FATIGUE:

AN IMPACT ON FIREFIGHTERS

EXECUTIVE LEADERSHIP

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An applied research project submitted to the National Fire Academy
as part of the Executive Fire Officer Program

December 2006

Certification Statement

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

The problem was that recent extended emergencies in Fort Lauderdale had taxed crew alertness and mental stability; potential service related errors and traumatic stress disorders were a result.

The purpose of this applied research projects (ARP) was to investigate the potential effects of fatigue on firefighters. Results of this study provided strategic analysis to identify and perhaps reduce the effects of responder fatigue.

In conducting this research, the author utilized the descriptive methodology that identified the following questions:

1. What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue?
2. What are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue?
3. What kind of guidelines and strategies are used in other industries where extended hours are worked? [hospitals, air traffic controllers, etc.]
4. How may this compare and contrast to the traditional 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules?
5. What potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricanes and tropical storms?

The procedures involved administering an internal Internet survey and conducting telephone interviews and then comparing the results to determine what the potential effects of fatigue were on firefighters and how to identify and possibly reduce responder fatigue.

The results indicated that there is a need to raise the awareness level of management and the subordinates of the Fort Lauderdale Fire-Rescue Department on fatigue, how it is caused, and how it may affect the human body either during normal operations or extended emergencies.

Recommendations based on this study and its findings are:

1. Identify factors that contribute to fatigue.
2. Choose control measures that can be used to effectively manage fatigue.
3. Implement the control measures.
4. Supervisors (Company Officers and Battalion Chiefs) should be trained on fatigue.
5. Evaluate crews' sleeping quarters for darkness, quiet, temperature control, and overall comfort.
6. Modify work schedules to better accommodate increasing alarm loads.
7. Provide additional staffing and response units during periods of peak-alarm activity.
8. Form a joint management/labor team to identify current issues of busy medical rescue units, and consider the possibility of rotating busy rescue teams.

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Introduction

Emergency personnel, like all workers, carry out their duties within an environment composed of a set of discrete elements. First there is the emergency itself. Whether it is a forest fire in the Northwest, a tornado in the Midwest, or a hurricane in the Southeast or Gulf Coast of North America, the emergency imposes certain exigencies upon the responders. Second, a social structure exists with specific social units, rules, and forms of association. An emergency response, therefore, takes place within a context of prescribed behaviors, expectations, and value judgments that are sometimes in conflict with each other. Third, there is a technology that must be understood in order to accomplish group goals. If the technology itself is implicated in the emergency, the entire emergency environment may be impacted. Clearly, a breakdown in any of these elements could result in worker injury and might heighten responder stress, fatigue and general well-being.

Olin L. Greene (1991), former United States Fire Administrator stated, “Stress is one of the most occupational hazards facing the modern fire service. It is important to recognize exactly how stress can adversely affect our health, job performance, career decision-making, morale, and family life” (p.VI). Could Mr. Greene have foreseen the coming of numerous hurricanes and natural disasters, the acts of terrorism, the presence of weapons of mass destruction and the additional stress these would apply to the fire service community back in 1991? The problem is that recent extended emergencies in Fort Lauderdale have taxed crew alertness and mental stability; potential service related errors and traumatic stress disorders are a result.

The purpose of this applied research project (ARP) is to investigate the potential effects of fatigue on firefighters. Results of this study will provide strategic analysis to identify and perhaps reduce the effects of responder fatigue.

Research methodology used for this applied research project was the descriptive method that identified the following questions:

1. What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue?
2. What are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue?
3. What kind of guidelines and strategies are used in other industries where extended hours are worked? [hospitals, air traffic controllers, etc.]
4. How may this compare and contrast to the traditional 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules?
5. What potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricanes and tropical storms?

Background and Significance

The City of Fort Lauderdale, Florida, is a cosmopolitan modest sized oceanfront coastal community located on South Florida's eastern coastline midway between Miami and West Palm Beach. It is densely populated with over 190,000 year-round residents making it the sixth largest city in the state. The City is just over 43 square miles encompassing seven miles of beachfront and 100 miles of inland navigable waterways. The City of Fort Lauderdale is affectionately known as "The Venice of America" (Nova Southeastern University, 1999). The City was established in 1911 and is the largest municipality within Broward County. It is characterized by an assortment of lifestyles and socioeconomic diverse population. Its boundaries stretch from the affluent oceanfront neighborhoods to the low-income areas adjacent to the Intestate 95 corridor.

In addition, the City of Fort Lauderdale houses the center of governmental, judicial, and financial activity in Broward County. Fort Lauderdale is structured into a manager/council form of government and operates on a fiscal budget of $504 million dollars that has been proposed for F/Y 2006-2007. The fiscal budget provides a complement of municipal services such as fire and EMS/transport, police, and regional water and wastewater systems. Of the overall proposed fiscal budget, the Fire-Rescue Department is allotted $61.3 million dollars or 12% of the city's annual operating budget. The Fire Department's organizational structure is the traditional and commonly accepted paramilitary rank and order style. It was established in 1912, a year after the incorporation of the City, and has been the only provider of fire suppression for the community (Nova Southeastern University, 1999).

According to the Fort Lauderdale Fire-Rescue Department's (2005), *Emergency Hurricane Procedures,* when a hurricane warning is declared by the National Hurricane Center for the City, the personnel of the next scheduled shift will report to their duty assignment as soon as possible, whilst the shift currently on duty at the time of the warning announcement will remain on duty for the "impact stage" and "post impact" operations (Fort Lauderdale Fire-Rescue Standard Operating Procedures [Article 1000], 2005). The remaining (third) shift shall report to duty when next scheduled, if conditions permit. By having two shifts working at the time of impact and post impact creates the concept of an "Alpha/Bravo" shift in which crews work for 12 hours and then rest for 12 hours so that there is always a non-fatigued crew working.

Prior to the 2000 Hurricane season, the Fort Lauderdale Fire-Rescue Department would have two shifts operating when a hurricane warning was issued. Personnel would call the main fire station when a watch was issued and leave their name and number where they could be reached so that when a warning was issued a representative from the fire department would call

them and advise them that they needed to report to duty as soon as their personal property was secured and where they were needed. Additionally, personnel that were reporting to duty for a hurricane warning were advised to bring a five day supply of the following items: (a) uniform trousers and tee shirts; (b) an extra pair of shoes/boots; (c) extra belt; (d) one uniform baseball cap; (e) undergarments; (f) toiletries/hygiene supplies; (g) personal pillow(s), sheets and blanket(s); and (h) air mattress or padded mat. This concept was to ensure that assigned personnel were adequately equipped and provided a sleep and human resource accommodation in the event that they would have to remain beyond a 48 hour shift.

During the 2005 Hurricane season, the City of Fort Lauderdale experienced two hurricanes - Katrina and Wilma. Hurricane Katrina was a minimal Category 1 hurricane on the Saffir-Simpson scale that remained off shore on August 24th 2005, and crossed the state to the south of Fort Lauderdale, and traveled into the Gulf of Mexico strengthening to a catastrophic Category 5 hurricane wreaking havoc and major devastation to the Gulf Coast states of Alabama, Mississippi and Louisiana. On October 24th 2005, Hurricane Wilma made landfall on the Southwest Coast of Florida as a Category 3 hurricane and crossed the state in six hours causing approximately $2 billion dollars in damage to Broward County.

In both those events, the Fort Lauderdale Fire-Rescue Department did not follow the Standard Operating Procedure for hurricanes. In lieu of following the normal written hurricane procedures, Fire Administration exercised their authority to staff all 12 engines and three ladder companies with an additional firefighter raising minimum staffing levels to four members. In addition, all advanced life support (ALS) rescue/transport companies were staffed from the normal two paramedics to three paramedics. Furthermore, operations chief officers were assigned a driver or aide to assist in the incident command processes.

Fire service personnel who worked during the “impact” and "post impact" stage were mandated to work up to seven days straight or an accrued overtime of 9296.50 hours just from Hurricane Wilma. The long hours worked not knowing if their respective families and homes were spared from the ravaging effect of a Category 2 hurricane greatly increased the anxiety and stress of those personnel working 168 hours during post damage operations.

According to the Missoula Technology & Development Center [USDA Forest Service] (n.d.), persons working over 16 hours on a regular shift will experience fatigue. In addition, most persons nearing 24 hours on a continuous shift will experience some form of cognitive impairment. This pales in comparison by having personnel work seven days straight with little or no sleep causing such fatigue to progress and vigilance decline – we don’t hear, see, think, or focus well and reactions are slow. Most personnel at this point are incapable of making self-determinations therefore the margin of safety needs to increase as fatigue progresses. Fire Administration or leadership must monitor and manage employee fatigue before personnel are injured or killed.

As the 2006 Hurricane season opens in “hurricane weary” South Florida, it is unclear how many hurricanes or tropical storms will make landfall in the South Florida area. It appears that past practice in the Fort Lauderdale Fire-Rescue Department may not have a feasibly written hurricane preparedness policy and protocol with regards to prevent the fatigue many overworked personnel experienced during the 2005 hurricanes.

This applied research project (ARP) will assess what the maximum hours are that a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue. Additionally, this research will identify what are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue. Moreover, this applied

research project will disclose guidelines and strategies that are used in other industries where extended hours are worked such as in hospitals, air traffic controllers, etc. Furthermore, this research project will examine other work schedules and compare and contrast them to the traditional 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules already in use. Finally, a discussion of what potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricane and tropical storms.

This applied research project on fatigue and its impact on firefighters is relevant to the course work included in the curriculum of the National Fire Academy's Executive Fire Officer Program (EFOP), *Executive Leadership (EL), R123* course (National Fire Academy [NFA], 2005). This researcher noted the three following distinct links:

First, *Unit 3: Developing Self as a Leader* summarized how leaders dealt with problems on a technical and adaptive level and how executives derailed if problems were not handled correctly.

Second, *Unit 4: Developing Decision-making Skills* correlated to diagnostic questions that a leader or executive must make and seven rules that can help improve the quality of the decision and its acceptance by subordinates.

Third, *Unit 7: Succession/Replacement Planning*, which is an organized and systematic way to ensure that employees in a particular organization are capable, competent, and willing to replace and/or succeed to strategic roles within the organization.

This ARP relates to the United States Fire Administration (USFA) operational objectives: (a) To focus on reducing the number of firefighter deaths by 25 percent over 5 years; and (b) To respond to emergent issues (FEMA, 2004). This paper is dedicated towards meeting the USFA

objectives by investigating the potential effects of fatigue on firefighters. Results of this study will provide strategic analyses to identify and reduce the effects of responder fatigue or possible death.

Literature Review

The literature review was organized around five specific research questions that were being investigated: (a) What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue? (b) What are the early warning symptoms of and potential problems related to fatigue and sleep deprivation? (c) What kinds of guidelines and strategies are used in other industries where extended hours are worked? [hospitals, air traffic controllers, railroads, etc.] (d) How may this compare and contrast to the traditional 24 on 24 off, 24 on and 48 off, and 10/14 firefighter work schedules? (e) What potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricanes and tropical storms?

First, what are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue? A study by the International Labor Organization for the United Nations has found that Americans work longer hours than anyone else in the industrialized world. The International Labor Organization declared that British workers were on the job 1,731 hours per year, French workers were working 1, 656 hours per year and the government was in the process of bringing the standard workweek down to 35 hours. Norwegians worked the fewest hours at 1,399. Most European workers have four weeks of vacation and many have more (Federation of Nurses and Health Professionals, 2003).

Additionally, the United States is the only “industrialized nation” where the trend is toward “working more hours with less.” In every other country, the trend is toward more time off. A study by the National Sleep Foundation found that 40 percent of American adults stated that, “they are so sleepy during the day that it interferes with their activities.”

Few authors appeared to have agreed that there are many styles of work schedules in place that are called “shift work.” Shift work involves working outside the normal daylight hours of 7:00 a.m. to 6:00 p.m. This style of work hour traditionally is the time period in which many people in our society work at a schedule consisting of seven to eight hour daily shift, five days per week. Conversely, shift workers are scheduled in non-traditional work hours in which one may work their respective shifts in the early evening, middle of the night, or extra long workdays such as a 10 hour day, or 14 hour night shift period. Workers may also work regular days at one time or another. Many shift workers “rotate” around the clock, which involves changing work times from day to evening or day to night. This change in shift may happen at different times of the week or at different times of the month. Police officers and firefighters, for example, often work rotating shifts. Other workers might have a “permanent” shift and only work at night or in the evenings (Rosa & Colligan, 1997; Widmar, 2003; Office of Rail Regulation [ORR], 2006).

Rosa and Colligan (1997) acknowledged that there are several reasons for shift work. A major reason is that modern technology has made it possible to do many activities at any time of the day or night. This “24-hour society” of ours requires that important services be provided at all times. Critical services include public safety (police and fire protection); military defense; health care; transportation; and public utilities (electrical power, water and telephone).

Firefighters must operate around the clock out of necessity and are not immune to the mental and physical consequences of sleep deprivation. Extended periods without sleep,

interrupted sleep, and working against the body's natural sleep/wake cycle negatively impacts performance and may contribute to workplace accidents. Employers can be held liable for accidents involving their sleep-deprived workers.

Widmar (2003) stated:

> The human body was not designed to work around the clock. Firefighters who work 24-hour shifts, a common fire service schedule, are subjected to lack of adequate sleep and interrupted sleep on duty because of alarm responses. They may not be able to obtain adequate sleep off duty because of family demands, daytime noises, and fighting their biological clocks. (p. 48)

Authors agreed there was evidence that human performance "deteriorates significantly" when people have been at constant work for more than 12 hours. Managers of safety critical work should consider whether any shift (including overtime) for critical safety workers could exceed that length, and the nature of the work that workers could be carrying out after the twelfth hour. Constant work hours less than 12 hours to the extent of which fatigue occurs may depend on other aspects of the working time pattern, such as adequacy of breaks taken during the shift and the length of interval since the previous duty (nature of the work and/or the working environment). Even shifts of eight hours or less can be fatiguing if the work is very intense or demands continuous concentration, or there are inadequate breaks (Office of Rail Regulation [ORR], 2006; McGlothlin, 2005).

Additionally, McGlothlin (2005) affirms, from an ergonomics and physiologic view, that highly repetitive work is a key stressor and contributor to musculoskeletal disorders. The body needs adequate recovery time within a shift (to minimize muscle fatigue) and between shifts (to allow the body to repair musculoskeletal micro trauma). Working 12-hour shifts robs the body

of timely recovery time. Evenly spaced recovery throughout the week appears to be better for the body than longer, grouped recovery periods.

Furthermore, authors declared that performing physically demanding work for longer durations (greater than 12-hours) may increase whole-body fatigue. The National Institute of Occupational Safety and Health (NIOSH) guide on work practices (Document DHHS No. 81-122) indicated that on average, workers should work at 33 percent of their maximal capacity when performing eight-hour shifts and that the number decreases to 28 percent when they work 12-hour shifts. The five (5) percent difference (between eight- and 12-hour shift workers) will translate into reduced productivity, especially in physically demanding environments (McGlothlin, 2005; Harrington, 2001; Jha, Duncan & Bates, 2001).

Conversely, Widmar (2003) acknowledged that tasks requiring brief, intense concentration can be performed with little impairment after sleep loss, but alertness and persistence are lost, and monotonous tasks suffer. Researchers suggested that emergency workers can temporarily overcome fatigue on critical calls but not so much on routine calls. Nothing can compensate for sheer exhaustion.

A few authors stated that managing work hours is critical for fatigue control because the number of hours a person works in a day, week, month, or year can contribute a great deal too how fatigued or alert he or she is. In addition, authors stated that as little as 17 to 19 hours of sustained wakefulness can impair performance likened to a person registering a 0.05% blood alcohol level. Moreover, those personnel working for a period of 24 consecutive hours without sleep may produce impairment equivalent to a 0.10% blood alcohol level (Queensland Department of Industrial Relations, 2005; Frakes & Kelly, 2004; Vila, Morrison & Kenney, 2002; Fire Department Safety Officers Association [FDSOA], 2005; Holmes, 2003).

According to ACTU (2000), it is recommended that the maximum hours to be worked in a day or a week (7 days) should not exceed the following, other than in emergency circumstances: (a) maximum of six consecutive eight-hour shifts; (b) maximum of two consecutive night shifts; (c) maximum of two consecutive 12-hour shifts; (d) maximum 12-hours overtime per week; (e) maximum 12-hours work per day (including overtime) except in emergency circumstances; and (f) maximum 48-hours rostered work per week. In emergency circumstances a maximum of 60-hours worked in one week may be necessary. It should not be worked on a regular basis or in consecutive weeks.

Moreover, ACTU (2000) affirms that where overtime is worked, it should be limited to a maximum of 12-hours per week. Overtime after 12-hour shifts is a high-risk practice and should never be worked other than in an emergency situation.

Widmar (2003) proclaims that adaptation to shift work appears to be a combination of biological, sleep, and social factors that vary by individual. Generally speaking, those who biologically require less sleep fare better in shift work that those who need more. Extreme morning people suffer more from shift work than “night owls.” In addition, age has been considered a factor for determining if a person can withstand shift work. After age 25, the ability to withstand night shifts decreases. Workers in their late 40s and early 50s become even less tolerant to the demands of shift work (Widmar, 2003).

During a 1983 congressional hearing on shift workers, sleep researcher Dr. Charles A. Czeisler stated, “…it has been assumed if an individual is ‘tough’ he or she should be able to handle almost any type of schedule. We must now begin to awake to the fact that this simply is not so” (Widmar, 2003, p. 50). Each and every person adjusts to shift schedules differently. For some, their physiology does not allow them to adjust at all. Others, however, experience peak

performances at night. There are exceptions among employees who work nights or rotating shifts.

According to Metcalf (2003) there was a bill in Congress that would restrict resident doctors' work hours to no more than 80-hours per week and no more than 24-hours of continuous sequential work. Furthermore, emergency department shifts would be limited to no more than 12-hours.If the justification for this little piece of legislation is necessary for patient safety in hospitals; it would not take too much to apply it to other professions involved in the provision of emergency medical care.

Metcalf (2003) stated:

> After all, how long do you think it will take until someone connects the dots between work hours, sleep deprivation, patient safety or emergency vehicle crashes, and EMS? If we don't connect the dots and do something about the issue, there are a lot of folks out there who will be glad to fix it for us. It's only a matter of time. (p. 5)

Second, what are the early symptoms of and potential problems related to sleep deprivation and fatigue? Sleep, like food, oxygen, and water is an essential biological need. Sleep re-energizes the body and allows the brain to accumulate and sort out information. Studies have shown that performance of newly learned skills does not improve until a person has had at least six-and preferably eight-hours of sleep. Widmar (2003) confirmed that during sleep, the body secreted hormones that affect growth, metabolic, and endocrine functions. Activity in the "sleeping" brain helps regulate gastrointestinal, cardiovascular, and immune functions.

Authors stated that sleep deprivation occurs when a person does not get sufficient amounts of quality sleep and/or experiences a circadian disturbance (Widmar, 2003; Dernocoeur, 2003; Jha, Duncan & Bates, 2001; Holmes, 2003). Work demands, family life, and certain

lifestyle choices can cause a person to sleep fewer hours than his or her body needs to maintain wakefulness and energy levels. Shift workers and night workers toil and sleep opposite to the body's natural wake/sleep cycle. Additionally, some medical conditions or medications may affect a person's quality of sleep.

In today's fast-paced world, sleep is frequently regarded as a luxury instead of a necessity. The general public views it as a commodity that can be sacrificed for money and lifestyles. Those who sleep less are considered ambitious, hard working, and tough. Unfortunately, this way of thinking contributes to a lethargic society.

According to authors, the National Sleep Foundation's 2002 *Sleep in America* poll found that one-third of the people in the United States regularly sleep six and a half hours or less per night, short of the seven and a half to eight hours recommended by scientists and researchers (Widmar, 2003; Dernocoeur, 2003; Jha, Duncan & Bates, 2001; Fire Department Safety Officers Association [FDSOA], 2005). Studies have proved that decreasing sleep time by one hour a night for seven consecutive nights is equivalent to staying up for 24-hours straight once a week. To be deficient of sleep results in the following symptoms: (a) drowsiness; (b) fatigue; (c) decreased alertness; (d) slowed reaction times; and (e) impaired thinking and judgment.

So, how can a person tell if they are sleep deprived or not? The indications that follow will identify if you are or not sleep deprived: (a) you need an alarm clock to wake you up at the appropriate time; (b) you struggle to get out of bed in the morning; (c) you feel irritable, tired, and stressed during the week; (d) you have trouble concentrating and remembering; (e) you fall asleep in warm rooms during meetings or classroom training sessions; (f) you need a nap to get through the day; (g) you feel drowsy while driving; and (h) you fall asleep within five minutes of going to bed (Widmar, 2003).

Sleep loss is cumulative and creates a sleep debt. Larger sleep debts require greater amounts of restorative sleep to return the body and mind to normal, rested levels. Consistently compromising sleep over long periods of time leads to chronic sleep deprivation.

Sleep deprivation affects mental processes and intellectual abilities. Additionally, it impedes decision-making and memory and reduces performance on challenging tasks and negatively affects psychomotor skills. Widmar (2003) stated that mood, productivity, communication skills and increased rates of on-the-job injuries are also attributed to sleepiness and fatigue. Authors declared that extended periods without sleep "may cause" hallucinations and paranoia (Widmar, 2003; Dernocoeur, 2003: Jha, Duncan & Bates, 2001).

Other effects that result from chronic sleep deprivation include (a) depression and mood swings; (b) gastrointestinal dysfunction; (c) adult-onset diabetes; (d) menstrual and infertility problems; (e) increased use of drugs and alcohol; (f) impaired sexual function; (g) less satisfaction in personal and domestic pursuits; (h) increased appetite and weight gain; and (i) personality changes, particularly loss of humor and increased rage (Widmar, 2003). Chronic sleep deprivation may be difficult to recognize. Dr. James B. Maas (1998) stated:

> Often we are totally unaware of our own reduced capabilities because we become habituated to low levels of alertness. Many of us have been sleepy for such a long time that we don't know what it's like to feel wide awake. (p. 59)

Authors stated that a combination of excessive overtime, insufficient sleep and irregular working hours may have been the catalyst that contributed to the critical decisions that led to the fatal 8:00 a.m. launch of the space shuttle Challenger in 1986, the 1989 grounding of the Exxon *Valdez* that caused the release of 11.2 million gallons of crude oil, and the 1984 head-on collision of two Burlington-Northern freight trains [five crew members were killed and seven locomotives

destroyed] (Widmar, 2003; International Transport Workers' Federation, n.d.; Officer of Rail Regulation [ORR], 2006; Fire Department Safety Officers Association [FDSOA], 2005).

Authors recognized the sleep/wake cycle as part of the body's natural *circadian rhythms.* While the circadian rhythm can be affected by exposure to light, an "internal clock" primarily governs it. This "internal clock," which is located in the hypothalamus, this genetically programmed mechanism controls rhythms of alertness, body temperature, and hormone production over a 24-hour cycle (Widmar, 2003; Dernocoeur, 2003; Koester, 1997; Belenky, n.d.)

Circadian rhythms vary from person to person. Some people are morning types or "larks." Morning people feel most active and alert early in the day and usually go to bed early in the evening. Others are evening types or "owls." Evening people feel most active in late afternoon or evening, and like to stay up late into the night. Most people, however, are somewhere in-between the strict morning and evening types (Rosa & Colligan, 1997; Widmar, 2003; Kuhn, 2001; Koester, 1997).

According to authors, each individual needs a different amount of sleep to awaken feeling refreshed. Individual's sleep requirements are genetic and may perhaps be hereditary. Scientists consider six to ten hours of sleep a normal range, with most people requiring seven and a half to eight and half hours of sleep in a 24-hour period. At least four to five hours of uninterrupted core sleep is required to maintain minimum performance levels (Widmar, 2003; Koester, 1997; Rosa & Colligan, 1997). Widmar (2003) and Koester (1997) agreed that sleep requirements change as a person ages and can be affected by their general health. The human body requires more sleep to heal and recuperate if a person is ill, stressed or depressed.

Authors acknowledged that sleep progresses through four distinct stages and a phase called rapid eye movement (REM).

1. Stage One – A relaxed, semiconscious state in which a person may be vaguely aware of his or her surroundings.
2. Stage Two – The actual beginning of sleep.
3. Stages Three and Four – Deeper sleep, during which body temperature drops; metabolic activity slows; and hormones responsible for growth, development, and tissue repair are secreted.
4. Stage Four – The deepest phase of sleep, when the body recovers and heals (Widmar, 2003; Koester, 1997; Rosa & Colligan, 1997; Missoula Technology and Development Center, n.d.).

Sleep then moves into the REM phase. During REM, the eyes move rapidly, breathing and heart rates become irregular, blood pressure fluctuates, and muscles become virtually paralyzed. REM plays a major role in memory storage and retention, new learning, and mental performance according to Widmar (2003) and Koester (1997). Rapid eye movement (REM) is also the stage of sleep where the most dreams occur.

For most individuals, sleep cycles last approximately 90 to 100 minutes and can repeat up to four or five times a night. If sleep patterns are interrupted too many times, a person will awaken feeling tired. Authors affirmed that a person's level of alertness highly depends on the stage of sleep he or she was in when awakened (Missoula Technology and Development Center, n.d.; Widmar, 2003; Koester, 1997; Kuhn, 2001). For example, in Stage One or Two, the individual is more likely to wake up feeling alert and refreshed. If he or she is roused during the REM phase, they will easily remember their dreams. But if they are awakened from Stages Three

or Four, they will experience sleep inertia, a state of confusion, and diminished performance experienced by waking suddenly from a deep sleep or nap (Kuhn, 2001; Widmar, 2003; Queensland Department of Industrial Relations, 2005).

People who are assigned to “work shifts” such as the graveyard shift, 11 p.m. - 7 a.m., tend to “sleep less” than those who work equivalent hours or the traditional, 9 a.m. - 5 p.m., work hours that do not intrude on the typical sleep period (11:00 p.m. – 7:00 a.m.). Sleep during the day is typically of poor quality due to circadian disruptions and environmental factors such as daylight, traffic and household noises (Rosa & Colligan, 1997; ACTU, 2000).

The times when a person works and sleeps affects the amount of sleep obtained, the quality of the sleep and the subsequent fatigue experienced. Long hours or shift work patterns that disrupt the body’s circadian rhythms often result in workers becoming fatigued.

Fatigue is a common complaint in the general, primary care and working population, with occurrence rates varying from seven percent to forty-five percent. In most cases, fatigue lacks a clear somatic cause and appears to be a functional symptom or complaint (Huibers, Bültmann, Kasl, Kant, van Amelsvoort, van Schayck, Swaen, 2004).

Authors agreed with fatigue being a mental or physical exhaustion that may prohibit a person from being able to function normally. Fatigue is mainly caused by a lack of sleep. However, fatigue is more than just feeling tired or drowsy – it is normal to become tired through physical or mental effort. Fatigue significantly affects a person’s ability to function. The most common effects associated with fatigue are: (a) desire to sleep; (b) lack of concentration; (c) impaired recollection of timing and events; (d) irritability; (e) poor judgment; (f) reduced capacity for effective interpersonal communication; (g) reduced hand-eye coordination; (h) reduced visual perception; (i) reduced vigilance; and (j) slower reaction times (Appendix A)

(International Transport Workers' Federation [ITF], n.d.; Aaronson, Teel, Cassmeyer, Neuberger, Pallikkathayil, Pierce, Press, Williams and Wingate, 1999; ACTU, 2000; Queensland Department of Industrial Relations, 2005; Missoula Technology and Development Center, n.d.).

Additionally, authors suggested that fatigued people are more likely to engage in risk taking behavior. Each of the common effects is relevant to many, if not all, occupations. Not only do these effects decrease performance and productivity within one's workplace, but they simultaneously increase the potential for accidents and injuries. People working in a fatigued state place themselves and others at risk, for the most part (a) when operating machinery [including driving vehicles], (b) when performing critical tasks that require a high level of concentration, and (c) where the consequences of error is serious (International Transport Workers' Federation, n.d.; Queensland Department of Industrial Relations, 2005; ACTU, 2000; Pati, Chandrawanshi & Reinberg, 2001).

Furthermore, fatigue has effects on one's health. Gastro-intestinal disorders and upper respiratory infections are the most common health problems related to fatigue according to authors. The body rhythm for digestion is designed for food to be eaten during the day irrespective of whether an individual is working or resting. This can cause problems when heavy or fatty foods are eaten at some point in the night. The most common complaints include (a) bowel habit changes, (b) digestive complaints and (c) increased risk of peptic (stomach) ulcers. Whilst the most common factor that causes upper respiratory illnesses or infections associated with fatigue is an increase in stress which reduces one's immune system (Queensland Department of Industrial Relations, 2005; International Transport Workers' Federation, n.d.; ACTU, 2000; Aaronson et al., 1999; Rosa, Colligan, 1997; Missoula Technology and Development Center, n.d.).

Moreover, the effects of fatigue increase with age. Authors confirmed people over 50 years of age tend to have lighter, fragmented sleep. This can prevent them from receiving the recuperative effects from a full night's sleep, and can make them more likely to become fatigued (Aaronson et al., 1999; Queensland Department of Industrial Relations, 2005; ACTU, 2000).

Finally, authors acknowledged women's reproductive health can be affected by fatigue. Fatigue and irregular sleep patterns have been associated with a number of negative effects for pregnant women and fertility rates. These negative effects include (a) irregular menstrual cycles, (b) increased risk of miscarriages, (c) low birth weight, and (d) higher occurrences of premature births (ACTU, 2000; Queensland Department of Industrial Relations, 2005; Harrington, 2001; Rosa, Colligan, 1997).

Third, what kind of guidelines and strategies are used in other industries where extended hours are worked such as in hospitals, air traffic controllers, etc.? Most jobs have a very standard schedule and an employee knows his or her schedule ahead of time. If the schedule changes or shift times change the worker will know several days in advance. This makes it easy to schedule other non-work activities, such as doctor appointments, ensuring that someone is home when the children get home from school, and physical fitness regimes. Other jobs are not so standard or predictable. For example, health care and emergency workers might respond to emergencies that keep them on the job much longer than expected. Or, they might be on-call for such emergencies. At a factory or nuclear power plant, a breakdown or last-minute call for a product might keep workers at the plant working overtime. Whilst railroad workers sometimes work off a "call board," which means that they can be assigned to a train at the last minute to move a "just-in-time" order of goods.

If workers cannot predict their schedules, it is difficult to get adequate rest. Maybe they just get to sleep when they are called back to work, or they have just worked a long shift when an emergency happens. Thus they may stay at work for a few more hours. Perhaps workers are on-call and never get deep, satisfying sleep because they are always listening for the phone, pager or alerting system. Some people call this "sleeping with one eye open."

According to the International Transport Workers' Federation (n.d.), fatigue is killing seafarers. Long hours, overwork and low staffing levels are causing ship collisions, groundings and sinkings, costing lives, ruining seafarers' health and endangering the environment. Every study, and countless accident investigations, underlines the scale of the danger.

There is no exact agreed legislative definition of seafarer fatigue – instead the International Maritime Organization (IMO) uses the working definition of "a reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including: (a) strength; (b) speed; (c) reaction time; (d) coordination; (e) decision-making; and (f) balance (International Transport Workers' Federation, n.d.).

Concern about accidents and excessive working hours on ships resulted in two key international agreements to limit duty hours and set requirements for rest periods: the 1995 amendments to the Standards of Training, Certification & Watchkeeping Convention (STCW 95) and the International Labour Organization [ILO] Convention 180 on Seafarer's Hours of Work and the Manning of ships. Additionally, many flag states have their own national regulations. The agreements according to International Transport Workers' Federation (n.d.), declared the limits on hours of work or rest were as follows: (a) maximum hours of work shall not exceed 14

hours in any 24-hour period; or 72 hours in any seven-day period; and (b) minimum hours of rest shall not be less than ten hours in any 24-hour period or 77 hours in any seven-day period.

Despite these regulations and conventions seafarers are still routinely worked to dangerous levels – not just illegally and through the falsification of work and rest timesheets, but because flag states can gain dispensation by claiming to increase leave and because there is more focus on hours of rest rather than hours of work.

A few authors stated that workers in other industries are protected – even prohibited- from working excessive hours. Truck drivers, railroad workers and airline crewmembers are protected by various rules and regulations related to working hours (Frakes & Kelly, 2004; DeLandre, Boag & Fletcher, 2002; MacDonald, 2005; Federation of Nurses & Health Professionals [FNHP], 2003; Office of Rail Regulation [ORR], 2006).

According to authors, pilots were protected by flying-time limits in the 1930s when airmail pilots were often killed in fatigue-related crashes after being forced to fly long hours. Those rules were amended in 1985 and those same rules are used today by the Federal Aviation Administration (FAA). Those rules are often supplanted by union contracts (MacDonald, 2005; DeLandre, Boag & Fletcher, 2002; Frakes & Kelly, 2004; Federation of Nurses & Health Professionals [FNHP], 2003; Maddox, 2005).

Under FAA rules, which dictate flying hours, pilots can fly no more than eight hours in a 24-hour period, no more than 30 hours in a week and no more than 1,000 in a year. Additionally, the FAA requires an eight-hour rest period each day that a pilot works. Authors affirmed that a recent FAA interpretation of the regulation said that pilots could not be on duty for more than 16 consecutive hours (MacDonald, 2005; Frakes & Kelly, 2004; Federation of Nurses & Health Professionals [FNHP], 2003; Maddox, 2005).

Pilots' union contracts and the Air Medical Safety Advisory Council (AMSAC), who represent air medical crews, usually go further, limiting not only flying time, but also total duty time, as pilots are often required to perform ground duty. Typically, the pilots' contracts limit pilots to 14 or 15 hours of total work each day. Pilots' unions continually push the FAA to make and enforce 14-hour duty days for pilots (Maddox, 2005) (Appendix B).

The Federation of Nurses and Health Professionals (2003) acknowledged that the National Transportation Safety Board (NTSB) has urged the FAA to improve its rules to prevent pilot fatigue. According to pilots' unions, many of their members are often pressured by management to fly beyond established limits, often facing wage garnishment, suspension and termination for declaring themselves too fatigued to continue flying.

On the other hand, flight attendants are crew members who perform essential routine and emergency safety duties, and were the only safety-sensitive aviation group with no regulations with respect to flight, duty or rest periods until September 19, 1994 when the Federal Aviation Administration (FAA) issued a regulation limiting the hours of work. The unions representing flight attendants stated that the regulation has many faults but acknowledged that it is better than having no protection at all. The basic provisions of the regulation are based on scheduled duty time-not actual duty time- and not flight time. The provisions are as follows and can be seen in (Appendix C):

1. A duty period is the period of time between reporting for an assignment, involving flight time and release from the assignment by the airline.
2. For scheduled duty periods in excess of 14 hours, an airline must increase the number of flight attendants on that flight depending upon the length of the scheduled duty period.

3. If a flight attendant is on reserve, this is not considered part of a duty period because duty periods must be associated with flight. This is not considered a rest period because the flight attendant is not relieved of all responsibility and duties with the air carrier. Sometimes referred to as “deadhead,” this is considered neither rest nor duty.
4. Even though the minimum scheduled rest period is nine hours, a flight attendant may be scheduled to receive only eight hours of rest provided there is a longer rest period following the next duty assignment.
5. Each flight attendant must be scheduled to receive 24-hours rest within each consecutive seven calendar days once they have been assigned duty (Federation of Nurses & Health Professionals [FNHP], 2003).

Furthermore, the National Air Traffic Controllers Association [NATCA] (2006), declared that controllers are restricted to no more than ten consecutive hours of work (unless there is an emergency – like a natural disaster) and must have eight hours off between shifts and cannot work more than six consecutive days without 24-hours off.

Moreover, a further negotiated restriction is that an air traffic controller will not be required to work more than two consecutive hours on an operational position without a break, unless operational conditions do not permit (no one to relieve you) (National Air Traffic Controllers Association [NATCA], 2006; Maddox, 2005).

A few authors declared that there are approximately 755 fatalities and 20,000 injuries that result every year because of fatigued commercial truck drivers. The Federal Motor Carrier Safety Administration (FMCSA) of the Department of Transportation (DOT) is responsible for federal regulations, which were adopted more than 60 years ago, to permit commercial drivers to drive

no more than ten consecutive hours before having an eight hour break and cannot work more than 70 hours over an eight day period (Utility Workers Union of America [UWUA], 2000; Federation of Nurses & Health Professionals [FNHP], 2003; Fuchs, McMaster, Smull, Getsy, Chang & Kozar, 2001).

The Motor Carrier Safety Improvement Act of 1999 has prompted the FMCSA to develop a long-term strategy and performance plan for the next ten years with one goal being the reduction of large truck-related fatalities by 50 percent by 2009. In response to the Motor Carrier Safety Improvement Act of 1999, the FMCSA has proposed new rules for commercial truck drivers. The proposed new rules include:

1. No more than 12 hours of driving time in a 24-hour period, with two hours of break time within the 12 hours.
2. Long-distance trucks would be required to carry electronic monitors to keep track of drivers' work hours (Utility Workers Union of America [UWUA], 2000).

The Federal Motor Carrier Safety Administration (FMCSA) has stated that the proposed new rules would prevent 2,600 accidents and as many as 115 fatalities every year.

Rail workers in freight and passenger operations have been covered for several decades by federal restrictions, which limit their duty time to 12 consecutive hours and a mandatory ten hour rest period. Worker fatigue had been identified by the National Transportation Safety Board (NTSB) as the number-one safety issue in the railroad industry (Officer of Rail Regulation [ORR], 2006; Federation of Nurses and Health Professionals [FNHP], 2003).

Given that there are 168 hours in a week, the opportunity for sleep is severely limited among interns who may work more than 80-hours per week. Their ability to sleep for the recommended eight hours per night becomes physically impossible and unavoidably leads to

progressively more severe chronic sleep restrictions (American Medical Association [AMA], 2005; Barger, Cade, Ayas, Cronin, Rosner, Speizer & Czeisler, 2005).

According to the American Medical Association [AMA] (2005), “total duty hours” represent those scheduled hours of activity associated with a residency program and include: (a) scheduled time providing direct patient care or supervised patient care; (b) scheduled time to participate in formal education activities; (c) scheduled time providing administrative and patient care services of limited or no educational value; and (d) time needed to transfer the care of patients.

Additionally, the resident physician total duty hours must not exceed 80 hours per week, averaged over a two-week period. Workdays that exceed 12 hours are defined as on-call and on-call assignments should not exceed 24 hours. The AMA (2005) confirmed that residents may remain on-duty for up to 30 hours to complete the transfer of care, patient follow-up, and education; however, residents should not be assigned new patients, cross-coverage of other providers’ patients, or continuity clinic during that time.

Furthermore, the AMA (2005) declared that on-call should be every third night and that there will be at least one consecutive 24-hour duty-free period every seven days both averaged over a two-week period. Finally, there should be a duty-free interval of at least ten hours before returning to duty.

The fourth, research question asked how may this compare and contrast to the traditional 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules? Over the years, the 24-hour duty schedule has been marketed as the most economical way to deliver fire and emergency medical services. According to Rule (1999), 24-hour scheduling trends originated in the early paid departments when firefighters had previously been on duty for six or seven days.

Occasionally firefighters would get days off, and in some cases, family visits and meal breaks were given on a staggered schedule to minimize staffing shortages.

A commonly used duty schedule was the two-shift, 84-hour duty week, in which a firefighter would work one 24-hour duty shift followed by a 24-hour period off. Duty schedules were further reduced to 72-, 67- and 63-hour duty weeks designed using a combination of 24-hour shifts and days off (Rule, 1999).

The next trend according to authors was the 56-hour duty week, which provided for three shifts using the 24-hour duty day. Further reductions have occurred through the collective-bargaining process and the influence of the Fair Labor Standards Act (Rule, 1999; Mississauga Firefighters, 2006). Although there has been a significant reduction in hours over the years, the 24/48 shift continues to be the dominant duty schedule for firefighters.

The Mississauga Fire Fighters Association [MFFA Local 1212] (2006) acknowledged that working a 24-hour shift schedule and having 48-hours off can lead to: (a) better overall health for firefighters; (b) an increased level of fire ground safety as firefighters would be better rested; and (c) firefighters always reporting for work after a complete nights sleep. Additionally, the MFFA (2006) declared that scientific evidence concluded that firefighters that worked a rotating schedule such as 10/14 exhibited a higher level of de-synchronization of the body's natural circadian rhythm than firefighters working a 24-hour shift schedule. Furthermore, MFFA (2006) affirmed that after busy night shifts, firefighters attempting to catch up on sleep during the day will at best, only "catnap," as they try to keep the circadian rhythm in synch. The firefighter will not fully replenish their body's energy reserves before the next work cycle.

Although tradition plays an important role in the fire service the 10/14 schedule offers a variety of advantages and opportunities without additional staff. According to Rule (1999) the

combination of a 10-hour duty day and a 14-hour duty night offers several benefits, including improved safety, reduction in sick time usage, increased productivity, improved project management and better quality of life for personnel.

Fatigue is a major factor in personal safety. A physically and mentally challenging incident that occurs early in a 24-hour shift can subject fire and emergency medical personnel to injury or possible even death due to fatigue and decreased alertness at an incident that may occur later on in the shift. Additionally, according to Rule (1999) when personnel handle multiple incidents during a single 24-hour shift, the competence of the crews and the quality of their service may be compromised. The 10/14 shift schedule can provide relief for fatigued and extremely busy crews through proper rest periods at the end of the ten or 14-hour duty shift.

In regards to decreasing sick time usage and overtime pay, Rule (1999) declared that by implementing a 10/14 schedule if an employee calls in sick with a non-job-related illness or injury they would be absent from either a ten- or 14-hour shift rather than 24 hours. Furthermore, if the fire agency chooses to pay employees overtime rather than run short for the shift; they would only have to pay for a split shift rather than a 24-hour one.

Certain gains that are not possible on the 24-hour shift can be achieved on the 10/14 duty schedule. With the exception of emergency responses, the work day on a 24-hour shift terminates between 1700 -1800 hours, and personnel go on a readiness/stand-by mode. Job related activities such as (a) training; (b) vehicle/building maintenance; (c) code enforcement; (d) public education; and (e) administrative tasks are not done after 1800 as the rest of the population either goes home for the day or are closed for the weekend or holiday (Rule, 1999). Moreover, a split shift such as the 10/14 offers more continuity than a day-on, day-off arrangement when it comes

to assigning personnel projects. Personnel can be scheduled to work four consecutive days to complete their assigned projects in a more efficient manner (Rule, 1999).

There are mixed opinions according to authors on which schedule provides the best quality of life to personnel. Rule (1999) acknowledged that employees who work 24-hour shifts often complain that the schedule limits family contact. Rule (1999) stated, “The 10/14 duty shift allows more frequent family contact opportunities, including eating dinner together if travel time to and from work is minimal” (p. 63). Whilst the Mississauga Fire Fighter Association [MFFA] (2006) and Holmes (2003) declared the 24-hour duty schedule gives employees time at home and greatly improves their health. According to Holmes (2003) working 24-hour shifts with 48-hours off assists many firefighters who work second jobs or “moonlight” to bring in extra money to their support families. Holmes (2003) stated, “Moonlighting promotes sleep loss quite simply by reducing the time available to sleep” (p.8). We then go back to the vicious cycle of personnel coming to work fatigued and sleep deprived. Is there a happy medium?

According to Rule (1999), to change to a 10/14 duty week is a break with custom and tradition for the vast majority of United States fire departments. A change in the status quo is disturbing to almost everyone, and the fire service is no exception. In fact, many would argue that the fire service is the most tradition-orientated of all municipal services.

The disadvantages of switching to a 10/14 duty schedule according to Rule (1999), is that employees will double their travel time to and from the fire station. When personnel are not restricted by a residency clause, commuting distances can be substantial. Travel costs, traffic congestion and pollution may be minimized by carpooling. Facilitating this requires assigning personnel to shifts and work sites by zip codes or other geographical boundary lines.
Rule (1999) stated:

> Agencies should change to the 10/14 schedule for the right reason, which has to be to provide the best delivery of the local fire protection system. The 10/14 shift shouldn't be used as a threat to keep the demands of labor at a minimum during the collective-bargaining process." (p. 63)

The final question asked what potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricanes and tropical storms. Fatigue management is a shared responsibility between management and workers as it involves factors both inside and outside of work. Employers or persons conducting a business or undertaking one are responsible for using a risk management approach to manage fatigue. Additionally, it is the responsibility of employees to ensure that they make appropriate use of their rest days and are fit for duty.

According to authors, maintaining comfortable temperatures, controlling excessive noise and providing well-lit duty areas and dark, quiet sleeping facilities are steps that some fire agencies have taken to make the workplace more comfortable and reduce employee fatigue (Widmar, 2003; Frank, 2004). Widmar (2003) further acknowledged that management should: (a) allow tired employees an extra hour or two of sleep, even after shift change, to help keep them awake on the drive home; (b) modify work schedules to better accommodate increasing alarm loads; (c) rotate busy units/crews with slower units; and (d) limit the length of time personnel can be assigned to busy companies. Furthermore, authors agreed that fatigue within the workplace should be managed using a risk management approach (Queensland Department of Industrial Relations, 2005; ACTU, 2000; Frank, 2004; Widmar, 2003; Vila, Morrison & Kenney, 2002).

According to the *Workplace Health and Safety Act 1995* (Workplace Health and Safety Act, 1995), there are five basic steps in the risk management process that corporations, fire-rescue agencies, and other business should follow to manage fatigue.

Step One: Identify factors that contribute to fatigue. Shift length and roster design may be placing workers at risk of sleep deprivation and fatigue. When employers are looking at rosters, it is important to assess whether the roster provides employees with a sufficient opportunity for rest and recovery between shifts.

When determining if roster design is contributing to fatigue, employers should consider the following: (a) length of shifts worked; (b) previous hours and days worked; (c) type of work being performed; and (d) time of day when the work is being performed. Additionally, there are many ways to identify workplace factors that contribute to fatigue. They include: (a) inspecting rosters; (b) consulting with employees; (c) consultations with workplace health and safety representatives and committees; (d) conducting a safety audit; (e) analyzing injury and incident/accident reports; and (f) conducting employee surveys.

Step Two: Assess risk. To assess risk, it is necessary to consider both likelihood and consequences. For each of the risks one must determine the following: (a) the likelihood [i.e. very likely, likely, unlikely, very unlikely] of an incident occurring at the workplace; (b) the consequences [i.e. extreme, major, moderate, minor] of an incident occurring at the workplace; (c) combining the likelihood and consequences estimates to rate the risk. Once the process has been completed, the ratings of each risk should be prioritized for further action.

Furthermore, the following should be considered when assessing the factors that contribute to fatigue: (a) time of day; (b) length of shifts worked; (c) lack of opportunity to recover from fatigue; (d) how often the situation occurs; (e) how many people are fatigued; (f)

the skills and experience of person fatigued; (g) any special characteristics of the people involved; (h) the duration of exposure to fatigue and (i) the level of risk inherent in the work.

Step Three: Decide on control measures. The ideal solution when managing fatigue is to completely eliminate factors that contributes to fatigue. This may involve the elimination of night shifts and extended working hours. If this is not possible, there are a number of control measures that may be used alone, or in combination, to minimize and control exposure to fatigue.

Because fatigue is caused by a combination of factors, the most effective way to manage it is by using a combination of risk control measures. Some of the control measures are as follows: (a) limiting shift work to essential jobs and tasks that must be completed at night; (b) scheduling later start times so that maximum night sleep can be obtained before starting work; (c) scheduling low risk work during periods of high fatigue, such as night time and/or in the latter half of shifts; and (d) scheduling complex tasks to be performed only during the day.

During this third step, administrative controls may be used only when there is no other practical control measure available or as a temporary measure until a permanent solution is found. Examples of administrative controls are: (a) sufficient supervision during periods of high fatigue and especially for hazardous work; (b) contingency plans if workers become fatigued [removing the fatigued worker from work activities]; (c) effective emergency responses; and (d) job rotation for repetitive or monotonous work, or work that involves heavy physical demands.

Step Four: Implement control measures. The fourth step is putting the control measures in place. This involves undertaking those activities that are necessary to allow the measures to operate effectively.

Work procedures need to be developed to ensure that fatigue control measures are effective. Effective fatigue control measures should define and communicate responsibilities. It

is important to clearly communicate that the control measures are being introduced to effectively manage fatigue. It is important to remember that workers are entitled to be consulted about any changes in the workplace that affect, or could affect, their safety. This consultation is achieved through the workplace health and safety committee, health and safety officer and health and safety representatives.

Employers should provide training to workers and supervisors on fatigue. This training program should include the following information: (a) common causes of fatigue including shift work and extended working hours; (b) potential health and safety impacts of fatigue; (c) how workers are responsible for making appropriate use of their rest days; and (d) how they should ensure they are fit for duty on duty days.

Step Five: Monitor and review. When working through this step, it is useful for employers to consider if the chosen control measures have been implemented, are the measures working and have any new problems developed. To answer those questions employers should: (a) consult with employees, supervisors and health and safety representatives; (b) measure exposure to fatigue – are workers still getting fatigued? (c) monitor incident/accident reports and assess the likelihood for fatigue contributing to the incident/accidents.

Widmar (2003) stated:

> Ignoring shift-fatigue problems can expose employers to litigation and lead to reactionary legislation. An Oregon court has already established that employers are responsible for monitoring employee fatigue and that an employer may be held liable for injuries sustained by fatigued and sleepy employees. Individuals may also be held liable in drowsy-driving crashes. Tired New Jersey drivers involved in fatal crashes could face up to 10-years in prison and fines up to $150,000. (p. 54)

Authors agreed that employers are not the only ones responsible for managing sleep deprivation and fatigue - employees need to be responsible as well (Vila, Morrison & Kenney, 2002; Widmar, 2003; Peltin, 2005; Smith, 2006; Parker, 2006).

Authors acknowledged that quality sleep is the primary weapon in the battle against sleep deprivation and fatigue. Firefighters must take advantage of opportunities for sleep, both on and off-duty. Sleeping areas at home and at the fire stations should be quiet and dark, and the room temperature should be cool (65° F - 70°F). Additionally, a comfortable, good-quality mattress is a must along with comfortable pillows and bedding. Good sleep habits are essential. Firefighters need to get an adequate amount of uninterrupted sleep every off-duty night. Going to sleep and waking up at the same times every day, even on weekends, is important for maintaining the body's circadian rhythms (Peltin, 2005; Smith, 2006; Parker, 2006; Widmar, 2003; Vila, Morrison& Kenney, 2002).

Moreover, authors confirmed other tips for quality sleep and reduction of fatigue. These tips include: (a) avoid eating, reading, and watching television in bed; (b) avoid nicotine prior to bedtime; (c) restrict caffeine intake and caffeinated beverages at least six hours before bedtime; (d) eat healthful foods - do not eat large meals within four to fives hours of sleeping; (e) do not use alcohol to induce sleep; (f) avoid long-term use of over- the- counter sleeping pills [can lead to addiction]; (g) reduce life stress as much as possible; (f) use relaxation techniques to relieve stress and invite sleep; and (g) exercise, but not more then four hours before bedtime (Widmar, 2003; Smith, 2006; Peltin, 2005; Parker, 2006; Frank, 2004).

Widmar (2003) avowed that for 24-hour shift workers, such as firefighters and emergency medical personnel, outdoor exercise during daylight hours can help maintain natural biological rhythms and increase sleep quality off-duty.

According to Holmes (2003) firefighters in the United Kingdom are being left behind while industries including road transportation, aviation, and petroleum plants are implementing fatigue management programs and reaping the personal and financial rewards of a safer and healthier workforce.

Holmes (2003) stated:

> The first step towards minimising [*sic*] fatigue in the Fire Service would be to increase awareness of the issue. One way of achieving this aim, while systematically assessing the underlying factors that contribute to fatigue in the Fire Service, would be to invite fire-fighters to participate in a survey on fatigue and how it relates to their work practices. Such a survey could inform the design of an education programme [*sic*] designed to arm fire-fighters with strategies to help them cope with the proven rigors of shiftwork. (p. 9)

Finally, authors concurred that napping is an effective coping strategy that can be used in anticipation of a long night or during extended operations (Peltin, 2005; Widmar, 2003; Jha, Duncan & Bates, 2001; Coburn, 2000). Research has shown that the restorative effects of a short nap were observed after a normal night's sleep, after a restricted night's sleep and even during 64-hours of continuous work. Furthermore, taking a brief break and clearing your mind has been shown to greatly enhance your creativity later in the day (Peltin, 2005).

According to authors, there is an abundance of sleep research that substantiates the positive effect of taking regular naps. Most of the research supports the effectiveness of improving mood, alertness and performance with a nap of 30 minutes or less (Peltin, 2005; Jha, Duncan & Bates, 2001; Coburn, 2000; Widmar, 2003). Naps longer than 30 minutes are recommended only when the sleep deprivation is significant enough to cause several of the symptoms that were presented earlier in the research.

Authors agreed that longer naps tend to create sleep inertia and reduce the effectiveness of evening sleeping (Peltin, 2005; Jha, Duncan & Bates, 2001). The effectiveness of napping increases when it's performed during the time of the lowest dips in your circadian rhythms. Although each person is different, this usually occurs between 1300 HRS and 1500 HRS (Peltin, 2005).

Coburn (2000) stated, "Some companies have developed napping policies and have provided napping facilities" (p.44). Authors declared that management need to understand the sleep issue that's confronting employees and then understand that napping can be a very important part of that. Companies long ago accepted that having free coffee available meant that you got a lot more productivity out of your employees all morning long. Napping is not that dissimilar; it's just not in the same frame of mind for most people (Peltin, 2005; Jha, Duncan & Bates, 2001; Coburn, 2000).

In an attempt to reduce sleep deprivation and fatigue amongst air traffic controllers, the Federal Aviation Administration [FAA] and Civil Aerospace Medical Institute (2001) have developed a compact disk (CD) that is given to air traffic controllers at their orientation called *Shiftwork Coping Strategies.* This compact disk discusses five topics that are related to sleep deprivation and fatigue. The topics include: (a) shiftwork; (b) circadian rhythms; (c) sleep; (d) disruptions; and (e) coping strategies. The CD runs approximately for one hour and assists the air traffic controller in understanding what he or she may experience while being employed.

In summary, emergency personnel, like all workers, carry out their duties within an environment composed of a set of discrete elements. First there is the emergency itself. The emergency imposes certain exigencies upon the responders. Second, a social structure exists with specific social units, rules, and forms of association. An emergency response, therefore, takes

place within a context of prescribed behaviors, expectations, and value judgments that are sometimes in conflict with each other. Third, there is a technology that must be understood in order to accomplish group goals. If the technology itself is implicated in the emergency, the entire emergency environment may be impacted. Clearly, a breakdown in any of these elements could result in worker injury and might heighten responder stress, fatigue and general well-being.

The maximum number of hours that a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue is greater than 12-hours, but even shifts of eight hours or less can be fatiguing if the work is very intense or demands continuous concentration, or there are inadequate breaks.

It is recommended that the maximum hours to be worked in a day or a week (7 days) should not exceed the following, other than in emergency circumstances: (a) maximum of six consecutive eight-hour shifts; (b) maximum of two consecutive night shifts; (c) maximum of two consecutive 12-hour shifts; (d) maximum 12-hours overtime per week; (e) maximum 12-hours work per day (including overtime) except in emergency circumstances; and (f) maximum 48-hours rostered work per week. In emergency circumstances a maximum of 60-hours worked in one week may be necessary. It should not be worked on a regular basis or in consecutive weeks.

Each and every person adjusts to shift schedules and work hours differently. For some, their physiology does not allow them to adjust at all. Others, however, experience peak performances at night.

There are various early symptoms of and potential problems that may be related to sleep deprivation and fatigue. The following symptoms will identify if you are or not sleep deprived: (a) you need an alarm clock to wake you up at the appropriate time; (b) you struggle to get out of

bed in the morning; (c) you feel irritable, tired, and stressed during the week; (d) you have trouble concentrating and remembering; (e) you fall asleep in warm rooms during meetings or classroom training sessions; (f) you need a nap to get through the day; (g) you feel drowsy while driving; and (h) you fall asleep within five minutes of going to bed. In addition, to these symptoms disruption of a person's circadian rhythm due to shift work can cause an individual to become sleep deprived.

Fatigue is mainly caused by a lack of sleep. However, fatigue is more than just feeling tired or drowsy – it is normal to become tired through physical or mental effort. Fatigue significantly affects a person's ability to function. The most common effects associated with fatigue are: (a) desire to sleep; (b) lack of concentration; (c) impaired recollection of timing and events; (d) irritability; (e) poor judgment; (f) reduced capacity for effective interpersonal communication; (g) reduced hand-eye coordination; (h) reduced visual perception; (i) reduced vigilance; and (j) slower reaction times

In other industries where extended hours are worked there are certain guidelines and strategies that have been developed and implemented to prevent fatigue. The International Maritime Organization (IMO) and International Transport Workers' Federation have declared limits on hours of work and rest for seafarers. They are as follows: (a) maximum hours of work shall not exceed 14 hours in any 24-hour period; or 72 hours in any seven-day period; and (b) minimum hours of rest shall not be less than ten hours in any 24-hour period or 77 hours in any seven-day period.

Under FAA rules, which dictate flying hours, pilots can fly no more than eight hours in a 24-hour period, no more than 30 hours in a week and no more than 1,000 in a year. Additionally, the FAA requires an eight-hour rest period each day that a pilot works. Furthermore, air traffic

controllers are restricted to no more than ten consecutive hours of work (unless there is an emergency – like a natural disaster) and must have eight hours off between shifts and cannot work more than six consecutive days without 24-hours off.

When comparing and contrasting the traditional 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules it was found that working a 24-hour shift schedule and having 48-hours off can lead to: (a) better overall health for firefighters; (b) an increased level of fire ground safety as firefighters would be better rested; and (c) firefighters always reporting for work after a complete nights sleep. In contrast, the combination of a 10-hour duty day and a 14-hour duty night offers several benefits, including improved safety, reduction in sick time usage, increased productivity, improved project management and better quality of life for personnel.

The disadvantages to either a 24 on 48 off or 10/14 schedule are as follows: (a) employees that work 24-hour shifts complain that the schedule limits time with their families; (b) employees that work 10/14 schedules will double their travel time to and from the fire station.

Lastly, in order for a fire-rescue agency to employ strategies to reduce responder fatigue during extended incidents such as hurricanes and tropical storms, management and employees need to share responsibility in developing a fatigue management program. The fatigue management program can be established by using a risk management process. There were five steps mentioned on how the process works.

Additionally, there were tips for better quality sleep and reducing fatigue. These tips included: (a) avoid eating, reading, and watching television in bed; (b) avoid nicotine prior to bedtime; (c) restrict caffeine intake and caffeinated beverages at least six hours before bedtime; (d) eat healthful foods - do not eat large meals within four to fives hours of sleeping; (e) do not use alcohol to induce sleep; (f) avoid long-term use of over- the- counter sleeping pills [can lead

to addiction]; (g) reduce life stress as much as possible; (f) use relaxation techniques to relieve stress and invite sleep; and (g) exercise, but not more then four hours before bedtime.

Finally, napping was discussed as an effective coping strategy that can be used in anticipation of a long night or during extended operations. A nap of 30 minutes or less improved an individual's mood, alertness and performance, but naps longer than 30 minutes created sleep inertia and reduced the effectiveness of evening sleep.

In order for a fire-rescue agency to develop a fatigue management program, they must increase their awareness of the issue at hand. Management should invite firefighters to partake in a survey to define what fatigue is and how it relates to their work practices.

Procedures

This applied research paper (ARP) used the descriptive method in gathering information regarding the effects of fatigue on firefighters, and develop strategies to reduce those effects during extended incidents such as hurricanes and other related weather events that may warrant emergency management activation deemed by the State of Florida Office of Emergency Management. The descriptive methodology focused on studying what the present situation is and attempting to predict future events or suggest a course of action to shape the future.

The literature review was promptly conducted at the National Fire Academy's Learning Resource Center (LRC) in Emmitsburg, Maryland during this author's attendance in the *Executive Leadership (EL) – R123* course, in May of 2006. The LRC was chosen because it has an enormous collection of indexed periodical resources related to emergency services. Moreover, the LRC provides an impressive archive containing previous works from former Executive Fire Officer Program (EFOP) students and practicum research papers conducted as requisite components of the EFOP.

Due the attractiveness of this ARP, the research from the LRC concluded with many results. There were numerous resources available that were recommended on the “Display Search” using the “LRC Starfinder®” computer program. The author proceeded to type “sleep” and “fatigue” in to the LRC Starfinder® program and found 58 journal articles, 16 reports, one applied research paper on the topic “sleep” and 27 journal articles, 24 reports and two applied research papers dealing with the topic “fatigue.” Many of the journal articles were listed for both topics. The information contained within the trade journal articles, reports and books revealed research findings that supported the knowledge claim being questioned.

Subsequently, an extensive search of the subject “fatigue” was conducted at the Broward County Main Library located in Fort Lauderdale, Florida. This revealed 687 possible pieces of research data, including: videos, documents and books associated with fatigue. Unfortunately, many of the reference materials dealt with chronic fatigue syndrome, compassion fatigue and fatigue on structures.

A comprehensive query on Broward County Library’s World Wide Web search engine, “InfoTrac One File” (library’s largest magazine database) revealed 7449 articles. Many of these articles were beneficial in researching the symptoms, effects, and number of work hours associated with fatigue and sleep deprivation on individuals, while others dealt with other issues.

Upon completion of research using journal articles, magazines, books and studies on fatigue/sleep deprivation, an internal survey was sent to lieutenants, driver-engineers, fire investigators and firefighters/paramedics within the Fort Lauderdale Fire-Rescue Department via the Internet (Microsoft Outlook) to post to 328 employees. A sample of the survey questions are provided in (Appendix D).

Interviews were another source of information and were conducted via telephone with individuals holding key positions within the City of Tamarac, Florida Fire Department, and the Florida Division of the State Fire Marshal. Kingman Schuldt, Deputy Fire Chief, with the City of Tamarac Fire & Rescue Department was the selected respondent because of his affiliation with Florida's State Emergency Response Committee, as Vice Chairman and his deployment to Mississippi after Hurricane Katrina. Additionally, Randall W. Napoli, Director, Division of State Fire Marshal, was chosen due to his position and as Commander of Task Force Florida, that was deployed to Mississippi after Hurricane Katrina in August of 2005.

The telephone interviews were conducted during the week of September 18th, 2006. Refer to (Appendix E) for an example of the telephone interview form used. Confirmation to the authenticity and content of the interviews can be verified by calling the main number of the Tamarac Fire Department Administration at (954) 597-3800 or the Florida State Fire Marshal's office at (850) 413-3601, and ask to speak with the listed respondents.

To summarize the research methodology, following the steps of David R. Krathwohl's *Model of the Chain of Reasoning* was the logic behind this author's approach. Krathwohl suggested following a model will aid in the replication of future study of the knowledge claim being investigated. He suggested first, study the conclusions from previous research, which includes explanations, rationale, theories or points of view. The second step, develop questions, hypotheses, predictions, or models. Third step involves the design and structure of the study. Fourth step is to gather the data, researching subjects, situations, observations, and basis of comparison and procedures. The fifth step is to summarize the data. The sixth step recommends determining the significance of the results. The seventh step is developing conclusions of the

study. The final study is the beginning of the next study by the same or different researcher (Borg & Gall, 1989).

Assumptions and Limitations

The procedures employed during this research project were based on several fundamental assumptions. First, it is assumed that all authors referenced in the literature review performed objective and unbiased research, and that the information and data obtained was accurate.

Secondly, the information that was gathered from the internal survey was in joint agreement with the objectives recognized by this applied research project. The reliance of the information provided by the respondents was based on their knowledge of fatigue or lack thereof.

For this applied research project, the internal survey identified and limited the target audience to firefighters including: (a) lieutenants; (b) driver-engineers; (c) fire investigators; and (d) firefighter/paramedics who are responding to a greater amount of alarms than upper managerial responders such as line chief officers and chief administrators within the Fort Lauderdale Fire-Rescue Department. The total number of surveys sent out via Internet (Microsoft Outlook) was 328.

The results of the survey are not based on scientific sampling. The survey represents a convenience sample of specific sets of data in regards to the potential effects of fatigue on firefighters within the organization.

The third assumption regarding this author's research findings, relates to the effectiveness and accuracy of data obtained when conducting telephone interviews. It was assumed that the respondents answered all questions fairly and accurately.

The only limitation was time. The six-month time limit imposed by the National Fire Academy to effectively prepare a thorough and comprehensive applied research project and in addition, compare and contrast pertinent research of this most important topic, did not allow for a more in-depth and comprehensive literature review or observational sleep study on the subject.

Definition of Terms

Shift work – A method of work organization under which groups or crews of workers succeed each other at the same workstations to perform the same operations, each crew working a certain schedule or shift so that the undertaking can operate longer than the stipulated weekly hours for any worker (Pati, Chandrawanshi & Reinberg, 2001. p. 32).

Ergonomics – A multidisciplinary activity dealing with interactions between humans and their total working environment plus stresses related to such environmental elements as atmosphere, heat, light, and sound as well as all tools and equipment of the workplace (O'Brien, 1995, p. 286).

Musculoskeletal – The combined system of muscles and bones that comprise the internal biomechanical environment (O'Brien, 1995, p. 314).

Endocrine – The term is applied to certain glands that produce secretions that enter the bloodstream or the lymph directly and are then carried to the particular gland or a tissue whose function they regulate (O'Brien, 1995, p. 284).

Psychomotor Skills – Physical actions that a person does or performs (Widmar, 2003, p. 46).

Circadian Rhythms – Programmed into the human body, causing us to be most alert during the day and want to be asleep at night; periodicity of 24 hours (Coburn, 2000, p.42).

Core sleep – The amount of sleep needed in order to maintain performance levels (Koester, 1997, p. 15).

Rapid Eye Movement (REM) – A form of sleep; where dreams occur, but our muscles remain inactive [which prevents us from acting out our dreams] (Peltin, 2005, p.69).

Sleep inertia – A recognized state of transition from sleep to wakefulness and results in a measurable decrease in alertness (De Landre, Boag & Fletcher, 2002, p. 24).

Flag State – Is the State of the flag which the vessel flies; In IMO Conventions, the flag State is sometimes referred to as the "Administration" (International Transport Workers' Federation, n.d., p. 6).

Call Board – A bulletin board that has freight or train schedules posted on it (Office of Rail Regulation [ORR], 2006, p. 10).

Deadhead – Dealing with the airline personnel; a flight attendant is on reserve and is not Relieved of all responsibilities or duties (Federation of Nurses & Health Professionals, 2003, p. 14).

Moonlight – A term used to mean that a person works a second job to bring in extra income (Holmes, 2003, p. 8).

Risk Management – Refers to an activity that involves the evaluation or comparison of risks and the development of approaches that change the probability or the consequences of a harmful action (FEMA, United States Fire Administration [USFA], 1996, p. 7).

Results

As part of the applied research project (ARP), an internal internet survey was sent to 328 members of the Fort Lauderdale Fire-Rescue Department (FTFLR) consisting of firefighter/paramedics, driver-engineers and lieutenants. Out of the 328 members that received the survey via Microsoft Outlook (on-line), only 92 members responded for a response rate of 28 percent (28%). In addition, two telephone interviews were conducted. One telephone interview

conducted for this ARP was with the Deputy Fire Chief, from the City of Tamarac Fire & Rescue Department, Florida, because of his affiliation with Florida's State Emergency Response Committee, as Vice Chairman and his deployment to Mississippi after Hurricane Katrina in 2005, and the other telephone interview conducted was with the Director, Division of State Fire Marshal, Florida, due to his position and as Commander of Task Force Florida, that was deployed to Mississippi after Hurricane Katrina in August of 2005.

The internal survey determined what members of the Fort Lauderdale Fire-Rescue (FTFLR) considered as issues with sleep deprivation and/or fatigue. They are as follows: (a) how many hours can a person function before feeling fatigued or sleep deprived; (b) what are the early warning signs and symptoms and/or potential problems; (c) how do firefighter shift work schedules compare and contrast to what's in place already; and (d) what strategies could be employed to reduce responder fatigue. The results of the internal survey are listed in (Appendix F and Appendix G).

Research Question One: What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue?

The internal survey question for the first research question was altered to discover what members of the FTFLR thought was the maximum hours a person can function before feeling fatigued. Twenty-seven members or eight percent (8%) of the responses stated that 12 and 16 hours where the maximum amount of hours that a person can function before feeling fatigued. Eighteen members or five and half percent (5.5%) stated that a person can function for 24-hours before feeling fatigued. Whilst 12 members or four percent (4%) checked the response other, stating that the maximum number of hours a person can work before becoming fatigued

depended upon the task or the person. Finally, seven members or two percent (2%) replied that it only took eight hours before a person felt fatigued.

Another survey question that related to research question one was – On the average, how many hours of sleep do **you** get a night at work? Seventy-five respondents or twenty-three percent (23%) stated that they averaged three to five hours of sleep at night while on-duty. Fifteen or five percent (5%) stated that they were able to get between six and a half to seven hours of sleep a night while on-duty and one respondent stated they were able to get seven to seven and a half hours of sleep while on-duty.

In telephone interviews with Kingman Schuldt, Deputy Fire Chief for the City of Tamarac Fire & Rescue Department, Florida, and Randall W. Napoli, Director, Division of State Fire Marshal, Florida, both were asked research question one, which stated: ***"What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue"?***

Kingman Schuldt stated:

> Twelve hour blocks are the most optimal amount of time that a person can work before becoming fatigued. However, responders or crews could work 24-hours with no rest, but would caution that the greater the work periods the lower the levels of proficiency and service (K. Schuldt, telephone interview, September 18, 2006).

Randall W. Napoli stated:

> Fourteen hours is the maximum amount of time that a person is allowed to work in the State Emergency Operations Center before loosing focus of what is going on with the emergency. Additionally, the heat and the workload have a significant effect on

responders and crews in which they can become fatigued in a matter of minutes or hours (R. Napoli, telephone interview, September 22, 2006).

Research Question Two: What are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue?

When the members of the Fort Lauderdale Fire-Rescue Department (FTFLR) were asked via the internal survey, if **they** or other members of the department suffered from sleep deprivation or burnout - 83 members or a 25% response rate declared that they did in fact suffer from sleep deprivation or burnout. Only seven respondents stated that they did not suffer from sleep deprivation or burnout.

When inquiring if the members of the FTFLR experienced sleep inertia, the internal survey question asked – Have you ever been awakened in the middle of the night and did not know where you were, perhaps experienced a surreal state of confusion, or were just confused? Or have you witnessed other in this state? Seventy-five or 23% stated that they have experienced this state of confusion, better know as sleep inertia. Five percent or 17 respondents acknowledged that they have never been awakened in the middle of the night and did not know where they were or were just confused.

In order to discover if the members of the FTFLR were sleep deprived or not, or had an understanding of what sleep deprivation was, the internal survey question that determined this asked – Have **you** or have seen others experience any of the following in regards to **not** getting enough sleep? Please check all that apply: (Appendix D, question nine). Seventy-one or 22% of the respondents stated they looked forward to “Kelly Days” or other types of leave to recuperate from a busy 24-hour shift. Sixty-nine or 21% of the respondents declared that they felt irritable, tired and stressed during the week, and 65 respondents stated that needed a nap to get through the

day. Fifty-four members (16%) replied that they struggled to get out of bed in the morning and that 51 members (15%) fell asleep in warm rooms or classroom training sessions. Forty-nine members stated that they felt drowsy while driving, unknown if this is while they are on-duty, driving home after shift, or during their off time. Forty-eight, (15%), members replied that they fell asleep within five minutes of going to bed; this statistic is unknown if it is while on-duty or off-duty. In regards to having trouble concentrating and/or remembering 39 fire-rescue members or 12% declared that they have experienced this from time to time especially after a busy 24-hour shift.

Thirty-three or 10% of the members confirmed that they needed more than one alarm clock to wake up in the morning and/or have experienced, or may be experiencing during off-duty hours adverse marital or relationship issues caused by lack of sleep. Thirty-one members avowed that they have become standoffish or empathetic in the discharge of their current duties while at work.

An interesting note was that 25 members, (8%), have called in a sick day to recoup from a prior busy shift. The human body requires more sleep to heal and recuperate if they person is ill, stressed or depressed. Finally, 15 respondents, (5%), declared that they are looking at a possible career change or move to a less busy department. The survey did not ask how many years the member had on the department or if he or she were close to retirement or were in the Deferred Retirement Option Plan (DROP).

Circadian rhythms vary from person to person. Some people are morning types while others are evening types. Most people are somewhere in-between. The internal survey question that was used to determine if members of the Fort Lauderdale Fire-Rescue Department (FTFLR) were morning types or night types was – Do you think **you** are a morning or night person? Forty-

four or 13% stated that they were morning types while 47 declared that they were definitely night people. The survey did not ask if the members were somewhere in-between.

To further investigate if members of FTFLR understood sleep deprivation, question 11 from the internal survey asked – Did you know that after two (2) days without sleep you can experience the following: illusions, hallucinations and paranoia? Fifty-five members replied "yes" that they knew sleep deprivation lead to illusions, hallucinations and paranoia, while 37 members stated "no."

In order to reveal what FTFLR members thought were the most common effects of fatigue; question 12 of the internal survey (Appendix D) was developed. The categories are listed in numerical order from highest to lowest. Eighty-two members stated that lack of concentration was the most common affect of fatigue. The second affect of fatigue was irritability in which 71 members checked. The third affect of fatigue was slower reaction times with 70 responses. Sixty-two respondents felt that the desire to sleep was another affect of fatigue. Poor judgment had 59 responses, while reduced interpersonal communications had 49 responses. There was a tie for the seventh most common affect(s) of fatigue in which 46 members stated that lowered morale, and impaired recollection of timing and events was important to them. The eighth common affect of fatigue according to members of the Fort Lauderdale Fire-Rescue Department (FTFLR) was poor patient care which received 45 votes. Forty respondents acknowledged that accidents (vehicle and on the fire ground or emergency scene) made up the ninth common affect. The tenth affect that members voted for was reduced hand-eye coordination which received 39 votes. The eleventh category which received 37 votes was reduced visual perception. The final category was high risk taking behavior which had 18 votes.

When asked if fatigue effected one's health such as: heart disease, high blood pressure, stomach ulcers and gastrointestinal disorders, depression and decreased immune function the results of the survey dictated that 72 or 22% members of FTFLR knew that fatigued effected one's health and 19 respondents did not know that fatigue affected their health.

When asked what the members of the Fort Lauderdale Fire-Rescue Department (FTFLR) thought were the consequences of fatigue (Internal Survey Question 14), eleven responses were as follows: (a) safety concerns; (b) poor work habits; (c) negative effects on a person's physical, emotional and mental functioning; (d) poor attitude; (e) not caring about station duties; (f) human body is not meant to be awakened and perform at 100%; (g) lack of motivation; (h) attitude and marriage problems; (i) difficult to function off-duty; (j) divorce; (k) part of the job. Additionally, 116 responses acknowledged that the consequences of fatigue were similar or exactly the same as the common effects of fatigue (Internal Survey Question 12) see (Appendix G).

Kingman Schuldt and Randall Napoli were then asked research question two via telephone: ***"What are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue?"***

Kingman Schuldt replied:

> I feel that the signs and symptoms and potential problems related to sleep deprivation and fatigue is reduced productivity, lapses in judgment and decision-making, which in turn result into reduced personal safety and operational practices both on the fire ground or emergency scene (K. Schuldt, telephone interview, September 18, 2006).

Randall W. Napoli declared:

> The signs and symptoms and potential problems related to sleep deprivation and fatigue are dependent on what the individual is actually doing. As managers or supervisors, we

> have to watch our personnel. Most individuals will not admit that they are fatigued if they are doing physical labor or performing search and rescue at an emergency scene. We as supervisors can see that personnel are stumbling; their ability to focus is decreasing they stop and look at what they are doing in a peculiar way (R. Napoli, telephone interview, September 22, 2006).

Research Question Four: How may this compare and contrast to the traditional 24 on 24 off, 24 on and 48 off, and 10/14 firefighter work schedules?

The internal survey (question 15) inquired if members of the Fort Lauderdale Fire-Rescue Department (FTFLR) liked working the traditional 24 on and 48 off shift schedule. Eighty-five respondents or 25 percent stated that they liked working 24 on and having 48-hours off to be with their families or working part-time jobs. One respondent stated that they did not enjoy working 24-hours on and having 48-hours off.

When asked if they would consider switching to 12-hour shifts if the choice was up to **them,** 23% or 77 responded "no" they would not switch to 12-hour shifts, while 10 respondents stated "yes" they would switch to a 12-hour shift if they had the opportunity.

The last question that was asked in reference to changing shift hours to a combination of a 10-hour duty day and a 14-hour duty night which could improve safety, reduce sick time usage and improve productivity, 23% or 75 respondents stated "no" they would not switch to a traditional 10/14 duty schedule, while 14 respondents affirmed that they would consider that duty schedule.

Kingman Schuldt and Randall W. Napoli were asked research question four: ***"How may this compare and contrast to the traditional 24 on 24 off, 24 on and 48 off, and 10/14 firefighter work schedules?"***

Randall W. Napoli replied:

> The optimum shift schedule to work is 12- hours. By using a 12-hour shift schedule firefighters can work solidly in the field before becoming fatigued. The traditional 10/14 work schedule that some fire departments have such as Fire Department of New York (FDNY) would work, but many employees [firefighters] may live two to three hours away from their fire station and this schedule would double their travel time immensely (R. Napoli, telephone interview, September 22, 2006).

Kingman Schuldt replied:

> Traditional 24 on and 48 off shift schedules have proven not to be the best scheduling model due to the increased effects of fatigue on the firefighters. Firefighters can not perform 100% after being awakened in the middle of the night and their chance of injury increases twofold. Unfortunately, labor unions do not support changing to 12-hour shifts (K. Schuldt, telephone interview, September 18, 2006).

Research Question Five: What potential strategies could be employed in the Fort Lauderdale Fire-Rescue Department (FTFLR) to reduce responder fatigue during extended incidents such as hurricanes and tropical storms?

Fatigue management is a shared responsibility between management and workers as it involvers factors both inside and outside of work. Question 18 of the internal survey was developed to determine if firefighters would be interested in sleeping an extra hour or two before driving home to ensure that they did not get into a motor vehicle crash, especially if their drive home was greater than one hour. Twelve percent or 41 respondents stated that they would be interested in sleeping an extra hour or two before driving home after a long, physically

demanding shift, while 15% or 51 respondents stated they would not take advantage of sleeping an extra hour or two after shift before they drove home.

To find out if the members of the Fort Lauderdale Fire-Rescue Department (FTFLR) thought that a mandatory minimum of two shifts of personnel utilizing an "Alpha/Bravo" 12-hour work schedule should be on-duty when a hurricane watch/warning was issued by the National Hurricane Center or according to FTFLR's *Hurricane Procedures,* 51 respondents stated that there should be two shifts on-duty when the watch/warning is declared and 41 respondents stated "no" to having two shifts on-duty.

A coping strategy that can be used in anticipation of a long shift or during extended operations is that of a nap. Question 20 of the internal survey asked members if they or have seen other members take naps during the shift. Seventy-four or 22% of the responses stated that they did indeed get a nap in during the shift, while 14 respondents stated that they did not take naps during work/shift. Forty-five or 14% of the respondents stated that they have indeed seen others nap while at the fire station.

When asked how long the naps were that the firefighters took during the shift seven respondents stated taking a 20 minute nap, 26 respondents advised that they took 30 minute naps, while 10 respondents revealed that they took 45 minute naps. Sixteen respondents admitted that they napped for 60 minutes and 19 members acknowledged that they slept greater than 60 minutes.

In speaking to Kingman Schuldt, Deputy Chief of Tamarac Fire & Rescue Department, Florida, via the telephone concerning staffing at large scale events such as hurricanes and tropical storms he stated, "That I am not familiar with the Fort Lauderdale staffing models, but suggest to have two shifts on-duty during the event would be advantageous" (K. Schuldt,

telephone interview, September 18, 2006). When this author spoke with Randall W. Napoli, Director, Division of State Fire Marshal, Florida, he stated:

> In order to properly handle a large scale event such as a tropical storm or hurricane, the fire department or response agency should be properly staffed. By having at least two shifts on-duty at the time of impact, the "Alpha/Bravo," or 12 hours on duty and 12 hours off duty split shift schedule could be implemented during busy response activity. Additionally, with such large scale events personnel are running on adrenaline and do not think about sleeping or eating, that is where the Safety Officer needs to enforce breaks and rehabilitation so that responders can take naps, eat, shower and rest. Furthermore, it is important to have enough people on-scene of the event or in rehab so that the incident commander can release crews so they can go home and check on their families and homes. By having crews released early, decreases their stress and anxiety levels so that they will be able to return to duty as soon as possible in the event that their homes and families are okay (R. Napoli, telephone interview, September 22, 2006).

The last question of the internal survey [Question 22] requested respondents to provide additional comments and/or suggestions that they felt were appropriate to the survey. A list of their responses is listed in (Appendix G).

Discussion

In reviewing the literature, the results of the internal survey and telephone interviews conducted for this applied research project (ARP), this author can establish that there is a need to raise the awareness level of Senior Staff Officers (management), and the subordinates of the Fort Lauderdale Fire-Rescue Department on fatigue, how it is caused, and how it may affect the human body either during normal operations or extended emergencies.

According to authors, fatigue can be described as mental or physical exhaustion that stops a person from being able to function normally. It is mainly caused by a lack of sleep. However, fatigue can be more than just feeling tired or drowsy – it is normal to become tired through physical or mental effort. Fatigue has been associated with the following factors: (a) spending long periods of time awake; (b) obtaining an inadequate amount of sleep over an extended period; and (c) obtaining an insufficient quality of sleep over extended periods (Koester, 1997; Holmes, 2003; Aaronson et al, 1999; Missoula Technology and Development Center, n.d.; ACTU, 2000).

Additionally, prolonged periods of physical and/or mental exertion without enough time to rest and recover can lead to fatigue. The level of fatigue may vary from person to person and is dependent on the following factors: (a) workload; (b) length of shift; (c) previous hours and days worked; or (d) time of day or night worked (Aaronson et al., 1999; Queensland Department of Industrial Relations, 2005).

Maddox (n.d.) stated:

> The concept of fatigue is more easily understood through common experiences than through quantitative research. It is not possible to measure fatigue directly, as one might measure blood pressure or the length of a person's hand. Fatigue is indirectly measured through its effects. (p.11)

Authors, internal survey results and the telephone interviews that were conducted for this applied research paper concerning research question one – what are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue concurred that human performance "deteriorates significantly" when people have been at constant work for more than 12 hours. Additionally, 27 respondents from the internal survey felt

that 16 hours was the maximum amount of hours a person could work before feeling fatigue, while 18 respondents felt that 24 hours was the maximum. Some authors and 19 respondents of the internal survey declared that even shifts of eight hours or less could be fatiguing if the work was very intense or demanded continuous concentration, or there were inadequate breaks (Office of Rail Regulation [ORR], 2006; McGlothin, 2005).

The author of this applied research paper (ARP) was curious to find out approximately how many hours of sleep members of the Fort Lauderdale Fire-Rescue Department slept while working their 24-hour shifts. Not to this author's surprise, 75 respondents stated that they averaged approximately three to five hours of sleep while on duty, while 15 respondents stated that they slept an average of six and a half to seven hours. Only one person actually stated that they slept for seven to seven and a half hours while at work. Since the internal survey did not require names of personnel responding, it is only assumed that one respondent was assigned at the Fort Lauderdale Executive Airport station where call volume averages 3 to 4 calls per shift.

Widmar (2003) proclaimed that adaptation to shift work appears to be a combination of biological, sleep, and social factors that vary by individual. Generally speaking, those who biologically require less sleep fare better in shift work that those who need more. Extreme morning people suffer more from shift work than "night owls." In addition, age has been considered a factor for determining if a person can withstand shift work. After age 25, the ability to withstand night shifts decreases. Workers in their late 40s and early 50s become even less tolerant to the demands of shift work (Widmar, 2003). This author can proclaim that as she ages, shift work has become harder.

There are many early warning signs and symptoms and potential problems related to sleep deprivation and fatigue that individuals and employers should be aware of. Authors stated

that sleep deprivation occurs when a person does not get sufficient amounts of quality sleep and/or experiences a circadian disturbance (Widmar, 2003; Dernocoeur, 2003; Jha, Duncan & Bates, 2001; Holmes, 2003). Work demands, family life, and certain lifestyle choices can cause a person to sleep fewer hours than his or her body needs to maintain wakefulness and energy levels. Shift workers and night workers toil and sleep opposite to the body's natural wake/sleep cycle.

In today's fast-paced world, sleep is frequently regarded as a luxury instead of a necessity. The general public views it as a commodity that can be sacrificed for money and lifestyles. Those who sleep less are considered ambitious, hard working, and tough. Unfortunately, this way of thinking contributes to a lethargic society.

Of the 92 respondents who partook in the internal survey, 83 members or a 25% response rate stated that **they** knew other people on the job that suffered from sleep deprivation. The author was surprised that seven respondents stated that they did not suffer from sleep deprivation and one respondent actually wrote a comment stating that he or she did not believe that "we" had a problem with sleep deprivation within the FTFLR.

According to authors, the National Sleep Foundation's 2002 *Sleep in America* poll found that one-third of the people in the United States regularly sleep six and a half hours or less per night, short of the seven and a half to eight hours recommended by scientists and researchers (Widmar, 2003; Dernocoeur, 2003; Jha, Duncan & Bates, 2001; Fire Department Safety Officers Association [FDSOA], 2005). Studies have proven that decreased sleep time by one hour a night for seven consecutive nights is equivalent to staying up for 24-hours straight once a week. This is in total agreement to what the authors have stated.

Widmar (2003) and, an internal survey question [question nine] asked how a person could tell if they were sleep deprived or not? The following indications will identify if you are or not sleep deprived: (a) you need an alarm clock to wake you up at the appropriate time; (b) you struggle to get out of bed in the morning; (c) you feel irritable, tired, and stressed during the week; (d) you have trouble concentrating and remembering; (e) you fall asleep in warm rooms during meetings or classroom training sessions; (f) you need a nap to get through the day; (g) you feel drowsy while driving; and (h) you fall asleep within five minutes of going to bed. The respondents of the survey agreed with Widmar's (2003) indications of deciding if they were sleep deprived or not.

The author added five additional indications that Widmar (2003) did not discuss just to get a more in-depth feel of what personnel from FTFLR really felt. The first indication that was added wanted to know if the respondent has become "standoffish" or "empathetic" in the discharge of their current duties. Thirty-one respondents checked this response stating "yes" they have become "standoffish" and "empathetic." The second indication identified that seventy-one respondents declared that they looked forward to "Kelly Days" or other types of leave to recuperate from a busy 24-hour shift. The third indication that was added inquired if personnel have experienced, or may be experiencing during off-duty hours adverse marital or relationship issues caused by lack of sleep. Thirty-three respondents checked this answer. This indication can assist supervisors as well as this author when it comes to counseling employees when they become angry in the station or with patients on an emergency scene.

The fourth indication that was added by the author inquired if personnel have called in a sick day to recoup from a prior busy shift? Twenty-five respondents indicated that they have called in sick just to recoup. This response can answer many questions for upper management

when they do sick time studies. This author wonders if management has ever considered sleep deprivation or fatigue as a reason that employees call in sick, or do they think that people just want the day off to do something personal.

The final indication that was added by the author asked if the employees was looking at a possible career change or move to a less busy department. Fifteen respondents stated “yes” to this question

Authors, survey respondents and the telephone interviews acknowledged that sleep deprivation affects mental processes and intellectual abilities. Additionally, it impedes decision-making and memory and reduces performance on challenging tasks and negatively affects psychomotor skills. Widmar (2003) Kingman Schuldt and Randall W. Napoli (telephone interviews) affirmed that behavioral mood swings, productivity, communication skills and increased rates of on-the-job injuries are also attributed to sleepiness and fatigue. Authors and 37 internal survey respondents confirmed that extended periods without sleep “may cause” hallucinations and paranoia (Widmar, 2003; Dernocoeur, 2003: Jha, Duncan & Bates, 2001).

Furthermore, authors and comments stated in the internal survey [question 14] found other effects that resulted from chronic sleep deprivation which included: (a) depression and mood swings; (b) gastrointestinal dysfunction; (c) adult-onset diabetes; (d) menstrual and infertility problems; (e) increased use of drugs and alcohol; (f) impaired sexual function; (g) less satisfaction in personal and domestic pursuits; (h) increased appetite and weight gain; and (i) personality changes, particularly loss of humor and increased rage (Widmar, 2003).

The literature review discussed *circadian rhythms* and how they may vary from person to person. Some people are morning types or “larks.” Morning people feel most active and alert early in the day and usually go to bed early in the evening. Others are evening types or “owls.”

Evening people feel most active in late afternoon or evening, and like to stay up late into the night (Rosa & Colligan, 1997; Widmar, 2003; Kuhn, 2001; Koester, 1997). An internal survey question requested that respondents identify if they were either a “morning” or a “night” person. The responses were fairly close – 44 respondents stated they were morning types and 47 stated that they were night types. This author can confirm that the Fort Lauderdale Fire-Rescue Department (FTFLR) has two types of employees. It’s amusing to witness the day people scatter to their bunkrooms around 9:00 p.m. and the night people becoming spunky.

Additionally, the literature review discussed how sleep progresses through four distinct stages, and how long sleep cycles usually last. It was interesting to note that if sleep patterns are interrupted too many times, a person will awaken feeling tired. That statement holds true for fire and emergency service workers. In FTFLR’s busy stations, sleep is interrupted at least four to five times a night. When crews finally do get to sleep, they cannot receive the four stages of sleep that the body needs to function properly.

The author was interested in finding out what guidelines and strategies were used in other industries where extended hours were worked such as hospitals, air traffic controllers, etc. to possibly create a standard operating procedure for her department pertaining to maximum hours a person could or should work.

The literature discussed seafarers regulations that were established by the International Transport Workers’ Federation (n.d.) declaring the limits on hours of work or rest were as follows: (a) maximum hours of work shall not exceed 14 hours in any 24-hour period; or 72 hours in any seven-day period; and (b) minimum hours of rest shall not be less than ten hours in any 24-hour period or 77 hours in any seven-day period.

A few authors stated that workers in other industries are protected – even prohibited- from working excessive hours. Truck drivers, railroad workers and airline crewmembers are protected by various rules and regulations related to working hours (Frakes & Kelly, 2004; DeLandre, Boag & Fletcher, 2002; MacDonald, 2005; Federation of Nurses & Health Professionals [FNHP], 2003; Office of Rail Regulation [ORR], 2006).

Truck drivers are protected by the Motor Carrier Safety Improvement Act of 1999 which requires commercial truck drivers (a) no more than 12-hours of driving time in a 24-hour period, with two hours of break time within the 12 hours; and (b) long-distance trucks are required to carry electronic monitors to keep track of drivers' work hours.

According to authors, pilots were protected by flying-time limits in the 1930s when airmail pilots were often killed in fatigue-related crashes after being forced to fly long hours. Those rules were amended in 1985 and the same rules apply today by the Federal Aviation Administration (FAA). Those rules are often supplanted by union contracts (MacDonald, 2005; DeLandre, Boag & Fletcher, 2002; Frakes & Kelly, 2004; Federation of Nurses & Health Professionals [FNHP], 2003; Maddox, 2005).

Under FAA rules, which dictate flying hours, pilots can fly no more than eight hours in a 24-hour period, no more than 30 hours in a week and no more than 1,000 in a year. Additionally, the FAA requires an eight-hour rest period each day that a pilot works. Authors affirmed that a recent FAA interpretation of the regulation said that pilots could not be on duty for more than 16 consecutive hours (MacDonald, 2005; Frakes & Kelly, 2004; Federation of Nurses & Health Professionals [FNHP], 2003; Maddox, 2005).

The National Air Traffic Controllers Association [NATCA] (2006), declared that controllers are restricted to no more than ten consecutive hours of work (unless there is an

emergency – like a natural disaster) and must have eight hours off between shifts and cannot work more than six consecutive days without 24-hours off.

It was interesting to note while pilots were and are protected under FAA guidelines, flight attendants who perform routine and emergency safety duties, were the only safety-sensitive aviation employee group with no regulations with respect to flight, duty or rest periods until September 19, 1994 when the Federal Aviation Administration (FAA) issued a regulation limiting the hours of work.

The last set of guidelines/strategies that the literature review discussed was that of resident doctors. According to Metcalf (2003) there was a bill in Congress that would restrict resident doctors' work hours to no more than 80-hours per week and no more than 24-hours of continuous sequential work. Furthermore, emergency department shifts would be limited to no more than 12-hours.If the justification for this little piece of legislation is necessary for patient safety in hospitals; it would not take too much to apply it to other professions involved in the provision of emergency medical care.

If we think about it, resident doctors do work long and stressful periods similar to emergency responders. This is especially true when it comes to a disaster situation where emergency crews might not be able to go home after their normal tour of duty much less sleep for days on end. Metcalf (2003) puts reality in perspective for us with this:

> After all, how long do you think it will take until someone connects the dots between work hours, sleep deprivation, patient safety or emergency vehicle crashes, and EMS? If we don't connect the dots and do something about the issue, there are a lot of folks out there who will be glad to fix it for us. It's only a matter of time. (p. 5)

Over the years, the 24-hour duty schedule has been marketed as the most economical way to deliver fire and emergency medical services. According to Rule (1999), 24-hour scheduling trends originated in the early paid departments when firefighters had previously been on duty for six or seven days.

The Mississauga Fire Fighters Association [MFFA Local 1212] (2006) acknowledged that working a 24-hour shift schedule and having 48-hours off can lead to: (a) better overall health for firefighters; (b) an increased level of fire ground safety as firefighters would be better rested; and (c) firefighters always reporting for work after a complete nights sleep. Additionally, the MFFA (2006) declared that scientific evidence concluded that firefighters that worked a rotating schedule such as 10/14 exhibited a higher level of de-synchronization of the body's natural circadian rhythm than firefighters working a 24-hour shift schedule.

When the author of this applied research project surveyed members of the Fort Lauderdale Fire-Rescue Department, if they liked working 24-hours on and having 48-hours off, 85 or 25 percent stated yes and one member stated no. By having 85 members stating "yes" it supports the Mississauga Fire Fighters Association acknowledgement that working 24-hours on and having 48-hours off may lead to better overall health and firefighters reported to duty well rested.

Conversely, Kingman Schuldt declared:

> Traditional 24 on and 48 off shift schedules have proven not to be the best scheduling model due to increased effects of fatigue on the firefighters. Firefighters cannot perform 100% after being awakened in the middle of the night and their chance of injury increases twofold (K.Schuldt, telephone interview, September 18, 2006).

Another question that this author asked in the internal survey was if personnel would consider switching to 12 hour shifts if the choice was up to them. Of the 92 responses to the survey, 77 respondents or 23% stated “no” they would not switch to a 12 hour shift, while 10 respondents stated “yes” they would switch to a 12-hour shift if they had the opportunity.

Randall W. Napoli stated, “The optimum shift schedule is 12-hours. By using a 12-hour shift schedule firefighters could work solidly in the field before becoming fatigued” (R. Napoli, telephone interview, September 22, 2006).

Although tradition plays an important role in the fire service the 10/14 schedule offers a variety of advantages and opportunities without additional staff. According to Rule (1999) the combination of a 10-hour duty day and a 14-hour duty night offers several benefits, including improved safety, reduction in sick time usage, increased productivity, improved project management and better quality of life for personnel.

When the author inquired if members of FTFLR would consider switching shift hours to a traditional 10/14 duty schedule [10 hour days and 14 hour nights] she received 14 responses stating that they would indeed consider switching to the 10/14 schedule, while 75 respondents stated they would not switch. The author and Randall W. Napoli understand why the response rate for not switching to a 10/14 duty schedule was so high. Many of the respondents live two to three hours away from their fire stations and this particular schedule would double their travel time.

There are mixed opinions according to authors on which schedule provides the best quality of life to personnel. Rule (1999) acknowledged that employees who work 24-hour shifts often complain that the schedule limits family contact. Rule (1999) stated, “The 10/14 duty shift allows more frequent family contact opportunities, including eating dinner together if travel time

to and from work is minimal" (p. 63). Whilst the Mississauga Fire Fighter Association [MFFA] (2006) and Holmes (2003) declared the 24-hour duty schedule gives employees time at home and greatly improves their health. According to Holmes (2003) working 24-hour shifts with 48-hours off assists many firefighters who work second jobs or "moonlight" to bring in extra money to their support families.

This author enjoys working the "now" traditional 24/48 schedule because she works a part-time job occasionally and just enjoys the down time where she can go to the beach or gym and just relax. The thought of switching to 12 hour shift or 10/14 schedule would not bother her either. It would just take sometime to get used to. She feels that more research would need to be done before her fire department changed shifts hours and there would have to be a lot of "buy-in" from the Local Labor Union 765.

Finally, when researching what potential strategies could be employed to reduce responder fatigue during extended emergencies such as hurricanes and tropical storms, found that fatigue management is a "shared responsibility" between management and workers since this involved factors both inside and outside of work. Employers or persons conducting a business or undertaking one are responsible for using a risk management approach to manage fatigue. Additionally, it is the responsibility of employees to ensure that they make appropriate use of their rest days and are prepared to report "fit for duty" the next assigned duty tour.

Most authors decided that fatigue within the workplace should be managed using a risk management approach (Queensland Department of Industrial Relations, 2005; ACTU, 2000; Frank, 2004; Widmar, 2003; Vila, Morrison & Kenney, 2002). There were five steps to the risk management process that were heavily discussed in the literature that labor and management of fire-rescue departments should consider reducing responder fatigue. In addition to a risk

management process, the survey results and telephone interviews coincided with authors in stating that “napping” is an effective coping strategy that can be used in anticipation of a long night or during extended operations (Peltin, 2005; Widmar, 2003; Jha, Duncan & Bates, 2001; Coburn, 2000). Research has shown that the restorative effects of a short nap were observed after a normal night’s sleep, after a restricted night’s sleep and even during 64-hours of continuous work. Furthermore, taking a brief break and clearing your mind has been shown to greatly enhance your creativity later in the day (Peltin, 2005).

With regard to the 12 hours on, 12 hours off during times of disasters or extreme emergency events, the author asked Randall W. Napoli, Director, Division of State Fire Marshal, who was deployed to Mississippi after Hurricane Katrina in August of 2005 as the commander in charge of all Florida Disaster Task Forces. He replied:

> In order to properly handle a large scale event such as a tropical storm or hurricane, the fire department or response agency should be properly staffed. By having at least two shifts on-duty at the time of impact, the “Alpha/Bravo,” or 12 hours on duty and 12 hours off duty split shift schedule could be implemented during busy response activity. Additionally, with such large scale events personnel are running on adrenaline and do not think about sleeping or eating, that is where the Safety Officer needs to enforce breaks and rehabilitation so that responders can take naps, eat, shower and rest. Furthermore, it is important to have enough people on-scene of the event or in rehab so that the incident commander can release crews so they can go home and check on their families and homes. By having crews released early, decreases their stress and anxiety levels so that they will be able to return to duty as soon as possible in the event that their homes and families are okay (R. Napoli, telephone interview, September 22, 2006).

This author is in agreement with Director Napoli, in that two shifts should be on-duty when a hurricane watch/warning has been issued and the use of a Safety Officer is crucial when crews are working at incidents.

There were additional comments and/or suggestions that personnel wrote concerning sleep deprivation and fatigue. Please refer to (Appendix G).

Recommendations

The research presented in this study has demonstrated the need for the Fort Lauderdale Fire-Rescue Department to raise the awareness level of Senior Staff Officers (management), and the subordinates on fatigue, how it is caused, and how it may affect the human body either during normal operations or extended emergencies.

Based on the literature review, internal Internet survey, telephone interviews, and the analysis of the results of this applied research project, the following recommendations have been designed to aggressively reduce the effects of responder fatigue during normal operations or extended emergencies for the Fort Lauderdale Fire-Rescue Department (FTFLR):

1. Identify factors that contribute to fatigue. Limit the number of consecutive hours an employee may work, including regular hours, overtime, and time trades (Appendix H). Additionally, management should: (a) consult with employees and conduct fatigue surveys; (b) conduct safety audits; (c) analyze injury and incident/accident reports; and (d) form workplace health and safety committees to identify workplace factors that may or have contributed to fatigue.
2. Choose control measures that can be used to effectively manage fatigue such as: (a) sufficient supervision during periods of high fatigue and especially for hazardous work; (b) contingency plans if workers become fatigued; (c) job

rotation for repetitive or monotonous work, or work that involves heavy physical demands.

3. Implement the control measures. Work procedures need to be developed to ensure that fatigue control measures are effective. Effective fatigue control measures should define and communicate responsibilities. It is important to clearly communicate that the control measures are being introduced to effectively manage fatigue. It is important to remember that workers are entitled to be consulted about any changes in the workplace that affect, or could affect, their safety. This consultation is achieved through the workplace health and safety committee, health and safety officer and health and safety representatives.
4. Supervisors (Company Officers and Battalion Chiefs) should be trained on fatigue. This training program should include the following information: (a) common causes of fatigue including shift work and extended working hours; (b) potential health and safety impacts of fatigue; (c) how employees are responsible for making appropriate use of their rest days; and (d) how employees should ensure they are fit for duty on duty days.
5. Evaluate crew's sleeping quarters for darkness, quiet, temperature control, and overall comfort (mattress inspections). Make upgrades as necessary to provide the best sleep environment possible.
6. Modify work schedules to better accommodate increasing alarm loads. Form committees to evaluate the 12-hour shift schedules or 10/14 shift schedules that other fire-rescue agencies may be using.

7. Provide additional staffing and response units during periods of peak-alarm activity. Implement peak-hour advanced life support (ALS) transport unit(s) to assist with the heavy call volume within the City to rest on-duty crews. Additionally, Senior Staff should enforce the Hurricane Standard Operating Procedure (SOP) that requires two shifts to be on-duty "pre-impact" and "post-impact" of a hurricane or tropical storm.
8. Form a joint management/labor team to identify current issues of busy medical units, apathy of crews, condition of their well-being, and get a straw vote from those teams if this is palatable. Then come to a viable solution to rotate busy rescue teams

A recommendation to the futures readers of this applied research project (ARP) is to continue the research on sleep deprivation and fatigue by contacting a Sleep Disorder Center in your local community to get additional information or request a sleep study to be done on you or your fire-rescue agency.

Fatigue is a major contributor to accidents, lost productivity, and poor quality of life. As the operational tempo continues to increase, the potential for fatigue-related problems will only become more serious.

However, safety, performance, and general operational readiness can be preserved by: (a) adhering to good work scheduling practices; (b) implementing proven fatigue countermeasures; (c) ensuring that off-duty personnel have sufficient sleep opportunities; and (d) making adequate daily sleep a top priority.

Just remember that sleep is a physical necessity – not a luxury. There is **NO** substitute for **SLEEP!**

References

Aaronson, L.S., Teel, C.S., Cassmeyer, V., Neuberger, G.B., Pallikkathayil, L., Pierce, J., Press, A.N., Williams, P.D. and Wingate, A. (1999, Spring). Defining and Measuring Fatigue. *Image: Journal of Nursing Scholarship, 31.1,* 45(+).

ACTU. (2000, September). *Health and Safety Guidelines for Shift Work and Extended Working Hours* (Occupational Health and Safety D No. 66/2000). Melbourne, Australia: Author.

American Medical Association (AMA). (2005, July, 7). *AMA Resident Work Hours Policy.* Retrieved August 31, 2006, from http://www.ama-assn.org/ama/pub/category/print/7094.html

Barger, L.K., Cade, B.E., Ayas, N.T. Cronin, J.W., Rosner, B. Speizer, F.E., and Czeisler, C.A. (2005, January, 31). Extended Work Shifts and the Risk of Motor Vehicle Crashes Among Interns. *The New England Journal of Medicine, 353, 2*, 125-134.

Belenky, G. (n.d.). *Sleep, Sleep Deprivation, and Human Performance in Continuous Operations.* Retrieved August 6, 2006, from http://www.usafa.af.mil/jscope/JSCOPE97/Belenky97/Belenky97.htm

Borg, W.R. and Gall, M.D. (1989). *Educational Research: An Introduction.* Boston, MA: Houghton Mifflin Company.

Coburn, E. (2000, September). Watching the Clock. *Occupational Hazards.* 42-44.

DeLandre, J., Boag, C. and Fletcher, A. (2002, September-October). Asleep at the controls. *Flight Safety Australia.* 24-29.

Dernocoeur, K.B. (2003, February). Sweet dreams? Sleep Deprivation and shift work in EMS. *Emergency Medical Services, 32 (2),* 55-59.

Federal Aviation Administration, the Office of Aviation Medicine and the Civil Aerospace

Medical Institute. (2001, December 12). *Shiftwork Coping Strategies.* [CD]. Key Multimedia Solutions, Inc.

Federation of Nurses and Health Professionals [FNHP]. (2003). *Stopping the Clock: Controlling The Use of Mandatory Overtime in the Health Care Industry.* Washington, DC: Author.

FEMA, United States Fire Administration. (2004). *2004-2005 Training Catalog: Catalog of Courses for the National Fire Academy and the Emergency Management Institute.* USFA 5-Year Operational Objectives. Emmitsburg, MD: Federal Emergency Management Agency.

FEMA, United States Fire Administration. (1991). *Stress Management: Model Program for Maintaining Firefighter Well-Being.* (USFA Contract No. EMW-85-C-2047). Emmitsburg, MD: Federal Emergency Management Agency.

FEMA, United States Fire Administration. (1996). *Risk Management Practices in the Fire Service.* Emmitsburg, MD: Federal Emergency Management Agency.

Fire Department Safety Officers Association. (2005, April). Sleep Factors and Accidents – Part I. *Health and Safety, 16 (4).*

Fort Lauderdale Fire-Rescue Department. (2005). *Standard Operating Procedures: Emergency Hurricane Procedures.* (Article 1000). Fort Lauderdale, FL: Author.

Frakes, M.A., Kelly, J.G. (2004, November/December). Shift length and on-duty rest patterns in rotor-wing air medical programs. *Air Medical Journal, 23 (6),* 34-39.

Frank, A.J. (2004, February). Fatigue Management. *EMS*, 84-86.

Fuchs, B.D., McMaster, J., Smull, G., Getsy, J., Chang, B., and Kozar, R.A. (2001, November). Underappreciation [*sic*] of Sleep Disorders as a Cause of Motor Vehicle Crashes. *American Journal of Emergency Medicine, 19, 7,* 575-578.

Harrington, J.M. (2001, January). Health Effects of Shift Work and Extended Hours of Work. *Occupational and Environmental Medicine, 58.1,* 68 (+).

Holmes, A. (2003, Summer). Sleepness [*sic*] Knights: Sleep Loss and its Contribution to Occupational Stress in the UK Fire Service. *Fire Safety, Technology and Management.* 7-10.

Huibers, M.J.H., Bültmann, U., Kasl, S.V., Kant, I.J., van Amelsvoort, L., van Schayck, C.P., Swaen, G.M.H. (2004, October). Predicting the Two-Year Course of Unexplained Fatigue and the Onset of Long-Term Sickness Absence in Fatigued Employees: Results from the Maastricht Cohort Study. *Journal of Occupational Environmental Medicine, 46, 10,* 1041-1047.

International Transport Workers' Federation. (n.d.). *Fight Fatigue: Safer Ships Demand Realistic Manning*. London, England: Author.

Jha, A.K., Duncan, B.W., Bates, D.W. (2001, July). *Making Health Care Safer: A Critical Analysis of Patient Safety Practices* (Chapter 46). Retrieved June 7, 2006, from http://www.ahrq.gov/clinic/ptsafety

Koester, R.J. (1997). *Fatigue: Sleep Management during Disasters and Substantial Operations.* Charlottesville, VA: dbs Productions.

Kuhn, G. (2001, January). Circadian Rhythm, Shift Work, and Emergency Medicine. *Annals of Emergency Medicine, 37:1,* 88-98.

Maas, J.B., Wherry, M.L., Axelrod, D.J., Hogan, B.R., Bloomin, J. (1998). *Power Sleep,* New York, NY: Harper Perennial.

Mac Donald, E. (2005, March – April). Only Pilots Get Tired and Other Urban Myths. *Air Medical Journal, 24, 2,* 63-65.

Maddox, M.E. (2005, January). *Shift work and Scheduling* (Chapter 4). Retrieved June 28, 2006, from http://www.hfskyway.faa.gov/HFAMI/lpext.dll

Mc Glothin, W.T. (2005, October). Shifting shift work. *Industrial Engineer, 37.10,* 52 (1).

Metcalf, B. (2003, April). It's only a matter of time. *On Scene, 17 (6),* 5.

Mississauga Fire Fighters Association. (2006, January). *24 Hours a Day.* Retrieved on July 31, 2006, from http://www.mississaugafirefighters.org

Missoula Technology and Development Center. (n.d.). *Fatigue Awareness.* Retrieved June 28, 2006, from http://www.fs.fed.us/firetraining/fatigue/fatigue.ppt

National Air Traffic Controllers Association (NATCA). (2006). *Union Contraction.* Retrieved July 27, 2006, from http://www.natca.org

National Fire Academy. (2005). *Executive Leadership – Student Manual.* Emmitsburg, MD: Author.

Nova Southeastern University. (1990). *Feasibility study for annexation proposals in Broward County, FL.* Public Administration Department.

O'Brien, D.P. (1995). *The Safety Officer's Concise Desk Reference.* Boca Raton, FL: Lewis Publishers.

Office of Rail Regulation (2006, July). *Managing fatigue in safety critical work* (Railways and Other Guided Transport Systems [Safety] Regulations 2006). United Kingdom: Author.

Parker, J.G. (2006, April). Watching the clock: Manage shiftworkers for optimum health and safety. *Safety and Health, 44*-47.

Pati, A.K., Chandrawanski, A. and Reinberg, A. (2001, July 10). Shift work: Consequences and management. *Current Science, 81, 1,* 32-52.

Petlin, S. (2005, May). Asleep at the Nozzle. *Fire Rescue Magazine*, 68-72.

Queensland Department of Industrial Relations (2005). *Fatigue Management Guide: Workplace Health and Safety Queensland.* Queensland, AU: Author.

Rosa, R.R., Colligan, M.J. (1997, July). *NIOSH: Plain Language About Shiftwork.* (DHHS [NIOSH] Publication No. 97-145). Washington, DC: U.S. Department of Health and Human Services.

Rule, C.H. (1999, August). Shift Change. *Fire Chief, 43 (8),* 62-63.

Smith, B. (2006, January). Coping with Shift Work. *Public Safety Communications, 72 (1),* 50-51.

Utility Workers Union of America [UWUA]. (2000, December 12). *Hours of Service of Drivers; Driver Rest and Sleep for Safe Operations.* (Docket No. FMCSA-97-2350). Washington, DC: Author.

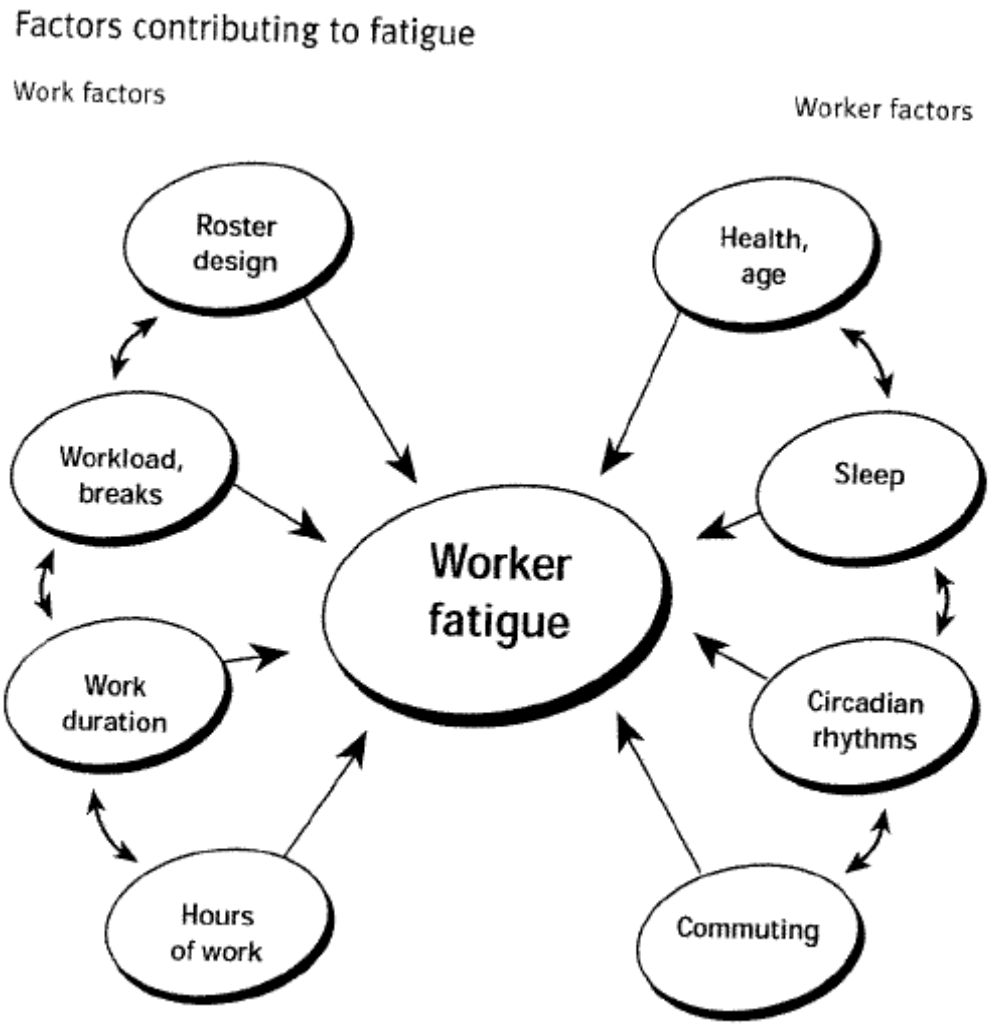
Vila, B., Morrison, G.B., and Kenney, D.J. (2002, March). Improving Shift Schedule and Work-Hour Policies and Practices to Increase Police Officer Performance, Health, and Safety. *Police Quarterly, 55, 1,* 4-24.

Widmar, R. (2003, June). Sleep to Survive: How to Manage Sleep Deprivation. *Fire Engineering, 156,* 45-54.

Workplace Health and Safety Act, 25 § 95 AC (1995).

Appendix A

Factors Contributing to Fatigue



Appendix B

Medical Crew Rest Guidelines

Recommended Practice (Final), May 4th, 2004 RP3—Medical Crew Rest Guidelines

The Air Medical Safety Advisory Council (AMSAC) highly recommends on-site medical crew shifts be scheduled in the same spirit as unscheduled pilot operations (limiting the duty day to a maximum of 14 hours with at least 10 hours uninterrupted rest between shifts). It is not recommended that any shifts be scheduled for any period to exceed 14 hours, and then only if the following 6 requirements are met:

1. The program can reasonably expect that the medical crewmembers will not be required to routinely perform any duties beyond those required for readiness of the aircraft, equipment, supplies, and/or administrative duties directly associated with the performance of their flight duties.
2. Those medical crewmembers are provided with access to and permission to rest after daily medical crew duties are met.
3. Medical crewmembers must have at least 10 hours of uninterrupted rest prior to any scheduled shift. This is intended to preclude back-to-back shifts with other employment or significant fatigue-causing activity prior to a shift.
4. A medical crew member must have the right to call "time out" from flight duties if the crewmember (or fellow flight team member) determines that he or she is unfit or feels unsafe to continue duty, no matter what the shift length. There should be no adverse personnel action or undue pressure to continue in this circumstance.
5. Management periodically reviews flight volume, frequency, and mission duration in determining the efficacy of scheduled shifts greater than 14 hours.
6. Medical crewmembers should not accept flights or shifts that they know will extend beyond 24 hours unless approved by a manager who can verify that crewmembers have had at least 10 consecutive hours uninterrupted rest in the previous 24 hours.

Recommended practices (RPs) are published under the direction of the Air Medical Safety Advisory Council. RPs are a medium for discussion of aviation and medical operational safety pertinent to the air medical community. RPs are not intended to replace corporate judgment, federal aviation regulations, company operations manuals, or organizational statements of purpose. Suggestions for subject matter are cordially invited.

Appendix C

Flight Attendant Work/Rest Schedule

SCHEDULED DUTY PERIOD	MINIMUM REST PERIOD	REDUCED REST PERIOD	REST PERIOD FOLLOWING REDUCED REST	NUMBER OF FLIGHT ATTENDANTS (+ Augmentation)
14 hours or less	9 hours	8 hours	10 hours	Minimum
14-16 hours	12 hours	10 hours	14 hours	Minimum + 1
16-18 hours	12 hours	10 hours	14 hours	Minimum +2
18-20 hours*	12 hours	10 hours	14 hours	Minimum +3

*Applies only to duty periods with one or more flights that land or take off outside the contiguous 48 states and the District of Columbia.

MANDATORY OVERTIME

Appendix D

Sample of the Internal Survey

Internal Survey on Fatigue

This survey is to gather information for an applied research project that I'm writing for my *Executive Fire Officer's Program, from the National Fire Academy*. This survey **will not** be used to identify any individual. To have usable data, members taking this survey are asked to be candid and honest. **Please do not put your name on this survey.** Please indicate your response by typing an "X" in the box next to your answer. Once you have electronically filled out the survey you can print and mail it to me [Lt. J. Lorber] "inter-office" or email it back to me [Jo-Ann Lorber], which ever is preferred. Results of the survey will be available after completion of the paper if you are interested. Thank you!

1 Please indicate your rank:

- [ ] Firefighter
- [ ] Driver/Engineer
- [ ] Lieutenant
- [ ] Fire Investigator *

2 What is your medical Designation?

- [ ] First Responder
- [ ] Emergency Medical Technician
- [ ] Paramedic

3 Fire Station or Bureau assigned:

Fire Station: # _____

Fire Investigation Unit: _____ (Check here if it applies)

4 Company or unit assigned:

- [ ] Rescue Company
- [ ] Engine Company
- [ ] Ladder Company
- [ ] Fire Investigation Unit

5

How many hours do <u>you</u> think that a person can function before feeling fatigued?

- [ ] 8 hours
- [ ] 12 hours
- [ ] 16 hours
- [ ] 24 hours
- [ ] Other: _____

_____

6 **On average, how many hours of sleep do <u>you</u> get a night while at work?**

- ☐ less than 6 hours _____ Please state the number of hours
- ☐ 6.5 - 7 hours
- ☐ 7 - 7.5 hours
- ☐ 7.5 - 8 hours
- ☐ Greater than 8 hours

*Fire Investigators assigned to the Fire prevention Bureau where additional duties other than supervisory or inspection functions include the assignment to a one week, 24 hour on-call rotation to respond to all fires as per FTLFRD SOP Article 304.

7 **Do you think, <u>you</u> or other members of the department suffer from sleep deprivation, or burnout?**

- ☐ Yes
- ☐ No

8

Have you ever been awakened in the middle of the night and did not know where you were, perhaps experienced a surreal state of confusion, or were just confused? Or have you witnessed others in this state?

- ☐ Yes
- ☐ No

9

Have <u>you</u> or have seen others experience any of the following in regards to <u>not</u> getting enough sleep? Please check all that apply:

☐	Need more than one alarm clock to wake up in the morning
☐	Struggle to get out of bed in the morning
☐	Feel irritable, tired and stressed during the week
☐	Have become standoffish or empathetic in the discharge of your current duties
☐	Have experienced, or may be experiencing during off-duty hours adverse marital or relationship issues caused by lack of sleep
☐	Look forward to "Kelly Days" or other types of leave to recuperate from a busy 24 hour shift
☐	Have called in a sick day to recoup from a prior busy shift
☐	Have trouble concentrating and remembering
☐	Fall asleep in warm rooms or classroom training sessions
☐	Need a nap to get through the day
☐	Feel drowsy while driving
☐	Looking at a possible career change or move to a less busy department

	Fall asleep within five minutes of going to bed

10

Do you think <u>you</u> are a morning person or night person?

- ☐ Morning
- ☐ Night

11

Did you know that after two (2) days without sleep you can experience the following: illusions, hallucinations and paranoia?

- ☐ Yes
- ☐ No

12

What do <u>you</u> think are the most common effects of fatigue? Please check all that apply:

	Desire to sleep
	Lack of concentration
	Impaired recollection of timing and events
	Irritability
	Poor judgment
	Reduced interpersonal communications
	Reduced hand-eye coordination
	Reduced visual perception
	Slower reaction times
	High risk taking behavior
	Poor patient care
	Lowered morale
	Accidents (vehicle and on the fire ground or emergency scene)

13

Did you know that there is health effects associated with fatigue such as: heart disease, high blood pressure, stomach ulcers and gastrointestinal disorders, depression, and decreased immune function?

- ☐ Yes
- ☐ No

14 **What do <u>you</u> think are the consequences of fatigue?**

15

Do you like working 24 hours on and having 48 hours off?

- ☐ Yes
- ☐ No

16

Would you consider switching to 12 hour shifts if the choice was up to <u>you</u>?

- ☐ Yes
- ☐ No

17 **Would you consider switching shift hours to a traditional 10/14 duty schedule [10 hour days and 14 hour nights]?**

- ☐ Yes
- ☐ No

18

If you were tired after a shift would <u>you</u> like to sleep an extra hour or two before driving home to ensure that you did not get into a motor vehicle crash?

- ☐ Yes
- ☐ No

19

Do you think a mandatory minimum of two shifts of personnel utilizing an "Alpha / Bravo" 12 hour work schedule should be on duty when a hurricane watch / warning is issued?

- ☐ Yes
- ☐ No

20

Have <u>you</u> or have seen others nap during the shift?

- ☐ Yes, you do
- ☐ No, you don't
- ☐ Have seen others nap

21

How long do you nap?

- ☐ 10 minutes
- ☐ 20 minutes
- ☐ 30 minutes
- ☐ 45 minutes
- ☐ 60 minutes
- ☐ Greater than 60 minutes
- ☐ I don't take naps at work

Please provide additional comments and/or suggestions you feel are appropriate in the space provided below.

Appendix E

Telephone Interview Form

CONDUCTED BY: _____ DATE: _____

INTERVIEWED BY: _____ TIME: _____

REASON SELECTED: _____ PLACE: _____

INTRODUCTION: My name is Lieutenant Jo-Ann Lorber, with the Fort Lauderdale Fire-Rescue Department, and I am currently in the National Fire Academy's, *Executive Fire Officer Program (EFOP).* I have just completed my fourth course in the EFOP, *Executive Leadership (R123),* and will be writing an applied research paper on the following topic: *Fatigue…An Impact on Firefighters.* Thank you for agreeing to this interview.

1. What are the maximum hours a person can function under stress before experiencing the negative effects of sleep deprivation and/or fatigue?

2. What are the early warning signs and symptoms and potential problems related to sleep deprivation and fatigue?

3. What are your opinions of 24 on 24 off, 24 on 48 off, and 10/14 firefighter work schedules?

4. What potential strategies could be employed in fire-rescue agencies to reduce responder fatigue during extended incidents such as hurricanes and tropical storms?

This concludes the interview. Would you like a copy of the completed applied research paper?

_____ YES _____ NO

I sincerely appreciate you taking time from your business schedule to assist me with this important research.

Before we close this interview, do you have any questions for me?

Thank you.

Appendix F

Internal Survey with Results Posted

Internal Survey on Fatigue

This survey is to gather information for an applied research project that I'm writing for my *Executive Fire Officer's Program, from the National Fire Academy*. This survey **will not** be used to identify any individual. To have usable data, members taking this survey are asked to be candid and honest. **Please do not put your name on this survey.** Please indicate your response by typing an "X" in the box next to your answer. Once you have electronically filled out the survey you can print and mail it to me [Lt. J. Lorber] "inter-office" or email it back to me [Jo-Ann Lorber], which ever is preferred. Results of the survey will be available after completion of the paper if you are interested. Thank you!

1 Please indicate your rank:

45	Firefighter
17	Driver/Engineer
27	Lieutenant
3	Fire Investigator *

2 What is your medical Designation?

0	First Responder
24	Emergency Medical Technician
68	Paramedic

3 Fire Station or Bureau assigned:

Fire Station: # _____

Fire Investigation Unit: _____ (Check here if it applies)

4 Company or unit assigned:

32	Rescue Company
46	Engine Company
9	Ladder Company
3	Fire Investigation Unit

5

How many hours do <u>you</u> think that a person can function before feeling fatigued?

7	8 hours
27	12 hours
27	16 hours
18	24 hours
12	Other: **Depends on the task and the person**

6 **On average, how many hours of sleep do <u>you</u> get a night while at work?**

75	less than 6 hours **3 - 5** Please state the number of hours
15	6.5 - 7 hours
1	7 - 7.5 hours
0	7.5 - 8 hours
0	Greater than 8 hours

*Fire Investigators assigned to the Fire prevention Bureau where additional duties other than supervisory or inspection functions include the assignment to a one week, 24 hour on-call rotation to respond to all fires as per FTLFRD SOP Article 304.

7 **Do you think, <u>you</u> or other members of the department suffer from sleep deprivation, or burnout?**

83	Yes
7	No

8

Have you ever been awakened in the middle of the night and did not know where you were, perhaps experienced a surreal state of confusion, or were just confused? Or have you witnessed others in this state?

75	Yes
17	No

9

Have <u>you</u> or have seen others experience any of the following in regards to <u>not</u> getting enough sleep? Please check all that apply:

33	Need more than one alarm clock to wake up in the morning
54	Struggle to get out of bed in the morning
69	Feel irritable, tired and stressed during the week
31	Have become standoffish or empathetic in the discharge of your current duties
33	Have experienced, or may be experiencing during off-duty hours adverse marital or relationship issues caused by lack of sleep
71	Look forward to "Kelly Days" or other types of leave to recuperate from a busy 24 hour shift
25	Have called in a sick day to recoup from a prior busy shift
39	Have trouble concentrating and remembering
51	Fall asleep in warm rooms or classroom training sessions
65	Need a nap to get through the day
49	Feel drowsy while driving
15	Looking at a possible career change or move to a less busy department

48	Fall asleep within five minutes of going to bed

10

Do you think <u>you</u> are a morning person or night person?

44	Morning
47	Night

11

Did you know that after two (2) days without sleep you can experience the following: illusions, hallucinations and paranoia?

55	Yes
37	No

12

What do <u>you</u> think are the most common effects of fatigue? Please check all that apply:

62	Desire to sleep
82	Lack of concentration
46	Impaired recollection of timing and events
71	Irritability
59	Poor judgment
49	Reduced interpersonal communications
39	Reduced hand-eye coordination
37	Reduced visual perception
70	Slower reaction times
18	High risk taking behavior
45	Poor patient care
46	Lowered morale
40	Accidents (vehicle and on the fire ground or emergency scene)

13

Did you know that there is health effects associated with fatigue such as: heart disease, high blood pressure, stomach ulcers and gastrointestinal disorders, depression, and decreased immune function?

72	Yes
19	No

14 **What do <u>you</u> think are the consequences of fatigue?**

See Appendix G for responses

15

Do you like working 24 hours on and having 48 hours off?

85	Yes
1	No

16

Would you consider switching to 12 hour shifts if the choice was up to <u>you</u>?

10	Yes
77	No

17 **Would you consider switching shift hours to a traditional 10/14 duty schedule [10 hour days and 14 hour nights]?**

14	Yes
75	No

18

If you were tired after a shift would <u>you</u> like to sleep an extra hour or two before driving home to ensure that you did not get into a motor vehicle crash?

41	Yes
51	No

19

Do you think a mandatory minimum of two shifts of personnel utilizing an "Alpha / Bravo" 12 hour work schedule should be on duty when a hurricane watch / warning is issued?

51	Yes
41	No

20

Have <u>you</u> or have seen others nap during the shift?

74	Yes, you do
14	No, you don't
45	Have seen others nap

21

How long do you nap?

0	10 minutes
7	20 minutes
26	30 minutes
10	45 minutes
16	60 minutes
19	Greater than 60 minutes
14	I don't take naps at work

Please provide additional comments and/or suggestions you feel are appropriate in the space provided below.

See Appendix G for responses

Appendix G

Internal Survey Write-In Response Questions

Question 14: What do <u>you</u> think are the consequences of fatigue?

1. Health Effects
2. Safety concerns
3. Poor work habits
4. Slowed response times
5. Injury
6. Stress which leads to physical disease
7. Behavioral disorders
8. Alcoholism
9. Poor interpersonal relationships
10. Health issues to social issues
11. Fighting with spouse
12. Heart attack from stress and anxiety
13. Not being able to have a normal sleep pattern causes irritability
14. Snap at people
15. Eat late or not very well
16. Gaining weight
17. Irritable
18. Decrease in physical abilities and cognitive and motor functions
19. Mental sharpness decreased
20. Lack of concentration

21. Negative effects on a person's physical, emotional and mental functioning
22. Irritable
23. Frequent cold and flu's
24. Poor health if you don't use your time off wisely
25. Poor attitude
26. Short temper
27. Loss of focus
28. Lethargy
29. Poor health
30. Social skills
31. Risk-taking
32. Not caring about station duties
33. Not wanting to work with other people
34. Downfall of everyone's health
35. Human body is not meant to be awakened and perform at 100%
36. Stress at home
37. Health problems with members in our department
38. Focus is clouded and thoughts wander
39. Irritable and short-tempered
40. Putting yourself at risk and your crew
41. Lack of motivation
42. Lowered life expectancy
43. Health issues

44. Poor performance
45. The obvious
46. Stomach problems
47. Less interest in the work you are performing
48. Look for shortcuts to get the job done
49. Medical conditions can become serious and need to be treated with medications
50. Short life span
51. Person, social, and family issues
52. Take short cuts and get hurt
53. Increase in accidents
54. Concentration is decreased
55. Temperament changes
56. Quality care
57. Irritability
58. Attitude and marriage problems
59. Drowsiness
60. Irritability
61. Lack of motivation
62. Poor judgment
63. Irritability
64. Irritability
65. Difficult to function off duty
66. Age a person

67. Give a person a feeling of just giving up due to being tired
68. Diabetes mellitus
69. High blood pressure
70. See question # 12
71. See question # 12
72. Many adverse affects to list here
73. I do not believe that we have a problem with sleep deprivation at this department
74. There are a few shifts a month where we are lucky to get 4 hours of sleep or so
75. See question # 12
76. See question # 12
77. Slower response to calls
78. More irritability toward patients
79. Divorce
80. See question # 12
81. Could put the life of your crew in danger
82. Become sick because you are not getting enough rest
83. See question # 12
84. Poor concentration
85. Short attention span
86. Body gets to a point that it will just shut down
87. Overall poor job performance
88. Poor judgment
89. Much of this fatigue is associated to members outside activities (not work related)

90. Affected functional ability

91. Possible health problems

92. Sudden death

93. Difficulty functioning on days off

94. Possible health problems

95. Sudden death

96. Difficulty functioning on days off

97. Feeling tired on my days off

98. Not willing to work 2nd job

99. Procrastinating things so that you could relax instead

100. Poor judgment and work habits

101. Physical fatigues

102. The consequences of fatigue are part of the job

103. This is what's required and we weren't drafted – we signed up for it

104. High blood pressure, heart disease and stress

105. Short temper, poor patient care, stress and poor interpersonal relationships

106. Serious injury

107. Wasted days off trying to catch up on sleep

108. See question # 12

109. Fatigue leads to stress. Stress leads to gray hair, weight gain and body cell breakdown.

110. Fatigue can also result in mental overload

111. See question # 12

112. Long-term effects on general health including blood pressure and cholesterol

113. See question # 12

114. Over the years it's harder for me to fall asleep and I've become a very light sleeper

115. Decreased cortisol along with many health risks (Refer to U.S. Navy study)

116. Poor health and well-being

117. Injuries both on and off-duty may increase due to lack of concentration

118. Relationships on and off-duty may suffer due to irritability and the need for rest

119. If you are in school, your quality of work and study may be affected

120. See question # 12

121. Bad, bad

122. I feel fatigue is a common problem in our career

123. A Captain from FDNY advised me that crews can't work 24 shifts on heavy rescues due to the amount of fires and calls.

124. Lack of sleep has taken a toll on my body due to working at the busy stations

125. I have seen changes in my friends @ work and have seen drastic changes in their appearance and in some cases their health

126. An upset of homeostasis within the body – this can manifest itself gradually or instantly on many levels depending on the age and frequency of fatigue inducing habits.

Question 22: Please provide additional comments and/or suggestions you feel are appropriate in the space provided below.

1. May become fatigued sooner based on amount of work.
2. Have to go home and nap for 2 hours to be functional otherwise I feel irritable, grumpy and don't want to be around others.
3. Too tired too write anymore.
4. 24 hours on and 72 hours off with no Kelly days (ideal work week)
5. Need more units on shift
6. 24 - 48 of with our families is important
7. Taking years off my life from going from sleeping to running calls.
8. Never make up the sleep that we loose.
9. Down time is also important when at work so that it can allow the mind to focus on things that are less intense so you can be ready for anything.
10. This job has changed from critical calls to uneducated callers who think 911 is the cure for everything - better call screening (bottom line).
11. This is an area that is very difficult to make absolute judgments. I get plenty of sleep and have no trouble sleeping or staying awake during the day either while on shift or the day after.
12. Some trucks are busier than others which can take a toll on a person.
13. The bid is good in that sense so you can switch to a less busy truck if the lack of sleep gets to you.
14. If I push myself too hard my body lets me know when it is time to back off and just sleep.
15. I don't know what I'd do with myself if I worked a "normal" 9 to 5 job.
16. After 18 years my body is used to the schedule and the hours.

17. I feel that it should be recommended for personnel working 24 hour shifts to take naps, especially busy stations with high call volumes.
18. I also think that rotating personnel throughout less busier stations would be beneficial so that everyone can have the ability to get an adequate amount of rest.
19. Personnel that are "stuck" at busy stations (not by choice or due to limited choice) and run a high volume of calls lack the proper amount of sleep which plays a vital role on their fatigue.
20. 24 hour shifts work for me
21. When we are not busy and all the work is completes we are allowed to rest when needed. It is up to each individual to use this time wisely to avoid being overtired or fatigued.
22. Rookies should be allowed to nap during the day if working for more than 24 hours straight (i.e. hurricanes, overtime, hold-ins).
23. I feel that there is no number one answer for the cure to fatigue. Some will have it more than others. Other factors also are involved (i.e. diet, exercise).
24. This also plays a tremendous role in how the human body overcomes the obstacle of fatigue.
25. Offer a 4 x 12 hour week to those who would like to work it. You are still going to have people who will not switch no matter what any study says or how bad they feel because of other obligations.
26. If enough people agree, you could have both shift schedules.
27. This survey only applies to our busy stations.
28. I think sleep is very important. I know if I don't get enough I am irritable.

29. Everyone is different. Some function well all the time, others more at night than day or vice versa.
30. As long as individuals do not go out partying the night before (pull an all nighter), they should be able to function appropriately.
31. I worked for a department that did two 12 hour shifts followed by three days off and three 12 hour shifts followed by two days off - would alternate shifts after 4 weeks. **HORRIBLE!**
32. Working that shift schedule (two 12 hour shifts) was hard for anyone to get real restful sleep. The department did some research and switched to 24/72's.
33. Employees are much happier and dept. can staff more units by using the 24/72 schedule.
34. I feel that maybe moving people to three different stations during a bid might decrease fatigue.
35. Use a cycle of one busy station and two slower ones to have a break after doing a couple of months at the busier station.
36. This (rotation) would work for the stations like 2/8 and 46 that just get hammered day after day.
37. Human beings can only be pushed so far. It's like having the accelerator to the floor - eventually something is going to give.

Appendix H

Consecutive Work Hours Memorandum

FORT LAUDERDALE FIRE-RESCUE
OFFICE OF THE FIRE CHIEF

MEMORANDUM NO: 01-053

DATE: December 19, 2001

TO: All Personnel

FROM: Otis J. Latin, Sr., Fire Chief/Director
Keith P. Allen, Deputy Chief, Operations
Rhoda M. Kerr, Deputy Chief, Administration

SUBJECT: Consecutive Work Hours

Effective January 1, 2002, no employee will be permitted to work more than forty-eight (48) hours in any seventy-two (72) hour time frame. This policy is being implemented to ensure the proper safety of employees, co-workers and the community, and to provide quality assurance for the patients we treat and serve. This policy can be modified by the Fire Chief during emergency or disaster conditions.

OJL:KPA:RMK:ps