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An Examination of Organizational Factors, Employer Perceived Barriers and Indirect Costs of Non-Compliance With the OSHA Bloodborne Pathogens Standard

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AN EXAMINATION OF ORGANIZATIONAL FACTORS, EMPLOYER PERCEIVED BARRIERS AND INDIRECT COSTS OF NON-COMPLIANCE WITH THE OSHA BLOODBORNE PATHOGENS STANDARD

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Title: An Examination of Organizational Factors, Employer Perceived Barriers and Indirect Costs of Non-Compliance with the OSHA Bloodborne Pathogens Standard

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This study examined a series of research questions in an attempt to analyze the perceived barriers, organizational factors, and indirect costs of non-compliance with the OSHA bloodborne pathogens standard. Examination of the public domain data indicated that the most frequently cited violations of the bloodborne pathogens standard has remained the same since the last OSHA publication on the topic in 2011. The study also provided additional detail on the most frequent violations giving the top ten versus top five for the study period of January 2013 to December 2015. The public domain database for the period studied indicates that organizations could expect to see a twenty-eight percent decrease on average from the initial penalty issued to the current penalty received.

The study determined there was no significant difference in the current penalties imposed and the availability of a full-time health and safety professional to comply with the standard. Likewise, there was no evidence of a significant difference in the current penalties imposed based on the presence or absence of a certified health and safety professional or if the organization participated in third party reviews of their bloodborne pathogens program prior to the inspection. The respondents from healthcare and social assistance organizations were not in agreement as to the perceived barriers to compliance as well as respondents from organizations classified as non-healthcare or "other." When examining whether the amount of a penalty was related to the presence or absence of a full-time health and safety professional in an organization,

again no significant differences were found. There was a significant positive correlation between the amount of a penalty received by an organization and the dollar amount of the indirect cost to respond to the citation. These indirect costs were above and beyond what would have been spent to be in compliance with the standard initially.

Recommendations for future research are provided to examine the cost of penalties and indirect costs to see if a model could be developed to predict the costs of compliance. The ability to predict and quantify these additional costs of compliance to a citation could be a useful incentive to encourage initial compliance with the standard by organizations.

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CHAPTER ONE

INTRODUCTION OF THE PROBLEM

The Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens standard describes safeguards to protect workers against the health hazards caused by infectious microorganisms in human blood that can lead to human disease. These pathogens include, but are not limited to, hepatitis B (HBV), hepatitis C (HCV), and human immunodeficiency virus (HIV). The requirements of the standard include development of a written exposure control plan, engineering and work practice controls, the use of personal protective equipment, hepatitis B vaccination, post-exposure follow-up, hazard communication, training, and recordkeeping as found in 29 CFR 1910.1030 (OSHA, 2012).

The standard applies to workers that can reasonably be anticipated to contact blood or other potentially infectious materials (OPIM) in the course of their employment. This standard was published in 1991 and was updated in 2001 to include requirements of the *Needlestick Safety and Prevention Act* (2000). Employer non-compliance with these requirements during enforcement inspections by OSHA are subject to monetary penalties.

Non-compliance with the standard continues to be an issue with employers more than two decades since inception of the requirements as evidenced by the continued frequency of OSHA citation penalties delivered to organizations during recent compliance inspections. The five most frequently cited sections of the Bloodborne Pathogens Standard in order of frequency are: “1) 1910.1030(c)(1)(i)] - Establishment of a written Exposure Control Plan; 2) 1910.1030(c)(1)(iv) - Review and update Exposure Control Plan; 3) 1910.1030(d)(2)(i)]- Use of engineering and work practice controls; 4) 1910.1030(f)(2)(i)] - Availability of HBV vaccination and 5) 1910.1030(g)(2)(i)] - Employee training program” (OSHA, 2016).

Gauging the perceived barriers to bloodborne pathogens compliance has typically been focused on the opinion of the employee in the work place as opposed to those of management. While the use of subject matter experts has long been considered a proven method of providing recommendations and feedback to organizations for the implementation of compliance directives or to improve quality performance in the healthcare industry (Hysong, 2009; Ruelas, 2014), relatively little has focused on bloodborne pathogens compliance. In addition, there appears to be a lack of research on the amount of time and money that an organization spends to address a bloodborne pathogens citation from an OSHA inspection beyond what would actually be required for compliance with the standard in the first place.

The research for this project investigated employer perceptions of the barriers to compliance, the use of subject matter experts, and the indirect cost of compliance. Showing that initial compliance with the regulation results in significant economic savings for an organization may potentially influence the likelihood of employer compliance. The ultimate goal of this research was to identify ways to improve compliance with the bloodborne pathogens standard and thereby prevent worker exposure while decreasing employer liability.

Significance of the Problem

Organizations classified by the North American Industrial Classification System (NAICS) as Code 62 "Health Care and Social Assistance" were issued a total of $1,251,784 in penalties by OSHA for all standards cited during the period of October 2014 through September 2015. Of this total, $521,164 or forty-two (42) percent were attributed to violations of the bloodborne pathogens standard for the same time period (OSHA, 2015). The U.S. Centers for Disease Control and Prevention (CDC) estimated that 5.6 million workers are potentially exposed to bloodborne pathogens annually (OSHA, 2016).

O'Malley (2007) has investigated the cost of managing an occupationally acquired exposure and estimated that the amount may be as high as $4,800 per case. Prüss-Üstün (2005) examined the global burden of disease that can be attributed to sharps injuries in healthcare workers. The results concluded that an estimate of 80,000 cases of hepatitis and 1,000 cases of HIV occurred in the year 2000 due to percutaneous incidents. Trim (2003) estimated a mean rate of 4 percent infection per 10,000 healthcare workers and noted that there is a significant amount of under reporting.

Questions to Be Researched

This study was designed to examine the organizational factors and barriers that are perceived by employers that led to the issuing of an OSHA citation for non-compliance with the federal bloodborne pathogens standard. The study examined recent inspections and subsequent violations of the bloodborne pathogens standard obtained from the U.S. Department of Data Management for OSHA violations and inspections from 2013 to 2015. An empirical review of information obtained in the database was completed and analyzed for historical trends, variations based on industrial settings, and the dollar amount of the penalties.

A survey instrument was developed by the researcher to collect organizational information unavailable from the federal database including a ranking of perceived barriers to compliance in terms of the reason for being issued the citation. The indirect costs associated with responding to the citation in opposition to the direct cost of labor and material for abating the hazards were quantified.

The design of the research study seeks to answer the following questions:

RQ 1: Does the availability of subject matter expert resources result in a significant difference in the amount of fine imposed on an organization?

RQ 2: Are there differences in agreement for the perceived barriers to compliance based on the industrial classification setting of an organization?

RQ 3: Is there a significant relationship between the amount of the fine imposed on an organization and the presence or absence of a full-time health and safety professional?

RQ 4: Are the indirect costs for the organization to respond to a violation related to the cost of the fine imposed?

Hypotheses

A series of hypotheses were developed to answer each of the research questions posed. The researcher proposed that the availability of subject matter expert resources prior to the inspection of the organization would have a positive effect on the outcome of the inspection as measured in the dollar amount of the current penalty. For purposes of the study, this included an examination of the organization's in-house availability of a health and safety professional; the certification level of the health and safety professional or the participation of the organization in an independent third party review prior to the inspection.

The following three hypotheses were developed in relation to RQ 1: "Does the availability of subject matter expert resources result in a significant difference in the amount of fine imposed on an organization?"

Hypothesis 1: Organizations that employ a full-time health and safety professional experience significantly lower fines if inspected than organizations that do not employ a full-time health and safety professional.

Hypothesis 2: Organizations that employee a certified health and safety professional experience significantly lower fines if inspected than organizations that do not employee a certified health and safety professional.

Hypothesis 3: Organizations that participate in a third party review experience significantly lower fines if inspected than organizations that do not participate in a third party review.

The OSHA bloodborne pathogens standard is applicable to any industrial setting that has the potential for exposure to employees based on work activity as opposed to just healthcare organizational settings (OSHA, 1991). This being the case, an assumption by employers that bloodborne pathogens compliance is strictly a healthcare institution problem is inaccurate. The researcher sought to examine if there were differences in perceived barriers to compliance for organizations classified as healthcare or social assistance that commonly deal with exposure settings than those that are not.

The study was designed to answer RQ 2: "Are there differences in agreement for the perceived barriers to compliance based on the industrial classification setting of an organization?" with the following hypothesis.

Hypothesis 4: Barriers to compliance are perceived differently by organizations not included in healthcare and social assistance than those organizations that are included in healthcare and social assistance

During the OSHA inspection process for bloodborne pathogens compliance, an organization may be issued a citation with a dollar amount penalty for the violation or they may be cited the penalty classification of "de minimus" that does not result in a fine. The third research question "Is there a significant relationship between the amount of the fine imposed on an organization and the presence or absence of a full-time health and safety professional?" was examined by the next hypothesis.

Hypothesis 5: There is a significant relationship between the amount of penalties received and the employment of a full-time health and safety professional by an organization

The cost of the inspection to the organization that receives a violation may be broken up into two general categories: direct costs and indirect costs. For purposes of this study, direct costs were defined as the amount of money that would have been spent by the organization prior to the inspection to implement the cited violations to become compliant with the standard. In other words, these costs would have been incurred by the organization had the employer been compliant with the cited violation of the standard. Examples of these direct costs could include purchasing of personal protective equipment, providing vaccinations, the purchase of equipment, or writing plans and procedures that were necessary for compliance.

For purposes of this study, indirect costs are the amount of money expended by the organization in addition to the cost of the penalty to respond to the violation. Examples include investigation of the allegations, posting of the citation, meetings with employees to explain the citations, attorney or other consultant fees to defend the allegations, preparation of formal responses to OSHA including attendance at meetings with OSHA, and possible media response. These costs would not have been incurred had the organization been found compliant during the inspection. The researcher proposed that the indirect costs to respond to the violation are related to the dollar amount of the penalty.

The study is designed to answer RQ 4: “Are the indirect costs for the organization to respond to a violation related to the cost of the fine imposed?” with the following hypotheses.

Hypothesis 6: The indirect cost to respond to a citation is significantly greater than the dollar amount of the fine imposed

Hypothesis 7: The indirect cost to respond to a citation is proportionate to the dollar amount of the fine imposed

Definition of Terms

These are the definition of terms that were used in the context of this research effort:

OSHA – Occupational Safety and Health Administration. A government agency in the Department of Labor to maintain a safe and healthy work environment

Abatement - the correction of the safety or health hazard/violation that led to an OSHA citation.

Direct Cost – the amount of money that would have been spent by the organization prior to the inspection to implement the cited violations to become compliant with the standard.

Indirect Cost - the amount of money expended by the organization in addition to the cost of the penalty to respond to the violation.

North American Industrial Classification System (NAICS*)* - the standard used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.

Penalty - the amount currently assessed for the inspection.

Citation - a unique identifier for the violation.

Violation – any non-compliance with the OSHA Bloodborne Pathogens standard or state program equivalent that was issued as part of a compliance inspection

Bloodborne Pathogen - pathogenic microorganisms that are transmitted via human blood and cause disease in humans.

Assumptions

There were three major assumptions of this research effort that need to be addressed. The first is that the survey respondents were knowledgeable and had the technical ability to answer

the survey instrument questions for their organization as a whole, or enlisted the assistance of someone that could provide the most accurate answer. The second assumption was that the organization answered the questions truthfully without consideration for any internal political motivation to skew the response. The third assumption was that the results of this research effort can be applied across the wide range of organizations that are required to meet the compliance requirements of the federal OSHA bloodborne pathogens standard.

Limitations

A significant limitation of this study was the selection of a three-year sampling period from 2013 to 2015 even though the federal regulations for bloodborne pathogens compliance have been in effect from 1991 to the present. Additional potential limitations were dependent on the number of survey responses returned and included small sample sizes for analysis, under representation of certain NAICS codes and the inherent design of the study that used bundling of NAICS codes as "other" for non-healthcare entities. The design of the study and the quantitative statistical methods chosen only determined the proposal of significant or non-significant correlation versus causation.

Delimitations

There were two delimitations to this study that should be noted. The study sample purposefully was chosen by design to include the total population of organizations that were found by the governing federal or state regulatory agency to be in non-compliance with the bloodborne pathogens standard throughout the U.S. The intent was to insure that respondents had actually been non-compliant. The other delimitation was the study design framework for the investigation of bloodborne pathogens standard issues relating to non-traditional healthcare settings that has not been the typical area of focus for research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

History of Bloodborne Pathogens

The concern of a worker being exposed to another human being's blood or body fluids, in or out of a healthcare setting, and contracting an illness, is a relatively recent occurrence in the field of occupational health and safety. In the healthcare work environment, the focus of infection control had primarily been on the prevention of patients contracting disease while they were being treated. No U.S. regulatory standards or worker protections guidelines were in place prior to the 1980s for exposure to bloodborne pathological microorganisms.

The situation began to change with the U.S. Centers for Disease Control and Prevention publication in the June 5, 1981, Morbidity and Mortality Weekly Report of a rare infection in five previously healthy men in Los Angeles involving a compromised immune system (MMWR, 1981). This publication in the scientific literature would mark the beginning of the public health concern known as Human Immunodeficiency Virus (HIV), leading to a wider interest in the protection of healthcare workers from viruses found in human blood and body fluids (MMWR, 1981).

Bloodborne Pathogens of Concerns

Human Immunodeficiency Virus (HIV)

The human immunodeficiency virus (HIV) is a retrovirus and is the causative agent of the disease known as Acquired Immunodeficiency Syndrome (AIDS). The virus is primarily spread from contact with infected blood but, can also be transmitted through other body fluids such as semen and vaginal secretions. It is estimated by the CDC that 50,000 people per year are infected by the virus. Survival of the HIV virus outside of the body is dependent on a host of factors such

as ambient temperature, humidity, sunlight, and initial viral titer level in the host. It is generally accepted that the virus will die within a few hours outside of the human body. The risk of contracting HIV from an occupational setting is considered to be relatively low with the process of most concern being contaminated needle stick injuries (CDC, 2016a).

Current research suggests that the probability of developing HIV infection following a needle stick event is 0.23 percent or 2.3 out of every 1,000 incidents (CDC, 2016b). There are no vaccinations available for the prevention of the illness and medical treatment focuses on slowing down progression versus curing of the disease. For these reasons, prevention is the chosen method of controlling the spread of the virus.

Hepatitis B Virus (HBV)

Hepatitis is the medical term for inflammation of the liver and can be caused by a number of medical conditions including infection from several types of viruses. Symptoms of the disease include fatigue, fever, diarrhea, joint and muscle aches, nausea, vomiting, abdominal pain, and a yellowing of the skin called jaundice (CDC, 2016c). The hepatitis B virus was discovered in 1965, and tests for identifying the virus in humans became available in 1971 where the focus of use was protecting blood bank products. HBV infected individuals may develop cirrhosis of the liver or cancer of the liver leading to death as described by Lee (1997).

The CDC currently estimates that there are between 700,000 and 1.4 million people living in the U.S. that have a chronic HBV infection. Since 1981 there has been a Federal Drug Administration (FDA) approved vaccination for prevention of contracting the HBV virus that was manufactured using the pooled blood of infected individuals. In 1986, a newer version of the vaccine was developed using recombinant DNA that did not require the use of blood from infected individuals. This vaccine has been in use as part of a national strategy to eliminate HBV

in the U.S. population since 1991. The results have been an 82 percent decline in the incidence of HBV over the last 20 years among children who have been vaccinated. The vaccine is also considered the first anti-cancer vaccination since the prevention of HBV prevents the development of cancer of the liver from the disease (CDC, 2016d,e).

Worker risk of contracting the disease is directly related to contact with blood and other potentially infectious material (OPIM) with the highest potential coming from a needle stick incident. The estimate for contracting HBV from a contaminated needle is 6 to 30 percent. HBV is known to live outside of the body on surfaces for up to 7 days with the potential to still cause infection (CDC, 2016f).

Hepatitis C Virus (HCV)

The hepatitis C virus causes inflammation of the liver with the majority of infected persons not knowing that they are ill or carry the virus. It is the most common chronic bloodborne infection in the U.S., and the CDC estimates that there are currently 2.7 million persons who have a chronic hepatitis C infection. Modes of transmission include contact with blood while sexual transmission is less frequent. Survival of the virus outside of the body can last for up to three weeks (CDC, 2016g).

Current research indicates that the risk of acquiring HCV infection following a needle stick incident is approximately 1.8 percent. There are medical treatments for HCV infection though there is currently no vaccine available as with HBV (CDC, 2016h).

Hepatitis D Virus (HDV)

Inflammation of the liver by the hepatitis D virus is not common in the U.S. but can also be transmitted to other humans by contact with blood. Disease from the HDV can only occur if

the individual is infected with HBV. Therefore, prevention is targeted towards the use of the hepatitis B vaccination (CDC, 2016).

Other Bloodborne Pathogens

There are other viral or bacterial pathogens that can be circulated in the blood and have the capability of being transmitted to workers. Frequently cited examples include syphilis, malaria, babesiosis, brucellosis, leptospirosis, Colorado tick fever, Creutzfeldt-Jakob disease, and viral hemorrhagic fevers (OSHA, 1999). In the U.S., most of these diseases are uncommon with the exception of syphilis and malaria; although the recent concern for Ebola, a viral hemorrhagic fever, since the outbreak in West Africa in 2014, has resulted in an emerging public health concern (Smith, 2015). The recent developments of the Zika virus public health initiatives in the U.S. also demonstrate the fluidity and evolving nature of bloodborne pathogen issues (Al-Qahtani, 2016).

U.S. Guidelines for Worker Protection

The first federal guidelines to protect worker exposure to bloodborne pathogens was issued by the CDC in 1983 as part of a publication entitled "Guidelines for Isolation Precautions in Hospitals." This document contains a section dealing with "Blood and Body Fluid Precautions" when a patient was known or suspected to be infected with a bloodborne pathogen (CDC, 1983). The next recommendations were from the CDC in 1987 in a publication entitled "Recommendations for Prevention of HIV Transmission in Health-Care Settings" (CDC, 1987).

The difference between the 1983 recommendations and those published in 1987 were the introduction of the concept of "Universal Precautions." All patients were now to be considered potentially infectious for HIV, HBV, and any other potential unknown bloodborne pathogen with regard to all blood and body fluids. In addition to the implementation of "Universal Precautions,"

the CDC also recommended the vaccination of healthcare workers with the Hepatitis B vaccine should they have the potential for exposure to blood. The publication “Recommendations for prevention of HIV transmission in health-care settings,” (CDC, 1987) also provided recommendations for the use of gloves as a method of barrier protection and emphasized that all of these recommendations were not to replace routine infection control practices already in place such as frequent hand washing.

In the occupational setting, Universal Precautions apply to blood and body fluids that are visibly contaminated with blood. They also apply to human tissue, cerebrospinal fluid (CSF), synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid as there have been studies showing the isolation of HIV or HBV in them and therefore present a potential risk to healthcare workers. Based on CDC research efforts, Universal Precautions do not apply to saliva, feces, nasal secretions, sputum, sweat, tears, urine, and vomitus unless there is visible blood since the occupational risk of transmission of HIV and HBV from these fluids and materials is considered extremely low (OSHA, 2016).

The National Institute for Occupational Safety and Health (NIOSH), a division of the CDC focusing on worker health and safety, has been instrumental in researching ongoing issues related to worker protection from bloodborne pathogens. Over the years, examples have included the 1999 publication "NIOSH Alert: Preventing Needlestick Injuries in Health Care Settings;" (NIOSH, 1999) that influenced the promulgation of the Needlestick Safety and Prevention Act by congress in 2000. With the advent of the internet regularly published research in “Science Blogs” are available on the NIOSH web page (NIOSH, 2013).

OSHA Regulations for Worker Protection

In March 1992, the Occupational Safety and Health Administration (OSHA) began enforcement of a new regulatory standard, 29 CFR 1910.1030 "Bloodborne Pathogens," to protect U.S. employees from occupational exposure to HBV, HIV, and OPIM. The regulation required a combination of methods to minimize or eliminate the probability of a worker becoming infected when working in a setting that had the potential for exposure. In addition to the use of personal protective equipment (PPE), the use of engineering controls, exposure control planning, training, worker vaccination for HBV, medical surveillance, signs, and labeling were also required (OSHA, 1991).

Job descriptions specifically cited that the regulation was to cover included hospital and long-term care medical professionals, dental workers, funeral home workers, law enforcement, and emergency workers including fire and rescue services. Opposition to the new regulations resulted in a legal challenge by the American Dental Association questioning the feasibility of the law. The standard was upheld by the court concluding that OSHA had provided enough evidence to show occupational exposure to blood was a significant risk and the compliance measures were relevant and feasible (DiMaggio, 1994).

Congress passed the Needlestick Safety and Prevention Act (2000) that mandated OSHA to revise the bloodborne pathogens standard with language specific to reducing needlestick injuries. OSHA revised the standard in 2001 to update the regulation requiring that employers must maintain a sharps injury log, implement the use of safe needle devices, and involve employees in the selection of the devices. The original provisions of the 1991 standard remained in effect (OSHA, 2001). Ongoing review of the standard continues to take place as part of the requirements of the federal Regulatory Flexibility Act. This act requires OSHA to determine the

continued need for the standard, if there is conflict with other Federal, State or local regulations, the impact on small business, and if technology or economic conditions have changed since the rule was promulgated (Stewart, 1981).

For example, the economic impact of the ongoing requirement for employer provision of the hepatitis B vaccination at no cost to the employee may be questioned. The U.S. Department of Health and Human Services (HHS) establishment of routine infant vaccination in 1991 should decrease the need for offering the vaccine as employees born after 1991 enter the workforce. The initial request for public comment on the review was published in the Federal Register during May of 2010 and as of December 2015, the findings have not yet been issued by the agency (Federal Register, 2015; Ruelas, 2014).

Pre-Hospital and Other Work Environments

This study examined work environments other than traditional healthcare settings. The provisions of the OSHA Bloodborne Pathogens standard are applicable to all employers and employees having the potential for exposure. In addition to hospital and traditional medical clinical settings, these can include a wide variety of other professions and work place settings. Knowledge and compliance information for the provisions of the standard in the hospital and medical clinics have been well documented. Other professions with bloodborne pathogens risk and their efforts for compliance are not well understood and have been the subject of current research efforts. The perception of risk or understanding of the problem for these non-traditional healthcare settings may be a factor in compliance.

Research efforts for settings not involving inpatients such as hospitals or nursing homes have been less prevalent. Gershon (2005, 2007) has studied these issues for correctional healthcare workers and non-hospital based registered nurses. Lehman (2010, 2012) has examined

bloodborne pathogens compliance in correctional facilities and risk reduction to workers in the body piercing and tattoo industries.

Occupational exposure to emergency services personnel such as fire and rescue services has also been investigated (Harris & Nicolai, 2010). These services may be provided on a continuing routine basis in the local community or in response to a large-scale natural or technological catastrophe either locally or nationally. In such instances Morgan (2007) looked at the risk of infection to these responders from human remains.

The overall consensus of these research efforts indicated deficiencies in OSHA bloodborne pathogens compliance for these various occupational setting that do not fall into the NAICS Code 62 "Health Care and Social Assistance."

Utilization of Subject Matter Experts

A portion of this research effort examines the use of subject matter experts. The use of subject matter experts has long been considered a proven method of providing recommendations and feedback to organizations for the implementation of compliance directives or to improve quality performance in the healthcare industry (Hysong, 2009; Ruelas, 2014). These individuals may be employed directly within the organization or hired as a third party on an as-needed basis. They may work individually or as members of an audit team. Early intervention and autonomy are often cited as key attributes in this process to have any lasting impact on ensuring compliance (Autonomy key to audit team effectiveness, 2005). One measure of assessing the competency of the subject matter expert is the designation of being a "certified professional."

Examples of certifications that are applicable to this research study include individuals that hold the designation of Certified Safety Professional (CSP), Certified Healthcare Safety Professional (CHSP), Certified Industrial Hygienist (CIH), and Certified Occupational Health

Nurse (COHN). The process of this credentialing effort usually involves a combination of a minimum number of years of work experience and written examination. The value of being certified is typically viewed as credibility, a more in depth knowledge base, and overall expertise in the specific subject matter (IBCSM, 2010; Lukes, 2003).

The value of the use of internal or third-party audit approaches to ensuring compliance is a complex subject with the primary objective being the communication to management of the strengths and weaknesses of the organization relative to the exact regulatory requirement being reviewed (Ruelas, 2014).

Perceived Barriers to Regulatory Compliance

This study investigated employers' perceived barriers to compliance. Gauging the perceived barriers to regulatory compliance by an organization has typically been focused on the opinion of the employee in the work place. Various studies have examined this topic as it directly relates to employee compliance with the OSHA bloodborne pathogens standard (Cheung, 2015; Kermode, 2005; Powers, 2016), safety compliance in general (Hayes, 1998), or a function of safety culture or climate within the organization (Hessels, 2015; O'Toole, 2002). Other studies have examined the organizational barriers to compliance as a role of the type of inspection performed such as an autonomy-supportive versus coercive approach to achieve regulatory compliance (Burstyn, 2010).

As might be expected, the cost of implementation is frequently cited as a barrier to regulatory compliance by organizations (Arrow, 1996; Loosemore, 2007; Sofie, 2000). There are relatively few studies that focus solely on the perceptions of management with regard to the organizations perceived barriers to regulatory compliance (Janicak, 1997; Riley, 2015).

Indirect Cost of OSHA Citations

The calculation of the hidden or indirect costs to an organization, those not typically measured by a business's accounting processes as a result of workplace accidents, has long been an area of interest for safety and health professionals. These costs are considered difficult to evaluate and quantify (Jallon, Imbeau, & de Marcellis-Warin, 2011b). Loss in production time, increases in workers compensation premiums, managing claims or workplace meetings are various examples (Jallon, Imbeau, & de Marcellis-Warin, 2011a). Factors that influence the severity or leniency of OSHA penalties during workplace safety enforcement activity have also been described as complicated ranging from geographical area, size of the organization, state or federal enforcement of the regulation, economic conditions and political affiliation of the President or local congressional leader at the time of the inspection (Mendeloff & Gray, 2005). Discounts for the size of the organization are built into the penalty structure process (Gallagher, 2015; Keller, 2013).

There appears to be a lack of research on the amount of time and money that an organization spends to address the citation from an OSHA inspection beyond what would actually be required for compliance with the standard in the first place. These additional or indirect costs are resources that are expended by the organization in addition to the cost of compliance and the dollar amount cost of penalty. Showing that initial compliance with the regulation results in significant economic savings for an organization may potentially influence the likelihood of employer compliance.

Summary and Justification of the Study

This review of the literature has determined that even though regulations governing the protection of workers from the exposure to bloodborne pathogens have been in existence for

twenty-five years (OSHA, 1991), employees are still found to be at significant risk. By not protecting these workers, employers are also at jeopardy for loss of revenue in addition to the human cost of non-compliance.

This review has shown that the majority of research and documents pertaining to bloodborne pathogens has focused on the modes and methods of transmission of disease (Alter, 1999; Cardo 1997; CDC, 2016; Grindle, 2014; Lanphear, 1994; Moloughney, 2001; Tarantola, 2006) in traditional inpatient healthcare settings such as hospitals (Dembski, 2011; Denis, 2003; Huang, 2002), nursing homes (Lofgren, 2008), and more recently homecare (Chalupka, 2008). In relation to this, relatively little research has been performed on non-healthcare exposure settings such as law enforcement, emergency rescue services, funeral homes, dentist offices, correctional facilities and the hospitality industry (Davidson, 2006; Gershon, 2005, 2007; Harris, 2010; Lehman, 2010, 2012). This study was designed to examine these other industries as a part of the research questions that were posed.

Furthermore, the review has shown that the focus of most research has been on direct employee and employer non-compliance issues with the standard (Cheung, 2015; Denis, 2003; Lymer, 2003) and employee perceptions (Lymer, 2004; Powers, 2016). This research effort investigated employer perceptions of the barriers to compliance; the use of subject matter experts and the indirect cost of compliance. Again, this study begins to fill the gap in the scientific body of knowledge for these areas.

CHAPTER THREE

METHODOLOGY

Data Required

Setting of the Study

The purpose of this study was to compare OSHA's enforcement of the bloodborne pathogens standards, 29 CFR 1910.1030, in healthcare organizations to non-healthcare organizations while also examining the influence of available resources prior to the citation; perceived barriers to compliance by the organization; and the indirect costs to the organization in response to receiving a citation and penalty. Organizations that received an inspection resulting in a citation for violation of any section of OSHA's Bloodborne Pathogens standard during the period of January 1, 2013 and December 31, 2015, were selected as participants for this study. The source of participants was the public domain U.S. Department of Labor Enforcement Data Catalog. This data catalog contains the OSHA Enforcement Data for all OSHA inspections that are conducted by the agency. Two files that provide information on the inspections and violations were chosen for the study.

The inspection file consists of detailed case information from OSHA inspections including the reason for the inspection, the scope of the inspection, and details of the organization inspected including business name and address. The violations file includes details on citations issued and the penalty assessments that resulted from violations of the OSHA standards. The specifics on demographics and organization location that is available in the inspection database can be combined with the violation database information using the common activity number of both files. The files were merged to obtain the particular information needed to conduct this study. The study was approved by the IUP Institutional Review Board (IRB).

Study Sample

A three-year period from January 1, 2013, through December 31, 2015, was chosen for this study. Organizations that were inspected by OSHA that resulted in violations of the Bloodborne Pathogens standard 29 CFR 1910.1030 were included. It was anticipated that the majority of the organizations receiving inspections would be classified by the North American Industrial Classification System (NAICS) as Code 62 "Health Care and Social Assistance" based on the Federal OSHA citation activity for the period of October 2014 to September 2015 (OSHA, 2015). Organizations from all other NAICS codes that received a citation were recoded as "Other" by the researcher.

The study sample included all organizations that were cited for noncompliance with either the federal OSHA 1910.1030 standards for bloodborne pathogens or an equivalent citation from an OSHA-Approved state plan for bloodborne pathogen during the study period. A power analysis using G-Power version 3.1.7 was conducted to guide future research efforts and recommended sample size for individual statistical methods. In addition to the use of the federal 1910.1030 OSHA bloodborne pathogens standard, violations are cited as Section 5193 for California; Part 554 for Michigan and 296-823 for the state of Washington. An initial review of the database showed the OSHA BBP standard was cited (1910.1030) for 11,704 violations during the period of 2010-2014 in 4,092 inspections. Of these 1,003 inspections were in NAICS 62.

Data Collection

Method of Obtaining Data

Public domain data from the U.S. Department of Labor OSHA Enforcement Database for inspections and violations was obtained through the OSHA webpage available at

http://ogesdw.dol.gov/views/data_summary.phpe . The variables that were used for analysis in the OSHA inspection database are presented in Table 1 and the violation database variables are presented in Table 2.

Table 1

U.S. Department of Labor OSHA Enforcement Database Inspections Variables

Display Name	Description	Variable Name	Data Type
Activity NR	Unique identifier for the inspection	activity_nr	Numeric
Address	Street address of site inspected	site_address	Alphanumeric
City	City of site inspected	site_city	Alphanumeric
Mailing Address City	Mailing address city	mail_city	Alphanumeric
Mailing Address State	Mailing address state postal abbreviation	mail_state	Alphanumeric
Mailing Address Zip Code	Mailing address postal zip code	mail_zip	Numeric
Mailing Street Address	Mailing address street	mail_street	Alphanumeric
NAICS	The unique code number that is assigned to the NAICS.	naics_code	Numeric
Name	Establishment being inspected	estab_name	Alphanumeric
Number in Establishment	Number of employees in establishment	nr_in_estab	Numeric
Open Date	Indicates when the inspection was started.	open_date	Numeric

Table 2

U.S. Department of Labor OSHA Enforcement Database Violations Variables

Display Name	Description	Variable Name	Data Type
Activity NR	Identifies the parent inspection	activity_nr	Numeric
Citation Id	Identifies the citation number. item number and item group of the issued citation.	citation_id	Alphanumeric
Current Penalty	Penalty amount	current_penalty	Alphanumeric
Standard	The OSHA standard violated	Standard	Alphanumeric

Additional variables for analysis were obtained using a survey instrument developed by the researcher. The variables from the survey included the availability and certification level of a health and safety professional, participation in a third-party review of the program and indirect costs to respond to the citation. Indirect costs, as estimated by the organization, were defined as the estimated total dollar amount spent by the organization investigating the allegations, posting of the citation, OSHA meetings, meetings with employees to explain the allegations, attorney or other consultant fees to defend the allegations and costs related to any media response. These costs did not include the cost of abatement to correct the violation.

Information pertaining to perceived barriers to compliance were also obtained in the survey. Respondents were asked to rank a set of perceived barriers to compliance. Organizational factors included the presence or absence of subject matter expert resources to understand the requirements or validate implementation. Subject matter expert resources were defined as the presence of a full-time health and safety professionals that may hold a professional certification

or the review of the bloodborne pathogens program by an independent agency. Other factors included the presence or absence of dedicated staff to implement the requirements, presence or absence of funding to implement the requirements, presence or absence of employee input to comply with the standard, presence or absence of management leadership to comply with the standard, and presence or absence of a perceived risk by the organization to comply with the standard.

Survey Instrument and Cover Letter

A paper cover letter and survey instrument were mailed to all organizations that received a violation of the bloodborne pathogens standard during the period of January 1, 2013, and December 31, 2015. A power analysis was performed to determine an adequate number of respondents for future research. The survey was addressed to the Human Resources Director with the organization's address on pre-printed labels. A stamped envelope addressed to the researcher were included with the survey in an effort to increase the probability of the survey being returned by the recipient. An option to respond using an internet link to the survey was also provided. The cover letter and the survey questions for the instrument are presented in Appendix A and B respectively.

Power Analysis

A power analysis was performed to identify the appropriate sample size of the study and provide guidance for future research. The power analyses was performed using G-Power version 3.1.7.

Data Analysis

All data from the study was analyzed using the IBM SPSS Version 24 software package. The variables from the violations dataset were examined using descriptive statistics including

mean, standard deviation, percentage, minimum and maximum penalty, types of citation received by NAICS classification, and annual historical trends for the dollar amount of the violation. The specific method of statistical analysis for each individual hypothesis to be tested are described as follows in an attempt to answer the previously described research questions. Again, the IBM SPSS Version 24 software package was utilized for each analysis.

Descriptive Statistics

Descriptive statistics were used to summarize the data in the enforcement data sets for the analysis of trends. These will include the mean, minimum, maximum, and standard deviation for each of the inspection, violation and survey instrument variables. Boxplots for outliers and tests for normality using Q-Q plots and Shapiro-Wilk tests were included.

Inferential Statistics

Inferential statistics were used to answer the research questions posed in this study. For all tests, and Alpha level of .05 was used to determine significance.

Univariate Analysis of Variance

A three-way analysis of variance (ANOVA) was initially proposed to determine if there is an interaction effect between three independent variables (presence or absence of a full-time health and safety professional, presence or absence of a certified health and safety professional, participation or non-participation in a third party review) on a continuous dependent variable (current penalty).

Assumptions for a three-way ANOVA include:

1. The dependent variable are measured on a continuous scale (i.e., it is measured at the interval or ratio level).
2. The independent variable consists of two or more categorical, independent groups.

3. There is independence of observations meaning that there is no relationship between the observations in each group or between the groups themselves.
4. There should be no significant outliers in the differences between the two related groups.
5. The dependent variable should be approximately normally distributed for each category of the independent variable.
6. There is homogeneity of variances.

Assumptions 1, 2 and 3 were met by design of the study. Assumption 4, no significant outliers, was determined using a histogram and box-plot as generated by SPSS. Outliers were found and were removed from the analysis. Assumption 5, normal distribution, was determined using a Shapiro-Wilks test and normal Q-Q plots as generated by SPSS for the residuals. Assumption 6, homogeneity of variances, was determined using Levene's test. Assumption 4, 5, and 6 were not met for the ANOVA analysis and the analysis continued using a Mann-Whitney U test. An additional assumption was required to perform this analysis, that being the non-normal distribution shapes are similar, and was determined using the SPSS statistics function.

The individual Mann-Whitney U tests for the three sets of variables were as follows:

Null Hypothesis 1 a: There is no significant difference in the mean ranks for current penalties for those organizations that employ a full-time health and safety professional versus those that do not.

Alternative Hypothesis 1a: There is a significant difference in the mean ranks for current penalties for those organizations that employ a full-time health and safety professional versus those that do not.

Null Hypothesis 1b: There is no significant difference in the mean ranks of current penalties for those organizations that employ a certified health and safety professional versus those that do not.

Alternative Hypothesis 1b: There is a significant difference in the mean ranks of current penalties for those organizations that employ a certified health and safety professional versus those that do not.

Null Hypothesis 1c: There is no significant difference in the mean rank of current penalties for those organizations that participate in a third party review versus those that do not.

Alternative Hypothesis 1c: There is a significant difference in the mean rank of current penalties for those organizations that participate in a third party review versus those that do not.

Kendall's Coefficient of Concordance

Kendall's Coefficient of Concordance (W) is a non-parametric statistic used to measure the amount agreement among raters for a particular subject. The value of 0 means a lack of concordance and is interpreted as no agreement in the rater's assessment, whereas a value of 1 means a strong concordance or complete agreement. Assumption for the use of W includes measurement of the rater data on an ordinal or interval scale although no assumption is made on the probability of the distribution.

Kendall's Coefficient of Concordance W was calculated for organizations' ranking of the perceived barriers for those organizations in NAICS 62 "Healthcare and Social Assistance" and all other NAICS classifications that were grouped as "Other". The significance of the coefficient of concordance was tested using a chi-squared test of significance to evaluate agreement among

organizations in their ranking for each group. A p value of .05 was used to determine significance. Descriptive statistics on the rankings were provided to identify differences in the mean rankings for the perceived factors leading to non-compliance for the NAICS 62 organizations and those grouped as "Other".

To answer RQ2 using Kendall's Coefficient of Concordance W the following null and alternative hypotheses were as follows:

Healthcare Organizations

Null Hypothesis 2: Respondents from healthcare organizations are not in agreement with regards to the perceived barriers to compliance.

Alternative Hypothesis 2: Respondents from healthcare organizations are in agreement with regards to the perceived barriers to compliance**.**

Non-Healthcare Organizations

Null Hypothesis 3: Respondents from non-healthcare organizations are not in agreement with regards to the perceived barriers to compliance.

Alternative Hypothesis 3: Respondents from non-healthcare organizations are in agreement with regards to the perceived barriers to compliance.

Point-Biserial Correlation

The Point-Biserial correlation is a measure of strength of association between a continuous level variable and a binary variable of nominal scale with only two values. The strength of association ranges from a perfect negative association indicated by -1; no indication of association indicated by the value 0; to a perfect positive association measured as +1. For this study the continuous variable of interest was the current penalty amount in dollars and the binary nominal value of the presence or absence of a full-time health and safety professional.

Assumptions for this analysis include normality of the continuous variable and homoscedasticity. A t-test was proposed to determine if the point-biserial correlation coefficient is significant using an alpha level of .05. However, because the assumption of normality of the dependent variable was violated, a Spearman rank-order correlation was used instead to test the following hypotheses:

> Null Hypothesis 4: There is no significant relationship between the amount of penalties received and the employment of a full-time health and safety professional by an organization
>
> Alternative Hypothesis 4: There is a significant relationship between the amount of penalties received and the employment of a full-time health and safety professional by an organization

Pearson Correlation

The Pearson correlation measures the degree of relationship between linear related variables. The strength of association ranges from a perfect negative association indicated by -1; no indication of association indicated by the value 0; to a perfect positive association measured as +1. A Pearson correlation coefficient was proposed to determine if there is a significant relationship between the indirect costs to an organization (ratio) and dollar amount of penalty (ratio). Assumptions for this analysis include the normal distribution of both variables, linearity and homoscedasticity. A t-test was proposed to determine if the Pearson correlation coefficient is significant using an alpha level of .05. However, because the assumptions of the test were not met, the Spearman Rho statistic was used to test the following null and alternative hypotheses:

> Null Hypothesis 5: There is no significant correlation between indirect costs to respond to a citation and the amount of the current penalty imposed

Alternative Hypothesis 5: There is a significant correlation between indirect costs to respond to a citation and the amount of the current penalty imposed

CHAPTER FOUR

DATA AND ANALYSIS

Participants

The survey participants of this study included a variety of organizations from numerous industries cited for violations of the OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030 as identified using OSHA inspection data. The types of industries by the NAICS codes were: 32, 33 Manufacturing; 42 Wholesale; 45 Retail Trade; 56 Administrative and Support and Waste Management and Remedial Services; 61 Educational Services; 62 Healthcare and Social Assistance; 71 Arts, Entertainment and Recreation; 72 Accommodation and Food Services; 81 Other Services (except Public Administration); and 92 Public Administration.

Surveys were received from seventeen (17) different states and the Commonwealth of Puerto Rico. The size of the organizations, as measured by the number of employees for each site, ranged from a minimum of 4 to a maximum of 3,500 as obtained from the OSHA inspection enforcement database. The mean number of employees was 206.

The self-described job titles of the individuals completing the survey included Human Resources Director, Human Resources Manager, Business Owner, Safety and Training Officer, Employee Health Service Case Manager, Quality Manager, Operations Manager, Director of Employee Health, Dentist, Safety Program Specialist, President, Manager, Office Manager, and General Manager.

Response Rate

The number of surveys mailed in this research study was 1,023. Of this total, 63 were returned as undeliverable resulting in 960 possible sites. The total number of respondents to the

survey was 39 to the online survey and 21 using the paper survey for total of 60 responses and a response rate of 6.25 percent.

Descriptive Statistics

The most frequently cited OSHA bloodborne violation for the period of January 1, 2013 and December 31, 2015 was 1910.1030 (c) (1) Exposure Control Plan (OSHA, 2016) for which 3,954 violations were issued. A summary of the leading 1910.130 standards cited is presented in Table 3.

Table 3

Ten Most Frequent Bloodborne Pathogens Violations – January 1, 2013 to December 31, 2015

Standard	Frequency	Percent
Written Exposure Control Plan - 1910.1030 (c)(1) i	768	19.4
Initial Employee Training - 1910.1030 (g)(2) I	274	6.9
Annual Exposure Plan Review - 1910.1030 (c)(1) iv	224	5.6
Hepatitis B Vaccination after training - 1910.1030 (f)(2) I	216	5.4
Engineering and Work Practice Controls - 1910.1030(d)(2) i	177	4.4
Provide Hepatitis B Vaccination - 1910.1030(f)(1) I	171	4.3
Contaminated Sharps Disposal - 1910.1030(d)(4)(iii)(a)	89	2.2
Schedule and Method of Implementation - 1910.1030(c)(1) (ii)(b)	79	2.0
Annual Employee Training - 1910.1030 (g) (2) (ii) (b)	66	1.6
Annual Documentation of Safety Devices -1910.1030(c)(1)(iv)(b)	48	1.2
Other Violations (each less than 1 percent of total)	1842	49
Total	3,954	100.0

The range of current penalties for all violations during this period was a minimum of $0 to a maximum of $70,000 for individual citations. The mean current penalty was $1,867 with a standard deviation of $2,970. The mean initial penalty was $2,579 resulting in an mean reduction in penalty of approximately 28 percent. The standard resulting in the largest current penalty was Engineering and Work Practice Controls (1910.1030 (d) (2) (i)) and Laundry (1910.1030 (d) (4) (iv)). The range of current penalties for survey respondents was a minimum of $70 to a maximum of $29,700 for individual citations with a mean of $3,277. Survey respondents

reported that the indirect costs of responding to the inspection ranged from a minimum of $0 to a maximum of $178,729 with a mean of $10,810.

Inferential Statistics

Inferential statistics were used to answer the research questions posed in this study. An alpha level of .05 was used to determine significance for all tests.

Univariate Analysis of Variance

To answer RQ 1 "Does the availability of subject matter expert resources result in a significant difference in the amount of fine imposed on an organization?" a three-way analysis of variance (ANOVA) was proposed and attempted to determine if there was an interaction effect between three independent variables (presence or absence of a full-time safety professional, presence or absence of a certified health and safety professional, participation or non-participation in a third party review) on a continuous dependent variable (current penalty). However, because the data did not meet the assumption of normality for the ANOVA procedure, individual Mann-Whitney U tests were performed.

The individual Mann-Whitney U results for the three sets of variables were as follows:

> Null Hypothesis: There is no significant difference in the mean ranks for current penalties for those organizations that employ a full-time health and safety professional versus those that do not.
>
> Alternative Hypothesis: There is a significant difference in the mean ranks for current penalties for those organizations that employ a full-time health and safety professional versus those that do not.

The results indicated that the results were not significant ($p > 0.05$) as depicted in Table 4. The researcher concluded there was no significant difference in the mean rankings for the current penalties imposed based upon the presence or absence of a full-time health and safety professional.

Table 4

Mann-Whitney U Results for Rankings of Current Penalties by Full/Part-time Health and Safety Professional

Fulltime Safety	N	Mean Rank	Sum of Ranks
Yes	17	21.06	358.00
No	24	20.96	503.00
Total	41		

Mann – Whitney U = 203.00, p = .979

Null Hypothesis: There is no significant difference in the mean ranks of current penalties for those organizations that employ a certified health and safety professional versus those that do not.

Alternative Hypothesis: There is a significant difference in the mean ranks of current penalties for those organizations that employ a certified health and safety professional versus those that do not.

The findings indicated that the results were not significant ($p > 0.05$) as depicted in Table 5.

Table 5

Mann-Whitney U Results for Rankings of Current Penalty by Professional Certification

Professional Certification	N	Mean Rank	Sum of Ranks
Yes	7	27.57	193.00
No	34	19.65	668.00
Total	41		

Mann-Whitney U = 73.00, p = .111

The researcher concluded there was no significant difference in the mean rankings for the current penalties imposed based upon the presence or absence of a certified safety professional.

> Null Hypothesis: There is no significant difference in the mean rank of current penalties for those organizations that participate in a third party review versus those that do not.
>
> Alternative Hypothesis: There is a significant difference in the mean rank of current penalties for those organizations that participate in a third party review versus those that do not.

The indicated that the results were not significant ($p<0.05$) as depicted in Table 6. The researcher concluded there was not a significant difference in the mean rankings for the current penalties imposed based upon the use of third party reviews.

Table 6

Mann-Whitney U Results for Third Party Review versus No Review and Current Penalty

Third Party Review	N	Mean Rank	Sum of Ranks
Yes	10	23.30	233.00
No	31	20.26	628.00
Total	41		

Mann-Whitney U = 132.00, N = 41, p = .485

Kendall's Coefficient of Concordance

To answer RQ2 "Are there significant differences in agreement for the perceived barriers to compliance based on the industrial classification setting of an organization?" Kendall's Coefficient of Concordance W was used. Ranking of the perceived barriers were classified as organizations in NAICS 62 "Healthcare and Social Assistance" and all other non-healthcare NAICS classifications that were grouped as "Other." The results of the Kendall's Coefficient of Concordance W appear in Tables 7 and 8.

Healthcare Organizations

The hypotheses tested for healthcare organizations were:

Null Hypothesis: Respondents from healthcare organizations are not in significant agreement with regards to the perceived barriers to compliance.

Alternative Hypothesis: Respondents from healthcare organizations are in significant agreement with regards to the perceived barriers to compliance**.**

The results indicated that the results were not significant ($\chi^2 = 5.341$, df = 5, p >0.05) and one can conclude there was no significant agreement as to the perceived barriers to compliance among members in the healthcare group (See Table 7).

Table 7

Mean Ranks of Perceived Barriers for NAICS 62 "Healthcare and Social Assistance"

Perceived Barriers	Mean Rank
Lack of subject matter resources to understand the requirements	3.38
Lack of dedicated safety staff to implement the requirements	2.78
Lack of funding to implement the requirements	3.66
Lack of employee input to comply with the standard	3.22
Lack of management leadership to comply with the standard	3.81
Lack of a perceived risk by the organization to comply with the standard	4.16

Kendall's Coefficient of Concordance W = .067, N = 15, $\chi^2 = 5.341$, d =5, p = .376

Non-Healthcare Organizations

The hypotheses tested for "Other" organizations were:

Null Hypothesis: Respondents from non-healthcare organizations are not in significant agreement with regards to the perceived barriers to compliance.

Alternative Hypothesis: Respondents from non-healthcare organizations are in significant agreement with regards to the perceived barriers to compliance.

The results indicated that the results were not significant ($\chi^2 = 10.233$, df = 5, p >0.05) and one can conclude there was no significant agreement as to the perceived barriers to compliance among members in the healthcare group (See Table 8).

Table 8

Mean Ranks of Perceived Barriers for Non-Healthcare (Other than NAICS 62)

Perceived Barriers	Mean Rank
Lack of subject matter resources to understand the requirements	2.90
Lack of dedicated safety staff to implement the requirements	3.50
Lack of funding to implement the requirements	4.73
Lack of employee input to comply with the standard	3.73
Lack of management leadership to comply with the standard	3.20
Lack of a perceived risk by the organization to comply with the standard	2.93

Kendall's Coefficient of Concordance W = .136, N = 15, $\chi^2 = 10.233$, df = 5, p = .069

The researcher wanted to determine, from a descriptive standpoint, if there were differences in how healthcare and social services professionals perceived barriers to compliance when compared to professionals in other industries (See Table 9).

Hypothesis: Barriers to compliance are perceived differently by organizations not included in healthcare and social services than those organizations that are included in healthcare and social services

From a descriptive standpoint, there were several differences in the rankings when comparing healthcare and social services to other industries. Healthcare and social services respondents rated a lack of a perceived risk by the organization to comply with the standard as the least important perceived barrier and lack of dedicated safety staff to implement the requirements as the most. Other industries rated a lack of funding to implement the requirements as the most and lack of subject matter resources to understand the requirements as the least.

Table 9

Mean Ranks of Perceived Barriers – "Healthcare and Social Assistance" compared to "Other Industries"

Perceived Barriers	Mean Rank Healthcare and Social Services	Mean Rank Other Industries
Lack of subject matter resources to understand the requirements	3.38	2.90
Lack of dedicated safety staff to implement the requirements	2.78	3.50
Lack of funding to implement the requirements	3.66	4.73
Lack of employee input to comply with the standard	3.22	3.73
Lack of management leadership to comply with the standard	3.81	3.20
Lack of a perceived risk by the organization to comply with the standard	4.16	2.93

Point-Biserial Correlation

To answer RQ3 "Is there a significant relationship between the amounts of the fine imposed on an organizations and the presence or absence of a full-time health and safety professional?" a Point-Biserial correlation procedure was proposed. However, because the assumption of normality of the dependent variable was violated, a Spearman rank-order correlation was used instead to test the following hypotheses:

> Null Hypothesis: There is a no significant relationship between the amount of the current penalty imposed and the employment of a full-time health and safety professional by an organization
>
> Alternative Hypothesis: There is a significant relationship between the amount of the current penalty imposed and the employment of a full-time health and safety professional by an organization

The results of the Spearman analysis were not significant (Spearman Rho = -.004, N = 43, p = .981) thus concluding there was no significant relationship between the current penalties received and the presence or absence of a full-time health and safety professional.

Pearson Correlation Coefficient

To answer RQ4, "Are the indirect costs for the organization to respond to a violation related to the cost of the fine imposed?" a Pearson correlation procedure was proposed. However, because the assumptions of the test were not met, the Spearman Rho statistic used to test the following null and alternative hypotheses:

> Null Hypothesis 5: There is no significant correlation between indirect costs to respond to a citation and the amount of the current penalty imposed
>
> Alternative Hypothesis 5: There is a significant correlation between indirect costs to respond to a citation and the amount of the current penalty imposed

The results of the Spearman statistic were found to be significant (Spearman Rho = .459, N = 27, p = .016). The researcher can conclude there is a significant positive relationship between the indirect costs reported to correct the violations and the amount of the current penalty imposed.

Post-Hoc Power Analysis

Because of the low response rate and small number of respondents obtained in this study, the researcher conducted post-hoc power analyses to provide guidance on future research. This post hoc power analysis was conducted to provide recommended sample sizes in future studies and to quantify the effect sizes obtained in this study.

Mann-Whitney U Test – Presence of a Safety Professional and Penalties

The first step in this analysis was to calculate the effect size, Eta Squared, using the following formula (Fritz, 2012) where Z equals the z-score for the analysis and N equals the sample size:

$$\eta^2 = \frac{z^2}{n-1}$$

The researcher obtained an effect size of 1.7 x 10^{-5} (Z = -0.026, N=40) which indicates there is no effect size present. Therefore, there is no value to running a power analysis.

Mann-Whitney U Test – Certification and Penalties

The researcher obtained an effect size of 0.064 (Z = -0.026, N=40) which indicates there is no effect size present. Therefore, there is no value to running a power analysis.

Mann-Whitney U Test – Third Party Review and Penalties

The researcher obtained an effect size of 0.012 ((Z = -0.7, N=40) which indicates there is no effect size present. Therefore, there is no value to running a power analysis.

Spearman Rho - Penalties and the Presence or Absence of a Full-time Health and Safety Professional

The effect size for this test was determined using r_s^2 to be 1.6 X 10^{-5} (r_s = -0.004) which indicates no effect exists and further analysis is unnecessary.

Spearman - Penalties and Costs

An effect size for this test was determined using r_s^2 to be 0.21 (r_s = -0.15) which falls between small and moderate. Using G Power 3.1.7, assuming a normal distribution, a ratio in cases between the two groups of 1, a sample size of approximately 792 cases would be needed to achieve a power of 0.8.

Kendall's Coefficient of Concordance W – Rankin of Perceived Barriers in Healthcare

Using the formula for converting W to r = MW-1/(M-1) where W equals Kendall's Coefficient of Concordance and M equals the number of samples an effect size (r^2) of 3.6 X 10^{-4} is calculated (W= .067, M= 15) which is a non-existent effect size.

Kendall's Coefficient of Concordance W – Rankin of Perceived Barriers in Other Industries

Using the formula (Zar, 1999) for converting W to r = MW-1/(M-1) where W equals Kendall's Coefficient of Concordance and M equals the number of samples an effect size (r^2) of $5.5 \text{ X } 10^{-3}$ is calculated (W= .136, M= 15) which is a non-existent effect size.

CHAPTER FIVE

DISCUSSION

Public Domain Data Review and Analysis

This research project consisted of an analysis of public domain data related to the topic of bloodborne pathogens that is readily available from the Occupational Safety and Health Administration. The source of information was the U.S. Department of Labor's Enforcement Data Catalog that contains the OSHA Enforcement Data for all OSHA inspections that are conducted throughout the U.S. The data catalog is continually updated by the regulatory agency as inspection activity begins and closes. By examining current data, the researcher intended to provide a review and analysis of recent regulatory action with regard to bloodborne pathogens enforcement across the U.S. as this data catalog provides information for all federal OSHA and state run equivalent compliance programs. The rationale was that the information published by OSHA on bloodborne pathogens enforcement is sporadic and limited in detail. The other source of data examined was information published on the OSHA webpage (www.osha.gov).

According to current information available on the OSHA webpage, the latest list of most frequently cited violations for the bloodborne pathogens standard is from the period of January 2001 to September 2011. During this period, the top five most frequently cited violations for this time period in order of most to least were reported to be (OSHA, 2016):

1. 1910.1030 (c) (1) (i) - Establishment of a written Exposure Control Plan,
2. 1910.1030 (c) (1) (iv) - Review and update Exposure Control Plan
3. 1910.1030 (d) (2) (i)- Use of engineering and work practice controls
4. 1910.1030 (f) (2) (i) - Availability of HBV vaccination
5. 1910.1030 (g) (2) (i) - Employee training program

The researcher questioned if the types and frequency of bloodborne pathogens violations for more recent years have continued to be the same or if there were changes to be found in enforcement. To answer this question all bloodborne pathogens inspection and violation files between January 2013 and December 2015 were analyzed for the types of violations cited. The data resulting from the time period of this study indicates that the types of violations has remained consistent for the top five but that the order of frequency was different as follows:

1. 1910.1030 (c) (1) (i)- Establishment of a written Exposure Control Plan
2. 1910.1030 (g) (2) (i) - Employee training program
3. 1910.1030 (c) (1) (iv) - Review and update Exposure Control Plan
4. 1910.1030 (f) (2) (i)- Availability of HBV vaccination
5. 1910.1030 (d) (2) (i) - Use of engineering and work practice controls

Establishment of a written exposure control plan continued to be the most frequently cited violation. Establishment of a written plan is considered to be a fundamental element of an OSHA compliant bloodborne pathogens program as discussed in the OSHA Compliance Officer instructions for inspection (OSHA, 2016). Review for the presence of the written program would therefore be expected with all inspection activity and could be a likely explanation for its ongoing listing of being the most frequency cited violation.

Whereas the OSHA webpage publication does not detail beyond that of the top five for the time period of 2001 to 2011, further analysis by the researcher provides additional insight for the 2013 to 2015 time period. The frequency of citations continued as follows to round out the top ten:

6. 1910.1030 (f) (1) (i)- Provide Hepatitis B Vaccination

7. 1910.1030 (d) (4)(iii) (a) - Contaminated Sharps Disposal
8. 1910.1030 (c) (1) (ii) (b) - Schedule and Method of Implementation
9. 1910.1030 (g) (2) (ii) (b) - Annual Employee Training
10. 1910.1030 (c) (1) (iv) (b) - Annual Documentation of Safer Devices

This information provides additional guidance for organizations seeking to audit their program using a loss reduction strategy. A review of the 2013 to 2015 data also shows that the most frequently cited standard of not having a written exposure control plan did not result in the highest penalty issued against an organization. The standard violation that resulted in the largest penalty of $70,000.00 was 1910.1030 (d) (2) (i) Engineering and Work Practice Controls that was listed as fifth. A penalty of $70,000 for violation of 1910.1030 (d) (4) (iv) Laundry was also issued and interestingly did not make the top ten list. The fine of $70,000 is reserved for willful or repeat violation of the standard. Organizations should be aware that the dollar amount of OSHA penalties for repeat and willful violations has increased from $70,000 to $126,000 effective August 2016 (OSHA, 2016). Adjustments to the penalty may also occur based on a number of factors such as the size of the organization and the number of employees exposed to the hazard. The researcher determined that the mean reduction in penalty for the 2013 to 2015 time period reviewed was twenty eight percent.

The OSHA webpage does not publish recent information on the type or frequency of enforcement action based on the business activity of organizations and was of interest to the researcher. When the researcher explored the types of organizations inspected by NAICS for 2013 to 2015 the most likely to be inspected was Healthcare and Social Assistance as was expected. The second most likely though were businesses classified as Arts, Entertainment and Recreation. The type of organizations least likely to be inspected during the time period

reviewed was found to be the construction industry as would be expected since this business sector is not covered under the general industry standards.

Collected Survey Data Review and Analysis

The study also involved the collection of survey information by the researcher from organizations that had received a violation of the bloodborne pathogens standard during the same time period of January 2013 to December 2015. The rationale for this approach was to supplement the public domain data for the known cost of the violation with additional variables to investigate the perceived barriers to compliance, the availability and type of subject matter resources prior to receiving the violation and what additional costs were incurred beyond abatement of the hazard and paying the current penalty.

This information proved to be a challenge for this study. An additional challenge was the issue of incomplete surveys or answers that did not lend to analysis. A common example was the use of the same number multiple times on the written Likert survey for the perceived barriers to compliance. The online survey did not allow for this to occur by designing the survey to force a response that did not involve a duplicate answer. The other most common obstacle for analysis was leaving an answer blank. This occurred on both the written and online surveys. There also were written comments on a number of the returned surveys.

Comments included that the responder thought there was an unfairness to the regulatory inspection, that some kind of employee clandestine activities were at fault for having the inspection in the first place and the respondent wasn't sure of the answer to a question so they left it blank. One potential explanation for these issues could be an uneasiness that even though their identity was confidentially collected, the data could be traced back to the specific

organization. Another explanation could be the stigma of reporting information associated with failure to comply with the law or an unwillingness to disclose additional costs of compliance.

The survey participants in this study did include a wide variety of organizations from numerous industries other than healthcare and social assistance who were cited for violations of the OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030. These participants included Manufacturing; Wholesale; Retail Trade; Administrative and Support and Waste Management and Remedial Services; Educational Services; Arts, Entertainment and Recreation; Accommodation and Food Services; Other Services (except Public Administration) and Public Administration. That the participants were not only from the healthcare industry was seen as a positive aspect of meeting the study design criteria.

Surveys were received from respondents in seventeen (17) different states and the Commonwealth of Puerto Rico. The sizes of the organizations, as measured by the number of employees, ranged from small businesses with a total of 4 employees to large corporations employing 3,500 persons. The mean number of employees was 206. In retrospect, this information could have been incorporated into the study design as a method of standardizing the current penalty cost between organizations. Particularly since penalty reductions are based on the size of the employer.

The self-described job titles of the individuals completing the survey included: Human Resources Director, Human Resources Manager, Business Owner, Safety and Training Officer, Employee Health Service Case Manager, Quality Manager, Operations Manager, Director of Employee Health, Dentist, Safety Program Specialist, President, Manager, Office Manager, and General Manager. Having the information provided by individuals with varying types of job functions could have negatively influenced the result when determining the perceived barriers to

compliance. The perspective of a safety professional could very well be different from that of a senior official or manager of an organization. Requesting a person representing a specific job title to respond to the survey may have reduced the variation but also would have created a further challenge for the study since job titles are so diverse.

The range of current penalties for survey respondents was a minimum of $70 to a maximum of $29,700 for individual citations. The mean current penalty was $3,277. Survey respondents reported that the indirect cost of responding to the inspection ranged from a minimum of $0 to a maximum of $178,729 with a mean cost of $10,810. The $178,729 was considered to be an outlier though the cost was likely real since it was being reported by a large municipality. Again the amount of a penalty would depend on the various factors previously mentioned.

The Research Questions

The purpose of this study was to examine organizational factors and perceived barriers to compliance with the ultimate goal of reducing worker exposure to bloodborne pathogens. The researcher proposed that organizational factors including the presence of a full-time safety professional, the presence of a certified health and safety professional, or participation in a third party review could have a significant effect on the current penalty cost. The cost of the current penalty for the surveyed organizations was available through the public domain data catalog. The rationale for the comparison was that the more resources available to the organizations, the less severe the penalty as evidenced by a lower dollar amount for the citation levied.

No significant differences were identified in the current penalties imposed on the organization when comparing the presence or absence of a full-time safety professional, the presence or absence of a certified health and safety professional or the participation in a third

party review of the program prior to the inspection. Therefore, the researcher concluded the presence of subject matter expert resources did not have a significant impact on reducing penalties imposed. Other factors effecting the independent variables that were not measured could be present and contributed to the positive, negative, or negligible impact on the current penalty imposed. For example, it could be that the focus of the subject matter resources were concentrated on compliance activities having little or no impact on the fines imposed. It is the researchers opinion it could also be the case that even though the resources were available, involvement in the implementation or assessment of the bloodborne pathogens program was minimal. In the healthcare setting, the focus could have been with other regulatory agency requirements such as a third party accreditation standards, local health department, and state health department mandates rather than OSHA compliance.

Other regulatory factors that play a role in determining the current penalties imposed could also be a significant influence. OSHA follows a regulation based approach to levying fines and typically adjusts penalties either up or down based upon a variety of factors. Examples of factors they take into account when determining the fines include the employer's past performance, timeliness of the abatement process, the size of the employer in terms of number of employees, the severity of the hazard, and the extent to which the employer made a good faith effort in complying (OSHA, 2016). Any one of these factors could positively or negatively offset the impact of subject matter resources when achieving compliance. Another example could be the failure of an organization to implement the recommendations for achieving compliance prior to the inspection. If two organizations employed a vastly different number of employees and both failed to act upon with the same exact recommendation from a subject matter resource to abate a hazard, both would be cited for the same violation. However, the

larger company with many employees would potentially be fined a greater amount than the one with fewer employees. Because this study did not examine the activities the subject matter resources were engaged in, further analysis is required to determine the extent to which the subject matter experts' roles in the organizations could impact fines for bloodborne standard violations. Further analysis is also needed to determine the impact OSHA based penalty adjustment factors had in determining the penalties imposed.

A goal of this study was to determine if there were differences in agreement for the perceived barriers to compliance based on the industrial classification setting of an organization. The rationale for this comparison was that healthcare and social assistance organizations have more experience implementing infectious disease programs than those in other non-healthcare industries. Based on the results of the Kendall's Coefficient of Concordance W, the researcher concluded that there was no significant agreement among the raters that participated in the survey for the healthcare and social assistance organizations group or non-healthcare and social services organizations classified as "other industries". Although the results were not significant for the individual groupings, there were notable differences. From a descriptive standpoint, there were several differences in the rankings when comparing healthcare and social assistance to other industries. Healthcare and social assistance respondents rated a lack of a perceived risk by the organization to comply with the standard as the least important perceived barrier and a lack of dedicated safety staff to implement the requirements as the most. This could potentially be interpreted as meaning healthcare and social assistance organizations understand the OSHA requirements, lack dedicated staff to implement the requirements, and that the lack of compliance is not due to underestimating the risk or urgency of implementation. The researcher proposes that refining the questions to focus on the type of risk such as operational versus

strategic in a future study with a larger sample size could provide valuable information to healthcare and social assistance organizations.

For the other industries not involved in healthcare and social assistance, a lack of funding to implement the requirements was identified as the least important perceived barrier to compliance. This study did not ask what the funding would be used for to become compliant and refining the question would be recommended in future investigations. Funding could be utilized by organizations for many different purposes to become compliant. Examples include personnel to implement requirements, engineering controls, administrative policy and procedure implementation, or personal protective equipment. The researcher proposes that refining the questions to focus on the specific uses of funding in a future study. The most important perceived barrier to compliance for this grouping was a lack of subject matter resources to understand the requirements. This may be interpreted as meaning the organizations do not feel they have an understanding of what needed to be done and put in place with regard to meeting the OSHA requirements but do have the funding to do so. Again, the use of a larger sample size is recommended and may have led to a finding of significant agreement for this group.

The researcher evaluated the differences in current penalties comparing organizations with a full-time safety professional and those that did not. The rationale for this comparison was an assumption that organizations with a full-time safety professional would likely receive lower penalties following an inspection. The researcher found that no significant difference was noted. Again the various considerations such as the influence of penalty adjustment factors discussed previously may also be applicable in this case.

The final research question examined in this study was posed to determine if the indirect costs for the organization to respond to a violation were related to the cost of the fine imposed.

The rationale was that the cost of the penalty was only a fraction of the overall cost to respond to the violation. The researcher concluded based on the result of the Spearman Rho correlation was that there was a significant positive correlation (Spearman Rho = .459, $p < 0.05$) between the indirect costs of responding to an OSHA bloodborne pathogens citation and the current penalty received by the organization. In this case, the positive correlation indicates that as the penalty imposed increased so did the indirect costs of responding to the citation. This could be expected because the greater the fine, perhaps the more severe the hazard present and the more people exposed thus requiring more money to correct. Further investigation could be conducted to develop a prediction model with additional variables to predict the money spent on compliance. This could provide valuable information on cost savings and serve to provide motivation for compliance

Conclusions

This study examined a series of research questions in an attempt to analyze the perceived barriers, organizational factors and indirect costs to compliance for the OSHA bloodborne pathogens standard. Examination of the public domain data indicated that the most frequently cited violations of the bloodborne pathogens standard has remained the same since the last OSHA publication on the topic in 2011. The study also provided additional detail on the most frequent violations giving the top ten versus top five for the study period of January 2013 to December 2015. The public domain database for the period studied indicates that organizations could expect to see a twenty-eight percent decrease on average from the initial penalty issued and the current penalty received.

The study determined there was no significant difference in the current penalties imposed and the availability of a full-time health and safety professional to comply with the standard.

Likewise there was no evidence of a significant difference in the current penalties imposed based on the presence or absence of a certified health and safety professional or if the organization participated in third party reviews of their bloodborne pathogens program prior to the inspection. The respondents from in healthcare and social assistance organizations were not in significant agreement as to the perceived barriers to compliance as well as respondents from organizations classified as non-healthcare or "other." When examining whether the amount of a penalty was related to the presence or absence of a full-time health and safety professional in an organization, again no significant differences were found.

There was a significant positive correlation between the amount of a penalty received by an organization and the dollar amount of the indirect cost to respond to the citation. These indirect costs were above and beyond what would have been spent to be in compliance with the standard initially.

Finally, collection of survey data proved to be a challenge for this study both in the quantity of responses returned to the researcher and quality of the information on the returned survey questionnaires. The use of postal mail as a survey method, changes in address or organizations going out of business, and respondent concern that the survey was a continuation of a regulatory process were all seen as detriments to the data collection process.

Recommendations for Future Research

The regular update of the OSHA public domain database for violations and inspections by the Department of Labor lends itself to ongoing research for the topic of bloodborne pathogens compliance. Tracking and tending of frequently cited violations would provide useful information to organizations looking to ensure their program meets regulatory requirements.

Examining the mean dollar amount of citations for specific sections of the standard could also prove useful as guidance for organizations with limited resources.

Suggested methods to improve the quantity and quality of response to survey questionnaires include collection of data as close as possible to completion of the inspection or issuance of the citation. This could be achieved by a researcher monitoring the public domain database in real time to request the information electronically or as an alliance with the regulatory agency to collect information at the close out conference of the inspection. A repeat investigation of the first three research questions of this study would be recommended if the number and quality of survey responses could be increased and a larger span of years used.

The final recommendation would be to examine the cost of penalties and indirect costs to see if a model could be developed to predict the costs of compliance. The ability to predict and quantify these additional costs of compliance to a citation could be a useful incentive to encourage initial compliance with the standard by organizations.

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Appendix A

Informed Consent Cover Letter

Date _____

Dear Human Resources Director:

Your organization is invited to participate in a research study being conducted through Indiana University of Pennsylvania as part of a doctoral dissertation. The purpose of this study is to investigate obstacles and perceived barriers to compliance by employers with the Occupational Safety and Health Administration (OSHA) bloodborne pathogens standard in healthcare and non-healthcare organizations.

Participation in this study involves completing and returning the enclosed survey. If you would like to respond on-line you may do so by copying and pasting the following link into your internet browser [INSERT Qualtrics link]. Participation entails no known risk and your responses on the survey will remain anonymous. Your participation in this study should require approximately 20 minutes.

Your participation in this study is voluntary and you are free to decide not to participate. Prior to responding you should gain permission from your employer to participate. There is no compensation for your participation in this study. However, your participation will benefit individuals and organizations that work with bloodborne pathogens by identifying challenges to adhering to OSHA standards.

If you choose to participate, the information obtained in this study may be published in scientific journals or presented at scientific meetings, but your identity will always be kept strictly confidential and your responses will not be connected to your name.

To obtain further information please contact:

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This project has been approved by the Indiana University of Pennsylvania Institutional Review Board for the Protection of Human Subjects, IRB Log No. 16-192, and Phone: 724-357-7730.

Thank you for participating in this important study.

Sincerely,

Ralph Estep

Appendix B

Survey Instrument

Bloodborne Pathogens Survey

All information will be kept anonymous and participation is voluntary.

On [FILL IN DATE], your organization received an OSHA inspection resulting in the issuance of a violation of the Bloodborne Pathogens Standard 29 CFR 1910.1030. Please answer the following questions below to the best of your ability and with the assistance of others in your organization if necessary:

1. Rank the following factors in order of importance on a scale of 1 to 6 (1 = most significant, 6= least significant) as reasons why your organization received the citation:

_____Lack of subject matter resources to understand the requirements

_____Lack of dedicated safety staff to implement the requirements

_____Lack of funding to implement the requirements

_____Lack of employee input to comply with the standard

_____Lack of management leadership to comply with the standard

_____Lack of a perceived risk by the organization to comply with the standard

2A. At the time of the citation which of the following did your organization employ (Circle only one):

a. No health and safety professional (Continue to Item #3A)
b. A part-time health and safety professional
c. A full-time health and safety professional

2B. If your organization employed any safety professional(s), did anyone hold a certification credential which objectively assessed and measured the professional knowledge and understanding of the practitioners engaged in occupational health and safety (Check one)?

Yes_____ No_____

If YES, which certification(s) did they hold? Circle all that apply.

a. Certified Safety Professional (CSP)

b. Certified Industrial Hygienist (CIH)

c. Certified Occupational Health Nurse (COHN)

d. Certified Healthcare Safety Professional (CHSP)

e. Other_____

3A. Prior to receiving the citation, was your Bloodborne pathogens program reviewed by an independent third party entity (Circle One):

a. Yes

b. No (Continue to Item #4)

3B. If yes, who reviewed the program (Circle One):

a. Corporate compliance officer

b. Government consultation program

c. Accreditation agency

d. Consultant

e. Other:_____

4. What were the estimated additional total whole dollar costs your organizations spent to respond to the citation? Examples include time spent on investigation of the allegations, posting of the citation, meetings with employees to explain the citations, attorney or other consultant fees to defend the allegations, and media response. $_____ (Do not include the cost of abatement to correct the violation or the cost of the penalty.)

5. Please provide your job title: _____