

Controlling the Risk of "Slip and fall" Injuries
in Military Dining Facilities

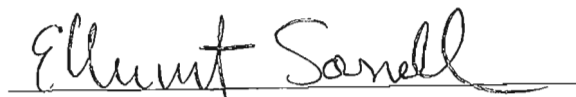
by

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A handwritten signature in black ink, reading "Elliott Sandell", written over a horizontal line.

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Abstract

The purpose of this study was to evaluate and control slip and fall injuries in military managed dining facilities. Data averages from cooking/serving areas, kitchen/fryer areas, dish/pot washing areas, kitchen/preparation areas, and public/patron eating areas were gathered to evaluate the extent to which dining facilities' coefficient of friction (COF) compared to the Occupational and Safety Health and Administration (OSHA) standard. The COF from the dining facilities in buildings 50, 606, 1306 and 2674 were measured. Open-ended and close-ended surveys were conducted at Ft. Lewis, WA and Fort McCoy, WI to determine the “root cause” of employee accidents. The ASM 725 slip meter was used to calculate the average COF of the flooring material in the dining facilities from January 13, 2010 to April 17, 2010. The COF averages for the first two months were not in compliance with OSHA standards. However all of the dining facilities COFs were in compliance with OSHA in the third month. Based on previous incidents from the organization, and results from surveys it was determined that the

organization's housekeeping procedures were in nonconformance, and that top management needed to establish, implement and maintain procedures for dealing with potential nonconformities, taking corrective action, and taking preventive action. It was also recommended that the military provide the proper personnel protective equipment (PPE) such as footwear for contractors that work in dining facilities.

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Chapter I: Introduction

Since 2001, the Casualty Insurance Provider Carrier (CNA, 2007) has identified restaurant patron slips and falls as the leading source of general liability (GL) claims. Restaurant slips and falls injure more than three million food service employees in the civilian sector. According to the National Floor Safety Institute (NFSI), the food service industry spends over two billion dollars on such injuries each year with injuries increasing 10% annually. According to the National Restaurant Association (NRA), slips and falls are the greatest source of GL claims within the restaurant industry. The Commercial Property and CNA loss results mirror the NRA injury statistics. The National Safety Council (NSC) states “Slip and fall injuries continue to be the leading source of GL losses incurred by our policyholders” (NSC, 2007, p. 10). Recognizing this fact, many organizations and businesses in the civilian sector have attempted to reduce this threat in the workplace (CNA).

While the civilian sector has attempted to reduce or even eliminate these threats, the military has taken few, if any, steps to improve workplace conditions in food service operations. In the event that an incident does occur, the military does not have an obligation to report slip and fall injuries to the NFSI. By adopting many of the same principles that the civilian sector has created to minimize slips and falls in food service operations, the military can greatly reduce these incidents in the workplace.

The military can emulate the civilian sector by improving poor floor conditions, poor visibility, lack of or poor condition of handrails and guardrails, poor accessibility, and lack of slip resistant walking surfaces. New procedures need to be in place with systematic auditing techniques that aid management in objectively identifying poor conditions that cause slip and fall accidents. Furthermore, since the primary issue for the military is worker slip and fall accidents, the study sampling was limited to work areas of the dining facilities where workers primary risk

exposure is from slip and falls.

Statement of the Problem

The number of falls in military dining facilities is problematic. These falls result in injuries, increased costs and decreased readiness of the forces.

Purpose of the Study

The purpose of this research was to develop a protocol to minimize conditions which lead to slips and falls in the workplace. The objectives of this study are to:

1. Identify the task which contributes to slips and trips hazards.
2. Identify processes which minimize risk to workers slip & fall accidents.
3. Evaluate the static coefficient of friction (SCOF) in dining operations as measured under conditions according to OSHA.
4. Clarify the consequences of slips and falls on wet and slippery surfaces, and the need to design the proper foot wear to prevent injuries from re-occurring.

Limitations of the Study

1. The lack of military standards limits the incorporation of legal requirements for reporting slip and fall injuries to the NFSI.
2. This study is limited to only slip and fall accidents in dining operations and does not take into account other types of injuries.
3. The lack of reported research on the topic within the different branches of the armed services also limited this study.

Definition of Terms

1. **Slip, trip and fall hazard.** Slip: Where there is too little friction or traction between your feet (footwear) and walking or working surface, and you lose your balance. Trip: When your foot (or lower leg) hits an object and your upper body continues moving, throwing you off balance. When you step down unexpectedly to a lower surface (misstep) and lose your balance, e.g., stepping off a curb. Fall: Occurs when you are too far off your center of balance.
2. **Minimize risk to workers slip and fall accidents.** Clean all slips immediately, marking spills and wet areas, mopping or sweeping debris from floors, removing obstacles from walkways and always keeping them free of clutter, securing (tacking taping, etc.) mats, rugs and carpets that do not lay flat, keeping working areas and walkways well lit, replacing used light bulbs and faulty switches.
3. **Static coefficient of friction (SCOF).** SCOF is the coefficient of friction value measured as two surfaces just begin to move against each other.
4. **Consequences of slips and fall.** Worker: pain, lost wages, temporary or permanent disability, reduced quality of life, depression. To employer: loss in productivity and business, increased industrial insurance premiums, costs associated with training replacement worker and cost of medical treatment.
5. **Purpose of designing proper footwear.** Properly fitting footwear prevents fatigue which, in turn, improves safety for the employee.

Chapter II: Literature Review

This chapter examines and evaluates slips, falls, and associated injuries which are common under the conditions in military dining facilities. The literature review includes the followings:

1. Overview of Slip and Fall Injuries
2. Reducing Risk with Preventative Measures
3. Reducing Risk with Proper Footwear
4. Effective Control Measures to Minimize Risk
5. Examine to quantify and eliminate slip potential in the workplace

Overview of Slip and Fall Injuries

The number of injuries from slips and falls in military dining facilities is problematic. The Casualty Insurance Provider Carrier (CNA, 2007) identified slips and falls as the leading source of general liability (GL) claims since 2001. Furthermore, the cooks in our military dining facilities with injuries from slips and falls receive time off from work for physical therapy. Their absence affects the mission and readiness of the organization and increases the stress on the remaining workforce.

Military dining facilities on Fort Lewis, Washington, and Fort McCoy, Wisconsin conducted surveys to provide information on the relationship between the severity of slips and falls and the quality of footwear and personnel protection equipment to the Quartermaster Management Plan. The survey will also provide one source of data to assist in planning, management decisions, and recommendations for the development of standard operating procedures. Hopper Oliver states, "Falls are common for soldiers and problematic for supervisors and staff of the dining facilities, the hospitals that treat them, and most importantly,

the injured person” (Oliver, 2000, p.10). Slips are the reported cause of approximately 30% of all falls causing fractures and closed head injuries. According to Hopper Oliver, “Head traumas like these are the most worrying since such trauma may significantly impair rehabilitation and long-term functionality for soldiers,” (Oliver, p. 12). Impaired rehabilitation both increases the length of stay in the hospital and the amount of long-term care provided by U.S. Army medical facilities (Oliver, p. 14). The health and wellness of the soldier is placed in direct risk without proper implementation of slip and fall management.

Falls can become a financial burden for taxpayers as well as increasing costs in training our force. There is an ever growing list of reasons why this is important. First, complaints can lead to congressional or media inquiry and litigation against those responsible. Second, patients’ relatives often suffer anxiety and anger because they feel that a fall should not have happened in a place where the working conditions are supposedly safe. Third, the feeling that someone must be at fault could make the leadership feel guilty and more focused on their liability than on meeting the mission requirements (Oliver).

For all these reasons, there has been an increasing focus on risk management to prevent falls and a feeling that something must be done. Such pressure creates a need for better guidance and policies on good practices to prevent falls and injury, or alternatively implement fall prevention policies based on having a healthy and readiness force (Oliver). Along with this pressure, it is important to note that many falls are an inevitable consequence of poor judgment that can induce physiological risk associated with acute medical illness, or with incidental cognitive impairment and pace instability allied to an unfamiliar environment (Oliver).

A zero-fall incident goal would motivate soldiers to practice safety and enforce standards in the workplace. The Army Regulation 385-10 has implemented additional vehicle training for

accidents where the vehicle rolls over. Implementation of similar training to help prevent slip and fall accidents can help lower the cost of rehabilitation (Army Regulation, 2007). However, even with the zero-fall goal accidents will still occur and it is extremely important that the leadership instills confidence by demonstrating that there is a risk management plan in place (Army Regulation).

According to the National Safety Council (NSC, 2007, p.18) regarding slips & falls in the workplace, their goals are to:

- Identify the impact of slips, trips and falls in the workplace.
- Recognize the various types of slips, trips and falls
- Recognize the OSHA regulations and other industry standards relating to slips, trips and falls
- Recognize the slip, trip and fall hazards
- Identify actions you can take to prevent slips, trips and falls

The NSC discusses human factors increasing the risk of slips, trips and falls. Some of the health and physical condition can impair a person's vision, judgment, and balance; they are:

- Eyesight, visual perception
- Age
- Physical state, fatigue
- Stress, illness
- Medications

The National Safety Council (NSC, 2007) describes behaviors as reactions you choose and control which can contribute to a slip, trip and fall injury; if you set yourself up for one.

Also, carrying or moving cumbersome objects can obstruct your view, impair your balance, and

prevent you from holding onto handrails. Poor housekeeping in workplaces allows clutter to accumulate, such as not maintaining clean dry floors, etc.; also using improper cleaning methods such as incorrectly using wax or polish or trying to clean up grease spill with water. Not using signage when slip or trip hazards exist is not in compliance with the Occupational Safety and Health Administration (OSHA). Inattentive behavior can be a cause in accidents, such as employees walking distractions such as using a cell phone, talking and not watching where you are going. Also, accidents occur from taking shortcuts such as not using walkways or designated cleared pathways, being in a hurry, and rushing around.

Reducing Risk with Preventative Measures

Slips happen where there is too little traction between the footwear and the walking surface. Common causes of slips are: wet and oily surfaces, occasional spills, weather hazards, loose unanchored rugs or mats, and flooring or other walking surfaces that do not have same degree of traction in all areas (OSHA). Trips happen when your foot collides or strikes an object causing you to lose balance and fall. Common causes of tripping come from obstructed view, poor lighting, clutter, wrinkled carpeting, uncovered cables, open bottom drawers and uneven steps, thresholds, and other walking surfaces (OSHA).

How can falls from trips and slips be prevented in the workplace? C. Jensen (Jensen, 1982) explains that taking the time to secure any and all carpeting and ensuring to properly maintain and clean floors throughout the workday can prevent falls in the workplace. This shows that excellent housekeeping standards, improving the quality of walking surfaces (flooring), selection of proper footwear, and appropriate pace of walking are critical for preventing fall accidents (Jensen, 1982).

Oliver (2000) also maintains that good housekeeping in the workplace is the fundamental step in preventing falls due to slips and trips. He goes a little further and includes the following:

- Cleaning all spills immediately
- Marking spills and wet areas
- Mopping or sweeping debris from floors
- Removing obstacles from walkways and always keeping them free of clutter
- Securing (tacking, taping, etc.) mats, rugs and carpets that do not lay flat
- Always closing file cabinet or storage drawers
- Covering cables that cross walkways, keeping working areas and walkways well lit
- Replacing used light bulbs and faulty switches

Without good housekeeping practices, any other preventive measures such as installation of sophisticated flooring, specialty footwear or training on techniques of walking and safe falling will never be fully effective (Oliver, 2000). One way to prevent all of the hazards would be to make a checklist for the kitchen manager or regional manager to look for when he or she is walking through the kitchen (Oliver, p. 32). Changing or modifying walking surfaces is the next level of preventing slip and trips. OSHA recommends and requires recoating or replacing floors, installing mats, pressure-sensitive abrasive strips or abrasive-filled paint-on coating and metal or synthetic decking can further improve safety and reduce risk of falling. “One way to make sure floors are always kept clean is by assigning someone, preferably the wash person, to clean the floor once every hour or two” (Oliver, p.23). However, it is critical to remember that high-tech flooring requires good housekeeping as much as any other flooring. In addition, resilient, non-slippery flooring prevents or reduces foot fatigue and contributes to slip prevention measures (OSHA).

The American Society for Testing and Materials (ASTM, 2000) form 1964-09 is a standard guide for composing walkway surface investigation and evaluation, also incident reporting forms for slips, stumbles, trips, and falls. It is intended to aid individuals or entities in the development of their own special reporting system by providing recommendations and data. It is recognized that a user may use this guide in its entirety or may extract only those segments providing the level of information required.

Depending on the intended use, a report form may be designed to be used alone or as a supplement to or incorporated within another report form (ATSM, 2000). However, this guide is not a final report form. It lists items considered appropriate for inclusion into a questionnaire, document, or report according to ASTM. Potential users include persons interested in the prevention and investigation of slip, trip, stumble, and fall phenomena, such as insurance company loss control specialists, industrial and commercial safety professionals, plant and facilities management personnel, forensic engineers, and research personnel concerned with factor correlation, statistics acquisition, loss control, and cost control. Data on record maintenance may be of special interest in the preparation of documents for firms seeking the International Organization for Standardization (ISO) 9000 certification.

Reducing Risk with Proper Footwear

Footwear is a vital part of safety in the workplace (OSHA). In workplaces like dining facilities, where employees spend the majority of their time on their feet, floors may become oily or wet despite the housekeeping measures (OSHA). To reduce risk during such an occurrence, preventative measures should also focus on selecting proper footwear. Since there is no footwear with anti-slip properties for every condition, consultation with manufacturers is highly recommended. Most restaurants require employees to purchase slip-resistant shoes from a

specific, certified manufacturer with a good warranty. There are also restaurants that require the employee to sign a waiver if they protest the purchasing of slip-resistant shoes. Properly fit footwear increases comfort and prevents fatigue which, in turn, improves safety for the employee (OSHA, 2008, p. 45). Along with properly fitting shoes there is also the mechanics of walking to consider. Walking and most other motions of the whole body involve the body's center of mass. Barrett Miller states "this theoretical area, commonly called the center of gravity (COG) which is related to footwear, is the balance point around which a movement operates" (Miller, 1998, p. 12).

While complex measurements are necessary to determine the exact location of the center of gravity, it is estimated that the COG in the average person who is standing about 55% of the distance between the floor and the person's height when viewed from the side (Miller, 1998, p. 16). The location of the center of gravity affects the way a person walks and falls, which may even affect the severity of the fall. When walking, the center of gravity moves alternately over the right and left foot. The average human walking pattern is called "striding bipedalism" because humans stand and walk with two feet in contact with the walking surface (Miller, 1998, p. 23). Relating this to falling in the workplace, this could show that some people are more prone to falling due to a higher or lower center of gravity or because they become unbalanced when transitioning from non-slick to slick surfaces.

Effective Control Measures to Minimize Risk

Effective control measures are another major factor in reducing slip and fall incidents (Miller, 1998). It is important to remember that while safety is a collective effort, it is the employers' responsibility to provide a safe work environment for all employees. These controls include: 1) creating checklists for employees to complete during their shift; 2) increasing the

inspections of the work area and 3) setting and enforcing consequences for employees that fail to meet the standards. OSHA recommends reducing the risk of slipping by decreasing contributing factors associated with employee error. This means employees should be encouraged to have situational awareness about their area of operations, to pay attention to where they are going, adjusting their stride to a pace suitable for the walking surface and their tasks, walking with the feet pointed slightly outward, and making wide turns at corners. One can reduce the risk of tripping by taking some simple measures like making sure that installed light sources provide sufficient light for tasks or using a flashlight if entering a dark room. Another simple measure is ensuring that things you are carrying or pushing do not prevent you from seeing any obstructions, spills, etc (OSHA).

Eliminate Slip Potential in the Workplace

According to the American National Standards Institute (ANSI), slip resistant floor treatments are supposed to prevent accidents (ANSI). That is important to employers and property owners because slip and fall accidents have been a significant cause of injuries. Evaluating the effectiveness of slip resistant however, has been largely a matter of trial and error because there has been no reliable method to gauge their performance scientifically. However, that is changing according to ANSI.

The American National Standards Institute (ANSI) B101 committee on slip, trip and fall prevention has released the nation's first ever floor safety standard designed to prevent worker slips and falls. According to ANSI, the standard enables property owners, insurers and flooring manufactures to better measure the risk of a slip and fall and, in turn, prevents such accidents. "This new standard reflects more than a decade of research by the National Floor Safety Institute

(NFSI) and is the first step in reducing unintentional slip and fall related injuries,” (ANSI, 2005, p. 45).

In 2007, the Center of Disease Control and Prevention (CDC) estimated that 2.2 million Americans sought emergency room treatment for an accident fall, making falls the leading cause of emergency room visits in the U.S. Using the new standard, a walkway’s slip resistance can be measured and categorized into one of three traction ranges: high, moderate or low. Floors categorized as high traction present a low risk of a slip and fall while moderate and low traction floors present an evaluated risk.

Summary

It is important to understand that the workplace can be a hazardous area to work in. Of the many different causes of on the job injuries, one of the most common is slipping and falling. Simple measures like making sure those workers wear the proper and approved foot wear and being conscientious of the manner of walking while at work could potentially save much trouble on down the road. Ultimately any injury sustained at work will come out of the taxpayers’ dollars in one way or another.

Chapter III: Methodology

The purpose of this research was to develop a protocol to minimize conditions which lead to slips and falls in military dining facilities. The focus of this preliminary study summarizes current research, practices, and regulations regarding walking/working surface slipperiness and coefficient of friction (COF) measurements. The methodology and data were reviewed from three aspects:

1. The biomechanics of walking and psycho-physiological factors involved in slips and falls studied by the scientific community,
2. Various measuring device model 725 slip meter and methods developed in an attempt to quantify the “slipperiness” of walking/working surfaces, and
3. An acceptable quantitative standard for the “slipperiness” of surfaces and the impact of the Americans with Disabilities Act (ADA) on such a standard.

Unresolved issues related to slip-resistance were identified. A multifaceted approach and synergy from researchers, the building industries, standards organizations, and government are needed to obtain consensus on such issues.

Data Required

The data required consists of accidents during the previous year (injuries that occurred during free body motion such as bending, climbing, reaching, standing, sitting, or slipping or tripping). Also, the type and age of footwear, the place of procurement, and the number of slip and fall incidents, and the severity of the incidents.

The installation food program managers at Fort McCoy gathered information on workers working eight to twelve hours a day. The sample population was every employee in the four main dining facilities on Fort McCoy; twenty surveys per facility for a total of 160 respondents.

Methods

The ASM 725 Slip Meter (American Slip Meter, Inc.) was used to measure the static coefficient of friction (SCOF) of various floor conditions, which was conducted at Ft. McCoy dining facilities. The ASM 725 Slip Meter was used to obtain the coefficient of friction (COF) readings. The meter is operationally calibrated prior to the readings being taken. The meter is fitted with neolite pads and is pulled across the surface being tested. The readings are recorded.

The first test was measured under dry conditions in the dining area. The second test was conducted around the kitchen area, were the fryers and cooking areas. The third test was conducted in the dishwashing areas.

The managers of each facility at Ft. Lewis and Ft. McCoy received the surveys with instructions to have the manager administer the survey and return the completed packets to the surveyor. Surveys used numeric scale tests with answers on a scale of 1 to 5. Each survey also contained an open-ended questionnaire. There was an identification number on each survey in order to keep the responses from each dining facility separate. A privacy disclaimer on the front of each survey allowed for informed consent. The facilities will administer the survey two additional times (the second week of the next two months) in order to track any changes in employee footwear and the number of slip and fall incidents (Appendix A, and B).

The process for categorizing the responses to an open-ended question (Appendix A) was to group each response with similar responses. The survey schedule took into account various weeks, days of the week, times of day, activities and locations. The most often mentioned responses to open-ended questions are presented in table format, similar to the closed-ended (multiple choice type questions), in the results section of this report (Appendix B). In general, open-ended questions were included because they tend to elicit the strongest and most important

responses from workers. They also lead to a relatively wide range of detailed responses and gave the respondents an opportunity to express their opinion on important issues the numerical survey may have missed. Employees filled out the survey on-site and handed them back to the manager. Employees unable to fill out the survey on-site could also choose to either mail or hand-carry the filled-out survey to the manager's office.

Data Analysis

The main purpose of the survey was to relate the quality of footwear to the amount and severity of injuries in military dining facilities. The data from the survey collected brand shoes was slip resistant shoes (Sketchers, Nike) and tread safe brands (Brahma, Fast Track). The age of the shoe can vary, depending on the cost and wear along the comfortableness for the employee. The managers concern is that the employees have black, slip resistant shoes. The dining facility has three shifts, in which the employees along with is the brand, age, and method of procurement of each employee's footwear along with the number of slips and falls. For the open-ended questions, workers will need to list their daily activities including food preparation, using fry stations which consist of storing, handling and disposing of hot cooking oil; using grilling stations, gas fryers which consist of changing oil and waste oil because the type of jobs done determines their risk for slips and falls, and footwear performs differently in various conditions.

Once surveyed, this data grouped according to age and sex will help determine which brand of footwear has the lowest rate of slips across the board. Example: The oil tank containers create the majority of slippery surfaces in the facility during routine usage. Brand "A" (slip resistant) is the leading brand in preventing slips in wet conditions, but Brand "B" (tread safe) is better at dealing with oily surfaces. After analysis, the data will allow recommendations to be

made for the standard footwear to be worn based upon the occupational risk of each employee (Example: Employee "A" deals primarily with wet conditions in the dish room, so they need to wear Brand X. Employee B deals primarily with the deep-fryers, so they need to wear Brand Y). Numerous slip tests were conducted during different shifts (after breakfast, lunch and dinner) in order to help determine the type of oily and wet conditions exist. The static coefficient of friction (C.O.F.) was measured before and after shifts, on various flooring samples. The coefficient of friction is an indicator of the slippery condition of a flooring material. The Americans with Disabilities Act (Section A 4.5.1) recommends a static coefficient of friction of 0.6 for accessible routes and 0.8 for ramps.

Chapter IV: Results of Study

The purpose and goal of the study was to find effective solutions to reduce the risk of slips, trips and falls in military dining facilities. Another goal of the study was to identify poor housekeeping methods that allow clutter to accumulate. This can occur by not maintaining clean dry floors and using improper cleaning methods, such as incorrectly using wax or polish or trying to clean up grease spills with water. Furthermore, an additional goal was to identify the “root cause” by addressing improper personnel protection equipment (PPE), such as the brand of shoes that the employee wears. The surveys that were conducted consisted of 17 questions, both open-ended and close-ended, with a population size of 160 employees (in Appendix’s A& B).

The methods used to achieve the objectives of the study were:

- Examine the brand of shoes
- The analysis of a survey questionnaire
- Using the ASM 725 Slip Meter to measure the static coefficient of friction (SCOF)

Objectives:

1. Identify the tasks which contribute to slips and trips hazards.
2. Identify processes which minimize risk to slip and fall accidents.
3. Evaluate the static coefficient of friction (SCOF) in dining operations as measured under conditions according to OSHA.
4. Clarify the consequences of slips and falls on wet and slippery surfaces and the need to design the proper footwear to prevent injuries from re-occurring.

Objective 1: Identify the tasks which contribute to slips and trips hazards. The researcher observations from employees and the information gathered from surveys that contributed to slip and fall accidents in carrying equipment or food items, dishwashing, slipping from slips, and serving food are displayed in Table 1. Overall 36 responded to the questions for a 23% response rate.

Table 1

Activities and Tasks with Slips and Falls

Question	0-5	5-6	7-9	10+
5. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while carrying objects in the workplace?	5			
6. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while dishwashing in the workplace?		6		
7. Approximately how many times have you slipped or fallen or noticed employees slip and fall from spills in the workplace?				17
8. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while serving food in the workplace?			8	

Furthermore, the conditions associated with damp slippery floors and improper footwear also have contributed to slip & fall accidents.

After each meal serving period, each shift has personnel assigned to clean the floors. The employees will use a no-rinse floor cleaner called Wash n' walk made by Ecolab. The cleaning of floors consisted of mopping all of the floors in each area: the cooking and serving areas, kitchen fryer areas, dish and pot washing area, the kitchen preparation area and the public patron area. The standing operating procedures indicate that all floors will be mopped after every meal shift. These periods consist of breakfast, lunch and dinner. On occasion the researcher noticed

that wet or slippery floor signs were not in place when the employee mopped the floor in one dining facility.

Some slip and fall incidents during the previous year were not recorded. According to conversations with employees, there were over 20 incidents of slip and fall injuries. The majority came from slipping or tripping on wet and greasy surfaces. One employee had to take two weeks off following a slip and fall injury.

Objective 2: Identify Processes Which Minimize Risk to Slip and Fall Accidents.

The second objective was to identify systems which will provide appropriate control measures to prevent or minimize slip and falls for the dining facilities employees. The review of survey questions provided guidelines regarding appropriate controls for slip and falls. The following questions present the analysis of current control systems perceived to be available and the current use of these control systems.

Table 2

Control Measures in Place

Survey Question	# Responding out 160	% Responding out of 160
1. What are the main causes of falling in the dining facility? (Objects on the floor, poor lighting, wet floors, greasy floors, etc.).	61	38%
Dry Floors	4	
Wet Floors	40	
Greasy Floors	15	
Lighting	2	
2. What brand of shoe do you wear?	157	98%
Resistant	57	
Tread Safe	49	
Other Brands	51	

3. Do Employee's follow the organization's SOP in cleaning floors within your facility to minimize slips and falls?	51	32%
Yes	12	
No	39	
4. Are there any additional controls that should be in place to further reduce the risk of slips and falls?	45	28%
Yes	35	
No	10	

With floors and surfaces, the coefficient of friction is an indicator of the slippery condition of a flooring material. The Americans with Disabilities Act (Section A 4.5.1) recommends a static coefficient of friction of 0.6 for accessible routes and 0.8 for ramps. The results from the coefficient of friction improved over the three month period of study in the dining facilities. In work areas where the walking and working surfaces are likely to be slippery, non-skid strips or floor coatings should be used. Since a minimum COF of 0.50 at a minimum is preferred for walking and working surfaces, management should strive for a surface which provides a minimum of 50% of this friction. If the working surface is very slippery, no footwear will provide a safe COF.

Objective 3: Evaluate the Static of Coefficient of Friction. The four dining facilities (DFACs) located on Ft. McCoy that static coefficient factor was measured were: Buildings 50, 606, 1306, and 2674 (Non Commission Academy). The four buildings' averages were consolidated for a three month period. The following flooring materials were examined: tile floor, concrete; the results are displayed in tables 3, 4 and 5. The photos for the DFACs are in Appendix C.

Table 3

Coefficient of friction readings for dining facilities bldg. 50, 606, 1306 and 2674

Date	Location	Condition	Rotation*				Avg	Comments
			1	2	3	4		
01/13/10	Cooking serving areas	Dry/tile surface areas	.38	.37	.39	.38	.38	Not in compliance
01/13/10	Kitchen /Fryer areas	Greasy surface	.32	.44	.42	.36	.39	Not in compliance
01/13/10	Dish / Pot washing area	Slightly damp surface/ cook finished mopping	.42	.44	.40	.44	.43	Not in Compliance
01/13/10	Kitchen/ Preparation area	Dry tile	.44	.46	.46	.42	.45	Not in Compliance
01/13/10	Public area/ patron eating area	Dry/ tile surface	.49	.46	.49	.47	.48	Not in Compliance

Table 3 describes the five areas that were measured on January 13, 2010. All averages in the five areas for the dining facilities were not in compliance according to OSHA 29 CFR 1910.22 (a) (2).

*Rotation is the orientation of the slip meter when the reading is taken. Four readings are taken for each area:

- 1- Towards the North
- 2- Towards the South
- 3- Towards the East
- 4- Towards the West

Table 4

Coefficient of friction readings for dining facilities 50, 606, 1306 and 2674

Date	Location	Condition	Rotation*				Avg	Comments
			1	2	3	4		
02/17/10	Cooking serving areas	Dry/tile surface areas	.47	.48	.45	.47	.47	Not in Compliance
02/17/10	Kitchen /Fryer areas	Greasy surface	.38	.42	.40	.43	.41	Not in Compliance
02/17/10	Dish / Pot washing area	Slightly damp surface/ cook finished mopping	.47	.44	.48	.46	.46	Not in Compliance
02/17/10	Kitchen/ Preparation area	Dry tile	.48	.49	.47	.49	.48	Not in Compliance
02/17/10	Public area/ patron eating area	Dry/ tile surface	.49	.50	.48	.51	.50	In Compliance

Table 4 describes the five areas that were measured on February 17, 2010. Four of the five averages for the dining facilities were not in compliance according to OSHA 29 CFR 1910.22 (a) (2).

*Rotation is the orientation of the slip meter when the reading is taken. Four readings are taken for each area:

- 1- Towards the North
- 2- Towards the South
- 3- Towards the East
- 4- Towards the West

Table 5

Coefficient of friction readings for dining facilities 50, 606, 1306 and 2674

Date	Location	Condition	Rotation*					Avg	Comments
			1	2	3	4			
03/26/10	Cooking serving area	Dry tile/ surface area	.52	.55	.60	.54	.55	In Compliance	
03/26/10	Kitchen/ fryer area	Greasy area/ surface	.58	.60	.51	.55	.56	In Compliance	
03/26/10	Dish/ pot washing area	Dry area	.58	.60	.57	.55	.59	In Compliance	
03/26/10	Kitchen preparation area	Dry tile surface	.58	.60	.61	.58	.59	In Compliance	
03/26/10	public area/ patron eating area	Just mopped / dry surface	.58	.62	.80	.68	.67	In Compliance	

Table 5 describes the five areas that were measured. All area averages for the dining facilities were in compliance according to OSHA 29 CFR 1910.22 (a) (2).

*Rotation is the orientation of the slip meter when the reading is taken. Four readings are taken for each area:

- 1-Towards the North
- 2- Towards the South
- 3- Towards the East
- 4-Towards the West

Figure 1 shows the average readings from the dining facilities in buildings 50, 60, 1306 and 2674 during the first-month of the study.

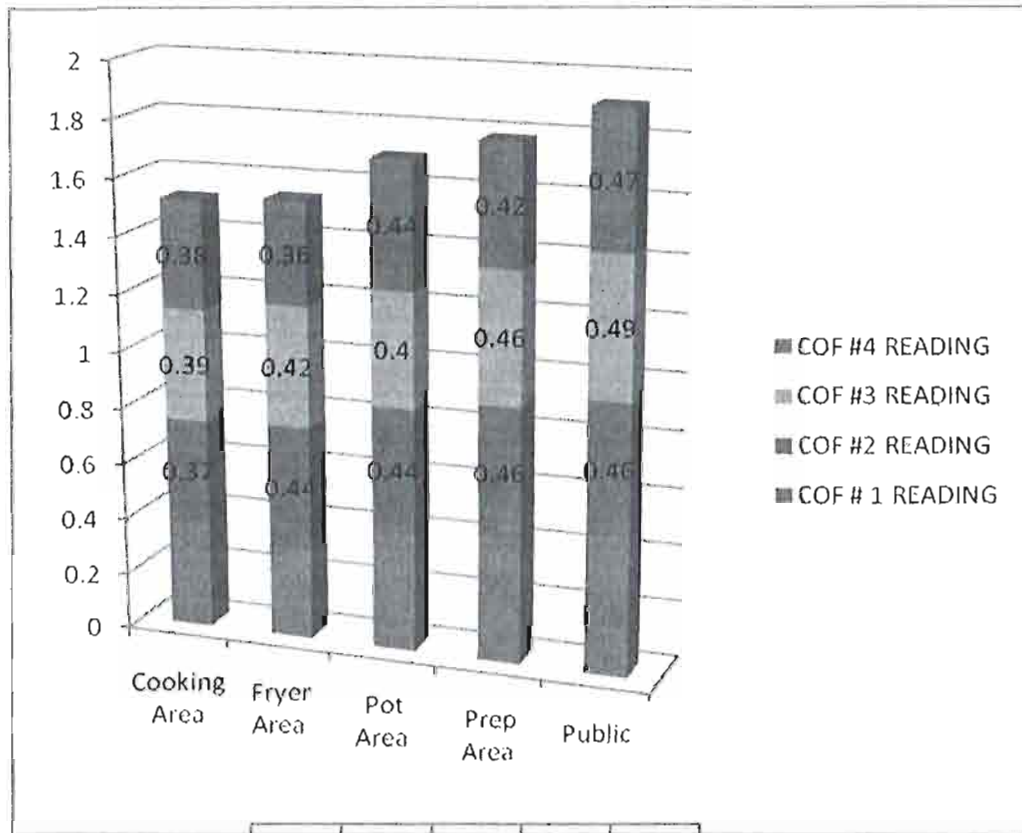


Figure 1: Coefficient of friction readings for 01/13/10

As Figure 1 shows, the four dining facilities' coefficient of factor for the first month were not in compliance with OSHA standards.

Figure 1 shows readings from the dining facilities in buildings 50, 60, 1306, and 2764 during the second- month of the study.

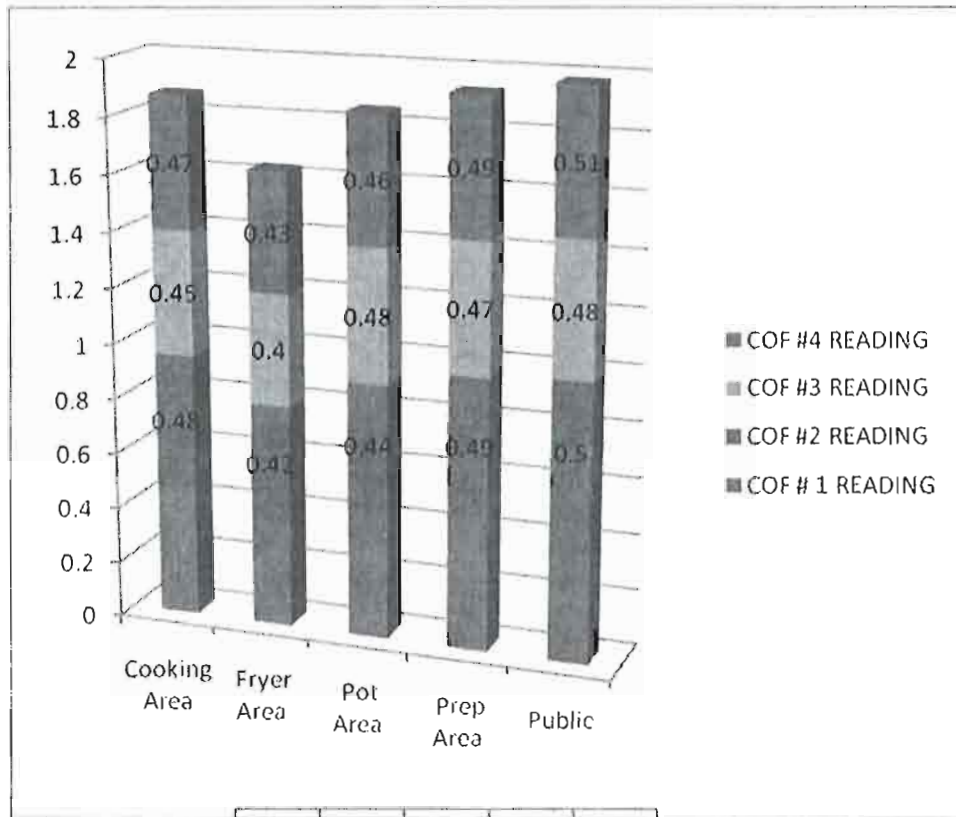


Figure 2: Coefficient of friction readings for 02/17/10

The second month COF increased from the first month but the public areas were in compliance.

Figure 3 shows readings from the dining facilities in buildings 50, 60, 1306, and 2764 during the third- month of the study.

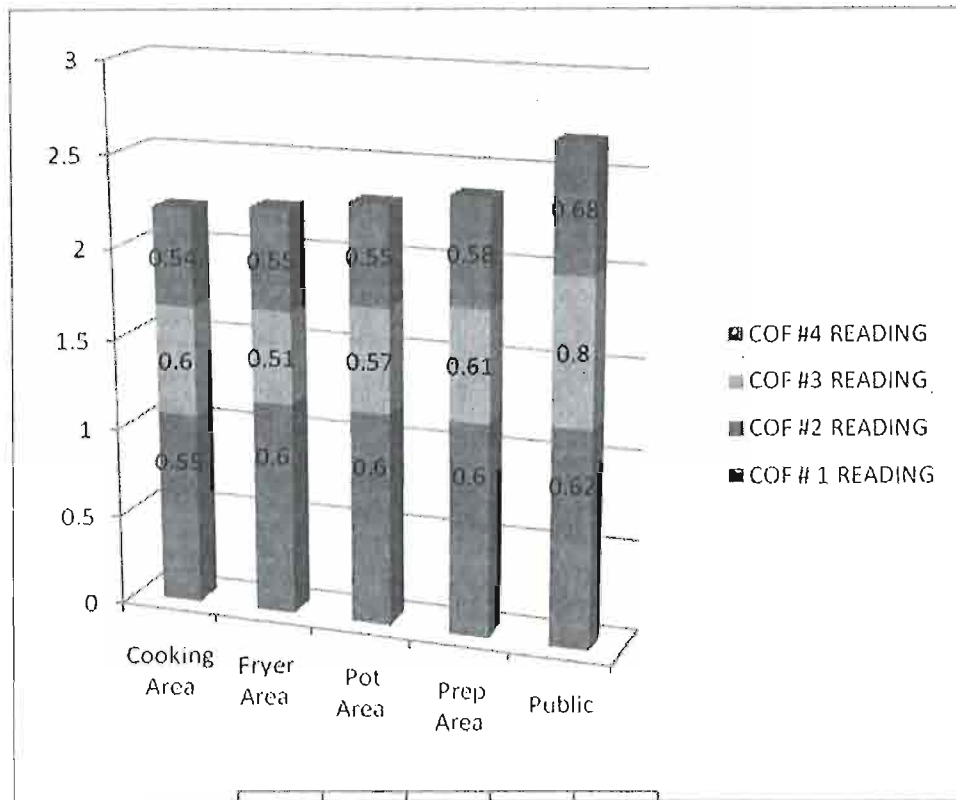


Figure 3: Coefficient of friction readings for 03/26/10

All of the four dining facilities' coefficient of factor for the third month were in compliance with OSHA standards.

Objective 4: The consequences of slip and fall and the need to wear the proper foot wear. According to the employees in the dining facility, they experienced numerous slip and fall accidents that were not recorded. Survey Question #18 addresses did you select a shoe that provide good traction? A total of 157 people responded to this question, 57 people wore resistant shoes, 49 people wore tread safe shoes and 51 wore other brands of shoes, and unsure if these shoes provide accurate traction. Regarding question #9 asking if any additional controls should be in place to further reduce the risk of slips and falls, 45 employees responded, 35 stated that more controls were needed.

Table 6

Adequate Traction for Shoes and Additional Control Measures in Place

Survey Question		# Responding out of 160	% Responding out of 160
9. Are there any additional controls that should be in place to further reduce the risks of slips and falls in reference to question 8?		45	28%
	Yes	35	
	No	10	
18. Did you select a shoe that provides good traction?		157	98%
	Yes	106	
	No	51	

Summary

The survey analysis illustrated positions working in the cook serving areas, the kitchen fryer areas, dish pot washing areas, kitchen preparation area and the public patron eating area where employees endure the greatest number slips and falls. It also identified the specific activities, tasks and conditions contributing to slip and falls. The analysis of personnel comments from employees highlighted which controls were available in contrast to which ones were being used. The analysis of the surveys also demonstrated perceptions from the employees' attitudes regarding their personnel protective equipment and the protocols and systems they felt should be implemented and periodically evaluated.

Chapter V: Summary, Conclusions and Recommendations

The number of falls in military dining facilities is problematic. These falls result in injuries, increased costs and decreased readiness of the forces. The purpose of this research was to develop a protocol to minimize conditions which lead to slips and falls in the workplace. The objectives of this study were to:

1. Identify the tasks which contribute to slips and trips hazards.
2. Identify processes which minimize risk to workers slip & fall accidents.
3. Evaluate the Coefficient of Friction (COF) in dining operations as measured under conditions according to OSHA.
4. Clarify the consequences of slips and falls on wet and slippery surfaces, and the need to design the proper foot wear to prevent injuries from re-occurring.

Methods and Procedures

The purpose of this research was to develop a protocol to minimize conditions which lead to slips and falls in military dining facilities. The focus of this preliminary study summarizes current research, practices, and regulations regarding walking/working surface slipperiness and coefficient of friction (COF) measurements. The methodology and data were reviewed from three aspects:

1. The biomechanics of walking and psycho-physiological factors involved in slips and falls studied by the scientific community,
2. Various measuring device model 725 slip meter and methods developed in an attempt to quantify the “slipperiness” of walking/working surfaces, and
3. An acceptable quantitative standard for the “slipperiness” of surfaces and the impact of the Americans with Disabilities Act (ADA) on such a standard.

Unresolved issues related to slip-resistance were identified. A multifaceted approach and synergy from researchers, the building industries, standards organizations, and government are needed to obtain consensus on such issues.

Major Findings

The evaluation of the survey and interview results are summarized and presented as they relate to each of the study objectives.

Objective 1. Objective 1 addressed the identification of tasks which contribute to slips and trips hazards. Roughly 23% of employees either slipped from falls or witness someone slipping and falling during work activities due to poor housekeeping and walking areas in the workplace.

They either slipped from carrying equipment, carrying food items, dishwashing, slipping from wet and greasy surfaces, or from serving food. This constitutes from poor housekeeping procedures, and top management must prevent risk and implement controls.

Objective 2. Objective 2 addressed the identification of processes which minimize risk to slip and fall accidents. The procedures of housekeeping were evaluated. The causes were identified, and managers started to take steps to improve their housekeeping procedures. Management knew that they had a problem started to work to fix their deficiencies in regards to housekeeping. Management discovered not only was it important to maintain a safe working environment and walking surface, but also these areas must be kept free of obstacles which cause slips and trips.

The researcher identified that adequate lighting when mopping must be obtained to ensure that floors are actually cleaned. Proper vision is also important in the prevention of slips and falls. Supervisors must ensure that employees work in adequate lighting conditions; moving

from light to dark areas, or vice versa, can cause temporary vision problems that might be just enough to cause a person to slip on an oil spill or trip over a misplaced object.

Objective 3. Objective 3 addressed the evaluation of the static coefficient of friction. The American Slip Meter 725 was used to measure the coefficient of friction by dragging along the floors and was measured in four directions. The floors were measured at the point at which the horizontal force acting upon the surface caused the meter to move. External computation was necessary since the scale was calibrated prior to each facility when moving this piece of equipment from one facility to the next.

During the evaluation, the researcher experienced during the first month that the floors were excessively dirty, greasy and in some cases wet from poor housekeeping procedures. Not all of the floors were not in compliance. The second evaluation readings improved, although four of the five areas were still not in compliance with OSHA. The only area that was in compliance was the patron area. During third evaluation, all of the facilities were in compliance with OSHA regulations. This was due to changing out the mops, using warm water on greasy surfaces, thorough mopping and cleaning of the facility, using wet and slippery signs in the appropriate areas and awareness of not being in compliance in the past.

Objective 4. Objective 4 addressed the consequences of slip and falls and the need to wear the proper foot gear. From the evaluation of the surveys and from employees, it can be determined that they did not understand the importance of having the right brand of tread shoe according to the brands that they wore. The 51 employees that wore other brands wore them for fashion and cost, not for the purpose of safety. The consequences for employees not wearing the proper personnel protective equipment is considered a nonconformity from management in the

organization, and top management must take steps in improving their organization's shortcomings.

Additional controls and effective training in housekeeping, in reference to exchanging mops and using certain mops in certain areas, were necessary to bring the organization to compliance; however, the organization must continue to increase the minimum standards according to the averages from the coefficient of friction readings. Dining facilities should revise the organization SOP in housekeeping, by using warmer water while mopping in greasy areas, such as the fryer areas, and ensuring employees are trained and that they follow the policy and procedures and standard operating procedures from the organization.

Conclusion

Management shall identify training needs associated with its Occupation Health and Safety (OH&S) risks and its OH&S management system for slips and falls in the workplace. Supervisors must establish, implement and maintain procedures to make persons working under their control aware of their standard operating procedures (SOP), consequences, actual or potential of their work activities, their behavior, and the OH&S benefits of improved personnel performance in housekeeping. Documentation of the organization's SOP should be available for the employees. This includes the policy and objectives in the organization for housekeeping. Also documents, including records, determined by the organization are necessary to ensure the effective planning, operation and control of processes that relate to the management of its SOP. The organization failed to document training in housekeeping procedures for their employees.

Recommendations

1. Top management should select high-traction slip-resistant flooring materials when building, expanding or remodeling facilities. Installation of such materials with

proven high traction characteristics is one of the best ways to avoid slip-and-fall issues. Know what the “out-of-the-box” slip resistance is on the floor materials in your facility. These numbers provide a baseline when considering changes to cleaning and floor maintenance practices.

2. Select floor cleaning and maintenance products with proven slip resistance characteristics that are compatible with the particular flooring surfaces in your facility. Good places to start are materials certified by the National Floor Safety Institute. Be alert for workers substituting cleaning materials or supplies. Ensure sufficient quantities of cleaning supplies are available.
3. Verify with the cleaning personnel that they are familiar with and are using the correct application procedures; if there is a change in personnel or contractor, monitor usage again. Separate cleaning materials and equipment between the “front of the house” and “back of the house” to reduce the likelihood of transporting a problem from one area to another. Color coding materials can provide instant recognition for personnel using the wrong equipment in the wrong area of the facility.
4. Ensure that permanently installed features like carpet runners and mats are included in the maintenance and housekeeping program. These materials need to be regularly inspected for the buildup of contaminants and deterioration that could lead to the creation of fall hazards. Keep in mind that while mats reduce the likelihood of producing slips, improperly maintained mats can create trip hazards. Consider using mats that have been certified by the NFSI.
5. One of the surest ways to prevent the transmission of grease, water and other materials from the “back of the house” to the “front of the house” is to implement a

good mat program. Ensure that the mats are frequently inspected and checked regularly for wear and the buildup of contaminants. A poorly managed and maintained mat program can significantly increase your likelihood of reducing the slip resistance of flooring surfaces.

6. Regularly review all the slip-and-fall incident reports associated with your facility and understand the critical factors associated with them. Look for trends in location, time of day, etc., and focus staff training on your cleaning procedures for these factors. Train your workers how to properly respond to slip-and-fall incidents.
7. Ensure that the staff is well trained in spill prevention and response programs. They need to know where the materials are located and how to use them in the event of an emergency. It is also important that staff understand the importance of reporting incidents and conditions that could result in incidents, even if none have actually occurred. These will be your first indication of a potential issue that should be addressed.
8. A walkway auditing program can help identify trends within your facility that can result in reduced slip resistance to flooring surfaces. To be effective, the testing should be completed in a consistent manner and include more than a single set of measurements. Consider using NFSI Certified walkway auditors. A complete list can be found on www.nfsi.org.
9. Train employees about established safety procedures, cleaning operations, and inspection procedures. Train workers to apply floor cleaning and maintenance products in accordance with the manufacturer's recommendations. Post written slip and fall prevention and accident handling policies in conspicuous places. Keep

records of all employees training including individuals trained, subject matter covered, training materials, and date of training.

Consider foreseeable conditions in the employee walking/working environment. For those employees that may be exposed to oily, wet or otherwise slippery walking surfaces, provide access to slip resistant footwear and make it a requirement. Consult with the army to provide footwear for contract workers and your supplier or manufacturer of footwear to select shoes that are the most appropriate for the situation.

References

- ANSI/ASSE A1264.2-2001 standard being revised. (2005) *Professional Safety*, 50 (6), 73-73.
- American Society for Testing Materials (ASTM). Retrieved 2000,
from www.astm.org/
- Army Regulation 385-10 (2007, November 27). The Army safety program. Retrieved from
<http://www.army.mil>.
- Center of Disease Control and Prevention. (2004), National Center for Injury Prevention and
Control. Retrieved April 13, 2008, from <http://www.cdc.gov/ncipc/osp/charts.htm>
- Commercial Property and Casualty Insurance Provider Carrier (2007). Risk Control Bulletin.
Retrieved June, 2009 CNA, from <http://www.cna.com/riskcontrol>
- Jensen, C. (1982). The investigation of slip and fall accidents. Retrieved 1982, from
<http://www.safety-engineer.com/complex.htm>
- International Organization for Standardization (ISO). Retrieved from www.iso.org/
- Miller, B. (1998). Measuring of Slip Resistance: a Legal and Practical Perspective. *Safety
& Health*, 158 (3), 62-66.
- Occupational Safety and Health Administration (OSHA). (n.d), Sec. 5 Duties. Retrieved
November 4, 2008,
from <http://www.osha.gov/SLTC/youth/resturant/index.html>
- Oliver D., Hopper A. (2000). Do Hospital Prevent Falls at Work? School of Healthcare
University Reading. Retrieved 2000,
from <http://www.wcbi.nlm.nih.gov/pubmed/11124762>
- National Floor Safety Institute (NFSI) (2003, September) Don't slip on floor safety. Retrieved
from <http://www.cleanlink.com/cp/article/Don%E2%80%99t-Slip-On-Floor-Safety-945>

National Restaurant Association (NRA) (2010, April 3). Retrieved

from www.restaurant.org/

National Safety Council (NSC). Injury facts (2007) Retrieved May 24, 2008,

from http://www.nsc.org/lrs/res/leadngcauses_ths_69_05.jpg

Appendix A Open-ended questions

1. What are the main causes of falling in the dining facility?
2. What brand of shoe do you wear?
3. Do employees follow the organizations standard operating procedures (SOP) in cleaning floors within your facility to minimize slips and falls?
4. What is your job at the dining facility?
5. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while carrying objects in the workplace?
6. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while dishwashing in the workplace?
7. Approximately how many times have you slipped or fallen or noticed employees slip and fall from spills in the workplace?
8. Approximately how many times have you slipped or fallen or noticed an employee slip and fall while serving food in the workplace?
9. Are there any additional controls that should be in place to reduce the risks of slips and falls in reference of question #8?
10. Does your manager recommend a certain kind of shoe? If so, what kind?
11. What is your age?
12. What is your sex?
13. How long have you worked at the dining facility?
14. What is your job at the dining facility?
15. Do you have any comments or suggestions about this survey?

Appendix B Closed-ended questions

16. You selected these shoes because they are comfortable.

- 1 = Strongly Agree
- 2 = Agree
- 3 = Neither Agree nor Disagree
- 4 = Disagree
- 5 = Strongly Disagree

17. You selected these shoes because they are in your price range.

- 1 = Strongly Agree
- 2 = Agree
- 3 = Neither Agree nor Disagree
- 4 = Disagree
- 5 = Strongly Disagree

18. You selected these shoes because they provide good traction.

- 1 = Strongly Agree
- 2 = Agree
- 3 = Neither Agree nor Disagree
- 4 = Disagree
- 5 = Strongly Disagree

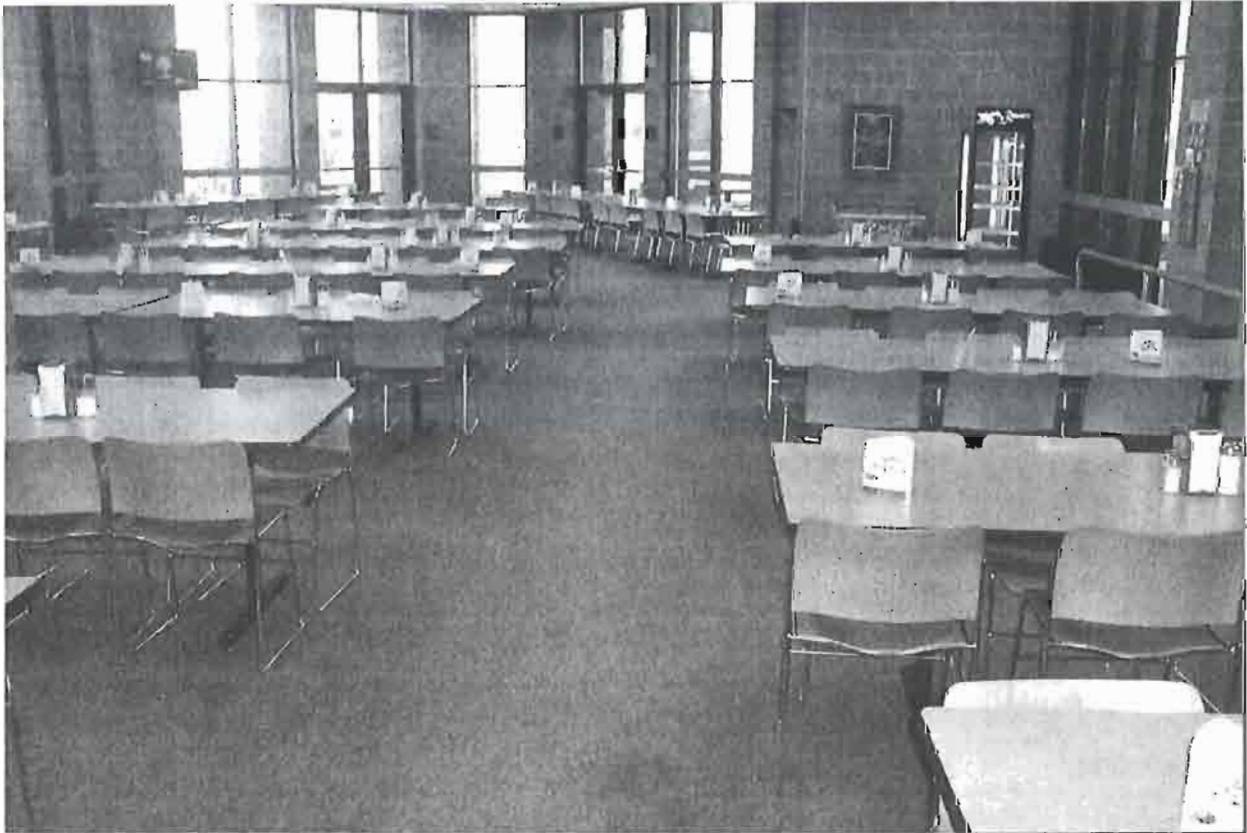
19. How often are your shoes inspected by your manager?

- 1 = Often
- 2 = Occasionally
- 3 = Rarely
- 4 = Never

20. What controls are in place in your dining facility to minimize slips and falls? Rate each control according to this scale.

- 1 = Extremely Effective
- 2 = Very Effective
- 3 = Effective
- 4 = Slightly Effective
- 5 = Not Effective

Appendix C Photos from the Dining Facilities on Ft. McCoy



Dining Facility 50 is the only dining facility patron area that is carpeted.



Photo of the cooking serving line area



Photo of the cooking area & fryer area.



Photo of the fryers with a greasy film on the floor surface.



Photo of uneven surfaces that patrons and employees walk through; poor house cleaning.



Photo of a floor without proper slippery wet sign posted.



Photo of floor with properly slippery wet sign posted.



Photo of the storage of pots that are turned reverse that produce a wet surface.



Photo of equipment is not properly stored in the right locations according to SOP.



Photo of a clean dining facility floor.



Photo of wet floor without slip and wet surface sign.



Photo of floor without slip and wet surface sign.



Photo of eating area for patrons; Dining Facility capacity to serve 350.

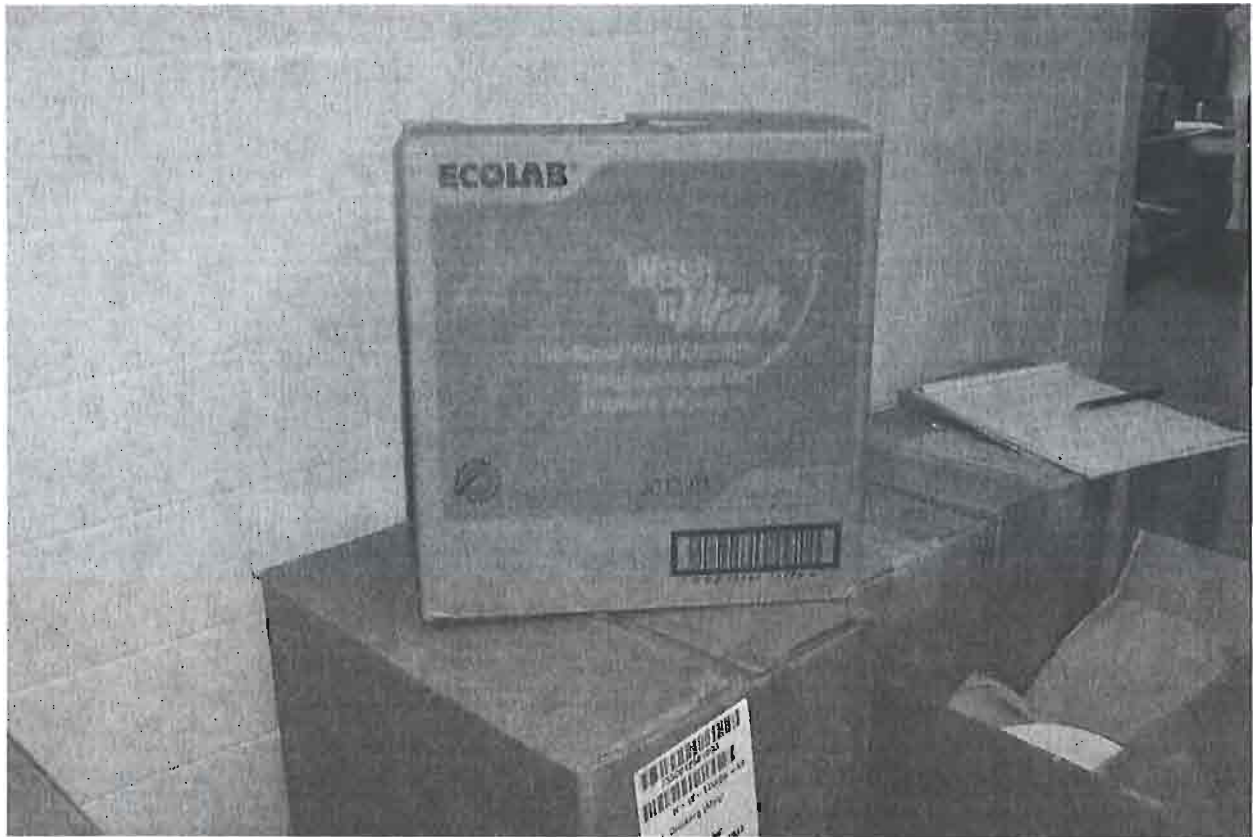


Photo of the product that the dining facilities use to clean their floors.