Evaluation of safety climate at a major public university

Several recent serious incidents in university laboratories have demonstrated the need for improvement in safety in academic settings. A recent report by the National Research Council of the National Academy calls for improvement in the safety culture of academic research. Safety culture is a collection of ideals and attitudes and quantitative measurement is not always possible. However, methods to measure "safety climate" have been developed and may be considered as a manifestation of the more broadly defined safety culture. Safety climate is a "snapshot" measurement of employees' perceptions, attitudes, and beliefs about risk and safety. A 2011 survey of laboratory personnel for the development of a Hazard Mitigation Plan was used to estimate the safety climate at a major public university. The initial survey data was culled to 26 questions relating to laboratory safety concerns and codified to estimate safety climate. The results of this study provided an estimated safety climate rating for this university of 3.72 ± 1.71, on a scale of 1–5, with 5 indicating very high perception of safety. The comparison of these results with published safety climate concepts and numerical values from other universities indicate an overall "high" perception of safety climate at this university.

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INTRODUCTION

The purpose of this paper is to estimate the safety climate at a major southern public university utilizing data from a recent survey. This southern university suffered a natural disaster from hurricane Gustav making landfall in 2008.[1] This event resulted in the Federal Emergency Management Agency

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(FEMA) providing funding for the university to develop a Hazard Mitigation Plan. Hazard mitigation planning is a systematic process to identify natural and man-made hazards threatening communities and to reduce potential adverse impacts through strategies that reduce risks and vulnerabilities. This university developed a Disaster Resistant University (DRU) plan pursuant to the requirements of the Disaster Mitigation Act of 2000.[2] Several surveys, including a survey of research personnel about laboratory safety, were conducted in 2011 to support the development of the Hazard Mitigation Plan.

Safety climate is a "snapshot" measurement of employees' perceptions, attitudes, and beliefs about risk and safety. Methods to quantitatively measure safety climate have been developed and are considered as one of the best indicators of general workplace safety. Safety climate has also been considered as a manifestation of the more broadly defined safety culture. Safety culture is a collection of ideals and attitudes and quantitative measurement is not always possible. However, safety professionals feel that indices of safety are important and often turn to the use of safety climate scales as a surrogate for safety culture. The relationships between safety climate and safety culture are strongly linked but the terms are not interchangeable. This paper utilizes an existing 2011 laboratory safety survey to estimate and characterize the safety climate at a major public university.

LABORATORY SAFETY IN ACADEMIA

Several serious incidents in academic laboratories have raised the discussion level on the methodology that can be utilized to improve safety in academic laboratories. The majority of the recent discussion has focused on improving the culture of safety in academia as demonstrated by a recent report from the National Research Council (NRC) of the National Academies. The NRC report examines the current state of the culture of safety in academic research and made recommendations for improving the safety culture in research laboratories.[3]

The renowned agricultural chemist and teacher, Justus von Liebig (1803–1873), was quoted in an 1890 address by August Kekulé as saying that "you have to ruin your health to get anywhere in chemistry".[4] However, work conditions for the modern researcher have greatly improved due to technological

advances in exposure control and increased safety awareness. Universities provide basic engineering controls to reduce levels of exposure such as fume hoods and biological safety cabinets. Occupational Safety and Health Administration (OSHA) rules require education of laboratory personnel in exposure control.[5] However, most universities do not have the same level of laboratory safety rules as found in industry.[6] For example, use of reactive chemical reviews and standard operating procedures are basic safety requirements in industry. In academic laboratories, the level and enforcement of safety requirements are at the discretion of the principal investigator. The general consensus is that this relaxed approach toward safety makes academic laboratories more dangerous than those in industry.[7]

In an industrial setting, safety is a significant concern and directly linked to job performance standards. Safety is reviewed in the perspective of being a system management priority where accidents arise from causal factors that reside at multiple levels within complex socio-technological economic systems. Accidents can result from actions of a frontline worker (active failure) but can often be traced to a decision made at higher level of the organization (latent failure). Analytical tools such as risk assessment methodologies are utilized to identify potential system failures and correct them. Industrial units tend to be well-defined structures with strong management organizations that have the authority to make necessary changes at various levels to impact safety.[8]

University research laboratories are unique workplaces due to the number and type of potential hazards. Commonly university laboratories harbor the potential for acute and chronic exposure to a wide range of toxic agents. Every major university has the potential to utilize biological, chemical, corrosive, explosive, flammable, physical, and radiological agents in research settings.[9] Additionally, the rise of cross-discipline incubator projects has helped to stretch and challenge the breadth of expertise of many faculty members. The scope of

operations at universities is often increasing in complexity due to further collaboration with individuals at other institutions. Therefore, increased organizational complexity and an independent mode of operation create a situation where it is especially difficult to build a strong safety culture in academia.[10]

Ashbrook[10] contends that the underlying reason for the weaker safety culture in academia is due to the decentralized nature of academic culture and the general lack of accountability. Laboratories in industry normally have strong lines of management, which can define a safety strategy and enforce its implementation. Universities function through the concept of shared governance between the Board of Trustees, the administration, the faculty, and the staff. This concept of rule by committee makes the application of any system perspective tool difficult because the general structure finds the concept of latent failures unacceptable. Without a justified consensus from all the involved parties, it is challenging to implement any program, not just laboratory safety programs.[10]

Improvement in laboratory safety via application of safety culture concepts to an academic organization is feasible. A strong positive safety culture is not a set of rules, but a commitment to safety throughout an organization. The largest challenge to improve safety and regulatory compliance in the research laboratory is to instill a mindset change at the university. University administration must make safety a priority and assume responsibility for developing, publicizing, and monitoring university safety policies. Faculty should be involved in making these policies and have the primary responsibility for their implementation. Research leaders must realize that they are responsible for the safety of their people and for the primary training of their personnel, be it informal on the job training or a formal introduction to the laboratory and its respective safety procedures. The environmental health and safety (EHS) department serves to promote the administration's policies and acts as reference sources for faculty. EHS

professionals must work with administrators, faculty, and researchers to help establish a strong, positive safety culture. Each party in a positive safety culture has clearly defined roles and must be held accountable.[3,10]

SAFETY CLIMATE AND SAFETY CULTURE

Both of the terms, safety climate and safety culture have been used to describe workplace safety in efforts to improve safety. These concepts have been studied from technical, social, and psychological viewpoints leading to the general consensus that: (1) a positive safety culture improves job safety, and (2) a safety climate survey can be used as a metric to assess safety performance. The concepts of safety climate and safety culture have their roots in organization theory research. While numerous definitions have been applied, organization climate is commonly considered as the generalized perceptions about the organization's items of concern. Organizational culture tends to reflect how people behave, how things are done, and the underlying values and beliefs of the organization.[11] The perception of the resulting attitudes and behavior help to establish the climate of the organization. The relationship between culture and climate can be complex and confusing but the concepts are useful tools for understanding the dynamics of institutional behavior and to foster organization improvement.[12]

The concepts of safety climate and safety culture utilize the base concepts of organization theory as directly related to safety such as safety attitude and safety values.[13] A literature review by Guldenmund[14] claims that the concepts of safety culture and safety climate are not well defined and that the relationship between the two is unclear. The definitions of both safety climate and safety culture tend to be global and are often based on the objectives of the researcher. In general, safety climate looks at the perceptions of the group members while safety culture also considers the groups beliefs and attitudes.[14]