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Signature of Student Date

An Evaluation of Workplace Conditions as Causative Factors to Incidents of Type III Workplace Violence in the Construction and Environmental Remediation Industries

BY

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Degree to Be Awarded: M.P.H.
Career MPH

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M.P.H., Emory University, 2010
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An Abstract of a Special Studies Project submitted to the Faculty of the Rollins School of Public Health of Emory University in Partial fulfillment of the requirements of the degree of Master of Public Health in the Career MPH Program
2010

Abstract

An Evaluation of Workplace Conditions as Causative Factors to Incidents of Type III Workplace Violence in the Construction and Environmental Remediation Industries

BY
By Michael Goldman CIH, CSP, CHMM, CPEA

Industry literature indicates that the causes of violence in the workplace are rarely investigated beyond the consideration of the interpersonal relationships of the workers. Although the effects of heat, excessive noise, repetitive tasks, and chemical exposure on worker behavior are well-documented, these environmental factors are not frequently examined in incidents of workplace violence. In fact, even though incidents of worker-on-worker violence in the workplace may be occurring in the construction and environmental remediation industries throughout the United States at rates higher than reported or investigated its root causes and contributing factors may not be investigated.

The primary purpose of this study was to establish a correlation between exposure to workplace hazards and incidents of workplace violence. The secondary purpose of this study was to determine the consideration given by investigators of workplace violence in the construction and environmental remediation industries, usually Health and Safety Professionals, to these physical and chemical stressors in their investigations. Key informant interviews with Health and Safety Professionals in these firms were conducted

to gather data about how these professionals conceptualize, document, and recommend corrections for the root causes and contributing factors of worker-on-worker violence. Establishing a relationship between exposure to workplace hazards and incidents of workplace violence is crucial to understanding the causes of workplace violence. Understanding the approach used by Health and Safety Professionals is important in the development of interventions that improve worker safety and decrease the incidence of workplace violence.

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Chapter 1: Introduction

The National Institute of Occupational Safety and Health (NIOSH) defines workplace violence as "violent acts, including physical assaults and threats of assault, directed toward persons at work or on duty" (NIOSH 1996). The Bureau of Labor Statistics reported in 2005 that 5 percent of all workplaces in the United States have experienced at least one incident of workplace violence. Typically, the larger the employer is, the more likely they are to experience incidents of workplace violence. Half of the workplaces with 1,000 or more workers reported incidents of workplace violence (BLS 2005).

Workplace violence takes several forms. NIOSH classifies these incidents into four types:

Table 1. Types of Workplace Violence as Defined by NIOSH

Type I	Criminal Intent	The perpetrator has no legitimate relationship to the business or its employee, and is usually committing a crime in conjunction with the violence. These crimes can include robbery, shoplifting, trespassing, and terrorism. The vast majority of workplace homicides fall into this category.
Type II	Customer/Client	The perpetrator has a legitimate relationship with the business and becomes violent while being served by the business.
Type III	Worker-on-Worker	The perpetrator is an employee or past employee of the business who attacks or threatens another employee(s) or past employee(s) in the workplace.
Type IV	Personal Relationship	The perpetrator usually does not have a relationship with the business but has a personal relationship with the intended victim.

Type III incidents accounted for 7 percent of the total homicides of United States workers from 1991 to 2001 (NIOSH 2006). When compared with other industries, violent incidents in the construction and environmental remediation industry are not considered frequent. However, when workplace violence occurs in this industry, it is most often Type III incidents. (Kennedy 2010).

In the construction and environmental remediation industry, a company's human resources professional is usually responsible for investigating and resolving worker on worker violence. Often the situation is viewed from the standpoint of the personal interaction of the workers. The resolution often involves a disciplinary action against the workers involved in the incident or termination of their employment. Because of the physical nature of these incidents, they are usually reported and investigated. However, worker-on-worker violence that has not escalated to physical harm, such as verbal abuse, bullying, and stalking, are anecdotally known to exist in the workplace but are often not reported and, therefore, not investigated (McElhaney, 2004). As a result, these unreported aggressive acts are not measured in national statistics on workplace violence.

A review of industry literature reveals that the perceived causes of violent incidents in the workplace are the psychological and emotional stresses on unbalanced individuals predisposed to violent activity. Although research in the fields of toxicology, industrial hygiene, occupational medicine, and safety has confirmed that chemical and physical stressors in the workplace can cause changes in the behavior and psychology of both balanced and unbalanced workers, these environmental conditions are rarely considered during investigations of violent incidents.

The following environmental stressors have been recognized by safety professionals and industrial hygienists as workplace hazards that may cause behavioral and psychological changes in workers (NIOSH 1973):

- Exposure to excessive heat and humidity
- Exposure to excessive noise
- Repetitive tasks
- Ergonomic stressors such as uncomfortable work positions and poor worker/machine interfaces
- Exposure to chemical toxins such as organic solvents and metals

The effects of exposure to these stressors may be exacerbated in those workers suffering other work- or non-work-related stresses, such as dealing with emotionally imbalanced co-workers, lack of adequate sleep because of shift changes or long hours, and substance abuse (CDC, 1996).

This study examines the possible correlations between physical and chemical agents in the workplace and incidents of workplace violence as well as the consideration given by investigators in the construction and environmental remediation industries to chemical and physical stressors in their investigations of worker-on-worker violence.

Chapter 2: Literature Review

Environmental Factors as Modifiers of Behavior

Certain environmental factors in the workplace have been shown to modify the behavior of workers, and there is extensive literature on these physiological and behavioral effects (NIOSH 1973). Occupational stressors as the cause of diseases and behavioral changes have been documented since the 1700 ‘s (Ramazzini, 2001) and in the following eras, industrial hygienists and safety professionals have monitored stressors in workplaces worldwide. However, a direct correlation between environmental factors and the incidence of workplace violence has not been widely discussed or studied.

The most well-documented environmental factors that cause behavioral changes in workers are chemical agents, excessive noise, repetitive motions, and excessive heat (ACGIH, 2010). Workplace exposures to biological hazards have been considered in this study as well.

Chemical Agents

The psychological, physiological, and toxicological effects of certain chemicals on the human body have been well-documented, and behavioral changes and mental disturbances resulting from chemical exposure that could lead to violence in workplace have been noted for many chemicals used in a wide variety of workplaces (Casarett, 1996).

Workplace exposure to metals and organic solvents is known to modify behaviors and increase excitability and irritation (Casarett 1996). Metals that are commonly found

in industrial settings and hazardous waste sites include mercury, lead, manganese, and tin. Of these metals, mercury and lead are the most commonly present at construction sites and environmental remediation sites in concentrations high enough to cause toxicity in adults.

Exposure to high levels of mercury causes the condition known as erethism, which is typified by antisocial behavior and emotional outbursts. Author Lewis Carroll illustrated this bizarre behavior with his character The Mad Hatter in *Alice's Adventures in Wonderland* (Carroll 2010). However, in construction and remediation settings, mercury toxicity is relatively uncommon, due to the chemical's heavy molecular weight, low boiling point, and low vapor pressure, which makes airborne exposure unlikely (Klaassen, 1997).

Lead is more common and pervasive at construction and remediation sites, commonly found in the form of dust. The dust is inhaled by workers and overexposure to lead in adults can cause irritability, anxiety, and sleep disorders. Often these symptoms are present in the absence of other physical symptoms such as anemia, peripheral neuropathies, wrist drop, and lead lines in the gums. In some cases, the mental and behavioral symptoms are present but the lead toxicity goes undiagnosed because of the lack of physical symptoms (Lessler, 2009).

Manganese and tin cause toxic responses similar to that of lead, but they are not frequently encountered in the construction or remediation industries. Other metals such as arsenic, thallium, bismuth and zinc, which are often found at hazardous waste sites, will display systemic pathologies prior to behavioral changes (Klaassen, 1997).

Organic solvents typically present behavioral changes in acute dosages and exposure scenarios. The mechanism by which solvents reach the brain via their ability to cross the blood/brain barrier is well-known. Epidemiological studies linking chronic exposures of organic solvents with antisocial behaviors have been reported to be inconclusive (Klaassen, 1997).

Excessive Noise

The reported psychological effects of noise include heightened anxiety and disturbance of sleep patterns. Studies have shown that prolonged exposure to noise in the work environment can cause an increase in accidents and a decrease in productivity. Studies have additionally indicated that prolonged exposure to excessive noise causes workers to interact with each other less (Raffle, 1994).

Repetitive Motions

Repetitive strain syndrome has been shown to have a psychological component that may cause changes in behavior in the workplace. The need for concentration in excessive monotonous work can increase levels of stress, which in turn can be exacerbated by meeting production demands. This type of stress may cause inappropriate or excessive responses to emotional stimuli (Raffle, 1994). While this certainly may cause a behavior modification that results in violent activity, excessively repetitive work is more common in a manufacturing setting than in construction and remediation work. A relationship with incidents of workplace violence has not been established.

Excessive Heat

In numerous studies, exposure to heat has received attention as a modifier of behavior in the workplace and linked to an increase in risky and unsafe behavior (Ramsey, 2006). Workers exhibit the safest work behavior and highest level of productivity when working at optimally comfortable temperatures (Ramseya, 1983). A physical state known as transient heat fatigue is defined as the temporary state of discomfort and mental or psychological strain arising from prolonged heat exposure. Workers that have not had time to acclimate to a hot work environment are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness, and vigilance. Workers suffering from transient heat fatigue also may exhibit increased excitability and irritation. The severity of transient heat fatigue will be lessened by a period of gradual adjustment to the hot environment (NIOSH, 1986).

Attributes of Workers at Risk for Violence

A review of the literature covering incidents of Type III workplace violence shows a tendency for studies to focus on the personality attributes of the employees. Profiles of individuals more likely to commit acts of violence in the workplace have been published by some researchers. The following attributes are listed by researchers of workplace violence (Morris, 2010):

- White male, 35 to 45 years old
- Criminal history
- Unable to tell the truth on many occasions
- Poor job performance

- Loner, not many friends and little contact with family
- Always disgruntled
- Blames others for everything
- Cannot take criticism
- Identifies well with violence
- Drug user

Morris and other researchers have compiled these profiles but have not specified the types of workplaces in which these data were collected. The profile is likely to be common to many types of industries. Being able to identify the attributes of a typical instigator of workplace violence can be useful, although many researchers describe this as "typecasting" and an overly simplistic view (Kelleher, 1997).

An alternative model has been proposed wherein a stressful experience leads an individual with predisposed personality traits to have specified emotional reactions that culminate in a violent act (Kelleher, 1997). The Society for Human Resource Management has attempted to quantify these stresses. According to its model, personality conflicts, marital problems, substance abuse, firings, and layoffs are the most common stresses that lead to workplace violence. It should be noted that environmental conditions were recognized as stressors in this model.

Even with an acceptable model, understanding the causes of workplace violence will be difficult since violent acts are not common workplace incidents and may be under-reported for fear of litigation or loss of a job (Laibig, 1995). It has been stated that the number of workers across all industries that have been the victims of workplace violence is estimated at 6 percent (Chappell and Dimartino, 2006).

Only one study was found that specifically focused on incidents of workplace violence in the construction industry. An Australian study examined the rates of violent incidents in construction workers. The rates are shown per 1000 workers. As Table 2 shows, the severity varied from verbal assaults to physical violence (Chappell and Dimartino, 2006).

Table 2. Rates of Violent Incidents in Australian Construction Workers from 1993 to 1998

	Severity of Violent Incident		
Craft	**Verbal**	**Threat**	**Physical Violence**
Contractor	17.3	8.0	2.7
Carpenter	16.0	2.7	2.7
Demolition	23.5	5.9	5.9

This data indicates that incidents of verbal abuse are far more common than incidents of physical violence. However, the study indicates that cases of verbal abuse and threats occur at the same rates as violence in the carpenter and demolition trades. The study does not establish why this is true for these trades.

Correlation of Violent Incidents and Environmental Factors

A direct correlation between incidents of workplace violence and worker exposure to environmental stressors has not been established by researchers. However, correlations have been drawn between environmental factors and safe work performance.

The results of a study conducted for NIOSH in 2002 indicated that worker exposure to temperature extremes influenced the ratio of unsafe behaviors noted by observers to total behaviors. (Ramseya, 1983) This study also specified the temperature range in which workers are least likely to commit unsafe acts. This range is between 17 and 23 degrees Celsius as measured with a wet bulb globe thermometer. This method of measurement is used to measure heat exposure factors in radiant and convective heat as well as humidity. While this study did not specifically cover workplace violence and was not conducted in the construction industry, it does conclude that worker behavior is impacted by environmental conditions (Ramsey 2002).

A correlation between exposures to environmental factors and violence in non-work settings was made by Australian researchers. This study indicated that violent activity was more likely to occur in a club, pub, or bar setting in which patrons were exposed to excessive noise, heat, and crowding. There are obvious differences between workplaces and drinking establishments, including alcohol and relaxed standards of behavior, but distinct correlations were drawn to violent incidents, described as either aggression or attack, and facilities that had been poorly maintained. The researchers stated that poorly maintained facilities had higher levels of noise, heat, and crowding (Hommel and Clark, 1994).

Other researchers state that a “clean, bright, and modern setting” as opposed a dilapidated work environment can deter aggression (Chappell and Dimartino, 2006). However, no additional information was given.

Chapter 3: Methodology

To learn about the workplace experiences of field personnel assigned to investigate worker-on-worker violence within the construction and environmental remediation fields, interviews were conducted with health and safety professionals in those industries. The interviews were designed to determine the average number of incidents of workplace violence, how the investigations into those incidents were conducted, and the outcomes for the workers and employers. The results of the interviews were tabulated and analyzed.

Selection Process

Initially, interview candidates were selected from Health and Safety Professional networks, including the Georgia Chapter of the American Society of Safety Engineers and the Board of Certified Safety Professionals, and from firms with a North American Industry Classification System Code of 541620, *Environmental Consulting Services*, or 237, *Heavy and Civil Engineering Construction*. The candidates who were selected to be interviewed were employed full-time as health and safety professionals and had at least 12 years professional management experience with implementing health and safety programs and conducting accident/incident investigations.

Once a candidate was selected, the author explained the purpose of the study to each candidate, asked if they wanted to participate in the study, and if they did, requested their consent to be taped during the interview. Eleven health and safety professionals

agreed to the terms of the interview and became part of the study. Typically, each interview lasted 1 hour.

It should be noted that two of interviewees had additional duties in Human Resources and were not solely dedicated to a Health and Safety role.

Approach

The health and safety professionals were interviewed using a general interview guide approach to discuss their experiences with violence in their workplace.

A questionnaire, attached as Appendix A, was developed for use as an outline during the interview. Although the questionnaire represented the format of the interview, the participants were encouraged to speak freely about the possible factors that caused the Type III incidents, the processes they used to investigate the incidents, and the corrective actions taken to prevent repeat occurrences.

Early in the interview, workplace violence was defined for the interviewees to ensure they understood that the definition included threatening and bullying behavior and not just physical violence. Once specific incidents were recalled by an interviewee, bracketing questions were asked to ascertain the interviewee's method for investigating each incident for root causes and contributing factors. General questions were asked to encourage the interviewees to engage in an open ended discussion about the incidents.

Data Analysis

The data collected during the interviews are best described as phenomenological: health and safety professionals were discussing their own experiences and responses to the incidents of worker-on-worker violence. None of the health and safety professionals

interviewed were directly involved in an incident of workplace violence. Each was called to investigate the incidents after the incidents were over as part of their office responsibilities.

Since the health and safety professionals were working from memory and not incident reports, much of the data are anecdotal. In many cases, the interviewees were able to recall the conditions that resulted in an act of workplace violence with a great deal of clarity because they were responsible for the investigation and in close physical proximity to the persons involved. Most of the incidents of workplace violence discussed in these interviews were dramatic, high profile events. If the causative factors were unclear, it was usually because the interviewee did not have a high level of engagement in the case.

Due to the qualitative nature of the data, the method of content analysis was used to determine recurring themes as well as anecdotes. Content analysis is useful in detecting themes in communications when the data are qualitative and somewhat subjective. In addition, content analysis is useful when describing themes in uncommon events. It should be stressed that incidents of workplace are not common and more quantitative methods of analysis, such as statistical analysis, are not likely to be effective with so few data points.

The themes were graphed as trends and are presented in the results sections. The anecdotal data were relayed by the health and safety professionals in stories and impressions and are difficult to quantify. Many of the anecdotes are presented in this study as examples of worker-on-worker violence and, where possible, used to illustrate probable causes of incidents and effective methods of control of causes.

Human Subjects Protection

The potential impacts of workplace violence could include criminal or civil proceedings. As defined by the United States Department of Health and Human Services, a "human subject" is defined as a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information (Health and Human Services, 2010).

Every effort was made to protect the privacy and security of the interviewees and the workers discussed during the interviews. Private information that could identify the workers was not sought from or given by the interviewees. At no time was the author given information that would allow him to identify either the victim or perpetrator of an incident of workplace violence. At no time were the workers involved in an incident sought out as potential interviewees or participants in the study.

Verbal consent was given at the beginning of each interview and was kept as part of the recorded interview.

Limitations

The interviews produced qualitative data from a sample of interviewees. While every effort was made to select a sample of interviewees with a variety of experiences, the findings may not be generalizable to all workplaces or settings. .In addition, i general, the Health and Safety Professionals discussed incidents that happened within the last 10 years of their careers and they may not have had direct involvement in the

investigation of the incident. Therefore, a discussion of root causes of these incidents may have the distortion of memory and the passage of time.

The interviewees were working from memory and not from written accident investigations or transcripts. In addition, the initial investigations may not have accurately gathered all of the information necessary to determine the root cause of the incident. Workers involved in these types of incidents are often not forthcoming when questioned by their employer, since answers may reveal personal or sensitive information such as romantic involvement or gang affiliation and criminal activity. Additionally, workers in these situations are often unable to articulate their motives. In cases where the investigator is remote or offsite, site conditions and contributing factors may remain unknown.

Although efforts were made to make the interviews as impersonal and objective as possible and avoid any personal details of the incidents, some Health and Safety Professionals may have been guarded during the interviews, if they believed that the information reflected negatively on their performance as managers. They may also have been reticent to discuss aspects of the incident history that showed their employer in a negative light.

In cases where environmental exposures to chemicals, biological, or physical agents were found to be contributing factors or determined to be root causes, there were no detailed exposure data to workplace hazards at the time of those incidents. Therefore, the data gained from the Health and Safety Professionals is highly subjective and qualitative. For example, the interviewee may have known that the incident occurred at a site that was contaminated with lead or where work was conducted in a hot environment

but detailed exposure data for these agents were not collected or could not be accessed during the interview. Therefore, determining a direct correlation between the causes of the incident and levels of exposure to the workplace hazard is difficult. Without accurate exposure data, root causes of incidents may not be able to be definitively identified and the connection remains speculative.

In addition, individual reactions to exposure to workplace chemical and physical hazards will vary between individuals. This is especially true in the case of exposure to heat. It is difficult to determine the effect that working in hot environments may have without being able to gauge the individual's level of acclimatization or tolerance.

Chapter 4: Results

Interviews were conducted with 11 Health and Safety Professionals that are currently active in the construction or environmental remediation field. The interviews were recorded and typically lasted for half an hour. The Health and Safety Professionals also had from 12 to 35 years experience in this field. A questionnaire was used during the interview.

Rates of Incidents

Of the 11 participants interviewed, nine had experience with incidents of Type III workplace violence in their work places. The interviewees were asked to focus on the last 10 years of their careers. In most cases, the Health and Safety Professionals had knowledge of two to five incidents of workplace violence or workplace bullying. Two of the interviewees worked for employers that had no reported incidents of workplace violence and one interviewee had experience with seven workplace incidents.

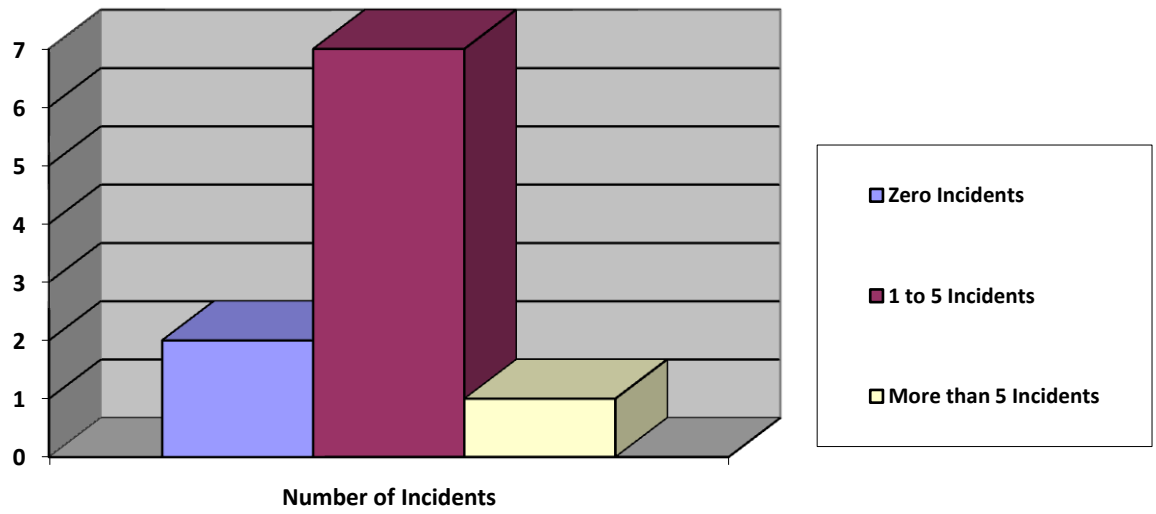

Figure 1 - Rate of Incidents of Workplace Violence Reported by Health and Safety Professionals in the last 10 Years

Many of the incidents discussed in the interviews did not escalate to violence but involved of threats and intimidation or "booby trapping" of work areas or equipment. For the purposes of this study, instances of bullying and intimidation will be included as instances of workplace violence.

The number of total workers this dataset represents would be extremely difficult to determine. It can be assumed that the number of workers represented by 10 years of experience by 11 Health and Safety Professionals is quite large. Therefore, the low total

number of incidents that were discussed indicates that these occurrences are not commonplace or that the majority of incidents are not reported to management.

Reported Causes for No Incidents

Two Health and Safety Professionals stated that their workplaces had no incidents of workplace violence. One of these interviewees stated that his place of employment had not experienced any violent incidents due to the fact that his employer required each field project to have a written security program. The other interviewee believed the zero incidence of violence resulted from the employer implementing safe and comfortable working conditions. He did state that workplace factors could be causative in theory.

Processes for Investigation

Among the employers of the interviewees, the responsibility for investigating incidents of workplace violence was typically the jurisdiction of the Health and Safety Professional. In most cases, input was solicited from Human Resources for the applicable firm. Only one interviewee stated that the incident investigation was handled solely by Human Resources.

Influence of Schedule on Incidents on Workplace Violence

The time of day during which an incident occurred was discussed with each interviewee. While two Health and Safety Professionals stated that they saw no pattern in the timing of the incidents and two of the answers were not applicable, the remaining interviewees saw a pattern in the timing of violent incidents. Four of the Health and

Safety Professionals detailed incidents that occurred during night shifts or extended shifts over weekends and each interviewee believed the shift hour or extended shift was a causative factor. Three interviewees stated that incidents at incidents at their workplaces were most often reported as occurring during the morning or lunchtime. One interviewee indicated that the events typically occurred toward the end of the shift.

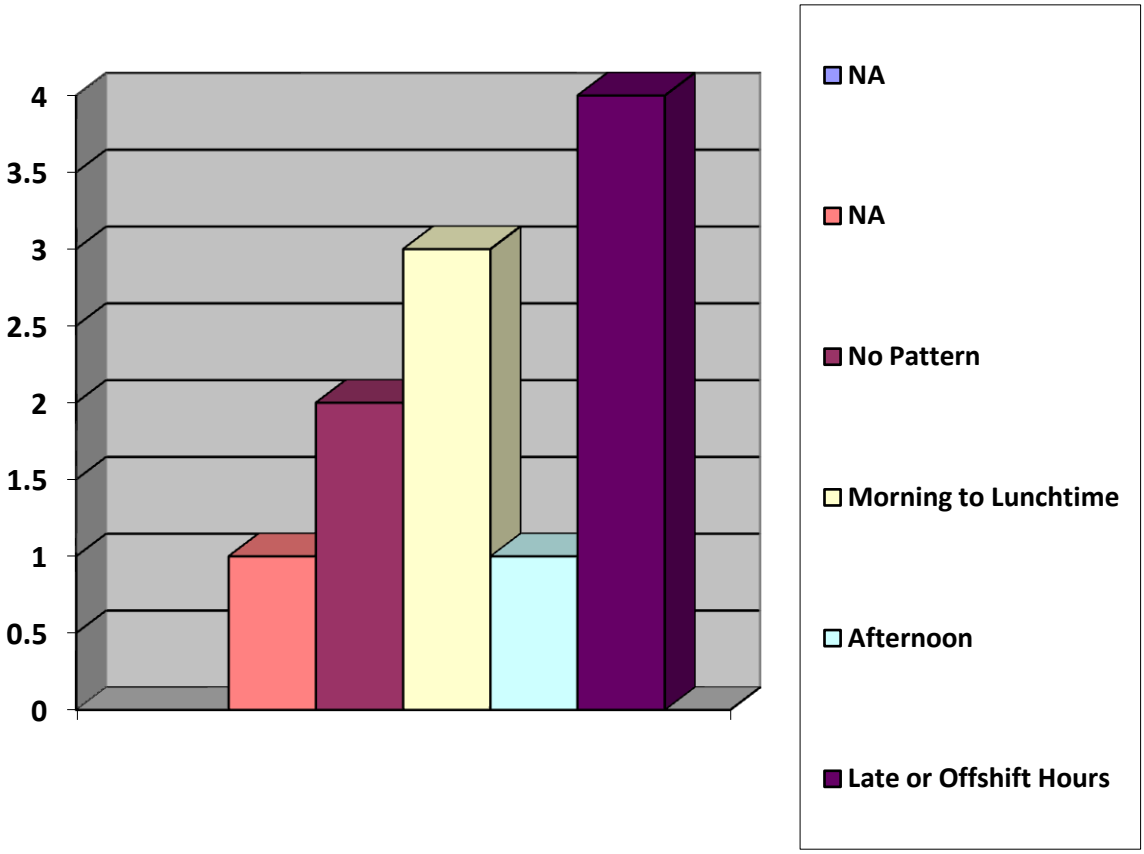

Figure 2 - Time of Workday that Incidents of Workplace Violence were reported to occur.

Shift work or work hours extending beyond the typical 40 hour work week were also discussed as a contributing factor. Four of the Health and Safety Professionals detailed incidents that occurred during night shifts or extended shifts over weekends.

Environmental Factors as Root Causes

Eight of the Health and Safety Professionals stated that they believed that environmental factors had been root causes in the incidents that they had investigated or that an environmental factor could be a root cause in a similar incident. Heat was the most common environmental factor mentioned as a possible root cause for incidents of workplace violence. Six of the interviewees stated that without a doubt, exposure to excessively hot environments had been a factor in a violent incident at their workplace. The other two interviewees, who had not investigated incidents of workplace violence, stated that theoretically heat and noise could be root causes of workplace violence.

In the cases where hot environments were suspected to be causative factors, the health and safety professional who reported the highest number of incidents stated that he often worked with local hires that had not been acclimated to the heat and were not "work-hardened" for the site conditions or the work schedule. Therefore, these workers were in conditions that may have led to transient heat fatigue. Conversely, the health and safety professional who reported the lowest rate of workplace violence stated that the workforce employed at his firm had been the same for a long period of time and were highly acclimated to hot environments.

While many of the Health and Safety Professionals believed excessive noise was a causative factor in many of their cases of workplace violence, detailed exposure records were not available. Only one interviewee stated that exposure to chemicals in the workplace, specifically metals, was a possible cause. Lead was known to be a contaminant at the site; however, detailed exposure records were not available. None of the interviewees believed that biological hazards such as insect bites or exposure to

poisonous or irritating plants had been possible causes in violent incidents. None of the interviewees believed that repetitive tasks/strains or ergonomic factors had been causes in the incidents that they investigated. All of the interviewees agreed that these types of stresses, chemical exposure, biological hazards and repetitive tasks/strains were not commonly noted on the projects that they managed.

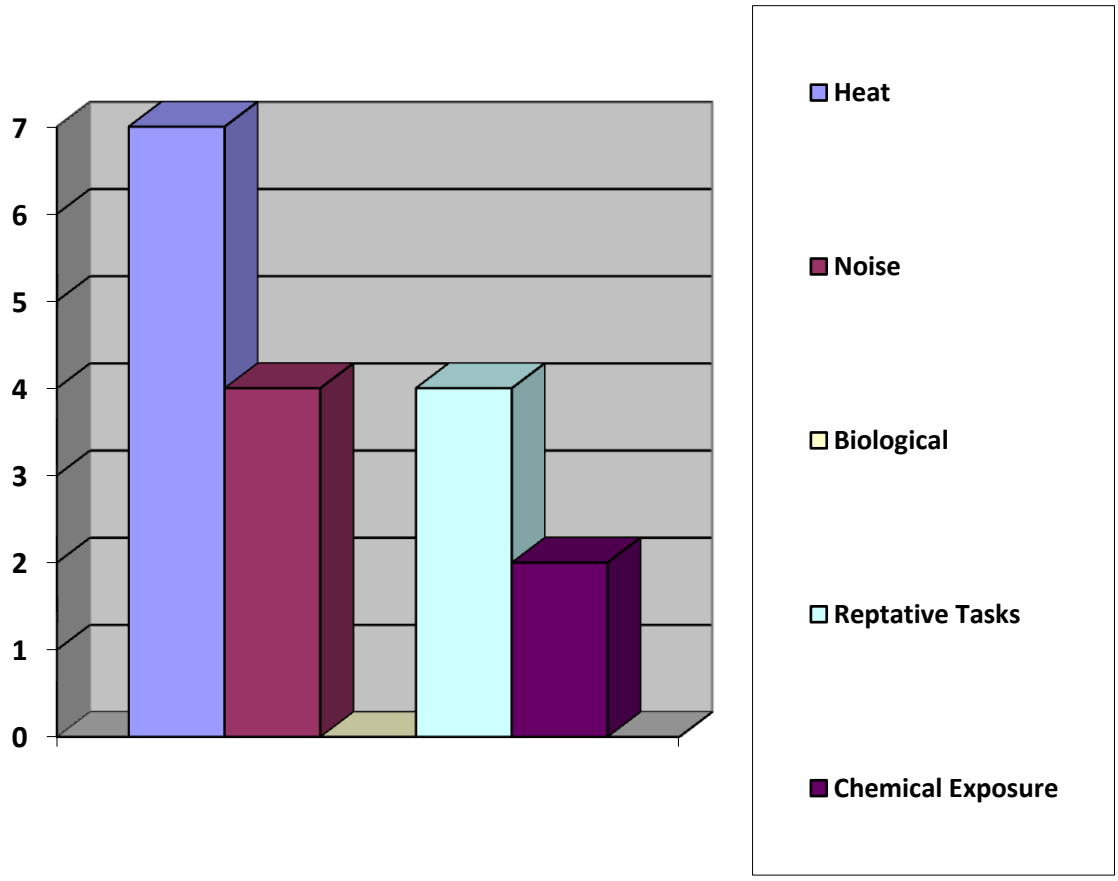

Figure 3 - Environmental Factors Considered as Possible Root Causes during Investigations by Health and Safety Professionals

Reporting and Corrective Actions

All eight Health and Safety Professionals who had experienced incidents of workplace violence had considered environmental factors as root causes and had reported them through their firm's incident reporting procedures. In addition, the recommendations for corrective actions they made were developed with the aim of minimizing exposure to these factors. However, two Health and Safety Professionals did not consider environmental factors as possible causes of workplace violence and therefore did not incorporate them into corrective measures.

Other Reported Potential Causes

The interviewees discussed other possible factors as potential root causes and causative factors for incidents of workplace violence. The factors discussed included:

- **Personality Type** - Only one interviewee said that workers could be profiled into personality types that are more likely to commit acts of work place violence. A military background and enthusiasm for guns were mentioned as likely personality or lifestyle traits. This description coincides well with the profile of the typical worker involved a workplace violence incident described by Morris and Kelleher.
- **Racial, Gang or Nationalistic Issues** - Two interviewees discussed gang membership and racial/nationalist tensions as possible causes of violent incidents in the workplaces that they managed. It was acknowledged that these factors existed outside of the workplace and may have been exacerbated by site conditions.
- **Substance Abuse** – Substance abuse was discussed as a factor in three of the interviews. The workplace with the highest the number of violent incidents had reported

the highest rates of incidents involving substance abuse. It was unclear whether or not the ingestion of these substances was occurring during work hours. This workplace also exposed workers to high levels of heat. The workforce had been hired only a short time before the incident and had not had time to acclimate to the heat.

- **Romantic/Personal Life Choice Issues (Type IV Incidents)** - Two incidents involved co-workers with troubled romantic/personal situations. These incidents were compelling enough for the interviewees to suggest that romantic/personal relationship situations should be considered as a potential cause of worker-on-worker violence in the workplace. In fact, one of these cases resulted in the only fatality noted during this study. Additionally, one interviewee linked the romantic/personal situation to substance abuse, stating the liaison began with after-work socializing.

Effectiveness of Corrective Actions

The Health and Safety Professionals who recommended corrective actions that included reducing exposures to environmental factors such as heat did not see repeated incidents of workplace violence. One interviewee stated that incidents of violence continued but he did not suspect the same root causes. In that case the interviewee was managing a site that was rife with racial and gang tensions that became more apparent as the project went on.

Chapter 5: Discussion and Implications

Rates of Occurrence

The average rate for Occupational Safety and Health Administration (OSHA) recordable injuries and illness in the construction industry is 6.9 (Bureau of Labor Statistics 2010). This is computed as 6.9 injuries or illnesses requiring medical attention above first aid for every 100 workers that work 2,000 hours apiece in a year. While Type III workplace violence is not common, irregular and unreliable reporting prevents the exact rate of worker-on-worker violence from being calculated. If enough data were available, a similar equation could be used to develop this rate, but for now, it can be assumed the rate for incidents of workplace violence will be significantly less than the OSHA recordable rate of injuries and illnesses. Of the hundreds of thousands of man-hours represented in this study of workplace violence in the construction and environmental remediation industry, less than three dozen incidents were reported to the 11 interviewees.

Severity of Incidents

The severity of the incidents can be more alarming than the rate of occurrence. Severity ranges from bullying to homicides. Threats and bullying are often ignored by management or not reported by the workers involved. However, as one interviewee advised incidents without severe outcomes should be considered "near misses." Threats or bullying may escalate to full-blown violence or homicide if left unchecked.

Type III incidents accounted for 7 percent of the total homicides in the workplace for United States workers from 1991 to 2001 (NIOSH 2006). A homicide disrupts the workplace environment and causes additional stress on workers not directly involved in the incident. Even the injury of a co-worker causes a heightened level of anxiety and stress among co-workers.

Root Causes

The majority of the literature available on workplace violence deals with Type I incidents. This type of workplace violence is the most common in the United States and often has the most drastic consequences. Most of the research that has been conducted on Type III incidents has focused on the personality and social aspects of the individuals involved. As discussed in Chapter 2, researchers have published profiles of the typical workers that will commit acts of violence in the work. During the interviews, for this study, each health and safety professional was asked whether or not they considered personality traits as a root cause of the violent incidents that they investigated. Only one interviewee professional discussed personality traits as a root cause, which indicates that root causes other than personality are causing incidents of workplace violence. Better methods of control and prevention will be established only after employers have a better understanding of the root causes of these violent incidents.

While the literature does not discuss environmental factors as root causes of violent incidents, interviews with Health and Safety Professionals indicate a possible correlation.

In the data provided by the interviewees, exposure to metals or solvents was mentioned as a possible factor in only one incident. In that incident, the suspected contaminant was lead, but no exposure data were gathered to support the assumption. that it was a contributing factor in the incident. Lead exposure can cause toxic effects on the central nervous system that may lead to personality changes and antisocial behavior. Historical examples of antisocial behavior that likely resulted from lead poisoning include several Roman emperors and the doomed Franklin expedition to the North Pole in the 1840s (Vollmann, 1994). However, it is likely that antisocial behaviors due to exposure to airborne contaminants will be more common in manufacturing settings than in construction or environmental remediation since the exposures scenarios in manufacturing more are likely to be long-term and chronic (Lessler, 2009). The transient nature of construction and environmental remediation work typically results in more acute exposure scenarios where behavioral changes are a less likely result of exposure. To determine the connection between chemical exposure and workplace violence, a large amount of industrial hygiene data, including levels of exposure over prolonged periods of time, would have to be collected. Even with these data, determining that lead exposure, and not another factor, is the causative factor may be difficult.

Organic solvents such as hexane, xylene and toluene are well documented to affect the central nervous system and are common contaminants on hazardous waste sites (Raffle 1994). While it is conceivable that behavioral changes due to exposure to these chemicals could result in a worker committing a violent act, no data are available for these chemicals and none of the health and safety professionals mentioned these chemicals as contributing factors during the interviews.

No interviewee discussed biological agents as the possible root causes of workplace violence. It is reasonable to assume that biological agents, including biting insects and poisonous plants, may present annoyances to construction and environmental remediation workers, but it is unknown if they cause the behavioral changes or temper flare-ups that results in violent behavior. While having poison ivy or dealing with the constant presence of black gnats on exposed skin, especially around the eyes and ears, can be stressful, these factors were not mentioned as causative factors in workplace violence by any of the interviewees.

Exposure to noise has been documented to heighten anxiety, increase tension, and disrupt the sleep patterns in exposed workers. It is also a pervasive health and safety risk on construction and environmental remediation sites. Noise exposure was mentioned as a possible contributing factor by two of the interviewees.

The OSHA-permissible exposure level (PEL) for noise is 90 dBA over an 8-hour shift without hearing protection. The threshold for which noise is irritating to individual workers is widely variable and will vary with pitch and the worker's distance to the source. Common construction site features including, power tools and heavy equipment, often produce noise at levels higher than the published exposure levels. Construction workers are often exposed to excessive levels of noise and compliance with OSHA or ACGIH standards is often not enforced.

However, while it is possible that exposure to excessive noise could cause the behavioral changes that lead to incidents of workplace violence; no data were gathered to determine levels of exposure. To correlate incidents of workplace violence and levels of noise would require collecting a large amount of exposure data. The data still may not

conclusively show it to be a root cause of a violent incident since violent incidents are rare. However, due to the behavioral changes caused by noise exposure, it does make an excellent candidate as a possible contributing factor.

Data from the interviews overwhelmingly indicates that exposure to hot environments is a leading contributing factor—if not a root cause—in these incidents. Heat is a pervasive health hazard in the construction and environmental workplaces. Due to a wide variation in physiological responses to exposure to heat, no data exists for how much heat exposure is necessary before an individual will behave violently or even display deleterious health effects such as heat stroke or heat exhaustion. Also, due to the wide variation in physiological responses to heat exposure, and due to the difficulty in assessing compliance, OSHA has been reluctant to regulate heat in the workplace. Recommendations have been made by other organizations such as NIOSH and the ACGIH, and the state of California has recently published a standard for heat exposure by workers, but there is no federal statute covering exposure to hot environments.

All of the Health and Safety Professionals mentioned heat as a present hazard on the sites that they managed and discussed heat as a possible factor in behavioral changes in workers. The interviewee reporting the highest number of incidents of workplace violence typically dealt with a workforce of local hires that were not acclimated to working in the heat. One interviewee who reported no incidents stated that he worked with a stable workforce of acclimatized individuals. This indicates a relationship between exposure to heat and behavioral changes that may cause violent incidents and that behavioral changes in workers exposed to hot work environments may decrease as workers become acclimatized. One interesting anecdote related to hot environments

portrays a fistfight between two equipment operators, who, prior to the incident, were described as close friends.

Methods of Investigating Incidents

While most of the interviewees stated that Health and Safety Professionals were involved to varying degrees in the investigation of incidents of workplace violence, two stated that they were not involved at all since their employers assumed incidents of workplace violence resulted from individual or aberrant psychologies, thereby necessitating Human Resources to take a lead role. The majority of the interviewed Health and Safety Professionals stated that they had some role in investigating the incidents since the events resulted in personal injury to the workers involved. Only two of the Health and Safety Professionals interviewed that they conducted the investigations without input from Human Resources or another group of professionals.

Implications of Controlling Environmental Factors

While exposure to physical, chemical, and biological stressors is known to cause antisocial behaviors and, therefore, may also cause incidents of workplace violence other health effects may be made manifest without a violent incident occurring. For example, an individual in an excessively hot workplace may begin to show symptoms of heat exhaustion or heat syncope long before a violent act occurs.

Methods for controlling exposure to these agents are well-known in the fields of safety and industrial hygiene. Three types of controls are typically employed in the workplace:

- Engineering controls where the workplace is altered to remove the sources of the hazards. Examples include increasing ventilation or installing enclosures around hazards. In the case of heat exposure, installing fans is the most common control method. However, this method can be deleterious if construction and outside-type work is being conducted in temperatures above 95 degrees Fahrenheit due the creation of convection currents that may actually increase the temperature of the workplace.
- Administrative controls to change employee behavior by carefully managing their work schedules. Examples include work/rest regimens recommended by the ACGIH for heat exposure, where workers alternate between working in a hot environment and resting in a cooler area.
- Personal protective equipment that provides a barrier between the worker and the hazard. It should be noted that personal protective equipment is effective only when properly worn and used by workers. Also, it may cause health effects from excessive heat due its impermeability.

In the construction and environmental remediation industries, personal protective equipment is the most commonly selected method of control of workplace hazards. This is primarily due to the transitory nature of these workplaces. While engineering controls are the most effective, construction and remediation projects do not last long enough to implement them.

Implications of Developing a Formal Security Plan

Only one interviewee worked for an employer that had implemented a formal security program, and this was the only employer that reported no cases of workplace violence. Although workplace violence is not the focal point of most security plans and programs, a formal security programs elevates employee awareness of workplace violence and specifies consequences for workers who engage in harmful acts. In addition, most security that do cover workplace violence typically cover Type 1 incidents and not Type III.

A review of the literature also indicates that Formal Security Plans are common in other industries besides construction and environmental remediation. The healthcare industry seems to be a leader in this arena.

Conclusions

Most of the interviewees doubt that incidents of workplace violence were the result of any "one thing" but believed that it is the culmination of a series of events. This series of events may start with an individual pre-disposed to react violently to his or her surroundings as profiled by Morris, Kelleher and other researchers. Even in the cases not involving pre-disposed, aberrant individuals, violent tendencies may be exacerbated in workplaces that cause exposure to known and recognizable hazards. It is indicated in the literature that these agents can cause behavioral changes in workers and the interviews indicated that environmental factors should be strongly considered as possible root causes or contributing factors in incidents of Type III workplace violence in the construction and environmental industries

Historically, the workers in the construction and environmental remediation industries are predominately male and blue collar. Therefore, it can be assumed that more individuals fitting the profile previously described may be present on construction and environmental remediation work sites than some other types of work settings such as offices or healthcare. In addition, other issues such as gang affiliation will be more present in a male dominated work sites. It is established that males are more likely to view violence as a problem solving strategy then women. Males throughout human history have been shown typically to be more apt to commit acts of violence. (Peterson and Wrangham, 1997) It is conceivable that some issues of workplace violence may be simply the result of a predominately male workforce. Additionally, construction and environmental remediation work is typically performed outside in the elements and weather without the climate controls that are typical in manufacturing settings. It can be assumed that exposures to heat and humidity will be higher and more difficult to control in construction than most other industries.

While the literature thus far has not discussed environmental factors as causative agents in incidents workplace violence, it has indicated that many agents do cause behavioral changes psychological effects that increase the likelihood of violent outbursts. Research conducted by Hommel and Clark indicated that environmental stressors, specifically noise and hot, crowded conditions, appeared responsible for an increase in violent incidents in pubs and bars in Australia. It can be assumed that these behavioral effects extend to other environments including the workplace. The interviewees indicated that of the environmental stressors that were discussed heat was

the most likely trigger for violent acts, though excessive noise and chemical exposure could not be ruled out as contributing factors.

To determine the exact threshold at which an environmental factor may influence an incident of workplace violence would be difficult due to both wide variations in the severity in which workers are impacted and to the infrequency of incidents of workplace violence when compared with the frequency of other health effects. For example, heat-related illness or hearing loss may be detected before there is any act of violence when workers are exposed to heat or noise. The advent of deleterious health effects occurring prior to a violent outburst may true in cases of exposure to chemicals or biological agents as well.

With the overwhelming evidence for behavioral changes caused by exposure to environmental factors, it can be concluded that environmental factors are contributing factors to many and likely causing some of the incidents of workplace violence seen in the construction and environmental remediation industry. This conclusion is supported by what many Health and Safety Professionals are seeing in the field and reporting through interviews. The majority of the Health and Safety Professionals interviewed believed that environmental factors were playing a part in the incidents that had seen. However, in most cases Human Resource Professionals oversee or conduct the investigation into the root causes of these incidents and Health and Safety Professionals are playing a smaller role. In this scenario, it is likely that many investigations are missing environmental factors as causative agents.

This scenario exists because of the mindset that violent incidents in the workplace are predominately the results of aberrant individuals that fit a predetermined profile.

While it is accepted that some individuals are more likely to behave violently, it cannot be assumed that this behavior is not influenced by environmental exposures in the workplace. It also cannot be assumed that individuals who do not fit this profile will not act violently when exposed to uncomfortable and toxic workplaces. What must be accepted is that the workplace conditions are affecting the psychology of the workers and when conditions are bad enough, violence is possible outcome.

Due to infrequency of these events and the lack of direct understanding between exposures and behaviors it is impossible to set a threshold at which a violent act may occur. In fact, other health effects may become more readily apparent first. However, it should considered a possibility that whenever workers are exposed to behavior-altering chemical and physical agents that an incident of workplace violence exists. Warning signs can be present in the form of minor incidents that do not result in violence. Incidents such as name calling and verbal bullying should be treated as near misses and should be investigated with the same level of rigor as more severe incidents. This is true since they are much more common and while not all incidents of verbal abuse escalate to violence, it can be assumed that threats and verbal abuse will likely precede violent outbursts. This is supported by the study of Australian construction workers conducted by Chappell and Dimartino. Investigating these incidents may also be especially valuable since they can reveal root causes before situations escalate to physical violence and injury and allow can work place hazards to be controlled using the methods discussed previously, or in cases where it is deemed necessary for individuals to be counseled or reprimanded.

However, controlling workplace hazards that may be contributing factors and root causes in potentially violent situations will require that they are included in the investigation of all workplace violence incidents. It may prove difficult to pinpoint any one cause of an incident of Type III workplace violence, but environmental factors including chemical exposures, biological agents, and exposure to noise and heat cannot be ruled out. Therefore it is crucial that Health and Safety Professionals trained in recognizing these hazards and evaluating their impact be involved in the investigation of these incidents.

It was also suggested in one interview that developing a formal plan in the form of a security program or procedure for handling workplace violence be developed. This is practice is established in many industries including healthcare and manufacturing and numerous resources exist for their development. (USDA 1998/Kennedy 2010) However, these programs are not common in the construction or environmental remediation industries. This can be assumed this is because of the rarity of the incidents or the transient nature of the projects themselves. However, this does not negate the fact that these incidents continue to occur and often with disrupting if not devastating results. It should be considered good business practice and in accordance with sound safety and health principles to prepare for dealing with incidents of workplace violence. In addition, this preparation should include the probability of workplace conditions as causative factors as well as the personality issues of individuals that may fit established profiles. Since exposure to environmental factors including heat, noise and chemicals are apparently influencing if not in some cases causing incidents of workplace violence, all investigations should include the involvement of trained Health and Safety Professionals

Workplace exposures to all of the environmental factors covered in this study can be controlled by implementing an effective health and safety program. It can be concluded that if exposures to factors that may be affecting worker behavior are controlled, then incidents of workplace violence may decrease. Testing this hypothesis will be difficult since the events are rare and other societal and psychological factors are often involved.

Currently, no regulatory agencies have published standards which cover workplace violence. While government agencies such as NIOSH and the FDA have published guidance, OSHA would be the most likely candidate to cover this in a specific regulation. It is also unlikely that OSHA would investigate a case of workplace violence unless it resulted in a serious injury or fatality or when the employer could be demonstrated to be somehow negligent. Even in those cases, OSHA would likely defer to local law enforcement for investigation and citation of the employers. In the case of a negligent employer, it is also likely that an OSHA compliance officer would be concerned with other aspects of the workplace instead of workplace violence issues.

Currently employers are not required to develop security programs that cover workplace violence. Insurance companies have been offering workplace violence insurance since the early 1990's. It is conceivable that an employer could be able to lower the premiums of these policies by controlling workplace hazards and developing a workplace violence prevention program but there are no legal drivers requiring employers to do so.

Incidents of workplace violence can be devastating, not only for the workers involved but also for rest of the workforce who may be psychologically traumatized by

the event. This study has demonstrated a possible link between exposure to behavior changing hazards and incidents of workplace violence and has indicated the value in developing a preventative program and involving Health and Safety Professionals in investigating incidents. It is always in the employer's best interest to control worker exposures to health and safety hazards for the simple reason that workers should never be exploited or mistreated. Additionally, implementing and effective safety program in the workplace lowers operating costs and prevents compliance issues. Demonstrating that workplace conditions may be causing incidents of workplace violence only further reinforces this viewpoint.

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Appendix 1 – Questionnaire

Title: An Evaluation of Workplace Conditions as a Contributing Factor to Incidents of Workplace Violence in Environmental Remediation and Construction Firms

Principal Investigator: Michael Goldman CIH, CSP, CHMM, CPEA

Interview Questionnaire:

Disclaimer/Permission: - This is study on the potential causes of workplace violence and your experiences investigating the incidences. Do I have your permission to tape this interview?

1. Has your workplace experienced incidents of workplace violence?
2. If no, why do you think your workplace has not experienced incidents of workplace violence?
3. If no, do you think that providing a safe and healthful workplace free from environmental factors/hazards has contributed to your company's experience of so little workplace violence?
4. If yes, can you describe the incidents?
5. Can you describe your process for investigating the root causes?
6. What were there root causes?
7. Do you think environmental factors could have played a part in the root causes?
8. What were the environmental factors that could have been present in this incident?
    a. Excessive heat?
    b. Excessive noise?
    c. Excessive hours?

d. Repetitive tasks?

e. Lack of drinking water?

f. Exposure to irritants/contaminants such as the following?

i. Dusts

ii. Biological hazards such as ticks, flies, fleas, irritating plants

iii. Metals

iv. Odors

9. Were environmental factors investigated during the investigation?

a. If not, why not?

b. If yes, were the environmental factors reported as possible root causes?

c. Were these factors addressed in corrective actions?

10. After corrective actions were in place were there repeated incidents of workplace violence?