the safety culture consciousness (Barnes, 1991). A safe work environment strengthens and supports individual safety behaviors, and this further affects behavior due to the influence workers have on one another. Furthermore, safety climate is correlated with employees’ compliance to safe work practices as well as workplace exposure incidents (Gershon, et al., 2000). Management is the motivational force and the source of necessary resources for employees. The OHSMS should have a health and safety policy, goals and objectives to demonstrate management’s involvement, and lastly, management should lead by example (Henk, 2010).

The Health Hazard Evaluation (HHE) Program is used by the National Institute for Occupational Safety and Health (NIOSH), however, NIOSH only evaluates each hazard and not a management system as a whole (National Institute of Occupational Safety and Health). The British Standards Institute (BSI), specifically the Occupational Health & Safety Advisory Services (OHSAS) in 1999 wrote an international occupational health and safety management system specification entitled OHSAS 18000 (Occupational Health & Safety Advisory Services, 2007). The BSI 18800 is the guide to the OHSMS which was written in 1996 and updated in 2004. The Canadian Centre for Occupational Health and Safety (CCOHS) published the first Canadian consensus-based workplace standard in 2006 entitled, Occupational Health and Safety

Management (CSA Z1000). As with the OHSAS 18000, this standard was created to be compatible with ISO systems such as ISO 9000 (Quality Management) and ISO 14000 (Environmental Management Standard) (Canadian Centre for Occupational Health and Safety, 2006). Similarly, the International Labour Organization (ILO) created the OSH 2001 which provides guidelines on OHSMS (International Labour Organization). Australia and New Zealand have several OHSMS standards and guidelines: AS/NZS 4801/4804 (Australian/New Zealand Standard; Occupational Health and Safety Management Systems), Victoria SafetyMAP, Australian Federal Government Safety-Wise, Western Australia WorkSafe Plan, South Australia Safety Achiever Business Scheme, and Queensland Tri-Safe (Makin & Winder, 2009).

Although OHSMS are still emerging and the ISO has not yet been agreed upon an occupational health and safety management system standard, the idea of an OHSMS is not entirely new. In 1989, OSHA created Safety and Health Program Management Guidelines that were published in 54 Federal Register 3904-3916 (Occupational Safety and Health Administration, 1989). The guidelines were never codified into the OSHA regulations due to the following reasons: (1) Not strong enough evidence that the guidelines would be useful; (2) If a different organization of the management program elements would promote the use; (3) If the guidelines should be mandated in a rule format, and (4) Which aspects of the safety and health management program should be in writing (OSHA). In 1982, before the guidelines were written, OSHA created the Voluntary Protection Program (VPP) which allowed worksites to implement systems to manage worker health and safety with the assistance of OSHA resulting in a qualifying Merit or Demonstration status (OSHA, 2007). A more recent OHSMS standard is the ANSI/AIHA Z10 – 2005 Standard published by the American National Standards Institute (ANSI) with the American Industrial Hygiene Association (AIHA). This standard is ISO and VPP compatible and can be used for any size and any type of organization. The standard was created

with over 40 members from different industry, labor, government, and special groups (Palassis, 2007), and is the first American consensus OHSMS standard.

As of 2007, only 30% of businesses have established health and safety systems (OSHA, 2007). Proctor and Gamble implemented an OHSMS that was designed to emphasize continuous improvement in health and safety. No standard was followed, but the elements used were not uncommon: organizational planning and support, standards and practices, training, and accountability and performance feedback (Fulwiler, 1993). A study done in Greece used the ISO 18001 (Information technology -- Radio frequency identification for item management -- Application requirements profiles) to construct a web file server, which served as a communication tool both within a hospital and between hospitals. The web file server was a means of supporting the OHSMS (Velonakis, Mantas, & Mavrikakis, 2006).

The OHSMS that was created in Victoria, Australia by the Department of Human Services – Public Hospital Sector was comprised of 15 individual elements which were divided into the following three categories: system structure, system activity, and system review. The components of each system are found in Figure 1. Although hard to directly compare (due to structure of the standards) all 15 components are present in the ANSI Z10 Standard. Similarly, the components not present in the system below which are in the ANSI Z10 Standard are management leadership, employee participation, planning elements, hierarchy of controls, and communication.

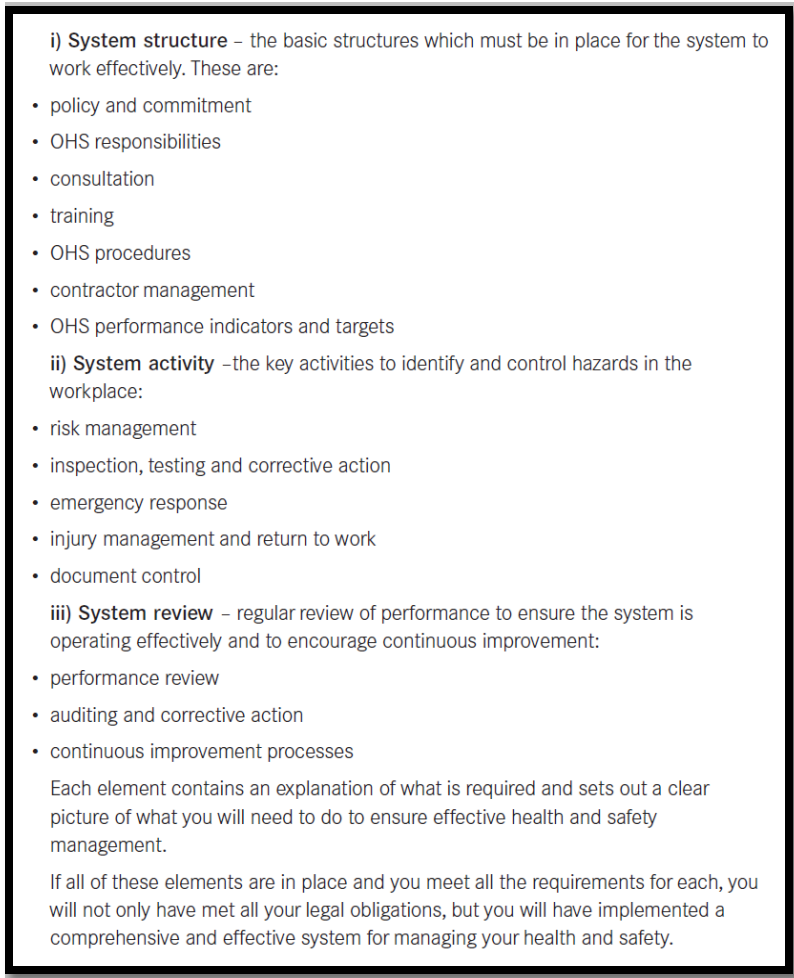


Figure 1: Structure of the Victoria, Australia Hospital OHSMS.

(Department of Human Services-Public Hospital Sector, 2003)

### Benefits of OHSMSs

In addition to lowering injury/illness incidence rates, OHSMS can be financially beneficial for organizations. Studies have shown a \$4 to \$6 return for every dollar invested in health and safety (OSHA, 2007). A recent study of 116 companies showed that those companies that implemented OHSMS had a higher number of safety performance measures than the companies that did not implement such a system (Bottani, Monica, & Vignali, 2009). In 2007, a comprehensive review on the effectiveness of OHSMS interventions was published. The researchers found in general positive results, but did not provide a solid statement of support of



OHSMS due to the relatively small number of published studies (13) and the heterogeneity of the OHSMS interventions found. From the eight databases searched and the criteria for the study, only one hospital was included in the study (Yassi, 1998; Robson, et al., 2007). The benefits of an OHSMS are further supported by Manuele who describes that positive safety culture decreases injury and illness rates and that implementing an OHSMS can lead to the improved safety culture. It is specifically stated that the ANSI Z10 Standard can lead to these decreases injuries and illnesses (Manuele, 2008).

### **ANSI/AIHA Z10 – 2005 Standard**

The ANSI Z10 Standard was published in 2005, and prior to this there was no consensus standard of an OHSMS in the U.S. The Standard was created based on ISO and VPP standards (Palassis, 2007). The premise of the ANSI Z10 Standard is that it can be easily integrated into current business systems. A major resource in creating this standard was the International Labour Organization's guidelines on Occupational Health and Safety Management Systems (ILO-OSH 2001). The ANSI Z10 Standard was intentionally created to be in harmony with ILO; however the Z10 Standard goes beyond the ILO guideline in certain respects. In addition, the Z10 Standard was designed to be considered by the International Organization for Standardization (ISO) (American Society of Safety Engineers). Furthermore, the Z10 Standard is compatible with other ISO Standards such as ISO 9000 (quality management systems) and ISO 14000 (environmental management systems). The ANSI Z10 Standard is comprised of six sections and 11 appendices which can be found in Appendix A (Manuele, 2008). Another aspect of the Z10 Standard is that it is not a specification standard, rather, it is a management system standard. This means that it provides broad *mandatory* elements and then *suggested* implementation strategies. This design was used because every organization may have different

implementation specifications based on the seriousness and risk of the organization's hazards and organizational structure. This approach maximizes the effectiveness of the OHSMS.

The ANSI Z10 Standard is compatible with the principles and tools developed by OSHA through the Voluntary Protection Program (VPP) (Palassis, 2007). The participants in OSHA's 2010 Injury and Illness Prevention Programs Stakeholder Meeting noted that the ANSI Z10 Standard was an effective model for improving worker health and safety (OSHA, 2010), especially the annual management review element (OSHA, 2010).

A key part of implementing a successful OHSMS is behavior change (Green, Kreuter, Deeds, & Partridge, 1980). The ANSI Z10 Standard takes this into account by emphasizing management leadership and employee participation.

To date, most literature pertaining to the ANSI Z10 Standard provides summaries of the standard, benefits of an OHSMS, and/or comparisons with other OHSMS (Manuele, 2008; Henk, 2010). Studies of implementation and system effectiveness of the ANSI Z10 Standard are not yet available. However, based on a review of the effectiveness of OHSMS implementation (Robson, et al., 2007), it is predicted that successful implementation of the ANSI Z10 Standard would have positive effects on safety and health culture, incidence rates, and financial losses (Henk, 2010).

#### **Colorado State University Veterinary Teaching Hospital (CSU VTH)**

Two health and safety audits were conducted at the VTH, but no formal plans to change the culture, control the hazards, or create an OHSMS were made. The 2003 auditor noted that the VTH had no comprehensive baseline and periodic surveys and no regular safety and health inspections. In addition, there was no facility-wide hazard prevention and control procedure. There was a system for reporting accidents, but not everyone knew how to use it or even knew that it existed; and there was no root cause analysis or incident trend analysis. There was not

much training associated with the job tasks, and the training that did exist did not typically have documentation associated with it. A few hazards were identified and abated, but these were only the results of reactive actions. The 2003 auditor did not assess radiation, hazardous waste disposal, biosecurity, or controlled substances.

In 2009, another audit was conducted without signs of much improvement from 2003. The audit conducted in 2009 was primarily based on OSHA regulations because these were generally considered minimum required standards. Over 100 inconsistencies with respect to OSHA criteria were found. The majority of the inconsistencies were related to electrical hazards. There was also a lack of safety controls, emergency and prevention plans, and hazards associated with walking and walking surfaces. Other deficiencies included issues associated with hazardous materials, personal protective equipment, environmental control, first aid, fire protection, material handling and storage, machinery and machine guarding, hand and portable powered tools, and toxic and hazardous substances.

## CHAPTER 3 – PURPOSE AND SCOPE

The purpose of this project was to accomplish two specific elements of the ANSI Z10 Standard at the Colorado State University (CSU) Veterinary Teaching Hospital (VTH), including Initial Review (element 4.1.1), and Assessment and Prioritization (element 4.2). In addition, ANSI Z10 element, Management Leadership and Employee Participation (element 3) was taken into account.

The initial review included (1) Creating a walkthrough checklist, interview questionnaire, and preliminary hazard assessment (PHA) matrix; (2) identifying hazards within the VTH; and (3) identifying the culture by noting management leadership and employee participation relative to health and safety. Assessment included (4) conducting a comprehensive risk assessment of service areas within the VTH; and (5) identifying regulations, standards, and/or requirements; (6) assessment of the management leadership and employee participation. Prioritization included (7) using the risk analysis to prioritize which service areas and issues management should address first; and (8) recommending protective strategies for each service area.

The scope of this project included the initial review; and assessment and prioritization of hazards and culture of the service areas in the VTH which were categorized into 20 different areas. The service areas included: (1) Reception/Call Center/Business Office/ Medical Records, (2) Maintenance, (3) Custodial/Animal Care, (4) Custodial/Barn Animal Care, (5) Pharmacy, (6) Central Supply, (7) Anesthesia, (8) Critical/Urgent Care, (9) Ophthalmology, (10) Dermatology, (11) Neurology, (12) Livestock, (13) Equine, (14) Small Animal Medicine, (15) Small

Animal Surgery, (16) Oncology, (17) Exotics, (18) Clinical Pathology, (19) Dentistry, and (20) Large Animal Surgery.

The rationale for this study was to create a baseline assessment, improve the quality of the health and safety programming at the CSU VTH and to provide a template by which other veterinary hospitals may use the methods and results to develop and implement their own OHSMS.

## CHAPTER 4 – METHODOLOGY

### **Site Selection and Subject Solicitation**

The Colorado State University (CSU) Veterinary Teaching Hospital (VTH) was selected via request from the College of Veterinary Medicine and Biomedical Sciences (CVMBS). The VTH underwent two health and safety audits in 2003 and 2009, but did not successfully correct all identified issues.

VTH Human Resources supplied a list of service areas with corresponding supervisor names and contact information. Supervisors were solicited via email for walkthroughs and interviews, and employees were solicited in person due to population size. All research was conducted in accordance with the Colorado State University (CSU) Institutional Review Board (IRB) and the Research Integrity and Compliance Review Office. The interviews were as random as possible to ensure the best representation of the research population. Since there were typically one or two supervisors per service area, there was not much basis for randomization. An email was sent with an IRB approved script asking all supervisors if they would like to volunteer to participate in an interview. Selecting an employee to interview was more randomized. The researcher walked around the hospital and approached groups of employees and used the same approved IRB script for recruitment.

## **Walkthrough Checklist, Preliminary Hazard Assessment (PHA), and Interview Questionnaire**

### **Development**

#### Walkthrough Checklist

A health and safety walkthrough checklist was created to evaluate health and safety hazards at the CSU VTH (See Appendix B). The checklist was largely based on two health and safety audits conducted by external consulting companies in 2003 and 2009. Only health and safety hazards with respect to VTH employees were evaluated in this thesis. Hazards solely related to the public, property, equipment, productivity, animals, and the environment were not assessed. The walkthrough checklist categories consisted of: 1) chemical; 2) physical; 3) explosives, flammables, and combustibles; 4) biohazards; 5) emergency preparedness; 6) general precautions; and 7) administration. Each category was comprised of subcategories and most subcategories had questions which served as a guideline to the researcher.

Certain elements (e.g., training) could not be observed during the walkthrough therefore some supervisors were asked if they would answer questions related to these elements after the walkthrough. However, if the researcher had already determined that an element did not exist (e.g., hearing conservation program), not all supervisors were asked the question related to the element. Examples of these questions included: (1) Have employees received any type of formal or informal hazard training? (2) Do you have a chemical hygiene plan? (3) Do you conduct safety equipment inspections? (4) Is there a hearing conservation program? (5) Are there emergency action plans? Please explain. (6) Is there a first aid kit available? (7) Do you have any reports and/or records related to health and safety?

The items that were evaluated during the walkthrough were either hazards or elements of controlling hazards (noteworthy practices). For data collection, it was noted that a hazard was

either present (denoted by an “x” on the checklist) or not present (denoted by an “NA” on the checklist). The denotations for hazards are as shown below in Table 1. Noteworthy practices (controls) were rated on a scale from 0 to 3, where a score of 0 meant “no control” and a score of 3 meant “good control.” This scale was chosen by the researcher because there is no neutral rating, which forced the researcher to conclude either a mostly positive association (score of 2 or 3) or mostly a negative association (score of 0 or 1). The ratings are as shown below in Table 2:

Table 1: The Code and Definition for Hazards Noted in Walkthrough.

Code	Definition
NE	Not evaluated
NA	not applicable/not present
X	Hazard is present

Table 2: The Score and Definition for Noteworthy Practices.

Score	Definition
0	No/none
1	Minimal
2	Okay
3	Good/yes

#### Preliminary Hazard Assessment (PHA)

A PHA was developed based on the walkthrough checklist (See Appendix C). A difference between the walkthrough checklist and the PHA was that the checklist contained details on observations whereas the PHA only contained the coding as presented in Table 1 and 2 above.

#### Interview Questionnaire

A questionnaire was created for supervisors and a slightly different version was created for employees. Supervisors and employees were asked about hazards, training, safeguards



(controls), and risks to obtain a general perspective to compare to the researcher's walkthrough observations. Both were asked about concerns, communication, protection, continual improvement, and involvement to obtain a sense of the safety culture. Also, both were asked about reporting accidents, injuries, and illnesses as well as Standard Operating Procedures (SOPs) to assess general knowledge of the employees.

Employees were asked how to handle an emergency situation during the interview. Supervisors (who volunteered) were asked this question during the walkthrough. During the interview, only supervisors were asked the following questions: (1) "How many employees do you supervise?" (2) "In which service areas do you work?" (3) "Are there hazardous chemicals and subsequent Material Safety Data Sheets (MSDS) in your service areas?"

Many other interview items were considered that could have influenced the respondent's answers to interview questions: the interviewer, the setting in which the interview was conducted, the length of the interview, the order of the questions, the wording of the questions, and conscious or subconscious behavior from the administrator. Since the interviewer's behavior and characteristics could have an effect on the respondent's answers (Frey & Oishi, 1995; Oppenheim, 1992) only one interviewer asked the interview questions to reduce bias and minimize inconsistencies (Schuman & Presser, 1981; Fowler & Mangione, 1990). It was a benefit of interviewing that the interviewer could clarify and probe respondents for more complete answers as well as be confident the respondent interpreted the question in the manner it was meant to be asked (Frey & Oishi, 1995; Houtkoop-Steenstra, 2000). The interview setting was typically in the same room for consistency (Lyberg & Kasprzyk, 1991; Czaja & Blaire, 1996). However, at times the same interview room was not available so a different room had to be used.

Since the sample population was in a hospital and their job duties may have included emergency care, the interviewer kept the interview as short as possible to help ensure that subjects could commit the time to complete the interview. Supervisors were asked 17 questions and employees were asked 15 questions. The interviews were between 30 and 60 minutes. Frey & Oishi (1995) recommended less than 60 minutes for an interview to minimize responder fatigue and less thoughtful or truthful responses (Oppenheim, 1992).

Many questionnaires and interviews use closed-ended questions because they are more efficient and reliable and produce more consistent results to interpret (Fink, 1995). In addition, several studies (Butler & Kitzinger; Belson, 1981; Groves, Fultz, & Martin, 1992) have demonstrated that it is nearly impossible to create a question that all respondents would interpret the same. Despite this, the researcher used open-ended questions because the advantages outweighed the limitations (Houtkoop-Steenstra, 2000), and the interviewer was capable of analyzing the answers (Fink, 1995). The advantages of the open-ended questions used in this study included: (1) interviewee freedom in responding in their own fashion while not limiting response alternatives (Peterson, 2000; Houtkoop-Steenstra, 2000; Fink, 1995); (2) allowance of unanticipated answers and descriptions per the respondent's perception as opposed to the researcher's (Fink, 1995); (3) because respondents were capable of providing their own answers, and all answers were not known (Fink, 1995). The limitations of the open-ended questions used in this study included (1) difficulty in interpretation and ability to compare; and (2) possibility of producing infrequent responses. Questions were, however, written in a clear and concise manner without slang or technical jargon that was not explained (Frey & Oishi, 1995).

Both the supervisor and employee interviews started off with simple, non-threatening, open-ended questions to maintain respondent's interest and give the interview a smooth start by making the response easy. This approach helped build the rapport of the interviewer with the respondent (Frey & Oishi, 1995; Oppenheim, 1992). Last, answers were recorded as close as possible to the exact words respondents used for quotable material and for more reliable analysis (Houtkoop-Steenstra, 2000).

### **Data Collection Methodology**

Data collection consisted of a safety and health walkthrough of the VTH and interviews with employees. The safety and health checklist was used for the walkthrough and the data from the checklist were transferred to the PHA matrix. Interviews with supervisors and employees were then completed and the interview information was added to the PHA matrix.

#### Walkthrough

Supervisors of each service area were contacted and informed of the intended walkthrough. The researcher met with each service area supervisor prior to the walkthrough. The supervisor showed the researcher which rooms in the VTH were used by the specific service area and pointed out any known hazards or items not to be touched. In some service areas, the supervisor escorted and assisted the researcher, and in others the researcher worked alone.

Questions regarding psychological stress and workplace violence were not asked. Workplace violence is a possibility in every work environment. In 2009, assaults and violent acts were the second leading cause (18%) of fatality in the workplace (Bureau of Labor Statistics, 2010). Psychological stress was assumed present for every service area (U.S. Department of Health and Human Services; Public Health Service; Centers for Disease Control and Prevention;

National Institute for Occupational Safety and Health). Hospitals in general have a higher than average stress level, and even more so in a teaching hospital (BLS, 1997; OSHA).

Employee involvement ratings were based on the interview data. If employees wanted to be involved in health and safety, a score of 2 was given (*okay*), if they wanted to and they were involved, they received a 3 (*good*), if they were not and did not want to be involved, the score was either a 1 or 0 (*minimal* or *none*). The designation between *none* and *minimal* was determined by the answers and attitudes of the respondents.

Similarly, management leadership was scored on attitude and responses. Supervisors who actually showed up to an interview were seen as having a greater priority for management leadership. The scores were subjective and if a supervisor was truly busy this was also taken into account.

### Interviews

After all health and safety walkthroughs of the 20 service areas were completed, the researcher conducted employee interviews. Due to time constraints, the goal was to interview one supervisor and one employee from each of the 20 service areas. The main goal of the interviews was to assess management leadership and employee participation. The interviews also provided additional information such as employee perspective of risks and hazards along with the general knowledge of employees. Last, an important reason for taking the time to interview employees was to start a change in the safety culture. Taking the time to sit down and have an open-ended question interview showed employees that someone cared about their perspectives and the health and safety of their workplace. This was proven by the email of gratitude and comments thanking the researcher for conducting the interviews. One respondent stated that with this interview they realized that they do not read the safety signs and have

decided to start. Another stated that the research was important and he/she hoped it helped to protect employees. The authors of the ANSI Z10 Standard wrote that for an Occupational Health and Safety Management System (OHSMS) to be successful there must be strong management leadership and employee participation; these two factors influence the safety culture of an organization.

### **Data Analysis**

The interview data were primarily used to score management leadership and employee participation, which were added to the PHA. The interview data and the walkthrough data were largely analyzed separately and then both used for the assessment of risk from operations within the VTH. The risk assessment was then used to prioritize the service areas based on the identified safety and health issues within the VTH.

### Walkthrough Data Analysis

There were 19 hazards that were evaluated during the health and safety walkthrough. The number of hazards present in each service area was summed. There were 30 noteworthy practices that were considered necessary and scored on a 0-3 scale. However, personal protective equipment (PPE) and respiratory protection were not evaluated due to lack of a task-based hazard assessment, which would have identified details such as specific chemical exposure, duration, and frequency. Such details would allow for proper selection of PPE as well as training, medicals exams, etc. that go along with proper PPE use. Therefore, unless a noteworthy practice was not applicable for a service area, there were 28 to be evaluated.

A series of calculations were executed to produce the average quality of noteworthy practices as well as the percentage of practices present within each service area since a mere summation would not have differentiated between a service area performing poorly on many

noteworthy practices verses an area that did very well on a few, but were completely lacking on others. For example, maintenance had 19 out of 28 possible noteworthy practices present in some manner (1-3) which was 68% of possible presence. The sum of the noteworthy practices was 27; divided by the number of practices (19) present equaled one, which was a *minimal* average quality of noteworthy practices. Similarly, equine also had 68% presence of applicable noteworthy practices, but this was 17 out of 25 possible practices present and also a summation of 27. The summation (27) divided by the number of practices present (17) equaled two, which was an *okay* average quality of noteworthy practices. However, it is important to note that even the *average* quality indicator is lacking important information and is just a tool to prioritize. Continuing with the same example, maintenance had one noteworthy practice with a score of 3 whereas equine did not have any noteworthy practices with a score of 3. Specific scores for each noteworthy practice in each service area can be found in Appendix C. By using this appendix, management can decide what is more important to them, higher frequency in presence of noteworthy practices or lower frequency of practices, but done well.

The calculation steps were as follows:

- 1) The number of noteworthy practices present out of 28 was determined. To conclude this, all applicable practices that had a 1, 2, or 3 score were counted and those with a 0 were not. This was done using the "COUNTIF" function in Microsoft Excel to increase time efficiency and decrease human error. In addition, this was double checked by the researcher.
- 2) The number of possible noteworthy practices was found (i.e., 28 minus any that were not applicable). This was also executed by using the "COUNTIF" function in Microsoft

Excel to increase time efficiency and decrease human error. Again, this was double checked by the researcher.

- 3) The ratio of the number of noteworthy practices present out of the total possible was calculated and presented as a percentage.
- 4) The total sum of the scores was then added, again using a Microsoft Excel function to minimize human error.
- 5) This summation (or score) was then divided by the number of noteworthy practices present.
- 6) The integer produced from step five was translated into the corresponding descriptive word that was used during the walkthrough (See Table 2).

#### Interview Data Analysis

Supervisors were asked slightly more and slightly different questions than employees. Each question was analyzed in the most appropriate and clear manner. This included paragraph form, table, statistics, and/or charts. Reporting of injuries and illnesses, communication of health and safety rules, near misses, and emergency action plans produced generally the same results and were therefore presented in paragraph form as opposed to detailed analysis per service area to reduce redundancy. Standard Operating Procedures (SOPs) and comments were analyzed and presented in paragraph form as well because a paragraph was sufficient for a clear presentation of results.

Response rates, hazards, training, controls, risk, protection and improvement, and involvement were all analyzed and presented in tables. The tables allowed for a clear assortment into useful categories. The hazards employees identified during the interview were

compared with the hazards observed by the researcher during the walkthrough. The results are displayed as a percentage; how many service area representatives identified the hazards out of the number of service areas identified by the researcher. An example of this is that 15 out of 20 service area interviewees identified that they had toxic and/or hazardous substances in their area. Training reported per the interview was categorized into types of training (none, pre hire, reactive training, EHS training, read and sign, verbal, video, and hands on). Type of controls reported during the interview were also categorized into types and displayed as a percentage (elimination, substitution, engineering, administrative, PPE, common sense, and reactive controls). Top risks reported during the interview were noted and presented as both a ratio and a percentage. Similarly, protection and continual improvement as well as employee involvement responses were both split into categories based on the answers received and presented as both a ratio and percentage.

Time worked in service area, health and safety concerns, how many employees supervisors oversee, and specific tasks or procedures that pose risk were excluded due to the way the questions were clarified by the researcher and the answers received, which were neither consistent, and in the final analysis, not needed

The reason for asking how long a worker had worked in a service area was to ascertain if the longevity that a worker was employed in one service area was related to the worker's familiarity with the hazards and risks in that service area. The question was excluded because some subjects answered how long they worked in the area and some specified how long they worked in the service area as well as how long they had been in the supervisory position.

The question about health and safety concerns was meant to assess the worker's stress level with respect to their concern of getting injured. This was probably the most inconsistent question in terms of asking and receiving answers. Some answered the question as it was



intended (i.e., do you feel safe?); others answered it as if health and safety were an everyday priority for them or not, which is also useful to know. It was not until after numerous interviews that the researcher specifically clarified that the question was intended to gauge subject concern of getting injured. The reason further explanation was provided was because almost all interviewees responded with a confused expression. Due to the inconsistency of asking and clarifying the question, it was excluded from the analysis.

Supervisors interpreted the question, "How many employees do you supervise?" differently. Some responded for direct supervision, some for indirect and direct, some only for full time state classified employees, and some included a combination of full time, hourly, part time, and students as well. Because the question was not a necessity to the research, and was inconsistently asked and clarified, it was excluded from the analysis.

The question related to specific tasks or operations that posed risk was also excluded in final analysis due to inconsistencies in clarification and interpretation. The question was asked for future training purposes. A task or procedure could be just as risky as a hazard itself and therefore, if these were identified in a reliable manner the data could be used to identify and create a training program for not only specific hazards and risks within a service area, but for specific tasks or procedures. Additional to the training, it would be suggested that an SOP be created for the identified risky tasks or procedures. This question, however, was interpreted differently by many and some became frustrated because for their service area the answer was obvious and they were annoyed by 'redundancy'.

Finally, the question pertaining to which areas employees worked was not analyzed, it was merely noted. This question was asked to help with future training and orientation programs. Most service areas had employees that only worked within that service area while others had employees that worked in numerous service areas within the VTH. This is important

because the employees that worked in multiple service areas had the potential to be exposed to hazards in all service areas in which he or she spends time.

Risk Assessment

The data analysis from the PHA and the interview were both used to determine the health and safety risk in each service area. Since many of the service areas had ubiquitous results for certain hazards and/or noteworthy practices, those parameters were analyzed for the entirety of the VTH (i.e., they were not analyzed for each service area). Subsequent to this, a risk assessment was conducted on individual service areas. The possible severity or consequence of an injury or illness for each service area was first assessed using the definitions listed below in Table 3. The probability of an injury or illness was then assessed for each service area using the definitions listed below in Table 4.

Table 3: Severity Terms and Associated Definitions

<b>Descriptive Word</b>	<b>Severity Description</b>
Catastrophic	Death or permanent total disability.
Critical	Permanent, partial, or temporary disability (excess of 3 months)
Marginal	Minor injury, lost workday accident.
Negligible	First aid or minor medical treatment.

Table 4: Probability Terms and Associated Definitions.

<b>Descriptive word</b>	<b>Probability Description</b>
Frequent	Likely to occur repeatedly
Probable	Likely to occur several times
Occasional	Likely to occur sometime
Seldom	Not likely to occur
Improbable	Can assume incident will not occur

Combining the severity and probability, a risk assessment matrix was used (see Appendix D) to determine the risk category. The definitions for the risk categories are presented below in Table 5.

Table 5: Management Decision Levels and their Associated Meaning.

<b>Risk category</b>	<b>Remedial action or acceptance</b>
Serious	Immediate action should be taken
High	Remedial action to have high priority
Medium	Remedial action to be taken within appropriate time
Low	Risk is acceptable; remedial action discretionary

Prioritization

The prioritization allows the VTH management to determine objectives which will offer OHSMS improvement and risk reduction. Health and safety issues that were ubiquitous throughout the VTH were pulled out of the area specific risk assessment and discussed as a separate entity. The prioritization per service area was directly based on the service area risk assessment. Risk was determined for each hazard that was specific to a service area resulting in a risk range per service area. To prioritize, frequency of risk rating was used. Therefore, the prioritization was based on the following:

Table 6: Definitions for Priority Ratings.

<b>Priority Rating</b>	<b>Meaning</b>
1	Three Serious Risks
2	Two Serious Risks
3	One Serious Risk
4	A Range With a Serious Risk
5	Two High Risks
6	One High Risk
7	Medium Risks

## CHAPTER 5 – RESULTS AND DISCUSSION

### **Interview Data Analysis**

Not every service area had both supervisor and employee volunteers that participated in the interviews and two of the service areas (Barn Care and Small Animal Surgery) did not provide representatives, therefore, the statistics discussed below were in relation to 18 of the 20 service areas. Some of the questions that were asked during the interview produced generally the same answers throughout the VTH. These were (1) reporting of injuries and illnesses, (2) communication of health and safety rules, (3) near misses, and (4) emergency action plans. Many of the questions needed clarification due to multiple interpretations by respondents. If clarification was needed, a definition was supplied. If further clarification was necessary, examples were given. Terms that were often clarified were: near miss, SOP, hazard, controls, and risk.

#### *Injuries and illnesses*

There was no incident/injury/illness or near miss database for the VTH. The injury/illness reports were never reviewed for trend analysis or used to define significant problems as well as make improvements. When an incident, injury, or illness occurred, employees were required to report the incident via the CSU Environmental Health Services (EHS) online webpage within four days. The report then went to Human Resources (HR) for additional questions to be answered. After HR, the report was sent to EHS. If the employee saw a doctor, the report was then be provided to HR. The reporting policy did not require the

employee to inform the supervisor of an incident or show a doctor's note. However, per the interviews (12 areas), employees usually reported to their supervisors first and then completed the incident form online. HR maintained a copy of all reports for about 5-7 years and filed them by incident date.

#### *Communication of Health and Safety Rules*

Communication of health and safety rules was not consistent throughout the VTH. In some instances only supervisors received updates and it was up to them to relay the information to all employees for whom they were responsible. Other employees thought there was only minimal or no communication at all. Most communication on health and safety policies and updates were via email, however, sometimes only supervisors received emails. Most supervisors communicated the updates to their employees either verbally or by printing and hanging the email up in an area where employees could see it. A few said the only communication was verbally at orientation. Some mentioned meetings, SOPs, and reference material as a form of communication. One person mentioned an in-person talk that the Hospital Director had given on the health and safety pertaining to Meningitis.

#### *Near Misses*

For the most part, employees were not aware of this term or concept. Once clarified, the majority of respondents identified that near misses happened on a daily basis; on the other hand, some did not. Some even stated their corresponding corrective actions; two people stated that if an animal was seen as aggressive, the cage was labeled to communicate this. Two people noted that if a sharp was found, the supervisor would be notified and a sharps report completed as well as sent to the administrators. Heavy intravenous (IV) pumps that were not secured would fall (sometimes on people); therefore Critical/Urgent Care (CCU) employees made a

policy that any pump higher than the user's waist level was to be secured to a pole. An employee stated that if she almost fell because of a wet floor, she either cleaned it up and/or put up a caution sign. Five interviewees stated that there were many near misses with violent patients, so restraints and/or muzzles would then be used. Other responses to the question "Have you encountered near misses and how do you manage them?" were "Not really;" "I guess I have;" and "yes, but not much you can do."

#### *Emergency Action Plans.*

The VTH had a written building safety plan that included fire, weather, and chemical emergencies among others, but it did not have all required elements per OSHA (29 CFR 1910.38). Although the VTH was not regulated under OSHA, it was considered best practice to follow the standards. The requirements per OSHA were as follows: (1) emergency escape procedures and emergency escape route assignments; (2) procedures to account for all employees after emergency evacuation has been completed; (3) rescue and medical duties for those employees who are to perform them; (5) the preferred means of reporting fires and other emergencies; (6) names or regular job titles of persons or service area employees who can be contacted for further information or explanation of duties under the plan; and (7) training when the plan is developed, if employee's responsibilities have changed, and when the plan is changed. In addition, specific elements which should be addressed for the VTH included: (1) stand-and-hold procedures (where certain employees stay with a patient rather than immediately evacuating); (2) alarm and/or notification differences for different emergencies; and (3) communication procedures for those that cannot hear via the paging system.

A few supervisors had printed out the current plan(s) and hung them up. The most common response for what to do in a fire situation was "get out." There was not a definitive

plan that identified designated muster areas to assemble outside or designated employees (sweepers) to assure that all employees evacuated. Another problem that arose was that of bringing or leaving patients. Per the interview, it was standard practice to grab a patient to bring outside during an emergency evacuation. This could lead to spread of disease or possibly further injury. In a fire emergency, the alarm sounds and lights flash. In a weather emergency, the alerts would come in on the National Oceanic and Atmospheric Administration (NOAA) weather alert system which would then be paged throughout the hospital.

### *Standard Operating Procedures*

The VTH did not have many formal SOPs. Furthermore, the only hospital-wide SOP that was continually mentioned was the sharps SOP due to its recent update and required read-and-sign training. Only two respondents identified the biosecurity manual as an SOP. Assessment of employee behavior (if SOPs were followed in practice) was not in the scope of this research. SOPs that were identified through the interviews were as follows: mixing Virkon®, fogging, biosecurity, sharps, chemotherapy manual and safe delivery, laundry procedures, fire emergency plan, diluting chemicals, dog bite report, operating the chutes in livestock, milking procedures in livestock, isolation procedures, and down horse protocol. Other answers to the question “Do you have a documented standard operating procedure for any tasks that pose a risk?” consisted of: “none”, “we don’t have risks”, “not sure”, and “not really, it’s mostly verbal”.

### *Response Rate*

The goal was to interview 40 participants from the VTH; ideally one supervisor and one employee from each service area. There were 29 of 40 (73%) personnel who volunteered to be interviewed. Of the 29 interviewees, 15 (52%) were supervisors and 14 (48%) were employees. The results are summarized per service area in Table 7 below. ‘NA’ was denoted for service

areas that had two interviewees but did not provide one supervisor and one employee each.

The zeros denote where an interview was desired, but no personnel volunteered.

Table 7: Number of Interviewees by Type per Service Area.

<b>Service Areas</b>	<b>Supervisor</b>	<b>Employee</b>
<b>Reception/ Call Center/Business Office/ Medical Records</b>	2	NA
<b>Maintenance</b>	1	1
<b>Custodial/Animal Care</b>	1	0
<b>Custodial/Barn Animal Care</b>	0	0
<b>Pharmacy</b>	1	1
<b>Central Supply</b>	1	1
<b>Anesthesia</b>	1	1
<b>Critical/Urgent Care</b>	1	1
<b>Ophthalmology</b>	1	1
<b>Dermatology</b>	1	1
<b>Neurology</b>	1	0
<b>Livestock</b>	1	1
<b>Equine</b>	1	0
<b>Small animal medicine</b>	0	1
<b>Small animal surgery</b>	0	0
<b>Oncology</b>	1	0
<b>Exotics (Zoo Med.)</b>	0	1
<b>Clinical Pathology</b>	NA	2
<b>Dentistry</b>	0	1
<b>Large Animal Surgery</b>	1	1

### *Hazards*

The question was asked, “A hazard is any act, exposure, or condition arising in and from the work performed in the work place that could result in injury or illness to the worker. What hazards are associated with your job tasks and/or those employees you supervise?” Responses



to this question varied greatly; some respondents did not think there were any hazards at all and other respondents reacted as if it would be difficult to list all the hazards because there were so many.

A comparison of the hazards identified by the researcher during the walkthrough to the hazards identified by VTH personnel via the interview process can be found below in Table 8. Therefore, the percentage depicts the awareness of the hazard. The complete table can be found in Appendix E. Seventy-five percent (75%) of the service areas were identified by interviewees as having toxic and/or hazardous substances present. Sixty-nine percent (69%) identified that violent patients were a hazard followed by 60% of the service areas identified by the interviewees as having ergonomic hazards. Conversely, not one service area interviewee identified heat stress, workplace violence, compressed gas, or the spread of human to human disease as hazards to which they were potentially exposed. Moreover, the possibility of workplace violence and the spread of human to human disease is a possibility in every service area. Assault and violent acts were the second leading cause of death in the workplace in 2009 (Bureau of Labor Statistics, 2010). If workers are not aware of the hazards to which they are potentially exposed, they may unknowingly place themselves in a hazardous situation.

Although there was a lack of awareness of many hazards, there were also hazards identified by the interviewees that the researcher had not specifically identified or anticipated during the walkthrough. For example, the possibility of incurring a burn was taken into account by the researcher when looking at first aid kit contents, but specific sources of burns were not identified. However, maintenance employees indicated that burns and catching clothes on fire from welding were hazards, and central supply employees indicated that burns from the steam produced by the autoclave was a hazard. Additional hazards identified by interviewees included:

allergic reactions to the allergens used to test the allergies of the patients (Dermatology); and crushed toes from the use of hydraulic examination tables (Large Animal Surgery). The researcher identified the hydraulic examination tables as a confined space and a possible unexpected release of hazardous energy (need for lockout/tagout), but did not have a specific hazard category for crushed limbs/digits. Livestock interviewees, however, did not identify what was hazardous about the hydraulics, just that they were a hazard. Again, the researcher identified the need for machine guards and lockout/tagout. The researcher and interviewee both identified violent patients as a hazard in Livestock, but the interviewee specifically noted the students as an indirect cause of the violent patients when stating that many students were learning and did not know proper restraint of animals. Lastly, zoonotic disease was identified by both the researcher and interviewee as a hazard for dentistry, but the interviewee pointed out that there was respirable bacteria as well (aerosolized bacteria).

Table 8: A Comparison of Hazards Identified by VTH Personnel to Researcher Observations.

<b>Hazard</b>	<b>No. of Times Hazard was Identified by VTH Interviewees</b>	<b>No. of Times Hazard was Identified by Researcher</b>	<b>Percent</b>
Toxic & Hazardous Substances	15	20	75%
Violent Patient	11	16	69%
Ergonomics	12	20	60%
Zoonotic Disease	10	20	50%
Bloods, Fluids, Sharps	8	20	40%
Radiation	3	11	27%
Lasers	1	5	20%
Noise	3	17	18%
Confined space	1	6	17%
Powered trucks/tractor	1	6	17%
Cranes & hoists	1	6	17%
Slips, Trips, and Falls	3	20	15%
Bloodborne Pathogens	2	20	10%
Hand/Portable Power Tools	1	13	8%
Electrical	1	20	5%
Heat stress	0	8	0%
Workplace Violence	0	20	0%
Compressed Gas	0	13	0%
Human to human	0	20	0%

### *Training*

Interviewees were asked what training they and their employees (if applicable) had received, the type of training, and if the training was documented. The complete training results can be found in Appendix F. The type of training and the number of service areas (out of the 18 areas that interviewed) which reported that type of training are presented in Table 9. Most employees received verbal on-the-job training. The second and third most reported training were pre-hire at the VTH and no training, respectively. The “not specified” category referred to the report of training on chemical hazards, Virkon®, stall cleaning, and the zoonotic diseases Methicillin-resistant *Staphylococcus aureus* (MRSA) and Leptospirosis. The platform in which they received this training was not specified. The training that was reported as documented

were biohazard training on the CSU campus, radiation training on the CSU campus, reading and signing the sharps policy online, verbal training and signature for working with chemotherapeutic drugs, and the forklift training taught at the VTH.

Supervisors were asked if both they and their employees had received training or education, and employees were asked if they had received training or education. It would have been a useful comparison to evaluate if there were discrepancies between the supervisors' and employees' answers, but 1) not every service area had one supervisor and one employee who volunteered to be interviewed and 2) many supervisors were unaware of what type of training, if any their employees received.

Table 9: Training Type Reported and Corresponding Number of Service Areas that Reported it.

<b>Training Type</b>	<b>No. of Service Areas</b>
Verbal	11
Pre VTH	7
None	6
EHS/Campus Training	5
Reading	5
Not Specified	4
Hands on	4
Pre Hire Reqs.	2
Reactive Training	2
Video	2

*Controls (Safeguards)*

Respondents were asked if controls were present in their service area and if they had suggestions for additional safeguards. Some respondents identified training as a safeguard, and, many respondents identified the muzzles as a safeguard post clarification.

The safeguards reported by the interviewees were categorized by the researcher into the hierarchy of controls (CDC, 2010). Two additional categories of safeguards were added based on interviewee answers; these included: 1) common sense, awareness, and communication, and 2) reactive controls such as spill kits and eyewash/shower stations. The complete results can be found in Appendix G, and the summarized results are shown below in Table 10.

A total number of 43 controls was used because this was the sum of the total number of controls (depicted as x's in Appendix G) reported from the interview. However, if three different controls were reported from the same service area but all three could be categorized under the same control definition (e.g., personal protective equipment), then they all were counted as one 'x' under that control category for that service area. PPE and administrative controls were the highest reported controls which are not preferable per the hierarchy of controls. Furthermore, common sense, awareness, and communication (i.e., verbal exchange of current susceptibility and aggressive patients), although good to have, are not forms of control.

Table 10: Controls Reported by the Interviewees.

<b>Type of Control</b>	<b>No. of Service Areas That Listed Control Type</b>	<b>Percentage</b>
PPE	13 of 43	30%
Administrative	11 of 43	26%
Engineering	8 of 43	19%
Common Sense', 'Awareness', 'Communication'	5 of 43	12%
Substitution and/or Dilution	4 of 43	9%
Elimination	1 of 43	2%
Reactive controls (spill kits, eyewash/showers)	1 of 43	2%

### *Top Risk*

Respondents were asked what they felt the riskiest part of their job was (as well as the employees they supervise if applicable). The summarized results of each of the 29 interviewees' opinions of their most significant safety and/or health risk are in Table 11 (full results found in Appendix H). Forty-one percent of the respondents identified patients as the greatest risk, followed by zoonotic disease (14%) and sharps (14%). These results differed from the study done in 2008 (Weaver, Newman, Lezotte, & Morley, 2010) at the VTH on the personnel perceptions of risks, where respondents identified and ranked hazards and injuries and illnesses, and named job-related incidents as well as the most severe incident. In the 2008 study, personnel were most concerned about chemicals (36.7%), followed by biological (26.7%), and lastly physical hazards (23.3%). Compared to the expert panel, VTH personnel perceived greater risk of sharps, ionizing radiation, loud noises, emissions from the digester, pesticides and insecticides. VTH personnel perceived less risk than the expert panel for patients, moving and lifting, anesthetic gases, disinfectants, antimicrobial-resistant bacteria, and sensitizing allergens (Weaver, Newman, Lezotte, & Morley, 2010). It is possible the answers differed due to the difference in interview population, questions, and administration of interview. It is also possible that personnel either understand the term risk differently or have learned since the past study.

Table 11: Top Risk Respondents Identified.

<b>Top Risk</b>	<b>No. of Employees Who Identified this Top Risk</b>	<b>Percentage</b>
Violent Patients	12 of 29	41%
Zoonotic Disease	4 of 29	14%
Sharps	4 of 29	14%
Ergonomics	3 of 29	10%
Chemotherapeutic Drugs	2 of 29	7%
Chemicals (Virkon® powder)	1 of 29	3%
Students (improper restraint)	1 of 29	3%
Welding	1 of 29	3%
Papercuts	1 of 29	3%

*Protection and Improvement*

Interviewees were asked if they felt there was protection and continual improvement of their health and safety (as well as their employees, if applicable). Twenty one of 29 (72%) respondents thought there was some sort of protection and improvement, while the remaining 8 of 29 (27%) did not think so. The answers to this interview question were categorized into six different categories based on the answers received. The responses can be seen in Table 12 (full results in Appendix I). Most of the interviewees (10 of 29, 34%) reported that they felt there was improvement in one or a few issues, but no improvement for the majority of issues. Seven of nine (24%) respondents reported that they did feel there was protection and continual improvement in the VTH. Fourteen percent (4 of 29,) reported that they did feel there was protection and continual improvement, but only recently (less than one year). The remaining eight respondents (27%) were either not sure, did not think so, or did not feel there was protection and improvement.

Table 12: Respondents Perceptions of Protection and Continual Improvement at the VTH.

<b>Respondent Answers</b>	<b>No. of Respondents Answers to Total Respondents</b>	<b>Percentage</b>
Yes, but only with one or a few things	10 of 29	34%
Yes	7 of 29	24%
Yes, but only recently	4 of 29	14%
Not sure	3 of 29	10%
Not really	3 of 29	10%
No	2 of 29	7%

### *Involvement*

Respondents were asked if they were involved in the health and safety aspect of the VTH, and if so, how. The answers are shown below in Table 13. Twenty-eight percent (8 of 29) of the interviewees responded that they would feel comfortable expressing concern to at least one person in the Director’s Office. However, this question was not consistently clarified to every interviewee since the definition of “involvement” was interpreted differently and many interviewees did not think of the different levels of involvement. The researcher sorted the answers into the categories as shown in Table 13 (full results in Appendix J), but it was not specifically asked to what degree the interviewee was involved.

Table 13: Respondent Answers to their Involvement in Health and Safety at the VTH.

<b>Involvement Level</b>	<b>No. with Response of Total Interviewees</b>	<b>Percentage</b>
Only with going to director's office with issues	8 of 29	28%
Department Level	7 of 29	24%
Both Levels	6 of 29	21%
No, and <i>would</i> like to be	3 of 29	10%
VTH Level	2 of 29	7%
Would like to, but don't feel people listen	2 of 29	7%
No, and <i>would not</i> like to be	1 of 29	3%



### **Walkthrough Data Analysis**

Each service area was evaluated for the presence or absence of 19 hazards identified in the safety and health walkthrough checklist. The number of hazards that were found in each service area is presented in Table 14 in order of the least to the most hazards present. The hazards themselves did not necessarily mean there was more risk; it just meant that there were relatively more or less hazards present in the service area. The number of hazards present ranged from 10 in the Reception/Call Center/Business Office/Medical Records Service Area (RCBM) to 19 in the Large Animal Surgery (LAS) Service Area. The complete results of the health and safety walkthroughs presented in the PHA can be found in Appendix C.

Table 14: The Number of Hazards Found per Service Area out of a Possible 19.

<b>Service Area</b>		<b>No. of Hazards (of 19)</b>
1	Reception/ Call Center/Business Office/ Medical Records	10
2	Clinical Pathology	11
3	Critical/Urgent Care	12
4	Pharmacy	13
5	Dermatology	13
6	Neurology	13
7	Small animal medicine	13
8	Small animal surgery	13
9	Exotics (Zoo Med.)	13
10	Dentistry	13
11	Custodial/Animal Care	14
12	Oncology	14
13	Central Supply	15
14	Equine	15
15	Custodial/Barn Animal Care	16
16	Anesthesia	16
17	Ophthalmology	16
18	Livestock	16
19	Maintenance	18
20	Large Animal Surgery	19

The percentages of noteworthy practices (i.e., spill response, hazard communication, equipment inspection, emergency preparedness, etc.) present in each service area are presented in Table 15 in descending order. The percentages are relative to their own service area, and there were 28 possible noteworthy practices that could be present in each service area. However, some areas had less noteworthy practices due to the fact that some were not applicable. For example, machine guarding and fall protection were not applicable practices for many areas and therefore were not taken into account. It is important to note that the percentages are displayed as the presence or non-presence of noteworthy practices and do not indicate how well each practice was carried out. Dermatology had the least amount of noteworthy practices present (52%), and Critical/Urgent Care and Clinical Pathology both had the most present (72%).

Table 15: The Percentage of Noteworthy Practices Present per Service Area.

Service Area		Noteworthy Practices
1	Critical/Urgent Care	72%
2	Clinical Pathology	72%
3	Livestock	70%
4	Large Animal Surgery	70%
5	Oncology	69%
6	Anesthesia	68%
7	Ophthalmology	68%
8	Equine	68%
9	Dentistry	68%
10	Maintenance	68%
11	Central Supply	67%
12	Neurology	67%
13	Small animal surgery	67%
14	Custodial/Animal Care	65%
15	Reception/ Call Center/ Business Office/ Medical Records	63%
16	Custodial/Barn Animal Care	62%
17	Small animal medicine	60%
18	Exotics (Zoo Med.)	58%
19	Pharmacy	56%
20	Dermatology	52%

Through a series of calculations (details found in methodology and the grey area of Appendix C), the average quality of noteworthy practices was determined (i.e., how well a noteworthy practice was being followed or performed). They are presented in descending order in Table 16 below. All of the service areas had some noteworthy practices present to address the identified hazards, but no service area was rated as ‘good’ for the implementation of

noteworthy practices. Twelve of 20 (60%) service areas were rated as *okay* for implementation of noteworthy practices and eight of 20 (40%) service areas were rated *minimal* for implementation of noteworthy practices.

Table 16: Average Quality of Noteworthy Practices per Service Area.

<b>Service Areas</b>	<b>Average Quality of Noteworthy Practices</b>
Reception/ Call Center/ Business Office/ Medical Records	Okay
Small animal surgery	Okay
Small animal medicine	Okay
Oncology	Okay
Neurology	Okay
Livestock	Okay
Equine	Okay
Dermatology	Okay
Dentistry	Okay
Custodial/Animal Care	Okay
Critical/Urgent Care	Okay
Clinical Pathology	Okay
Pharmacy	Minimal
Ophthalmology	Minimal
Maintenance	Minimal
Large Animal Surgery	Minimal
Exotics (Zoo Med.)	Minimal
Custodial/Barn Animal Care	Minimal
Central Supply	Minimal
Anesthesia	Minimal

### Health and Safety Hazards Present in all Service Areas:

Many hazards on the walkthrough checklist were found to be present in all or nearly all service areas. The VTH should address these hazards on a hospital-wide level as opposed to within each service area. For example, a hospital wide policy should be written as opposed to a service area specific policy. Similarly, training on a certain hazard should be hospital-wide as opposed to specific service areas. In addition, the risk assessment was meant to aid in the prioritization of hazards in service areas. If these elements were not taken out of the risk assessment, it may not have led to significant differences in risk. Therefore, the following hazards were not included in the service area risk assessments: (1) toxic and hazardous substances; (2) ergonomics (specifically lifting and restraining); (3) slip, trips, and falls; (4) electrical; (5) bloodborne pathogens; (6) bloods, fluids, and sharps; (7) zoonotic disease; (8) human to human spread of disease; (9) workplace violence; (10) Violent patients; and (11) workplace stress.

#### *Toxic and Hazardous Substances:*

Every service area had the potential exposure to toxic and hazardous substances. All service areas had cleaning chemicals. Some areas used the chemicals more frequently and with different durations. Some area employees were exposed to Formalin and Chemotherapeutic drugs as well as other potentially hazardous drugs (medicines) that others were not.

#### *Ergonomics:*

Every service area had the potential for ergonomic hazards. Employees from many different service areas stood on hard ground (inside or concrete) for long shifts. RCBM employees spent a lot of time sitting, but it was discovered in the interview that EHS had

completed ergonomic assessments in these areas and loaned items to minimize ergonomic hazards. Maintenance, surgeons, and every worker who handled or lifted heavy objects or patients were at risk of injury (OSHA). Surgeons are often in static or awkward positions for a long duration. This can lead to muscle fatigue and pooling of blood in lower extremities. In addition, standing on hard surfaces can lead to pain in the feet (OSHA).

*Slips/Trips/Falls:*

Every service area had the potential for injury from slips, trips, or falls. Some specific issues that were observed or raised during the interview were as follows:

- Many electrical cords were observed on the floors of Large Animal Surgery.
- Animal Care employees reported that the “non-slip” floors were more slippery when wet.
- Pharmacy had a lot of boxes in walkways.

*Electrical Hazards and Associated Noteworthy Practices:*

Many areas throughout the VTH were lacking sufficient electrical safety which could lead to electrical hazards. Per the 2009 audit (Hellman & Associates, 2009); there was a great quantity of electrical hazards, but not great severity. Electrical safety was a measure of how well the electrical hazards were controlled. Per the health and safety walkthrough checklist electrical items that were evaluated consisted of: electrical equipment free of water, oil, chips, and excessive dust; all box covers in place; labeled disconnects; ground fault circuit interrupters (GFCI)s where needed; grounding plugs for in use extension cords; power strips prohibited of being daisy chained; electrical cords off the floor; no wiring or cords with frayed or deteriorated

insulation; and sufficient access to working space to provide ready and safe operations and maintenance. Some hazards observed at the VTH:

- Electrical devices not approved for wet locations
- Extension cords through holes in walls, ceilings, or floors
- Use of temporary devices for permanent situations
- Damaged or frayed electrical cords
- Blocked or unlabeled disconnects

*Bloodborne Pathogens, Blood, Fluids, & Sharps, Zoonotic, and Human to Human Disease:*

Every service area was at risk for bloodborne pathogens; bloods, fluids, and sharps; zoonotic disease; and the spread of disease from human to human. There was a 300 page biosecurity protocol that was accessible via the VTH employee website, but there was no required training pertaining to it (interview).

*Violent Patient and Workplace (coworker) Violence:*

With the exception of Central Supply, Clinical Pathology, and Dentistry every service area was at risk for violent patients. Reception often delegated the task of placing a collar on the patient to the owner. However, this was not a formal policy and as some employees were not comfortable with doing this, the decision was left to Reception personnel. Although the VTH as a whole was at risk of violent patients, there was a greater risk of adverse affect from large animals.



Workplace violence could not be observed in this study, but it was assumed as a possible hazard for every service area since it is a possible hazard for nearly every occupation (Bureau of Labor Statistics, 2010).

*Workplace Stress:*

This was not addressed during the walkthrough, but workplace stress is commonly found in hospital settings (OSHA). Hospital personnel deal with life-threatening injuries and illnesses while working long shifts and tight schedules. They have a significant amount of paperwork, work with intricate or malfunctioning equipment, stressed patients and owners, as well as teaching students and working with new technology.

Health and Safety Hazards Present Some Service Areas:

*Hand & Portable Power Tools, Confined Space, Powered Trucks & Tractors, Cranes & Hoists, Lasers, Radiation, and Heat Stress:*

These categories all varied in terms of their presence or non presence throughout the VTH service areas. The hazards of greatest concern were the confined spaces in LAS and the lasers used throughout the hospital. The only training an employee had on laser safety was either prior to their hiring at the VTH or verbally from their supervisor. Radiation safety seemed to be the most strictly regulated at the hospital. There were required radiation courses that employees had to attend which were held on CSU's main campus. The details of these courses were not evaluated as they were outside the scope of this project.

*Compressed Gas:*

With the exception of RCBM, Pharmacy, Ophthalmology, Dermatology, Neurology, and Clinical Pathology, the other 15 service areas had compressed gas. Most cylinders seemed in

good condition; however, many were not stored and transported with caps on. In addition, CCU personnel stored one cylinder on its side on a bottom shelf where employees could knock it. The Anesthesia storage room in LAS had cylinders that were upright, but not secured with chains.

*Noise:*

Employees from nearly every service area, with the exception of Small Animal Surgery and Exotics, had complaints regarding noise. Much of these complaints were attributed to current and ongoing construction that was occurring in the VTH.

General Trends of Noteworthy Practices for all Service Areas:

Noteworthy Practices for Chemical Hazards:

*Handling and Storage:*

VTH employees in all of the service areas handled and stored toxic and/or hazardous chemicals in an *okay to good* (rating of 2-3) manner with the exception of the Pharmacy Service Area whose employees handled and stored chemicals in a *minimally* (rating of 1) healthy and safe manner. Every service area had at least one toxic or hazardous chemical present to which VTH employees could be exposed. Most of the chemical substances were cleaning/disinfecting agents. However, this assessment did not include drugs administered to patients (aside from chemotherapeutic drugs). The Pharmacy service area had many cabinets with items on top of each other in a disorderly fashion, which included, in part, glass containers and chemicals. In addition, there were many boxes, of various items including chemicals, stored in the aisles that impeded the means of egress.

### *Spill Kits:*

Per the VTH policy, large spills (“a spill that may contaminate the water supply, sewer, or any other area and is too large to be easily handled by VTH personnel”) or highly hazardous chemical spills were not to be cleaned up by employees. However, it was VTH policy that benchtop spills be cleaned up with absorbent pillows, and if the employee felt comfortable and familiar with the chemical, he/she can use the “proper spill kit and follow directions that are with the spill kit.” However, not all service areas that housed toxic/hazardous chemicals had a chemical spill kit to clean up chemical spills. The spill kits should at least contain goggles, proper gloves, a gown, and some absorbent material (Seibert, 2011). It was noted that only the Oncology, Pharmacy, and Clinical Pathology Service Areas had spill kits for chemotherapeutic chemicals. Per OSHA’s Hazardous Waste Operations and Emergency Response (HAZWOPER) standard 29 CFR 1910.120, all employees working with hazardous substances that are instructed to clean up spills shall be trained and provided with the appropriate resources.

### *Hazard Communication and Chemical hygiene plan:*

Hazard communication was inadequate throughout the VTH. None of the service areas had a chemical hygiene plan, nor had any hazard assessments been conducted to determine what personal protective equipment (PPE) was needed. It was observed that some service areas did have Material Safety Data Sheets (MSDS) binders, although not all hazardous chemicals were included in the binders. Some employees had received informal hazard communication training, but most had not received any formal, documented hazard communication training. Some employees requested better training on chemical safety. Most chemical containers were labeled, but the few that were not were mostly those chemicals that were transferred to countertop dispensers. A chemical hygiene plan, per OSHA, is a written program developed and

implemented by a qualified (by training or experience) individual who sets forth procedures, equipment, PPE and work practices to protect employees from health hazards as well as meets the requirements of 29 CFR 1910.1450(e); Chemical Hygiene Plan.

*Sanitation:*

For the most part, sanitation was ranked as *okay* to *good*. However, a few important issues were observed. Sanitation was ranked by the following elements: leak proof waste receptacles, clearly marked non-potable water outlets, separate facilities for street clothes and PPE if change rooms are required, sanitary toilets, showers, and change rooms, eating/drinking/food storage allowed only in designated areas, and no potential for exposure to hazardous substances in designated food areas (Ellwood, 2003).

- Neither Maintenance nor Animal Care had a designated eating/drinking/food storage area that was free from potential exposure to hazardous substances.
- Pharmacy had beverages stored in a refrigerator with medicine and chemicals, as well as food stored in a refrigerator with equine plasma.
- A bag of open chips was observed in Anesthesia.
- Many sinks throughout the VTH were lacking a non-potable water sign.

Noteworthy Practices for Physical Hazards:

*Equipment Inspection and Lockout/Tagout:*

These two areas were generally deficient throughout the hospital. Equipment inspection was generally inadequate throughout the VTH, and lockout/tagout was not implemented anywhere in the VTH. A lockout/tagout safety program is designed to protect employees from

unexpected startup of machinery and equipment or release of hazardous energy during service or maintenance activities. Equipment specific procedures are generally required when there is a potential for stored or residual energy or the reaccumulation of energy after the equipment is shutdown, there is more than one single energy source associated with the equipment, or the service work creates a hazard for other employees (OSHA 29 CFR 1910.147). Examples of equipment that should have a lockout/tagout procedure are the LAS exam tables and the green and red chutes in Livestock.

*Hearing Conservation Program:*

Based on employee complaints and unknown noise levels, noise monitoring should be conducted. The results of the noise monitoring would identify if a hearing conservation program (29 CFR 1910.95) should be implemented. In the interim, if employees have noise complaints, it would be best practice to provide hearing protection along with a training program. Maintenance, Animal Care, and Barn Care are the only service areas that had hearing protection.

Noteworthy Practices for Explosives, Flammable, and Combustibles:

*Fire Protection and Fire Extinguishers:*

Fire protection was generally deficient throughout the hospital, although not all service areas needed the same level of protection. Fire protection was evaluated by the following criteria: only approved, vented containers and portable tanks used; are flammables and combustibles stored with incompatibles; are proper metal storage cabinets used where applicable; do they exceed the proper amount of flammables and combustibles; and are the cabinets labeled.

Not all service areas had ready access to a portable fire extinguisher nor had VTH employees been trained to use a portable fire extinguisher. Fire extinguishers have to be within a 50 foot reach for class B fires (29 CFR 1910.157(d)(4)). Per the VTH Building Safety Plan, all personnel shall “know how to properly use fire safety equipment.” Furthermore, there was only annual testing, whereas OSHA requires monthly inspections as well (29 CFR 1910.157(e)(2)). Conversely, most of the fire extinguishers were mounted in a well-seen location and not moved from that location.

- Critical Urgent Care (CCU) and Small Animal Surgery had CO<sub>2</sub> fire extinguishers. CO<sub>2</sub> extinguishers are not intended for ordinary combustible material (Type A fires) such as paper, wood, cardboard, and most plastics. They are used only for class B and C fires (OSHA, 2007).
- All other service areas had ABC Dry Chem which can be used on Type A, B, and C fires, but will ruin electrical equipment.
- Some service areas did not have a fire extinguisher in the area and depend on the extinguishers in the hallways (the distances were not measured by the researcher).
- Maintenance had an old, unused fire extinguisher that had not yet been properly disposed.
- The green lines that hung down from the ceiling throughout the hospital were O<sub>2</sub> lines, but were not labeled.
- CCU had a cylinder stored on its side on a bottom shelf where it is sticking out and could be knocked.

- Storage room (H116) in Large Animal Surgery had many compressed gas cylinders. Many cylinders were secured with chains, one was lying on its side, and five small cylinders in a corner were not secured.

Emergency Preparedness:

*Means of Egress and Emergency Action and Fire Prevention Plans:*

Emergency preparedness as a whole for the VTH was *nonexistent* to *okay*. There was a building safety plan that included many different types of emergencies, but the plan was general and lacked important information such as distinguishing alarms, evacuation meeting points (in a fire emergency), a means of accounting for employees, proper training, etc. The plan was not evaluated in detail for that was outside the scope of this project. Furthermore, the policy and procedure were not well known throughout the hospital. The majority of the deficiencies in the means of egress were a lack of signage. Conversely, most service areas had a clear and unobstructed pathway to evacuate the building safely. The Dermatology Service Area did not have exit signs in any of the exam rooms and there was no sign on one of the rounds room doors. In addition to the fire, chemical, and weather emergency plans, there should be emergency preparedness plans written for workplace and client violence.

General Precautions:

*Safety Color Codes & Signs and Tags, and First Aid:*

Safety color codes, signs, and tags, as well as first aid were on the low end (*nonexistent* to *okay*) throughout the different service areas. There were many signs throughout the hospital in various colors; however, the colors had no meaning and no trend. There were black, red, navy blue, light blue, green, yellow, etc. signs. This can be problematic if employees start to associate colors instead of reading the words. Most service areas did not have first aid kits. Most either

had all the items necessary in their service area or would attend to Pharmacy for necessary items. Pharmacy employees stated that they did not have a lot of band aids, ibuprofen, etc. that other areas might need. In addition, there was no burn cream in any service area, including Pharmacy. The service areas that did have first aid kits and were relatively far away from Pharmacy did not have a designated employee to be responsible for the update of the contents and there had not been an assessment to ascertain what the kits should contain. Most service areas had eyewash stations and deluge showers, but not all. Some service areas depended on saline bottles which are only sufficient for a foreign object in the eye and not a chemical splash. In addition, most eyewash/deluge showers had been installed fairly recently (a few months before the walkthrough) and not one employee knew where it came from, who installed it, or most importantly, how to use them. In addition, most of the eyewashes were supplied with non-potable water. Per ANSI, all eyewash stations must be connected to a potable water source (ANSI/ISEA Z358.1-2009).

*Machine Guarding and Walking/Working Surfaces:*

Machine guarding was not an applicable precaution to most service areas, but for those that it was necessary, the guards were in general, lacking. On the other hand, walking and working surfaces were generally adequate for the hospital.

*Personal Protective Equipment and Respiratory Protection:*

Personal protective equipment and respiratory protection were not evaluated (noted as “NE” in the PHA) during this preliminary hazard assessment due to insufficient information. A hazard assessment must first be done to determine if the proper PPE is being used as well as maintained. Along with this should be training on use and limitations of the PPE, which also cannot be completed until a hazard assessment has been conducted specifically for PPE.



### *Controls and Training:*

Controls in general throughout the hospital were *minimal* and *okay* at best. The controls evaluated consisted mainly of good housekeeping, safety and health rules and work practices effectively in place, and feasible engineering controls in position. Preventative maintenance programs were also evaluated. Training is a control that was assessed in a separate category. Training was identified as *minimal* throughout the VTH. A major lack of minimum requirements and orientation training was noted. The training that was in place consisted of either independently reading lengthy pages; or informal, verbal, non-documented training. There was some training such as the radiation training and the forklift training that were not assessed in this assessment due to the scope of the project.

### *Industrial Hygiene Monitoring:*

Industrial hygiene monitoring was inadequate since many service area employees had the potential to be exposed to numerous chemical, physical, and biological hazards. With the exception of CCU and Reception, none of the service areas had any industrial hygiene assessments or monitoring. CCU interviewees reported that noise monitoring was conducted, and in response, many of the metal cages were replaced with plastic cages. No post monitoring assessments were done to verify acceptable noise levels. Reception interviewees conveyed that EHS conducted ergonomic assessments for their service area. No other service area employees stated that their area had industrial hygiene monitoring done. It is important to note that the researcher did not ask every supervisor or service area interviewee if this had been done because some areas did not have workers that were willing to speak with the researcher.

Administration:

*Administration & Supervision, Planning & Evaluation, Project Review, Standard Operating Procedures, and Reporting & Recording:*

These were the most deficient areas of the PHA matrix that were almost ubiquitous throughout the VTH. There was no formal health and safety administration and supervision, planning and evaluation, or project review. The SOP ratings were based on observations made during the walkthrough combined with answers from supervisor's post-walkthrough and interview data. Therefore, even though there were hospital-wide SOPs such as the Sharp's Policy, if there was no mention and no observance of an SOP, it was possible for a service area to score a 0 (none). The service areas scored *none* to *okay* for presence and knowledge of SOPs as well as reporting and recording.

*Management Leadership and Employee Participation:*

Management leadership and employee participation with respect to health and safety was for the most part nonexistent. Many employees (including supervisors) interviewed had a great attitude, but health and safety was not most employee's priority. Of the service areas, CCU, Maintenance, Animal Care, and Clinical Pathology seemed to exert the most leadership and involvement via attitude, involvement on committees, certifications, and daily addressing of health and safety issues. Management leadership and employee participation were assessed primarily through the interviews. These were fairly biased scores since they were decided based on zero to two representatives. If no supervisors responded to the opportunity to be interviewed, it was automatically recorded as a zero for management leadership.

## **Service Area Risk Assessments**

These risk assessments were based on the severity of an incident and the probability of that incident occurring. Using these two parameters, the risk was determined by using the risk assessment matrix (Figure 2). Some service areas were designated as a range of risk due to the multiple events and hazards that were taken into consideration. Please note that the risk assessments specific to service areas were not based on all hazards present in the service area because many were addressed as a whole for the VTH. The items listed below were identified hazards specific to a service area. However, if a VTH-wide hazard posed a greater risk for a specific service area, then it was addressed in accordance to a specific service area for the risk assessment. A summary of the risk assessment is presented in Table 17.

Probability of OCCURRENCE or EXPOSURE for selected unit of time or activity	<b>CATASTROPHIC</b> Death or permanent total disability	<b>CRITICAL</b> Disability in excess of 3 months	<b>MARGINAL</b> Minor injury, lost workday incident	<b>NEGLIGIBLE</b> First Aid or Minor Medical Treatment
<b>Frequent</b> Likely to occur repeatedly	<b>SERIOUS</b> Immediate action should be taken	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time
<b>Probable</b> Likely to occur several times	<b>SERIOUS</b> Immediate action should be taken	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time
<b>Occasional</b> Likely to occur sometime	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary
<b>Seldom</b> Not likely to occur	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary
<b>Improbable</b> Very unlikely- may assume exposure will not happen	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary	<b>LOW</b> Risk acceptable: remedial action discretionary	<b>LOW</b> Risk acceptable: remedial action discretionary

Figure 2: Risk Assessment Matrix

Table 17: Summary of Risk for Each Service Area\*.

Service Areas	Hazard	Severity	Probability	Risk
<b>Administrative:</b>				
Reception/ Call Center/Business Office/ Medical Records	Angry Client	Cr	Se	M
	Fire	Cr	Se	M
	Filing Cabinets	Cr	Im	L
	Papercuts	Ne	Pr	M
Maintenance	Welding	Ma-Ca	Oc	M-S
	Moving Hay	Ma-Ca	Oc	M-S
Custodial/Animal Care	Cleaning Chem.	Ma, Ca	Oc, Se	M-H
	LAS Pits	Ca	Oc	S
	Sharps(puncture)	Ne	Fr	M
	Sharps(zoonotic)	Ca	Se	H
	Wet Floors	Ma	Oc	M
Custodial/Barn Animal Care	Fogging	Cr	Se	M
	Tools	Cr	Oc	H
	Large Animals	Cr	Oc	H
<b>General Hospital Services</b>				
Pharmacy	Chemo. Drugs	Ca	Se	H
	Acids	Cr	Se	M
Central Supply	Sharps(puncture)	Ne	Fr	M
	Sharps(zoonotic)	Ca	Se	H
	Autoclave	Cr	Oc	H
<b>Clinical Services</b>				
Anesthesia	Radiation	Cr	Se	M

	Anesth. Gas	Ca	Oc	S
Critical/Urgent Care	Patients	Ca	Oc	S
	Chemo. Drugs	Ca	Se	H
	Compressed Gas	Cr	Oc	H
Ophthalmology	Formalin	Ca	Se	H
	Laser	Ca	Se	H
	Zoonotic	Cr	Se	M
Dermatology	Laser	Ca	Im	M
	Allergen	Cr	Oc	H
Neurology	Chemo. Drugs	Ca	Se	H
	Rabies	Ca	Im	M
Livestock	Chutes	Ca	Oc	S
	Acid/Base Drums	Ca	Oc	S
Equine	Chemo. Drugs	Ca	Se	H
Small Animal Medicine	Zoonotic	Ca	Oc	S
Small Animal Surgery	Anesth. Gas	Ca	Oc	S
	Radiation	Cr	Se	M
	Formalin	Ca	Oc	S
	Tools	Cr	Se	M
Oncology	Chemo. Drugs	Ca	Se	H
Exotics (Zoo Med.)	Violent Patient	Ca	Se	H
	Laser	Ca	Se-Pr	H-S
Clinical Pathology	Zoonotic	Ca	Se	H
Dentistry	Zoonotic	Ca	Oc	S
Large Animal Surgery	Lasers	Ca	Oc	S
	LAS Pits	Ca	Oc	S
	Radiation	Cr	Se	M
	Anesth. Gas	Ca	Oc	S

\*Ne=Negligible; Ma=Marginal; Cr=Critical; Ca=Catastrophic; Fr=Frequent; Pr=Probable; Oc=Occasional; Se=Seldom; Im=Improbable; L=Low; M=Medium; H=High; and S=Serious.

*Reception/ Call Center/Business Office/ Medical Records (RCBM):*

The RCBM Service Areas were all addressed as one service area in the PHA. There were a total of 10 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for these service areas were *low* to *medium*, which was based on the following possible incidents and their analysis:

- Angry clients were a threat in this service area, but the probability of encountering an angry client was *seldom*. However, if an angry client was realized, the severity of the encounter could be *catastrophic* in the worst case scenario of gunfire. The severity of encountering an angry client was reduced to *critical* since the VTH staff could alert the police via a silent alarm button at Small Animal Reception and the Business Office.
- Medical Records employees stored all of their files as hardcopies and there was no fire extinguisher in the room. The probability of a fire was *seldom*, but if incurred could be *critical*.
- The moving filing cabinets in Medical Records could potentially crush a worker which could be *critical*. However, there was a protocol in place, emergency stop pedal, and a mechanical stop response to pressure (human or object in aisle) if the emergency stop pedal should fail to work which reduces the probability to *improbable*.
- The most common hazard noted in this service area per the interviews was paper cuts. The probability of suffering a paper cut in these service areas is *probable* with a severity rating of *negligible*.

*Maintenance:*

There were a total of 18 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to serious*, which was based on the following possible incidents and their analysis:

- Welding was mentioned as a hazard in the interview, but only for potential skin burns and catching clothes on fire. They had two smoke eaters and an exhaust fan in the ceiling above the welding area (Jim Flowers). OSHA typically requires local exhaust ventilation (LEV) and an approved respirator along with appropriate PPE and face shield (29 CFR 1926.353). The VTH did not require the use of respirators (interview). The consequences of welding depend on many factors such as type of metal fumes emitted from the welding, length of time welding is performed, concentration of the metals, and controls used. Even from acute exposures, health effects range from lung irritation and pulmonary edema to cancer and death (*marginal to catastrophic*). Welding tasks depended on what needed to be fixed and on current projects. It was reported to the researcher that maintenance employees may weld once a month or every day for a week. For this risk assessment, the probability was noted as *occasional*.
- Hay was moved every day, as the animal feed was replenished daily. The probability of an incident was *occasional* based on the activity of leaning tall ladders against unstable hay to climb up and lift and move 80-100lb hay bales. If an incident were to occur the severity would range from *marginal to catastrophic* because of the potential consequence of death or permanent disability although it was more probable the consequence would be a permanent, partial, or temporary disability.



*Custodial/Animal Care:*

There were a total of 14 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *medium* to *serious*, which was based on the following possible incidents and their analysis:

- Although cleaning chemicals were addressed as a whole for the VTH, the concern in this area was greater than others because the primary task was cleaning everything in the VTH apart from the barn area (which was taken care of by the Barn Care Service Area). Therefore, the chemicals were used for a much longer duration and at a higher concentration. The chemicals used in this service area may cause acute effects from dermatitis to death (OSHA). The likelihood of a *marginal* consequence was *occasional*, and the likelihood of a *catastrophic* consequence was *seldom*.
- Large Animal Surgery (LAS) pits in the VTH were confined spaces because they were large enough for a person to enter and carry out work, they had limited egress, and they were not designed for long periods of occupancy (OSHA). The LAS pits under the exam tables could be permit required confined spaces because the hydraulic tables could fall and trap an employee (OSHA). All the tables were different and some had been altered by the VTH, therefore a separate assessment of each table should be done to identify fail mechanisms and controls. The consequences could be *catastrophic* and the probability of this incident is *occasional*.
- Sharps were named the top risk in the interviews for this service area. Although there had been a newly updated sharps policy and some improvements were seen, occurrences still happen on a *frequent* basis. Usually, employees experience a *negligible* consequence.

- If a disease is contracted from a sharp, it could be catastrophic (Canadian Centre For Occupational Health and Safety, 2005). It was difficult to estimate what the risk would be in the VTH for transmission of zoonotic disease and the severity of that disease. Employees seemed to be unaware of the significance of zoonotic diseases, which increased the probability of contracting a zoonotic disease. One study indicated that two thirds of sharps were contaminated (Leggat, Smith, & Speare, 2009). In addition zoonotic diseases can be transferred through a series of other mediums aside from sharps, such as blood and other fluids (Weese & Faires, 2009). Weese and Faires conducted a study of 226 veterinary technicians and found that only 3.5% needed medical attention. Therefore, the risk assessment is concluded to be *seldom* chance of a *catastrophic* event.
- An employee mentioned that the “non-slip” floors were more slippery than normal floors when wet. This would most likely lead to a slip or fall which could result in a *marginal* consequence with a probability of *occasional* occurrence.

*Custodial/Barn:*

There were a total of 16 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to high*, which was based on the following possible incidents and their analysis:

- Fogging of the barn stalls occurred *seldom*, there was a protocol, and PPE. Furthermore the protocol was currently being assessed and updated. However, there was a complaint of a sore throat post-fogging even with the current PPE. Therefore, the severity could be *critical*.

- The tools that were used could potentially be *critical*. A worker was observed cutting a piece of metal with a hack saw on his knee. The catastrophic consequence has an *occasional* probability of occurrence.
- Although violent patients were addressed as a whole for the VTH, the employees in this service area were exposed to large animals with less training than those currently in or have graduated from a veterinary program. Therefore, the consequence of a *critical* event occurring was *occasional*.

*Pharmacy:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to high*, which was based on the following possible incidents and their analysis:

- Chemotherapeutic and other hazardous medicines had many controls associated with them. There was formal and documented training on the chemotherapeutic drugs, but this was not evaluated by the researcher. The area also had PPE and engineering controls for chemo in addition to SOPs and MSDSs. However, there was still a lot of transporting and could easily drop and break, leading to exposure. Chemotherapeutic drug exposure can be life threatening (MacDondald, 2009), therefore it was *catastrophic*. Work with chemo drugs was frequent, but likelihood of a catastrophic incident considering the current controls was *seldom*.
- Acids could be *critical* in consequence depending on the acid and the concentration as well as the controls associated with it. Work with acids was frequent, but the likelihood of a critical incident was *seldom*.

*Central Supply:*

There were a total of 15 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to high*, which was based on the following possible incidents and their analysis:

- As with the Animal Care Service Area, the probability of a puncture from a sharp is *frequent* while the severity was *negligible*. Similarly, the probability of contracting a *catastrophic* zoonotic disease from a sharp was *seldom* likely to occur.
- Although personnel did not enter the autoclave, it is a confined space because it is large enough for a person to enter and carry out work, has limited egress, and is not designed for long periods of occupancy (OSHA). The autoclave could be a permit required confined space because it could entrap or asphyxiate an employee who enters (OSHA). The bigger issue with the autoclave was the steam which was released several times per day. The steam could burn an employee which could be *critical*. The supervisor was very strict on training employees to back away as they open the autoclave to avoid a burn. With the training, the probability of a *critical* occurrence was *occasional*.

*Anesthesia:*

There were a total of 16 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to serious*, which was based on the following possible incidents and their analysis:

- Radiation was pretty well controlled with training and badges, although training was not cross checked by researcher, the 2009 audit by Hellman & Associates stated that the VTH was in compliance with the Colorado Department of Public and the Environment

(CDPHE). Therefore, a *catastrophic* incident was *improbable*. Similarly, a *critical* incident was *seldom* likely to occur.

- Waste anesthetic gases (especially doses for horses) (CDC; NIOSH, 2007) could lead to unconsciousness, nausea, dizziness, headaches, fatigue, irritability, drowsiness, coordination and judgment problems, sterility, miscarriages, birth defects, cancer, and liver and kidney disease, and was therefore *catastrophic*. (OSHA). Since no controls were observed or mentioned during the interview, it was assumed the likelihood of a *catastrophic* incident was *occasional*.

#### *Critical/Urgent Care (CCU):*

There were a total of 12 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *high to serious*, which was based on the following possible incidents and their analysis:

- The CCU Service Area employees were the first to see a patient and attempt diagnosis. In addition, since they were the first to assess a patient, they were the first to encounter the aggressiveness of the patient. This could result in higher probability of a violent patient hazard and zoonotic disease transmission. CCU employees did not wear precautionary PPE to prevent airborne transmission of a disease. In addition, there was no requirement for vaccinations; these were only used in a reactive situation. Therefore, the severity could be *catastrophic* and the probability was *occasional*.
- As with the Pharmacy Service Area, CCU employees also worked with chemotherapeutic drugs. Similarly, it could be *catastrophic*. Work with chemotherapeutic drugs was frequent, but likelihood of a *catastrophic* incident considering the current controls was *seldom*.

- It was observed during the walkthrough that CCU had a compressed gas cylinder stored laying down, on a bottom shelf and sticking out so workers could trip on it. Compressed gas cylinders should be stored upright and chained up at all times (29 CFR 1910.101) (OSHA). If this were to be knocked, it could lead to an explosion, fire, or toxic release which could be *critical*. The likelihood of this occurring is *occasional*.

*Ophthalmology:*

There were a total of 16 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to high*, which was based on the following possible incidents and their analysis:

- Formalin was occasionally used in this service area. Acute affects of formalin in the liquid or vapor form include eye and respiratory irritation. Ingesting formalin in large amounts could lead to severe abdominal pains, nausea, vomiting and possible loss of consciousness. Furthermore, formalin (formaldehyde) is a suspected carcinogen. These consequences could be *catastrophic*; however the probability of occurrence was *seldom*. (29 CFR 1910.1048(c)(1) and 29 CFR 1910.1048 App A).
- There was a Diode laser under lock and key, only used by supervisors, with safety glasses, however this could still lead to *catastrophic* consequences, but the likelihood was *seldom*. Please note that an assessment of the current PPE that was used in conjunction with the laser was not assessed as it should be with the rest of the VTH PPE hazard assessment.
- Although all service areas are at risk of zoonotic diseases, ophthalmology employees spent a lot of time with their faces very close to patients. This could lead to higher risk

of biting and possible transfer of disease. The consequences could be *critical* and the likelihood would be *seldom*.

*Dermatology:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *medium* to *high*, which was based on the following possible incidents and their analysis:

- Dermatology employees used the small laser from Exotics rarely and with safety glasses. The 2009 audit classified the Exotics laser as a 3b or 4 leading to a high priority where immediate action should be taken to address the hazard. Therefore, the severity could be *catastrophic*, but with the infrequency of use, an *improbable* catastrophe.
- Dermatology employees were frequently exposed to allergens which could lead to “sensitization and exacerbation of allergic diseases” (Samadi, Heederik, Krop, Jamshidifard, Willemse, & Wouters, 2010). This could *occasionally* lead to *critical* consequences.

*Neurology:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *medium* to *high*, which was based on the following possible incidents and their analysis:

- As with the Pharmacy and CCU, Neurology employees also worked with chemotherapeutic drugs. Similarly, it could be *catastrophic*. Work with chemotherapeutic drugs was frequent, but likelihood of a *catastrophic* incident considering the current controls was *seldom*.

- Rabies could lead to death which would be *catastrophic*, but the likelihood is *improbable* because one can be treated rather quickly (Centers for Disease Control and Prevention, 2010).

*Livestock:*

There were a total of 16 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *serious*, which was based on the following possible incidents and their analysis:

- The hydraulic chutes in this area were insufficient in both machine guards and lockout/tagout procedures. These deficiencies could lead to *catastrophic* consequences. The chutes were used frequently, but there was oral training as well as procedural and warning signs on the chutes as well which would lead to an *occasional* likelihood of occurrence.
- There were large drums of acid and alkaline chemicals to clean the milk machine. They were both stored on the same plastic tray in the milk room. The liquid acid cleaner and liquid caustic chlorinated cleaner were corrosive. Furthermore, the MSDS stated that the liquids were incompatible with each other. The consequences could be *catastrophic*. The likelihood of the catastrophe was *occasional*.

*Equine:*

There were a total of 15 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *high*, which was based on the following possible incidents and their analysis:



- As with the Pharmacy, CCU, and Neurology, Equine employees also worked with chemotherapeutic drugs. Similarly, it could be *catastrophic*. Work with chemotherapeutic drugs was frequent, but likelihood of a *catastrophic* incident considering the current controls was *seldom*.

*Small Animal Medicine:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *serious*, which was based on the following possible incidents and their analysis:

- There was a higher risk of zoonotic disease in this area because the employees' primary task was to take fluid samples. It was observed that samples had been taken without the use of gloves. Zoonotic diseases can lead to death so the consequences are therefore *catastrophic*. Although there was frequent exposure to blood and other fluids, the researcher considered the possibility of a transfer of zoonotic disease that would lead to *catastrophic* consequences, and therefore the likelihood is *occasional*.

*Small Animal Surgery (SAS):*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *medium to serious*, which was based on the following possible incidents and their analysis:

- As with Anesthesia, SAS employees could have been exposed to waste anesthetic gases frequently which can lead to unconsciousness, nausea, dizziness, headaches, fatigue, irritability, drowsiness, coordination and judgment problems, sterility, miscarriages, birth defects, cancer, and liver and kidney disease, and is therefore *catastrophic* (OSHA). The likelihood of a *catastrophic* incident was *occasional*.

- As with Anesthesia, radiation was pretty well controlled with training and badges, although training was not cross checked by researcher, the 2009 audit by Hellman & Associates stated that the VTH was in compliance with the Colorado Department of Public and the Environment (CDPHE). Therefore, a *catastrophic* incident was *improbable*. Similarly, a *critical* incident is *seldom* likely to occur.
- Formalin was frequently used in this service area. Acute effects of formalin in the liquid or vapor form include eye and respiratory irritation. Ingesting formalin in large amounts could lead to severe abdominal pains, nausea, vomiting and possible loss of consciousness. Furthermore, formaldehyde was a suspected carcinogen. These consequences were *catastrophic*, while the likelihood of an incident was *occasional* due to the frequency of use (29 CFR 1910.1048(c)(1) and 29 CFR 1910.1048 App A).
- Hand/portable power tools can lead to *critical* consequences from vibration or direct contact leading to lacerations, etc. The likelihood of this effect was *seldom*.

*Oncology:*

There were a total of 14 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *high*, which was based on the following possible incidents and their analysis:

- As with the Pharmacy, CCU, Neurology, and Equine chemotherapeutic drug exposure could be *catastrophic*, but there was oral training and the use of the Phaseal® engineering control which makes the probability *seldom*. Please note the researcher did not ask each service area employee if the Phaseal® control was used as this was not a known control per the beginning of the study, however, this was the only service area to mention such a control aside from the training.

*Exotics (Zoo Med):*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *high to serious*, which was based on the following possible incidents and their analysis:

- Animal violence in this area was much different because the employees treated a variety of exotic animals that the workers may not have been as familiar with as far as handling and/or transfer of diseases. This could lead to a *seldom* occurrence of a *catastrophic* incident.
- The laser used in Exotics was assessed in the 2009 audit which classified the laser as a 3b or 4 leading to a high priority where immediate action should be taken to address the hazard. Therefore, the severity could be *catastrophic*. The frequency of laser use was not determined. Therefore, the likelihood of occurrence is most likely *seldom* to *probable*. Please note an employee reported the use of PPE in conjunction with the laser; the PPE should be assessed during a hazard/task specific evaluation for more accurate risk determination.

*Clinical Pathology:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *high*, which was based on the following possible incidents and their analysis:

- Clinical Pathology employees were exposed to a greater amount of zoonotic diseases since they primarily analyze fluid samples. They recently started wearing gloves, but there was still a *seldom* chance of a *catastrophic* effect.

*Dentistry:*

There were a total of 13 hazards present out of a possible 19, and the quality of noteworthy practices was *okay*. The risk rating for this service area was *serious*, which was based on the following possible incidents and their analysis:

- Dentistry employees had a higher risk of contracting a zoonotic disease due to the inhalable aerosolized bacteria. In addition, the ventilation was questionable, and no respirators were used. There was an *occasional* chance of a *catastrophic* consequence.

*Large Animal Surgery:*

There were a total of 19 hazards present out of a possible 19, and the quality of noteworthy practices was *minimal*. The risk rating for this service area was *medium to serious*, which was based on the following possible incidents and their analysis:

- Employees in this service area used lasers during surgery. Exposure to high concentrations of smoke may cause ocular and upper respiratory tract irritation and create visual problems. Smoke may contain toxic gases that could have the potential for adverse health effects, including mutagenic and carcinogenic impacts. Most lasers used in surgery were Class 4 as they were designed to deliver laser radiation for the purpose of altering biological tissue. These can cause serious eye injuries, skin burns, and respiratory hazards when breathing. These are *catastrophic* injuries that have a likelihood of *occasional* occurrence (OSHA).
- Personnel occasionally went into the pits under the exam tables after surgeries to collect dropped equipment. There was a possibility for the hydraulics to fail. All the tables were different and some have been altered by the VTH, therefore a separate

assessment of each table should be done to identify fail mechanisms and controls. There was an *occasional* chance of a *catastrophic* incident.

- As with Anesthesia and Small Animal Surgery, radiation was pretty well controlled with training and badges, although training was not cross checked by researcher, the 2009 audit by Hellman & Associates stated that the VTH was in compliance with the Colorado Department of Public and the Environment (CDPHE). Therefore, a *catastrophic* incident is *improbable*. Similarly, a *critical* incident was *seldom* likely to occur.

### **Prioritization**

The prioritization was based on the service area risk assessments (Table 17). Based on the risks found, a priority rating scale was created (Table 18) and applied to the service area specific risks (Table 19).

**Table 18:** Priority Ratings and their Respective Definitions

<b>Priority Rating</b>	<b>Meaning</b>
1	Three Serious Risks
2	Two Serious Risks
3	One Serious Risks
4	A Range With a Serious Risk
5	Two High Risks
6	One High Risk
7	Medium Risks

Table 9: Prioritization of Service Areas.

Service Areas	Priority
Large Animal Surgery	1
Small Animal Surgery	2
Livestock	2
Custodial/Animal Care	3
Anesthesia	3
Critical/Urgent Care	3
Small Animal Medicine	3
Dentistry	3
Maintenance	4
Exotics (Zoo Med.)	4
Custodial/Barn Animal Care	5
Central Supply	5
Ophthalmology	5
Pharmacy	6
Dermatology	6
Neurology	6
Equine	6
Oncology	6
Clinical Pathology	6
Reception/ Call Center/Business Office/ Medical Records	7

It is important to note that many of the *serious* risks that were found in specific service areas were hazards for other service areas as well, and therefore could be addressed as a whole as opposed to concentrating on one service area at a time. Anesthetic waste gas was a *serious* risk for Large Animal Surgery, Small Animal Surgery, and Anesthesia, however other areas use or have the potential to be exposed to this hazard. Toxic and hazardous substances (chemical hazards) were a hospital wide health and safety concern as well. The formalin used in Small Animal Surgery and the acid and base drums in Livestock were found to be *serious* chemical risks. Similarly, the spread of zoonotic disease and possibility of violent patients were both

hospital wide concerns. However, zoonotic disease was found to be a *serious* risk in Small Animal Medicine and Dentistry, and violent patients were a *serious* risk for Critical/Urgent Care employees. Last, lasers in LAS and Exotics were both *serious* risks, but lasers were also reported to be used in Anesthesia, Ophthalmology, Dermatology, and Clinical Pathology Service Areas.

*Serious* risks found that were specific to only one or two service areas included the LAS pits under the exam tables (confined spaces) and the hydraulic equipment in Livestock. The Maintenance Service Area was the only area with employees who weld and move hay. Both of these activities were found to have a risk range of *medium* to *serious*.

## **Limitations and Future Research**

### Preliminary Hazard Assessment

Since this was an initial review that included a preliminary hazard assessment, there were elements that were outside the scope of this project that are important to note in the creation and implementation of an OHSMS. Since the PHA was conducted per service area, hallways and some rooms and offices were not evaluated by the researcher. In addition, the researcher did not create a chemical inventory and did not note medicines. Since the PHA was organized by service area, one overall risk rating per service area was presented in the results which served as a baseline assessment that allowed for prioritization per service area and not per specific task or hazard. However, the overall risk rating was based on specific tasks and/or conditions for which the severity and probability of an incident can be reviewed and addressed by VTH management.

### Sampling Period

There were also limitations to the sampling data that were collected during the walkthrough. The data were collected between August and November 2010. Seasonal changes

can impact hazards and should be taken into account when doing a walkthrough to note items such as decreased personal hygiene (an employee commented that the water in the barn took too long to warm in the Winter leading to decreased hand washing). Other issues that could arise in colder seasons are increased slips on ice, cold stress if working outdoors, increased concentrations of exhaust gases if fuel-powered equipment is used in enclosed spaces (e.g. barn), and noise due to more doors and windows being closed. Another limitation was that only day shift workers were interviewed. There could be differences between the shifts (especially security issues) that should be taken into account for the rest of the planning phase.

#### Walkthrough and Interview Data

Limitations to the walkthrough checklist and the interview questionnaire consisted of not all supervisors answering questions post walkthrough, interviewee selection method, and different interpretations of open-ended questions. Supervisors were asked to meet post-walkthrough to answer questions that could not be observed or answered by the researcher. However, not all supervisors were willing or able to do this.

Employee selection for the interviews was completed by walking around and randomly asking groups of employees if they would like to volunteer for an interview, however, this could have been more randomized. For example, the number of employees could have been determined, assigned a number, and selected, and written via email and so on until one responded yes. However, this was not the method due to time constraints. Also, there was not a large sample population for the interviews.

The interviews varied greatly in respondent interpretation and should have been administered in a more consistent fashion. A script could have been written of what to say if respondents needed clarification or probing, and noted when and if clarification and probing



was used. Despite the limitations and disadvantages of using open ended questions, the researcher found the data to be very useful in ways that closed ended questions could not have. The open ended questions allowed for the respondents to reply from their perspective and according to their preference.

## CHAPTER 6 – RECOMMENDATIONS AND CONCLUSIONS

### **Recommendations**

Recommendations to address reported and observed health and safety issues for VTH-wide issues as well as each service area are discussed below with specific examples. In general, controls should follow the 'hierarchy of controls' which includes elimination, substitution, engineering, administrative, and lastly personal protective equipment (CDC, 2010).

Many of the hazards were ubiquitous, or found in at least several service areas throughout the hospital. To minimize redundancy, only service-area specific hazards were noted per service area and all others were addressed hospital-wide.

#### General Recommendations:

Anesthesia, Animal Care, and Maintenance Service Area employees were not only exposed to hazards within their specific service areas, but to every service area in which they worked. Therefore, these employees need to be taken into account when determining service area specific training plans.

- Training was one of the most substantial deficiencies throughout the VTH. The development of a comprehensive training program and the implementation of such a program should be first and foremost for all VTH employees at some level. This research identified specific health and safety issues for each service area and therefore should assist in the identification of training needs.

- Hazard Communication Training: Numerous workers requested more thorough and formal training on chemical products including, but not limited to, Virkon® and chemical cleaners.
- Sharps Training: For enhanced training and education on sharps hazards, the researcher recommends video training depicting animal care and central supply and realistic situations they encounter on a daily basis.
- Emergency Equipment Training: It seemed to the researcher that there were many eyewashes installed throughout the VTH in recent months, yet not one person the researcher asked knew how to operate them.
- Emergency Response Training: The VTH Building Safety Plan required workers to clean up benchtop spills and be able to use all safety equipment. However, not all service areas had spill kits and fire extinguisher training was not offered.
- Safety Culture Training: This training should include how employee attitude can impact the safety culture of an organization. The researcher noted that there was a range of safety attitudes (positive and negative) observed during the walkthrough, and many very positive attitudes during the interviews. Many of the supervisors were eager to enact more formal and strict health and safety policies. A challenge with this organization was that it was not only a Veterinary Hospital, but it is a teaching hospital with many new technologies as well as inexperienced and learning minds. The researcher noted that there were incidents of clashes between the students and the other employees. Some interviewees stated that students believed that the hospital staff was their cleanup crew. An employee heard one student state that she/he felt like “free

labor” for the hospital. Conversely, some full-time employees felt that the students did not care as much about cleaning up after themselves because they were not employed by the VTH or worried about losing a job, per se.

- Ergonomics: All employees should be trained on ergonomic hazards and how they specifically relate to their job tasks.
- Forklift training: Forklift training was done on site at the VTH. This training was not assessed since it was outside the scope of this study. However, the OSHA standard for heavy machinery reference could be used as a reference (1910.178 powered industrial trucks (forklifts) training should address 1910.178(l)(3)).
- Communication: Better communication should be used to convey the injury and illness recordkeeping procedures in the VTH because it was apparent through the interviews that everyone seemed to know of the website, but no consistent answer was received in regards to the procedure.
- Incident Database: Near misses should be added to the injury and illness database so that future incidents can be avoided.
- Incident Analysis: Injury/illness/near miss trend analysis should be conducted and used to prioritize ongoing issues. Trend analysis could greatly assist VTH management in controlling hazards and avoiding future injuries and illnesses. The 2009 audit (Hellman & Associates, 2009) recommended obtaining data reports from EHS to conduct the trend analysis.
- Employee Involvement: Employees should be encouraged to participate in health and safety. There were many different levels of involvement. Involvement (participation) can

span from employee participation on committees, input on pivotal VTH decisions, health and safety meetings, and solicitation of employee emails for health and safety suggestions. It was very positive that so many of the interviewed subjects were comfortable in approaching the Director's Office with health and safety concerns because this too is a level of involvement. Many interviewees stated that personnel would like more emails asking for input on health and safety issues or invitations to pertinent safety meetings.

- Signs and Tags: A color scheme should be implemented for safety color codes, signs, and tags. No color scheme was identified for safety color codes, signs, or tags. Color schemes become entrenched in the subconscious (e.g., green means "go" and red means "stop") and are a more universal form of communication. The researcher recommends that the VTH management comply with ANSI Z535.1 – 2006, the American National Standard for Safety Colors. The safety colors are the same for the Department of Transportation (DOT) and the National Highway Traffic Safety Administration (NHTSA). This standard has also been used in Canada. Colors should be kept to a minimum to prevent confusion and visual fatigue. Signs with symbols are understood better in the case of color blind employees (red-green confusion) (Industrial Accident Prevention Association, 2007).
- Toxic and hazardous substances: VTH management should create a chemical hygiene plan that includes a hazard communication program. The reasons for this are as follows: (1) VTH personnel had the potential to work with very harmful chemicals; (2) They were not aware of some aspects of the chemicals in which they should be (i.e., MSDSs, proper PPE, potential effects, etc.); and (3) Many personnel voiced concern and requested

further education (training) (e.g., Virkon<sup>®</sup>, triple-clean procedure, A-456-N dermatitis and respiratory issues). Cleaning and disinfectant chemicals should be evaluated by a knowledgeable person (i.e., health and safety expert, consultant, etc.). The evaluation should consist of an attempt to eliminate all possible unnecessary chemicals or uses of them (frequency), and possibilities to substitute chemicals which are equally effective and less toxic. A-456-N was recently replaced because it was discontinued, but the only tests that were conducted were related to effectiveness and not toxicity. The outcome was an equally toxic alternative instead of a less toxic one. Other specific concerns were as follows:

- CCU employees stated they were the only employees that still had to triple clean, which was accomplished by using the chemical 456 followed by bleach/tide, and finishing with 456.
- Concern with Virkon<sup>®</sup> was brought up by multiple VTH personnel.
- Per the personnel responses, there was chemotherapeutic agent training as well as documentation of the training. However, the training was not assessed for completeness or effectiveness. VTH management should consider assessing the training and its effectiveness. Furthermore, employee concern with regard to hazards from chemotherapeutic agents was brought up during the interviews. Affected service areas included Oncology, Equine, Neurology, CCU, and Pharmacy.
- Formalin: It was not in the scope of the project to evaluate specific chemicals, however, per the interviews and walkthroughs, it was revealed that formalin was used in several areas such as Small Animal Surgery and Ophthalmology.

Since formalin (formaldehyde) is a suspected carcinogen, there should be chemical specific training and controls for the use of this chemical (OSHA, 2008; OSHA, 2006).

- Spill response: Since the VTH Building Safety Plan required employees to contain and clean up benchtop spills, a training plan and clean-up requirements should be created and implemented. The current plan calls for absorbent pillows to be used for cleanup, but only a couple of areas had this resource.
- Ergonomics: In general, VTH management should communicate to employees that manual lifting should be minimized and engineering controls should be implemented (OSHA). A task-hazard assessment should be completed to determine specific ergonomic hazards that should be corrected, but some general concerns were as follows:
  - Reception/Call Center/Business Office/Medical Record's ergonomic hazards were mostly related to sitting.
  - Surgeon's ergonomic hazards were largely long, static, and awkward positions.
  - Maintenance and most other areas ergonomic hazards were lifting and restraining heavy objects and/or patients.
- Slips, Trips, and Falls: Uneven floors should be eliminated and non-slip surfaces should be used. In addition, spills should be cleaned up immediately, clutter and obstructed work areas should be eliminated, adequate staffing levels should be present, and cords should not be left out as a tripping hazard (OSHA).

- Animal Care employees reported that the non-slip floors were more slippery when wet.
  - Numerous cords were observed on floors that posed a tripping hazard.
  - Virkon® created unevenness in the concrete floors (due to erosion) in the Equine and Livestock Service Areas which created a tripping hazard.
- Electrical: The 2009 auditors found many electrical hazards in the VTH. The VTH management should consider hiring a safety professional to develop an electrical safety plan using the 2009 audit in conjunction with this research.
- Workplace Violence: A violence prevention program should be created and implemented. Workplace violence is a possibility in every work environment and therefore, must be accounted for by VTH management in both the written policies and training. OSHA provides a health and safety topics page dedicated to workplace violence information (OSHA). There are currently no standards pertaining to workplace violence, but OSHA provides many resources for hazard awareness, possible solutions, and additional information such as training.
- Biohazards: The 300 page VTH biosecurity manual was not assessed by the researcher for this project. Although the VTH is not under OSHA jurisdiction because it is a state institution, OSHA Standard 29 CFR 1910.1030 (bloodborne pathogen/sharps) writes that there should be a written exposure control plan, exposure follow up, maintenance of medical and training records, safety needle devices, proper handling and disposal, and appropriate PPE. These elements should be present in the biosecurity manual. In



addition, the researcher recommends a summary (fact sheet/poster) as well as training on this manual.

- Sharps: Although sharps were a serious risk and of great concern to the majority of the hospital interviewees, there have already been many controls implemented to address this hazard. For example, the sharps policy was updated, all personnel were required to read and sign the sharps policy, sharps must be reported in a formal manner, and there was feedback from the interviewees that improvements were made. However, the problem of sharps being found by cleaning crews and sharps found in the laundry still persisted. Therefore, the author recommends that employees in every area do a sweep for sharps that were left out and not disposed of properly (in the biohazard bins) after shifts are concluded. In addition, a sign should be placed near the laundry as a reminder to check pockets for sharps. If the problem still persists, the researcher suggests creating and requiring an in-person training session as opposed to the current read-and-sign the policy online training.
- Violent patients: Training on how to address violent patients should be done for both small- and large-animal handlers. As previously discussed, this hazard was named the top risk by interviewees.
  - Muzzles should be used as a proactive control as opposed to a reactive one.
  - Differentiation should be made between the consequences and likelihood of large animal verse small-animal injuries.
  - Many answers per the interviews with respect to training and controlling violent patient were that veterinary school covered this topic for students. First, this

training was not assessed by the researcher, but the assumption was that there should always be some sort of training upon hire to attain consistency in animal handling techniques. Furthermore, there were many VTH personnel who worked with (or in the vicinity) of animals who had not been trained at veterinary school (i.e. Barn Care, Animal Care, and Maintenance).

- Stress: VTH management should educate personnel on job stress; identify work-related stressors; and address stress in meetings by communicating feelings, gaining support, and sharing innovative ideas. Management should create and implement a stress-management program and provide adequate staff and reasonable shifts. "Hospital work often requires coping with some of the most stressful situations found in any workplace. Hospital workers must deal with life-threatening injuries and illnesses complicated by overwork, understaffing, tight schedules, paperwork, intricate or malfunctioning equipment, complex hierarchies of authority and skills, dependent and demanding patients, and patient deaths; all of these contribute to stress." OSHA offered additional information and ideas on how to address workplace stress (OSHA). Management should provide a resource to which employees can talk to when they are stressed. This resource should be on-site for best results, but could also be a hotline or someone in house who VTH personnel feel comfortable talking with and is capable of dealing with such issues.
- Emergency planning: VTH management should implement distinguished alarms/communication procedures for different emergencies (fire, weather, chemical, violence, disease etc.). The procedures should be agreed upon by management and

employees should be effectively trained on the procedures. Some specific issues related to emergency planning were as follows:

- Weather: Not all VTH personnel responded with the same answer as to what action to take in a weather related emergency. Some stated to take shelter in the bathrooms, and most stated to gather around the central part of the building or similarly, gather in front of CCU. The researcher believes this could be overly crowded and possibly not fit all personnel. Management should analyze and address this aspect of the procedure.
- There was no procedure to account for employees during an emergency evacuation.
- Another substantial deficiency was the lack of alarm differentiation and communication of type of emergency to all service areas. For instance, Pharmacy employees stated that they did not typically hear pages on the overhead speakers.
- Noise: Service areas that have employees who complained about noise exposure should be monitored to determine noise-exposure levels. The hierarchy of industrial hygiene controls should be used to control the noise.
- Safety equipment inspections: Inspections of safety equipment were not accomplished and/or documented. Safety equipment that should be included in a preventative maintenance program are fire extinguishers, eyewash/safety showers, emergency egress pathway lighting, emergency exit lighting, and ground fault circuit interrupters (GFCIs) (Hellman & Associates, 2009).

- Violent clients: It was noted in the interview that there have been cases of violent clients both in the reception area and in the barn/breezeway area (at night) which would affect Barn Care, Equine, Livestock, Anesthesia, and any employee who goes outside the VTH building at night.
  - It was noted during the interviews that incidents involving angry clients (violent or threatening) have occurred in the Reception Service Area. Reception and the Business Office service areas both have silent alarms, but this was not mentioned during the interviews, it was discovered by the researcher at a later date. Since this was not brought to the attention of the researcher during the interviews, it is assumed that many employees were not aware of the silent alarms. Therefore, a training session should be conducted on this matter to assure that all affected personnel are aware of this procedure.
  - It was reported that transients (i.e., the homeless) have been seen near the barn; some took shelter; some entered in to see a famous animal. Per the interview, the breezeway (the Barn and Livestock areas) stays open too much after hours when the weather is nice and security is more lax during the night shifts. The recommendation is to install more illumination and security measures near the barn area for night shift safety.
- Compressed gas: The researcher recommends to store all cylinders upright and secure with chains, and when cylinders are not in use or being transported, assure that caps are in place (OSHA) 29 CFR 1910.101.
  - There was a compressed gas cylinder stored lying down in the CCU service area, on a bottom shelf and sticking out so that workers could potentially trip on it.

- The Anesthesia storage room in LAS had cylinders that were upright, but were not secured with any chains.
  - In addition, most cylinders were not stored or transported with caps in place.
- Waste anesthetic gas: Areas of most concern were Anesthesia, Small Animal Surgery, Large Animal Surgery and any other service area which uses anesthetic gas. The researcher recommends to: (1) Implement scavenging systems, (2) check that ventilation is adequate, (3) conduct area and personal monitoring, (4) make sure there is routine ventilation maintenance, and (4) obtain and store baseline liver and kidney data for effected employees (OSHA; CDC; NIOSH, 2007).
  - Waste anesthetic gases (especially doses for horses) (CDC; NIOSH, 2007) can lead to unconsciousness, nausea, dizziness, headaches, fatigue, irritability, drowsiness, coordination and judgment problems, sterility, miscarriages, birth defects, cancer, and liver and kidney disease.
- Radiation: This seemed to be pretty well controlled based on the 2009 audit observations, the researcher's observations in this study, and the interviewee's responses. However, the VTH radiation program was not specifically addressed. Therefore, the researcher recommends cross referencing the VTH controls with the following OSHA recommendations: (1) Create a barrier wall with lead, (2) use lead PPE, (3) operate from outside room whenever possible, (4) create a maintenance program with a designated person responsible (21 CFR 1000 Radiological Health), (5) separate storage area from radioactive sources and make sure adequately shielded (OSHA).
- Rabies: Only Neurology mentioned this as a concern, however any service area that had the potential for a patient bite was also at risk. Although rabies can be treated rather quickly which reduces the risk, education should be given to all affected personnel

(Centers for Disease Control and Prevention, 2010). As a preventative option, the CDC suggests all veterinarians receive a pre-exposure vaccine (CDC, 2010).

- Hydraulic equipment: This hazard was both observed by the researcher and voiced as a concern by employees. Therefore, the researcher recommends VTH management to: (1) Routinely monitor equipment, (2) train employees to visually inspect each time before use, and use appropriate PPE, and (3) make sure there is a failsafe mechanism and all employees are aware of it. (machinery and machine guarding 29 CFR 1910.211-.222). Specific equipment of concern was the Large Animal Surgery exam tables and the Livestock chutes (Big Green and Big Red).
- Lasers: Anesthesia, Ophthalmology, Dermatology, Exotics, Clinical Pathology, and Large Animal Surgery employees all reported the use of lasers. Since there was no hazard assessment to determine correct PPE or training pertaining to this hazard, the researcher recommends that: A program should be created following ANSI Z136.1 (American National Standard for Safe Use of Lasers) and all employees should be trained on it. Second, appropriate PPE should be supplied (OSHA; OSHA).
- Lockout/tagout (lack of): A lockout/tagout safety program should be created. The elements should include an assessment, written procedures, training, and work practices. The program is designed to protect employees from unexpected startup of machinery and equipment or release of hazardous energy during service or maintenance activities. Equipment specific procedures are generally required when there is a potential for stored or residual energy or the reaccumulation of energy after the equipment is shutdown, there is more than one single energy source associated with the equipment, or the service work creates a hazard for other employees (OSHA 29

CFR 1910.147). Equipment that should have a lockout/tagout procedure is the LAS exam tables and the green and red chutes in Livestock.

- Confined space: The Large Animal Surgery pits and the autoclave in Central Supply were confined spaces. The 2009 audit (Hellman & Associates, 2009) stated the VTH needed to determine if steam sterilizer in central services and LAS pits are or are not permit-required confined spaces. The researcher believes these are possibly permit-required confined spaces because the LAS exam table could fall and trap employees and the autoclave could entrap or asphyxiate an employee. The researcher recommends a written program in accordance with OSHA Standard 29 CFR 1910.416.
- Tools: Proper tools should be used for the job along with the proper work station. The researcher witnessed a few instances of improper use. VTH management should ensure all personnel are trained and abide by this.

#### Service Area Recommendations

##### *Reception/ Call Center/Business Office/ Medical Records:*

(1) Mount a CO<sub>2</sub> fire extinguisher in medical records and formally train and document all personnel required on how to correctly use a fire extinguisher. (2) Medical records employees at the VTH use a hard copy system. Updating this system to computers would solve issues of papercuts as well as risk of rapidly spreading fire. Another benefit of updating to a computer based system is the ease of transferring files and the comfort and security of backed up files.

##### *Maintenance:*

(1) All maintenance personnel should be trained on the major hazards in every area since they work throughout the VTH. (2) A new procedure for moving hay should be developed,

such as moving the hay by machine operation. (3) Industrial hygiene monitoring should be done on the ventilation for the welding area to ensure that it is adequately functioning. Personal monitoring for welding fumes should be done as well. (4) Proper clothing should be supplied and worn to minimize catching on fire. "Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed" (OSHA, 2009). (5) In addition, training should be provided. (6) Recommendations for compressed gas, radiation, and lockout/tagout can be found in the general recommendations section.

*Custodial/Animal Care:*

(1) A competent person should make sure there is a failsafe mechanism on the hydraulics of LAS tables (not one person the researcher spoke with was sure if one was present, and the 2009 audit did not find a failsafe). If so, assure that all employees are aware of the mechanism as well as how it works. If not, install a failure mode safe mechanism. (2) Provide a step stool or ladder for animal care personnel to use when entering and exiting the LAS pits. (3) There were complaints of the 'non-slip' floors being more slippery than regular floors when they get wet (e.g., Ward 3). Assess this and consider replacing the floors or introducing an alternate control such as different shoes employees could wear. (4) Recommendations for sharps, compressed gas, radiation, confined spaces, and lockout/tagout can be found in the general recommendations section

*Custodial/Barn:*

(1)The researcher observed an employee improperly using a tool which led to the assumption that employees have not been properly trained with respect to tool use. Therefore, training should be given on how to properly use tools. (2) There was an employee response of a



sore throat post-fogging even with the current PPE. Therefore, the fogging protocol should be reviewed and revised and subsequent training should be given. (3) Recommendations for compressed gas, radiation, lockout/tagout, and violent patients can be found in the general recommendations section.

*Pharmacy:*

(1) A separate refrigerator should be used and kept away from possible contamination. It was observed that food was stored and used in the same area that drugs were stored and used. (2) A Hazard Communication Program should be created and used to train on chemotherapeutic, acids, and other drugs. This program is especially important for pharmacy employees because these drugs were present in high quantities and worked with daily. Also, pharmacy employees diluted many chemicals that were provided give to the rest of the VTH. (3) Fix the intercommunication system to assure that pharmacy employees can hear pages. Recommendations for chemotherapeutic agents can be found in the general recommendations section.

*Central Supply:*

As discussed previously, steam from the autoclave was a burn hazard. It should first be analyzed for an engineering control that can be placed in this area to minimize the steam from the autoclave. If this is not possible then an administrative procedure should be created and put into place along with hands on formal documented training. Recommendations for compressed gas, sharps, and confined spaces can be found in the general recommendations section.

*Anesthesia:*

The main concerns for Anesthesia were waste anesthetic gas, compressed gas, radiation, and lasers which were all discussed in the general recommendations section.

*Critical/Urgent Care:*

CCU's employees' main concerns were chemotherapeutic drugs, compressed gas cylinders, and the fact that they were the first service area to assess a patient leaving them more susceptible to violent patients and zoonotic disease. Therefore, the researcher recommends the VTH should consider vaccination requirements. Muzzles should be used as proactive control rather than reactive. Last, there was a worker concern with bleach due to the frequency of use and the caustic properties. The researcher recommends an assessment of chemicals currently used in triple clean (456 and bleach) and elimination of bleach if possible. Recommendations for compressed gas and antineoplastic agents can be found in the general recommendations section.

*Ophthalmology:*

A specific concern which was brought up during the interviews was that Ophthalmology employees spent a great deal of time with their faces close to the patients which led to increased risk of zoonotic disease as well as risk of animal bites. Therefore, the researcher recommends the creation of an SOP for eye exams that include always muzzling patients and administrator wearing an approved respirator. In addition, employees should be trained on this SOP. Recommendations for radiation and lasers can be found in the general recommendations section.

*Dermatology:*

A concern brought up during the interview was exposures to allergens which can cause sensitization and exacerbation of allergic diseases. Therefore, the researcher recommends the control of allergen exposure and implementation of a health surveillance program. (Samadi, S., Heederik, D., Krop, E., Jamshidifard A., Willemse, T., and Wouters, I. Allergen and endotoxin exposure in a companion animal hospital. 2009. *Occup Environ Med* 2010; 67: 486-492) Recommendations for radiation and lasers can be found in the general recommendations section.

*Neurology:*

Employee concerns consisted of hitting their heads on the razors (for fur trimming) which hung down from the ceiling in some rooms. An engineering control should be implemented that make the razors hang higher from the ceiling, or not at all. (3) Neurology interviewees recommended that the VTH should consider installing hydraulic tables with wheel locking mechanisms (per interview). Recommendations on radiation and chemotherapeutic drugs can be found in the general recommendations section.

*Livestock:*

Livestock employees stored a large drum of liquid acid cleaner and a large drum of caustic chlorinated cleaner (both corrosive) next to one another. These chemicals are incompatible with each other and should not be stored next to one another (as per the MSDSs). The researcher recommends separating the acid and base drums in the milk room. Livestock used two large hydraulic chutes which had exposed pinch points. The researcher recommends

attaching machine guards to chutes to eliminate these. Last, refer to the general recommendations section for compressed gas hazards and recommendations.

*Equine:*

Equine Service Area had chemotherapeutic drugs, compressed gas, and large animal violence as concerns which were all addressed in the general recommendations section.

*Small Animal Medicine:*

Small Animal Medicine was at greater than average risk (compared to other service areas) for zoonotic disease. This was because the employee's primary task was to take fluid samples. Furthermore, it was observed that samples had been taken without the use of gloves. Employees should be made aware the risk of zoonotic transmission. Last, refer to general recommendations section for the compressed gas hazard.

*Small Animal Surgery:*

Waste anesthetic gas, radiation, compressed gas, formalin, and tools were all hazards identified for this area that were addressed in the general recommendations section above.

*Oncology:*

Chemotherapeutic drugs, compressed gas, radiation, and lasers were all hazards identified for this area that were addressed in the general recommendations section above.

*Exotics (Zoo Med):*

Animal violence was a higher risk in this area because this service area's employees saw a variety of animals with which employees may not have been familiar. Therefore, the

researcher recommends specified training, or a procedure which includes researching an unfamiliar animal as well as its zoonotic diseases prior to handling.

*Clinical Pathology:*

This area had a higher risk for zoonotic diseases because the main task involved handling animal fluids. It was reported during the interview, that employees only recently started wearing gloves. It seemed the perception of this hazard was lacking. Therefore, in addition to the VTH-wide training, the researcher recommends an emphasis on this hazard, importance of wearing gloves and disinfecting procedures.

*Dentistry:*

This area was at increased risk for zoonotic disease due to the inhalable exposure of aerosolized bacteria. Respiratory protection was not worn, and there was employee concern with the ventilation in the room. Therefore, a hazard specific assessment should be done to determine the concentration of aerosolized bacteria in the air, determine if a problem exists, check the ventilation, and per the hierarchy of controls, a respirator is a last line of defense, but a sufficient solution to this potential problem. There were complaints of noise due to dogs and the air compressor in room. Therefore, noise monitoring should be conducted to determine exposure. The electrical box outside the surgery pit has an alarm that goes off if there is too much electricity running through it. The alarm goes off frequently, the problem has been reported, but nothing has done about it. This problem should be addressed and fixed. If an alarm goes off, it is supposed to mean that there is a problem that employees should be concerned about immediately. However, the employees are being conditioned to ignore this sound and associate the alarm only with annoyance. Last, refer to the previous section for recommendations on compressed gas and radiation.

### *Large Animal Surgery:*

Compressed gas, waste anesthetic gas, static awkward postures, lasers, confined spaces, and radiation were all determined to be hazards for this service area. However, these have been addressed in the previous section because more than one service area was at risk for these hazards.

## **Conclusions**

### Previous Audits

The 2003 auditors named the five health and safety deficiencies which posed the greatest health and safety risks. These were: 1) emergency response plan and procedure, 2) hazard communication program, 3) personal protective equipment program, 4) basic electrical safe practices and electrical safety inspections, and 5) sharps control and disposal.

The 2009 auditors organized the health and safety deficiencies by OSHA subpart. The most frequent deficiencies found were related to electrical (22 deficiencies), followed by toxic and hazardous substances (14 deficiencies). The remaining deficiencies included walking/working surfaces; exit routes, emergency action plans, and fire prevention plans; and occupational health and environmental controls (10 deficiencies).

### Conclusions of this Study

In contrast to the previous health and safety audits, this study went beyond only the identification of hazards. The researcher estimated the overall risk for each service area based on observations and interviews, prioritized the service areas in order of mitigation efforts, and identified hospital-wide health and safety issues. In addition, the researcher provided recommendations to mitigate hazards and provided the groundwork to implement an OHSMS.

In order to make effective health and safety improvements, the researcher suggests that serious risks for each service area be addressed first. Hospital-wide issues should then be addressed after the service area *serious* risks are addressed (i.e., before the *high*, *medium* and *low* risks in each service area) as this would demonstrate to VTH personnel in all departments that health and safety is valued by management and action is being taken. As VTH management reviews and corrects these risks, they should include employees in the development of solutions and changes because employee involvement is a key fundamental component of the ANSI Z10 Standard.

Per the service area priority list (Table 19), Large Animal Surgery was identified as the highest risk service area (Priority 1), followed by Small Animal Surgery and Livestock (Priority 2). The *serious* risks in LAS were anesthetic waste gas, LAS pits (confined spaces), and lasers. The *serious* risks in SAS were anesthetic waste gas and chemicals (formalin). The *serious* risks in Livestock were chemicals (acid and base drums) and the hydraulic equipment (animal chutes).

To minimize redundancy, if the *serious* risk in a service area is also a health and safety issue in another service area, the solutions should be executed at the same time. For example, the confined space in Central Supply Service Area was deemed a *high* risk versus the confined space in LAS that was deemed a *serious* risk due to the different estimated severities and probabilities of the hazard being realized. However, it would ease the burden on management by addressing both confined space issues at the same time. Similarly, if a *serious* risk for a service area was a hospital-wide issue, then again, the issue should be addressed for the whole hospital at that time. For example, zoonotic disease was a health and safety issue throughout the VTH; therefore, instead of concentrating solely on Small Animal Medicine, management

should address zoonotic disease with a hospital-wide program which would include mitigating the *serious* risk in Small Animal Medicine.

Most of the other service area-specific *serious* risks (Table 17) were hospital-wide or multiple service-area issues and should be addressed after the issues identified in Large Animal Surgery, Small Animal Surgery, and Livestock. These hospital-wide issues included: violent patients, anesthetic waste gas, zoonotic diseases, and chemicals. The remaining *serious* risks were associated with the welding operations and hay moving in the Maintenance Service Area (priority rating 4; Table 19).

The hospital-wide health and safety issues were excluded from the risk assessment and are presented here in arbitrary order. The issues that need to be addressed are PPE and respiratory hazard assessments; ergonomics (specifically lifting and restraining); emergency action plans; training; the creation of an injury/illness/fatality database and subsequent trend analysis; toxic and hazardous substances (Hazard Communication Program); and electrical hazards.

#### Supplementary Efforts in Implementing an OHSMS (per the ANSI/AIHA Z10 Standard)

The initial review, assessment, and prioritization have been completed for the hazards and risks at the VTH with respect to the 20 service areas. Demonstrated management leadership for health and safety was lacking, but the potential for improvement was noted by the researcher. Many supervisors were eager to identify hazards and were concerned about health and safety. Many employees were currently involved in health and safety (e.g., building proctor, biosecurity committee, sharps policy, emergency planning and/or related meetings); however, there were employees who stated that they would like to be more involved.



Per the ANSI Z10 Standard, the planning phase (element 4) is not yet complete. Objectives, implementation plans, allocation of resources, and plans for ongoing review should be developed. Once the planning phase is completed, implementation and operation (element 5) should be completed. Evaluation and corrective action (element 6) requires monitoring and measurement among other elements. Some specific areas to monitor and measure have already been identified in this research and can be found in the recommendations above. Management review (element 7) is the final step to implementing an OHSMS. Once implementation is complete, the OHSMS must continue to operate in a continuous manner of “plan, do, check, act” which enables the system to continually improve.

## REFERENCES

- Abrams, A. (n.d.). LEGAL PERSPECTIVES - ANSI Z10-2005 Standard Occupational Health and Safety Management Systems.
- American Society of Safety Engineers. (n.d.). *The Compass; Management Practice Specialty Newsletter*. Retrieved 2011, from Impact of ANSI Z10:  
<http://www.asse.org/publications/standards/z10/docs/z10compass.pdf>
- Barnes, S. B. (1991). *Attribution Processes and Integrated Management Approaches Relative to Current Industrial Safety Program Practices*. Department of Environmental Health. Fort Collins, CO: Colorado State University.
- Belson, W. A. (1981). *The Design and Understanding of Survey Questions*. Aldershot: Gower.
- Blair, A., & Hayes, H. (1982). Mortality Patterns Among US Veterinarians. *International Journal of Epidemiology*, 11, 391-397.
- BLS. (1997). *Industries with the most cases of occupational stress*. Retrieved from The Editor's Desk: <http://www.bls.gov/opub/ted/1999/Oct/wk4/art03.htm>
- Bottani, E., Monica, L., & Vignali, G. (2009). Safety Management Systems: Performance differences between adopters and non-adopters. *Safety Science*, 47, 155-162.
- Bovornsuppasri, C. A. (2005). *A Readiness Assessment of Company XYZ to Implement OSHA's Voluntary Protection Program*. MS in Risk Control. Wisconsin: Graduate School of University of Wisconsin-Stout.
- Bureau of Labor Statistics*. (2009). Retrieved from <http://www.bls.gov/iif/>
- Bureau of Labor Statistics*. (2009). Retrieved from [http://www.bls.gov/news.release/archives/osh\\_10212010.htm](http://www.bls.gov/news.release/archives/osh_10212010.htm)
- Bureau of Labor Statistics*. (2010).
- Butler, D., & Kitzinger, U. (n.d.). *The 1975 Referendum*. London: Macmillan.
- Canadian Centre for Occupational Health and Safety. (2006). Retrieved from <http://www.ccohs.ca/headlines/text190.html>
- Canadian Centre For Occupational Health and Safety. (2005). *Diseases*. Retrieved 2011, from Needlestick Injuries: [http://www.ccohs.ca/oshanswers/diseases/needlestick\\_injuries.html](http://www.ccohs.ca/oshanswers/diseases/needlestick_injuries.html)

- CDC. (2010, June). *Engineering Controls*. Retrieved 2011, from <http://www.cdc.gov/niosh/topics/engcontrols/>
- CDC. (2010, March). *Should my staff and I be vaccinated?* Retrieved 2011, from Rabies: [http://www.cdc.gov/rabies/specific\\_groups/veterinarians/staff.html](http://www.cdc.gov/rabies/specific_groups/veterinarians/staff.html)
- CDC; NIOSH. (2007). *Occupational Hazards in Hospitals, Waste Anesthetic Gases*. Retrieved 2011, from NIOSH Publication No. 2001-151: <http://www.cdc.gov/niosh/docs/2007-151/>
- CDC; NIOSH. (2007). *Waste Anesthetic Gases - Occupational Hazards in Hospitals*. Retrieved 2011, from NIOSH Publication No.2007-151: <http://www.cdc.gov/niosh/docs/2007-151/>
- Centers for Disease Control and Prevention. (2010, December). *Rabies Prevention and Control*. Retrieved 2011, from <http://www.cdc.gov/rabies/>
- Czaja, R., & Blaire, J. (1996). *Designing Surveys: A guide to decisions and procedures*. London: Pine Forge Press.
- Department of Human Services-Public Hospital Sector. (2003). *Occupational Health and Safety Management Framework Model*. Melbourne: Metropolitan health & Aged Care Services Division and Rural & Regional Health & Aged Care Services Division.
- Dewit, M. (2004). Managing the Proliferation of EHS and Related Management systems.
- Doidge, J. P. (1997). Successful Health and Safety Management. *Perfusion* , 12, 217-220.
- Ellwood, C. (2003). *CSU VTH Audit*. AOEH, LLC.
- Fink, A. (1995). *How to Ask Survey Questions*. Sage Publications, Inc.
- Fowler, F. J., & Mangione, T. W. (1990). *Standardized Survey Interviewing: Minimizing interview-related error*. Newbury Park: Sage Publications, Inc.
- Frey, J. H., & Oishi, S. M. (1995). *How to Conduct Interview by Telephone and inPerson* (Vols. Survey Kit, Vol 4). Sage Publications, Inc.
- Fulwiler, R. D. (1993). Health and Safety's Stewardship of Key Business Values: Employees, Public Trust, and Responsibility to Shareholders. *American Industrial Hygiene Association Journal* , 54, 697-700.
- Gabel, C. (2000). A Study of Risk Factors for Injuries Among Minnesota Veterinarians. *Doctoral Thesis* . Minneapolis, Minnesota: University of Minnesota.
- Gabel, C. L., & Gerberich, S. G. (2002). Risk Factors for Injury Among Veterinarians. *Epidemiology* , 13 (1), 80-86.

- Gershon, R., Karkashian, C., Grosche, J., Murphy, L., Escamilla-Cejudo, A., Flanagan, P., et al. (2000). Hospital Safety Climate and its Relationship with Safe Work Practices and Workplace Exposure Incidents. *Journal of Infection Control* , 28 (3), 211-221.
- Green, L. W., Kreuter, M. W., Deeds, S. G., & Partridge, K. S. (1980). *Health Education Planning; A Diagnostic Approach*. Mayfield Publishing Company.
- Groves, R., Fultz, N. H., & Martin, E. (1992).
- Hashemi, K., Brown, R., & Buckley, A. (1990). Accidents in Practice. *Veterinary Record* , 133, 580.
- Hellman & Associates. (2009). *CSU VTH Audit*.
- Hendrix, C. M., McClelland, C. L., Kahn, K. L., Thompson, I., & Pence, P. A. (2002). Healthy People 2010-New Opportunities for Veterinary Medicine in the 21st Century. *Journal of the American Veterinary Medicine Association* , 221 (7), 951-957.
- Henk, S. (2010). *Comparison of OSHA Consultation 21(D) Form 33 with ANSI/AIHA Z10-2005 American National Standard - Occupational Health and Safety Management Systems*. Ph.D., Department of Environmental and Radiological Health Sciences. Fort Collins: Colorado State University.
- Housekeeping*. (n.d.). Retrieved 2011, from Hospital eTool:  
<http://www.osha.gov/SLTC/etools/hospital/housekeeping/housekeeping.html#HazardousChemicals>
- Houtkoop-Steenstra, H. (2000). *Interaction and the Standardized Survey Interview; The Living Questionnaire*. Cambridge: Cambridge University Press.
- Industrial Accident Prevention Association. (2007). *Safety Signs and Colour at Work*. Retrieved 2011, from <http://www.iapa.ca/pdf/safsigns.pdf>
- International Labour Organization. (n.d.). Retrieved from [http://www.ilo.org/safework/areasofwork/lang-en/WCMS\\_DOC\\_SAF\\_ARE\\_MNG\\_EN/index.htm](http://www.ilo.org/safework/areasofwork/lang-en/WCMS_DOC_SAF_ARE_MNG_EN/index.htm)
- International Organization for Standardization. (n.d.). ISO 14000. *Environmental Management Systems* .
- Jeyaretnam, J., & Jones, H. (2000). Physical, Chemical and Biological Hazards in Veterinary Practice. *Australian Veterinary Journal* , 78, 751-758.
- Labodová, A. (2004). Implementing Integrated Management Systems Using a Risk Analysis Based Approach. *Journal of Cleaner Production* , 12, 571-580.
- Landercasper, J., Cogbill, T., Strutt, P., & Landercasper, B. (1988). Trauma and the Veterinarian. *Journal of Trauma* , 28, 1255-1259.

- Langley, R., Pryor, W., & O'Brien, K. (1995). Health Hazards Among Veterinarians: A Survey and Review of Literature. *Journal of Agromedicine* , 2 (1), 23-52.
- Leggat, P., Smith, D., & Speare, R. (2009). Exposure Rate of Needlestick and Sharps Injuries Among Australian Veterinarians. *Journal of Occupational Medicine and Toxicology* , 25 (4).
- Lipton, B., Hopkins, S., Koehler, J., & DiGiacomo, R. (2008). A Survey of Veterinarian Involvement in Zoonotic Disease Prevention Practices. *Journal of the American Veterinary Medical Association* , 233, 1243-1249.
- Lloyd, J. W., & King, L. J. (2004). What are the Veterinary Schools and Colleges Doing to Improve the Nontechnical Skills, Knowledge, Aptitudes, and Attitudes of Veterinary Students. *Journal of American Veterinary Medical Association* , 224 (12), 1923-1924.
- Lyberg, L., & Kasprzyk, D. (1991). *Data Collection Methods and Measurement Error: an overview*.
- MacDonald, V. (2009). Chemotherapy: Managing Side Effects and Safe Handling. *Canadian Veterinary Journal* , 50, 665-668.
- Makin, A.-M., & Winder, C. (2009). Managing Hazards in the Workplace Using Organisational Safety Management Systems: a safe place, safe person, safety systems approach. *Journal of Risk Research* , 12 (3-4), 329-343.
- Manuele, F. A. (2008). *Advanced Safety Management-Focusing on Z10 and Serious Injury Prevention*. Hoboken, NJ: John Wiley and Sons.
- Massoomi, F., Neff, B., Pick, A., & Danekas, P. (2008). Implementation of a Safety Program for Handling Hazardous Drugs in a Community Hospital. *American Journal of Health-System Pharmacists* , 65, 861-865.
- Morrow, W. M., & Langley, R. L. (1996). A Survey of Personal and Occupational Health and Safety Training for US and Canadian Veterinary Schools. *Journal of Agromedicine* , 3, 23-35.
- National Institute of Occupational Safety and Health. (n.d.). Retrieved from <http://www.cdc.gov/niosh/hhe/>
- National Safety Council. (2009). Retrieved from [http://www.nsc.org/news\\_resources/injury\\_and\\_death\\_statistics/Pages/EstimatingtheCostsofUnintentionalInjuries.aspx](http://www.nsc.org/news_resources/injury_and_death_statistics/Pages/EstimatingtheCostsofUnintentionalInjuries.aspx)
- Occupational Health & Safety Advisory Services. (2007). Retrieved from <http://www.ohsas-18001-occupational-health-and-safety.com/>
- Occupational Safety and Health Administration. (1989). Retrieved 2011, from <http://www.labtrain.noaa.gov/osha600/refer/menu16c.pdf>

Oppenheim, A. N. (1992). *Questionnaire Design, Interviewing and Attitude Measurement*. New York: Basib Books, Inc.

OSHA. (2007). Retrieved from <http://www.osha.gov/SLTC/etools/safetyhealth/helpfulstatistics.html>

OSHA. (2008). Retrieved from <http://www.osha.gov/Publications/safety-health-management-systems.pdf>

OSHA. (n.d.). *Ergonomics*. Retrieved 2011, from Hospital eTools: <http://www.osha.gov/SLTC/etools/hospital/hazards/ergo/ergo.html>

OSHA. (2007). *Evacuation Plans and Procedures eTool*. Retrieved 2011, from Fire Extinguishers: [http://osha.gov/SLTC/etools/evacuation/portable\\_about.html](http://osha.gov/SLTC/etools/evacuation/portable_about.html)

OSHA. (2008). *Formaldehyde*. Retrieved 2011, from 1910.1048(c)(1): [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=10075&p\\_table=STANDARDS](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10075&p_table=STANDARDS)

OSHA. (n.d.). *Hazardous Chemicals*. Retrieved 2011, from Hospital eTool: <http://www.osha.gov/SLTC/etools/hospital/housekeeping/housekeeping.html#HazardousChemicals>

OSHA. (2010, June). Injury and Illness Prevention Program Stakeholder Meeting.

OSHA. (2010, August). *Injury and Illness Prevention Program Stakeholder Meeting*. Retrieved from <http://www.osha.gov/dsg/topics/safetyhealth/08032010stakeholder-notes.html>

OSHA. (2010, June). *Injury and Illness Prevention Program Stakeholder Meeting*. Retrieved from <http://www.osha.gov/dsg/topics/safetyhealth/06102010stakeholder-notes.html>

OSHA. (n.d.). *Laser Hazards*. Retrieved 2011, from Safety and Health Topics: <http://www.osha.gov/SLTC/laserhazards/index.html>

OSHA. (n.d.). *Laser/Electrosurgery Plume*. Retrieved 2011, from Safety and Health Topics: <http://www.osha.gov/SLTC/laserelectrosurgeryplume/index.html>

OSHA. (n.d.). *Radiation Exposure*. Retrieved 2011, from Hospital eTool: <http://osha.gov/SLTC/etools/hospital/clinical/radiology/radiology.html#Radiation>

OSHA. (2007). *Safety and Health Management Systems eTool*. Retrieved 2010, from <http://www.osha.gov/SLTC/etools/safetyhealth/mod1.html>

OSHA. (n.d.). *Slips/Trips/Falls*. Retrieved 2011, from Hospital eTools: <http://www.osha.gov/SLTC/etools/hospital/hazards/slips/slips.html>

- OSHA. (n.d.). *Stress*. Retrieved 2011, from Hospital eTool:  
<http://www.osha.gov/SLTC/etools/hospital/hazards/stress/stress.html>
- OSHA. (2006). *Substance technical guidelines for formalin*. Retrieved 2011, from 1910.1048 App A:  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10076](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10076)
- OSHA. (n.d.). *Surgical Suite Module*. Retrieved 2011, from Hospital eTool:  
<http://www.osha.gov/SLTC/etools/hospital/surgical/surgical.html>
- OSHA. (n.d.). *Surgical Suite Module*. Retrieved 2011, from Hospital eTool:  
<http://osha.gov/SLTC/etools/hospital/surgical/surgical.html>
- OSHA. (1996). *The control of hazardous energy (lockout/tagout)*. Retrieved 2011, from 1910.147:  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_id=9804&p\\_table=STANDARDS](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9804&p_table=STANDARDS)
- OSHA. (2007). *Voluntary Protection Program*. Retrieved 2011, from  
<http://www.osha.gov/dcsp/vpp/>
- OSHA. (2009). *Welding, Cutting, and Brazing*. Retrieved 2011, from 1910.252(b)(ii)(I):  
[http://osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9853](http://osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9853)
- OSHA. (n.d.). *Workplace Stress*. Retrieved 2011, from Hospital eTools:  
<http://www.osha.gov/SLTC/etools/hospital/icu/icu.html#WorkplaceStress>
- OSHA. (n.d.). *Workplace Violence*. Retrieved 2011, from Safety and Health Topics:  
<http://www.osha.gov/SLTC/workplaceviolence/>
- Palassis, J. (2007). Retrieved from <http://www.aiha.org/aihce07/handouts/po116palassis.pdf>
- Pascal, D. (1997). *Quality, Safety, and Environment: Synergy in the 21st Century*. Milwaukee, Wisconsin: ASQC Quality Press.
- Peterson, R. A. (2000). *Constructing Effective Questionnaires*. Thousand Oaks: Sage Publications, Inc.
- Poole, A. (1998). Survey of Occupational Hazards in Companion Animal Practices. *Journal of American Veterinary Medical Association* , 212, 1386-1388.
- Rapas, L., Predut, J., Mocanu, A., & Popescu, M. (2000). *Modern Occupational Health Systems in the Industrial Workplace and in Hospitals - Comparative Analysis of Romania Experience*. Brussels: TUTB-SALTSA Conference.

- Robson, L. S., Clarke, J. A., Cullen, K., Bielecky, A., Severin, C., Bigelow, P. L., et al. (2007). The Effectiveness of Occupational Health and Safety Management System Interventions: A systematic review. *Safety Science* , 45, 329-353.
- Saad, S. G. (2003). Integrated Environmental Management for Hospitals. *Indoor Built Environment* , 93-98.
- Samadi, S., Heederik, D. J., Krop, E., Jamshidifard, A.-R., Willemse, T., & Wouters, I. M. (2010). Allergen and Endotoxin Exposure in a Companion Animal Hospital. *Occupational Environmental Medicine* , 67, 486-492.
- Schuman, H., & Presser, S. (1981). *Questions and Answers in Attitude Surveys: Experiments on question form, wording, and context*. Orlando, FL: Academic Press.
- Seibert, P. J. (2011). *SafetyVet*. Retrieved from Spill Kits: <http://www.safetyvet.com/osha/spillkit.htm>
- Tomiczek, A., Stumpo, C., & Downey, J. F. (2006). Enhancing Patient Safety through the Management of *Clostridium difficile* at Toronto East General Hospital. *Healthcare Quarterly* , 9, 50-53.
- U.S. Department of Health and Human Services; Public Health Service; Centers for Disease Control and Prevention; National Institute for Occupational Safety and Health. (n.d.). Publication No. 99-101. DHHS (NIOSH).
- Velonakis, E., Mantas, J., & Mavrikakis, I. (2006). A Site of Communication Among Enterprises for Supporting Occupational Health and Safety Management System. *Studies in Health Technology and Informatics* , 124, 395-403.
- Weaver, D. R., Newman, L. S., Lezotte, D. C., & Morley, P. S. (2010). Perceptions Regarding Workplace Hazards at a Veterinary Teaching Hospital. *Journal of the American Veterinary Medical Association* , 237 (1), 93-100.
- Weese, S. J., & Faires, M. (2009). A Survey of Needle Handling Practices and Needlestick Injuries in Veterinary Technicians. *Canadian Veterinary Journal* , 50, 1278-1282.
- Yassi, A. (1998). Utilizing Data Systems to Develop and Monitor Occupational Health Programs in a Large Canadian Hospital. *Methods of Information in Medicine* , 37 (2), 125-129.



## APPENDICES

Appendix A: The Table of Contents from the ANSI/AIHA Z10 Standard.

- 1) Define:**
  - a. Scope
  - b. Purpose
  - c. Application
- 2) Management leadership and employee participation**
  - a. Management leadership
    - i. Occupational health and safety management system
    - ii. Policy
    - iii. Responsibility and authority
  - b. Employee participation
- 3) Plan:**
  - a. Initial review (2003 audit)
  - b. Ongoing review (2009 audit)
  - c. Assessment
  - d. Prioritization
  - e. Objectives
  - f. Implementation plans and allocation of resources
- 4) Implementation and Operation:**
  - a. Operational elements
    - i. Hierarchy of controls (Appendix g)
    - ii. Design review and management of change
    - iii. Procurement
    - iv. Contractors
    - v. Emergency preparedness
  - b. Education, training, and awareness
  - c. Communication
  - d. Document and record control process
- 5) Evaluation and corrective action**
  - e. Monitoring and measurement
  - f. Incident investigation (Appendix H)
  - g. Audits (Appendix I)
  - h. Corrective and preventive actions
  - i. Feedback to the planning process
- 6) Management review**
  - j. Review process (Appendix J)
  - k. Review outcomes and follow up (Appendix K- Bibliography and References)

Appendix B: Walkthrough Legend and Checklist.

Code	Definition
R	OSHA regulatory category
RW	OSHA required written program
w	Other written programs/documentation
GEC	General environmental control

		X-present	0-none/no	1-minimal	2-okay	3-good/yes
<b>R</b>	<b>Tox/haz substance</b>					
	<b>Material handling/storage</b>					
	Are bags, containers, boxes, etc. stored in a stable and secure manner?					
	Are storage areas free from accumulation of materials that constitute tripping, fire, explosion or pest hazards?					
	Do signs warn of clearance limits?					
<b>W</b>	<b>Hazardous material spill response</b>					

<b>R (GEC)</b>	<b>Sanitation</b>					
	Are waste receptacles leak proof, clean (equipped with solid, tight fitting lids if putrescible waste)?					
	Are all non-potable water outlets clearly marked?					
	Are toilets shared by both genders lockable?					
	Do all sinks and showers have hot and cold or tepid water, hand soap and towels or blowers?					

	If change rooms are required by a standard, are there separate facilities for street clothes and PPE?					
	Are all toilets, showers and change rooms clean and sanitary?					
	Is eating/drinking/food storage allowed only in designated areas?					
	Are lunchrooms or areas for food consumption in areas in which there is no potential for exposure to hazardous substances?					
<b>RW, S</b>	<b>Hazard Communication</b>					
	Have employees received any type of formal or informal hazard training? Explain.					
	Are containers properly labeled?					
	Are MSDS available to employees?					
<b>RW, S</b>	<b>Chemical hygiene plan</b>					
<b>W</b>	<b>Ergonomics</b>					
	<b>Slips, trips, and falls</b>					
<b>R</b>	<b>Electrical</b>					
	Is all electrical equipment free of water, oil, chips and excessive dusts?					
	Are all box covers in place, panelboard and cabinet doors closed, receptacle covers in place and intact, unused openings closed?					
	Are disconnect switches legibly and durably marked at the point of origin?					
	Are GFCIs installed where needed?					
	Do all portable headlamps have guards?					
	Are electrical appliances such as vacuum cleaners, polishers, and vending machines grounded and are the ground plugs securely attached?					
	Do extension cords being used have a grounding plug?					
	Are power strips securely attached to the work station, wall or column?					
	Are power strips prohibited from being daisy-chained and this practice is not in use at any work stations?					
	Are all electric cords off the floor and securely attached affixed to work stations?					

	Is wiring and cords free of frayed or deteriorated insulation? Are flexible cords and cables free of splices or taps?					
	Is sufficient access and working space provided and maintained about all electrical equipment to permit ready and safe operations and maintenance?					
<b>W</b>	<b>Electrical safety</b>					
<b>R</b>	<b>Hand/portable power tools</b>					
<b>RW, R (GEC)</b>	<b>Confined spaces</b>					
<b>R, W</b>	<b>Powered trucks/tractors</b>					
	Are only trained and authorized personnel permitted to operated the trucks or tractors? Explain training program.					
	Are procedures in place to ensure safe operation of trucks/tractors? (observing facility speed limits, maintaining safe distances from other vehicles and lift trucks/tractors, keeping trucks/tractors under control at all times, fuel tanks not filled with the engine running, proper placement of loads, arms/legs inside, no passengers, no standing under loads, brakes set when unattended, safe distance from edges, backing down inclines)					
	Are trucks/tractors examined before they are placed in service (at least daily)?					
	Are trucks/tractors clean and free from excess oil, grease?					
	Is storage and handling of gas and diesel fuel in accordance with NFPA Storage and Handling of Liquid Petroleum Gasses (NFPA No. 58-1992)?					
	Where general lighting is less than 2 lumens per square foot, is auxiliary directional lighting provided on the truck/tractor?					
	Is there sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.?					
<b>R</b>	<b>Cranes and hoists</b>					
	Are only designated persons permitted to operate cranes? How are designated persons trained, evaluated and documented?					
	Do cranes meet the specifications of ANSI safety code for Overhead and Gantry Cranes, ANSI B30.2.0?					
	Are all modifications checked by the manufacturer or qualified engineer, tested, re-rated and the new rated load displayed?					

	Is the rated load plainly marked on each side of the crane and each hoist?					
	Are trolley stops provided at the limit of travel, fastened to resist applied forces and of a height at least equal to the radius of the wheel, are bridge and trolley bumpers provided?					
	Are inspections performed both frequently (daily to monthly for operating systems, deterioration or leakage in hydraulic systems, hooks, hoists, chains, ropes) AND periodically (1 -12 month intervals for complete inspections, loose bolts, deformed/cracked/corroded members, cracks/worn sheaves and drums, brake systems, load/wind indicators, chain drive sprockets, electrical apparatus, etc.)?					
	Are all new or altered cranes tested prior to initial use?					
	Is there a preventative maintenance program in place, based on the manufacturers' recommendations?					
	Are slings NOT knotted or shortened with bolts, kinked, loaded in excess of their rated loads, securely attached to loads, padded from sharp edges of loads?					
	Are slings, fasteners and attachments inspected each day by a competent person?					
	Are defective/damaged slings removed from service immediately?					
	Is the rated capacity (or code) marked?					
	Are precautions taken to protect the sling from the environment, if necessary (vapors, sprays, mists, liquids, caustics, temperature)?					
<b>W</b>	<b>Fall protection</b>					
<b>W, S</b>	<b>Safety equipment inspection</b>					
<b>RW, R (GEC)</b>	<b>Lockout/tagout</b>					
	<b>Noise</b>					
<b>RW, S</b>	<b>Hearing conservation</b>					
<b>W</b>	<b>Lasers</b>					
<b>W</b>	<b>Radiation</b>					

	<b>Heat Stress</b>						
<b>I</b>	<b>Psychological stress</b>						
	<b>Violent patient</b>						
	<b>Workplace violence</b>						
<b>R</b>	<b>Compressed gas</b>						
	Are cylinders inspected to determine if they are in safe condition? (leaking, corroded, gouged, bulging, dents, greasy, rust, scale, neck threads)						
	Are cylinders securely stored in labeled areas with the caps on?						
	Are cylinders removed from service when defective?						
	<b>Fire protection/Flammables and Combustibles</b>						
	Are only approved, vented containers and portable tanks (<60 gal) used?						
	Are safety cans 5 gallons or less in volume (2 gallons for Class 1A)?						
	Where used or stored, are there ignition sources, heat, static or incompatibles?						
	Are liquid dispensing and transfer operations protected by grounding and bonding, spill collection devices?						
	Are metal storage cabinets used for flammables (100F) and combustibles (>100 F)? Approved and in good condition: 18 gauge steel, double walled with 1 ½ " air space, joints sealed, 3 point lock, door sill > 2" above bottom?						
	Do cabinets contain less than 120 gallons; <60 gal Class I (<100 F flash pt) or Class II (100-140F flash pt) and Class III (>140 flash pt)?						
	Are there less than 3 cabinets in an area? Separated by 100 feet or more?						
	Are all cabinets labeled: "Flammable – Keep Fire Away"?						
	<b>Portable Fire Extinguishers</b>						
	Are extinguishers mounted so they are readily accessible? (40 lb @ 5'; > 40 lb @ < 3 ½')						
	Are extinguishers kept in designated places at all times? (instructions facing outward)						

<b>S</b>	Are extinguishers maintained in a fully charged and operating condition?					
	Are portable fire extinguishers selected and distributed based on the classes of anticipated fires and size and degree of hazard? (Class A and D, 75' or less; Class B, 50' or less; Class C, within 10' of an inside storage area)					
<b>S</b>	Are visual inspections of hand held extinguishers conducted monthly; annual maintenance checks, and hydrostatic testing conducted as needed? (every 5 to 10 years or when corrosion of damaged) are the tags current?					
	Have employees been trained in the use of extinguishers and incipient fire fighting (initial and annual familiarization, proper use of designated to do so)?					
<b>RW</b>	<b>Bloodborne pathogens</b>					
	<b>Bloods, fluids, and sharps</b>					
	<b>Zoonotic disease</b>					
	<b>Animal to animal disease</b>					
	<b>Human to human disease</b>					
<b>R</b>	<b>Means of egress</b>					
	Are exits sufficient to permit the prompt escape of occupants in case of fire or other emergency?					
	Are exits clearly marked with illuminating signs, letters at least 6" high, 3/4" wide and strong contrasting colors?					
	Are exit and directional signs provided at each door, intersection, stairway, ramp and other locations as necessary to egress easy? Are deadends marked "Not an Exit"?					
	Are exits free of obstructions?					
	Do all exits discharge directly outside to an adequate space? (protected from vehicular traffic, free of ices and snow accumulation)					
	Where exits are through glass doors, are the doors fully tempered? Are doors that swing in both direction provided with viewing panels in each door?					
<b>RW</b>	<b>Emergency action plan/Fire prevention plan</b>					

<b>S</b>	Is there a written emergency action plan that includes: escape procedures and route assignments, procedures for critical equipment, rescue and medical duties, means of reporting emergencies, post-evacuation accounting procedures, names and titles of contacts for additional information?					
<b>S</b>	Is the plan kept at the workplace and available for review? Have all employees been informed of the plan?					
	Is there an alarm system in place? Is it distinctive?					
<b>S</b>	Are sufficient numbers of employees trained to assist in evacuations? Are they properly informed of the plan and their assignments?					
	Is spill containment and clean-up materials readily available and appropriate for the materials used at the facility?					
<b>S</b>	Is there a written fire prevention plan that includes the following: major fire hazards and controls, names or titles of personnel who maintain systems, names or titles of personnel responsible for control of fuel sources hazards, maintenance procedures for heat producing equipment?					
	Are accumulations of flammable/combustible waste controlled?					
<b>S</b>	Are employees apprised of the hazards and appropriate controls?					
<b>R (GEC)</b>	<b>Safety color code/signs &amp; tags</b>					
	Is red used for identification of fire protection equipment, emergency stop buttons, lights and barriers?					
	Is yellow used to demarcate caution and physical hazards such as falling, tripping, striking, etc.?					
	Are danger, caution and safety instruction signs in place where needed (chemical use, PPE, work instructions, flammable areas, etc.)?					
	Are danger signs red, black and white? Caution signs yellow with black letters? Safety instruction signs white with green or black letters?					
	Are accident prevention signs used as appropriate (LO/TO, confined space, etc.)?					
<b>R</b>	<b>First aid/Medical</b>					
<b>S</b>	Are medical personnel readily available for advice and consultation on matters of employee health?					



<b>S</b>	Is a clinic or hospital in close-proximity and used for treatment of injured employees?						
	Are first aid supplies readily available? Are they sufficient for the type of injury/illness anticipated? Have the contents been approved by a physician?						
<b>S</b>	Who is responsible for periodically inspecting and restocking the kits?						
	Are eyewash and deluge showers located for immediate use in areas where materials and processes warrant?						
<b>S</b>	Are the eyewash and deluge showers inspected and tested periodically? How often? Inspection documentation available?						
<b>R</b>	<b>Machine guarding</b>						
<b>R</b>	<b>Walking/working surfaces</b>						
	Are work sites clean, orderly and uncluttered?						
	Are surfaces kept dry, or if wet, platforms used or covered with slip resistant materials?						
	Are safe clearances present where mechanical handling equipment is used?						
	Are permanent aisles and passageways marked?						
	Are cover and/or guardrails provided over open pits, tanks, vats, ditches, etc.?						
<b>RW</b>	<b>Personal protective equipment</b>						
<b>S</b>	Has a hazard assessment been conducted to determine what hazards are present and selection based on the assessment? (records maintained, written certification, date, person certifying)						
<b>S</b>	Who is responsible for evaluating the need for PPE in the event of process/material changes?						
	Is adequate PPE supplied as needed: head, face, eye, foot, hand, respiratory, etc?						
	Do employees provide their own PPE? If so, is its adequacy, proper maintenance, and sanitation ensured by the employer?						
	Does all PPE meet ANSI standards?						
	Is defective PPE removed from service?						
	How is proper PPE usage enforced/ensured?						

	Is all equipment maintained in a sanitary condition ready for use? Are supplies adequate? Is PPE readily available to employees?					
<b>S</b>	Are employees trained (when PPE is necessary, what type, donning/doffing, limitations, care, maintenance, etc.)? is the training conducted when there are changes in PPE or operations, or if it is demonstrated that employees do not have adequate knowledge?					
<b>S</b>	Is a written certification that verifies that employees have received and understood the training (dates, subject)?					
	Is eye and face protection provided when flying particles, molten metal, chemicals, radiation, etc. are present? Are side shields used when there is a hazard from flying objects?					
	Is hearing protection provided when needed? Has initial monitoring been conducted?					
	Are warning signs posted at all entrances to areas with noise levels in excess of 90 dBA?					
	Are signs and labels posted on individual pieces of equipment as appropriate?					
	Are prescription lenses provided? Do employees with corrective lenses wear only approved safety glasses?					
	Is chemical protective clothing worn as needed?					
	Has chemical protective clothing been selected using manufacturer's permeation/degradation guides? Is selection documented?					
<b>RW</b>	<b>Respiratory protection</b>					
	Is the feasibility of engineering controls investigated prior to requiring respirators? Are such investigations documented?					
	Have standard written respirator procedures been developed? Do they address selection, fit testing, medical monitoring, use cleaning, maintenance and training, routine and possible emergency uses?					
	Is there a written employee respiratory training program?					
	Is the person issuing respirators trained to make the proper selection?					
	How are respirator cleaned, used and stored?					
	Is an adequate supply of respirators and associated parts maintained? Does a qualified person perform repairs?					
	Is fit testing conducted?					
	Are employees evaluated to ensure they are physically able to wear a respirator prior to use?					
<b>R</b>	<b>Controls (hazard prevention and control &amp; Hazard controls/chemical fume hoods)</b>					

	Are hazard controls or chemical fume hoods used properly (sash height, materials blocking slots, etc.)?					
	Gauges, monitors and alarms are operating correctly?					
	Chemical fume hood is clean and orderly?					
<b>S</b>	Is there a preventative maintenance program to ensure proper operation of the hazard controls/chemical fume hoods?					
<b>S</b>	Are the controls periodically checked to ensure proper operation?					
	Are feasible engineering controls in place?					
	Are effective safety and health rules and work practices in place?					
	Are applicable OSHA-mandated (or volunteer) programs effectively in place?					
	Is housekeeping properly maintained?					
<b>RW</b>	<b>Training</b>					
<b>I</b>	Do employees receive appropriate safety and health training?					
<b>I</b>	Does new employee orientation includes applicable safety and health information?					
<b>I</b>	Do supervisors receive appropriate safety and health training?					
<b>I</b>	Is safety and health training provided to managers?					
<b>W</b>	<b>Industrial hygiene monitoring</b>					
	<b>Administration and supervision</b>					
	Safety and health program tasks are each specifically assigned to a person or position for performance or coordination.					
	Each assignment of safety and health responsibility is clearly communicated.					
	Individuals with assigned safety and health responsibilities have the necessary knowledge, skills, and timely information to perform their duties.					
	Individuals with assigned safety and health responsibilities have the authority to perform their duties.					
	Organizational policies promote the performance of safety and health responsibilities.					
	Organizational policies result in correction of non-performance of safety and health responsibilities.					
<b>S</b>	<b>Planning and evaluation</b>					
	Workplace injury/illness data are effectively analyzed.					
	Hazard incidence data are effectively analyzed.					
	A safety and health goal and supporting objectives exist.					

	An action plan designed to accomplish the organizations safety and health objectives is in place.					
	A review of formal programs is conducted at least annually.					
<b>W, S</b>	<b>Health &amp; Safety project review</b>					
<b>W, S</b>	<b>Standard operating procedures</b>					
<b>R, W</b>	<b>Report/Record</b>					
	Is the OSHA poster displayed in a prominent place where all employees are likely to see it?					
<b>S</b>	Are supplemental records kept (injury/illness reports; incident investigations; workers' compensation)?					
	Is the OSHA Occupational Noise Exposure Standard posted?					
	Are operating permits and records current for elevators, air pressure tanks, boilers, etc.?					
<b>S</b>	Are employee training records current?					
<b>S</b>	Are medical records current?					
	Are records of required equipment inspections, confined spaces entry permits, hoists/cranes, etc. maintained?					
<b>I</b>	<b>Management leadership</b>					
	Top management policy establishes clear priority for safety and health.					
	Top management considers safety and health to be a line rather than a staff function.					
	Managers personally follow safety and health rules.					
	Managers delegate the authority necessary for personnel to carry out their assigned safety and health responsibilities effectively.					
	Managers allocate the resources needed to properly support the organizations safety and health system.					
	Managers assure that appropriate safety and health training is provided.					
	Managers support fair and effective policies that promote safety and health performance.					
	Top management is involved in the planning and evaluation of safety and health performance.					
	Top management values employee involvement and participation in safety and health issues.					
<b>I</b>	<b>Employee participation</b>					

	There is an effective process to involve employees in safety and health issues.					
	Employees are involved in organizational decision making in regard to safety and health policy.					
	Employees are involved in organizational decision making in regard to the allocation of safety and health resources.					
	Employees are involved in organizational decision making in regard to safety and health training.					
	Employees participate in hazard detection activities.					
	Employees participate in hazard prevention and control activities.					
	Employees participate in safety and health planning activities.					
	Employees participate in the evaluation of safety and health performance.					
<b>Miscellaneous Safety Concerns</b>						
	Do conditions exist where temperature extremes are encountered? Explain. What hazard controls are in place?					
	Do work conditions exist where it would be unsafe to work alone? Explain. What procedures are in place to address these conditions?					
	Do material handling situations exist where very heavy or awkward items are to be moved? Explain. What hazard controls are in place to address these conditions?					
	Do work conditions exist where potential cumulative trauma disorder hazards exist? Explain. What hazard controls are in place to address these hazards?					

Appendix C: Preliminary Hazard Assessment Matrix

Service Areas	Chemical Hazards										Physical Hazards													
	Tox./Haz. substances (x, NA)	Material handling/storage (0-3)	Spill response (0-3)	Sanitation (0-3)	Hazard Communication (0-3)	Chemical hygiene plan (0-3)	Ergonomic (x, NA)	Slips, trips, & falls (x, NA)	Electrical (x, NA)	Electrical safety (0-3)	Hand/portable power tools (x, NA)	Confined space (x, NA)	Powered trucks/tractor (x, NA)	Cranes & hoists (x, NA)	Fall protection (0-3)	Equipment inspection (0-3)	Lockout/tagout (0-3)	Noise (x, NA)	Hearing to reservation (0-3)	Lasers (x, NA)	Radiation (x, NA)	Heat stress (x, NA)	Violent patient	
<b>Overall</b>	0	2	2				1					2	0		1									
2003 Audit																								
2009 Audit	3x,14x	x	x	0	1	x		22x				0	x	x	x	0		0	x					
<b>Administrative:</b>																								
Reception/ Call Center/Business Office / Medical Records	x	3	0	3	1	0	x	x	x	2	NA	NA	NA	NA	NA	NA	NA	0	NA	NA	NA	NA	x	x
Maintenance	x	2	0	1	2	0	x	x	x	1	x	x	x	0	1	0	x	1	NA	x	x	x	x	x
Custodial/Animal Care	x	2	0	1	2	0	x	x	x	1	NA	x	NA	0	1	0	x	1	NA	x	x	x	x	x
Custodial/Barn Animal Care	x	2	0	2	2	0	x	x	x	1	x	NA	x	NA	0	2	1	x	1	NA	x	x	x	x
<b>General Hospital Services</b>																								
Pharmacy	x	1	1	0	1	0	x	x	x	2	NA	x	x	NA	0	NA	x	0	NA	NA	NA	NA	x	x
Central Supply	x	2	0	2	2	0	x	x	x	1	x	x	NA	NA	2	0	x	0	NA	NA	x	NA	x	x
<b>Clinical Services</b>																								
Anesthesia	x	2	0	2	1	0	x	x	x	1	NA	x	NA	x	2	NA	x	0	x	x	NA	x	x	x
Critical/Urgent Care	x	2	0	3	1	0	x	x	x	2	NA	NA	NA	NA	0	NA	x	0	NA	NA	NA	x	x	x
Ophthalmology	x	2	0	2	2	0	x	x	x	2	NA	NA	x	NA	1	NA	x	0	x	x	x	x	x	x
Dermatology	x	3	0	2	0	0	x	x	x	2	NA	NA	NA	NA	0	NA	x	0	x	x	NA	x	x	x
Neurology	x	2	0	2	1	0	x	x	x	1	x	NA	NA	NA	NA	NA	x	0	NA	x	NA	x	x	x
Livestock	x	2	0	2	1	0	x	x	x	2	x	NA	x	NA	1	0	x	0	NA	NA	x	x	x	x
Equine	x	2	0	2	2	0	x	x	x	1	x	NA	x	NA	0	NA	x	0	NA	NA	x	x	x	x
Small animal medicine	x	2	0	2	2	0	x	x	x	2	x	NA	NA	NA	0	NA	x	0	NA	NA	NA	x	x	x
Small animal surgery	x	3	0	2	1	0	x	x	x	1	x	NA	NA	NA	1	NA	NA	NA	NA	NA	x	x	x	x
Oncology	x	2	2	2	1	0	x	x	x	2	x	NA	NA	NA	0	0	x	0	NA	x	NA	x	x	x
Exotics (Zoo Med.)	x	2	0	2	2	0	x	x	x	0	x	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	x	x	x
Clinical Pathology	x	3	2	3	1	0	x	x	x	3	NA	NA	NA	NA	0	NA	x	0	x	NA	NA	NA	x	x
Dentistry	x	3	0	2	2	0	x	x	x	1	x	NA	NA	NA	1	NA	x	0	NA	x	NA	NA	x	x
Large Animal Surgery	x	2	0	2	1	0	x	x	x	1	x	x	x	NA	1	0	x	0	x	x	NA	NA	x	x



Administration										
Leadership (0-3)										
Employee involvement (0-3)										
# Hazards (out of 19)										
# practices present of 28 (1-3)										
# possible (out of 30)										
# present/# possible										
Total sum (out of 90 if no NAs)										
Total score/number present										
Average quality of noteworthy practices										
Risk										
10	15	24	63%	28	2	2	Okay	Med		
18	19	28	68%	27	1	1	Minimal	Ser		
14	17	26	65%	27	2	2	Okay	Ser		
16	16	26	62%	20	1	1	Minimal	Hi-Se		
13	14	25	56%	16	1	1	Minimal	Ser		
15	18	27	67%	25	1	1	Minimal	Hi-Se		
16	17	25	68%	25	1	1	Minimal	Ser		
12	18	25	72%	29	2	2	Okay	Ser		
16	17	25	68%	25	1	1	Minimal	Ser		
13	13	25	52%	21	2	2	Okay	Ser		
13	16	24	67%	25	2	2	Okay	Me-Se		
16	19	27	70%	29	2	2	Okay	Hi-Se		
15	17	25	68%	27	2	2	Okay	High		
13	15	25	60%	23	2	2	Okay	Ser		
13	16	24	67%	25	2	2	Okay	Me-Ser		
14	18	26	69%	27	2	2	Okay	Hi-Se		
13	14	24	58%	20	1	1	Minimal	Ser		
11	18	25	72%	34	2	2	Okay	High		
13	17	25	68%	26	2	2	Okay	Ser		
19	19	27	70%	25	1	1	Minimal	Ser		



Appendix D: Risk Assessment Matrix

Probability of OCCURRENCE or EXPOSURE for selected unit of time or activity	<b>CATASTROPHIC</b> Death or permanent total disability	<b>CRITICAL</b> Disability in excess of 3 months	<b>MARGINAL</b> Minor injury, lost workday incident	<b>NEGLIGIBLE</b> First Aid or Minor Medical Treatment
<b>Frequent</b> Likely to occur repeatedly	<b>SERIOUS</b> Immediate action should be taken	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time
<b>Probable</b> Likely to occur several times	<b>SERIOUS</b> Immediate action should be taken	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time
<b>Occasional</b> Likely to occur sometime	<b>SERIOUS</b> Immediate action should be taken	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary
<b>Seldom</b> Not likely to occur	<b>HIGH</b> High priority remedial action	<b>MEDIUM</b> Take remedial action at appropriate time	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary
<b>Improbable</b> Very unlikely-may assume exposure will not happen	<b>MEDIUM</b> Take remedial action at appropriate time	<b>LOW</b> Risk acceptable: remedial action discretionary	<b>LOW</b> Risk acceptable: remedial action discretionary	<b>LOW</b> Risk acceptable: remedial action discretionary

Appendix E: Hazards Noted in Interviews and Walkthroughs.

		Hazards																										
		Toxic & Hazardous Substances	Ergonomics	Slips, Trips and Falls	Electrical	Hand/Portable Power Tools	Confined Space	Powered trucks/tractor	Cranes & hoists	Noise	Lasers	Radiation	Heat stress	Violent Patient	Workplace Violence	Compressed Gas	Biohazardous pathogens	Bloods, Fluids, Sharps	Zoonotic Disease	Human to human	Burns and clothes catching on fire from welding	Steam from autoclave	Allergic to allergens	Hydraulic Equipment	Students	Aerosolized Bacteria		
Service Areas	Reception/ Call Center/Business Office/ Medical Records	W	W, I	W, I	W									W, I	W	W	W	W, I	W									
	Maintenance	W, I	W, I	W, I	W	W, I	W	W, I	W	W	W	W	W, I	W	W	W	W	W	W	W	I							
	Custodial/Animal Care	W, I	W	W, I	W	W, I			W		W	W	W	W	W	W	W	W, I	W									
	Custodial/Barn Animal Care	W	W	W	W	W		W		W	W	W	W	W	W	W	W	W	W	W								
	Pharmacy	W, I	W, I	W	W	W	W		W				W	W		W	W	W	W	W								
	Central Supply	W, I	W	W	W	W	W	W		W		W		W	W	W	W	W, I	W	W		I						
	Anesthesia	W, I	W, I	W	W		W		W	W, I	W	W, I		W, I	W	W	W	W, I	W	W								
	Critical/Urgent Care	W, I	W, I	W	W				W					W, I	W	W	W, I	W	W, I	W								
	Ophthalmology:	W, I	W, I	W	W	W		W	W	W	W	W	W	W, I	W		W	W, I	W, I	W								
	Dermatology	W	W, I	W	W				W	W	W	W		W, I	W		W	W, I	W, I	W			I					
	Neurology	W, I	W, I	W	W	W				W		W		W	W	W	W	W	W	W								
	Livestock	W, I	W, I	W	W, I	W		W	W	W			W	W, I	W	W	W	W	W	W						I	I	under violent patient
	Equine	W, I	W, I	W	W	W		W, I	W			W	W, I	W	W	W	W	W	W, I	W								not specified
	Small animal medicine	W, I	W, I	W	W	W			W				W, I	W	W	W	W	W, I	W	W								
	Small animal surgery	W	W	W	W	W						W		W	W	W	W	W	W	W								
	Oncology	W, I	W	W	W	W			W		W		W, I	W	W	W	W	W	W, I	W								
	Exotics (Zoo Med.)	W	W	W	W	W				W, I			W, I	W	W	W	W	W, I	W, I	W								
	Clinical Pathology	W, I	W	W	W				W, I	W				W		W, I	W, I	W, I	W, I	W								
	Dentistry	W, I	W	W	W	W			W, I		W, I			W	W	W	W	W	W, I	W							I	under zoonotic
	Large Animal Surgery	W, I	W, I	W	W	W	W	W	W	W		W, I	W	W, I	W	W	W	W, I	W	W			I					crushed toes, only ID confined and lo/to

Note: "W" was a hazard noted during the walkthrough, and "I" was a hazard noted during the interview.

Appendix F: Interview Responses to Types of Training.

Training		None	Pre VTH	Pre Hire Reqs.	Reactive Training	Not Specified	EHS/Campus Training	Reading	Verbal	Video	Hands on	
Service Areas	Reception/ Call Center/Business Office/ Medical Records	x					x					
	Maintenance			x	x	x	x				x	
	Custodial/Animal Care									x		
	Custodial/Barn Animal Care											
	Pharmacy	x			x							
	Central Supply	x						x		x		
	Anesthesia	x	x					x				
	Critical/Urgent Care											
	Ophthalmology:	x	x							x		
	Dermatology		x				x			x	x	
	Neurology				x				x			
	Livestock			x	x					x		
	Equine	x	x									
	Small animal medicine										x	
	Small animal surgery											
	Oncology			x							x	
	Exotics (Zoo Med.)									x		x
	Clinical Pathology						x		x	x	x	
	Dentistry		x					x				
	Large Animal Surgery						x		x		x	
Type	None	Pre VTH	Pre Hire Reqs.	Reactive Training	Not Specified	EHS/Campus Training	Reading	Verbal	Video	Hands on		

Appendix G: Interview Results Pertaining to Controls.

		Controls							SUGGESTIONS
		Elimination	Substitution and/or Dilution	Engineering	Administrative	PPE	Common Sense, 'Awareness', 'Communication'	Reactive controls (Spill kits, eyewash/showers)	
Service Areas	Reception/ Call Center/Business Office/ Medical Records	x	x			x			
	Maintenance		x	x		x			Think and be cautious
	Custodial/Animal Care					x			
	Custodial/Barn Animal Care								
	Pharmacy			x	x	x		x	Equipment for powders
	Central Supply				x	x	x		
	Anesthesia			x	x	x	x		
	Critical/Urgent Care		x	x	x	x	x		
	Ophthalmology:		x	x	x	x			Wants formal training. Wear mask on one month cleaning spree
	Dermatology			x	x				Replace all tables with hydraulic tables. More hand sanitizers
	Neurology			x		x			
	Livestock				x	x			
	Equine				x				Better patient assessment.
	Small animal medicine			x	x				Does not want more controls
	Small animal surgery								
	Oncology								
	Exotics (Zoo Med.)				x				More training on handling exotic species
Clinical Pathology				x	x	x			
Dentistry					x			Check ventilation in the room.	
Large Animal Surgery					x	x			

Appendix H: Highest Risk Identified by Interviewees.

		Violent Patients	Zoonotic Disease	Sharps	Ergonomics	Chemotherapeutic Drugs	Chemicals (Virkon powder)	Students (improper restraint)	Welding	Papercuts
<b>Service Areas</b>	Reception/ Call Center/Business Office/ Medical Records				x					x
	Maintenance	x						x		
	Custodial/Animal Care			x						
	Custodial/Barn Animal Care									
	Pharmacy					xx				
	Central Supply			xx						
	Anesthesia	x			x					
	Critical/Urgent Care	x			x					
	Ophthalmology:	xx								
	Dermatology	x	x							
	Neurology	x								
	Livestock						x	x		
	Equine	x								
	Small animal medicine	x								
	Small animal surgery									
	Oncology	x								
	Exotics (Zoo Med.)		x							
	Clinical Pathology		x	x						
	Dentistry		x							
	Large Animal Surgery	xx								

Appendix I: Answers to the Interview Question "Do you feel there is protection and continual improvement of health and safety?"

		Yes	Yes, but only recently	With one or some things	Not sure	Not really	No
<b>Service Areas</b>	Reception/ Call Center/Business Office/ Medical Records	xx					
	Maintenance	xx					
	Custodial/Animal Care			x			
	Custodial/Barn Animal Care						
	Pharmacy		x	x			
	Central Supply		x	x			
	Anesthesia	x		x			
	Critical/Urgent Care			x			x
	Ophthalmology:			x		x	
	Dermatology				xx		
	Neurology			x			
	Livestock	x		x			
	Equine						x
	Small animal medicine					x	
	Small animal surgery						
	Oncology		x				
	Exotics (Zoo Med.)	x					
	Clinical Pathology		x		x		
	Dentistry			x			
Large Animal Surgery			x		x		

Appendix J: Answers Pertaining to the Interview Question Relating to the Involvement of Employees in the Health and Safety Aspect at the VTH.

		Both Levels	VTH Level	Dept. Level	Would like to, but don't feel people listen	No, and would like to be	Only with going to director's office with issues	No, and would not like to be
<b>Service Areas</b>	Reception/ Call Center/Business Office/ Medical Records			xx				
	Maintenance	x			x			
	Custodial/Animal Care	x						
	Custodial/Barn Animal Care							
	Pharmacy	x		x				
	Central Supply		x			x		
	Anesthesia						xx	
	Critical/Urgent Care				x		x	
	Ophthalmology:					xx		
	Dermatology						x	x
	Neurology	x						
	Livestock		x	x				
	Equine						x	
	Small animal medicine	x						
	Small animal surgery							
	Oncology			x				
	Exotics (Zoo Med.)						x	
	Clinical Pathology	x		x				
Dentistry			x					
Large Animal Surgery						xx		