TECHNICAL REPORT ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME [SIWES]

HELD AT

Quarrylink Concept Limited situated at KM 14, Ilorin
Old Ogbomosho Road, Eyeinkorin, Kwara State.

WRITTEN BY

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SUBMITTED TO DEPARTMENT OF MINERALS AND PETROLEUM RESOURCES ENGINEERING.

In partial fulfillment for the requirement of the award of National Diploma [ND] in Minerals and Petroleum Resources Engineering Technology Kwara State Polytechnic, Ilorin.

HELD BETWEEN

September-November, 2024

DEDICATION

This is dedicated to Almighty God the maker of the universe who gives me the opportunity to start and complete my Student Industrial Work Experience Scheme.

I also dedicate it to my family and also the Managing Director of QuarryLink Concept for their support financially. support towards my academics.

My sincere appreciation goes to **Alhaji Muhammed Adebayo** for accepting me as a trainee in their firm. Special thanks to family, friends and colleagues throughout my SIWES program.

ACKNOWLEDGMENT

All praise and adoration to Almighty God for the inspiration, guidance and strength throughout my SIWES training.

I owe my profound gratitude to my HOD and all my lecturers in my department for their immense support towards my academics .

My since appreciation goes to Alhaji Muhammed Adebayo for allowing me as a trainee in your firm

Special thanks go to family and friends.

PREFACE

This report is to give account on the experience I had during my SIWES.

It also entails the working system used at Quarrylink Concept

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CHAPTER ONE

1.0 INTRODUCTION TO SIWES

The Student Industrial Work Experience Scheme [SIWES] was established by the Industrial Training Fund [ITF] IN 1973 to enable student of tertiary institution to have technical knowledge of industrial work base on their course of study before the completion of their program in their respective institutions. The major background behind the embankment of students in SIWES was to expose them to the industrial environment and enable the to develop occupational competences so that they can live readily contribute their quota to national economic and technological development after graduation.

Student Industrial Work Experience Scheme [SIWES] has been necessarily required for the award of diploma and degree certificate in specific discipline in Nigeria institutions of higher learning in accordance with the educational policy.

`1.1 MISSION

SIWES is charged with the responsibility of promoting and encouraging the acquisition of skills, commerce and industry with the view of generating pool of trained indigenous manpower sufficient to meet the need of the economy. It is aimed at developing the human resources of the nation. It builds the nation's work force to promote the economy of the nation.

1.2 VISION

The vision of SIWES is to prepare students to contribute to their nation and strengthen the student in practical aspect.

1.3 AIMS AND OBJECTIVES

The aim of study was to evaluate the impact of SIWES on technical skills development in the Nigeria economy. This is to enable institutions of higher learning and other stakeholders access the performance of their roles in the schemes.

OBJECTIVES

The Industrial Training Fund policy document No. 1 of 1973. Which established SIWES outline the objectives of the schemes. The objectives are to ;

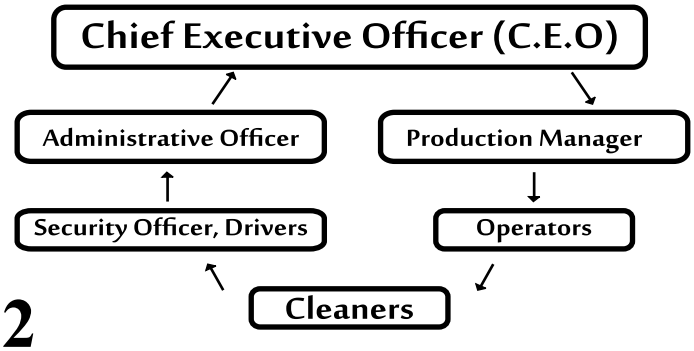
a. Provide an avenue for the student in institution of higher learning to acquire industrial skills and experience during their course of study.

b. Prepare student for industrial work situation that they are likely to meet after graduation
c. Expose student to work methods and techniques in handling equipment and machinery that may not be available in their institution
d. Make the transition from school to the world of work carrier and enhances students contacts for later job placements.
e. To provide students with industrial skills and needed experience during their course of study.

1.4 LOCATION AND BRIEF HISTORY OF ESTABLISHMENT

QuarryLink Concept Limited is located at KM14, Ilorin old Ogbomosho Road, eyeinkorin Kwara State. The organization was established in the year 2014. The company deals with marble [dolomite] production for different uses and purposes. The company has a working turn which covers 50tons of marble per day. Meanwhile the company also involves in marketing various blasting accessories such as Ammonium Nitrate, Gelatin, Detonating cord and safety fuse [cap]
The company has two quarries which are for marble [dolomites] production including one magazine, the locations are ; Igbeti quarry site , Oyo State and Eyeinkorin quarry site along Ogbomosho Road, Kwara State which is the permanent site, and magazine is located at Isale osin along Idofin road, Kwara state. These quarries do not enjoy sophisticated mining techniques and intermediate extractive technology due to lack of financial support and governmental involvement almost all production operations are manually carried out by local settlers

1.5 ORGANIZATION STRUCTURE [INCLUDING ORGANOGRAM]



CHAPTER TWO

MARBLE

2.1 INTRODUCTION OF MARBLE

Marble is a metamorphic rock that forms when limestone or dolostone is subjected to heat and pressure over thousands of years. The word MARBLE comes from the ancient Greek word MARMAROS which means crystalline rocks or shining stone. It is created as a result of the metamorphic or combination of rocks under intense pressure and temperature, the main component of marble is Calcium Carbonate and contains acidic oxide.

2.2 TYPES OF MARBLE

The two main types of marble are;

1. **CALCITIC MARBLE**

This Is the most common type of marble, primarily composed of calcite [Calcium Carbonate]. It is known for its durability and is often used in construction and sculpture, this gives it a relatively soft structure compared to other type of stones making it easier to work with for carving and shaping. Its compound consists of one Calcium atom, one Carbon atom and three Oxygen atoms [CaCO3]. It can be found in different colors depending on the geological conditions and the mineral content during the formation.

2. **DOLOMITIC MARBLE**

This type of marble contains a significant amount of dolomite in addition to calcite i. e [CaMg [Co3]2]. Dolomitic marble is generally harder and more resistant to weathering than calcitic marble, making it suitable for outdoor applications. It is made up of 60% of Calcium Carbonate i.e 20% of Calcium, 40% of Magnesium Carbonate and 12% of Magnesium. It can also appear in different color depending on the geological environment it's been extracted from such as white, grey, pink, cream, brown and green.

1.3 ADVANTAGES OF MARBLE

1. Aesthetic Appeal: Marble is renowned for its beauty and elegance. Its unique veining and wide range of colors can enhance the visual appeal of any space.

2. Durability: While it is softer than some stones, marble is still quite durable when properly maintained. It can withstand significant wear and tear, making it suitable for high-traffic areas.

3. Heat Resistance: Marble is heat resistant, which makes it an excellent choice for kitchen countertops. It can handle hot pots and pans without damage.

4. Versatility: Marble can be used in various applications, including flooring, countertops, sculptures, and decorative elements. Its versatility allows it to fit into different design styles.

5. Timelessness: Marble has been used for centuries and is often associated with luxury and sophistication. Its classic look never goes out of style.

6. Easy to Clean: With regular sealing and proper care, marble surfaces can be relatively easy to clean and maintain.

1.4 FORMATION OF MARBLE

Marble forms through a process called metamorphism, which involves the alteration of limestone or dolomite under high pressure and temperature conditions. Here's a step-by-step overview of how marble is formed:

1. Original Rock: The process begins with limestone (composed mainly of calcium carbonate) or dolomite (calcium magnesium carbonate).

2. Heat and Pressure: When these rocks are subjected to intense heat and pressure over geological time, the minerals within them undergo a transformation. This typically occurs due to tectonic forces that create conditions deep within the Earth's crust.

3. Recrystallization: During metamorphism, the original minerals in limestone or dolomite recrystallize. This process changes the texture and structure of the rock, resulting in the formation of marble. The calcite crystals grow larger, giving marble its characteristic appearance.

4. Formation of Veins: As the metamorphic process continues, minerals can also be introduced into the rock, leading to the formation of veining patterns that are often seen in marble.

5. Final Product: The end result is a dense, durable, and aesthetically pleasing stone known as marble, which can be polished to a high shine.

CHAPTER THREE

CRUSHING AND GRINDING

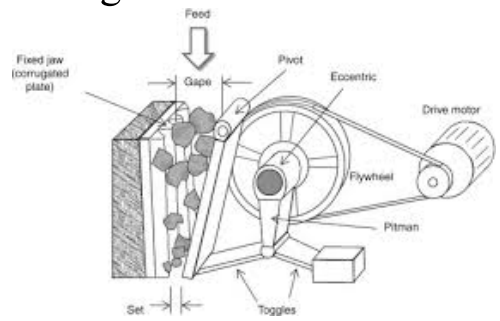
3.1 Crushing is the process of reducing the size of solid bodies by breaking down of rocks with the aid of external forces, as a result of adhesion forces joining the separate particle of the solid body are overcome and new surfaces are exposed. Crushing in the mining sector is a crucial process that involves breaking down large rocks into smaller, more manageable pieces. This is typically done in several stages, which include primary, secondary, and sometimes tertiary crushing, depending on the desired size of the final product. There are two major types of crushing which are primary and secondary crushing.

1. Primary Crushing: This is the first stage of crushing, where large boulders are reduced to smaller pieces. This is often done using jaw crushers or gyratory crushers. The goal is to reduce the material to a size that can be further processed.

2. Secondary Crushing: After primary crushing, the material is further reduced in size using secondary crushers, which can include cone crushers or impact crushers. This stage aims to achieve a more uniform particle size.
We were involved in primary crushing at Quarrylink concept and we make use of jaw crusher as one of the power tools used in primary crushing.

3.2 CRUSHING EQUIPMENTS

1. JAW CRUSHER: These are one of the most common types of primary crushers. They use a set of jaws to crush the material by applying compressive force. Jaw crushers are known for their ability to handle large volumes of material and are often used in the initial stage of crushing.



2. BUCKET CLASSIFIER; it helps in the transfer of the sample to the mill machine

3. MILL MACHINE;

Hand tools are being used for example in a situation where we have larger samples than the adjusted size of the jaw of the crusher so here are some of it;

1. Hammers: Heavy hammers are often used to break rocks manually. They can be used alone or in conjunction with other tools.

4. Sledgehammer: A heavier version of a hammer, sledgehammers are used for more forceful impacts, making them effective for breaking larger rocks.

6. Shovels and Spades: While not directly used for crushing, these tools are essential for moving crushed material and preparing the site for further work.

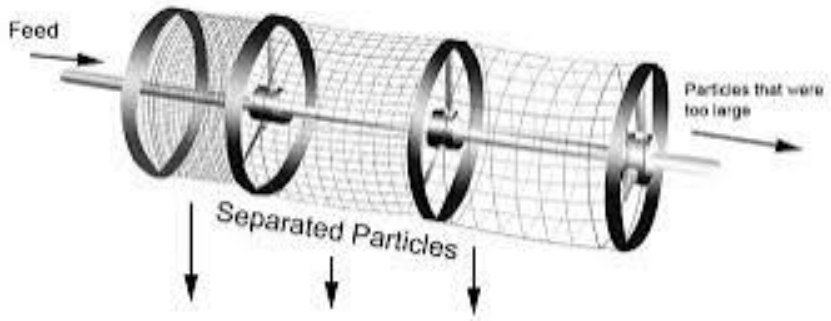
3.3 SCREENING

Screening is a process used in various industries, including mining and construction, to separate materials based on size. It involves passing the crushed material through screens or sieves that allow smaller particles to pass while retaining larger ones.

Types of Screens
There are different types of screens used in the screening process, including:

- Vibrating Screens: These use vibrations to help move materials across the screen surface, effectively separating them by size.
- Static Screens: These are fixed and rely on gravity to allow smaller particles to fall through while larger particles remain on top.
- Rotary Screens: These are cylindrical and rotate, allowing material to be separated as it moves through the screen.

I was familiar with rotary screen during my SIWES and an example of the kind of equipment used which is also in use at the organization is TROMMEL SCREEN. The product from the trommel screen is known as CHIPPINGS



3.4 PROCESSING OF MILLING MACHINE AND TROMMEL PRODUCT

The milling machine used for crushing marble typically involves a specialized type of milling process designed to break down the marble into smaller particles or powder. These machines use mechanical force to grind the marble into finer particles.

MILLING MACHINE PROCESS

Starting from the crusher it has two jaws [stationery and rotating]. The rotating jaw press the sample on the stationary to pieces it through an electric motor below it is a chute[feeder] which feeds the chain and cups in bucket classifier.

The bucket classifier has an electric motor above it that contains chains and cups that passes the partially crushed sample into the hopper and through another chute to the mill machine. The mill machine has rotating gears used to blend the samples, it has some mechanisms which at a high sped pulverize the sample through another motor. Then it passes it to the blower which stands as a filter which separate the exhaust alternatively known as GUAGE from the final product [calcium] in the form mesh. The product is used in many things like livestock feed, a paint company, beverages, pharmatieucals and so on.

TROMMEL SCREEN PROCESS

The process is being powered by a diesel engine alternatively known as prime muller is being connected to the crusher through a belt [just as we know that a crusher has both stationary and rotating jaws] which aids the movement of the jaws. It is adjustable depending on the size requested by customers or company desired size i.e the jaws. The crusher has two pulleys with belts one is being attached from the diesel engine to the crusher and another from the crusher to the trommel so therefore, the first one aids the movement of the crusher and the other aids the movement of the trommel.

Then it has a chute that feed the sample from the crusher to the trommel screen/screen mesh, as the gear rotates it aids the rotation of the screen mesh and the bigger sizes comes out at the last end which is known as size 4,then would be returned into the crusher again to gain desired sizes.

The trommel produces chippings of different sizes i.e size 1,2,3,and 4. It plays the role of a sieve ,it is cylindrical in shape and its being placed horizontally to aid the movement of the product through the gear due to gravity.

CHAPTER FOUR
BLASTING

BLASTING is a controlled method used o break rocks or other materials using explosives. We therefore have two different types of rocks and these are intrusive rocks [under the bed rock] and extrusive rocks [on the earth surface]. So, for blasting to occur in an intrusive rock we have to cut across the rock so these process leads us to drilling operations

TYPES OF BLASTING

1. Primary Blasting; This is the initial blast that breaks up large volume of rock. It typically uses explosives to create a significant fracture, allowing for the removal of large rock masses. The goal is to achieve a desired fragmentation size to make further handling easier.

2. Secondary Blasting ; This method follows primary blasting and is used to further break down the larger fragments created during the primary blast. It's often necessary when the primary blast leaves oversized rocks that are difficult to handle or transport. Secondary blasting can involve smaller explosives or techniques like controlled blasting to achieve the desired size.

Both primary and secondary blasting are being practiced at Quarrylink.

4.1 PRODUCTION SYSTEM IN QUARRYLINK

DRILLING

It is the process of creating hole son a rock surface. we have several types of drilling methods here are some of it;

1. Rotary Drilling: This is the most widely used method, especially in oil and gas exploration. It involves rotating a drill bit to cut through rock and soil. The drill bit is typically attached to a long drill string, and drilling fluid is circulated to cool the bit and remove cuttings.

2. Percussion Drilling: In this method, the drill bit is dropped repeatedly onto the rock to break it apart. It's often used for shallow wells and in hard rock formations. The technique is effective for drilling through tough materials.

So as to enhance a successful drill holes a certain pattern will have to be considered here are some of the drilling patterns;

1. Square Pattern: Holes are drilled in a square grid. This pattern is often used in flat terrain and allows for uniform distribution of explosives.

2. Rectangular Pattern: Similar to the square pattern but with varying distances between holes in one direction. This is useful for specific geological conditions or when targeting particular rock formations.

3. Triangular Pattern: Holes are arranged in a triangular formation. This pattern can provide better fragmentation and is often used in steep or irregular terrain.
Some others are staggered, v-cut, straight- cut, etc.

These patterns are obtained by using budding and spacing i.e the measurement between drilled holes.

1. Budding: This is the practice of creating a pattern of drill holes in a specific configuration to ensure effective blasting. Budding helps in achieving better fragmentation and controlling the direction of the blast. It often involves adjusting the depth and angle of the holes based on the geological conditions.
2. Spacing: This refers to the distance between adjacent drill holes. Proper spacing is crucial for ensuring that the explosive energy is effectively Drilling patterns in blasting refer to the arrangement and spacing of boreholes drilled into rock before blasting operations. The design of these patterns is crucial for effective fragmentation and control of the blasting.

FACTORS AFFECTING BUDDING AND SPACING

1. Jaw feed
2. Depth of the hole
3. Type of rock

Typically, engineers will calculate the optimal distances based on these factors to maximize efficiency and safety during blasting operations .FREE SPACE is an opening to have a proper fragmentation i.e the line facing the free space is budding while the one that goes to the left and right is the spacing .

4.2 EQUIPMENTS USED IN DRILLING OPERATIONS

1.Rotary Drilling Rigs: These are the main pieces of equipment used to create boreholes. It creates holes through rocks/soil allowing placement of charges for blasting open mines.

2. Drill Bits: These are the cutting tools attached to the end of the drill string. They come in various shapes and sizes, such as flat bits for soft rock and diamond bits for hard rock.

3. Drill Rods: These are the long, cylindrical tubes that connect the drill bit to the drilling rig. They transmit the rotational force from the rig to the bit.

5. Air Compressors: is a machine used to reduce the volume of gas or air and increase pressure. It I used to pump out excess waters in the boreholes.

6. Wagon Drill: are used for production drilling in open cast mine and quarry, grouting and anchoring.

7. Jack Hammer or Sinkers: mainly used for drilling vertical holes sufficient stability, it is used for hard rocks.

4.3 CHARGING AND STEMMING OF DRILLED HOLES

CHARGING This involves filling the drilled holes with explosives. The type of explosive used can vary based on the rock type and the desired fragmentation. The charging process must be done carefully to ensure that the explosives are placed correctly and securely within the hole. Proper charging is essential for achieving the intended blast results.

In charging of holes there are three stages and these are the primer charge, column charge and stemming height.

Firstly, a primer charge is positioning a suitable primer within a charge or column of explosives. Primer charge is the first explosive being dropped into the hole with the detonating cord attached to it. It's alternatively known as base charge, it is used to cut across the rock from the base then followed by another explosives with an electric detonator.

Secondly, column charge is a continuous unbroken column of explosives or blasting agent in a borehole. It's at this stage we add ANFO [Ammonium Nitrate +Fuel Oil] into the hole after dropping the prime charger and enough explosives so the ANFO is added till it starts showing in the hole.

Thirdly, stemming height is at the point where chippings of the smallest size are added into the hole.

STEMMING After charging the hole with explosives, stemming is the process of filling the remaining space in the hole with inert materials, such as crushed rock or sand. Stemming helps to confine the explosive energy within the hole, which improves the efficiency of the blast and reduces the risk of fly rock. It also helps in controlling the direction of the blast.

Reasons for stemming
1. It is used for confining the explosives
2. It is used for reducing cracks
3. It is used for sealing the collar

Together, charging and stemming are critical for ensuring effective blasting operations, maximizing fragmentation, and minimizing environmental impact. After this the boreholes are connected following the drilling design or pattern with the use of appropriate electric detonators for each holes and detonating cord and this is the last stage of blasting which is known as **CONNECTION OF HOLES**

4.4 BLASTING ACCESSORIES

DETONATOR

A detonator is a crucial device used in blasting operations to initiate explosives. It serves as the trigger that sets off the explosive charge within a drilled hole. There are two main types of detonators these are;

i. Electric Detonators: These are triggered by an electric current. They allow for precise timing and coordination of blasts, which can enhance safety and efficiency. They are typically hot wire [low voltage], exploding bridge wire[high voltage] or explosive foil [very high voltage].

ii. Non-Electric Detonators: These rely on shock waves or flame to initiate the explosive. They are often used in situations where electric detonation may pose a risk, such as in wet or hazardous environments.

Electric detonators are used at Quarrylink.

4.5 EXPLOSIVES

An explosive is a substance that undergoes a rapid chemical reaction, producing a large amount of gas and heat. This reaction can create a shock wave, which is used for various purposes, including demolition, mining, and military applications. The main type of explosives used at Quarrylink is SOLAR GEL- E EXPLOSIVES.

Solar gel-e is a type of solar energy technology that utilizes gel-based materials to capture and heat, convert solar energy into usable power. It is generally used in dry holes in order to provide better fragmentation in every kind of rocks and lower explosives cost.

4.6 DETONATING CORD

Detonating cord is a flexible plastic tube that contains a core of high explosive material, usually a type of PETN (pentaerythritol tetranitrate) with the PETN exploding at a rate of approximately 6400m/s. It is used to initiate the detonation of explosives at a distance. The cord can be laid out in various configurations and is often used in demolition, mining, and military applications.

When ignited, the detonating cord transmits a shock wave along its length, which can then trigger other explosives connected to it. One of the key advantages of detonating cord is its ability to ensure simultaneous detonation of multiple charges, providing precise control over the timing and sequence of explosions.

4.7 AMMONIUM NITRATE+ FUEL OIL [ANFO]

ANFO stands for Ammonium Nitrate Fuel Oil, which is a widely used bulk explosive. It consists of a mixture of ammonium nitrate (a common fertilizer) and fuel oil. ANFO is known for its effectiveness, stability, and low cost, making it a popular choice in mining, quarrying, and construction. It consists of 96% of porous filled Ammonium Nitrate [AN] which act as oxidizing agent and absorbent for the Fuel and 4% of Fuel Oil [FO].

The ammonium nitrate provides the oxidizer, while the fuel oil serves as the fuel component. When detonated, ANFO produces a high-pressure shock wave, making it suitable for breaking rock and other materials. It is often used in large quantities and can be easily transported and handled. In a situation whereby there is still a lot of water in the borehole after the use of compressor, explosives alone are advisable to be used because when ANFO reacts with water it melts.

These are the list of the basting accessories used during my training at Quarrylink, we still have other blasting accessories such as

a. Safety Fuse
b. Delay and Relay Detonators
c. Plain cap, and so on.

4.8 SAFETY PRECAUTIONS IN BLASTING

1. Training and Certification: Only trained and certified personnel should handle explosives and perform blasting operations. Regular training updates are crucial.

2. Proper Planning: A detailed blasting plan should be developed, outlining the type of explosives to be used, the sequence of blasts, and safety zones.

3. Warning Signals: Use clear warning signals to alert personnel and the public before a blast. This includes using sirens or flags.

4. Safety Zones: Establish a safety perimeter around the blasting site to keep unauthorized personnel away. The size of the zone may depend on the type and amount of explosives used.

5. Monitoring Conditions: Weather conditions can affect blasting safety. Avoid blasting during adverse conditions, such as high winds or heavy rain.

6. Inspection of Equipment: Regularly inspect and maintain blasting equipment and explosives to ensure they are in good working condition.

7. Use of Personal Protective Equipment (PPE): Personnel should wear appropriate PPE, such as helmets, goggles, and hearing protection.

8. Emergency Procedures: Have a clear emergency response plan in place in case of an accident or unexpected event during blasting operations.

9. Post-Blast Assessment: After the blast, the area is assessed for safety, and the broken material is collected for further processing, such as crushing or milling.

CHAPTER FIVE

RECOMMENDATION AND CONCLUSION

5.0 RECOMMENDATION

Mining as the bedrock of modern civilization, government should be actively involved in mining industry. If mining of iron could enhance the economy of China and make it to compete with the five best economies in the world this tells us how much mining activities can boost and enhance the economy of our country Nigeria. So, a valuable industrial mineral like marble has what it takes to influence the economy of this nation of ours. I hereby recommend follows;

1. Government should revive the mining sector in Nigeria and equip tertiary institution of Nigeria so as to be able to train students in mining and related discipline.

2 Government should try and make life easier and more comfortable for local settlers and miners in these communities.

3. Government should improve mine safety & health.

5.1 CONCLUSION

During my SIWES Program. I got to discover how marble is useful in different aspects to the economy. I was also exposed to the processes involved in carrying out blasting operations (both primary and secondary blasting).

Also, I learnt some operations outside engineering discipline due to the fact that engineering work in a multidisciplinary environment and acquire knowledge and skill through work experience that may allow them to practice in associated areas of sciences, engineering, sales, marketing or management.

As a result of the program, I am more confident to build my future career which I have already started in QUARRYLINK CONCEPT LIMITED.

I enjoyed all the beautiful moments that I spent at QUARRYLINK CONCEPT LIMITED under the supervision of ALH. MUHAMMED ADEBAYO, which makes me enjoy almost all the areas and aspect of mining activities.