ASSESSING OCCUPATIONAL SAFETY AND HEALTH HAZARDS AT WORKPLACES IN UGANDA: A CASE OF FOUR ENGINEERING MATERIALS TESTING LABORATORIES.

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DECLARATION

I, Fred Moses Lusundo, hereby declare that this dissertation is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree of a University or other institution of higher learning, except where due acknowledgement has been made in the text and reference list.

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APPROVAL

The undersigned certifies that he has read and hereby recommends for acceptance by Kyambogo University, a research dissertation entitled: ***Assessing Occupational Safety and Health Hazards in Workplaces in Uganda: A Case of four Engineering Materials Testing Laboratories*** in partial fulfillment of the requirements for the award of Masters of Science Degree in Construction Technology and Management of Kyambogo University.

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(Supervisor)

DEDICATION

I dedicate this dissertation piece to my dear mother, Ms. Miriam Nantege Babirye, my wife, and children.

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To the management of Kyambogo University, I would like to express my sincere gratitude and appreciation for providing me with the chance to pursue a master's degree and for assigning me the best supervisors, Dr. John Muhumuza Kakitahi, and Eng. Joel Mubiru whose expert guidance and counseling have inspired me to success. More gratitude is extended to Eng. Dr. Sam Bulolo, who guided me in the post Viva Voce corrections.

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LIST OF ACRONYMS AND ABBREVIATIONS

AS .....:Australia

CML .....Central Materials Laboratory

EML..... Engineering Materials Laboratory

GET ……..Geotechnical Engineering and Technology

GFS ……Geotechnical Foundation Services

HIRARC.....Hazard Identification Risk Assessment Risk Control

ILO ..... International Labour Organisation

MoGLSD.....Ministry of Gender Labour and Social Development

MoW&T .....Ministry of Works and Transport

NZS..... New.Zealand

OSH .....Occupational Safety and Health

OSHA .....Occupational Safety and Health Act

PPE ..... Personal Protective Equipment

SI.....Safety Index

SOP.....Standard Operating Procedures

SPSS .....Statistical Package for Social Sciences

UNBS .....Uganda National Bureau of Standards

WHO..... World Health Organisation

ABSTRACT

Workplaces in Uganda are mandated to satisfy the requirements of the Occupational Safety and Health Act (OSHA), 2006 regarding the Occupational Safety and Health of workers. Despite of the above, many workplaces in Uganda including Engineering Materials Testing Laboratories have continued not to satisfy the above requirements. Although different strategies to manage OSH risks have been devised and several entities like Safety committees and Ministry of Gender Labour and Social development (MoGLSD) empowered by the act to ensure compliance of work places, OSH in engineering materials testing laboratories has remained a challenge; thereby exposing staff and visitors to the laboratories to serious OSH hazards including physical injuries and long-term health risks like cancer. It is these compliance gaps that this study is set to examine, using the case of Engineering Materials Laboratory (EML), CentralMaterials Laboratory (CML), Geotechnical Foundation Services Ltd (GFS) and Geotechnical Engineering and Technology Laboratory Ltd (GET). The study used both quantitative and qualitative research designs. Quantitative data collection was supported by the use of questionnaires with closed ended questions administered to 60 respondents and then qualitative data, by use of an interview guide. The study findings indicate that for all laboratories,risks due to chemical hazards ranked highest, followed by risks due to accident hazards. Risks due to physical hazards ranked third for EML as opposed to risks due to ergonomics and psycho-social factors that ranked third for CML, GFS and GET. Risks due to ergonomics and psycho-social factors ranked lowest for EML as opposed to risks due to physical hazards factors that ranked lowest for CML, GFS and GET. Consequently, the assessment of the level of compliance to Uganda's OSH regulatory framework indicated that GET, GFS, EML and CML were 88%, 83.4%, 79.7% and 76% compliant respectively, implying that there are still gaps in the implementation of OSHA, 2006. In conclusion, the study attributes these gaps to inadequate financial resources allocated for OSH operations and laxity in implementing OSH management strategies by the various key players among others.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

This research examines the Occupational Safety and Health (OSH) hazards in workplaces,specifically considering four (4) Engineering materials testing laboratories namely; Engineering Materials Laboratory (EML), which is a public laboratory, located in the Testing Department of the Uganda National Bureau of Standards (UNBS), the Central Materials Laboratory (CML) which is a public laboratory under the Ministry of Works and Transport, the Geotechnical Foundation Services Ltd (GFS), which is a private laboratory located after Club Agenda along Lukadde road off the Kireka – Kyaliwajara road and the Geotechnical Engineering and Technology Laboratory Ltd (GET), which is a private laboratory located opposite Kumbuzi along the Karerwe – Gayaza road.

This chapter involves the background of the study, statement of the problem, purpose of the study, research objectives, research questions, conceptual framework, scope of the study, significance of the study, justification of the study and operational definitions.

1.2 Background to the Study

Globally, the International Labour Organization report estimated that, annually 2.78 million workers die from work-related accidents and occupational diseases (of which 2.4million are disease-related) and another 374 million workers suffer from non-fatal work-related accidents (Safety and health at the heart of the future of work., 2019).

The ILO estimates that around 2.3 million women and men worldwide die each year fromwork-related accidents and diseases. This equates to over 6,000 deaths every

day. Globally, there are approximately 340 million work-related injuries and 160 million victims of work-related diseases each year, with work-related diseases causing the majority of worker deaths, and hazardous substances alone are estimated to cause 651,279deaths annually (The enormous burden of poor working conditions 2021).

The occurrence of work-related safety and health issues in majority of the African countries is a result of wanting attention given to OSH by industry and the government (Puplampu and Quartey, 2012). Little information is available about occupational diseaseand injury in Africa on which to base work-related health and safety outcomes. No system is in place to collect such data regularly and proactively, relying on compensation or "passive notification" to either health authorities or labor inspectorate in the event of an accident at the workplace (Mrema *et al.,* 2015).

With recent industrial developments, African countries need to invest heavily in workplace health and safety practices. A big number of African countries are in financial difficulty, but building a competitive continent requires competitive investment to build a safe continent for foreign direct investment (Puplampu and Quartey, 2012).

Like any other developing countries, in Uganda, Occupational accidents are manifested in the continual outbreak of fires, collapsing construction site walls, and the emergence of work-related illnesses. Occupational hazards can cause instant or deferred symptoms, reliant on exposure duration, the exposure intensity, and individual vulnerability (Bridget, 2019). Only an average of 64% of workers worldwide consistently use the correct PPE (OSHA 3151-12R). Uganda reports a high rate of non-use of required personal protective equipment (PPE) (60%), increasing the risk of

biological and non-biological hazards in government and privately-owned hospitals (Ndejjo *et al.*, 2015).

Although much has been achieved in the Ugandan economy's performance, it does not meet the safety and health standards necessary to warrant the safety and health of the workforce. This has had a direct impact on the productivity of the workforce and has hadimplications for poverty alleviation. Poor working conditions have contributed to changes in Uganda's workplace, which have resulted in poor working methods, procedures, inadequate awareness of labor laws, and inadequate awareness of workers' rights and responsibilities (Anna, 2017).

The challenges in enforcing the OSH Act of 2006 include inadequate remedies for labor officials, non-recognition of unions, non-functioning labor courts, double recognition ofunions by employers, non-regularization of work, and ignorance of enforcement of lawsby both workers and employers (Anna, 2017).

1.3 Statement of the Problem

Workplaces in Uganda are mandated to satisfy the requirements of OSHA, 2006 regardingOccupational Safety and Health. These include general duties, obligations and responsibilities of employers, general duties of employers and the self-employed, duties,rights and responsibilities of workers, health and welfare, fire preparedness, machinery,plant and equipment, hazardous materials and chemical safety and special provisions.

Despite of the above, many workplaces in Uganda have continued not to satisfy the aboverequirements. In many Engineering Materials Testing Laboratories, the above

regulationshave not been adequately implemented thereby exposing staff and visitors to the laboratories to serious OSH hazards. Apart from the isolated cases of staff who have suffered minor and moderate physical injuries for example body cuts, many staff could beexposed to long-term health risks resulting from inhalation of dangerous gases, cement powder, and so on. This could result into the acquisition of deadly diseases like cancer, the attendant economic costs that are expensive for the respective organizations, compensation losses, workday losses, production interruptions, training and reconversion,expensive early retirements as well as health-care expenditure.

Therefore, there is a need to assess the OSH hazards in workplaces in Uganda to show their level of adherence to OSHA, 2006 using the aforementioned two laboratories as a case study.

According to Uganda's Vision 2040 and Human Needs Promotion, this study will help inthe achieving of some of the National Development Priorities (NDP) by contributing to Increase in the percentage share of national labour force employed from 70.9% (2010) to94% (2040), Increase in life expectancy at birth from 51.5 years (2010) to 85 years (2040)and Increase in labour productivity (GDP per worker) from USD 1017 (2010) to USD 19770 (2040).

According to Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development, this study is in line with goals 3.9, 3.d and 8.8. If workplaces in Uganda do not consider operational OSH management systems, their employees will continue to face increasing health and safety issues resulting in unexplained absenteeism, illness, ill-health and dissatisfaction, resulting in poor organizational performance and poor overall

performance.

1.4 Objectives of the Study

1.4.1 Main Objective

The main objective of this investigation is to study the compliance capacity of the Engineering Materials Laboratory, the CentralMaterials Laboratory, the Geotechnical Foundation Services Ltd and the Geotechnical Engineering and Technology Laboratory Ltd to Uganda's Occupational Safety and Health Regulations, OSHA 2006.

1.4.2 Specific Objectives

The specific objectives are:

i. To assess the risks within the selected Engineering Materials Laboratories in Uganda,

ii. To identify the risk management strategies for OSH in the selected Engineering Materials Laboratories in Uganda,

iii. To propose a compliance evaluation matrix for Occupational Safety and Health for Engineering Materials Testing laboratories in Uganda; and

iv. To assess the level of compliance of the selected Engineering Materials Laboratories to the requirements of Uganda's OSH Regulatory framework.

1.5 Research Questions

i. What are the hazards and risks to occupational safety and health at workplaces?

ii. What are the risk management strategies for occupational safety and health at workplaces?

iii. To what extent have workplaces complied with the requirements of Uganda's OSH

Regulatory framework?

1.6 Justification of the study

This study will provide information as to whether staff working in selected engineering materials laboratories in Uganda are working in a safe environment. There is need to study the long-term health effects that may manifest resulting from continuous exposure to hazardous workingconditions. Of late, Management of one of the selected laboratories has learned that about 40% of staff (representing 26 outof 64 staff) in the Testing department of UNBS and 44.4% of Engineering Materials Laboratory staff (representing 4 out of 9 staff) are willing to be transferred to other departments (UNBS Testing Department's Mid-year report, 2022) and this could be partly because the staff would feelsafer working in another environment.

1.7 Significance of the Study

i. The study results will raise the awareness of the Management of the selected testing laboratories under study regarding the hazards and risks in the laboratories so as to review policies of managing the risks for improved OSH of staff and all peoplewho access the facilities.

ii. The research's findings will advance knowledge, particularly in the field of occupational safety and health in engineering material testing laboratories.

iii. Future candidates, especially those who plan to conduct research in related areasof laboratory occupational safety and health will be able to use the findings of this study as a literature review.

1.8 Scope and Limitations of the Study

1.8.1 Geographical scope

The study was conducted at the UNBS Headquarters in the Engineering Materials Laboratory located at Bweyogerere Industrial and Business Park, plot 2-12, Bypass link in Kira Municipality in Wakiso District, at the Central Materials Laboratory which is located at Kinawataka, Kampala, Central region, at the Geotechnical Foundation Services Ltd, which is located after Club Agenda along Lukadde road off the Kireka – Kyaliwajara road and the Geotechnical Engineering and Technology Laboratory Ltd, which is located opposite Kumbuzi along the Karerwe – Gayaza road.

1.8.2 Content scope

The study was limited to assessing Occupational Health and Safety Hazards in workplaces. It was however be guided by objectives including; the assessing of the risks within the selected Engineering Materials Laboratories in Uganda,identification of the risk management strategies for OSH in the selected Engineering Materials Laboratories in Uganda, and assessing the level of compliance of the selected laboratories under study to the requirements of Uganda's OSH Regulatory framework.

The study considered information relating to the period of eighteen years that is 2004 -2022. This range of eighteen years will be considered because the research done in this period related to this study is current, reliable and covers the inception and operationalization of OSHA, 2006.

1.8.3 Time scope.

The study was initially programmed to take 12 months, from May 2022 to May 2023. However due to need to widen the study scope, the research was re-scheduled to end

in March 2024, as summarizedin Appendix I.

1.9 Conceptual framework

Occupational Safety and Health at workplaces is considered a functional outcome of Hazard and Risk management with a variety of factors namely, Risk assessment, Risk management strategies which have a bearing on the Level of compliance of workplaces to Uganda's OSH regulatory framework of 2006. Policy and Financing factors play a pivotal role in ensuring that hazards and risks management yields Occupational Safety and Health at work places.

Hazard identification was be done for accident hazards, physical hazards, psycho-social hazards, chemical hazards, and ergonomics.

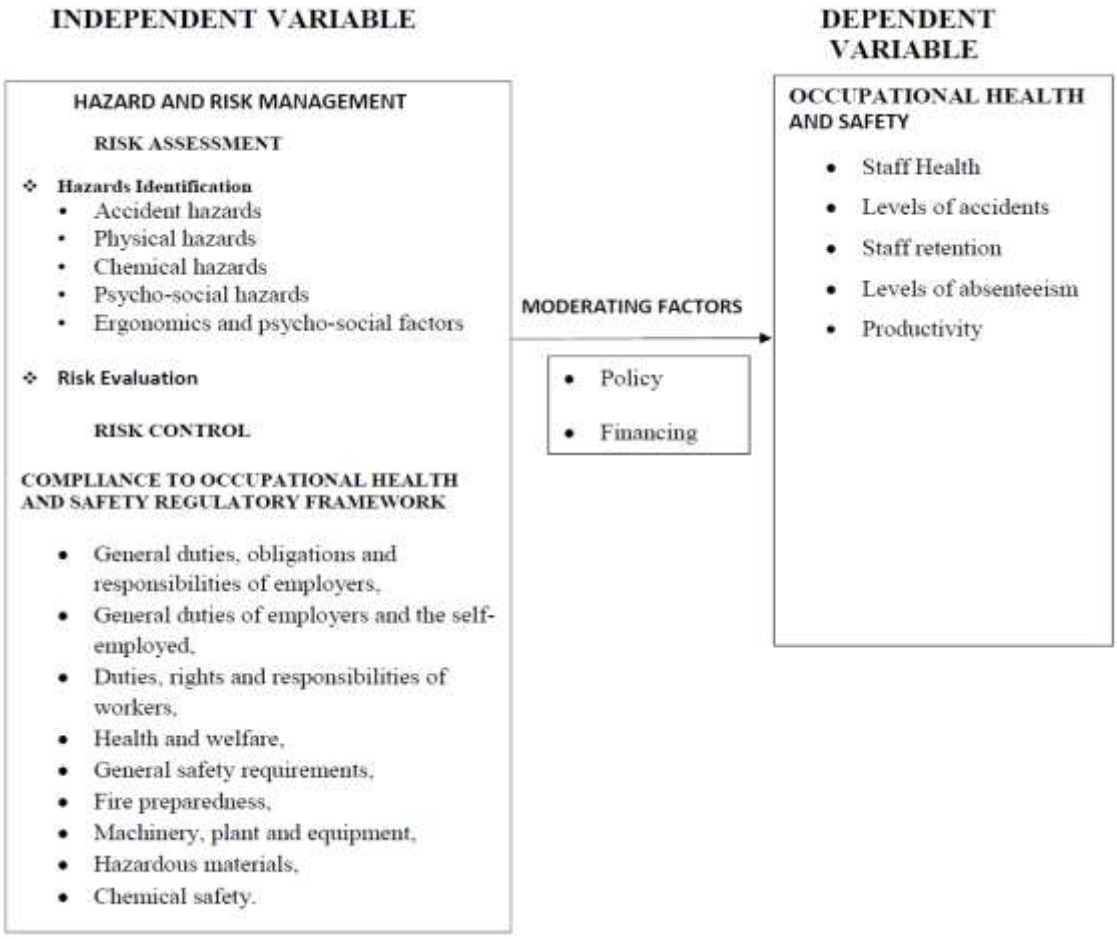

Figure 1.1: Conceptual framework

1.10 Summary of Chapter One

This chapter involved a brief introduction of the research, the background of the study, statement of the problem, purpose of the study, research objectives, research questions, justification of the study, the significance of the study, scope and limitations of the study and the conceptual framework.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature related to risk assessment and risk management of occupational safety and health (OSH) in workplaces specifically targeting the testing environment. The literature has theoretical review, conceptual review and actual review. It is also presented according to research objectives and themes that were involved. These include assessing of risks associated with workers in selected engineering materials testing laboratory environment, identification of the risk management strategies to OSH in the engineering materials testing laboratory environment, resulting into the assessment of the level of compliance of the selected engineering materials testing laboratories under study to the requirements of Uganda's OSH Regulatory framework of 2006. Workplace health and safety is the most important contentious issue in the realization of industrial development. "Health is not everything, but without health, everything is nothing," said German philosopher Schopenhauer, who was born in 1788 and died in 1860. The welfare of an employee while they are at work is thus covered by one definition of health, safety, and integration, which includes all relevant factors. The World Health Organization (WHO) defines workplace health as activities related to medicine, safety, workplace hygiene, ergonomics, work psychology, rehabilitation, physiotherapy, and others. (Fitriah and Mardani, 2019).

Safety, on the contrary, includes defending people against physical injury. According to the International Occupational Hygiene Association (IOHA), occupational safety and health (OSH) is the science of forecasting, identifying, appraising, and regulating workplace hazards that may have animpact on the health and welfare of employees

while also considering any probable negative effects on the local community and the general environment. In light of this,OSH is portrayed as promoting and upholding the highest level of physical, mental, and social well-being for workers across all occupations (Fitriah and Mardani, 2019).

2.2 Theoretical Review

2.2.1 Risk Assessment at Workplaces

(a)Theories for Hazards Identification at Workplaces: Theory of Three Types of Hazards

The study of hazard theory is crucial because it forms the core of system safety theory and serves as the foundation for safety management and safety valuation (Zhang *et al*., 2011).

Tian *et al*. (2006) advanced the Theory of Three Types of Hazards and categorized the hazardous sources into three types: the first type is the accidental release of energy and harmful substances in the system; then the second type relates to the hazard factor due to ineffective functions (such as safety device failure, individual unsafe actions), thereby limiting the first hazard source; the third type includes company safety decisions, organizational errors (organizational procedures, culture, regulations, rules), and unsafe behavior or errors of organizers, and so on.

The degree of damage of accidents and hazards is obtained by the first dangerous sources, besides; the probability of occurrence is dependent on the second. Overall, the third typeis the key reason for the workplace hazards ‘occurrence. It is also the possible reason forthe former two, especially the second type.

Accidents are typically the result of numerous hazards acting together. A direct hazard isone that is responsible for property loss and fatalities. In general, the consecutive initiation of one or more hazards is also necessary for the unintentional release of a hazard's power. The accident chain and accident activating system are made up of these, which are referred to as the first, second, nth triggering hazards. The first triggering risk is the risk that occurs first, and it typically involves people, animals, or natural energy (such as wind, rain, thunder, and lightning, earthquakes, or sunlight). Second, thedirect hazard's stability is reflected in the first triggering hazard's minimum triggering energy. The stability of the direct hazard can also be improved by identifying and removing the cause of the triggering condition. Finally, the direct hazard may manifest in one of two ways: either it may result in an accident due to the actions of all groups of triggering hazards, or it may, in the case of direct hazard acting in a governing capacity, cause the energy of direct hazards to continuously flow in a stable direction until it finally transforms into inherent safety energies (Zhang *et al.*, 2011).

(b) Theories for Risk Evaluation at Work places: Grey system Theory

The method used for this theory is known as the Grey Occupational Risk Assessment Model (GORAM). With the aid of expertise, this method enables the combination of quantitative and qualitative elements during the occupational risk assessment process. This method of workplace risk assessment makes it possible to integrate subjective employee assessments with objective factors related to workplace hazards. Usage of statistical means for risk valuation (which is seldom applicable due to inadequate information) aims to eliminate the natural multiplicity of the workforce. Consequently,

occupational risk assessments at particular workplaces must be differentiated, for example, according to the worker's age, gender, or skill level. (Nowak *et al*., 2019).

Consequently, employees contrast in cases of particular valuations of the parameters such as the chance of occurrence of an unwanted event or the degree of exposure to the identified hazard. A common scenario, for instance, a worker in an entity valuates that the chance of falling down from a given level is insignificant, while another worker finds it quite likely. This calls for the use of tools that consider particulate, hard to evaluate, and probable information in workplace risk assessment. The GORAM method relies on three fundamental decision-making factors:

1) Hazardous Event: Specific risks discovered at work (ni),

2). Decision Making Criteria—The model made use of the likelihood of a hazardous event (j1), the exposure factor (j2), and potential consequences (j3) as three decision-making criteria. The risk assessment method known as the Risk Score method is the source of the indicated decision-making criteria.

3). The grouping indicator k is predicated on the ability to obtain the following values: k = 1—very high risk (unacceptable), k = 2—high risk (remedies required), k = 3—medium risk (tolerated—monitoring required), and k = 4—low risk (acceptable—remedies not required).

Establishing the importance of the hazard sorting criteria is the first step in the GORAM method. There are several ways to obtain weights, such as the Thurstone's method or the Analytical Hierarchical Process (AHP) method (Wiecek *et al*., 2019). Due to its simplicity and high popularity, the AHP method is the most commonly used.

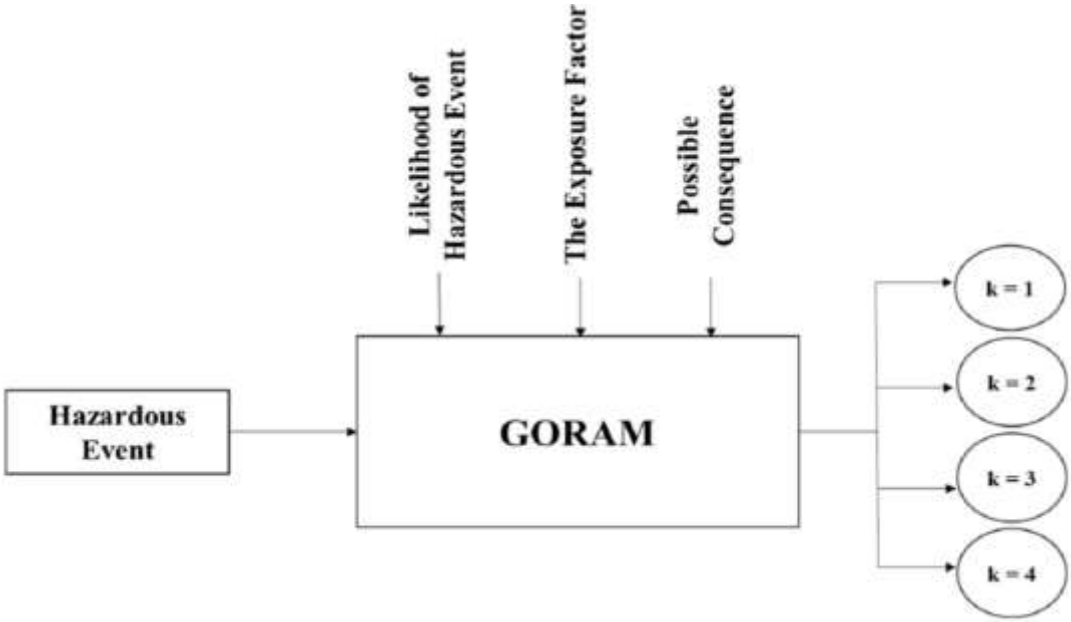

Figure 2. 1: Structure of the GORAM Method (Source: Nowak et al., 2019)

2.2.2 Theories for Risk Management at Workplaces

(a) Resource-Based Theory or View (RBV)

Wenefeldt (1984) put forth this theory. It has a methodology of researching and detecting a company's strategic merits basing on observation of the diverse mix of organizational assets, expertise, skills, and intangibles.

RBV's fundamental tenet is that each organization has a "unique" set of resources, including tangible and intangible assets and the organizational capabilities to take advantage of those assets, which makes them fundamentally different from one another. All companies develop capabilities from these resources, and when fully developed, they are the source of the company's competitive edge (Assey, 2019).

Therefore, it is clear that the firm's resources are crucial to the process of health and safety management. Successful operation of an occupational health and safety strategy by a company is therefore highly reliant on the available resources.

Assey (2019) further asserts that resources may include both physical and human capital and sufficient resources would allow the company to effectively implement its health and safety management strategies to enhance its productivity.

(b) Theory of Planned Behavior (TPB)

Human behavior towards the use of organizational resources defines the level of occupational safety. One of the most commonly applied psychological theories across disciplines to estimate changes in human behavior is Ajzen's theory of planned behavior.According to Ajzen (1991), TPB provides a structure for studying pathways between beliefs and actions. This model explains how individual factors lead people to certain behaviors. His two components of TPB, namely attitudes to behavior (ATB), subjectivenorms (SN) and perceptual behavioral control (PBC), influence a person's behavior.

Thus, behavioral attitudes (that is, behavioral beliefs), subjective norms (that is, normative beliefs or social influences), and perceived behavioral control (that is, ease of engaging with the behavior or difficulty) all affect one's intention to engage in a behavior. The power of an individual's behavioral intentions is the result of the amalgamation of thesefactors (Okeke-Uzodike, 2021).

2.3 Conceptual Review

Workplace hazards are conditions that can endanger an employee's health on the job. The field of workplace safety and health is charged with safeguarding and promoting workers' health as well as deterring sicknesses and injuries related to the workplace. It seeks to improve the environment and working conditions (ILO, 1998).

The laboratory is a place of work in which human beings face publicity to diverse ranges of hazards. It is an area in which a healthful and secure operating manner or methods are required and protection is key, as employees are vulnerable to many dangers because of the character of the operating environment.

These risks include physical, mechanical, biological, chemical, psychosocial factors, and ergonomic conditions and these account for many health outcomes.

The work environment is an environment in which the policies, procedures and systemsare designed to enable employees to achieve organizational goals and personal satisfaction at work.

Putting employees in a positive work environment is a common objective of all employers and leaders in an organization. Such a workplace includes favorable working conditions, prompt feedback management, and recognition of career objectives. A workplace that is healthy is one which recognizes health risks and, controls them if they cannot be eliminated (Assey, 2019).

According to the International Hazard Datasheets on Occupation Laboratory Worker (2000), a laboratory worker is a person who conducts laboratory tests and maintains laboratory equipment to assess the chemical, microbiological, and physical properties or composition of various materials.

2.4 Actual review

2.4.1 Occupational Risk Assessment at Workplaces

(a) Hazard Identification, Risk Assessment, and Risk Control (HIRARC)

Hazard Identification, Risk Assessment, and Risk Control (HIRARC) as a cornerstone

ofrisk management has recently become a fundamental of organizational planning, management, and operational practices. Hazard identification and risk assessment is the process for detecting and evaluating both potential and existing hazards at work sites, plus the methods to regulate or do away with identified hazards. (Ahmad *et al*., 2016).

Hazard Identification is a procedure used to detect potential cases or events that can cause workplace accidents and diseases (Pertiwi *et al.*, 2021). Based on ISO 45001:2018, there are several considerations for employers and workers when identifying workplace hazards and assessing risk:

(i) Routine and non-routine activities at work.

(ii) Activities of all parties accessing the workplace, including contractors, suppliers,guests and visitors.

(iii) Human behavior, skills, and other human factors.

(iv) Dangers from outside the workplace.

(v) Hazard at work (Prastawa, 2021).

Electrics and electronics laboratories have ergonomics issues with majority of the activities in the laboratory requiring standing postures and activities. Analysts require to stand for a long period to accomplish the task given (Shuaib *et al*., 2009). The hazards related to laboratory works are summarized in the table found in ILO-International Hazard Data Sheet on Occupation.

(b) Hazard Identification and Risk Assessment (HIRA) Approach

According to Mariawati, *et al*.(2021), HIRA is a process that determines whether a hazard exists, calculates the risk's magnitude, and determines whether the risk is

acceptable or not. HIRA is a method for identifying potential risks of workplace mishaps. It is logical, all-inclusive, and appropriate to perform algorithms. The process comprises four processes, namely i) Hazard identification, ii) risk assessment, iii) risk analysis, and iv) monitoring and appraise.

The objectives of HIRA are as follows:

1) To recognize all potential risks (hazards) to workers and others;
2) To take into account the high risk of harm to anyone in the circumstances of a specific case and the resulting severity (risk); and
3) To make it possible for employers to organize, implement, and monitor preventive measures that will guarantee that risks are always effectively managed.

In this study, the goal of hazard identification and risk assessment is to evaluate the key operations of tasks that pose significant risks to the health and safety of workers in addition to evaluating the risks relating to specific equipment due to energy sources, working conditions, or tasks performed. To identify the key corrective action to mitigate the risk or remove a danger, each risk is given a risk rating.

2.4.2 Risk Evaluation at Workplaces

Risk is a yardstick used to examine and assess the hazard. Each of the three primary factors—consequence or severity, exposure, and probability—has a predetermined rating. The risk level is calculated by multiplying the values of these three variables. According to Ahmad *et al*. (2016), Risk can be computed by the following formula:

$$\text{Risk (R)} = \text{Likelihood (L)} \times \text{Severity (S)} \quad \text{.....Equation (1)}$$

To define the risk level, the risk assessment matrix has to be determined. The calculations of the risk assessment matrix to yield the risk level consist of the steps

below:

1. Computation of weightage average index (WAI) for the likelihood of hazards

2. Computation of weightage average index (WAI) for the severity of hazards

3. Computation of risk (WAI likelihood x WAI severity) of hazard

4. Determination of the risk assessment matrix in (Table 2.1) and risk level (Table 2.2).

The weightage average index is computed based on the formula in Equation (2):

$$\text{Weightage Average Index (WAI)} = \frac{\Sigma wi\ fi}{\Sigma fi} \qquad \ldots\ldots\ldots\ldots \text{Equation (2)}$$

where:

wi = assigned weight for a particular class under the 5-point Likert scale

fi = corresponding frequency of that specific class

i = 1, 2, 3, 4, 5 that demonstrated the 5-point Likert scale according to specific context.

The computation of WAI for each hazard is interpreted by a schedule of risk assessment matrix in table 2.1 and the indication of risk level in table 2.2. The result from the computation of risk assessment is known as the scale of the risk level.

Table 2.1: Risk Assessment Matrix

LIKELIHOOD OF HAZARDS	SEVERITY OF HAZARDS				
	INSIGNIFICANT (1)	MINOR (2)	MODERATE (3)	MAJOR (4)	FATAL (5)
RARE (1)	1	2	3	4	5
UNLIKELY (2)	2	4	6	8	10
POSSIBLE (3)	3	6	9	12	15
LIKELY (4)	4	8	12	16	20
ALMOST CERTAIN (5)	5	10	15	20	25

Source: HIRARC Accidents at Power plant (Ahmad, *et al*., 2016)

Table 2.2: Indication of Risk Level

RISK LEVEL	
1 to 2	LOW
3 to 6	MEDIUM
7 to 12	HIGH
More than 12	EXTREME

Source: HIRARC Accidents at Power plant (Ahmad, *et al*., 2016)

To examine the occupational risk in the study laboratories, this research was conducted inline with fundamental safety procedure, which includes hazards identification and risk assessment.

2.4.3 Risk Control at Workplaces

Risk control is the process of exclusion or disbanding of a hazard such that it no longer pose a risk to workers. The four rating features of risk under normal recognition, basing on measures taken against risk exposure are:

i. Excellent: entity implements policies that adhere to industry norms and best practices. The likelihood of loss is considered average;

ii. Good: entity takes steps that are in line with workplace standards coupled with best practices. Possibility of loss is rendered average;

iii. Fair: although an organization adopts some policies that come close to industrybest practices and workplace standards, there are still some gaps. Loss possibility is thought to have slightly increased;

iv. Poor: the entity has significant staffing gaps and falls far short of best practices and workplace standards. Loss potential has significantly increased (Ahmad *et al*., 2016).

The risk management or control strategies at workplaces follows the hierarchy below:

1. **Elimination**

   Elimination is a long-lasting risk mitigation measure and ought to be prioritized as the first option to physically remove the hazard.

2. **Substitution**

   Substitution is a mitigation measure meant to replace the hazard.

3. **Engineering control**

   Engineering is a regulatory effort meant to detach people from the hazard.

4. **Administrative control**

   Administrative control is meant to change the way people work.

5. **Personal Protective Equipment (PPE)**

   PPE is based on body parts like the head, eye, ear, respiratory, hand, and foot that need to be protected from potential hazards. (Prastawa, 2021).

Pertiwi *et al*. (2021) summarized the above listed risk controls in the Figure 2.2.

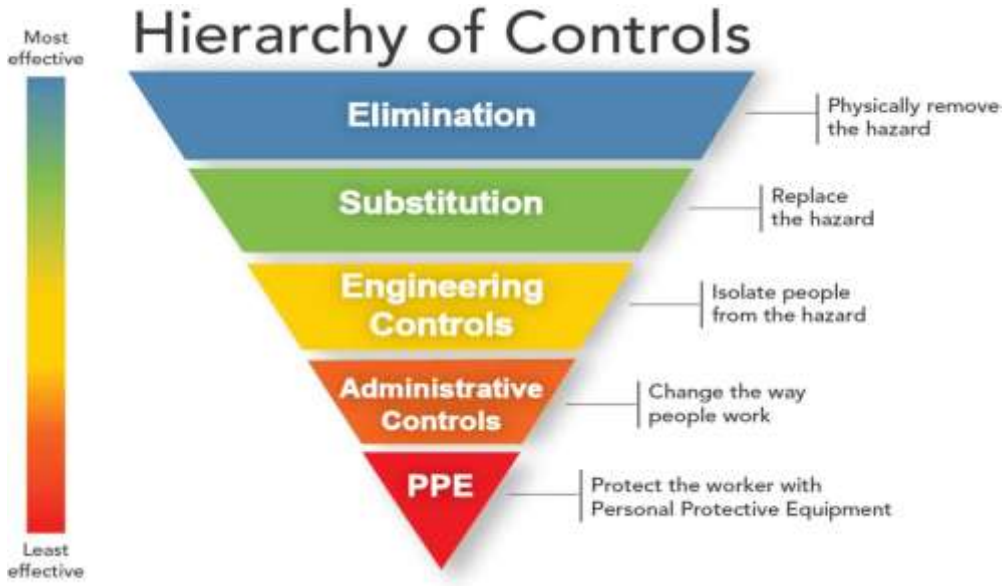

Figure 2.2: Hierarchy of OSH Risk control

Source: Risk management of Material Laboratory of Bali State Polytechnic (Pertiwi, 2021)

Laboratory safety management majorly focuses on refining safety culture and management methods. Laboratory leadership is crucial in establishing a strong safety culture as it improves safety performance and reduces the incidence of laboratory accidents (Zhang *et al*., 2011).

Some studies on human unsafe behavior show that most laboratory accidents are due to man-made operation errors (Shariff and Norazahar, 2012).

According to other studies on management factors, hazardous materials, machinery, and equipment are found in laboratories. If poorly managed, these items pose risks that could result in fatalities or serious injuries (Zhang *et al*., 2011).

2.4.4 Assessment of the Level of Compliance of Workplaces to the Requirements of Uganda's OSH Regulatory Framework.

The Ugandan parliament then, passed new labor laws in 2006, including the EmploymentAct of 2006 (which establishes the terms of the employment relationship between parties), the Occupational Safety and Health Act of 2006 (which deals with safety and health-related issues at work), and the Labour Union Arbitration and Settlement Act of 2006 (which deals with the resolution of labor-related disputes between parties).

However, the absence of cognizance and obliviousness of the regulations by both employers and employees greatly add to occupational violations in the under developed world. The working population is mostly uneducated, semi-educated and lacking expertise. In addition, these do not have the requisite market skills, becoming susceptible to abuses and unfavorable working conditions. Low education levels

expose employees to occupational exploitations as well as safety and health desecrations. This is all due to their minimal cognizance of labour rights and labour laws (Anna, 2017).

The Ministry of Gender Labour and Social Development (MOGLSD) in Uganda has not developed a general checklist for OSH in Laboratories. The assessment of compliance of workplaces and for this study the EML, CML, GFS and GET to the OSHA, 2006 Regulations will be anchored on the observance of the following regulatory framework provisions:

- General duties, obligations, and responsibilities of employers,
- General duties of employers and the self-employed,
- Duties, rights and responsibilities of workers,
- Health and welfare,
- General safety requirements
- Fire preparedness,
- Machinery, plant and equipment,
- Hazardous materials,
- Chemical safety and special provisions.

A checklist for Engineering Materials Laboratories OSH will be developed and evaluated using the ELMERI Observation method to ascertain compliance with the Uganda's OSHA, 2006.

(a) The ELMERI Observation Method

The ELMERI observation method was developed by a Finnish researcher called

Heikki Laitinen. The methodology for measuring workplace safety indexes is hinged on a premise that appraises both working conditions and employee conduct and is a valid and proactive way to measure workplace safety performance (Dalyan *et al.*, 2021).

In the assessment, every item in each part of the workplace, or other area highlighted for observation, is observed and rated as true or false. If an observed item complies with theELMERI Observation Rules, it is rated as "Correct"; otherwise, it is rated "false". If there is an item that cannot be calculated during the observation round, or if the observer does not know how to rate the item, this will show up as a "no observation". The safety index is expressed by the following formula (Laitinen *et al.*, 2013):

$$\text{Safety Index} = \frac{No.of\ Correct\ Items}{No.of\ Correct\ Items + No.of\ not\ correct\ items} .100 \quad \text{....Equation (3)}$$

Workplace safety indices are stated as a percentage (%) and are shown between 0 - 100. In a workplace with a safety index of 70%, it means that 70 out of every 100 occupational health and safety elements are good practices in terms of workplace health and safety. The safety index and accident incidence are inversely proportional. The ELMERI method portrays the instantaneous conditions at the time of the observation; therefore, it is necessary to regularly repeat the observation. ELMERI Observation Method targets to better the present situation by repeating it weekly, monthly, or in periods pre-determined by the users. Hence, safety susceptibilities identified in the foregoing audit are kept under constant check. This method, which measures the effectiveness of the OSH management system with statistical data, assists

in the measurement of the corrective-preventive action steps (Dalyan *et al.*, 2021).

The Elmeri system is the simplest indirect approach of quantitative risk assessment, which rightly does not affect the revealing of occupational hazards. The method is disadvantageous in that all factors that influence the occupational safety are presumed tobe the same. Inspite of this, the application of the Elmeri's system permits the planning of occupational safety actions to eradicate the known inconsistencies, highlights the potential causes of future accidents, assists in the determination of the requirements for improvement, to set objectives and to measure the results of the work done in the area ofworkplace health and safety.

The Elmeri's index, is indirectly related to the existence and valuation of particular risks in the workplace and is anchored on the supposition that the severity of the outcomes related with possible hazards is previously catered for in the statutory health and safety requirements (Bochkovskyi and Sapozhnikova, 2018). He concluded that any recognised risk assessment approaches cannot be taken into consideration to achieve effectiveness and widespread acceptance due to the undervaluation of the human factor component as a crucial constituent of risk.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter centers on the methodology used by the candidate in the study, which includes; the research design, study population, the sample size and selection, sampling techniques and procedure, data collection methods, data collection instruments, validity and reliability, procedure of data collection, data analysis and measurement of variables.

3.2 Research Design and Approach

The candidate used a case study research design. Katebire, (2007) defines a case study as a qualitative research design that contains a deep investigation of a single event instead of using big samples and following a stiff procedure to study the restricted number of variables. He adds that case studies offer a systematic way to evaluate events, gather data, analyze the data, and report results. The candidate used both quantitative and qualitative methods for data collection and analysis.

3.3 Study Population

The study population had a total of 88 staff of which 35 staff were from the Central Materials Laboratory, randomly selected from four (4) sections of the laboratory (soil, concrete, chemical and bitumen laboratories) and the administration; while the entire population of 9 staff were considered from the Engineering Materials Laboratory; which is broadly divided into two sections (cement, cementitious products and clay products and steel, steel products and other engineering materials laboratories). Further, the population considered 19 staff from the Geotechnical Foundation

Services laboratory (GFS) from Laboratory management and three sections (Geotechnical, Soil testing and Concrete and aggregate testing); while 25 staff were considered from the Geotechnical Engineering and Technology Laboratory (GET) from five sections (Geotechnical, Soil testing, Chemical testing, Asphalt testing and Concrete and aggregate testing). This study population mainly considered respondents who included staff from CML namely: The Chief Materials Engineer, 2 Principal Engineers, 3 Senior Engineers, 1 Senior Chemist, 10 Civil Engineers, 8 Laboratory Technicians and 10 Laboratory Assistants. The staff from EML included: 1 Principal Engineer (Head of Laboratory), 1 Senior Engineer, 5 Materials Engineers (One of which was the Quality Coordinator), 1 Laboratory Technician and 1 Laboratory Assistant. The staff from GFS laboratory included; 1 Laboratory Manager, 1 Quality Manager, 1 Health and safety officer, 1 Laboratory Engineer, 3 Senior Technicians, 6 Technicians and 6 Laboratory Assistants. The staff from GET laboratory included; 1 Senior Laboratory Engineer (Quality Coordinator), 7 Laboratory Engineers, 10 Technicians and 7 Laboratory Assistants and 1 Health and safety officer.

The study used a sample size from the CML of the Chief Materials Engineer, 2 Principal Engineers, 3 Senior Engineers, 1 Senior Chemist, 8 Civil Engineers, 7 LaboratoryTechnicians and 9 Laboratory Assistants, making a total of 31 respondents. The sample size from the EML included 1 Principal Engineer, 1 Senior Engineer, 5 MaterialsEngineers, 1 Laboratory Technician and 1 Laboratory Assistant, making 9 respondents. The sample size from the GFS included 1 Laboratory Engineer, 1 Health and safety officer, 6 Laboratory Technicians and 5 Laboratory Assistants, making 13

respondents. The sample size from the GET included 1 Senior Laboratory Engineer (Quality Coordinator), 5 Laboratory Engineers, 1 Health and safety officer, 6 Laboratory Technicians and 6 Laboratory Assistants, making 19 respondents. The grand sample size was 72 respondents, derived from the following formula;

$n = \frac{N}{1+Ne^2}$ ……Equation (4)

Where N = Number of the total population

n = sample size

e^2 = 0.05 level of significance

$n = \frac{88}{1+88x0.05^2}$

$n = \frac{88}{1.22}$

n = 72 (sample size from EML, CML, GFS and GET)

3.4 Sampling Techniques and Procedure

Purposive sampling techniques were employed to choose civil engineers, laboratory technicians, Health and Safety Officers and laboratory assistants for their special knowledge and experience they may have on the study under investigation. This technique has high accuracy and reliability, prompting the selected sample to be a valid representation of the study population. The Senior and Principal staff respondents were chosen from the study laboratories using the purposive sampling method.

3.5 Data Collection Methods

3.5.1 Questionnaire Method

A knowledge, attitude and practice questionnaire survey were employed to physically collect primary data about safety laboratory practices from the selected staff sample.

This method was cheaper and made it possible to gather much data within ashort time. The method is key in collecting quantitative research data.

3.5.2 Interviewing Method

An interview is a conversation or dialogue between two or more people during which the interviewer probes the interviewee for information. This method is useful in capturing qualitative data. According to Amin (2005), an interview guide helps researchers to acquire detailed information about the study in question. Additionally, it can be adjusted, allowing the researcher to go over the questions to ensure that the respondents are providing the information required (Odiya, 2009).

3.5.3 Observation Method

The four laboratories were visited under this study to observe the conditions and the findings were noted. An observation checklist was used to collect these.

3.6 Data Collection Instrument

3.6.1 Questionnaire

The questionnaire instrument was used to gather primary data from thetarget staff of the four study laboratories. Open and close-endedself-administered questionnaires were designed, and given to the respondents. The close-ended questionnaires had respondents restricted to a fixed set of responses with options to choosefrom and these responses were anchored on a four-point Likert scale. Odiya (2009) and Katebire (2007) assert that close-ended questions help to keep the respondent focused, remove immaterial responses and further increase the response rate. The hazards identification questionnaire had three sections: the first section sought information about the location, time, date and questionnaire number; the second section had questions about

the general demographics of the respondents while the third section had questions seekingto identify the occupational hazards in the study area (see appendix A).

Open-ended questionnaires helped to explore and collect detailed data, allowing collection of adequate data in a short period.

The risk management questionnaire had three sections: the first section sought information about the location, time, date and questionnaire number; the second section had questions about the general demographics of the respondents while the third section had questions seeking to identifythe risk management strategies for the various risks' classifications in the study area (see appendix B).

3.6.2 Interview Guide

For this instrument, guides for laboratories were developed and used in line withthe applicable provisions of Uganda's OSHA, 2006. The interview guide was mainly used for data collection while filling the observation-based compliance evaluation matrix (seeappendix C), with the eighteen (18) key informants (4 from EML, 5 from CML, 4 from GFS and 5 from GET) selected from the study sample size. The method was preferred because the intended respondents were few and the candidate filled the matrix. To maintain the confidentiality of the respondents, the following coding was adopted as per the presentation in Table 3.1.

Table 3.1: Coding for Interview Respondents

Study Laboratory	Respondent	Code
Engineering Materials Laboratory (EML)	Respondent 1	EML.1
	Respondent 2	EML.2
	Respondent 3	EML.3
	Respondent 4	EML.4
Central Materials Laboratory (CML)	Respondent 1	CML.1
	Respondent 2	CML.2
	Respondent 3	CML.3
	Respondent 4	CML.4
	Respondent 5	CML.5
Geotechnical Foundation Services Laboratory (GFS)	Respondent 1	GFS.1
	Respondent 2	GFS.2
	Respondent 3	GFS.3
	Respondent 4	GFS.4
Geotechnical Engineering and Technology Laboratory (GET)	Respondent 1	GET.1
	Respondent 2	GET.2
	Respondent 3	GET.3
	Respondent 4	GET.4
	Respondent 5	GET.5

3.6.3 Observation Checklist

In this instrument, the candidate developed and used checklists in line with the applicableprovisions of Uganda's OSHA, 2006 to observe the laboratory environment. The Hazards identification observation checklist had two sections: the first section sought informationabout the location, time, date and questionnaire number while the second section had questions seeking to identify the occupational hazards in the study area (see appendix C).

3.6.4 Document Review

This was used to source for secondary data. The risk registers and the quarterly departmental reports for financial year 2022/2023 were reviewed for the study laboratories entities. Document review is a key source of background information and likewise provides a "behind the scenes" view of a program that may not be directly

observable thereby facilitating a candidate to come up with key and relevant issues that may not have been noticed through other means (Creswell, 2014).

3.7 Data Quality Control

3.7.1 Validity of Data collection instruments

Instruments must measure accurately what they are supposed to measure. According to Katebire (2007), the degree to which the traits were to be measured arepresent in the data collected by an instrument is referred to as validity. The ability of an instrument to gather reliable data, or to measure what it was designed to measure, is knownas validity (Odiya, 2009). Validity and reliability checks were done using a sample of 10 purposively selected staff from SMAT Technical Services Ltd, which is a privately-owned engineering materials testing laboratory, located along Mawanda road in Kamwokya, Kampala.

The content validity index (CVI) was computed (Equation 5). The computed content validity indexes are compared to a cutoff value of 0.7, according to Amin (2005). Any calculated CVI that is greater than 0.7 indicates that the instrument is valid. According toOdiya (2009), the computed CVI should exceed 0.6. The formula below was used in thecalculation of the CVI:

$$CVI = \frac{R}{R+IRR+N} \quad \text{.....Equation (5)}$$

Where;

Relevant (R), Neutral (N), Irrelevant (IR).

Table 3.2. shows the presentation of the CVI results

Table 3. 2: Validity Indices

Item	Content Validity Index
Hazards Identification	0.784
Risk Management strategies	0.715

The calculated CVIs are above the threshold values set by both Odiya (2009) and Amin (2005), thereby implying the validity of the questions in the tools.

3.7.2 Reliability of Data Collection Instruments

Reliability concerns the measure of how correct the instrument is and how steady the datait collects is (Katebire, 2007). According to Amin (2005), an instrument's stability when measuring the object it is intended to measure is referred to as reliability. A pilot test was performed at SMAT Technical Services Ltd, where data were collected on a comparable population to establish the quality of data collection tools. Using the SPSS-provided Cronbach Alpha (α) at 0.05 level of significance, the questionnaire's reliability was evaluated. Table 3.3 presents the Cronbach test results.

Table 3. 3: Reliability Indices

Item	**Cronbach Alpha (α)**	**Number of Questions**
Hazards Identification	0.753	24
Risk Management strategies	0.709	5

The validity of the reliability indices was at above 0.7, the yardstick in a survey (Odiya, 2009). This meant that the questions in the tools were reliable.

3.8 Measurement of Variables

According to Lovelace and Brickman (2013), measurement of variables is done using developed questions based on the nominal and ordinal scales. The nominal scale helps to measure questions on background characteristics. This is so because the nominal

scale has a provision for labels, which help to categorize study items. The ordinal scale is a ranking scale that has the property of order that can quantify the items of the dependentand independent variables. The ranking was done using the four-point Likert Scale (Where 1= Strongly agree, 2 = agree, 3 = disagree and 4 = Strongly disagree). This provided numerical data for quantitative analysis.

3.9 Analysis of Data

3.9.1 Analysis of Qualitative Data

The dispensation of qualitative data involves familiarization with the data via reading, evaluation, re-coding, identification of subjects, and investigation of connections between classes following data collection (Lacey and Luff, 2001).

By utilizing content analysis, which involved the apprehension of the fundamental contexts, the qualitative data were analyzed. The gathered data were grouped into themes and then analysed in line with the research objectives.

3.9.2 Analysis of Quantitative Data

Quantitative data were analysed by grouping it and utilizing statistical presentations for example tables showing frequencies and percentages, pie charts, in addition to graphs forbetter interpretation with (SPSS version 22) software.

3.10 Ethical Considerations

Ethics define the legality or illegitimacy to do something, or what ethical research procedure entails (Neuman, 2006). To uphold research ethics, permission to undertake thestudy in the four study laboratories was sought from the respective laboratory heads.

Other ethical procedures, which were followed included seeking consent of the

respondents. This included enlightening the respondents regarding the aim of the study prior to their participation. A preamble was used to presentthe information. This was accomplished using the questionnaire's opening and introductory remarks. Confidentiality of the responses was guaranteed in that the research instruments (questionnaires plus interview guide) did not capture the name of any respondent. None of the respondents was obliged to divulge their personal details such as phone number, e-mail and their name. The questionnaires were anonymous. In reporting results, pseudonyms were used to analyse interview responses. Additionally, data security was ensured by storing the completed questionnaires under lockable cabinets, and then protection of data and information using passwords input on computerto deter unauthorized access.

3.11 Chapter Summary

The chapter provided the procedure on data collection to permit the realization of the goalsof the research by considering the survey population, who provided relevant information about the study, that is, management, engineers, technicians and laboratory assistants. The chapter also presented the sample selection procedures, data collection, data processing and analysis in addition to ethics considerations in collecting and handling the data.

CHAPTER FOUR

PRESENTATION, DISCUSSION, AND ANALYSIS, OF RESULTS

4.1 Introduction

In this chapter, research findings are presented and analyzed. The chapter begins with descriptive features of the respondents in terms of response rate and then, demographic features. The chapter further presents study findings under themesdeveloped from the four objectives set in Chapter One and related with the literature reviewed in Chapter Two. The actual presentation, analysis, and interpretation of the research findings was preceded by the response rate that helped to provide a synopsis of the representativeness of the findings to the targeted study sample.

4.2 Response Rate

Response rate is a key aspect in establishing the quality of study findings (Krishnan and Poulose, 2016). It is expressed as the ratio of the number of targeted respondents to those interviewed (Morton *et al*., 2012). Rarely does a research tool receive a 100% response rate unless it is administered forcibly to a captive audience (Krishnan and Poulose, 2016). The study initiallytargeted 72 respondents out of which 9 were from EML, 31 from CML, 13 from GFS while 19 were from GET. Table 4.1 indicates that the response rate for EML was 95.5% (21/22*100), the response rate for CML was 72.7% (40/55*100), the response rate for GFS was 75.0% (21/28*100) while the response rate for GET was 79.1% (34/43*100). The response rate was high in all cases implying that the findings are representative and informative. This corollary is supported by the findings of Morton *et al*. (2012), who demonstrated that studies with a much lower response rate—below 50% of the sample—are frequently less accurate

than those with a much higher described response rate, say 70% and above.

The interpretation made is equally supported by Krishnan and Poulose (2016) that high response rates indicate that the study population was truly represented by the sample, hence increasing the key stakeholders' acceptance and credibility of the research findings. It is indicative that the participants are interested in the study especially when it is investigating matters of criticalimportance. Occupational Safety and Health is very pertinent at workplaces accounting to why this study attracted reasonably higher numbers of participants in the study testing laboratories. The candidate further attributes the high response rate for EML (95.5%) to the smallnumber of staff, which made it easy for his research assistant to follow up and get all the responses.

Table 4.1: Response Rates for the Study Laboratories

Study Laboratory	Instrument	Target responses	Actual responses	Response rate (%)
EML	Hazards Identification Questionnaire	9	9	100
	Risk Management Questionnaire	7	7	100
	Interview Guide	6	5	100
	Total	**22**	**21**	
	Overall Response rate			**95.5**
CML	Hazards Identification Questionnaire	31	25	71
	Risk Management Questionnaire	15	10	66.7
	Interview Guide	9	5	71
	Total	**55**	**40**	
	Overall Response rate			**72.7**
GFS	Hazards Identification Questionnaire	13	10	
	Risk Management Questionnaire	9	7	
	Interview Guide	6	4	
	Total	**28**	**21**	**75.0**
	Overall Response rate			
GET	Hazards Identification Questionnaire	19	16	
	Risk Management Questionnaire	15	12	
	Interview Guide	9	6	
	Total	**43**	**34**	**79.1**
	Overall Response rate			**80.6**

Source: Primary Data (2024)

4.3 Demographic characteristics of respondents

The sample size of 72 (Seventy-Two) laboratory staff was used for this research and out of the sample size, only 60 (Sixty) of the staff participated. EML had 9 (nine) respondents contributing to 15% of the total study participants, CML had 25 (Twenty-Five) respondents a contributing to 41.6% of the total study participants, GFS had 10 respondents contributing to 16.7% of the total study participants while GET had 16 respondents contributing to 26.7% of the total study participants . The participants'

gender,age, education level, and laboratory experience distribution among the 60 (Sixty) staff working in the four study laboratories is shown in Figure 4.1,4.2, 4.3 and 4.4 below.

4.3.1 Gender of Respondents

Figure 4.1 displays the characteristics for the respondents' gender in the four research laboratories

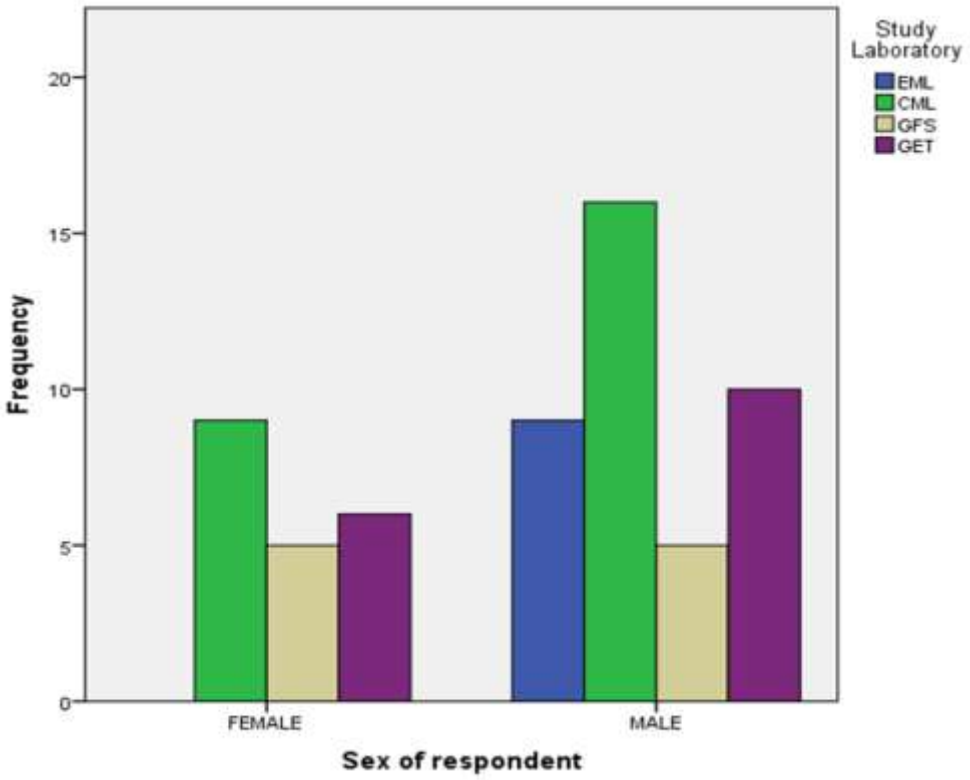

Figure 4.1: Gender Characteristics of Respondents from the Study Laboratories

Source: Primary Data (2024)

Discussion

The result indicates that the gender of the participants comprised 33.3% females and 66.7% males. EML had no female participant since it had no female staff, but it had 9 (nine) males making 100% of the EML sub-sample. CML had 9 (nine) females and 16

(sixteen) males,making 36% and 64% of the CML sub-sample respectively. GFS had 5 (five) females and 5 (five) males,making 50% and 50% of the GFS sub-sample respectively. GET had 6 (six) females and 10 (ten) males,making 37.5% and 62.5% of the GET sub-sample respectively as illustrated in figure 4.1. A key informant from the EML justified theabsence of female staff in this laboratory as follows:

> *"…….over the years, advertisements (internal and external) have been made to fill vacancies in the EML with special encouragement of qualifying females to apply, but the turn up has been low. Even the few who have been applying have not managed to excel in interviews so as to be employed at this laboratory….."* (As reported by EML.2).

4.3.2 Age of Respondents

Figure 4.2 displays the characteristics for the respondents' age in the four Study laboratories.

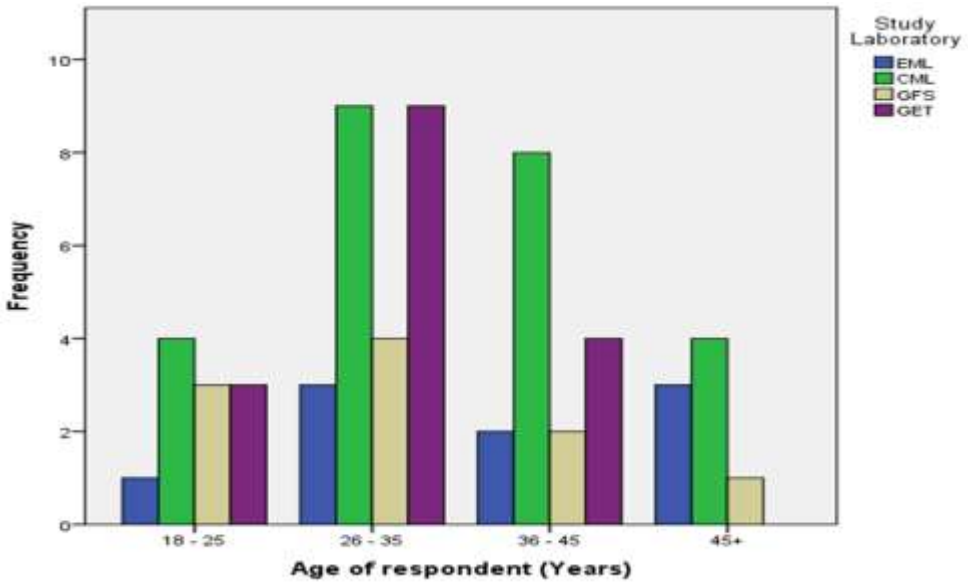

Figure 4.2: Age Characteristics of Respondents from the Study Laboratories

Source: Primary Data (2024)

Discussion

The age distribution of respondents was such that for EML sub-sample, age range 18 –

25years were made up of 1 (one) staff making 11.2%, age range 26 – 35 years had 3 (three)staff making 33.3%, age range 36 – 45 years had 2 (two) staff making 22.2%, and age range 45 years had 3 (three) staff making 33.3%. For the CML sub-sample, age range 18 – 25 years were made up of 4 (four) staff making 16%, age range 26 – 35 years had 9 (nine) staff making 36%, age range 36 – 45 years had 8 (eight) staff making 32%, and age range above 45 years had 4 (four) staff making 16%. For the GFS sub-sample, age range 18 – 25 years were made up of 4 (four) staff making 40%, age range 26 – 35 years had 4 (four) staff making 40%, age range 36 – 45 years had 1 (one) staff making 10%, and age range above 45 years had 1 (one) staff making 10%. Meanwhile for the GET sub-sample, age range 18 – 25 years were made up of 4 (four) staff making 25%, age range 26 – 35 years had 10 (ten) staff making 62.5%, age range 36 – 45 years had 2 (two) staff making 12.5%, and age range above 45 years had no staff.

Overall, the age distribution of the participants in the ranges 18 – 25, 26 – 35, 36 – 45 and above 45 years of the study was 21.7%, 43.3%, 21.7%, and 13.3% respectively, as illustrated in figure 4.2. This demonstrates that the age range of 26 to 45, which has 39 respondents and accountsfor 65% of the sample population overall, is the largest. Since all of the respondents were over the age of 18, the comments were likely the product of thoughtful adults.

4.3.3 Respondents' Education Level

Figure 4.3 displays the characteristics for the respondents' level of education in the four research laboratories.

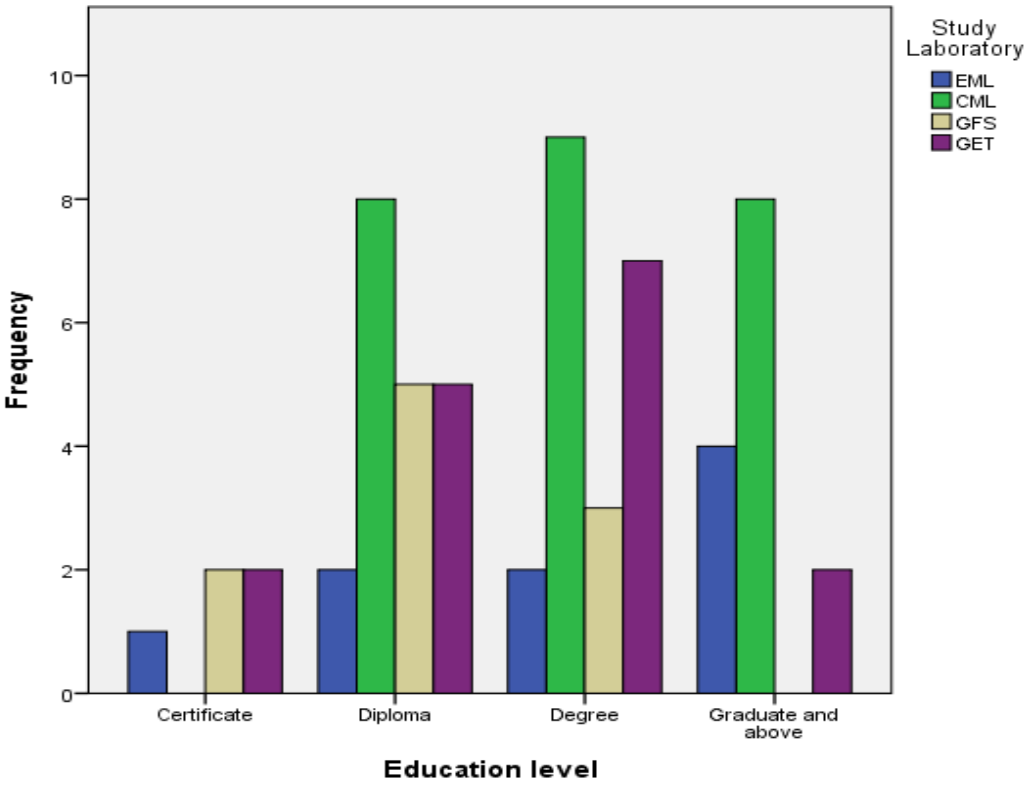

Figure 4. 3: Education characteristics of Respondents from the Study laboratories

Source: Primary Data (2024)

Discussion

The education level distribution for the study laboratories shows that for EML sub-sample, 1 (one) respondent at certificate level making 11.2%, 2 (two) respondents at diploma level making 22.2%, 2 respondents at degree level making 22.2% and 4 (four) respondents at graduate level and above making 44.4% of the sub-sample. For the CML sub-sample, no respondent was at certificate level, 8 (eight) respondents at diploma level making 32%, 9 respondents at degree level making 36% and 8 (eight) respondents at graduate level and above making 32% of the sub-sample. For the GFS sub-sample, 2 (two) respondents at certificate level making 20%, 5 (five) respondents at diploma level making 50%, 3 (three) respondents at degree level making 30% and no respondent at graduate level and above while for the GET sub-sample, 2 (two) respondents at certificate level making 12.5%, 5 (five) respondents atdiploma level

making 31.2%, 7 (seven) respondents at degree level making 43.8% and 2 (two) respondents at graduate level and above making 12.5% of the sub-sample as illustrated in figure 4.3 above. Overall, the education level distribution for the study sample stood at 8.3%at certificate level, 33.3% at diploma level, 35% at degree level and 23.4% at graduatelevel and above. The high number of postgraduate respondents tallies with the finding that the highest number of respondents is above 26 years old as shown in figure 4.2, which shows that there has been a great effort for the staff in three of the laboratories (EML, CML and GET). to advance their education as they work. This assured the candidate that the responses from the study sample were from informed minds.

4.3.4 Laboratory Experience of Respondents

Figure 4.4 displays the characteristics for laboratory experience of the respondents in the four study laboratories.

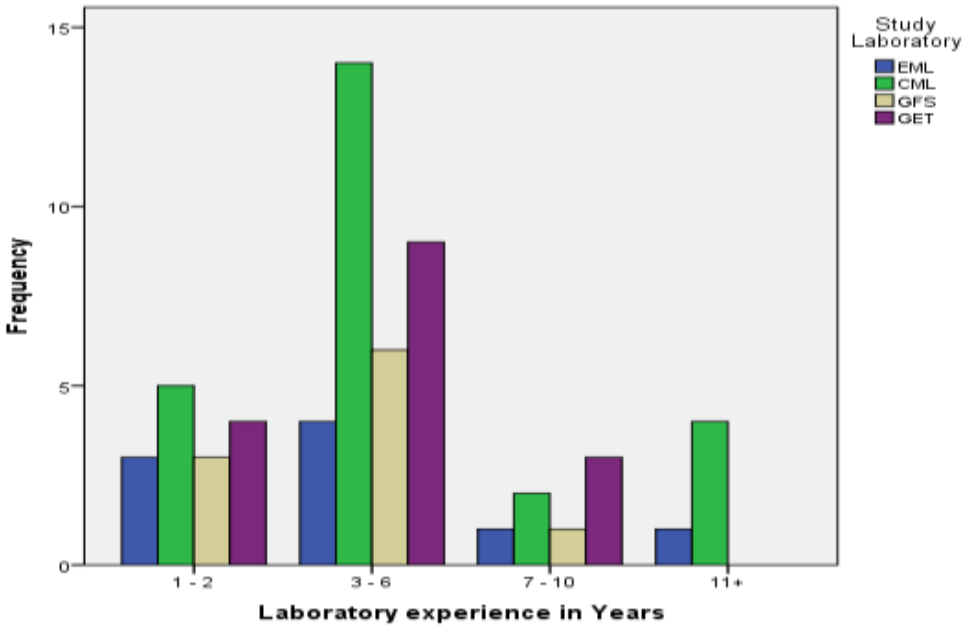

Figure 4. 4: Laboratory experience characteristics of Respondents from the Study laboratories

Source: Primary Data (2024)

Discussion

Figure 4.4 gives the result of the laboratory experience of respondents in the four research laboratories. The result shows that for EML sub-sample, the laboratory experience is such that 3 (three) staff had 1 – 2 years making 33.3%, 4 (four) staff had 3 – 6 years making 44.4%, 1 (one) staff had 7 – 10 years making11.2% and 1 (one) staff had 11 years and above making 11.1%. For the CML sub-sample, 5 (five) staff had 1 – 2 years making 20%, 14 (fourteen) staff had 3 – 6 years making 56%, 2 (two) staff had 7 – 10 years making 8% and 4 (four) staff had 11 years and above making 16%.

For the GFS sub-sample, 3 (three) staff had 1 – 2 years making 30%, 6 (six) staff had 3 – 6 years making 60%, 1 (one) staff had 7 – 10 years making 10% and no staff had 11 years and above. Meanwhile for the GET sub-sample, 4 (four) staff had 1 – 2 years making 25%, 9 (nine) staff had 3 – 6 years making 56.2%, 3 (three) staff had 7 – 10 years making 18.8% and no staff had 11 years and above as illustrated in figure 4.4. Overall, the laboratory experience distribution for the study sample stood at 25% for 1 – 2 years, 55% for 3 – 6 years, 11.7% for 7 – 10 years and 8.3% for 11 years and above. This shows that overall and for individual laboratories, the largest number of respondent staff had laboratory experience of 3 – 6 years, and 75% of the study sample had laboratory experience of 3 years and above; which gave the indication that the respondents were knowledgeable about the variables under study.

4.4 Risks Within the Study Engineering Materials Laboratories

Objective one (1) was to assess the risks within the selected Engineering Materials Laboratories in Uganda. The risk assessment included hazards identification and risk

evaluation. Hazards identification was done for the following hazards; accident hazards, physical hazards, chemical hazards, psycho-social hazards and ergonomics.

Risk (R) = Likelihood (L) x Severity (S)

Weightage Average Index (WAI) = $\frac{\Sigma wi\ fi}{\Sigma fi}$

where:

wi = assigned weight for a particular class under the 5-point Likert scale

fi = corresponding frequency of that specific class

i = 1, 2, 3, 4, 5 that demonstrated the 5-point Likert scale according to specific context.

Risk (R) = Weighted Average Index (Likelihood) x Weighted Average Index (Severity)

Risk (R) = WAI_L x WAI_S

4.4.1 Hazards Identification for Engineering Materials Laboratory (EML)

Tables 4.2 to 4.5 show the hazards identification and risk evaluation for EML.

Table 4.2: Accident Hazards Identification/Risk Evaluation for EML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		EML								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum WL\ fi/\sum fi$)	$W_S * f_i$	WAIs ($\sum WS\ fi/\sum fi$)	Risk ($WAI_L x WAI_S$)
1	Accident	Falls of heavy objects on the head and feet	9	1	4	9	2.1	36	3.9	8.2
		Falls from ladders and other elevated platforms	9	1	4	9		36		
		Slips and falls on wet, uneven, or damaged floors	9	2	4	18		36		
		Cuts and stabs from sharp edges, and broken materials	9	3	3	27		27		
		Fire and explosions in work with flammable gases, liquids, and solids	9	1	5	9		45		
		Chemical burns from corrosive fluids	7	1	4	7		28		
		Eyestrain from work with optical and electron microscopes, telescopic manipulators, computers (VDU), work in dark or semi-dark rooms	9	4	3	36		27		
		Entanglement of clothes, hair, fingers, and arms in rotating and other moving equipment, in particular centrifuges, mixers, blenders	9	1	4	9		36		
		Electrocution and electric shock	9	2	5	18		45		
		Acute poisoning by a wide variety of poisonous gases, liquids, and solids used as starting materials or released in chemical reactions	9	4	4	36		36		
		Burns and scalds from flames, hot surfaces, hot gases, and liquids	9	2	3	18		27		
		Damage to eyes from laser beams, splashes of chemicals, corrosive gases, and flying particles	9	1	4	9		36		
		Flying particles from the bursting of centrifuges e.g., angle grinders and autoclaves	9	4	4	36		36		
TOTAL			115			241		451		

Source: Primary Data (2024)

Table 4.3: Physical Hazards Identification/Risk Evaluation for EML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**EML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
2	Physical	Ionizing radiation: Beta particles, alpha particles, x-rays, gamma rays, neutrons	9	1	4	9	2.3	36	3.0	6.3
		Non-ionizing radiation: Infrared radiation, visible light, ultraviolet light, laser radiation, microwave, and radiofrequency radiation; very- and extremely-low frequency electromagnetic fields	9	1	2	9		18		
		High amplitude whole-body vibration and noise in subsonic (including infrasound) or ultrasonic ranges from vibrating or rotating mechanical equipment or from ultrasound equipment	9	5	3	45		27		
TOTAL			**27**			**63**		**81**		

Source: Primary Data (2024)

Table 4.4: Chemical Hazards Identification/Risk Evaluation for EML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**EML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
3	Chemical	Exposure to an extremely wide variety of chemical substances including substances that are corrosive, neurotoxic, irritating, toxic, allergenic, carcinogenic, mutagenic, teratogenic, asphyxiating, radioactive	9	3	4	27	3	36	4	12
TOTAL			**9**			**27**		**36**		

Source: Primary Data (2024)

Table 4. 5: Ergonomics and psycho-social Hazards Identification/Risk Evaluation for EML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		EML								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum WL\ fi/\sum fi$)	$W_S * f_i$	WAIs ($\sum WS\ fi/\sum fi$)	Risk ($WAI_L x WAI_S$)
1	Ergonomics and psycho-social	Musculoskeletal effects from routine work in a fixed position (esp. long-time standing)	9	1	3	9	1.5	27	3.2	4.8
		Overexertion while moving or otherwise handling bulky and heavy pieces of equipment, packages of chemicals, etc	9	1	4	9		36		
		Cumulative trauma disorders (CTD) as a result of repetitive manual operations, e.g., in pipetting, non-automated counting, manual polishing, etc	9	2	4	18		36		
		Psychological effect of "getting accustomed" to routinely encountered hazards with the resulting loss of alertness	9	3	4	27		36		
		Nuisance odours from chemical substances	9	1	2	9		18		
		Problems associated with unusual working schedules (work at night, on holidays, etc.) required by the continuity of experiments	9	1	2	9		18		
TOTAL			54			81		171		

Source: Primary Data (2024)

4.4.2 Hazards Identification for Central Materials Laboratory (CML)

Tables 4.6 to 4.9 show the hazards identification and risk evaluation for CML.

Table 4. 6: Accident Hazards Identification/Risk Evaluation for CML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**CML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\,fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\,fi/\sum fi$)**	**Risk (WAI_LxWAI_S)**
1	Accident	Falls of heavy objects on the head and feet	25	1	4	25	2.2	100	3.9	8.6
		Falls from ladders and other elevated platforms	25	1	4	25		100		
		Slips and falls on wet, uneven, or damaged floors	25	2	4	50		100		
		Cuts and stabs from sharp edges, and broken materials	25	3	3	75		75		
		Fire and explosions in work with flammable gases, liquids, and solids	25	2	5	50		125		
		Chemical burns from corrosive fluids	25	3	4	75		100		
		Eyestrain from work with optical and electron microscopes, telescopic manipulators, computers (VDU), work in dark or semi-dark rooms	25	2	3	50		75		
		Entanglement of clothes, hair, fingers, and arms in rotating and other moving equipment, in particular centrifuges, mixers, blenders	25	1	4	25		100		
		Electrocution and electric shock	25	2	5	50		125		
		Acute poisoning by a wide variety of poisonous gases, liquids, and solids used as starting materials or released in chemical reactions	25	4	4	100		100		
		Burns and scalds from flames, hot surfaces, hot gases, and liquids	25	2	3	50		75		
		Damage to eyes from laser beams, splashes of chemicals, corrosive gases, and flying particles	25	1	4	25		100		
		Flying particles from the bursting of centrifuges e.g., angle grinders and autoclaves	25	4	4	100		100		
TOTAL			**325**			**700**		**1275**		

Source: Primary Data (2024)

Table 4.7: Physical Hazards Identification/Risk Evaluation for CML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**CML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
2	Physical	Ionizing radiation: Beta particles, alpha particles, x-rays, gamma rays, neutrons	25	1	4	25	2.0	100	3.0	6.0
		Non-ionizing radiation: Infrared radiation, visible light, ultraviolet light, laser radiation, microwave, and radiofrequency radiation; very- and extremely-low frequency electromagnetic fields	25	1	2	25		50		
		High amplitude whole-body vibration and noise in subsonic (including infrasound) or ultrasonic ranges from vibrating or rotating mechanical equipment or from ultrasound equipment	25	4	3	100		75		
TOTAL			**75**			**150**		**225**		

Source: Primary Data (2024)

Table 4. 8: Chemical Hazards Identification/Risk Evaluation for CML

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**CML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
3	Chemical	Exposure to an extremely wide variety of chemical substances including substances that are corrosive, neurotoxic, irritating, toxic, allergenic, carcinogenic, mutagenic, teratogenic, asphyxiating, radioactive	25	3	4	75	3	100	4	12
TOTAL			**25**			**75**		**100**		

Source: Primary Data (2024)

***Table 4.9*: Ergonomics and psycho-social Hazards Identification/Risk Evaluation forCML**

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**CML**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
1	Ergonomics and psycho-social	Musculoskeletal effects from routine work in a fixed position (esp. long-time standing)	25	3	3	75	2.3	75	3.2	7.4
		Overexertion while moving or otherwise handling bulky and heavy pieces of equipment, packages of chemicals, etc	25	2	4	50		100		
		Cumulative trauma disorders (CTD) as a result of repetitive manual operations, e.g., in pipetting, non-automated counting, manual polishing, etc	25	2	4	50		100		
		Psychological effect of "getting accustomed" to routinely encountered hazards with the resulting loss of alertness	25	3	4	75		100		
		Nuisance odours from chemical substances	25	3	2	75		50		
		Problems associated with unusual working schedules (work at night, on holidays, etc.) required by the continuity of experiments	25	1	2	25		50		
TOTAL			**150**			**350**		**475**		

Source: Primary Data (2024)

4.4.3 Hazards Identification for Geotechnical Foundation Services Laboratory (GFS)

Tables 4.10 to 4.13 show the hazards identification and risk evaluation for GFS.

Table 4. 10: Accident Hazards Identification/Risk Evaluation for GFS

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		GFS								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum WL\ fi/\sum fi$)	$W_S * f_i$	WAIs ($\sum WS\ fi/\sum fi$)	Risk ($WAI_L x WAI_S$)
1	Accident	Falls of heavy objects on the head and feet	10	1	4	10	1.8	40	3.9	7.0
		Falls from ladders and other elevated platforms	10	1	4	10		40		
		Slips and falls on wet, uneven, or damaged floors	10	1	4	10		40		
		Cuts and stabs from sharp edges, and broken materials	10	3	3	30		30		
		Fire and explosions in work with flammable gases, liquids, and solids	10	3	5	30		50		
		Chemical burns from corrosive fluids	10	3	4	30		40		
		Eyestrain from work with optical and electron microscopes, telescopic manipulators, computers (VDU), work in dark or semi-dark rooms	10	1	3	10		30		
		Entanglement of clothes, hair, fingers, and arms in rotating and other moving equipment, in particular centrifuges, mixers, blenders	10	1	4	10		40		
		Electrocution and electric shock	10	1	5	10		50		
		Acute poisoning by a wide variety of poisonous gases, liquids, and solids used as starting materials or released in chemical reactions	10	3	4	30		40		
		Burns and scalds from flames, hot surfaces, hot gases, and liquids	10	3	3	30		30		
		Damage to eyes from laser beams, splashes of chemicals, corrosive gases, and flying particles	10	1	4	10		40		
		Flying particles from the bursting of centrifuges e.g., angle grinders and autoclaves	10	1	4	10		40		
TOTAL			**130**			**230**		**510**		

Source: Primary Data (2024)

Table 4.11: Physical Hazards Identification/Risk Evaluation for GFS

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**GFS**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
2	Physical	Ionizing radiation: Beta particles, alpha particles, x-rays, gamma rays, neutrons	10	1	4	10	1.7	40	3.0	5.1
		Non-ionizing radiation: Infrared radiation, visible light, ultraviolet light, laser radiation, microwave, and radiofrequency radiation; very- and extremely-low frequency electromagnetic fields	10	1	2	10		20		
		High amplitude whole-body vibration and noise in subsonic (including infrasound) or ultrasonic ranges from vibrating or rotating mechanical equipment or from ultrasound equipment	10	3	3	30		30		
TOTAL			**30**			**50**		**90**		

Source: Primary Data (2024)

Table 4.12: Chemical Hazards Identification/Risk Evaluation for GFS

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**GFS**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L ($\sum WL\ fi/\sum fi$)**	**$W_S * f_i$**	**WAIs ($\sum WS\ fi/\sum fi$)**	**Risk ($WAI_L x WAI_S$)**
3	Chemical	Exposure to an extremely wide variety of chemical substances including substances that are corrosive, neurotoxic, irritating, toxic, allergenic, carcinogenic, mutagenic, teratogenic, asphyxiating, radioactive	10	3	4	30	3	40	4	12
TOTAL			**10**			**30**		**40**		

Source: Primary Data (2024)

Table 4.13: Ergonomics and psycho-social Hazards Identification/Risk Evaluation for GFS

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		GFS								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum W_L f_i/\sum f_i$)	$W_S * f_i$	WAI_S ($\sum W_S f_i/\sum f_i$)	Risk ($WAI_L x WAI_S$)
1	Ergonomics and psycho-social	Musculoskeletal effects from routine work in a fixed position (esp. long-time standing)	10	3	3	30	2.2	30	3.2	7.0
		Overexertion while moving or otherwise handling bulky and heavy pieces of equipment, packages of chemicals, etc	10	2	4	20		40		
		Cumulative trauma disorders (CTD) as a result of repetitive manual operations, e.g., in pipetting, non-automated counting, manual polishing, etc	10	1	4	10		40		
		Psychological effect of "getting accustomed" to routinely encountered hazards with the resulting loss of alertness	10	2	4	20		40		
		Nuisance odours from chemical substances	10	3	2	30		20		
		Problems associated with unusual working schedules (work at night, on holidays, etc.) required by the continuity of experiments	10	2	2	20		20		
TOTAL			60			130		190		

Source: Primary Data (2024)

4.4.4 Hazards Identification for Geotechnical Engineering and Technology Laboratory (GET)

Tables 4.14 to 4.17 show the hazards identification and risk evaluation for GET.

Table 4.14: Accident Hazards Identification/Risk Evaluation for GET

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		GET								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum WL\ fi/\sum fi$)	$W_S * f_i$	WAIs ($\sum WS\ fi/\sum fi$)	Risk ($WAI_L x WAI_S$)
1	Accident	Falls of heavy objects on the head and feet	16	1	4	16	1.8	64	3.9	7.0
		Falls from ladders and other elevated platforms	16	1	4	16		64		
		Slips and falls on wet, uneven, or damaged floors	16	1	4	16		64		
		Cuts and stabs from sharp edges, and broken materials	16	3	3	48		48		
		Fire and explosions in work with flammable gases, liquids, and solids	16	3	5	48		80		
		Chemical burns from corrosive fluids	16	3	4	48		64		
		Eyestrain from work with optical and electron microscopes, telescopic manipulators, computers (VDU), work in dark or semi-dark rooms	16	2	3	32		48		
		Entanglement of clothes, hair, fingers, and arms in rotating and other moving equipment, in particular centrifuges, mixers, blenders	16	1	4	16		64		
		Electrocution and electric shock	16	1	5	16		80		
		Acute poisoning by a wide variety of poisonous gases, liquids, and solids used as starting materials or released in chemical reactions	16	3	4	48		64		
		Burns and scalds from flames, hot surfaces, hot gases, and liquids	16	3	3	48		48		
		Damage to eyes from laser beams, splashes of chemicals, corrosive gases, and flying particles	16	1	4	16		64		
		Flying particles from the bursting of centrifuges e.g., angle grinders and autoclaves	16	1	4	16		64		
TOTAL			208			384		816		

Source: Primary Data (2024)

Table 4.15: Physical Hazards Identification/Risk Evaluation for GET

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**GET**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L** ($\sum WL\,fi/\sum fi$)	**$W_S * f_i$**	**WAIs** ($\sum WS\,fi/\sum fi$)	**Risk (WAI_LxWAI_S)**
2	Physical	Ionizing radiation: Beta particles, alpha particles, x-rays, gamma rays, neutrons	16	1	4	16	2.0	64	3.0	6.0
		Non-ionizing radiation: Infrared radiation, visible light, ultraviolet light, laser radiation, microwave, and radiofrequency radiation; very- and extremely-low frequency electromagnetic fields	16	1	2	16		32		
		High amplitude whole-body vibration and noise in subsonic (including infrasound) or ultrasonic ranges from vibrating or rotating mechanical equipment or from ultrasound equipment	16	4	3	64		48		
TOTAL			**48**			**96**		**144**		

Source: Primary Data (2024)

Table 4. 16: Chemical Hazards Identification/Risk Evaluation for GET

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		**GET**								
S.N	**Hazard Type**	**Identified Hazard**	**Response Frequency (f_i)**	**Likelihood Assigned Weight, W_L (1-5)**	**Severity Assigned Weight, W_S (1-5)**	**$W_L * f_i$**	**WAI_L** ($\sum WL\,fi/\sum fi$)	**$W_S * f_i$**	**WAIs** ($\sum WS\,fi/\sum fi$)	**Risk (WAI_LxWAI_S)**
3	Chemical	Exposure to an extremely wide variety of chemical substances including substances that are corrosive, neurotoxic, irritating, toxic, allergenic, carcinogenic, mutagenic, teratogenic, asphyxiating, radioactive	16	3	4	48	3	64	4	12
TOTAL			**16**			**48**		**64**		

Source: Primary Data (2024)

Table 4.17: Ergonomics and psycho-social Hazards Identification/Risk Evaluation for GET

HAZARD IDENTIFICATION/RISK EVALUATION FORM										
Laboratory:		GET								
S.N	Hazard Type	Identified Hazard	Response Frequency (f_i)	Likelihood Assigned Weight, W_L (1-5)	Severity Assigned Weight, W_S (1-5)	$W_L * f_i$	WAI_L ($\sum WL\ fi/\sum fi$)	$W_S * f_i$	WAIs ($\sum WS\ fi/\sum fi$)	Risk ($WAI_L x WAI_S$)
1	Ergonomics and psycho-social	Musculoskeletal effects from routine work in a fixed position (esp. long-time standing)	16	3	3	48	2.0	48	3.2	6.4
		Overexertion while moving or otherwise handling bulky and heavy pieces of equipment, packages of chemicals, etc	16	2	4	32		64		
		Cumulative trauma disorders (CTD) as a result of repetitive manual operations, e.g., in pipetting, non-automated counting, manual polishing, etc	16	1	4	16		64		
		Psychological effect of "getting accustomed" to routinely encountered hazards with the resulting loss of alertness	16	2	4	32		64		
		Nuisance odours from chemical substances	16	3	2	48		32		
		Problems associated with unusual working schedules (work at night, on holidays, etc.) required by the continuity of experiments	16	1	2	16		32		
TOTAL			**96**			**192**		**304**		

Source: Primary Data (2024)

4.4.5 Risk Evaluation for the Study Laboratories

Tables 4.2 to 4.17 show the risk evaluation for the different hazards categories in the study laboratories.

The comparative risk evaluation for the four study laboratories is summarized in Figure 4.5.

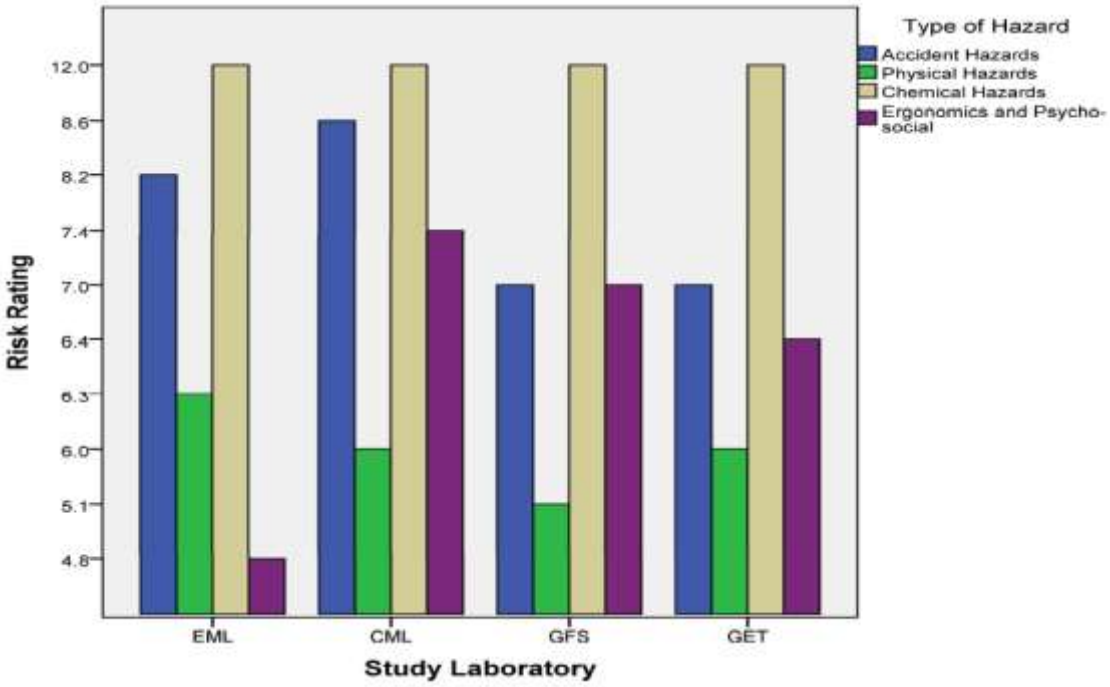

Figure 4. 5: Hazards Risk Rating based on Study Laboratories

Source: Primary Data (2024)

Discussion

Fig. 4-5 shows the graph of hazards ratings based on the four study laboratories. It is observed thatin general every laboratory has all hazards regardless of the risk levels. Chemical hazardsare highest in all the laboratories (risk level 12). For EML, these chemical hazards are mainly in the cement and cementitious products testing laboratory where the analysts had inadequate PPE like the appropriate face masks to prevent inhalation of cement powder. Given that EML was still housed in a temporary structure, there was no provision of a fume hood to help evacuate dangerous gases or dust from the testing environment. Safe disposal of hazardous waste was also lacking at EML. For CML, chemical hazards were high because they handle more chemical tests than EML and their fume hood had been faulty and non-functional for a long time. CML have an incinerator for disposing some of the hazardous waste. However, some chemical wastes were still being discharged to the environment before treatment.

The high levels of chemical hazards in GFS and GET resulted from the fact that whereas these laboratories handle a big number of chemical tests, they do not have fume hoods. The available nose masks for the Analysts cannot guarantee their total safety from the gaseous emissions resulting from the various chemical reactions during analysis.

Accident hazards were ranked second highest for all the laboratories. Both public laboratories (EML and CML) and a private laboratory (GFS) had inadequate PPE for general and specific testing operations; EML and CML lacked sample preparation tables fitted with the appropriate tools for preparing metallic product samples. Regarding preparedness for fire hazards, EML was found to have both fire extinguishers and fire hydrants while CML, GFS and GET only had fire extinguishers in place.

EML scored lowest risk levels in ergonomics and psycho-social factors because most of the activities in this laboratory are short run and can be done in seated position (laboratory seats were readily available). Additionally, EML deals with few chemical tests, attracting less nuisance odours from chemical substances. CML scored the highest risk levels in ergonomics and psycho-social factors because many of the activities in this laboratory required long run standing postures. Even for activities that could permit working in seated position, the majority of the CML's testing staff lack laboratory stools, thereby standing for a long period so as to accomplish the task given. This is worse for lactating and expectant mothers resulting into musculoskeletal effects. Additionally, CML deals with a great quantity of chemicals thereby attracting nuisance odours. The ergonomics and psycho-social issues in GFS and GET

laboratories are a result of staff working for long hours in standing posture due to the nature of the activities and also nuisance odours from the big quantities of chemicals handled in these laboratories.

Physical hazards ranked lowest for three study laboratories namely CML, GFS and GET since the equipment in use did not discharge ionizing or non-ionizing radiations. CML had additionally installed sound test dampers around key noise producing machines like the Los angeles abrasion machine for testing aggregates, although the laboratory had a considerable number of machines that caused high amplitude vibrations to the operating staff.

The higher risk level for physical hazards at EML compared to the other three study laboratories results from the fact that in addition to noise and vibrations from the metal grinder machine, metal polishing machine and the jolting table, EML has a handheld XRF metal spectrometer, which is associated with the emission of X-rays or Gamma rays.

Most of the related previous studies have been done by examining hazards and risks in different laboratories. In a study conducted at Universiti Malaysia Perlis (UniMAP), hazards were identified in four different laboratories namely, Electrical & Electronics, Computer & Software, Mechanical & Process and Material & Sciences. It was reported that Electrics and electronics laboratories had ergonomics issues (risk level 6), where most of the activities in the lab required static postures and activities, making the students to stand for a period of time to complete the task given. Chemical hazards are identified low even in chemical laboratory due to students and staff practicing safe work procedures (Shuaib *et al*., 2009).

4.5 Risk Management Strategies for OSH in the Study Laboratories

Objective two (2) was to identify the risk management strategies for OSH in the selected Engineering Materials Testing Laboratories in Uganda.

Prastawa (2021) established the risk management strategies at workplaces to include: Elimination, Substitution, Engineering Control, Administrative Control, and Personal Protective Equipment (PPE).

The risk management was assessed following the Hazard Identification, Risk Assessment,Risk Control (HIRARC) mechanism as summarised in the tables 4.18 to 4.21. The risk levels were determined following the rating scale; >12 (Extreme), 7-12 (High), 3 – 6 (Medium) and 1- 2 (Low) (Ahmad *et al*., 2016). The respondents were staff at Technician level, officer level, senior level and principal level of service.

Tables 4.18, 4.19, 4.20 and 4.21 show the summary of the risk management strategies for OSH in the Study laboratories.

4.5.1 Risk Management Strategies for OSH in the Engineering Materials Laboratory

Table 4. 18: Risk Management Strategies for OSH in the Engineering Materials Laboratory (EML)

S.N TYPE	HAZARD	RISK ASSESSMENT		*RANK*	*EXISTING CONTROL MEASURES*	CONTROL ACTIVITIES	CANDIDATE'S OBSERVATIONS
		RISK	**RISK LEVEL**				
1	Accident	8.2	High	***2***	Personal Protective Equipment(PPE)	Use of safety gear like gloves, safety shoes, helmets, googles, etc	Most of these are provided periodically but staff rarely use them
					Engineering control	Routine maintenance of equipment, Use of alternative approaches, Use of SOP,	Equipment maintenance culture is still poor. Laboratory has no fume hood.
					Administrative control	Work authorization, strict adherence to safety procedures, Staff training	Safety procedures not strictly adhered to. No evidence of staff training
2	Physical	6.3	Medium	3	Risk monitoring	Monitoring the risks to ensure that they do not increase in levels	No evidence of OSH risks monitoring
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	Safety procedures not strictly adhered to. No evidence of staff training
					Personal Protective Equipment(PPE)	Use of safety gear like ear plugs	Not Available
3	Chemical	12	High	1	Substitution	Use of alternative methods,	No evidence seen
					Elimination	Eliminate the risk source whenever possible	Not possible
					Personal Protective Equipment (PPE)	Use of safety gear like Gloves, Nose masks, googles, etc	No appropriate nose masks and googles in use
					Engineering control	Use of SOP, Routine maintenance of equipment	No Fume hood in place
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	Safety procedures not strictly adhered to. No evidence of staff training
4	Ergonomics and psycho-social	4.8	Medium	4	Administrative control	Sensitisation of staff about OSH, Plan usual working schedules, job rotation,provision of laboratory stools for permitted working in a seated position, Staff training	Only Staff training lacking.
					Engineering control	Mechanisation of heavy-duty manual activities	Limited heavy duty manual activities

Source: Primary Data (2024)

4.5.2 Risk Management Strategies for OSH in the Central Materials Laboratory

Table 4. 19: Risk management strategies for OSH in the Central Materials Laboratory (CML)

S.N TYPE	HAZARD	RISK ASSESSMENT		RANK	EXISTING CONTROL MEASURES	CONTROL ACTIVITIES	CANDIDATE'S OBSERVATIONS
		RISK	**RISK LEVEL**				
1	Accident	8.6	High	2	Personal Protective Equipment (PPE)	Use of safety gear like gloves, safety shoes, helmets, googles, etc	Inadequate supply of PPE and staff rarely use them
					Engineering control	Routine maintenance of equipment, Use of alternative approaches, Use of SOP,	Equipment maintenance culture is still poor. Fume hood is faulty.
					Administrative control	Work authorization, strict adherence to safety procedures, Staff training, Staff sensitisation	Safety procedures not strictly adhered to. No evidence of staff training
2	Physical	6.0	Medium	4	Risk monitoring	Monitoring the risks to ensure that they do not increase in levels	No evidence of OSH risks monitoring
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	Safety procedures not strictly adhered to. No evidence of staff training
					Personal Protective Equipment (PPE)	Use of safety gear like ear plugs	Not Available
3	Chemical	12	High	1	Substitution	Use of alternative methods,	No evidence seen
					Elimination	Eliminate the risk source whenever possible	Not possible
					Personal Protective Equipment (PPE)	Use of safety gear like Gloves, Nose masks, googles, etc	No appropriate nose masks and googles in use
					Engineering control	Use of SOP, Routine maintenance of equipment	Fume hood in place but non-functional
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	Safety procedures not strictly adhered to. No evidence of staff training
4	Ergonomics and psycho-social	7.4	High	3	Administrative control	Sensitisation of staff about OSH, Plan usual working schedules, job rotation,provision of laboratory stools for permitted working in a seated position, Staff training	Staff training lacking. Insufficient laboratory stools for Analysts.
					Engineering control	Mechanisation of heavy-duty manual activities	Inadequate mechanization of heavy duty manual activities

Source: Primary Data (2024)

4.5.3 Risk management strategies for OSH in the Geotechnical Foundation Services Laboratory

Table 4. 20: Risk management strategies for OSH in the Geotechnical Foundation Services Laboratory (GFS)

S.N TYPE	HAZARD	RISK ASSESSMENT		RANK	EXISTING CONTROL MEASURES	CONTROL ACTIVITIES	CANDIDATE'S OBSERVATIONS
		RISK	RISK LEVEL				
1	Accident	7.0	High	2	Personal Protective Equipment(PPE)	Use of safety gear like gloves, safety shoes, helmets, googles, etc	Inadequate supply of PPE and sometimes Staff provide for themselves.
					Engineering control	Routine maintenance of equipment, Use of alternative approaches, Use of SOP,	Equipment maintenance culture is still poor. Laboratory has no fume hood
					Administrative control	Work authorization, strict adherence to safety procedures, Staff training, Staff sensitisation	No evidence of staff training and Staff sensitisation
2	Physical	5.1	Medium	4	Risk monitoring	Monitoring the risks to ensure that they do not increase in levels	No evidence of OSH risks monitoring
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	No evidence of staff training and Staff sensitisation
					Personal Protective Equipment(PPE)	Use of safety gear like ear plugs	Not Available
3	Chemical	12	High	1	Substitution	Use of alternative methods,	No evidence seen
					Elimination	Eliminate the risk source whenever possible	Not possible
					Personal Protective Equipment (PPE)	Use of safety gear like Gloves, Nose masks, googles, etc	No appropriate nose masks and googles in use
					Engineering control	Use of SOP, Routine maintenance of equipment	No Fume hood in place
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	No evidence of staff training and Staff sensitisation
4	Ergonomics and psycho-social	7.0	High	3	Administrative control	Sensitisation of staff about OSH, Plan usual working schedules, job rotation,provision of laboratory stools for permitted working in a seated position, Staff training	Staff training and Staff sensitisation lacking.
					Engineering control	Mechanisation of heavy-duty manual activities	Inadequate mechanization of heavy duty manual activities

Source: Primary Data (2024)

4.5.4 Risk management strategies for OSH in the Geotechnical Engineering and Technology Laboratory

Table 4.21: Risk management strategies for OSH in the Geotechnical Engineering and Technology Laboratory (GET)

S.N TYPE	HAZARD	RISK ASSESSMENT		RANK	EXISTING CONTROL MEASURES	CONTROL ACTIVITIES	CANDIDATE'S OBSERVATIONS
		RISK	**RISK LEVEL**				
1	Accident	7.0	High	2	Personal Protective Equipment (PPE)	Use of safety gear like gloves, safety shoes, helmets, googles, etc	Most of these are provided periodically but some staff rarely use them
					Engineering control	Routine maintenance of equipment, Use of alternative approaches, Use of SOP,	Equipment maintenance culture is good. Laboratory has no fume hood
					Administrative control	Work authorization, strict adherence to safety procedures, Staff training	No evidence of staff training
2	Physical	6.0	Medium	4	Risk monitoring	Monitoring the risks to ensure that they do not increase in levels	No evidence of OSH risks monitoring
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	No evidence of staff training
					Personal Protective Equipment (PPE)	Use of safety gear like ear plugs	Not Available
3	Chemical	12	High	1	Substitution	Use of alternative methods,	No evidence seen
					Elimination	Eliminate the risk source whenever possible	Not possible
					Personal Protective Equipment (PPE)	Use of safety gear like Gloves, Nose masks, googles, etc	No appropriate nose masks and googles in use
					Engineering control	Use of SOP, Routine maintenance of equipment	No Fume hood in place
					Administrative control	Work authorization, strict adherence to safety procedures, Staff sensitisation about the job risks, Staff training	No evidence of staff training
4	Ergonomics and psycho-social	6.4	Medium	3	Administrative control	Sensitisation of staff about OSH, Plan usual working schedules, job rotation, provision of laboratory stools for permitted working in a seated position, Staff training	Only Staff training lacking.
					Engineering control	Mechanisation of heavy-duty manual activities	Inadequate mechanization of heavy duty manual activities

Source: Primary Data (2024)

Regarding the reported risk control measures and activities in Tables 4.18 to 4.21, it was noted that they were quite adequate to lower the high risks to medium risks and the medium risks to low risks in the study laboratories if the gaps highlighted in the last column under "Candidate's Observations" are closed by the respective laboratories' management. One of the key informants said the following:

> *"……The management is aware of the steps that must be taken to improve OSH in this laboratory,however its efforts are crippled by the limited funding from Government towards facilitation of OSH. The situation has been exacerbated by the lapse in the economy caused by the Covid-19 pandemic, which resulted into budget cuts for all Government supported entities including CML. Some of the infrastructure gaps contributing to risks will be addressed when the new laboratorystructure currently under construction is completed and occupied….."* (As reported by CML.3). In the same vein, another key informant from EML had this to say:

> *"……Apart from the inadequate PPE given to this laboratory, there is no functional safety committee to help in enforcing the national OSH regulations. The Risk division at UNBS is very thin on the ground and only handles management system risks. No inspectors from MoGLSD have been seen on the ground conducting safety audits as stipulated by the national OSH regulations in a long time. There is urgent need to improve the financial facilitation towards laboratory OSH by Government / management and also operationalization of the mandated OSH enforcing entities….." (As reported by staff EML.1).*

A key informant from GFS had this to say:

> *"……The laboratory management sometimes provides PPE to staff. However, the replenishment takes long and as such individual staff end up providing for themselves some critical PPEs when they feel that they are working under unsafe conditions……" (*As reported by staff GFS.1*).*

When asked as to why there was no fume hood in such a spacious facility primarily constructed as a laboratory at GET, a key informant from GET had this to say:

> *"…….It is true that this facility has a lot of space, but we had underrated the potential chemical hazards in the Chemical laboratory, thinking that gloves and nose masks were adequate to protect the Analysts. This research has awakened us and I believe that management will consider installing a fume hood in the Chemical laboratory soon……"* (As reported by staff GET.3)

The moderating factors affecting the dependency of Occupational Health and Safety (Dependent variable) on Hazards and Risks Management (Independent variable) are the policy and financing issues. For instance, according to the Auditor General's consolidated report (2023), among the severe limitations that existed in UNBS' enforcement capabilities and infrastructure to test products were the weak laws and institutional roles, low enforcement capacity and un upgraded infrastructure. The report highlighted the need to develop/review OSH policy, laws, regulations, technical standards, strategy, code of conduct, guidelines and manuals. The report further emphasized the need to register all workplaces in Uganda.

According to a report by the Auditor General on enforcement of OSH activities at workplaces by the department of OSH under MoGLSD (2016), only 756 (0.1%) workplaces had been registered out of the estimated over 1 million workplaces. This makes the supervision of the implementation of OSHA, 2006 very hard by MoGLSD.

Other policy and financing issues affecting the effectiveness of OSH include; Management's negligence and lack of priority for OSH, lack of OSH education within the

institutions, lack of investment in OSH management and so on (Kojo *et al*., 2019).

By addressing the above issues, the occupational health and safety of workers will automatically improve. The study findings in general indicate that Government and laboratory management have much to do in enhancing OSH management in testing laboratories.

4.6 Compliance Evaluation Matrix for Occupational Safety and Health for Engineering Materials Testing Laboratories in Uganda

Objective three (3) was to propose a compliance evaluation matrix for Occupational Safety and Health for Engineering Materials Testing laboratories in Uganda. This observation-based compliance evaluation matrix was developed considering the requirements of Uganda's OSH regulatory framework (2006) and the ELMERI observation method. Only those provisions of Uganda's OSH regulatory framework that were relevant to Engineering Materials Testing Laboratories were extracted. The developed observation-based compliance evaluation matrix is attached in Appendix D.

4.7 Level of Compliance of the Study Engineering Materials Laboratories to the Requirements of Uganda's OSH Regulatory Framework

Objective four (4) was to assess the level of compliance of the selected Engineering Materials Laboratories to the requirements of Uganda's OSH Regulatory framework (2006). This assessment for each of the study laboratories was done using the developed observation-based compliance evaluation matrix for OSH as discussed in section 4.6.

Table 4.22 shows the summary of the computed ELMERI safety indexes for the applicable nine provisions of Uganda's OSH regulatory framework for the four study laboratories.

Table 4.22: ELMERI Safety Index of the study Laboratories

Uganda's OSHA (2006) Provision	Study Laboratory Safety Index (SI)			
	EML (%)	**CML (%)**	**GFS (%)**	**GET (%)**
General duties, obligations, and responsibilities of employers (Part III)	47.8	39.1	41.7	50
General duties of employers and the self-employed (Part IV)	85.7	87.5	71.4	71.4
Duties, rights and responsibilities of workers (Part VI)	100	100	100	100
Health and Welfare (Part VIII)	65.7	78.9	78.9	97.4
General Safety Requirements (Part IX)	100	40	100	100
Fire Preparedness (Part X)	60	63.6	100	100
Machinery, Plant and Equipment (Part XI)	100	100	100	100
Hazardous Materials (Part XII)	80	90.5	80	90
Chemical Safety and Special Provisions (Part XIII)	77.8	84.6	78.6	83.3
ELMERI Safety Index (%)	**79.7**	**76.0**	**83.4**	**88.0**

Source: Primary Data (2024)

4.7.1 Level of Compliance of the Engineering Materials Laboratory to the Requirements of Uganda's OSH Regulatory Framework

For EML, the detailed assessed observation-based compliance evaluation matrix is contained in Appendix E. From table 4.22 above, the candidate found that the general safety index (SI) for EML was 79.7% (i.e. the EML was 79.7% compliant to the requirements of Uganda's OSH regulatory framework (2006)).

It was established that the provision with the lowest safety index was general duties, obligations, and responsibilities of employers with SI = 47.8%, the provisions with the highest safety index were duties, rights and responsibilities of workers, general safety requirements, and machinery, plant and equipment with SI = 100%.

4.7.2 Level of Compliance of the Central Materials Laboratory to the Requirements of Uganda's OSH Regulatory Framework

For CML, the detailed assessed observation-based compliance evaluation matrix is contained in Appendix. F. From table 4.22 above, the candidate found that the general safety index for CML was 76.0 % (i.e. the CML was 76% compliant to the requirements of Uganda's OSH regulatoryframework (2006)).

It was established that the provision with the lowest safety index were general duties, obligations, and responsibilities of employers with SI = 39.1%, the provisions with the highest safety index were duties, rights and responsibilitiesof workers, and machinery, plant and equipment with SI =100%.

4.7.3 Level of Compliance of the Geotechnical Foundation Services Laboratory to the Requirements of Uganda's OSH Regulatory Framework

For GFS, the detailed assessed observation-based compliance evaluation matrix is contained in Appendix. G. From table 4.22 above, the candidate found that the general safety index for GFS was 83.4 % (i.e. the GFS was 83.4% compliant to the requirements of Uganda's OSH regulatoryframework (2006)).

It was established that the provision with the lowest safety index were general duties, obligations, and responsibilities of employers with SI = 41.7%, the provisions with the highest safety index were duties, rights and responsibilitiesof workers, general safety requirements, fire preparedness and machinery, plant and equipment with SI =100%.

4.7.4 Level of Compliance of the Geotechnical Engineering and Technology Laboratory to the Requirements of Uganda's OSH Regulatory Framework

For GET, the detailed assessed observation-based compliance evaluation matrix is contained in Appendix. H. From table 4.22 above, the candidate found that the general safety index for GET was 88.0 % (i.e. the GET was 88% compliant to the requirements of Uganda's OSH regulatoryframework (2006)).

It was established that the provision with the lowest safety index were general duties, obligations, and responsibilities of employers with SI = 50%, the provisions with the highest safety index were duties, rights and responsibilitiesof workers, general safety requirements, fire preparedness and machinery, plant and equipment with SI =100%.

The ELMERI Safety Index for workplaces (SI) ranges from 0 – 100 %. Therefore, the closer the SI to 100%, the safer the workplace. The S.I of 0% shows total non-compliance. From the findings in Table 4.22, there is evidence that of the four study laboratories, GET has the safest work environment followed by GFS, which is followed by EML and lastly CML. The scores further indicate that generally the management of the study laboratories (that is the Employers) need to seriously attend to their duties, obligations, and responsibilities as stipulated in the OSHA 2006 in order to improve compliance.

4.8 Chapter Summary

In this chapter, the study findings were presented, discussed and analysed in line with the objectives. The research's main findings have shown that the Engineering materials testing laboratories face OSH hazards categorized under accident, physical, chemical and

ergonomics andpsycho-social. Additionally the study has shown that these laboratories fall short of meeting all the applicable requirements of the national OSH regulations (OSHA, 2006). The predisposing factors causing the failure of the laboratories to meet the regulatory requirements of OSH were also presented and a matrix constructed that showed the most significant provisions. Cognizant of the emerging gaps, this study has designed an observation - based compliance evaluation matrix, which is hoped to narrow the gaps in OSH management for engineering materials testinglaboratories in Uganda.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study assessed occupational safety and health hazards in workplaces in Uganda with particular reference to engineering materials testing laboratories. This chapter presents a summary of the findings, conclusions and recommendations.

5.2 Summary

The study's main objective was to investigate the compliance capacity of the Engineering Materials Laboratory, the Central Materials Laboratory, the Geotechnical Foundation Services Ltd and the Geotechnical Engineering and Technology Laboratory Ltd to Uganda's Occupational Safety and Health Regulations, OSHA 2006. The specific objectives to thestudy were: to assess the risks within the selected Engineering Materials Laboratories in Uganda, to identify the risk management strategies for OSH in the selected Engineering Materials Laboratories in Uganda, to propose a compliance evaluation matrix for Occupational Safety and Health for Engineering Materials Testing laboratories in Uganda and to assess the level of compliance of the selected Engineering Materials Laboratories to the requirements of Uganda's OSH Regulatory framework. This research engaged a case study research design. Questionnaires together with interviews were administered to the nominated respondents. These yielded response rates of 95.5%, 72.7%, 75% and 79.1% for EML, CML, GFS and GET respectively; which by implication revealed that the study was timely as a large percentage were interested in participating. The results were analyzed using SPSS version 22 and presented using descriptive means.

Regarding the risks within the study laboratories, the findings identified that for all laboratories, risks due to chemical hazards ranked highest, followed by risks due to accident hazards. Risks due to physical hazards ranked third for EML as opposed to risks due to ergonomics and psycho-social factors that ranked third for CML, GFS and GET. Risks due to ergonomics and psycho-social factors ranked lowest for EML as opposed to risks due to physical hazards factors that ranked lowest for CML, GFS and GET. From the compliance evaluation of the study laboratories to the requirements of OSHA, 2006, the safety indices indicated that private laboratories provided safer working environment than public laboratories.

Reverberating upon the existing risks in the four laboratories, the OSH risk management strategies inplace as observed were largely similar. The use of PPE cut across all risk levels except for risks due to ergonomics and psycho-social factors.For high and medium risk levels, the respondents reported that the risk management strategies in use included elimination, substitution, engineering controls and administrative controls, and risk monitoring. Despite the existence of the above reported risk management strategies, the generally high-risk levels for the two public laboratories (EML and CML) points at gaps in both Government / Management's financial and policy support to OSH, enforcing the implementation of the risk management strategies by workers as well as conducting of regular OSH awareness and training for laboratory staff.

The risk levels in the two private laboratories (GFS and GET) can also be improved through Government's policy improvement, laboratory's management support to OSH

operations, enforcing the implementation of the risk management strategies by workers as well as conducting of regular OSH awareness and training for laboratory staff.

5.3 Conclusions

5.3.1 Risks in the selected Engineering Materials Laboratories in Uganda

According to the results of risks identification for the four study laboratories, the hazards that were potentially risky in the conducting of the laboratory tests on engineering materials were chemical hazards, accident hazards, physical hazards and ergonomics and psycho-social hazards. Risks due to chemical hazards ranked highest, followed by risks due to accident hazards in all the four study laboratories. Risks due to physical hazards ranked third for EML as opposed to risks due to ergonomics and psycho-social factors that ranked third for CML, GFS and GET. Risks due to ergonomics and psycho-social factors ranked lowest for EML as opposed to risks due to physical hazards factors that ranked lowest for CML, GFS and GET.

The identified risks are serious and thus need urgent attention to be lowered in risk levels by the management of the study laboratories. Priority should be given to lowering the risks due to chemical hazards, which had the highest scores.

5.3.2 Risk Management Strategies for OSH in the selected Engineering Materials Laboratories in Uganda

The respondents from both study laboratories put across workable risk management strategies as summarized in tables 4.18 to 4.21. However, judging from the high and extreme risk levels obtained in this study, the laid down risk management strategies

appeared not to be adequately implemented by the study laboratories, thereby creating room for increase in risk levels. These gaps include inadequate financial resources allocated for OSH operations, inactive safety committees and lack of safety audits from the MoGLSD, lack of risk monitoring tools, laxity in the use of PPEs by workers, lack of staff training on OSH, inadequate staff sensitization on OSH among others. The management of the study laboratories should close the gaps highlighted in the last column 'Candidate's Observations' in tables 4.18 to 4.21 so as to improve on the risk management for OSH.

5.3.3 Level of Compliance of the Study Laboratories to the Requirements of Uganda's OSH Regulatory Framework

Assessment of the level of compliance of the study laboratories to Uganda's OSH regulatory framework indicated that EML, CML, GFS and GET were 79.7%, 76%, 83.4% and 88% compliant to the requirements ofUganda's OSH regulatory framework (2006) respectively. The findings suggest that GET was the most compliant to the national OSH regulatory framework followed by GFS, EML and CML. The candidate envisages that once EML and CML got new permanent and furnished building structures as planned for EML and as was being implemented by CML, then the compliance levels would increase.

5.4 Recommendations

There is need for the study laboratories to develop risk registers capturing both OSH risks and management system risks. The risk registers will help in the monitoringof risk levels in the laboratories.

Institutional safety committees for the laboratories should be activated and empowered to do routine safety inspections of the laboratories. This will help in enhancing hazards identification and ensuring that the planned risk management strategies are being implemented.

Government should increase financial support to OSH operations in the public study laboratories, in addition to developing of modern permanent laboratory structures and facilities for EML & CML.Management of the study laboratories should do compulsory periodic medical checkups for the workers, preferably twice every year. This will make it easier to track how the workplace environment affects employees' health.

Management should regularly conduct OSH awareness and training for staff in the study laboratories. Additionally, periodic OSH audits should be done both internally and by MoGLSD Inspectors with the help of the compliance evaluation matrix developed by this study. This will improve OSH management in the study laboratories.

Management of EML and CML should have designated Health and Safety Officers preferably within their staff for easy monitoring OSH operations.

Management of the study laboratories should look out for all the respective provisions of Uganda'sOSHA 2006 for which this study has rated "**Not correct**" and "**No observation**" in the respectivecompliance evaluation matrices (see Appendices E to H) and ensure compliance.

The developed observation-based compliance evaluation matrix for OSH in engineering

materialstesting laboratories (see Appendix D) should be updated in future whenever there is an amendmentof any of the applicable provisions of Uganda's OSHA 2006.

5.5 Areas for further research

The discoveries reported in this research are informative and conclusive for OSH in public and private engineering materials in house testing laboratories environment in Uganda. However, there is need for studies of OSH in field activities carried out by engineering materials testing laboratories in Uganda.

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APPENDICES

APPENDIX A: Hazards Identification Questionnaire

OCCUPATIONAL HAZARDS IDENTIFICATION QUESTIONNAIRE, ENGINEERING MATERIALS TESTING LABORATORIES

As a requirement at the graduate level of study at Kyambogo University, Lusundo Fred Moses, is currently conducting research on assessing the Occupational Safety and Health hazards at workplaces, taking the case study of four engineering materials testing laboratories.

The purpose of the survey shall be to identify the various occupational hazards in the four engineering materials testing laboratories. The information collected during this study shall be treated with a high level of confidentiality and the information shall be used for academic purposes only.

This questionnaire has three sections to be filled (the location, General demographics and Occupational hazards). Your willingness to respond is highly appreciated and the questionnaire shall not take a lot of time. You are free at any point of responding to the questionnaire to withdraw.

A) Section one: Details of location, time, Date and questionnaire number

Laboratory: ……..

Time: …….. Date: …….. Questionnaire number:……

B) Section two: General demographics

(Tick the appropriate cycle)

1. Which gender are you?

◯ Male ◯ Female

2. Which age group do you belong to?

○ Between 18-25 ○ between 26-35 ○ between 36-45years ○ More than 45 years

3. What is your marital status?

○ Single ○ Married ○ Divorced ○ Separated ○ Widow/Widower

4. Which position level do you hold in this laboratory?

○ Principal ○ Senior ○ Officer ○ Technical ○ Lab. Assistant

5. For how many years have you worked in this laboratory?

○ Between 1-2 ○ between 3-6 ○ between 7-10 ○ 1 and above Other ○ (specify):…

6. Which education level have you attained so far?

○ Certificate ○ Diploma ○ Degree level ○ Graduate level and above

○ Other (Specify)……

C) Section three: Occupational Hazards

This section will examine the potential hazards under the classification of Accident hazards, Physical hazards, Chemical hazards, Psycho-social hazards, and Ergonomics. The responses will be rated on the following Likert scale:

1-Strongly agree, 2-Agree, 3- Disagree, 4- Strongly disagree

C-1: Accident Hazards

Have you experienced (or do you see a possibility of the existence of) the following hazards in your work environment:

S.n	Identified Hazards	1	2	3	4
7	Falls of heavy objects on the head (from overhead storage shelves) and feet?				
8	Falls from ladders and other elevated platforms?				
9	Slips and falls on wet, uneven, or damaged floors?				
10	Cuts and stabs from sharp edges, and broken materials?				
11	Fire and explosions in work with flammable gases, liquids, and solids?				
12	Chemical burns from corrosive fluids?				
13	Eyestrain from work with optical and electron microscopes, telescopic manipulators, computers (VDU), work in dark or semi-dark rooms, etc?				
14	Entanglement of clothes, hair, fingers, and arms in rotating and other moving equipment, in particular centrifuges, mixers, blenders, etc?				
15	Electrocution and electric shock?				
16	Acute poisoning by a wide variety of poisonous gases, liquids, and solids used as starting materials or released in chemical reactions?				
17	Burns and scalds from flames, hot surfaces, hot gases, and liquids?				
18	Damage to eyes from laser beams, splashes of chemicals, corrosive gases, and flying particles?				
19	Flying particles from the bursting of centrifuges e.g., angle grinders and autoclaves?				

20. Any other (Specify)

……...

C-2: Physical Hazards

Have you experienced (or do you see a possibility of the existence of) the following hazards in your work environment:

S.n	Identified Hazards	1	2	3	4
21	Ionizing radiation: Beta particles, alpha particles, x- rays, gamma rays, neutrons?				
22	Non-ionizing radiation: Infrared radiation, visible light, ultraviolet light, laser radiation, microwave, and radiofrequency radiation; very- and extremely-low frequency electromagnetic fields?				
23	High amplitude whole-body vibration and noise in subsonic (including infrasound) or ultrasonic ranges from vibrating or rotating mechanical equipment or from ultrasound equipment?				

24. Any other (Specify)

……...

C-3: Chemical Hazards

Have you experienced (or do you see a possibility of the existence of) the following hazards in your work environment:

S.n	Identified Hazards	1	2	3	4
25	Exposure to an extremely wide variety of chemical substances including substances that are corrosive, neurotoxic, irritating, toxic, allergenic, carcinogenic, mutagenic, teratogenic, asphyxiating, radioactive, etc?				

26. Any other (Specify) ……

C-4: Ergonomics, psychosocial and Organizational factors

Have you experienced (or do you see a possibility of the existence of) the following hazards in your work environment:

S.n	Identified Hazards	1	2	3	4
27	Musculoskeletal effects from routine work in a fixed position (esp. long-time standing)?				
28	Overexertion while moving or otherwise handling bulky and heavy pieces of equipment, packages of chemicals, etc?				
29	Cumulative trauma disorders (CTD) as a result of repetitive manual operations, e.g., in pipetting, non-automated counting, manual polishing, etc.?				
30	Psychological effect of "getting accustomed" to routinely encountered hazards with the resulting loss of alertness?				
31	Nuisance odours from chemical substances?				
32	Problems associated with unusual working schedules (work at night, on holidays, etc.) required by the continuity of experiments				

33 Any other (Specify)
……...

34 Do you have any questions or comments?

……

……

……

Thank you for your participation! If you shall have other questions about the study, contact me at flusundo@gmail.com or on 0782450714, student at Kyambogo University.

APPENDIX B: Risk Management Questionnaire

OCCUPATIONAL RISK MANAGEMENT QUESTIONNAIRE, ENGINEERING MATERIALS TESTING LABORATORIES

As a requirement at the graduate level of study at Kyambogo University, Lusundo Fred Moses is currently conducting research on assessing the Occupational Safety and Health hazards at workplaces, taking the case study of four engineering materials testing laboratories.

The purpose of the survey shall be to identify the risk management strategies in place for the various occupational hazards in the four (4) laboratories.

The information collected during this study shall be treated with a high level of confidentiality and the information shall be used for academic purposes only.

This questionnaire has three sections to be filled (the location, General demographics and Risk management strategies). Your willingness to respond is highly appreciated and the questionnaire shall not take a lot of time.

A. Section one: Details of location, time, Date, and questionnaire number

Laboratory:

…….

Time: …… Date: …….. Questionnaire number:……

B. Section two: General demographics

1. Gender ☐ Male ☐ Female

2. Age group

☐ 18 – 25 Years ☐ 26 – 35 Years ☐ 36-45Years Above 45 Years ☐

3. For how long have you been working in this laboratory?

☐ Below 2 Years ☐ 2 – 5 Years ☐ 6-10Years Above 10 Years ☐

4. Which position level do you hold in the laboratory?

☐ Technician ☐ Officer ☐ Senior ☐ Principal

5. For how long have you worked in the position in (4) above?

……

1 Section three: Risk Management Strategies

This section will examine the prevailing Risk management strategies that are being used by Management to check Low risks, Medium risks, High risks, and Extreme risks.

- **Low risks** have minor severity, are acceptable- remedies not required, e.g. leading to disability but no permanent injury,
- **Medium risks** have serious severity, have to be tolerated – monitoring required, e.g. leading to non-fatal injury, permanent disability,
- **High risks** have fatal severity with remedies required, e.g. leading to approximately one single fatality, major property damage,
- **Extreme risks** have catastrophic severity and are un acceptable, e.g. leading to numerous fatalities, irrecoverable property damage and productivity.

C-1: Low risks

6. Which risk management strategies do you use to manage Low risks?

……

……

C-2: Medium Risks

7. Which risk management strategies do you use to manage medium risks?

……

……

C-4: Extreme Risks

8. Which risk management strategies do you use to manage High risks?

   ……

   ……

9. Do you have any questions or comments?

……

……

Thank you for your participation! If you shall have other questions about the study, please contact me at flusundo@gmail.com or on 0782450714, student at Kyambogo University.

APPENDIX C: Observation Checklist

OCCUPATIONAL HAZARDS IDENTIFICATION OBSERVATION CHECKLIST, ENGINEERING MATERIALS TESTING LABORATORIES

As a requirement at the graduate level of study at Kyambogo University, Lusundo Fred Moses, is currently conducting research on assessing the Occupational Safety and Health hazards at workplaces, taking the case study of four engineering materials testing laboratories.

The purpose of the survey shall be to identify the various occupational hazards in the four engineering materials testing laboratories.

The information collected during this study shall be treated with a high level of confidentiality and the information shall be used for academic purposes only.

This Observation Checklist has two sections to be filled by the Researcher (the location, and Occupational hazards). During the survey, the researcher will interact with some staff, and their willingness to respond is highly appreciated.

D) Section one: Details of location, time, Date, and questionnaire number

Laboratory: …….

Time: …….. Date: …….. Questionnaire number:……

E) Section two: Occupational Hazards

This section will examine the potential hazards under the classification of Physical hazards, Chemical hazards, Ergonomics, and Psycho-social hazards.

The responses will be rated on the following Likert scale:

1-Strongly agree, 2-Agree, 3- Disagree, 4- Strongly disagree

B-1: Physical Hazards

S.n	Identified Hazards	1	2	3	4
1	Presence of any disturbing noise in the workplace?				
2	Workers subject to vibrations?				
3	Temperature extremes that could affect workers, equipment, or materials?				
4	Workers exposed to any radiation?				
5	Workers working at times of day that could affect vision?				

6. Any other (Specify) ……...

B-2: Chemical Hazards

S.n	Identified Hazards	1	2	3	4
7	Workers exposed to anything that can be inhaled, ingested, or absorbed into the body?				
8	All chemicals labeled and classified properly?				
9	All workers dealing with chemicals trained or certified in handling those specific chemicals?				
10	Provisions supplied for possible chemical accidents?				
11	Proper disposal of chemical hazards available?				

12. Any other (Specify) ……...

B-3: Ergonomics/ Work design Hazards

S.n	Identified Hazards	1	2	3	4
13	Injury or strain arising from the design and organization of a worker's workspace?				
14	Presence of blind spots or poorly lit areas in the workspace?				
15	Are all shelving or storage units secured?				
16	Walking and driving paths clear and free of obstructions?				
17	Presence of access to emergence escape routes?				
18	Presence of emergency fire fighting equipment e.g Fire hydrants, Fire extinguishers?				
19	Availability of an equipped First Aid box in an accessible location?				
20	Presence of a functional Safety officer for the section?				

21. Any other (Specify) ……...

B-5: Psycho-social Hazards

S.n	Identified Hazards	1	2	3	4
22	Workers at risk from threats or violent attacks from the public?				
23	Individuals at risk from bullying or aggression from other employees within the company?				
24	Tasks evenly distributed to prevent one individual from experiencing work overload?				
25	Job roles defined so that workers do not feel uncertain and lack job control?				

26 Any other (Specify) ……...

27 Additional comments

……

……

……

APPENDIX D: Observation-based Compliance Evaluation Matrix for OSH in Engineering Materials Testing laboratories inUganda

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 1 of 9		
S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Duty of employers to protect workers	Employer takes all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost			
			Employer ensures, as far is reasonably practicable, that the working environment is kept free from any hazard due to pollution by using technical measure to new plant/ processes or adding to existing plant/processes or using supplementary technical measures			
			Provision and maintenance of plant and systems of work that give, as far as is reasonably practicable, a safe working environment including its vicinity			
			Arrangements for ensuring safety and absence of risks to health, in connection with the use, handling, storage and transport of articles and substances			
			Provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking			
			Provision and maintenance of means of access to and exit from the workplace, that are safe and without risks to health			
			Provision and maintenance of a working environment for the workers, that is, as far as is reasonably practicable, safe, without risks to health and which is adequate, regarding facilities and arrangements for the welfare of workers at work			
			Provision, where necessary, of adequate personal protective equipment to prevent, as far as is reasonably practicable, the risks of accidents or of adverse effects on health			
		Safety and health measures of employers	An employer who has at least twenty workers at a workplace shall prepare, and as often as may be appropriate, revise a written statement of policy with respect to the safety and health of employees while at work			
			An employer who has at least twenty workers at a workplace shall make arrangements for carrying out the statement of policy			
			An employer who has at least twenty workers at a workplace shall bring the statement of policy and any revision of it to the notice of all the employees			
		Safety representatives	The Minister shall make regulations to provide for the appointment, in prescribed cases, of safety representatives			
			Every employer has a duty to consult a safety representative in the making and sustenance of arrangements, which enable the employer and the workers to co-operate effectively in promoting the development of measures to ensure the safety and health of employees			
		Safety Committees	Presence of a Safety Committee appointed by the employer for a workforce of at least 20 workers			
			Safety representatives represent employees on a safety committee			
			A safety committee keeps under review the measures taken to ensure the safety and health of employees and any other functions as may be prescribed			
		Employer to consultwith workers' organisations	Consultation on the role of the workers' organisation in the practical implementation of measures prescribed under this Act			
			Provision of close collaboration at all levels, between the employer and the workers in the application of the measures prescribed under this Act.			
			A representative of the employers and that of the workers accompanying an Inspector or any other authorised person supervising the application of any measures prescribed under this Act, except where the inspector or authorized person is of the view that the accompaniment shall prejudice the performance of his or her duties.			

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Employer to monitor and control the releaseof dangerous substances into the environment	Employer to arrange for equipment and apparatus to monitor the air, soil, and water pollution in case there is major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes, or soil and which are a danger to the animal and plant life			
			Records of monitoring in subsection (above) to be kept and made available to an Inspector.			
		Employer to provide protective gear	Employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.			
			Employer ensures that personal protective equipment provided is used whenever it is required			
		Employer to provide alternative suitable employment	Job rotation in case an assignment involves continuous exposure of the worker to dangerous emissions or to substances and agents, which are medically found to be harmful to health.			
		Employer to supervise the health of workers	Employer conducts a pre-assignment medical examination of workers, before assignment to specific tasks which may involve danger to their health or of that of others			
			Employer conducts periodic medical examinations of workers during employment which involves exposure to a particular hazard to health			
			Employer informs a worker concerned of any health hazards involved in his or her work			
		Medical records of workers to be kept	Employer keeps and maintains records of the medical examination information in a format and for a period to be prescribed by the Minister, and avails these records for epidemiological and other research			
			To the extent determined by the Commissioner, records kept under this section include information onoccupational exposure to air pollution and other harmful agents			
Total: 29 regulations under General duties, obligations, and responsibilities of employers						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 2 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
2	General duties of employers and the self-employed (Part IV)	Employers' duty to persons other than employees	Employer conducts his or her undertaking in a way that ensures, as far as is reasonably practicable, that any person who is not in his or her employment but who may be affected by the undertaking, is not exposed to risks to his or her health and safety.			
			Where two or more employers undertake activities simultaneously at one workplace, they have a duty to collaborate, in order to comply with the prescribed measures, without prejudice to the responsibility of each of the employers, for his or her workers.			
		Employer to display guide safety precautions	Employer displays or provides guide safety precautions to any persons who may be affected by the manner in which the employer conducts his or her undertaking, whether or not that person is his or her worker			
			Employer displays all information in his or her possession or control concerning the way in which he or she conducts the undertaking, which may affect any person's health or safety			
		Duty to provide safe premises	A person in control of premises provides the means of access to and exit from the premises or any plan or substances in the premises and takes any measures that are reasonable for a person in his or her position to ensure, as far as is reasonably practicable, that the premises remain safe and without risk to health			
			Person in control of premses maintains or repairs the premises or any means of access to or exit from the premises			
			Person in control of premses ensures the safety of or the absence of risk to health arising from a plant or substances in the premises			
		Duty of controller of premises to keep air free of pollutants	Person with control of premises uses the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and renders harmless and inoffensive any substances that may be emitted.			
Total: 8 regulations under General duties of employers and the self-employed						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 3 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
3	Duties, rights and responsibilities of workers (Part VI)	Duty of workers to take care	Workers take reasonable care for the health and safety ofthemselves and of any other person who may be affectedby their acts or omissions at work			
			In case of duty or requirement imposed on an employer or any other person, by or under a statutory provision, workers do cooperate with the employer, as far as is necessary, to enable the duty or requirement to be performed or complied with.			
			Representatives of the workers in an undertaking cooperate with an employer in all measures to eliminate or minimize risks to health and safety at work provided in this Act and any other law			
		Duty to report dangerous situation to immediate supervisor	Worker reports immediately to a supervisor any situation which the worker has reasonable grounds to believe presents an imminent or serious danger to his or her life or health or to the life or health of any other persons in the premises.			
			Employer before taking remedial action does not require the worker to return to a work situation where there is reported continuing imminent or serious danger to life or health.			
		Workers' right to move away from dangerous situation	A worker who removes himself or herself from a work situation which he or she has reasonable justification to believe presents an imminent and serious danger to his or her life or health is not punished or subjected to undue consequences, provided the danger is confirmed by the Commissioner.			
		Workers not to be penalized for complying with Act	An employer does not levy or permit to be levied on any worker any penalty in respect of anything done or provided under this Act			
		Reckless or intentional interference with safety measures	A person who intentionally or recklessly interferes with or misuses anything provided in the interest of health, safety or welfare under this Act, commits an offence.			
Total: 8 regulations under Duties, rights and responsibilities of workers						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	……	Date:	Sheet 4 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
4	Health and Welfare (Part VIII)	Buildings at workplaceto be of sound construction, etc	Buildings forming part of the Laboratory are of sound construction and are kept in a good state of repair			
			Every building used as a workplace is designed to protect workers from the weather			
			Every building used as a workplace has a water-tight roof			
			Every building used as a workplace is free from any significant amount of dampness that is liable to affect thesafety of the building or the health of the workers			
			Where any process carried out in a workplace renders the floor of a building of the workplace liable to be wet to an extent that necessitates the wetness to be removed by drainage, a drainage system is be provided and maintained in the building			
		Workplaces to be kept clean	Every workplace kept in a clean state and free from effluvia arising from any drain, sanitary convenience or other nuisance			
			Any accumulation of dirt and refuse removed daily by a suitable method from the floor and benches of workrooms, and from the staircases and passages			
			The floor of every workroom is cleaned at least once in every week by an effective and suitable method			
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they have a smooth impervious surface, are washed with hot water and soap or cleaned by some other suitable method, at least once every fourteen months			
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they arekept painted with oil paint or varnished, are re-painted or re-varnished at least once every seven years, and at least once every fourteen months are washed with hot water and soap or cleaned by some other suitable method			
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, in any other case, are kept whitewashed or colour-washed and the whitewashing or colour-washing be repeated at least once every fourteen months			
		Healthy and safe working environment	A suitable room temperature is secured for workers in buildings, having regard in any workplace, to the numbersof workers, the ventilation and air movement, the air humidity and temperature of the surroundings			
			Laboratory is not, while work is being carried on, so over-crowded, so as to cause risk of injury to the health ofthe workers			
			Every workroom is not less than three metres in height, measured from the floor to the lowest point of the ceiling or where there is no ceiling, to the lowest point of the roofing material			
			Provision of an effective and suitable system for securing and maintaining the circulation of fresh air, in each workroom			
			Where mechanical means of ventilation are used, they are regarded as satisfactory if they provide a supply of airthat adequately removes odours and contamination of the atmosphere that arises from human occupation of the room			
		Workplaces to have suitable lighting	Suitable lighting, whether natural or artificial, secured and maintained in every part of a workplace in which any person works or passes			
			All glazed windows and skylights used for lighting workrooms are, so far as is practicable, kept clean on both the inner and outer surfaces and free from obstruction, except in cases of whitewashing or shading of windows and skylights, for the purpose of mitigating heat or glare			

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Workplaces to have suitable lighting	All apparatus provided for producing artificial lighting are be properly maintained			
		Provision of adequatesanitary conveniences	In the Laboratory, sufficient and suitable sanitary conveniences for the workers are provided, maintained and kept clean			
			In the Laboratory, effective provisions are made for lighting the conveniences			
			Where persons of both sexes are or are intended to be employed, the conveniences have proper, separate accommodation for persons of each sex			
			Where persons of both sexes are or are intended to be employed, the conveniences have separate approaches for each sex			
			The conveniences for each sex are indicated by a suitable notice.			
		Provision of adequate wholesome drinkingwater	An adequate supply of wholesome drinking water provided and maintained at suitable points in a workplace, conveniently accessible to all workers			
		Provision of adequatewashing facilities	Employer provides and maintains for the use of workers, adequate and suitable facilities for washing, which are conveniently accessible and kept in a clean condition			
			Where any premises become a workplace after the coming into force of this Act (2006), the washing facilities be provided adjacent to the sanitary conveniences			
		Cloakrooms	A suitable cloakroom provided and maintained for the use of workers			
		Facilities for sittingdown	Where workers have reasonable opportunity to sit during the period of their work, sufficient and suitable seats are provided and maintained by the employer, to enable the workers take advantage of the opportunity to sit.			
			Where a substantial proportion of any work can be properly done while sitting, an employer provides and maintains, for each employee doing the work, a seat of a design, construction and dimension suitable for that work			
		Facilities for meals	Employer provides and maintains adequate facilities for taking meals, due regard being made to the number of workers who remain on the premises during meal times			
			The facilities for taking meals be situated away from the habitual work positions and also include tables and chairs or benches with backrests.			
		First aid at the workplace	Employer provides a first-aid room or a room capable of being used for the purpose of administering first-aid			
			Where the provision of a first-aid room is not reasonably practicable, an employer provides and maintains a readily accessible first-aid box or cupboard of a prescribed standard			
			A first-aid room, box or cupboard does not contain articles other than those which are necessary for administering first-aid			
			A first-aid room, box or cupboard is under the charge of a responsible person and where more than a specified number of persons are employed, the person in charge is trained in first aid treatment			
			The person in charge of a first-aid room, box or cupboard is readily available during working hours			
			A notice stating the name of the person in charge of a first-aid room, box or cupboard is posted in a conspicuous place in the workplace			
Total: 38 regulations under Health and Welfare						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 5 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
5	General Safety Requirements (Part IX)	General Safety Requirements	There is, as far as is reasonably practicable, provision and maintainance of safe means of access to every place at which any person has to work at any time			
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are soundly constructed and properly maintained			
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, as far as is reasonably practicable, are kept free of obstructions which may cause a worker to fall or suffer any other injury			
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are kept free of any substance likely to cause an employed person to slip			
			The staircases on the premises inside and outside a building have hand-rails and guard-rails which are properly maintained at all times			
			A staircase has at least one hand-rail throughout the length of the staircase			
			A staircase has a hand-rail on the open sided section and a lower rail in the gap between the hand-rail at the open- sided section and the tread-level, unless that gap is filled in a way that prevents persons from falling through			
			Where a staircase or any part of it is specifically liable to cause an accident because of its construction, or for any other reason, there is a handrail on each side of the staircase			
			There is sufficient, clear and unobstructed space at every machine while it is in motion to enable work to be carried on without unnecessary risk			
Total: 9 regulations under General Safety Requirements						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 6 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
6	Fire Preparedness (Part X)	Means of escape in case of fire	Laboratory premises has means of escape from fire, for workers, as may be reasonably required in the circumstances, and in determining what is required by way of escape, regard was paid to the number of persons expected to be working in the premises at any one time and to the number of persons other than employed persons expected to be in the premises at that time			
			All means of escape from fire are properly maintained and kept free from obstruction			
			The contents of any room in which a person is employed are arranged or disposed to provide a free passage way for the persons employed in the room, as a means of escape in case of fire			
			The door of the Laboratory which afford a means of exit for a person employed in the workplace is not locked or fastened in such a manner that it cannot be easily and immediately opened from inside			
			In the case of any Laboratory constructed or converted for use as a Laboratory after the commencement of this Act, all doors which afford means of exit from the Laboratory for the persons employed in it, are, except in the case of sliding doors, constructed to open outwards			
			Every window, door, or other exit which afford means of escape in case of fire or giving access to it, other than the means of exit in ordinary use, is distinctively and conspicuously marked by a notice printed in red letters of an adequate size			
			Effective steps are taken to ensure that all the persons employed are familiar with the means of escape in case of fire, and with the routine to be followed in case of fire			
		Fire extinguishing gadgets	Laboratory has provision of readily accessible and well maintained, means of extinguishing fire, which is adequate and suitable, having regard to the circumstances of each case			
		Safe keeping of inflammable substances	All stocks of highly inflammable substances are kept in a fire-resistant store or in a safe place outside any occupied buildings			
			The store is not situated in a way that endangers the means of escape from the workplace or from any part of the workplace by persons employed in it, in the event of fire occurring in any part of the workplace			
		Occupier's duty to ensure adequate fire response	Laboratory staff are aware that it is their responsibility to ensure adequate preparedness and response to any fire incidents in their premises			
Total: 11 regulations under Fire Preparedness						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 7 of 9		
S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
7	Machinery, Plant and Equipment (Part XI)	Fencing of dangerous machinery, plant, and equipment	Every flywheel directly connected to any prime mover and every moving part of any prime mover, is securelyfenced, whether the flywheel or prime mover is situated in an engine-house or not			
			Every part of an electric generator, motor or rotary converter and every flywheel directly connected to it, is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises as it would be if it were securely fenced			
			Every part of the transmission machinery is securely fenced unless it is in such a position or of such constructionthat is safe to every person employed or working on the premises, as it would be if it were securely fenced			
			Every dangerous part of any machinery, other than a prime mover and transmission machinery is securely fenced unless it is in a position or of construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced			
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked butwhere this is not possible, the requirement is deemed to be satisfied where a device is provided which automatically prevents any employed person or his or her clothing from coming into contact with the dangerous parts			
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked butwhere this is not possible, the requirement is deemed to be satisfied where a device is provided which stops the machine immediately in case of approach by an employed person to a dangerous part			
			Any part of a stock-bar which projects beyond the headstock of a lathe is securely fenced unless it is in a positionthat is safe to every employee on the premises as it would be if it were securely fenced			
			All fencing or other safeguards provided under this Part of the Act is be of substantial construction and is constantly maintained and kept in position while the parts required to be fenced or safeguarded are in motion or inuse			
		Efficient control of power	Efficient devices or appliances are provided and maintained in every room or place where work is carried on, by which power can promptly be cut off from the transmission machinery in that room or place, where there is eminent danger			
			Every machine intended to be driven by mechanical power is provided with an efficient starting and stoppingappliance and the control of the starting and stopping appliance of which is in such a position as to be readilyand conveniently operated by the person operating the machine			
		Self-acting machines	No traversing part of any self-acting machine and no material carried by it is, if the space over which it runs is a space which any person is liable to pass in the course of his or her employment or at any other time, allowed on itsoutward or inward traverse to run within a distance of five centimetres from any fixed structure which is not part of the machine			
			All practicable steps are taken by instructions to the person in charge of the machine to ensure that a person employed is not in the space between any traversing part of a self-acting spinning mule and any fixed part of the machine towards which the traversing part moves on the inward run, except when the machine is stopped, with thetraversing part on the outward run			
Total: 12 regulations under Machinery, Plant and Equipment						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		%		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	.....	Date:	Sheet 8 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
8	Hazardous Materials (PartXII)	Handling of hazardous materials	Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by enclosure of the plant used in the process			
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by removal or prevention of accumulation of any dust that may escape inspite of the enclosure			
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by exclusion or effective enclosure of possible sources of ignition			
			Where there is dust of a character and an extent liable to explode on ignition, in a plant in the above process, unless the plant is constructed to withstand the pressure likely to be produced by an explosion, all practicable steps are taken to restrict the spread and effects of the explosion by the provision of chokes, baffles and vents, or other equally effective appliances, to the plant			
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to remove the substance and any fumes arising from it			
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to render them non-explosive or non-inflammable			
			Where any plant, tank or vessel is subjected to an operation in above, no explosive or inflammable substance is allowed to enter the plant, tank or vessel until the metal has cooled sufficiently to prevent any risk of igniting the substance			
		Electrical apparatus, etc to be fit for work meant	All electrical apparatus, fittings and conductors are sufficient in size and power for the work they are meant forand are constructed, installed, protected, worked and maintained to prevent danger, as far as is reasonably practicable			
		Toxic materials to be used as last resort	Toxic materials or substances are only used where the use of a nontoxic material or substance is not reasonably practicable			
			Without prejudice to subsection above, where toxic materials or substances are present or used, the number of employed persons exposed to risk is kept to a minimum and where there is a recognised antidote, supplies of the antidote are kept readily available			
			In any Laboratory premises where there are operations to which this Act applies, nothing is done to or in connection with toxic materials except under an efficient exhaust draught system			
			Provision of an exhaust draught system constructed, placed and maintained, to prevent the escape into the air oftoxic materials of a character and to an extent liable to be a danger to the health of employed persons			
			Where there is a risk that a toxic material or substance may be ingested, an employed person doesnot not eat, drinkor smoke in any workroom or other place where the material or substance is handled			
			Without prejudice to any other requirement for washing facilities, where there is a risk to health from contamination of the surface of the body, washing facilities are provided and maintained and conveniently situated near the place where the toxic material or substance is used			

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (PartXII)	Toxic materials to be used as last resort	In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practicable			
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to arrange for periodical medical examination			
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner mayserve upon an occupier or employer, a notice requiring him or her to provide additional protective clothing			
		Drenching facilities for emergency cases	Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency adequate and readily accessible means of drenching with water, for any employee who is splashed with these liquids			
			Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency sufficient and suitable means of flushing or irrigating the eyes, conveniently situated and clearly indicated by a distinctive sign which is visible at all times			
		Lifting of heavy loads	An employee does not lift, carry or move a load which is heavy and likely to cause him or her injury			
		Workers not to be exposed to ionizing radiation, etc	Effective measures are taken, as far as is practicable, to restrict the extent to which workers may be exposed to ionising radiation in the course of their employment			
			An employee is not exposed to ionizing radiation, lasers, ultra-violet, infrared light and other electromagnetic radiations, for more than is reasonably necessary, for the purposes of his or her work, and in any case, everything practicable is done to minimise the exposure			
		Provision of personal protective gear	Where any process carried out at a Laboratory is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury, is provided with suitable and appropriate personal protective equipment and clothing to protect him or her from risk or injury			
			An employer supplies and maintains personal protective equipment, free of charge to the employees, and provide instructions for their use.			
		Protection of eyes in certain processes	In the case of any of the processes specified in Schedule 8 (Processes Requiring Provision of Suitable Goggles or Effective Screens), suitable goggles or effective screens are provided, to protect the eyes of the persons employed in the process			
Total: 25 regulations under Hazardous Materials						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD						
	STUDY LABORATORY:	……	Date:	Sheet 9 of 9		
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
9	Chemical Safety and Special Provisions (Part XIII)	General precautions in handling chemicals	Whenever possible, hazardous substances are replaced by harmless or less harmful substances			
			Operations likely to result in contamination of the work environment by hazardous substances are isolated from the remainder of the premises to reduce the number of people exposed			
			Processes which involve a significant risk of exposure to very hazardous substances are, as far as is reasonably practicable, performed within an enclosed system, to prevent any contact between the hazardous substance and any person.			
			Direct contact with hazardous substances is, as far as is reasonably practicable, avoided by the use of automatic processes or by remote control systems			
			Only duly authorised and adequately trained workers participate in dangerous operations and their training is upgraded at suitable intervals			
			When circumstances make it necessary for a worker to enter an atmosphere contaminated by a harmful concentration of a hazardous substance, the worker is made fully aware of the hazards and is provided with and wear appropriate protective equipment			
		Provision of chemical data sheets	For hazardous chemicals, chemical safety data sheets containing detailed essential information, regarding the identity, supplier and classification of the chemical, and the hazards, safety precautions and emergency procedures required for the chemicals are provided to an employer, by a manufacturer or importer of the chemical			
		Labelling of hazardous chemicals	The employer ensures that the packages of a hazardous chemical delivered to the Laboratory, are labelled and that the appropriate chemical safety data sheet for the chemical is delivered to the Laboratory			
			A list or register of the chemical safety data sheets is kept at the workplace			
			A copy of chemical safety data sheets and of the list of the safety data sheets are given to the workers concerned and are availed to their representatives for consultation, at any time			
		Duty of suppliers, manufacturers, etc	Suppliers, manufacturers and importers of equipment ensure that machines, process plants, instruments are designed and supplied to users in a suitable condition and with the relevant information and that their operation and use contribute as little as possible, to the contamination of a work environment, and that they do not present, as far as is reasonably practicable, any health hazard to workers during production operations, maintenance work and other activities			
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that all chemicals are classified based on their characteristics including toxic, chemical or physical, corrosive and irritant properties; and allergenic and sensitising, carcinogenic, teratogenic and mutagenic effects as well as their effects on the reproductive system			
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are marked to indicate their identity, to enable persons handling or using them to recognise and distinguish between them when receiving them and when using them, so that they are used safely			
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are labelled in a uniform manner with legible, durable labels which are easily understood by workers and other persons			
Total: 14 regulations under Chemical Safety and Special Provisions						
		ELMERI Safety Index (SI) = Total No. of Correct Items* (100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**%**		
		General ELMERI Safety Index (SI) = Average Safety Index of provisions = SUM (SI)/Number of provisions		**%**		

APPENDIX E: Assessed Observation based Compliance evaluation Matrix for OSH in Engineering Materials Laboratory

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

	STUDY LABORATORY:	EML	Date: 06/02/2024		Sheet 1 of 9	
S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Duty of employers to protect workers	Employer takes all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost	1		
			Employer ensures, as far is reasonably practicable, that the working environment is kept free from any hazard due to pollution by using technical measure to new plant/ processes or adding to existing plant/processes or using supplementary technical measures		1	
			Provision and maintenance of plant and systems of work that give, as far as is reasonably practicable, a safe working environment including its vicinity	1		
			Arrangements for ensuring safety and absence of risks to health, in connection with the use, handling, storage and transport of articles and substances	1		
			Provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking	1		
			Provision and maintenance of means of access to and exit from the workplace, that are safe and without risks to health	1		
			Provision and maintenance of a working environment for the workers, that is, as far as is reasonably practicable, safe, without risks to health and which is adequate, regarding facilities and arrangements for the welfare of workers at work	1		
			Provision, where necessary, of adequate personal protective equipment to prevent, as far as is reasonably practicable, the risks of accidents or of adverse effects on health		1	
		Safety and health measures of employers	An employer who has at least twenty workers at a workplace shall prepare, and as often as may be appropriate, revise a written statement of policy with respect to the safety and health of employees while at work			1
			An employer who has at least twenty workers at a workplace shall make arrangements for carrying out the statement of policy			1
			An employer who has at least twenty workers at a workplace shall bring the statement of policy and any revision of it to the notice of all the employees			1
		Safety representatives	The Minister shall make regulations to provide for the appointment, in prescribed cases, of safety representatives			1
			Every employer has a duty to consult a safety representative in the making and sustenance of arrangements, which enable the employer and the workers to co-operate effectively in promoting the development of measures to ensure the safety and health of employees		1	
		Safety Committees	Presence of a Safety Committee appointed by the employer for a workforce of at least 20 workers	1		
			Safety representatives represent employees on a safety committee		1	
			A safety committee keeps under review the measures taken to ensure the safety and health of employees and any other functions as may be prescribed		1	
		Employer to consult with workers' organisations	Consultation on the role of the workers' organisation in the practical implementation of measures prescribed under this Act			1
			Provision of close collaboration at all levels, between the employer and the workers in the application of the measures prescribed under this Act.		1	
			A representative of the employers and that of the workers accompanying an Inspector or any other authorised person supervising the application of any measures prescribed under this Act, except where the inspector or authorized person is of the view that the accompaniment shall prejudice the performance of his or her duties.		1	

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Employer to monitor and control the release of dangerous substances into the environment	Employer to arrange for equipment and apparatus to monitor the air, soil, and water pollution in case there is major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes, or soil and which are a danger to the animal and plant life		1	
			Records of monitoring in subsection (above) to be kept and made available to an Inspector.		1	
		Employer to provide protective gear	Employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.	1		
			Employer ensures that personal protective equipment provided is used whenever it is required	1		
		Employer to provide alternative suitable employment	Job rotation in case an assignment involves continuous exposure of the worker to dangerous emissions or to substances and agents, which are medically found to be harmful to health.		1	
		Employer to supervise the health of workers	Employer conducts a pre-assignment medical examination of workers, before assignment to specific tasks which may involve danger to their health or of that of others		1	
			Employer conducts periodic medical examinations of workers during employment which involves exposure to a particular hazard to health	1		
			Employer informs a worker concerned of any health hazards involved in his or her work	1		
		Medical records of workers to be kept	Employer keeps and maintains records of the medical examination information in a format and for a period to be prescribed by the Minister, and avails these records for epidemiological and other research		1	
			To the extent determined by the Commissioner, records kept under this section include information on occupational exposure to air pollution and other harmful agents			1
Total: 29 regulations under General duties, obligations, and responsibilities of employers				**11**	**12**	**6**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**47.8%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
2	General duties of employers and the self-employed (Part IV)	Employers' duty to persons other than employees	Employer conducts his or her undertaking in a way that ensures, as far as is reasonably practicable, that any person who is not in his or her employment but who may be affected by the undertaking, is not exposed to risks to his or her health and safety.	1		
			Where two or more employers undertake activities simultaneously at one workplace, they have a duty to collaborate, in order to comply with the prescribed measures, without prejudice to the responsibility of each of the employers, for his or her workers.			1
		Employer to display guide safety precautions	Employer displays or provides guide safety precautions to any persons who may be affected by the manner in which the employer conducts his or her undertaking, whether or not that person is his or her worker	1		
			Employer displays all information in his or her possession or control concerning the way in which he or she conducts the undertaking, which may affect any person's health or safety	1		
		Duty to provide safe premises	A person in control of premises provides the means of access to and exit from the premises or any plan or substances in the premises and takes any measures that are reasonable for a person in his or her position to ensure, as far as is reasonably practicable, that the premises remain safe and without risk to health	1		
			Person in control of premses maintains or repairs the premises or any means of access to or exit from the premises	1		
			Person in control of premses ensures the safety of or the absence of risk to health arising from a plant or substances in the premises	1		
		Duty of controller of premises to keep air free of pollutants	Person with control of premises uses the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and renders harmless and inoffensive any substances that may be emitted.		1	
Total: 8 regulations under General duties of employers and the self-employed				**6**	**1**	**1**

ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items) **85.7%**

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

	STUDY LABORATORY:	EML	Date: 06/02/2024		Sheet 3 of 9	
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
3	Duties, rights and responsibilities of workers (Part VI)	Duty of workers to take care	Workers take reasonable care for the health and safety ofthemselves and of any other person who may be affected by their acts or omissions at work	1		
			In case of duty or requirement imposed on an employer or any other person, by or under a statutory provision, workers do cooperate with the employer, as far as is necessary, to enable the duty or requirement to be performed or complied with.	1		
			Representatives of the workers in an undertaking cooperate with an employer in all measures to eliminate or minimize risks to health and safety at work provided in this Act and any other law	1		
		Duty to report dangerous situation to immediate supervisor	Worker reports immediately to a supervisor any situation which the worker has reasonable grounds to believe presents an imminent or serious danger to his or her life or health or to the life or health of any other persons in the premises.	1		
			Employer before taking remedial action does not require the worker to return to a work situation where there is reported continuing imminent or serious danger to life or health.	1		
		Workers' right to move away from dangerous situation	A worker who removes himself or herself from a work situation which he or she has reasonable justification to believe presents an imminent and serious danger to his or her life or health is not punished or subjected to undue consequences, provided the danger is confirmed by the Commissioner.	1		
		Workers not to be penalized for complying with Act	An employer does not levy or permit to be levied on any worker any penalty in respect of anything done or provided under this Act	1		
		Reckless or intentional interference with safety measures	A person who intentionally or recklessly interferes with or misuses anything provided in the interest of health, safety or welfare under this Act, commits an offence.	1		
Total: 8 regulations under Duties, rights and responsibilities of workers				**8**	**0**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY:	EML	Date: 06/02/2024	Sheet 4 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Buildings at workplace to be of sound construction, etc	Buildings forming part of the Laboratory are of sound construction and are kept in a good state of repair	1		
			Every building used as a workplace is designed to protect workers from the weather	1		
			Every building used as a workplace has a water-tight roof	1		
			Every building used as a workplace is free from any significant amount of dampness that is liable to affect the safety of the building or the health of the workers	1		
			Where any process carried out in a workplace renders the floor of a building of the workplace liable to be wet to an extent that necessitates the wetness to be removed by drainage, a drainage system is be provided and maintained in the building			1
		Workplaces to be kept clean	Every workplace kept in a clean state and free from effluvia arising from any drain, sanitary convenience or other nuisance	1		
			Any accumulation of dirt and refuse removed daily by a suitable method from the floor and benches of workrooms, and from the staircases and passages	1		
			The floor of every workroom is cleaned at least once in every week by an effective and suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they have a smooth impervious surface, are washed with hot water and soap or cleaned by some other suitable method, at least once every fourteen months	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they are kept painted with oil paint or varnished, are re-painted or re-varnished at least once every seven years, and at least once every fourteen months are washed with hot water and soap or cleaned by some other suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, in any other case, are kept whitewashed or colour-washed and the whitewashing or colour-washing be repeated at least once every fourteen months			1
		Healthy and safe working environment	A suitable room temperature is secured for workers in buildings, having regard in any workplace, to the numbers of workers, the ventilation and air movement, the air humidity and temperature of the surroundings	1		
			Laboratory is not, while work is being carried on, so over-crowded, so as to cause risk of injury to the health of the workers	1		
			Every workroom is not less than three metres in height, measured from the floor to the lowest point of the ceiling or where there is no ceiling, to the lowest point of the roofing material		1	
			Provision of an effective and suitable system for securing and maintaining the circulation of fresh air, in each workroom	1		
			Where mechanical means of ventilation are used, they are regarded as satisfactory if they provide a supply of air that adequately removes odours and contamination of the atmosphere that arises from human occupation of the room	1		
		Workplaces to have suitable lighting	Suitable lighting, whether natural or artificial, secured and maintained in every part of a workplace in which any person works or passes	1		
			All glazed windows and skylights used for lighting workrooms are, so far as is practicable, kept clean on both the inner and outer surfaces and free from obstruction, except in cases of whitewashing or shading of windows and skylights, for the purpose of mitigating heat or glare	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Workplaces to have suitable lighting	All apparatus provided for producing artificial lighting are be properly maintained		1	
		Provision of adequate sanitary conveniences	In the Laboratory, sufficient and suitable sanitary conveniences for the workers are provided, maintained and kept clean	1		
			In the Laboratory, effective provisions are made for lighting the conveniences	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have proper, separate accommodation for persons of each sex		1	
			Where persons of both sexes are or are intended to be employed, the conveniences have separate approaches for each sex		1	
			The conveniences for each sex are indicated by a suitable notice.		1	
		Provision of adequate wholesome drinking water	An adequate supply of wholesome drinking water provided and maintained at suitable points in a workplace, conveniently accessible to all workers	1		
		Provision of adequate washing facilities	Employer provides and maintains for the use of workers, adequate and suitable facilities for washing, which are conveniently accessible and kept in a clean condition		1	
			Where any premises become a workplace after the coming into force of this Act (2006), the washing facilities be provided adjacent to the sanitary conveniences		1	
		Cloakrooms	A suitable cloakroom provided and maintained for the use of workers		1	
		Facilities for sitting down	Where workers have reasonable opportunity to sit during the period of their work, sufficient and suitable seats are provided and maintained by the employer, to enable the workers take advantage of the opportunity to sit.	1		
			Where a substantial proportion of any work can be properly done while sitting, an employer provides and maintains, for each employee doing the work, a seat of a design, construction and dimension suitable for that work	1		
		Facilities for meals	Employer provides and maintains adequate facilities for taking meals, due regard being made to the number of workers who remain on the premises during meal times		1	
			The facilities for taking meals be situated away from the habitual work positions and also include tables and chairs or benches with backrests.		1	
		First aid at the workplace	Employer provides a first-aid room or a room capable of being used for the purpose of administering first-aid		1	
			Where the provision of a first-aid room is not reasonably practicable, an employer provides and maintains a readily accessible first-aid box or cupboard of a prescribed standard	1		
			A first-aid room, box or cupboard does not contain articles other than those which are necessary for administering first-aid	1		
			A first-aid room, box or cupboard is under the charge of a responsible person and where more than a specified number of persons are employed, the person in charge is trained in first aid treatment	1		
			The person in charge of a first-aid room, box or cupboard is readily available during working hours			1
			A notice stating the name of the person in charge of a first-aid room, box or cupboard is posted in a conspicuous place in the workplace		1	
Total: 38 regulations under Health and Welfare				**23**	**12**	**3**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**65.7%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024 Sheet 5 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
5	General Safety Requirements (Part IX)	General Safety Requirements	There is, as far as is reasonably practicable, provision and maintainance of safe means of access to every place at which any person has to work at any time	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are soundly constructed and properly maintained	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, as far as is reasonably practicable, are kept free of obstructions which may cause a worker to fall or suffer any other injury	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are kept free of any substance likely to cause an employed person to slip	1		
			The staircases on the premises inside and outside a building have hand-rails and guard-rails which are properly maintained at all times	1		
			A staircase has at least one hand-rail throughout the length of the staircase	1		
			A staircase has a hand-rail on the open sided section and a lower rail in the gap between the hand-rail at the open-sided section and the tread-level, unless that gap is filled in a way that prevents persons from falling through			1
			Where a staircase or any part of it is specifically liable to cause an accident because of its construction, or for any other reason, there is a handrail on each side of the staircase			1
			There is sufficient, clear and unobstructed space at every machine while it is in motion to enable work to be carried on without unnecessary risk	1		
Total: 9 regulations under General Safety Requirements				**7**	**0**	**2**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024 Sheet 6 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
6	Fire Preparedness (Part X)	Means of escape in case of fire	Laboratory premises has means of escape from fire, for workers, as may be reasonably required in the circumstances, and in determining what is required by way of escape, regard was paid to the number of persons expected to be working in the premises at any one time and to the number of persons other than employed persons expected to be in the premises at that time	1		
			All means of escape from fire are properly maintained and kept free from obstruction		1	
			The contents of any room in which a person is employed are arranged or disposed to provide a free passage way for the persons employed in the room, as a means of escape in case of fire	1		
			The door of the Laboratory which afford a means of exit for a person employed in the workplace is not locked or fastened in such a manner that it cannot be easily and immediately opened from inside	1		
			In the case of any Laboratory constructed or converted for use as a Laboratory after the commencement of this Act, all doors which afford means of exit from the Laboratory for the persons employed in it, are, except in the case of sliding doors, constructed to open outwards	1		
			Every window, door, or other exit which afford means of escape in case of fire or giving access to it, other than the means of exit in ordinary use, is distinctively and conspicuously marked by a notice printed in red letters of an adequate size		1	
			Effective steps are taken to ensure that all the persons employed are familiar with the means of escape in case of fire, and with the routine to be followed in case of fire		1	
		Fire extinguishing gadgets	Laboratory has provision of readily accessible and well maintained, means of extinguishing fire, which is adequate and suitable, having regard to the circumstances of each case	1		
		Safe keeping of inflammable substances	All stocks of highly inflammable substances are kept in a fire-resistant store or in a safe place outside any occupied buildings		1	
			The store is not situated in a way that endangers the means of escape from the workplace or from any part of the workplace by persons employed in it, in the event of fire occurring in any part of the workplace			1
		Occupier's duty to ensure adequate fire response	Laboratory staff are aware that it is their responsibility to ensure adequate preparedness and response to any fire incidents in their premises	1		
Total: 11 regulations under Fire Preparedness				**6**	**4**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**60.0%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024 Sheet 7 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
7	Machinery, Plant and Equipment (Part XI)	Fencing of dangerous machinery, plant, and equipment	Every flywheel directly connected to any prime mover and every moving part of any prime mover, is securely fenced, whether the flywheel or prime mover is situated in an engine-house or not	1		
			Every part of an electric generator, motor or rotary converter and every flywheel directly connected to it, is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises as it would be if it were securely fenced	1		
			Every part of the transmission machinery is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced	1		
			Every dangerous part of any machinery, other than a prime mover and transmission machinery is securely fenced unless it is in a position or of construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced	1		
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which automatically prevents any employed person or his or her clothing from coming into contact with the dangerous parts	1		
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which stops the machine immediately in case of approach by an employed person to a dangerous part	1		
			Any part of a stock-bar which projects beyond the headstock of a lathe is securely fenced unless it is in a position that is safe to every employee on the premises as it would be if it were securely fenced			1
			All fencing or other safeguards provided under this Part of the Act is be of substantial construction and is constantly maintained and kept in position while the parts required to be fenced or safeguarded are in motion or in use	1		
		Efficient control of power	Efficient devices or appliances are provided and maintained in every room or place where work is carried on, by which power can promptly be cut off from the transmission machinery in that room or place, where there is eminent danger	1		
			Every machine intended to be driven by mechanical power is provided with an efficient starting and stopping appliance and the control of the starting and stopping appliance of which is in such a position as to be readily and conveniently operated by the person operating the machine	1		
		Self-acting machines	No traversing part of any self-acting machine and no material carried by it is, if the space over which it runs is a space which any person is liable to pass in the course of his or her employment or at any other time, allowed on its outward or inward traverse to run within a distance of five centimetres from any fixed structure which is not part of the machine			1
			All practicable steps are taken by instructions to the person in charge of the machine to ensure that a person employed is not in the space between any traversing part of a self-acting spinning mule and any fixed part of the machine towards which the traversing part moves on the inward run, except when the machine is stopped, with the traversing part on the outward run			1
Total: 12 regulations under Machinery, Plant and Equipment				**9**	**0**	**3**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024 Sheet 8 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Handling of hazardous materials	Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by enclosure of the plant used in the process			1
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by removal or prevention of accumulation of any dust that may escape inspite of the enclosure			1
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by exclusion or effective enclosure of possible sources of ignition			1
			Where there is dust of a character and an extent liable to explode on ignition, in a plant in the above process, unless the plant is constructed to withstand the pressure likely to be produced by an explosion, all practicable steps are taken to restrict the spread and effects of the explosion by the provision of chokes, baffles and vents, or other equally effective appliances, to the plant			1
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to remove the substance and any fumes arising from it	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to render them non-explosive or non-inflammable	1		
			Where any plant, tank or vessel is subjected to an operation in above, no explosive or inflammable substance is allowed to enter the plant, tank or vessel until the metal has cooled sufficiently to prevent any risk of igniting the substance	1		
		Electrical apparatus, etc to be fit for work meant	All electrical apparatus, fittings and conductors are sufficient in size and power for the work they are meant for and are constructed, installed, protected, worked and maintained to prevent danger, as far as is reasonably practicable	1		
		Toxic materials to be used as last resort	Toxic materials or substances are only used where the use of a nontoxic material or substance is not reasonably practicable	1		
			Without prejudice to subsection above, where toxic materials or substances are present or used, the number of employed persons exposed to risk is kept to a minimum and where there is a recognised antidote, supplies of the antidote are kept readily available			1
			In any Laboratory premises where there are operations to which this Act applies, nothing is done to or in connection with toxic materials except under an efficient exhaust draught system		1	
			Provision of an exhaust draught system constructed, placed and maintained, to prevent the escape into the air of toxic materials of a character and to an extent liable to be a danger to the health of employed persons		1	
			Where there is a risk that a toxic material or substance may be ingested, an employed person doesnot not eat, drink or smoke in any workroom or other place where the material or substance is handled	1		
			Without prejudice to any other requirement for washing facilities, where there is a risk to health from contamination of the surface of the body, washing facilities are provided and maintained and conveniently situated near the place where the toxic material or substance is used	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Toxic materials to be used as last resort	In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practicable			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to arrange for periodical medical examination			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional protective clothing			1
		Drenching facilities for emergency cases	Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency adequate and readily accessible means of drenching with water, for any employee who is splashed with these liquids	1		
			Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency sufficient and suitable means of flushing or irrigating the eyes, conveniently situated and clearly indicated by a distinctive sign which is visible at all times	1		
		Lifting of heavy loads	An employee does not lift, carry or move a load which is heavy and likely to cause him or her injury		1	
		Workers not to be exposed to ionising radiation, etc	Effective measures are taken, as far as is practicable, to restrict the extent to which workers may be exposed to ionising radiation in the course of their employment			1
			An employee is not exposed to ionizing radiation, lasers, ultra-violet, infrared light and other electromagnetic radiations, for more than is reasonably necessary, for the purposes of his or her work, and in any case, everything practicable is done to minimise the exposure			1
		Provision of personal protective gear	Where any process carried out at a Laboratory is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury, is provided with suitable and appropriate personal protective equipment and clothing to protect him or her from risk or injury	1		
			An employer supplies and maintains personal protective equipment, free of charge to the employees, and provide instructions for their use.	1		
		Protection of eyes in certain processes	In the case of any of the processes specified in Schedule 8 (Processes Requiring Provision of Suitable Goggles or Effective Screens), suitable goggles or effective screens are provided, to protect the eyes of the persons employed in the process	1		
Total: 25 regulations under Hazardous Materials				**12**	**3**	**10**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**80.0%**		

EVALUATION OF ENGINEERING MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: EML Date: 06/02/2024 Sheet 9 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
9	Chemical Safety and Special Provisions (Part XIII)	General precautions in handling chemicals	Whenever possible, hazardous substances are replaced by harmless or less harmful substances	1		
			Operations likely to result in contamination of the work environment by hazardous substances are isolated from the remainder of the premises to reduce the number of people exposed		1	
			Processes which involve a significant risk of exposure to very hazardous substances are, as far as is reasonably practicable, performed within an enclosed system, to prevent any contact between the hazardous substance and any person.			1
			Direct contact with hazardous substances is, as far as is reasonably practicable, avoided by the use of automatic processes or by remote control systems			1
			Only duly authorised and adequately trained workers participate in dangerous operations and their training is upgraded at suitable intervals	1		
			When circumstances make it necessary for a worker to enter an atmosphere contaminated by a harmful concentration of a hazardous substance, the worker is made fully aware of the hazards and is provided with and wear appropriate protective equipment	1		
		Provision of chemical data sheets	For hazardous chemicals, chemical safety data sheets containing detailed essential information, regarding the identity, supplier and classification of the chemical, and the hazards, safety precautions and emergency procedures required for the chemicals are provided to an employer, by a manufacturer or importer of the chemical		1	
		Labelling of hazardous chemicals	The employer ensures that the packages of a hazardous chemical delivered to the Laboratory, are labelled and that the appropriate chemical safety data sheet for the chemical is delivered to the Laboratory			1
			A list or register of the chemical safety data sheets is kept at the workplace			1
			A copy of chemical safety data sheets and of the list of the safety data sheets are given to the workers concerned and are availed to their representatives for consultation, at any time			1
		Duty of suppliers, manufacturers, etc	Suppliers, manufacturers and importers of equipment ensure that machines, process plants, instruments are designed and supplied to users in a suitable condition and with the relevant information and that their operation and use contribute as little as possible, to the contamination of a work environment, and that they do not present, as far as is reasonably practicable, any health hazard to workers during production operations, maintenance work and other activities	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that all chemicals are classified based on their characteristics including toxic, chemical or physical, corrosive and irritant properties; and allergenic and sensitising, carcinogenic, teratogenic and mutagenic effects as well as their effects on the reproductive system	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are marked to indicate their identity, to enable persons handling or using them to recognise and distinguish between them when receiving them and when using them, so that they are used safely	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are labelled in a uniform manner with legible, durable labels which are easily understood by workers and other persons	1		
Total: 14 regulations under Chemical Safety and Special Provisions				**7**	**2**	**5**

ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items) **77.8%**

General ELMERI Safety Index (SI) = Average Safety Index of prpvisions = SUM (SI)/Number of provisions **79.7%**

APPENDIX F: Assessed Observation based Compliance evaluation Matrix for OSH in Central Materials Laboratory

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

	STUDY LABORATORY:	CML	Date: 07/02/2024		Sheet 1 of 9	
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
1	General duties, obligations, and responsibilities of employers (Part III)	Duty of employers to protect workers	Employer takes all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost	1		
			Employer ensures, as far is reasonably practicable, that the working environment is kept free from any hazard due to pollution by using technical measure to new plant/ processes or adding to existing plant/processes or using supplementary technical measures		1	
			Provision and maintenance of plant and systems of work that give, as far as is reasonably practicable, a safe working environment including its vicinity	1		
			Arrangements for ensuring safety and absence of risks to health, in connection with the use, handling, storage and transport of articles and substances	1		
			Provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking	1		
			Provision and maintenance of means of access to and exit from the workplace, that are safe and without risks to health		1	
			Provision and maintenance of a working environment for the workers, that is, as far as is reasonably practicable, safe, without risks to health and which is adequate, regarding facilities and arrangements for the welfare of workers at work	1		
			Provision, where necessary, of adequate personal protective equipment to prevent, as far as is reasonably practicable, the risks of accidents or of adverse effects on health		1	
		Safety and health measures of employers	An employer who has at least twenty workers at a workplace shall prepare, and as often as may be appropriate, revise a written statement of policy with respect to the safety and health of employees while at work			1
			An employer who has at least twenty workers at a workplace shall make arrangements for carrying out the statement of policy			1
			An employer who has at least twenty workers at a workplace shall bring the statement of policy and any revision of it to the notice of all the employees			1
		Safety representatives	The Minister shall make regulations to provide for the appointment, in prescribed cases, of safety representatives			1
			Every employer has a duty to consult a safety representative in the making and sustenance of arrangements, which enable the employer and the workers to co-operate effectively in promoting the development of measures to ensure the safety and health of employees		1	
		Safety Committees	Presence of a Safety Committee appointed by the employer for a workforce of at least 20 workers		1	
			Safety representatives represent employees on a safety committee		1	
			A safety committee keeps under review the measures taken to ensure the safety and health of employees and any other functions as may be prescribed		1	
		Employer to consult with workers' organisations	Consultation on the role of the workers' organisation in the practical implementation of measures prescribed under this Act			1
			Provision of close collaboration at all levels, between the employer and the workers in the application of the measures prescribed under this Act.		1	
			A representative of the employers and that of the workers accompanying an Inspector or any other authorised person supervising the application of any measures prescribed under this Act, except where the inspector or authorized person is of the view that the accompaniment shall prejudice the performance of his or her duties.		1	

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Employer to monitor and control the release of dangerous substances into the environment	Employer to arrange for equipment and apparatus to monitor the air, soil, and water pollution in case there is major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes, or soil and which are a danger to the animal and plant life		1	
			Records of monitoring in subsection (above) to be kept and made available to an Inspector.		1	
		Employer to provide protective gear	Employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.	1		
			Employer ensures that personal protective equipment provided is used whenever it is required	1		
		Employer to provide alternative suitable employment	Job rotation in case an assignment involves continuous exposure of the worker to dangerous emissions or to substances and agents, which are medically found to be harmful to health.	1		
		Employer to supervise the health of workers	Employer conducts a pre-assignment medical examination of workers, before assignment to specific tasks which may involve danger to their health or of that of others		1	
			Employer conducts periodic medical examinations of workers during employment which involves exposure to a particular hazard to health		1	
			Employer informs a worker concerned of any health hazards involved in his or her work	1		
		Medical records of workers to be kept	Employer keeps and maintains records of the medical examination information in a format and for a period to be prescribed by the Minister, and avails these records for epidemiological and other research		1	
			To the extent determined by the Commissioner, records kept under this section include information on occupational exposure to air pollution and other harmful agents			1
Total: 29 regulations under General duties, obligations, and responsibilities of employers				**9**	**14**	**6**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**39.1%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024 Sheet 2 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
2	General duties of employers and the self-employed (Part IV)	Employers' duty to persons other than employees	Employer conducts his or her undertaking in a way that ensures, as far as is reasonably practicable, that any person who is not in his or her employment but who may be affected by the undertaking, is not exposed to risks to his or her health and safety.	1		
			Where two or more employers undertake activities simultaneously at one workplace, they have a duty to collaborate, in order to comply with the prescribed measures, without prejudice to the responsibility of each of the employers, for his or her workers.	1		
		Employer to display guide safety precautions	Employer displays or provides guide safety precautions to any persons who may be affected by the manner in which the employer conducts his or her undertaking, whether or not that person is his or her worker	1		
			Employer displays all information in his or her possession or control concerning the way in which he or she conducts the undertaking, which may affect any person's health or safety	1		
		Duty to provide safe premises	A person in control of premises provides the means of access to and exit from the premises or any plan or substances in the premises and takes any measures that are reasonable for a person in his or her position to ensure, as far as is reasonably practicable, that the premises remain safe and without risk to health	1		
			Person in control of premses maintains or repairs the premises or any means of access to or exit from the premises	1		
			Person in control of premses ensures the safety of or the absence of risk to health arising from a plant or substances in the premises	1		
		Duty of controller of premises to keep air free of pollutants	Person with control of premises uses the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and renders harmless and inoffensive any substances that may be emitted.		1	
Total: 8 regulations under General duties of employers and the self-employed				**7**	**1**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**87.5%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024 Sheet 3 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
3	Duties, rights and responsibilities of workers (Part VI)	Duty of workers to take care	Workers take reasonable care for the health and safety ofthemselves and of any other person who may be affected by their acts or omissions at work	1		
			In case of duty or requirement imposed on an employer or any other person, by or under a statutory provision, workers do cooperate with the employer, as far as is necessary, to enable the duty or requirement to be performed or complied with.	1		
			Representatives of the workers in an undertaking cooperate with an employer in all measures to eliminate or minimize risks to health and safety at work provided in this Act and any other law			1
		Duty to report dangerous situation to immediate supervisor	Worker reports immediately to a supervisor any situation which the worker has reasonable grounds to believe presents an imminent or serious danger to his or her life or health or to the life or health of any other persons in the premises.	1		
			Employer before taking remedial action does not require the worker to return to a work situation where there is reported continuing imminent or serious danger to life or health.	1		
		Workers' right to move away from dangerous situation	A worker who removes himself or herself from a work situation which he or she has reasonable justification to believe presents an imminent and serious danger to his or her life or health is not punished or subjected to undue consequences, provided the danger is confirmed by the Commissioner.	1		
		Workers not to be penalized for complying with Act	An employer does not levy or permit to be levied on any worker any penalty in respect of anything done or provided under this Act	1		
		Reckless or intentional interference with safety measures	A person who intentionally or recklessly interferes with or misuses anything provided in the interest of health, safety or welfare under this Act, commits an offence.	1		
Total: 8 regulations under Duties, rights and responsibilities of workers				**7**	**0**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Buildings at workplace to be of sound construction, etc	Buildings forming part of the Laboratory are of sound construction and are kept in a good state of repair		1	
			Every building used as a workplace is designed to protect workers from the weather	1		
			Every building used as a workplace has a water-tight roof	1		
			Every building used as a workplace is free from any significant amount of dampness that is liable to affect the safety of the building or the health of the workers	1		
			Where any process carried out in a workplace renders the floor of a building of the workplace liable to be wet to an extent that necessitates the wetness to be removed by drainage, a drainage system is be provided and maintained in the building	1		
		Workplaces to be kept clean	Every workplace kept in a clean state and free from effluvia arising from any drain, sanitary convenience or other nuisance	1		
			Any accumulation of dirt and refuse removed daily by a suitable method from the floor and benches of workrooms, and from the staircases and passages	1		
			The floor of every workroom is cleaned at least once in every week by an effective and suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they have a smooth impervious surface, are washed with hot water and soap or cleaned by some other suitable method, at least once every fourteen months	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they are kept painted with oil paint or varnished, are re-painted or re-varnished at least once every seven years, and at least once every fourteen months are washed with hot water and soap or cleaned by some other suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, in any other case, are kept whitewashed or colour-washed and the whitewashing or colour-washing be repeated at least once every fourteen months	1		
		Healthy and safe working environment	A suitable room temperature is secured for workers in buildings, having regard in any workplace, to the numbers of workers, the ventilation and air movement, the air humidity and temperature of the surroundings	1		
			Laboratory is not, while work is being carried on, so over-crowded, so as to cause risk of injury to the health of the workers	1		
			Every workroom is not less than three metres in height, measured from the floor to the lowest point of the ceiling or where there is no ceiling, to the lowest point of the roofing material	1		
			Provision of an effective and suitable system for securing and maintaining the circulation of fresh air, in each workroom	1		
			Where mechanical means of ventilation are used, they are regarded as satisfactory if they provide a supply of air that adequately removes odours and contamination of the atmosphere that arises from human occupation of the room	1		
		Workplaces to have suitable lighting	Suitable lighting, whether natural or artificial, secured and maintained in every part of a workplace in which any person works or passes	1		
			All glazed windows and skylights used for lighting workrooms are, so far as is practicable, kept clean on both the inner and outer surfaces and free from obstruction, except in cases of whitewashing or shading of windows and skylights, for the purpose of mitigating heat or glare		1	

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Workplaces to have suitable lighting	All apparatus provided for producing artificial lighting are be properly maintained	1		
		Provision of adequate sanitary conveniences	In the Laboratory, sufficient and suitable sanitary conveniences for the workers are provided, maintained and kept clean	1		
			In the Laboratory, effective provisions are made for lighting the conveniences	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have proper, separate accommodation for persons of each sex	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have separate approaches for each sex	1		
			The conveniences for each sex are indicated by a suitable notice.	1		
		Provision of adequate wholesome drinking water	An adequate supply of wholesome drinking water provided and maintained at suitable points in a workplace, conveniently accessible to all workers		1	
		Provision of adequate washing facilities	Employer provides and maintains for the use of workers, adequate and suitable facilities for washing, which are conveniently accessible and kept in a clean condition		1	
			Where any premises become a workplace after the coming into force of this Act (2006), the washing facilities be provided adjacent to the sanitary conveniences		1	
		Cloakrooms	A suitable cloakroom provided and maintained for the use of workers		1	
		Facilities for sitting down	Where workers have reasonable opportunity to sit during the period of their work, sufficient and suitable seats are provided and maintained by the employer, to enable the workers take advantage of the opportunity to sit.	1		
			Where a substantial proportion of any work can be properly done while sitting, an employer provides and maintains, for each employee doing the work, a seat of a design, construction and dimension suitable for that work	1		
		Facilities for meals	Employer provides and maintains adequate facilities for taking meals, due regard being made to the number of workers who remain on the premises during meal times	1		
			The facilities for taking meals be situated away from the habitual work positions and also include tables and chairs or benches with backrests.	1		
		First aid at the workplace	Employer provides a first-aid room or a room capable of being used for the purpose of administering first-aid		1	
			Where the provision of a first-aid room is not reasonably practicable, an employer provides and maintains a readily accessible first-aid box or cupboard of a prescribed standard	1		
			A first-aid room, box or cupboard does not contain articles other than those which are necessary for administering first-aid	1		
			A first-aid room, box or cupboard is under the charge of a responsible person and where more than a specified number of persons are employed, the person in charge is trained in first aid treatment	1		
			The person in charge of a first-aid room, box or cupboard is readily available during working hours	1		
			A notice stating the name of the person in charge of a first-aid room, box or cupboard is posted in a conspicuous place in the workplace		1	
Total: 38 regulations under Health and Welfare				**30**	**8**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**78.9%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024 Sheet 5 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
5	General Safety Requirements (Part IX)	General Safety Requirements	There is, as far as is reasonably practicable, provision and maintainance of safe means of access to every place at which any person has to work at any time		1	
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are soundly constructed and properly maintained		1	
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, as far as is reasonably practicable, are kept free of obstructions which may cause a worker to fall or suffer any other injury		1	
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are kept free of any substance likely to cause an employed person to slip	1		
			The staircases on the premises inside and outside a building have hand-rails and guard-rails which are properly maintained at all times			1
			A staircase has at least one hand-rail throughout the length of the staircase			1
			A staircase has a hand-rail on the open sided section and a lower rail in the gap between the hand-rail at the open-sided section and the tread-level, unless that gap is filled in a way that prevents persons from falling through			1
			Where a staircase or any part of it is specifically liable to cause an accident because of its construction, or for any other reason, there is a handrail on each side of the staircase			1
			There is sufficient, clear and unobstructed space at every machine while it is in motion to enable work to be carried on without unnecessary risk	1		
Total: 9 regulations under General Safety Requirements				**2**	**3**	**4**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**40.0%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
6	Fire Preparedness (Part X)	Means of escape in case of fire	Laboratory premises has means of escape from fire, for workers, as may be reasonably required in the circumstances, and in determining what is required by way of escape, regard was paid to the number of persons expected to be working in the premises at any one time and to the number of persons other than employed persons expected to be in the premises at that time	1		
			All means of escape from fire are properly maintained and kept free from obstruction		1	
			The contents of any room in which a person is employed are arranged or disposed to provide a free passage way for the persons employed in the room, as a means of escape in case of fire		1	
			The door of the Laboratory which afford a means of exit for a person employed in the workplace is not locked or fastened in such a manner that it cannot be easily and immediately opened from inside	1		
			In the case of any Laboratory constructed or converted for use as a Laboratory after the commencement of this Act, all doors which afford means of exit from the Laboratory for the persons employed in it, are, except in the case of sliding doors, constructed to open outwards	1		
			Every window, door, or other exit which afford means of escape in case of fire or giving access to it, other than the means of exit in ordinary use, is distinctively and conspicuously marked by a notice printed in red letters of an adequate size		1	
			Effective steps are taken to ensure that all the persons employed are familiar with the means of escape in case of fire, and with the routine to be followed in case of fire		1	
		Fire extinguishing gadgets	Laboratory has provision of readily accessible and well maintained, means of extinguishing fire, which is adequate and suitable, having regard to the circumstances of each case	1		
		Safe keeping of inflammable substances	All stocks of highly inflammable substances are kept in a fire-resistant store or in a safe place outside any occupied buildings	1		
			The store is not situated in a way that endangers the means of escape from the workplace or from any part of the workplace by persons employed in it, in the event of fire occurring in any part of the workplace	1		
		Occupier's duty to ensure adequate fire response	Laboratory staff are aware that it is their responsibility to ensure adequate preparedness and response to any fire incidents in their premises	1		
Total: 11 regulations under Fire Preparedness				**7**	**4**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**63.6%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
7	Machinery, Plant and Equipment (Part XI)	Fencing of dangerous machinery, plant, and equipment	Every flywheel directly connected to any prime mover and every moving part of any prime mover, is securely fenced, whether the flywheel or prime mover is situated in an engine-house or not			1
			Every part of an electric generator, motor or rotary converter and every flywheel directly connected to it, is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises as it would be if it were securely fenced			1
			Every part of the transmission machinery is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced	1		
			Every dangerous part of any machinery, other than a prime mover and transmission machinery is securely fenced unless it is in a position or of construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced	1		
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which automatically prevents any employed person or his or her clothing from coming into contact with the dangerous parts	1		
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which stops the machine immediately in case of approach by an employed person to a dangerous part	1		
			Any part of a stock-bar which projects beyond the headstock of a lathe is securely fenced unless it is in a position that is safe to every employee on the premises as it would be if it were securely fenced	1		
			All fencing or other safeguards provided under this Part of the Act is be of substantial construction and is constantly maintained and kept in position while the parts required to be fenced or safeguarded are in motion or in use	1		
		Efficient control of power	Efficient devices or appliances are provided and maintained in every room or place where work is carried on, by which power can promptly be cut off from the transmission machinery in that room or place, where there is eminent danger	1		
			Every machine intended to be driven by mechanical power is provided with an efficient starting and stopping appliance and the control of the starting and stopping appliance of which is in such a position as to be readily and conveniently operated by the person operating the machine	1		
		Self-acting machines	No traversing part of any self-acting machine and no material carried by it is, if the space over which it runs is a space which any person is liable to pass in the course of his or her employment or at any other time, allowed on its outward or inward traverse to run within a distance of five centimetres from any fixed structure which is not part of the machine			1
			All practicable steps are taken by instructions to the person in charge of the machine to ensure that a person employed is not in the space between any traversing part of a self-acting spinning mule and any fixed part of the machine towards which the traversing part moves on the inward run, except when the machine is stopped, with the traversing part on the outward run			1
Total: 12 regulations under Machinery, Plant and Equipment				**8**	**0**	**4**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024 Sheet 8 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Handling of hazardous materials	Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by enclosure of the plant used in the process	1		
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by removal or prevention of accumulation of any dust that may escape inspite of the enclosure	1		
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by exclusion or effective enclosure of possible sources of ignition	1		
			Where there is dust of a character and an extent liable to explode on ignition, in a plant in the above process, unless the plant is constructed to withstand the pressure likely to be produced by an explosion, all practicable steps are taken to restrict the spread and effects of the explosion by the provision of chokes, baffles and vents, or other equally effective appliances, to the plant	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to remove the substance and any fumes arising from it	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to render them non-explosive or non-inflammable	1		
			Where any plant, tank or vessel is subjected to an operation in above, no explosive or inflammable substance is allowed to enter the plant, tank or vessel until the metal has cooled sufficiently to prevent any risk of igniting the substance	1		
		Electrical apparatus, etc to be fit for work meant	All electrical apparatus, fittings and conductors are sufficient in size and power for the work they are meant for and are constructed, installed, protected, worked and maintained to prevent danger, as far as is reasonably practicable	1		
		Toxic materials to be used as last resort	Toxic materials or substances are only used where the use of a nontoxic material or substance is not reasonably practicable	1		
			Without prejudice to subsection above, where toxic materials or substances are present or used, the number of employed persons exposed to risk is kept to a minimum and where there is a recognised antidote, supplies of the antidote are kept readily available			1
			In any Laboratory premises where there are operations to which this Act applies, nothing is done to or in connection with toxic materials except under an efficient exhaust draught system		1	
			Provision of an exhaust draught system constructed, placed and maintained, to prevent the escape into the air of toxic materials of a character and to an extent liable to be a danger to the health of employed persons		1	
			Where there is a risk that a toxic material or substance may be ingested, an employed person doesnot not eat, drink or smoke in any workroom or other place where the material or substance is handled	1		
			Without prejudice to any other requirement for washing facilities, where there is a risk to health from contamination of the surface of the body, washing facilities are provided and maintained and conveniently situated near the place where the toxic material or substance is used	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Toxic materials to be used as last resort	In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practicable			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to arrange for periodical medical examination			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional protective clothing			1
		Drenching facilities for emergency cases	Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency adequate and readily accessible means of drenching with water, for any employee who is splashed with these liquids	1		
			Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency sufficient and suitable means of flushing or irrigating the eyes, conveniently situated and clearly indicated by a distinctive sign which is visible at all times	1		
		Lifting of heavy loads	An employee does not lift, carry or move a load which is heavy and likely to cause him or her injury	1		
		Workers not to be exposed to ionising radiation, etc	Effective measures are taken, as far as is practicable, to restrict the extent to which workers may be exposed to ionising radiation in the course of their employment	1		
			An employee is not exposed to ionizing radiation, lasers, ultra-violet, infrared light and other electromagnetic radiations, for more than is reasonably necessary, for the purposes of his or her work, and in any case, everything practicable is done to minimise the exposure	1		
		Provision of personal protective gear	Where any process carried out at a Laboratory is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury, is provided with suitable and appropriate personal protective equipment and clothing to protect him or her from risk or injury	1		
			An employer supplies and maintains personal protective equipment, free of charge to the employees, and provide instructions for their use.	1		
		Protection of eyes in certain processes	In the case of any of the processes specified in Schedule 8 (Processes Requiring Provision of Suitable Goggles or Effective Screens), suitable goggles or effective screens are provided, to protect the eyes of the persons employed in the process	1		
Total: 25 regulations under Hazardous Materials				**19**	**2**	**4**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**90.5%**		

EVALUATION OF CENTRAL MATERIALS TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: CML Date: 07/02/2024 Sheet 9 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
9	Chemical Safety and Special Provisions (Part XIII)	General precautions in handling chemicals	Whenever possible, hazardous substances are replaced by harmless or less harmful substances	1		
			Operations likely to result in contamination of the work environment by hazardous substances are isolated from the remainder of the premises to reduce the number of people exposed	1		
			Processes which involve a significant risk of exposure to very hazardous substances are, as far as is reasonably practicable, performed within an enclosed system, to prevent any contact between the hazardous substance and any person.	1		
			Direct contact with hazardous substances is, as far as is reasonably practicable, avoided by the use of automatic processes or by remote control systems		1	
			Only duly authorised and adequately trained workers participate in dangerous operations and their training is upgraded at suitable intervals	1		
			When circumstances make it necessary for a worker to enter an atmosphere contaminated by a harmful concentration of a hazardous substance, the worker is made fully aware of the hazards and is provided with and wear appropriate protective equipment	1		
		Provision of chemical data sheets	For hazardous chemicals, chemical safety data sheets containing detailed essential information, regarding the identity, supplier and classification of the chemical, and the hazards, safety precautions and emergency procedures required for the chemicals are provided to an employer, by a manufacturer or importer of the chemical	1		
		Labelling of hazardous chemicals	The employer ensures that the packages of a hazardous chemical delivered to the Laboratory, are labelled and that the appropriate chemical safety data sheet for the chemical is delivered to the Laboratory	1		
			A list or register of the chemical safety data sheets is kept at the workplace			1
			A copy of chemical safety data sheets and of the list of the safety data sheets are given to the workers concerned and are availed to their representatives for consultation, at any time		1	
		Duty of suppliers, manufacturers, etc	Suppliers, manufacturers and importers of equipment ensure that machines, process plants, instruments are designed and supplied to users in a suitable condition and with the relevant information and that their operation and use contribute as little as possible, to the contamination of a work environment, and that they do not present, as far as is reasonably practicable, any health hazard to workers during production operations, maintenance work and other activities	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that all chemicals are classified based on their characteristics including toxic, chemical or physical, corrosive and irritant properties; and allergenic and sensitising, carcinogenic, teratogenic and mutagenic effects as well as their effects on the reproductive system	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are marked to indicate their identity, to enable persons handling or using them to recognise and distinguish between them when receiving them and when using them, so that they are used safely	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are labelled in a uniform manner with legible, durable labels which are easily understood by workers and other persons	1		
Total: 14 regulations under Chemical Safety and Special Provisions				**11**	**2**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**84.6%**		
		General ELMERI Safety Index (SI) = Average Safety Index of prpvisions = SUM (SI)/Number of provisions		**76.0%**		

APPENDIX G: Assessed Observation-based Compliance Evaluation Matrix for OSH in Geotechnical Foundation Services Laboratory

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

	STUDY LABORATORY:	GFS	Date: 09/02/2024		Sheet 1 of 9	
S/N	**OSHA, 2006 Regulatory Provision**	**Section**	**Particulars**	**Study Laboratory – Elmeri evaluation**		
				Correct	**Not Correct**	**No Observation**
1	General duties, obligations, and responsibilities of employers (Part III)	Duty of employers to protect workers	Employer takes all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost		1	
			Employer ensures, as far is reasonably practicable, that the working environment is kept free from any hazard due to pollution by using technical measure to new plant/ processes or adding to existing plant/processes or using supplementary technical measures	1		
			Provision and maintenance of plant and systems of work that give, as far as is reasonably practicable, a safe working environment including its vicinity	1		
			Arrangements for ensuring safety and absence of risks to health, in connection with the use, handling, storage and transport of articles and substances	1		
			Provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking		1	
			Provision and maintenance of means of access to and exit from the workplace, that are safe and without risks to health	1		
			Provision and maintenance of a working environment for the workers, that is, as far as is reasonably practicable, safe, without risks to health and which is adequate, regarding facilities and arrangements for the welfare of workers at work	1		
			Provision, where necessary, of adequate personal protective equipment to prevent, as far as is reasonably practicable, the risks of accidents or of adverse effects on health	1		
		Safety and health measures of employers	An employer who has at least twenty workers at a workplace shall prepare, and as often as may be appropriate, revise a written statement of policy with respect to the safety and health of employees while at work			1
			An employer who has at least twenty workers at a workplace shall make arrangements for carrying out the statement of policy			1
			An employer who has at least twenty workers at a workplace shall bring the statement of policy and any revision of it to the notice of all the employees			1
		Safety representatives	The Minister shall make regulations to provide for the appointment, in prescribed cases, of safety representatives			1
			Every employer has a duty to consult a safety representative in the making and sustenance of arrangements, which enable the employer and the workers to co-operate effectively in promoting the development of measures to ensure the safety and health of employees		1	
		Safety Committees	Presence of a Safety Committee appointed by the employer for a workforce of at least 20 workers		1	
			Safety representatives represent employees on a safety committee		1	
			A safety committee keeps under review the measures taken to ensure the safety and health of employees and any other functions as may be prescribed		1	
		Employer to consult with workers' organisations	Consultation on the role of the workers' organisation in the practical implementation of measures prescribed under this Act		1	
			Provision of close collaboration at all levels, between the employer and the workers in the application of the measures prescribed under this Act.	1		
			A representative of the employers and that of the workers accompanying an Inspector or any other authorised person supervising the application of any measures prescribed under this Act, except where the inspector or authorized person is of the view that the accompaniment shall prejudice the performance of his or her duties.			1

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Employer to monitor and control the release of dangerous substances into the environment	Employer to arrange for equipment and apparatus to monitor the air, soil, and water pollution in case there is major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes, or soil and which are a danger to the animal and plant life		1	
			Records of monitoring in subsection (above) to be kept and made available to an Inspector.		1	
		Employer to provide protective gear	Employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.	1		
			Employer ensures that personal protective equipment provided is used whenever it is required	1		
		Employer to provide alternative suitable employment	Job rotation in case an assignment involves continuous exposure of the worker to dangerous emissions or to substances and agents, which are medically found to be harmful to health.	1		
		Employer to supervise the health of workers	Employer conducts a pre-assignment medical examination of workers, before assignment to specific tasks which may involve danger to their health or of that of others		1	
			Employer conducts periodic medical examinations of workers during employment which involves exposure to a particular hazard to health		1	
			Employer informs a worker concerned of any health hazards involved in his or her work		1	
		Medical records of workers to be kept	Employer keeps and maintains records of the medical examination information in a format and for a period to be prescribed by the Minister, and avails these records for epidemiological and other research		1	
			To the extent determined by the Commissioner, records kept under this section include information on occupational exposure to air pollution and other harmful agents		1	
Total: 29 regulations under General duties, obligations, and responsibilities of employers				**10**	**14**	**5**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**41.7%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 2 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
2	General duties of employers and the self-employed (Part IV)	Employers' duty to persons other than employees	Employer conducts his or her undertaking in a way that ensures, as far as is reasonably practicable, that any person who is not in his or her employment but who may be affected by the undertaking, is not exposed to risks to his or her health and safety.		1	
			Where two or more employers undertake activities simultaneously at one workplace, they have a duty to collaborate, in order to comply with the prescribed measures, without prejudice to the responsibility of each of the employers, for his or her workers.			1
		Employer to display guide safety precautions	Employer displays or provides guide safety precautions to any persons who may be affected by the manner in which the employer conducts his or her undertaking, whether or not that person is his or her worker	1		
			Employer displays all information in his or her possession or control concerning the way in which he or she conducts the undertaking, which may affect any person's health or safety	1		
		Duty to provide safe premises	A person in control of premises provides the means of access to and exit from the premises or any plan or substances in the premises and takes any measures that are reasonable for a person in his or her position to ensure, as far as is reasonably practicable, that the premises remain safe and without risk to health	1		
			Person in control of premses maintains or repairs the premises or any means of access to or exit from the premises	1		
			Person in control of premses ensures the safety of or the absence of risk to health arising from a plant or substances in the premises	1		
		Duty of controller of premises to keep air free of pollutants	Person with control of premises uses the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and renders harmless and inoffensive any substances that may be emitted.		1	
Total: 8 regulations under General duties of employers and the self-employed				**5**	**2**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**71.4%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 3 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
3	Duties, rights and responsibilities of workers (Part VI)	Duty of workers to take care	Workers take reasonable care for the health and safety ofthemselves and of any other person who may be affected by their acts or omissions at work	1		
			In case of duty or requirement imposed on an employer or any other person, by or under a statutory provision, workers do cooperate with the employer, as far as is necessary, to enable the duty or requirement to be performed or complied with.	1		
			Representatives of the workers in an undertaking cooperate with an employer in all measures to eliminate or minimize risks to health and safety at work provided in this Act and any other law	1		
		Duty to report dangerous situation to immediate supervisor	Worker reports immediately to a supervisor any situation which the worker has reasonable grounds to believe presents an imminent or serious danger to his or her life or health or to the life or health of any other persons in the premises.	1		
			Employer before taking remedial action does not require the worker to return to a work situation where there is reported continuing imminent or serious danger to life or health.	1		
		Workers' right to move away from dangerous situation	A worker who removes himself or herself from a work situation which he or she has reasonable justification to believe presents an imminent and serious danger to his or her life or health is not punished or subjected to undue consequences, provided the danger is confirmed by the Commissioner.	1		
		Workers not to be penalized for complying with Act	An employer does not levy or permit to be levied on any worker any penalty in respect of anything done or provided under this Act	1		
		Reckless or intentional interference with safety measures	A person who intentionally or recklessly interferes with or misuses anything provided in the interest of health, safety or welfare under this Act, commits an offence.	1		
Total: 8 regulations under Duties, rights and responsibilities of workers				**8**	**0**	**0**

ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items) **100.0%**

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 4 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Buildings at workplace to be of sound construction, etc	Buildings forming part of the Laboratory are of sound construction and are kept in a good state of repair	1		
			Every building used as a workplace is designed to protect workers from the weather	1		
			Every building used as a workplace has a water-tight roof	1		
			Every building used as a workplace is free from any significant amount of dampness that is liable to affect the safety of the building or the health of the workers	1		
			Where any process carried out in a workplace renders the floor of a building of the workplace liable to be wet to an extent that necessitates the wetness to be removed by drainage, a drainage system is be provided and maintained in the building	1		
		Workplaces to be kept clean	Every workplace kept in a clean state and free from effluvia arising from any drain, sanitary convenience or other nuisance	1		
			Any accumulation of dirt and refuse removed daily by a suitable method from the floor and benches of workrooms, and from the staircases and passages	1		
			The floor of every workroom is cleaned at least once in every week by an effective and suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they have a smooth impervious surface, are washed with hot water and soap or cleaned by some other suitable method, at least once every fourteen months	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they are kept painted with oil paint or varnished, are re-painted or re-varnished at least once every seven years, and at least once every fourteen months are washed with hot water and soap or cleaned by some other suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, in any other case, are kept whitewashed or colour-washed and the whitewashing or colour-washing be repeated at least once every fourteen months	1		
		Healthy and safe working environment	A suitable room temperature is secured for workers in buildings, having regard in any workplace, to the numbers of workers, the ventilation and air movement, the air humidity and temperature of the surroundings		1	
			Laboratory is not, while work is being carried on, so over-crowded, so as to cause risk of injury to the health of the workers	1		
			Every workroom is not less than three metres in height, measured from the floor to the lowest point of the ceiling or where there is no ceiling, to the lowest point of the roofing material		1	
			Provision of an effective and suitable system for securing and maintaining the circulation of fresh air, in each workroom	1		
			Where mechanical means of ventilation are used, they are regarded as satisfactory if they provide a supply of air that adequately removes odours and contamination of the atmosphere that arises from human occupation of the room	1		
		Workplaces to have suitable lighting	Suitable lighting, whether natural or artificial, secured and maintained in every part of a workplace in which any person works or passes	1		
			All glazed windows and skylights used for lighting workrooms are, so far as is practicable, kept clean on both the inner and outer surfaces and free from obstruction, except in cases of whitewashing or shading of windows and skylights, for the purpose of mitigating heat or glare	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Workplaces to have suitable lighting	All apparatus provided for producing artificial lighting are be properly maintained	1		
		Provision of adequate sanitary conveniences	In the Laboratory, sufficient and suitable sanitary conveniences for the workers are provided, maintained and kept clean	1		
			In the Laboratory, effective provisions are made for lighting the conveniences	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have proper, separate accommodation for persons of each sex	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have separate approaches for each sex	1		
			The conveniences for each sex are indicated by a suitable notice.	1		
		Provision of adequate wholesome drinking water	An adequate supply of wholesome drinking water provided and maintained at suitable points in a workplace, conveniently accessible to all workers		1	
		Provision of adequate washing facilities	Employer provides and maintains for the use of workers, adequate and suitable facilities for washing, which are conveniently accessible and kept in a clean condition	1		
			Where any premises become a workplace after the coming into force of this Act (2006), the washing facilities be provided adjacent to the sanitary conveniences		1	
		Cloakrooms	A suitable cloakroom provided and maintained for the use of workers		1	
		Facilities for sitting down	Where workers have reasonable opportunity to sit during the period of their work, sufficient and suitable seats are provided and maintained by the employer, to enable the workers take advantage of the opportunity to sit.	1		
			Where a substantial proportion of any work can be properly done while sitting, an employer provides and maintains, for each employee doing the work, a seat of a design, construction and dimension suitable for that work	1		
		Facilities for meals	Employer provides and maintains adequate facilities for taking meals, due regard being made to the number of workers who remain on the premises during meal times		1	
			The facilities for taking meals be situated away from the habitual work positions and also include tables and chairs or benches with backrests.		1	
		First aid at the workplace	Employer provides a first-aid room or a room capable of being used for the purpose of administering first-aid	1		
			Where the provision of a first-aid room is not reasonably practicable, an employer provides and maintains a readily accessible first-aid box or cupboard of a prescribed standard	1		
			A first-aid room, box or cupboard does not contain articles other than those which are necessary for administering first-aid	1		
			A first-aid room, box or cupboard is under the charge of a responsible person and where more than a specified number of persons are employed, the person in charge is trained in first aid treatment	1		
			The person in charge of a first-aid room, box or cupboard is readily available during working hours	1		
			A notice stating the name of the person in charge of a first-aid room, box or cupboard is posted in a conspicuous place in the workplace		1	
Total: 38 regulations under Health and Welfare				**30**	**8**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**78.9%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHO

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 5 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
5	General Safety Requirements (Part IX)	General Safety Requirements	There is, as far as is reasonably practicable, provision and maintainance of safe means of access to every place at which any person has to work at any time	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are soundly constructed and properly maintained	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, as far as is reasonably practicable, are kept free of obstructions which may cause a worker to fall or suffer any other injury	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are kept free of any substance likely to cause an employed person to slip	1		
			The staircases on the premises inside and outside a building have hand-rails and guard-rails which are properly maintained at all times			1
			A staircase has at least one hand-rail throughout the length of the staircase			1
			A staircase has a hand-rail on the open sided section and a lower rail in the gap between the hand-rail at the open-sided section and the tread-level, unless that gap is filled in a way that prevents persons from falling through			1
			Where a staircase or any part of it is specifically liable to cause an accident because of its construction, or for any other reason, there is a handrail on each side of the staircase			1
			There is sufficient, clear and unobstructed space at every machine while it is in motion to enable work to be carried on without unnecessary risk	1		
Total: 9 regulations under General Safety Requirements				**5**	**0**	**4**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 6 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
6	Fire Preparedness (Part X)	Means of escape in case of fire	Laboratory premises has means of escape from fire, for workers, as may be reasonably required in the circumstances, and in determining what is required by way of escape, regard was paid to the number of persons expected to be working in the premises at any one time and to the number of persons other than employed persons expected to be in the premises at that time	1		
			All means of escape from fire are properly maintained and kept free from obstruction	1		
			The contents of any room in which a person is employed are arranged or disposed to provide a free passage way for the persons employed in the room, as a means of escape in case of fire	1		
			The door of the Laboratory which afford a means of exit for a person employed in the workplace is not locked or fastened in such a manner that it cannot be easily and immediately opened from inside	1		
			In the case of any Laboratory constructed or converted for use as a Laboratory after the commencement of this Act, all doors which afford means of exit from the Laboratory for the persons employed in it, are, except in the case of sliding doors, constructed to open outwards	1		
			Every window, door, or other exit which afford means of escape in case of fire or giving access to it, other than the means of exit in ordinary use, is distinctively and conspicuously marked by a notice printed in red letters of an adequate size	1		
			Effective steps are taken to ensure that all the persons employed are familiar with the means of escape in case of fire, and with the routine to be followed in case of fire	1		
		Fire extinguishing gadgets	Laboratory has provision of readily accessible and well maintained, means of extinguishing fire, which is adequate and suitable, having regard to the circumstances of each case	1		
		Safe keeping of inflammable substances	All stocks of highly inflammable substances are kept in a fire-resistant store or in a safe place outside any occupied buildings	1		
			The store is not situated in a way that endangers the means of escape from the workplace or from any part of the workplace by persons employed in it, in the event of fire occurring in any part of the workplace	1		
		Occupier's duty to ensure adequate fire response	Laboratory staff are aware that it is their responsibility to ensure adequate preparedness and response to any fire incidents in their premises	1		
Total: 11 regulations under Fire Preparedness				**11**	**0**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 7 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
7	Machinery, Plant and Equipment (Part XI)	Fencing of dangerous machinery, plant, and equipment	Every flywheel directly connected to any prime mover and every moving part of any prime mover, is securely fenced, whether the flywheel or prime mover is situated in an engine-house or not			1
			Every part of an electric generator, motor or rotary converter and every flywheel directly connected to it, is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises as it would be if it were securely fenced			1
			Every part of the transmission machinery is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced			1
			Every dangerous part of any machinery, other than a prime mover and transmission machinery is securely fenced unless it is in a position or of construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced			1
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which automatically prevents any employed person or his or her clothing from coming into contact with the dangerous parts			1
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which stops the machine immediately in case of approach by an employed person to a dangerous part			1
			Any part of a stock-bar which projects beyond the headstock of a lathe is securely fenced unless it is in a position that is safe to every employee on the premises as it would be if it were securely fenced			1
			All fencing or other safeguards provided under this Part of the Act is be of substantial construction and is constantly maintained and kept in position while the parts required to be fenced or safeguarded are in motion or in use			1
		Efficient control of power	Efficient devices or appliances are provided and maintained in every room or place where work is carried on, by which power can promptly be cut off from the transmission machinery in that room or place, where there is eminent danger	1		
			Every machine intended to be driven by mechanical power is provided with an efficient starting and stopping appliance and the control of the starting and stopping appliance of which is in such a position as to be readily and conveniently operated by the person operating the machine	1		
		Self-acting machines	No traversing part of any self-acting machine and no material carried by it is, if the space over which it runs is a space which any person is liable to pass in the course of his or her employment or at any other time, allowed on its outward or inward traverse to run within a distance of five centimetres from any fixed structure which is not part of the machine	1		
			All practicable steps are taken by instructions to the person in charge of the machine to ensure that a person employed is not in the space between any traversing part of a self-acting spinning mule and any fixed part of the machine towards which the traversing part moves on the inward run, except when the machine is stopped, with the traversing part on the outward run			1
Total: 12 regulations under Machinery, Plant and Equipment				**3**	**0**	**9**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 8 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Handling of hazardous materials	Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by enclosure of the plant used in the process			1
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by removal or prevention of accumulation of any dust that may escape inspite of the enclosure	1		
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by exclusion or effective enclosure of possible sources of ignition			1
			Where there is dust of a character and an extent liable to explode on ignition, in a plant in the above process, unless the plant is constructed to withstand the pressure likely to be produced by an explosion, all practicable steps are taken to restrict the spread and effects of the explosion by the provision of chokes, baffles and vents, or other equally effective appliances, to the plant	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to remove the substance and any fumes arising from it	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to render them non-explosive or non-inflammable			1
			Where any plant, tank or vessel is subjected to an operation in above, no explosive or inflammable substance is allowed to enter the plant, tank or vessel until the metal has cooled sufficiently to prevent any risk of igniting the substance			1
		Electrical apparatus, etc to be fit for work meant	All electrical apparatus, fittings and conductors are sufficient in size and power for the work they are meant for and are constructed, installed, protected, worked and maintained to prevent danger, as far as is reasonably practicable	1		
		Toxic materials to be used as last resort	Toxic materials or substances are only used where the use of a nontoxic material or substance is not reasonably practicable	1		
			Without prejudice to subsection above, where toxic materials or substances are present or used, the number of employed persons exposed to risk is kept to a minimum and where there is a recognised antidote, supplies of the antidote are kept readily available	1		
			In any Laboratory premises where there are operations to which this Act applies, nothing is done to or in connection with toxic materials except under an efficient exhaust draught system		1	
			Provision of an exhaust draught system constructed, placed and maintained, to prevent the escape into the air of toxic materials of a character and to an extent liable to be a danger to the health of employed persons		1	
			Where there is a risk that a toxic material or substance may be ingested, an employed person doesnot not eat, drink or smoke in any workroom or other place where the material or substance is handled	1		
			Without prejudice to any other requirement for washing facilities, where there is a risk to health from contamination of the surface of the body, washing facilities are provided and maintained and conveniently situated near the place where the toxic material or substance is used	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Toxic materials to be used as last resort	In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practicable			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to arrange for periodical medical examination			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional protective clothing			1
		Drenching facilities for emergency cases	Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency adequate and readily accessible means of drenching with water, for any employee who is splashed with these liquids	1		
			Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency sufficient and suitable means of flushing or irrigating the eyes, conveniently situated and clearly indicated by a distinctive sign which is visible at all times	1		
		Lifting of heavy loads	An employee does not lift, carry or move a load which is heavy and likely to cause him or her injury	1		
		Workers not to be exposed to ionising radiation, etc	Effective measures are taken, as far as is practicable, to restrict the extent to which workers may be exposed to ionising radiation in the course of their employment			1
			An employee is not exposed to ionizing radiation, lasers, ultra-violet, infrared light and other electromagnetic radiations, for more than is reasonably necessary, for the purposes of his or her work, and in any case, everything practicable is done to minimise the exposure			1
		Provision of personal protective gear	Where any process carried out at a Laboratory is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury, is provided with suitable and appropriate personal protective equipment and clothing to protect him or her from risk or injury	1		
			An employer supplies and maintains personal protective equipment, free of charge to the employees, and provide instructions for their use.		1	
		Protection of eyes in certain processes	In the case of any of the processes specified in Schedule 8 (Processes Requiring Provision of Suitable Goggles or Effective Screens), suitable goggles or effective screens are provided, to protect the eyes of the persons employed in the process			1
Total: 25 regulations under Hazardous Materials				**12**	**3**	**10**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**80.0%**		

EVALUATION OF GEOTECHNICAL FOUNDATION SERVICES TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GFS Date: 09/02/2024 Sheet 9 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
9	Chemical Safety and Special Provisions (Part XIII)	General precautions in handling chemicals	Whenever possible, hazardous substances are replaced by harmless or less harmful substances	1		
			Operations likely to result in contamination of the work environment by hazardous substances are isolated from the remainder of the premises to reduce the number of people exposed	1		
			Processes which involve a significant risk of exposure to very hazardous substances are, as far as is reasonably practicable, performed within an enclosed system, to prevent any contact between the hazardous substance and any person.		1	
			Direct contact with hazardous substances is, as far as is reasonably practicable, avoided by the use of automatic processes or by remote control systems		1	
			Only duly authorised and adequately trained workers participate in dangerous operations and their training is upgraded at suitable intervals	1		
			When circumstances make it necessary for a worker to enter an atmosphere contaminated by a harmful concentration of a hazardous substance, the worker is made fully aware of the hazards and is provided with and wear appropriate protective equipment		1	
		Provision of chemical data sheets	For hazardous chemicals, chemical safety data sheets containing detailed essential information, regarding the identity, supplier and classification of the chemical, and the hazards, safety precautions and emergency procedures required for the chemicals are provided to an employer, by a manufacturer or importer of the chemical	1		
		Labelling of hazardous chemicals	The employer ensures that the packages of a hazardous chemical delivered to the Laboratory, are labelled and that the appropriate chemical safety data sheet for the chemical is delivered to the Laboratory	1		
			A list or register of the chemical safety data sheets is kept at the workplace	1		1
			A copy of chemical safety data sheets and of the list of the safety data sheets are given to the workers concerned and are availed to their representatives for consultation, at any time	1		
		Duty of suppliers, manufacturers, etc	Suppliers, manufacturers and importers of equipment ensure that machines, process plants, instruments are designed and supplied to users in a suitable condition and with the relevant information and that their operation and use contribute as little as possible, to the contamination of a work environment, and that they do not present, as far as is reasonably practicable, any health hazard to workers during production operations, maintenance work and other activities	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that all chemicals are classified based on their characteristics including toxic, chemical or physical, corrosive and irritant properties; and allergenic and sensitising, carcinogenic, teratogenic and mutagenic effects as well as their effects on the reproductive system	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are marked to indicate their identity, to enable persons handling or using them to recognise and distinguish between them when receiving them and when using them, so that they are used safely	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are labelled in a uniform manner with legible, durable labels which are easily understood by workers and other persons	1		
Total: 14 regulations under Chemical Safety and Special Provisions				**11**	**3**	**1**

ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items) **78.6%**

General ELMERI Safety Index (SI) = Average Safety Index of prpvisions = SUM (SI)/Number of provisions **83.4%**

APPENDIX H: Assessed Observation based Compliance evaluation Matrix for OSH in Geotechnical Engineering and Technology Laboratory

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GET Date: 12/02/2024 Sheet 1 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Duty of employers to protect workers	Employer takes all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost	1		
			Employer ensures, as far is reasonably practicable, that the working environment is kept free from any hazard due to pollution by using technical measure to new plant/ processes or adding to existing plant/processes or using supplementary technical measures	1		
			Provision and maintenance of plant and systems of work that give, as far as is reasonably practicable, a safe working environment including its vicinity	1		
			Arrangements for ensuring safety and absence of risks to health, in connection with the use, handling, storage and transport of articles and substances	1		
			Provision of adequate and appropriate information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the safety and health of the employees, and the application and use of occupational safety and health measures, taking into account the functions and capabilities of the different categories of workers in an undertaking			1
			Provision and maintenance of means of access to and exit from the workplace, that are safe and without risks to health	1		
			Provision and maintenance of a working environment for the workers, that is, as far as is reasonably practicable, safe, without risks to health and which is adequate, regarding facilities and arrangements for the welfare of workers at work	1		
			Provision, where necessary, of adequate personal protective equipment to prevent, as far as is reasonably practicable, the risks of accidents or of adverse effects on health	1		
		Safety and health measures of employers	An employer who has at least twenty workers at a workplace shall prepare, and as often as may be appropriate, revise a written statement of policy with respect to the safety and health of employees while at work		1	
			An employer who has at least twenty workers at a workplace shall make arrangements for carrying out the statement of policy		1	
			An employer who has at least twenty workers at a workplace shall bring the statement of policy and any revision of it to the notice of all the employees		1	
		Safety representatives	The Minister shall make regulations to provide for the appointment, in prescribed cases, of safety representatives			1
			Every employer has a duty to consult a safety representative in the making and sustenance of arrangements, which enable the employer and the workers to co-operate effectively in promoting the development of measures to ensure the safety and health of employees	1		
		Safety Committees	Presence of a Safety Committee appointed by the employer for a workforce of at least 20 workers		1	
			Safety representatives represent employees on a safety committee		1	
			A safety committee keeps under review the measures taken to ensure the safety and health of employees and any other functions as may be prescribed		1	
		Employer to consult with workers' organisations	Consultation on the role of the workers' organisation in the practical implementation of measures prescribed under this Act		1	
			Provision of close collaboration at all levels, between the employer and the workers in the application of the measures prescribed under this Act.	1		
			A representative of the employers and that of the workers accompanying an Inspector or any other authorised person supervising the application of any measures prescribed under this Act, except where the inspector or authorized person is of the view that the accompaniment shall prejudice the performance of his or her duties.			1

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
1	General duties, obligations, and responsibilities of employers (Part III)	Employer to monitor and control the release of dangerous substances into the environment	Employer to arrange for equipment and apparatus to monitor the air, soil, and water pollution in case there is major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes, or soil and which are a danger to the animal and plant life		1	
			Records of monitoring in subsection (above) to be kept and made available to an Inspector.		1	
		Employer to provide protective gear	Employer to provide adequate and suitable protective clothing and protective equipment to the workers of his or her undertaking.	1		
			Employer ensures that personal protective equipment provided is used whenever it is required	1		
		Employer to provide alternative suitable employment	Job rotation in case an assignment involves continuous exposure of the worker to dangerous emissions or to substances and agents, which are medically found to be harmful to health.	1		
		Employer to supervise the health of workers	Employer conducts a pre-assignment medical examination of workers, before assignment to specific tasks which may involve danger to their health or of that of others		1	
			Employer conducts periodic medical examinations of workers during employment which involves exposure to a particular hazard to health		1	
			Employer informs a worker concerned of any health hazards involved in his or her work	1		
		Medical records of workers to be kept	Employer keeps and maintains records of the medical examination information in a format and for a period to be prescribed by the Minister, and avails these records for epidemiological and other research		1	
			To the extent determined by the Commissioner, records kept under this section include information on occupational exposure to air pollution and other harmful agents		1	
Total: 29 regulations under General duties, obligations, and responsibilities of employers				**13**	**13**	**3**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**50.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GET Date: 12/02/2024 Sheet 2 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
2	General duties of employers and the self-employed (Part IV)	Employers' duty to persons other than employees	Employer conducts his or her undertaking in a way that ensures, as far as is reasonably practicable, that any person who is not in his or her employment but who may be affected by the undertaking, is not exposed to risks to his or her health and safety.		1	
			Where two or more employers undertake activities simultaneously at one workplace, they have a duty to collaborate, in order to comply with the prescribed measures, without prejudice to the responsibility of each of the employers, for his or her workers.			1
		Employer to display guide safety precautions	Employer displays or provides guide safety precautions to any persons who may be affected by the manner in which the employer conducts his or her undertaking, whether or not that person is his or her worker	1		
			Employer displays all information in his or her possession or control concerning the way in which he or she conducts the undertaking, which may affect any person's health or safety	1		
		Duty to provide safe premises	A person in control of premises provides the means of access to and exit from the premises or any plan or substances in the premises and takes any measures that are reasonable for a person in his or her position to ensure, as far as is reasonably practicable, that the premises remain safe and without risk to health	1		
			Person in control of premses maintains or repairs the premises or any means of access to or exit from the premises	1		
			Person in control of premses ensures the safety of or the absence of risk to health arising from a plant or substances in the premises	1		
		Duty of controller of premises to keep air free of pollutants	Person with control of premises uses the best practicable means to prevent the emissions into the atmosphere from the premises, of toxic or offensive substances and renders harmless and inoffensive any substances that may be emitted.		1	
Total: 8 regulations under General duties of employers and the self-employed				**5**	**2**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**71.4%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GET Date: 12/02/2024 Sheet 3 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
3	Duties, rights and responsibilities of workers (Part VI)	Duty of workers to take care	Workers take reasonable care for the health and safety ofthemselves and of any other person who may be affected by their acts or omissions at work	1		
			In case of duty or requirement imposed on an employer or any other person, by or under a statutory provision, workers do cooperate with the employer, as far as is necessary, to enable the duty or requirement to be performed or complied with.	1		
			Representatives of the workers in an undertaking cooperate with an employer in all measures to eliminate or minimize risks to health and safety at work provided in this Act and any other law	1		
		Duty to report dangerous situation to immediate supervisor	Worker reports immediately to a supervisor any situation which the worker has reasonable grounds to believe presents an imminent or serious danger to his or her life or health or to the life or health of any other persons in the premises.	1		
			Employer before taking remedial action does not require the worker to return to a work situation where there is reported continuing imminent or serious danger to life or health.	1		
		Workers' right to move away from dangerous situation	A worker who removes himself or herself from a work situation which he or she has reasonable justification to believe presents an imminent and serious danger to his or her life or health is not punished or subjected to undue consequences, provided the danger is confirmed by the Commissioner.	1		
		Workers not to be penalized for complying with Act	An employer does not levy or permit to be levied on any worker any penalty in respect of anything done or provided under this Act	1		
		Reckless or intentional interference with safety measures	A person who intentionally or recklessly interferes with or misuses anything provided in the interest of health, safety or welfare under this Act, commits an offence.	1		
Total: 8 regulations under Duties, rights and responsibilities of workers				**8**	**0**	**0**
ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)				**100.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

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S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Buildings at workplace to be of sound construction, etc	Buildings forming part of the Laboratory are of sound construction and are kept in a good state of repair	1		
			Every building used as a workplace is designed to protect workers from the weather	1		
			Every building used as a workplace has a water-tight roof	1		
			Every building used as a workplace is free from any significant amount of dampness that is liable to affect the safety of the building or the health of the workers	1		
			Where any process carried out in a workplace renders the floor of a building of the workplace liable to be wet to an extent that necessitates the wetness to be removed by drainage, a drainage system is be provided and maintained in the building	1		
		Workplaces to be kept clean	Every workplace kept in a clean state and free from effluvia arising from any drain, sanitary convenience or other nuisance	1		
			Any accumulation of dirt and refuse removed daily by a suitable method from the floor and benches of workrooms, and from the staircases and passages	1		
			The floor of every workroom is cleaned at least once in every week by an effective and suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they have a smooth impervious surface, are washed with hot water and soap or cleaned by some other suitable method, at least once every fourteen months	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, where they are kept painted with oil paint or varnished, are re-painted or re-varnished at least once every seven years, and at least once every fourteen months are washed with hot water and soap or cleaned by some other suitable method	1		
			Inside walls and partitions, ceilings or tops of rooms, walls, sides, tops of passages and staircases, in any other case, are kept whitewashed or colour-washed and the whitewashing or colour-washing be repeated at least once every fourteen months	1		
		Healthy and safe working environment	A suitable room temperature is secured for workers in buildings, having regard in any workplace, to the numbers of workers, the ventilation and air movement, the air humidity and temperature of the surroundings	1		
			Laboratory is not, while work is being carried on, so over-crowded, so as to cause risk of injury to the health of the workers	1		
			Every workroom is not less than three metres in height, measured from the floor to the lowest point of the ceiling or where there is no ceiling, to the lowest point of the roofing material	1		
			Provision of an effective and suitable system for securing and maintaining the circulation of fresh air, in each workroom	1		
			Where mechanical means of ventilation are used, they are regarded as satisfactory if they provide a supply of air that adequately removes odours and contamination of the atmosphere that arises from human occupation of the room	1		
		Workplaces to have suitable lighting	Suitable lighting, whether natural or artificial, secured and maintained in every part of a workplace in which any person works or passes	1		
			All glazed windows and skylights used for lighting workrooms are, so far as is practicable, kept clean on both the inner and outer surfaces and free from obstruction, except in cases of whitewashing or shading of windows and skylights, for the purpose of mitigating heat or glare	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
4	Health and Welfare (Part VIII)	Workplaces to have suitable lighting	All apparatus provided for producing artificial lighting are be properly maintained	1		
		Provision of adequate sanitary conveniences	In the Laboratory, sufficient and suitable sanitary conveniences for the workers are provided, maintained and kept clean	1		
			In the Laboratory, effective provisions are made for lighting the conveniences	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have proper, separate accommodation for persons of each sex	1		
			Where persons of both sexes are or are intended to be employed, the conveniences have separate approaches for each sex	1		
			The conveniences for each sex are indicated by a suitable notice.	1		
		Provision of adequate wholesome drinking water	An adequate supply of wholesome drinking water provided and maintained at suitable points in a workplace, conveniently accessible to all workers	1		
		Provision of adequate washing facilities	Employer provides and maintains for the use of workers, adequate and suitable facilities for washing, which are conveniently accessible and kept in a clean condition	1		
			Where any premises become a workplace after the coming into force of this Act (2006), the washing facilities be provided adjacent to the sanitary conveniences	1		
		Cloakrooms	A suitable cloakroom provided and maintained for the use of workers	1		
		Facilities for sitting down	Where workers have reasonable opportunity to sit during the period of their work, sufficient and suitable seats are provided and maintained by the employer, to enable the workers take advantage of the opportunity to sit.	1		
			Where a substantial proportion of any work can be properly done while sitting, an employer provides and maintains, for each employee doing the work, a seat of a design, construction and dimension suitable for that work	1		
		Facilities for meals	Employer provides and maintains adequate facilities for taking meals, due regard being made to the number of workers who remain on the premises during meal times	1		
			The facilities for taking meals be situated away from the habitual work positions and also include tables and chairs or benches with backrests.	1		
		First aid at the workplace	Employer provides a first-aid room or a room capable of being used for the purpose of administering first-aid	1		
			Where the provision of a first-aid room is not reasonably practicable, an employer provides and maintains a readily accessible first-aid box or cupboard of a prescribed standard	1		
			A first-aid room, box or cupboard does not contain articles other than those which are necessary for administering first-aid	1		
			A first-aid room, box or cupboard is under the charge of a responsible person and where more than a specified number of persons are employed, the person in charge is trained in first aid treatment	1		
			The person in charge of a first-aid room, box or cupboard is readily available during working hours	1		
			A notice stating the name of the person in charge of a first-aid room, box or cupboard is posted in a conspicuous place in the workplace		1	
Total: 38 regulations under Health and Welfare				**37**	**1**	**0**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**97.4%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

STUDY LABORATORY: GET Date: 12/02/2024 Sheet 5 of 9

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
5	General Safety Requirements (Part IX)	General Safety Requirements	There is, as far as is reasonably practicable, provision and maintainance of safe means of access to every place at which any person has to work at any time	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are soundly constructed and properly maintained	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, as far as is reasonably practicable, are kept free of obstructions which may cause a worker to fall or suffer any other injury	1		
			All floors, steps, passages, walkways and gangways, including any supports or supporting structure, are kept free of any substance likely to cause an employed person to slip	1		
			The staircases on the premises inside and outside a building have hand-rails and guard-rails which are properly maintained at all times	1		1
			A staircase has at least one hand-rail throughout the length of the staircase	1		1
			A staircase has a hand-rail on the open sided section and a lower rail in the gap between the hand-rail at the open-sided section and the tread-level, unless that gap is filled in a way that prevents persons from falling through	1		1
			Where a staircase or any part of it is specifically liable to cause an accident because of its construction, or for any other reason, there is a handrail on each side of the staircase	1		1
			There is sufficient, clear and unobstructed space at every machine while it is in motion to enable work to be carried on without unnecessary risk	1		
Total: 9 regulations under General Safety Requirements				**9**	**0**	**4**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

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S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
6	Fire Preparedness (Part X)	Means of escape in case of fire	Laboratory premises has means of escape from fire, for workers, as may be reasonably required in the circumstances, and in determining what is required by way of escape, regard was paid to the number of persons expected to be working in the premises at any one time and to the number of persons other than employed persons expected to be in the premises at that time	1		
			All means of escape from fire are properly maintained and kept free from obstruction	1		
			The contents of any room in which a person is employed are arranged or disposed to provide a free passage way for the persons employed in the room, as a means of escape in case of fire	1		
			The door of the Laboratory which afford a means of exit for a person employed in the workplace is not locked or fastened in such a manner that it cannot be easily and immediately opened from inside	1		
			In the case of any Laboratory constructed or converted for use as a Laboratory after the commencement of this Act, all doors which afford means of exit from the Laboratory for the persons employed in it, are, except in the case of sliding doors, constructed to open outwards			1
			Every window, door, or other exit which afford means of escape in case of fire or giving access to it, other than the means of exit in ordinary use, is distinctively and conspicuously marked by a notice printed in red letters of an adequate size	1		
			Effective steps are taken to ensure that all the persons employed are familiar with the means of escape in case of fire, and with the routine to be followed in case of fire	1		
		Fire extinguishing gadgets	Laboratory has provision of readily accessible and well maintained, means of extinguishing fire, which is adequate and suitable, having regard to the circumstances of each case	1		
		Safe keeping of inflammable substances	All stocks of highly inflammable substances are kept in a fire-resistant store or in a safe place outside any occupied buildings	1		
			The store is not situated in a way that endangers the means of escape from the workplace or from any part of the workplace by persons employed in it, in the event of fire occurring in any part of the workplace	1		
		Occupier's duty to ensure adequate fire response	Laboratory staff are aware that it is their responsibility to ensure adequate preparedness and response to any fire incidents in their premises	1		
Total: 11 regulations under Fire Preparedness				**10**	**0**	**1**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

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S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
7	Machinery, Plant and Equipment (Part XI)	Fencing of dangerous machinery, plant, and equipment	Every flywheel directly connected to any prime mover and every moving part of any prime mover, is securely fenced, whether the flywheel or prime mover is situated in an engine-house or not			1
			Every part of an electric generator, motor or rotary converter and every flywheel directly connected to it, is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises as it would be if it were securely fenced			1
			Every part of the transmission machinery is securely fenced unless it is in such a position or of such construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced			1
			Every dangerous part of any machinery, other than a prime mover and transmission machinery is securely fenced unless it is in a position or of construction that is safe to every person employed or working on the premises, as it would be if it were securely fenced			1
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which automatically prevents any employed person or his or her clothing from coming into contact with the dangerous parts			1
			Secure fencing for machinery is through the provision of an effective guard which may be fixed or interlocked but where this is not possible, the requirement is deemed to be satisfied where a device is provided which stops the machine immediately in case of approach by an employed person to a dangerous part			1
			Any part of a stock-bar which projects beyond the headstock of a lathe is securely fenced unless it is in a position that is safe to every employee on the premises as it would be if it were securely fenced			1
			All fencing or other safeguards provided under this Part of the Act is be of substantial construction and is constantly maintained and kept in position while the parts required to be fenced or safeguarded are in motion or in use			1
		Efficient control of power	Efficient devices or appliances are provided and maintained in every room or place where work is carried on, by which power can promptly be cut off from the transmission machinery in that room or place, where there is eminent danger	1		
			Every machine intended to be driven by mechanical power is provided with an efficient starting and stopping appliance and the control of the starting and stopping appliance of which is in such a position as to be readily and conveniently operated by the person operating the machine	1		
		Self-acting machines	No traversing part of any self-acting machine and no material carried by it is, if the space over which it runs is a space which any person is liable to pass in the course of his or her employment or at any other time, allowed on its outward or inward traverse to run within a distance of five centimetres from any fixed structure which is not part of the machine	1		
			All practicable steps are taken by instructions to the person in charge of the machine to ensure that a person employed is not in the space between any traversing part of a self-acting spinning mule and any fixed part of the machine towards which the traversing part moves on the inward run, except when the machine is stopped, with the traversing part on the outward run			1
Total: 12 regulations under Machinery, Plant and Equipment				**3**	**0**	**9**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**100.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

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S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Handling of hazardous materials	Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by enclosure of the plant used in the process	1		
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by removal or prevention of accumulation of any dust that may escape inspite of the enclosure	1		
			Where there may be escape of dust of a character and to an extent liable to explode on ignition, as a result of grinding, sieving or any other process which gives rise to dust, all practicable steps are taken to prevent the explosion by exclusion or effective enclosure of possible sources of ignition	1		
			Where there is dust of a character and an extent liable to explode on ignition, in a plant in the above process, unless the plant is constructed to withstand the pressure likely to be produced by an explosion, all practicable steps are taken to restrict the spread and effects of the explosion by the provision of chokes, baffles and vents, or other equally effective appliances, to the plant	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to remove the substance and any fumes arising from it	1		
			Any plant, tank or vessel which contains or has contained any explosive or inflammable substance is not subjected to any welding, brazing or soldering operation or to any cutting operation which involves the application of heat, until all practicable steps are taken to render them non-explosive or non-inflammable	1		
			Where any plant, tank or vessel is subjected to an operation in above, no explosive or inflammable substance is allowed to enter the plant, tank or vessel until the metal has cooled sufficiently to prevent any risk of igniting the substance	1		
		Electrical apparatus, etc to be fit for work meant	All electrical apparatus, fittings and conductors are sufficient in size and power for the work they are meant for and are constructed, installed, protected, worked and maintained to prevent danger, as far as is reasonably practicable	1		
		Toxic materials to be used as last resort	Toxic materials or substances are only used where the use of a nontoxic material or substance is not reasonably practicable	1		
			Without prejudice to subsection above, where toxic materials or substances are present or used, the number of employed persons exposed to risk is kept to a minimum and where there is a recognised antidote, supplies of the antidote are kept readily available	1		
			In any Laboratory premises where there are operations to which this Act applies, nothing is done to or in connection with toxic materials except under an efficient exhaust draught system		1	
			Provision of an exhaust draught system constructed, placed and maintained, to prevent the escape into the air of toxic materials of a character and to an extent liable to be a danger to the health of employed persons		1	
			Where there is a risk that a toxic material or substance may be ingested, an employed person doesnot not eat, drink or smoke in any workroom or other place where the material or substance is handled	1		
			Without prejudice to any other requirement for washing facilities, where there is a risk to health from contamination of the surface of the body, washing facilities are provided and maintained and conveniently situated near the place where the toxic material or substance is used	1		

S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
8	Hazardous Materials (Part XII)	Toxic materials to be used as last resort	In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional bathing facilities including showers, where practicable			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to arrange for periodical medical examination			1
			In case where toxic materials or substances are manufactured, handled, used or stored, the Commissioner may serve upon an occupier or employer, a notice requiring him or her to provide additional protective clothing			1
		Drenching facilities for emergency cases	Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency adequate and readily accessible means of drenching with water, for any employee who is splashed with these liquids	1		
			Where dangerous or corrosive liquids are used, there is provision and maintainance, for use in case of an emergency sufficient and suitable means of flushing or irrigating the eyes, conveniently situated and clearly indicated by a distinctive sign which is visible at all times	1		
		Lifting of heavy loads	An employee does not lift, carry or move a load which is heavy and likely to cause him or her injury	1		
		Workers not to be exposed to ionising radiation, etc	Effective measures are taken, as far as is practicable, to restrict the extent to which workers may be exposed to ionising radiation in the course of their employment			1
			An employee is not exposed to ionizing radiation, lasers, ultra-violet, infrared light and other electromagnetic radiations, for more than is reasonably necessary, for the purposes of his or her work, and in any case, everything practicable is done to minimise the exposure			1
		Provision of personal protective gear	Where any process carried out at a Laboratory is likely to cause bodily injury which cannot be prevented by other means, every worker involved in that process, who is liable to bodily injury, is provided with suitable and appropriate personal protective equipment and clothing to protect him or her from risk or injury	1		
			An employer supplies and maintains personal protective equipment, free of charge to the employees, and provide instructions for their use.	1		
		Protection of eyes in certain processes	In the case of any of the processes specified in Schedule 8 (Processes Requiring Provision of Suitable Goggles or Effective Screens), suitable goggles or effective screens are provided, to protect the eyes of the persons employed in the process	1		
Total: 25 regulations under Hazardous Materials				**18**	**2**	**5**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**90.0%**		

EVALUATION OF GEOTECHNICAL ENGINEERING AND TECHNOLOGY TESTING LABORATORY'S COMPLIANCE TO OSHA, 2006 REGULATIONS USING THE ELMERI'S OBSERVATION METHOD

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S/N	OSHA, 2006 Regulatory Provision	Section	Particulars	Study Laboratory – Elmeri evaluation		
				Correct	Not Correct	No Observation
9	Chemical Safety and Special Provisions (Part XIII)	General precautions in handling chemicals	Whenever possible, hazardous substances are replaced by harmless or less harmful substances	1		
			Operations likely to result in contamination of the work environment by hazardous substances are isolated from the remainder of the premises to reduce the number of people exposed	1		
			Processes which involve a significant risk of exposure to very hazardous substances are, as far as is reasonably practicable, performed within an enclosed system, to prevent any contact between the hazardous substance and any person.		1	
			Direct contact with hazardous substances is, as far as is reasonably practicable, avoided by the use of automatic processes or by remote control systems		1	
			Only duly authorised and adequately trained workers participate in dangerous operations and their training is upgraded at suitable intervals	1		
			When circumstances make it necessary for a worker to enter an atmosphere contaminated by a harmful concentration of a hazardous substance, the worker is made fully aware of the hazards and is provided with and wear appropriate protective equipment			1
		Provision of chemical data sheets	For hazardous chemicals, chemical safety data sheets containing detailed essential information, regarding the identity, supplier and classification of the chemical, and the hazards, safety precautions and emergency procedures required for the chemicals are provided to an employer, by a manufacturer or importer of the chemical	1		
		Labelling of hazardous chemicals	The employer ensures that the packages of a hazardous chemical delivered to the Laboratory, are labelled and that the appropriate chemical safety data sheet for the chemical is delivered to the Laboratory	1		
			A list or register of the chemical safety data sheets is kept at the workplace	1		
			A copy of chemical safety data sheets and of the list of the safety data sheets are given to the workers concerned and are availed to their representatives for consultation, at any time	1		
		Duty of suppliers, manufacturers, etc	Suppliers, manufacturers and importers of equipment ensure that machines, process plants, instruments are designed and supplied to users in a suitable condition and with the relevant information and that their operation and use contribute as little as possible, to the contamination of a work environment, and that they do not present, as far as is reasonably practicable, any health hazard to workers during production operations, maintenance work and other activities			1
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that all chemicals are classified based on their characteristics including toxic, chemical or physical, corrosive and irritant properties; and allergenic and sensitising, carcinogenic, teratogenic and mutagenic effects as well as their effects on the reproductive system	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are marked to indicate their identity, to enable persons handling or using them to recognise and distinguish between them when receiving them and when using them, so that they are used safely	1		
			Suppliers, manufacturers, importers or distributors of hazardous substances ensure that the containers of all hazardous substances are labelled in a uniform manner with legible, durable labels which are easily understood by workers and other persons	1		
Total: 14 regulations under Chemical Safety and Special Provisions				**10**	**2**	**2**
		ELMERI Safety Index (SI) = Total No.of Correct Items*(100)/(Total No. of Correct Items + Total No. of Not Correct Items)		**83.3%**		
		General ELMERI Safety Index (SI) = Average Safety Index of prpvisions = SUM (SI)/Number of provisions		**88.0%**		

APPENDIX I: Survey Timetable

Period/Months (2022 - 2024)	**May 22**	**June 22**	**July 22**		**August 22**	**September 22**			**October 22**		**November 22**			**December 22**		**January 23**		**March 23**		**October 23 – April 24**		
Description of Works				W 4		W 1	W 3	W 4	W1 – W2	W2 – W4	W 1	W 2	W3 – W4	W1	W2– W4	W1 – W2	W3– W4	W1- W2	W3 - W4			W4
Review of Literature																						
Research title submission																						
Proposal development																						
Proposal submission and presentation																						
Questionnaire development																						
Data collection																						
Analyzing and interpreting the output																						
Draft report writing																						
Intention to submit																						
Report submission																						
Presentation																						
Report Corrections																						
Final Report submission																						

APPENDIX J: Introductory Letter

APPENDIX K: Corrections Matrix