The Islamic University of Gaza
Deanship of Research and Graduate Studies
Faculty of Science
Master of Environmental Management and Monitoring

الجامعـــــــة الإســـلاميـة بغـزة
عمادة شئون البحث العلمي والدراسات العليا
كليـــــــــة العلـــــــوم
ماجستير الإدارة والمراقبة البيئية

Assessment of Occupational Health Risks Among Workers in Wastewater Treatment Plants, Gaza Strip, Palestine

تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة في قطاع غزة، فلسطين

by

Mohammed M. Albahnasawi

Supervised by

Pro.Mohammad R. Al Agha
Professor of Environmental Sciences

Dr. Ashraf Eljedi
Associate Professor of International Public Health

A Thesis Submitted In Partial Fulfillment of The Requirements for The Degree of Master of Science In Environmental Science

June /2018

إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Assessment of Occupational Health Risks Among Workers in Wastewater Treatment Plants In Gaza Strip, Palestine

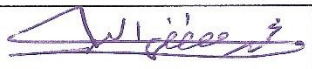
تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة في قطاع غزة، فلسطين

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وأن هذه الرسالة ككل أو أي جزء منها لم يقدم من قبل الاخرين لنيل درجة أو لقب علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

Declaration

I understand the nature of plagiarism, and I am aware of the University's policy on this.

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted by others elsewhere for any other degree or qualification.

Student's name:	محمد مصطفى البهنساوي	اسم الطالب:
Signature:		التوقيع:
Date:	١٥/١/٢٠١٨م	التاريخ:

بسم الله الرحمن الرحيم

الجامعة الإسلامية بغزة
The Islamic University of Gaza
عمادة البحث العلمي والدراسات العليا
هاتف داخلي: 1150

الرقم Ref ج س غ/35/
التاريخ Date 2018/09/01م

نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة عمادة البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ **محمد مصطفى صالح البهنساوي** لنيل درجة الماجستير في كلية **العلوم**/ برنامج **علوم بيئية/الإدارة والمراقبة البيئية** وموضوعها:

تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة في قطاع غزة - فلسطين

Assessment of Occupational Health Risks Among Workers in Wastewater Treatment plants, Gaza Strip - Palestine

وبعد المناقشة التي تمت اليوم **الاربعاء 3 ذو الحجة 1439هـ** الموافق **2018/08/15م** الساعة **التاسعة صباحاً**، في قاعة مبنى **طيبة** اجتمعت لجنة الحكم على الأطروحة والمكونة من:

أ. د. محمد رمضان الأغا	**مشرفاً ورئيساً**	.....
د. أشرف يعقوب الجدي	**مشرفاً**	.....
د. ياسر زيدان النحال	**مناقشاً داخلياً**	.....
د. منصور صبحي اليازجي	**مناقشاً خارجياً**	.....

وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في **كلية العلوم/برنامج علوم بيئية/الإدارة والمراقبة البيئية**.

واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله تعالى ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق،،،

عميد البحث العلمي والدراسات العليا

أ. د. مازن إسماعيل هنية

عمادة البحث العلمي والدراسات العليا
الجامعة الإسلامية غزة
Deanship of Research and Graduate Studies

التاريخ: ٢ / ٩ / 2018

الرقم العام للنسخة	3106706	اللغة	

الموضوع/ استلام النسخة الإلكترونية لرسالة علمية

قامت إدارة المكتبات بالجامعة الإسلامية باستلام **النسخة الإلكترونية** من رسالة

الطالب/ محمد مصطفى صالح اليمنساري

رقم جامعي: 172150050 قسم: البيئة وعلوم الأرض كلية: العلوم

وتم الاطلاع عليها، ومطابقتها بالنسخة الورقية للرسالة نفسها، ضمن المحددات المبينة أدناه:

- تم إجراء جميع التعديلات التي طلبتها لجنة المناقشة.
- تم توقيع المشرف/المشرفين على النسخة الورقية لاعتمادها كنسخة معدلة ونهائية.
- تم وضع ختم "عمادة الدراسات العليا" على النسخة الورقية لاعتماد توقيع المشرف/المشرفين.
- وجود جميع فصول الرسالة مجمَّعة في ملف (WORD) وآخر (PDF).
- وجود فهرس الرسالة، والملخصين باللغتين العربية والإنجليزية بملفات منفصلة (PDF +WORD)
- تطابق النص في كل صفحة ورقية مع النص في كل صفحة تقابلها في الصفحات الإلكترونية.
- تطابق التنسيق في جميع الصفحات (نوع وحجم الخط) بين النسخة الورقية والإلكترونية.

ملاحظة: ستقوم إدارة المكتبات بنشر هذه الرسالة كاملة بصيغة (PDF) على موقع المكتبة الإلكتروني.

والله ولي التوفيق،

توقيع الطالب

محمد مصطفى اليمنساري

إدارة المكتبة المركزية

أ. محمد [illegible]

224

Abstract

Background: - Workers in the wastewater treatment sector are responsible for day-to-day operation, maintenance, troubleshooting and problem solving of the municipal industrial and other wastewater treatment plants and are exposed to a wide range of risks such as biological, physical and chemical., Phycological and work environment due to their working environment.

Objective:- The Study aimed to assess occupational health risks among waste water treatment planet (WWTP) workers in Gaza strip.

Method: - the participants are 58 workers distributed to 30 in WWTP and 28 workers on pumping station, the researcher used a self-administered questionnaire in total respondents 58 worker, SPSS version 22 was used for data analysis, vital signs (blood pressure, respiratory rate, heart rate) was measured to all participant.

Results:- The result showed that workers has good knowledge on physical 72.99%, chemical 71.17 %, biological 72.41% , Accident hazards 78.16%, psychological 76.92%, 45.83% of workers reported that they don't received training on safety procedures, and 62% of workers don't received training courses in dealing with hazardous materials, the study show that 48.3% of working smoke in work area ,that may be lead to high risk fire in station specially every station has generator and fuel tank . 56.9% of workers don't have any knowledge about what disease are caused by microbes in wastewater. 60.3% of worker don't receive any courses on safety procedures and 56.9% of workers don't get first aid course and evacuation process. Despite the worker has good knowledge about symbols the researcher doesn't find any nameplate in any site was visited, 51.7% of workers don't receive periodic medical checkups. 13.8% of workers receive milk, workers from Rafah area. The study results revealed that there was a statistically significant relationship between all study domains about the knowledge of different types of risks, except the biological domain knowledge with accident risk knowledge.

Conclusion: - The results of this study concluded that there was a lack of formal on-the-job training for workers with regard to strategies for identifying and avoiding health and safety risks and that workers needed periodic medical examination.

الملخص

الخلفية العلمية :- العاملون في مجال معالجة المياه العادمة مسؤولون عن العمليات اليومية و الصيانة ،أية مشاكل يتم التعامل معها باليد في محطات معالجة المياه العادمة الخارجة من البلديات أو المصانع ، العاملون في محطات معالجة المياه العادمة ومحطات الضخ يتعرضون للمخاطر الفيزيائية و الكيميائية و البيولوجية و النفسية ومخاطر طبيعة العمل خلال ممارستهم أعمالهم في بيئة العمل .

هدف الدراسة :-تقييم المخاطر التي يتعرض لها العاملين في محطات معالجة المياه العادمة في قطاع غزة.

منهجية الدراسة :- أجريت الدراسة على ٥٨عامل موزعين على النحو التالي ٣٠في محطات معالجة المياه العادمة و ٢٨فى محطات الضخ و استخدم الباحث استبانة للفئة المستهدفة وتم التحليل باستخدام برنامج التحليل الاحصائي ،تم قياس العلامات الحيوية (ضغط الدم ،معدل التنفس، ضربات القلب)لجميع المشاركين .

النتائج:-أظهرت النتائج أنه لدى العاملين دراية بالمخاطر الفيزيائية ٧٢,٩٩% والكيميائية ٧١,١٧%و البيولوجية ٧٢,٤١%وخاطر الحوادث ٧٨,١٦%و المخاطر النفسية ٧٦,٩٢%. لكن بما يتعلق بالإجراءات السلامة والأمان أظهر النتائج أن ٤٥,٨٣%من العمال لم يتلقوا أي تدريب على إجراءات السلامة و٦٢ %من العمال لم يتلقوا أي تدريب بخصوص التعامل مع المواد الخطرة، وأظهرت نتائج الدراسة أن ٤٨,٣% من العمال يدخنون في مكان العمل مما يؤدي الى إمكانية عالية في نشوب حريق علما بانه كل المحطات يوجد بها مولد كهربائي وخزان وقود .كم أظهرت نتائج الدراسة بأن ٥٦,٩% من العمال ليس لديهم دراية كافية بالأمراض التي تسببها الميكروبات الموجود في مياه الصرف الصحي، كما أظهرت نتائج الدراسة بأن ٥٦,٩% من العمال لم يتلقوا أي دورات في كيفية إطفاء الحرائق و عملية الإخلاء على الرغم من ان لدى العمال معرفة جيدة برموز المخاطر الا انه لا يوجد أي إشارة تحذيرية في أي محطة، و أظهرت نتائج الدراسة بأن ٥١,٧% من العمال لا يتم عمل فحوصات طبية دورية لهم ، و فقط ١٣,٨% من العمال يتم إعطائهم حليب بصفة دورية وهم ضمن منطقة رفح. أظهرت الدراسة أنه يوجد علاقة إحصائية بين المعرفة بالمخاطر بأنواعها المتعددة ماعدا المخاطر البيولوجية مع مخاطر الحوادث .

الملخص :-تلخصت نتائج الدراسة أنه يوجد نقص في التدريب المهني لدي العاملين بما يتعلق بمخاطر الصحة والسلامة و استراتيجيات التجنب، كم خلصت الدراسة بان العمال بحاجة الى فحص طبي دوري.

DEDICATION

This research is dedicated to:

To the Spring that never stops giving, to my mother and father who weaves my happiness with strings from them merciful heart... to my mother and father

Whose support, encouragement, and love made this endeavor possible (My wife Alaa)

To whose love flows in my veins, and my heart always remembers them, to my brothers and sisters, Alaa, Ahmed, ʿAbed Allah, Shada, Bushra and Gidaa…

TO ALL OF MY FRIENDS AND COLLEAGUES…

ACKNOWLEDGEMENTS

First, all praises and glory are due to **ALLAH** for all the bounty and support granted to me. This work would not be done without God's endless guidance and support.

I would like to take this opportunity to sincerely thank all individuals who have helped me in this effort. Primarily, I would like to thank my supervisors and mentor **Prof. Mohammad R. Al Agha** and **Dr.Ashraf Eljedi** for their unlimited guidance, encouragement, and support. I am really indebted to this man for his valuable advice and his vision which inspired this research.

I am deeply indebted and grateful to **Eng. Nehad Al Kateeb**-Department of wastewater management -for his kind cooperation in facilitating my access to the visited field and providing me the needed data

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AHA	American Heart Association
AIDS	Acquired Immune Deficiency Syndrome
BLS	Bureau of Labor Statistics
CHD	Chronic Heart Disease
CMWU	Coastal Municipalities Water Utility
CVD	Cardiovascular Disease
ECG	Electrocardiogram
EF	Ejection Fraction
FEV1	Forced Expiratory Volume in the 1st second
FVC	Forced Vital Capacity
GNP	Gross National Product
H2S	Hydrogen Sulfide
HAV	Hepatitis A Virus
HEV	Hepatitis E Virus
ILO	International labor Organization
LVH	Left Ventricular Hypertrophy
NIOSH	National Institute of Occupational Safety and Health
OSH	Occupational Safety and Health
PCBs	Polychlorinated Biphenyl
PCR	Polymerase Chain Reaction
PEF	Peak Expiratory Flow rate
PM	Particulate Matter
PPE	Personal Protective Equipment
STPW	Sewage Treatment Plant Worker
WHO	World Health Organization
WRMDs	Work Related Musculoskeletal Disorders
WWTP	Wastewater Treatment Plant

Statistical Abbreviation

ANOVA	Analysis of Variance
CI	Confidence Interval
DF	Degrees of Freedom
F	F test
M	Mean
N	Number
OR	Odds Ratio
SD	Standard Deviation
SE	Standard Error
sig	significance
SPSS	Statistical Package for the Social
t	T test

Chapter One
Introduction

CHAPTER 1 : Introduction

1.1 Background of The Study

Wastewater Treatment Plants are complex engineering systems whose failure to meet performance standards can have adverse impacts on sewage and ecosystems. The WWTP system must be designed to be able to handle uncertain flow and loading conditions and any sources of unforeseen circumstances that may lead to non-compliance events with effluent standards set to protect public health and the environment. The main objective of WWTP is the removal of contaminants from wastewater to reach a range of liquid waste standards under a set of environmental, cost and regulatory constraints (Talebizadeh et al, 2014).

Wastewater is considering a negative resource, both from an aesthetic perspective and because of its noticeable unpleasant odor, the hazardous effects of untreated wastewater on both human and environment. The environmental risk is mainly due to overloading of physical and chemical components associated with human activity into an aquifer, while the health risk is mainly the result of pathogenic contamination (Kvernberg, 2012).

During many years, work in the wastewater treatment field was account as the most hazardous, especially due to deaths involving confined space entry. This field is considered to some extent less hazardous now, but treatment plant workers still suffer from health problems and deaths. These experiences occur in specific event involving chemicals in the sewer system and in regular work exposures throughout the plant and its processes (Brown, 1997).

Risk assessment is a dynamic process that allows companies and organizations to develop a proactive risk management policy. The components of risk assessment are therefore the basis for the implementation of appropriate preventive measures and, as directed, should be the starting point of any Occupational Safety and Health Management System (OSH). Important concepts in risk management are risk and risk concepts. A hazard is a source, condition or action with the potential for harm in terms of injury or ill health, or a combination of these. Therefore, any hazard anywhere in the workplace may have the potential effects of injury for workers, either an occupational accident or occupational disease, the risk is a combination of the

likelihood of a serious event or exposure and the severity of the injury or ill health that can occur due to the event or exposure.

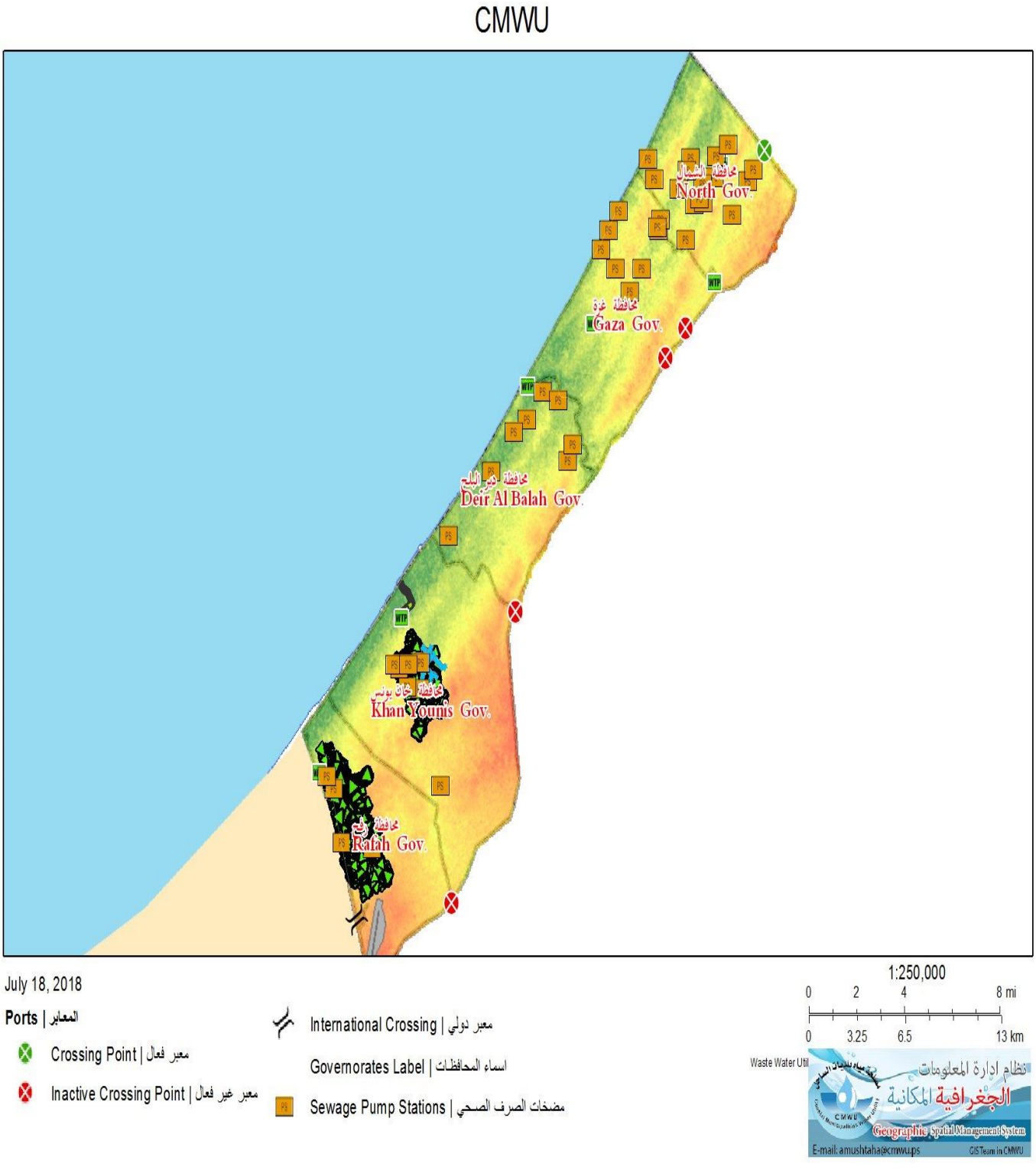
1.2 Significance of the Study

The importance of this study can be seen in separate ways. The study could provide bases for the establishing of health and safety policies Wastewater treatment plant workers in Gaza strip.

In addition, this work provides an opportunity to WWTPs workers to explain and evaluate their specific relating roles in health and safety issues. Additionally, this work makes it easy WWTP workers to increase their awareness of wastewater plant risks, and thus help them make best use of their available resources. The study concerned with a health and safety risk assessment conducted WWTP workers considered the first one in Gaza use the scientific approach of risk assessment wastewater plant therefore developing a could be used as reference material for policy makers in making decisions relating health and safety practices and policies.

Table (1-1): The existing centralized wastewater treatment plants in Gaza strip
Source (ARIJ, 2015)

Wastewater Treatment plant	Actual Flow(m^3/day)	Status of WWTP	Number of workers
North Gaza Beit Lahia	Above 18,000 m^3/day, when original design flow was 5,000 m^3/day	Established in 1974, design capacity 5,000 m^3/day, currently overloaded, under rehabilitation &Expansion with a convening pipe line of 8km to NGWWTP achieving a design capacity of 30,000 m^3/day	9
Gaza Wastewater Treatment Plant (Gaza Central)	42000	Established in 1979 upgraded in 1996 to increase its capacity to 12,000 m^3/day, upgraded again in 1998 to reach a treatment capacity of 35,000 m^3/day, currently through an Emergency Project to reach a design capacity of 50,000 m^3/day, with funds from the KFW.	21
Khan Younis	Only temporary basin	Established in 2007, in 2009 second lagoon was added a in (Almawassi area), in 2003 a third lagoon was added (Hai El-Amal), after 2007 was established an alternative lagoon to collect and treat wastewater before pumping it to the sea; currently are works on building a new WWTP with a capacity of 26,600 m^3/day as first phase.	3
Rafah	8000	Established in 1989, with treatment capacity of 4,000 m^3/day. Upgraded to increase its treating capacity to 20,000 m^3/day, getting advantage of the availability of the destroyed boarder concrete pieces after the Israeli forces withdraw out of Gaza.	6
Wasta (Middle govrnerates)	16000	established in 2015 in Wadi Gaza near the coastal road and serves the station the entire central region	6
Total			45



Figure(1-1): existing centralized wastewater treatment plants and sewage pumping station in Gaza strip.

Source: http://gis.cmwu.ps/

1.3 Research Aim and Objectives

- **The general objective of the study** is to assess health risks among wastewater treatment plant workers in Gaza Strip, Palestine.
- **The specific objectives of the study** are:

1. To assess health and safety risks for wastewater treatment plant workers.
2. To assess the level of knowledge regarding health and safety risks among Wastewater treatment plant workers.
3. To assess the health practice of workers to counteract the occupational risks.

1.4 Research Methodology

- To achieve the objectives of this research, the following tasks will be executed:
  a) Literature Review: - Revision of accessible references as books, studies and researches relative to the topic of this research which may include: occupational health, wastewater treatment, chemical hazards, biological hazards.
  b) Field Survey (Self-Reported Questionnaire): - a questionnaires will be distributed to 45 workers of wastewater treatment plants distributed at five plants, a questionnaire includes risk assessment about health and safety, Knowledge about risks and health practice of workers, Others a questionnaire will be distributed to workers in pumping station of sewage.
  c) Assessment of health status by taking vital sings (blood pressure. heart rate. respiratory rate).
  d) Site visit: -
     - Visit five wastewater treatment plants and evaluate the safety procedures in force at these plants,
     - visit fifty-five wastewater pumping stations and evaluate the safety procedures in force at these stations.
  e) Formal interview: - Conduct formal interviews with the managers of wastewater treatment plants evaluate the procedures used to minimize accidents during work.
  f) Data Analysis and Interpretation: - In order to achieve the early stated objectives, the data of the study will analyze through the use of statistical

package of social sciences (SPSS) version 22 through descriptive and inferential statistical analyses.

Chapter Two
Literature Review

CHAPTER 2 : Literature Review

This chapter presents a literature review for this research, which is divided into two major sections. The first is dealing with literature review of occupational health and safety, the second is dealing with literature review of wastewater treatment hazards.

2.1 Occupational Safety and Health

Occupational safety and health (OSH) is the science of anticipation, recognition, evaluation and control of hazards arising in or from the workplace that could trigger harm effects on the health and wellbeing of workers. Besides work- related disorders, it also encompasses all contextual factors that affect health within a work environment (Alli, 2008).

Developing countries have 75% of the world workforce; above 125 million workers are victims of occupational accidents and diseases annually. In the era of quick industrial growth, the occupational morbidity pattern is fast changing. Bad occupational health and, in turn, less working capacity could cause an economic loss of up to 20% of the Gross National Product (GNP) (Zodpey et al, 2009).

The protection of workers against sickness, disease and injury related to the working environment, as presented in the Preamble to the Constitution of the International Labor Organization (ILO), and become a central issue for the Organization for last century, and remain to be so today. Occupational safety and health is a key part in implementation sustained decent working conditions and strong preventive safety cultures (Alli, 2008).

Occupational health should aims at: the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention though workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and, to summarize: the adaptation of work to man and of each man to his job. (ILO/WHO, 1995).

2.1.1 **Occupational Safety and Health and Environment**

Environmental health, which contains occupational health, is a large area in which data discuss all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviors, environmental and occupational health questions focused on understanding whether an exposure is a potential health hazard or risk, evaluating the exposure to understand the level and magnitude of risk, and exploring interventions to mitigate exposure or risk, environmental health questions focus on understanding whether an exposure is a potential health hazard or risk using exposure assessments to recognize the extent and magnitude of exposure, and interventions to prevent or mitigate exposure or risk (Morgan, 2016).

Hazard: a physical situation with a possibility for human injury, spoil to property, harm to the environment or some combination of these (Alli, 2008).

Risk: the likelihood of an unwanted event with specified consequences happening within a specified time or in specified events. It may be expressed either as the number of specified events in unit time or as a probability, depending on the circumstances (Alli, 2008).

Occupational health practice contains activities for the protection and promotion of workers' health and for the improvement of working conditions and environment carried out by occupational safety and health professionals as well as other specialists, both within the enterprise and without, as well as workers' and employers' representatives and the competent authorities (Alli, 2008).

2.1.2 **OSH Hazards and Risks**

Kibe demonstrate that poorly maintained equipment's, danger machineries, and exposure to hazardous chemicals among others, are parts of work environment that have the potential of causing immediate and sometimes intensely harm to a worker. These include. Potential injuries include loss of hearing, eye sight or body like cuts, burns, bruises, broken bones and electric shock (Kibe,2016).

Occupational health and safety effects during the construction phase, operation and deactivate of water and sanitation facilities are common. Occupational safety and health impacts associated with the operational phase of water and sanitation projects

include: - Accidents and injuries, Chemicals exposures, Hazardous atmosphere, Exposure to pathogens and vectors, and Noise (Kibe,2016).

Work at wastewater plants is often physically demanding and could involve hazards such as open water, trenches, and slippery walkways, working at heights, energized circuits and heavy equipment's. Work at wastewater treatment plants could also involve entry into confined spaces like manholes, sewers, pipelines, storage tanks, wet walls, digesters, and pump stations. Methane generated from anaerobic treatment of organic matter can lead to fire and explosions. Wastewater treatment may include the use of potentially dangerous chemicals including strong acids and bases, chlorine, sodium and calcium hypochlorite and ammonia. Industrial wastewater may contain radioactive substances and heavy metals, which accumulate in the sludge. Potential sources of exposure to radionuclide include pumps and piping where mineral scales accumulate, lagoons and flocculation and sedimentation tanks where residual sludge accumulate; filters, pumping stations and storage where sludge accumulates (Kibe,2016)

Wastewater may contain potentially hazardous chemicals depending on the where the wastewater coming from, drinking water treatment processes and industries discharging to the sewer, may including chlorinated organic solvents and pesticides, PCB's, polycyclic aromatics, petroleum hydrocarbons, flame retardants, nitrosamines, heavy metals, asbestos, dioxins and radioactive materials (Kibe,2016)

In addition, workers may be exposed to hydrogen sulfide, methane, carbon monoxide chloroform and other chemicals generated during wastewater treatment. Oxygen may be displaced or consumed by microorganisms during the aerobic biodegradation of organic matter, thus resulting in areas where wastewater or wastewater residues are processed (Kibe,2016)

Workers and staff at wastewater and sludge treatment facilities and fields where treated wastewater or sludge is applied as well as operators of sludge collections can be exposed to many pathogens contained in sewage. Processing of sewage can generate bio- aerosols which are suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds and fungi. These microorganisms can remain suspended in the air for extended periods of time, retaining viability or infectivity. Workers may be exposed to endotoxins, which are produced

within a microorganism released upon destruction of the cell and which can be carried by airborne dust particles (Kibe,2016)

Vectors for sewage pathogen include insects e.g. flies, rodents, rats and birds According to (Brown 1997), Workers may be exposed to pathogens by breathing, direct touch, ingestion or through skin cuts or punctures. Infection with an enteric organism can be confirmed by the worker's medical history or by showing that more of the disease organism is shed in the feces than was originally received by the worker, or infection can be inferred if the worker begins to produce antibodies against the disease. Brown 1997 explained that for AIDS to be transmitted via sewerage would involve blood in the urine or feces of the infected individuals to be discharged in the sewer. Infection would have to involve contact of this material with cuts or broken skin (Brown, 1997).

Larcher and Sohail indicate that the injuries types and frequencies that occur to construction workers related to tasks that they implement. Some include –Falls, Overexertion or strenuous movement, Handling falling or flying objects, Contacts with stationery objects, contact with moving objects, contact with heat or cold, Contact with chemicals, Exposure to electricity, and Fire, explosions or blasts. ILO (2002) state that the International Standards on Safety and Health are set by the international Organization. These standards are based on International Conventions and recommendations on occupational Safety and Health. The most important is the 155-convention of 1981 concerning occupational Safety and Health and working environment which applies to all workers in all areas of economic activities (Larcher,1999).

The convention articulates the principles for a national policy on occupational safety and health and sets out actions to be taken by the state, employer and trade unions. The policy should be given effect through the development and enforcements of laws, then there should be adequate and suitable systems of inspection, and the enforcement system to give adequate penalties for the violations of the laws (Kibe,2016). There are potential injuries during the building and operation of water and sanitation facilities. Physical, biological social, psychological, ergonomically and biological aspects do affect work environment and staff health. However, these risks and hazards are of varying degrees and acceptability. The OSHA tasks the employer with responsibility

of managing and containing the levels of risks and staff exposure as well as the costs increasing from injuries of people within the work environment. The staff safety is paramount to enhance productivity (Robson,2007).

2.1.3 **Work Environment**

Satisfying work in a safe and pleasant environment is a source of health and well-being; yet the physical, psychological and organizational work environment is all too often responsible for injury and disease. The health of adults of working age affects economic and social development. Recent occupational health data indicate that 40%-50%, of the world population is exposed to hazardous conditions in the workplace. It is estimated that approximately 120 million occupational accidents occur worldwide each year, with200,000 fatalities. Every year between 68 million and 157 million new cases of occupational diseases arise because of various types of work-related exposures in addition, approximately 30% -50% of workers in industrialized countries experience psychological stress. Environmental stressors such as hazardous conditions are one cause, but occupational stress results from work organization (e.g. workload, lack of autonomy and control over work, shift work, wage scales and routine, repetitive work). Stress associated with work organization has been shown to contribute to cardiovascular disease, muscular skeletal problems and other conditions. Other than the transfer of danger technologies, the changing nature of work will have a dramatic impact on worker's health. Technological innovations will result in job losses, replacement of full time work and part-time work, more work in the informal sector and self-employment. Unfortunately, only 5%-10% of workers in developing countries and 20%-50% of workers in industrialized countries have access to adequate occupational health services (European Agency for Safety and Health at work., 2007). The healthy workplace principle gives a worth tool for developing or reinforcing occupational health and health standards so that conditions are continuously enhanced for the working population. However, a healthy workplace environment is not only without hazards, but also provides an environment that is stimulating and satisfying for those who work there. The healthy organization acknowledges all the elements of occupational health and safety in developing policies and programs for the wellbeing of its workers. The relationships that exist here may be difficult to ascertain because it

could be influenced by single or various combinations of variables. Depending on the approach and combinations, the result might be quite different (WHO, 2002).

2.1.4 **Work-Related Musculoskeletal Disorders and Pain**

the work-related musculoskeletal disorders (WRMDs) have aroused great interest in doctors and researchers and have spoken to them since the beginning of the 18th century. These disorders are usually characterized as injuries or dysfunction primarily involving the main supporting structures of the body, including nerves, muscles, bones, joints and cartilage (NIOSH), which have been attributed to the cumulative effect of frequent movements and / or situations Long-term alienations that often occur in the working environment and eventually lead to excessive use, sprains, strains, tears, seizures and / or other connective tissue injuries (NIOSH, 2001).

It is important to distinguish between WRMDs from general pain disorders attributable to out-of-work injuries eg falls, car accidents, etc.), autoimmune diseases, and / or other causative factors unrelated to professional duties Bureau of Labor Statistics (BLS, 2010).

Epidemiological evidence suggests that musculoskeletal disorders represent the largest single category of diseases registered as occupational diseases in the United States of America ((BLS, 2010).

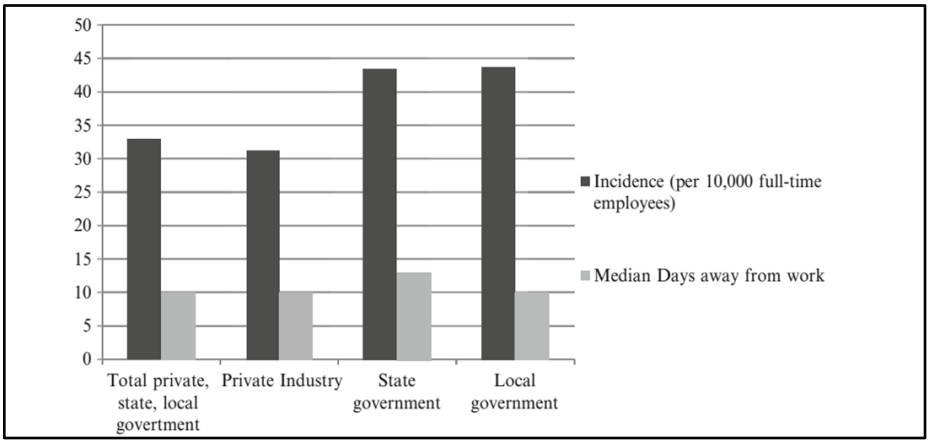


Figure (2-1):Incidence and median of work missed across private industry. Local government, and state government 2009 (BLS, 2010).

2.1.5 **Cardiovascular Disease and the Workplace**

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide, accounting for 30% of all global deaths. According to the American Heart Association (AHA), one in three Americans suffers from a type of cardiovascular disease, including high blood pressure and coronary heart disease (CHD). The total direct and indirect costs of CVD operations are estimated at the US $ 300 billion in the United States in 2007 alone (Roger et al, 2011).

The risk is a potential adverse effect on a factor or circumstance. For example, mesothelioma is considered a cause of asbestos, and physical trauma caused by falls is considered a hazard to work in the highlands. The risk may be serious (eg death) or relatively trivial (eg transient irritation of upper airway) (Handbook of Occupational Health and Wellness, 2012).

Risk is the probability that a hazard will be realized, given the nature and extent of a person's exposure to an agent or circumstance. For example, the risk of mesothelioma from asbestos depends on the type of fibers and the amount that it is inhaled. There is no risk of mesothelioma from the handling of intact asbestos products if no fibers are inhaled. A risk in an individual corresponds to an excess rate of the adverse outcome in a population of exposed people. Thus, populations of asbestos workers have an elevated rate of mesothelioma (Handbook of Occupational Health and Wellness, 2012).

2.2 Wastewater

Each community produces both liquid and solid waste and air emissions. Liquid wastewater - is essentially a water supply to the community having been used in a variety of applications. From the point of view of the sources of generation, wastewater can be defined as a mixture of effluents or water transferred from the residence, institutions, commercial and industrial establishments, as well as groundwater. Surface water, and storm water that may be present (Metcalf and Eddy, 2004).

When untreated wastewater accumulates and can be turned into sewage, the decomposition of the organic matter it contains will result in inconvenient conditions including the production of foul gases. In addition, untreated wastewater contains many pathogenic microorganisms that live in the human intestinal tract. Wastewater

also contains nutrients that can stimulate the growth of aquatic plants and may contain toxic compounds or potentially mutagenic or carcinogenic compounds. For these reasons, the immediate and non-invasive removal of wastewater from their sources of generation, followed by treatment, reuse or waste in the environment is necessary to protect public health and the environment (Metcalf and Eddy, 2004)

2.2.1 **Chemical Hazards**

Hydrogen sulfide (H2S) is a bloated gas that is said to cause eye and respiratory irritation at concentrations of about 20-50 ppm and death at concentrations of around 500 ppm (Guidotti, 2010). Concentrations of H2S concentrations were reported in low ranges of pp h mattresses with eye irritation, although the role of other contaminants (Schinasi et al, 2011).

Hydrogen sulfide (H2S) is produced naturally from geothermal fields. It is also created through industrial sources such as plant and animal products, rayon production, oil and gas refineries, pulp and paper industry. The health effects of H2S are significantly increased with the dose, ranging from rotten egg odor (0.13-15.15 ppm) to respiratory irritation, eye and throat (100 ppm), solar nerve paralysis (150 ppm) and coma (1000 ppm) (Hendrickson et al,2004).

Exposure to high concentrations may be extremely dangerous and lead to immediate breakdown or death. Most deaths in the industry (Guidotti, 2010), which studies the short-term effects of low exposure to H2S (2 to 10 ppm), occurred in healthy adults who found that during exercise, odor intensity and oxygen irritation increased, (Fiedler et al., 2008). However, no trends between dose and sensory or cognitive measures and respiratory function have been described. Empirical studies suggest that short-term health effects are limited in healthy adults. The health effects of Low exposure at the community level, at the limit And 0.5 to 90 ppm, from industrial or natural sources of H2S. The settings include exposure to surrounding H2S communities close to commercial farming and volcanic or terrestrial sources

Fiedler examined the relationship between H2S levels and cognitive test results before and after exposure. Increase ratings in odor intensity, irritation and unpleasant dose with H2S. No trends were observed with levels of exposure in cognitive measures, including finger tapping and simple reaction time, but the time of complex interaction

and verbal learning were much less during exposure. However, the authors concluded that more 2S or fatigue theme. They also examined the effect of H2S levels on respiratory function. Participants reported greater respiratory symptoms (eg sneezing, nasal congestion, choking, irritation of the larynx, or irritation of the nose) and / or fewer respiratory symptoms (ie, shortness of breath, tingling, chest tightness, chest pain or cough) At 5 ppm exposure to H2S, compared to 0.5 ppm H2S (Fiedler et al., 2008).

A study with individual measurements was conducted by (Inserra et al. 2004) in Dakota and South Sioux, Nebraska, communities with industrial sources of H2S exposure. The study used curing processes to generate exposure map and classification of residential areas as 9090 ppm exposure to H2S and <50 ppb2S. The population was assessed with a series of neurological behavioral tests. The researchers reported that of 28 tests evaluated, live in areas with higher H2S levels was associated with statistically insignificant performance, albeit only marginally weaker in memory and grip strength tests. The authors concluded that exposed and non-exposed groups did not differ significantly in cognitive function (Reed BR, 2014).

Many studies investigate the relationship between day-to-day levels of H2S and respiratory outcomes. A study by Carlsen et al., 2012 in Reykjavik, Iceland, reported an increase in prescriptions for asthma drugs or adrenergic drugs three to five days after their rise in H2S. The number of individuals with asthma medication was increased by 2% (95% CI = 0.4-3.6) per μg / m 3 in H2S. The H2S study was observed from one large traffic intersection. (Carlsen et al., 2012).

A study of sewage maintenance workers in Egypt by Farahat et al. (2010) examined a cognitive impairment such as simple reaction time, latency P300, simple mental state test, a forward and backward number due to exposure to H2S. The average exposure level of H2S was 4.8 ppm (range = 5-6.6 ppm). The researchers found that exposed workers had significantly longer reaction times and worse performance in neuropsychological tests than non-exposed workers. However, other potential chemical exposures (such as chlorine dioxide and sodium nitrate) and biological hazards (such as bacteria) have not been measured to control potential humoral effects. (Farahat et al,2010).

Schinasi et al., 2011 examined the associations of hog odor and air pollutants (ie, H2S, PMs endotoxin) with two lung function tests (FEV1), peak exhalation rate (PEF) and physical symptoms, including respiratory symptoms, Skin and eye irritation, gastrointestinal, neurological, and other symptoms. Confusion was avoided by comparing the participants against themselves rather than using the control group. The results of participants were compared in days with increased exposure to H2S to their results in days with reduced exposure to H2S (intra-person analysis). They found that other respiratory symptoms. Self-reported results such as nasal runny nose may be affected by external factors such as odors and discomfort. Lung function measured by PEF and FEV1 was not significantly associated with H2S exposure (Schinasi et al, 2011).

2.2.2 **Biological Hazards**

Raw wastewater contains a wide variety of microorganisms, such as viruses, bacteria, fungi, and primates, which can be irritant during mechanical agitation and water ventilation. Ventilation systems are the main sources of biophysics in wastewater treatment plants. Large numbers of airborne microorganisms have been observed in indoor facilities, which may be explained by internal walls that hinder the dispersion of vital compounds, as well as inadequate ventilation and reduced rates of reduced solar radiation. (Guo, 2014).

Bioaerosols Is a complex mixture that contains many factors that can cause changes in lung or lung function, such as an internal toxin, allergens, fungal toxins and (1 → 3) - β-D-glucans. According to current knowledge, the internal toxin is described as a key factor in professional environments, a group of 78 STPW of a large wastewater treatment plant has been studied. Inhaled dust was collected to assess internal toxin using personal aerosol samples. Endotoxin was tested with the Limulus lysate amoebocyte lysate, chromogenic test. Breathing measurements were performed on Mondays, after two days of absence from work, with the use of a portable respirator. FCR1 and FEV1 parameters were analyzed. Multi-factor regression modeling was performed to determine the parameters significantly associated with exposure to the internal toxin. The study covered all workers in the factory who were working in the morning from 6 am to 2 pm. During the measurement period. All participants were

covered by men. On average, participants were 43 years old and worked for 8.5 years at this sewerage station. The relatively low levels of internal toxin among workers in the wastewater treatment plant may lead to small but significant reductions in FIF1 transformation. The observed relationship was independent of organic dust concentrations and usually smoking. Respiratory protection should be provided for STPW (Cyprowski, 2015).

Raw sewage contains many pathogenic organisms, including bacteria, viruses, fungi, worms, and primates. Workers in WWTPs are exposed to these organisms as well as to H2S, causing many health hazards. A total of 43 workers were studied at Barka Al-Subeeh Company. An equal number of the non-exposed comparison group was studied. All participants were asked about their personal demographic data, symptoms of injury, respiratory illness, and cardiovascular manifestations. Spirometric measurements were performed at the end of the work shift. Standard ECG with 12 points per participant was also taken. For those suffering from positive ECG, Echocardiography was also performed. Hepatitis A (HAV) and hepatitis E (HEV) antibodies were also screened. Blood samples of heparin were measured to measure hemoglobin in sulfur, as an indicator of exposure to H2S. Stools were analyzed by Polymerase Chain Reaction PCR for Leptospira spirochete. Wastewater treatment plant workers suffered from body aches, abdominal pain, wheezing, asthma and dyspnea more frequently than the comparison group ($P < 0.05$). The obstructive pattern of impaired lung function and elevated mean hemoglobin average was more common among wastewater treatment plant workers compared to the comparison group. Levels of antibodies against HAV and HEV as well as the frequency of positive PCR fecal test results for L. spirochete were significantly higher among wastewater treatment plant workers compared to the comparison group. The prevalence of ventricular left (LVH) according to ECG and ejection fraction mean (EF) measured by echocardiography was significantly more frequent in wastewater treatment plant workers than the comparison group (Al-Batanony, 2011).

2.2.3 **Gastrointestinal System Symptoms**

The process of wastewater treatment includes the emission of odors and biological agents in the form of bioaerosol. Depending on the wind direction and force, the season

of the year, and the terrain of the area where the plant is located, the emission of pollutants may extend outside the plant premises, which also poses the risk of exposure to populations living near the plant. Contaminants can reach the gut and start with improvised reactions (such as gram-negative bacteria, staphylococci, and internal toxins) and thus cause disorders such as nausea, vomiting, diarrhea, abdominal pain (Joremkow, 2017).

The study was conducted on two populations: one from the vicinity of the wastewater treatment plant (experimental group: 586) and the other from outside the plant impact area (control group: 502 inhabitants). The search area was divided into the distance from the plant (A, B, C). The questionnaire included questions about gastrointestinal disorders. Compared to the control group, the population reported more than once: nausea, vomiting, and frequent diarrhea. Gastrointestinal disturbances were associated with air pollution by pathogenic Staphylococcus aureus (OR = 7) and odors (OR 7.34; Chlorine 3,43 to 15,72) emitted from the plant, and also living in Zone A versus Area C (OR = 3.47; CI 1.00-12.07), use of domestic gas stove (OR 2.21; CI 1.03-4.70), and age of respondents (0.98; CI 0.96-1.00). The study showed that with increased distance from the plant, the incidence of reported gastrointestinal disturbances decreased. Living in the vicinity of a sewage treatment plant favors the occurrence of gastrointestinal symptoms among the local population (Joremkow, 2017).

Occupational hazards of wastewater exposed to workers for the development of Helicobacter pylori and parasitic infections received little attention. Studies have shown that the pterosaurs infected with the acute organism have been released into the feces and can be transmitted by contaminated water and thus can pose a major health problem for sanitation workers. A cross-sectional study was conducted for 60 workers working in the wastewater treatment plant in Mansoura, maintaining the sewage collection system and 30 non-identical references working as foodstuff and supervisors at Mansoura University hospitals. Data were collected for demographic, occupational and gastrointestinal symptoms. Also, laboratory procedures include, complete blood counts, stool culture analysis and detection of H. pylori antigen have been completed using immunochromatographic rapid assay. The prevalence of H. pylori bacteria in sanitary workers was 56.7% compared to 16.7% for the control group with a statistically significant difference between the two groups. Heartburn with or

without acute pain was the only significant intestinal symptom among sanitation workers (43.3%) compared to the control group (20.0%). The prevalence of E. histolytica in both high and low groups was high (65% and 56.6%) respectively, with no statistically significant differences. Giardia Lamblia was more frequent in the sanitation workers (20.0%) than the comparison workers (10.0%) without much difference. The fecal culture was negative for pathogens (Salmonella or Shigella) in both groups. The risk of H. pylori infection was significantly higher among workers with PPE impairment (OR, 3.00, CI 95%: 1.07-10.35), and workers with a working life> 20 years (OR = 4.71, 95% CI: 1.10-20.20), workers over the age of 45 (OR 4.27, 95% CI: 1.00-18.15) and low-intensity workers (OR 11.2, 95% CI: 1.23-101.89). In the analysis of logistic regression, independent predictors of helminth infection were found in low-educated sanitation workers (OR 43.35), poor compliance with PPE (OR 5.21), and H. bronchitis infection with or without choroidal pain. Healthcare. On the logistic regression, low level of education and poor adherence to personal protective equipment were important factors for predicting helminth infection in sanitation workers. (Awadalla, 2011).

Chapter Three
Methodology

CHAPTER 3 : Methodology

This chapter describes the methodology used in this research. The methodology used to accomplish this study uses the following techniques: information on research design, research groups, questionnaire design, statistical data analysis, content validity, empirical study.

3.1 Study Design

The design of this study is a cross sectional retrospective correlation study was chosen as appropriate to achieve the aims, and to assess health risks among wastewater treatment plant workers in Gaza Strip, and to assess the level of knowledge regarding health and safety risks among Wastewater treatment plant workers.

3.2 Research Chapters

Chapter I of the research thesis included identifying and defining the problems and establishment objective of the study and development research plan.

Chapter II of the research included a summary of the comprehensive literature review. Claims management literature has been reviewed.

Chapter III describes the methodology of research and identifies proposed processes design and evaluation guidelines flowcharts, with details of stages and process.

Chapter IV of the research was data analysis and discussion. Statistical Package for the Social Sciences, (SPSS) was used to perform the required analysis.

Chapter V include **the** final phase includes the conclusions and recommendations.

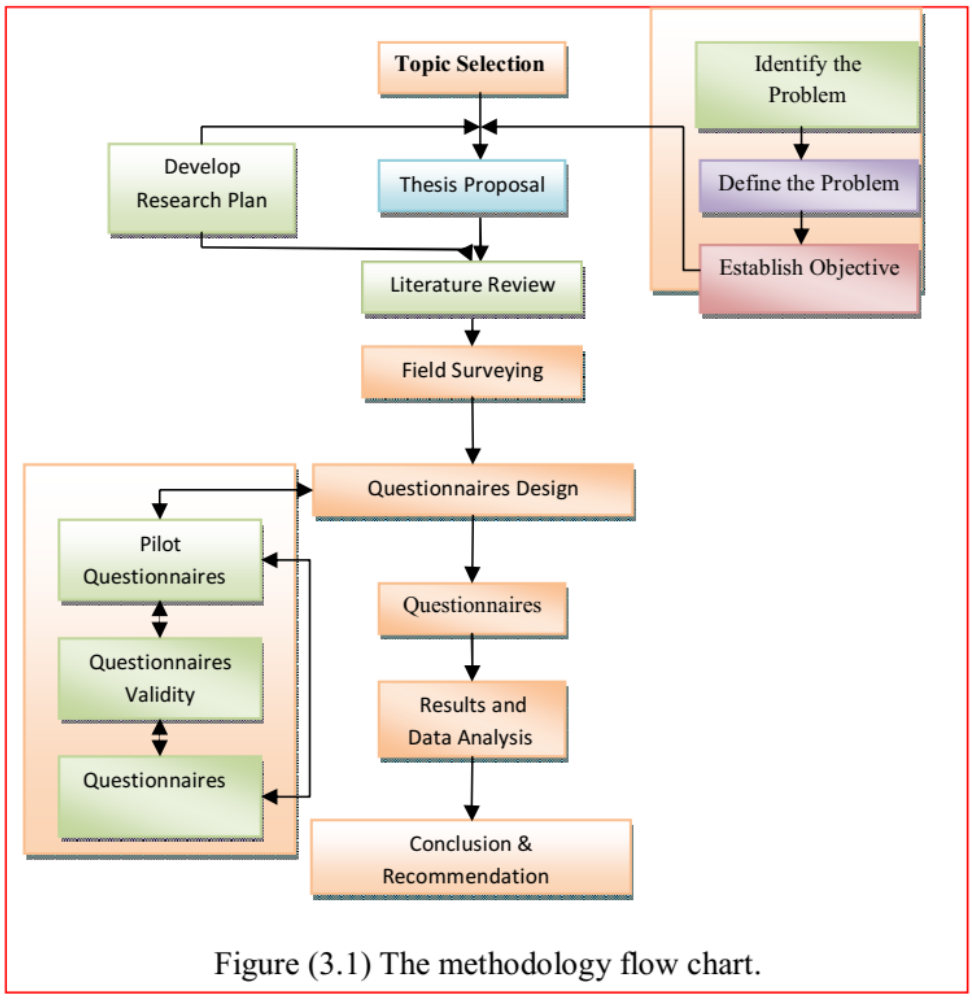


Figure (3-1): Methodology flowchart, which leads to achieve the research objective.

3.3 Study Population

Study population consists of all workers who works in wastewater treatment plants in Gaza Strip and workers who works in wastewater pumping station in Gaza strip.

3.4 Study Settings

The study performed at the Gaza strip consist of five governates.

3.5 Study Sample

The total number of workers in wastewater treatment plants is 45, and the total number of workers in wastewater pumping station is 96, 58questionnaires were distributed to

members of the sample,30 to workers in wastewater treatment plants ,and 28 of them to workers in wastewater pumping station.

In Gaza Strip there is a complicated situation in wastewater system treatment because their multiple management system for example Rafah area under CMWU direct management but Gaza city under municipality. of Gaza direct management.

According pumping stations there two types of stations big and small station, the big one need workers and small one operates automatically without need to any operator.

According the difference between WWTP and pumping station, WWTP need more workers, but pumping station need just guard.

Figure (3-2): WWTP in Gaza Strip

Source: - The quality of Gaza Strip Sea Water Report 20016,Environment Quality Authority.

Table (3.1) Number of station , Number of workers , Number of sample.

Area	Number of stations	Number of workers	Number of selected workers
Gaza Governorate	9	36	9
Khan Younis Governorate	3	9	4
Rafah Governorate	5	11	3
North Gaza Governorate	20	33	11
The Middle of Gaza Governorate	5	7	1
Total	42	96	28

Table (3.2) Number of plant, Number of workers ,Number of sample .

Area	Number of plant	Number of workers	Number of selected workers
Gaza Governorate	1	21	18
Khan Younis Governorate	1	3	-
Rafah Governorate	1	6	5
North Gaza	1	9	7
The Middle of Gaza Governorate	1	6	-
Total	5	45	30

3.6 Period of The Study

The study was conducted from August 2017 to May 2018, it was started by preparing research proposal, then get the approval from the University to start the study in September 2017, the approval from Gaza strip municipal to start data collection, designing the data collection instruments, after pilot study, data collected from December 2017 to February 2018and then data analysis and writing in March to May2018.

3.7 Data Collection and Methodology

In order to collect data for this research, secondary resources were used to collect data such as books, journals, statistics and web pages, as well as primary resources that are not available in secondary resources through direct and indirect methods: indirect method included Questionnaires on interviews distributed to a community Study to obtain their views on Occupational Health Hazards Assessment among workers in sewage stations, Gaza Strip, Palestine, while the direct method includes the measurement of vital signs including blood pressure, heart rate, and respiration rate. Analysis of data on the use of descriptive analysis and the use of the main program (SPSS).

3.8 Study Tools

3.8.1 Self-Reported Questionnaire

A modified questionnaire of the International Hazard Datasheets on Occupation Wastewater Treatment Plant Operator What is a Hazard Datasheet on Occupation. 2012. The questionnaire was sent to a specialist in environment, health and to environmental engineres.an Arabic version is attached in (Annex 2).

The questionnaire was provided with an explanatory message explaining the purpose of the study, the response method, the research objective, and information security to encourage high response. The questionnaire included multiple-choice questions: which are widely used in the questionnaire. The diversity of these questions first aims at achieving the research objectives and gathering all the necessary data that can support the discussion, conclusions, and recommendations in the research.

The questionnaire is classified into the following section: -

First section: personal information.

Second section: knowledge of health and safety standards.

Third section: previous accident happened on work.

Fourth section: hazardous symbol.

3.8.2 **Vital Signs Measurement**

Blood pressure measured by (sphygmomanometer).

heart rate measured from radial artery and respiratory rate measured by observed chest movement.

Figure (3-3): sphygmomanometer.

3.8.3 **Site Visit**

Site visit was performed from 16/12/2017 to 8/1/2018.

- Three big WWTP was visited Gaza plant, Rafah and North Gaza Beit Lahia plant.
- twelve big pumping stations was visited.

Figure(3-4): Bar Screen in Pumping Station

Figure(3-5): Generators in Pumping Station.

Figure(3-6): Workers During Clean Pumping Station.

Figure(3-7): PPE in Pumping Station.

Figure(3-8): Place were Workers Sleep During Duty in WWTP .

Table (3-1): Number of pumping station visits

Area	Number of visited Sites
Gaza	3
Khan Younis	1
Rafah	3
Beit Lahia	1
Wasta	1
Jablia	2
Beit Hanon	1
Total	12

3.9 Pilot Study

A pilot study of the questionnaire was conducted before the results were collected from a sample test. Provides a pilot test of the questionnaire, which is a question formulation, identifying ambiguous questions, testing the techniques used to collect data, and measuring the effectiveness of the standard call for respondents.

3.10 Validity of The Research Instruments

The validity of the instrument could be defined as a determination of the extent to which the instrument actually reflects the abstract structure being examined. The validity refers to the degree to which the instrument measures what is supposed to be "measured". High validity is the absence of systematic errors in the measuring instrument. When the instrument is in effect; it truly reflects the concept, it is supposed to measure it. Achieving good health care requires research design and sample selection. The questionnaire was moderated by the supervisor and five experiences in bidding and bidding environments to evaluate the procedure of the questions and method of analyzing the results. Experience agreed that the questionnaire was valid and appropriate enough to measure the purpose of the questionnaire

3.10.1 **Content Validity of The Questionnaire**

content validity testing was conducted by consulting two expert teams. The first step was to assess and determine whether the questions agreed with the scope of the items and to what extent these items reflected the concept of the research problem. The other party was asked to assess that the instrument used was statistically valid and that the questionnaire was designed in a manner well enough to provide relationships and tests between variables. The two expert groups agreed that the questionnaire was valid and appropriate enough to measure the concept of interest in certain adjustments.

3.11 Statistical Analysis .

To achieve the research objective, the researcher used the Statistical Package for Social Sciences (SPSS) to process and analyze the data

Statistical methods are as follows:

1- Frequency and percentage.
2- Person correlation coefficients for measuring validity of the items of the questionnaires.
3- chi square test.

3.12 Ethical Consideration

An official approval was obtained from Gaza municipal, and Costal Municipalities Water Utility.

Every participant in the study received a complete explanation about the research purposes and confidentiality. All the ethical consideration observed respect for people and human rights and respect for truth. Confidentiality was given and maintained.

Chapter Four
Result and Discussion

CHAPTER 4 : Result and Discussion

This chapter presents the results of the statistical analysis of the data and their interpretation. Descriptive analysis represents the socioeconomic and demographic characteristics and health profile variables for study participants.

4.1 Descriptive Analysis

The researcher used to describe the basic features of the data in the study. They provide simple summaries about the sample and the measures. Together with simple graphic analysis, they form the basis of virtually every quantitative analysis of data.

4.1.1 **Socioeconomic and demographic related variables**

Table (4-1): The frequency distribution of study respondents age, gender, marital status and participant occupation (n=58)

Variable	Category	N	Percent %
Participant Age Category	20 Years old or Less	1	1.7
	21 - 30 Years old	6	10.3
	31 - 40 Years old	18	31.0
	41 - 50 Years old	18	31.0
	51 - 60 Years old	15	25.9
	M± SD 46 ±7		
Participant Gender	Male	58	100
	Female	0	0
Marital Status	Single	2	3.4
	Married	56	96.6
Participant Occupation	Engineer	8	13.8
	Worker	19	32.8
	Guard	6	10.3
	Professional	25	43.1

From the above shown table 4.1 the researcher summarized some sociodemographic variables in and the rest of the variables were divided into other tables as the researcher

collected each linked group of variables together to facilitate comparison between them.

According to table 4.1, the researcher found that the study respondents predominant age group was 21-30 years old as it represented n=18, 31% of study respondents with the same frequency and percent with the age group 41 - 50 Years old respectively, followed by the age group 51 - 60 years old n =25, 25.9% and the lowest number was among age group 20 years old or less n=1, 1.7%.

Concerning study respondents gender the researcher found that all study respondents were males n= 58, 100% due to the work nature.

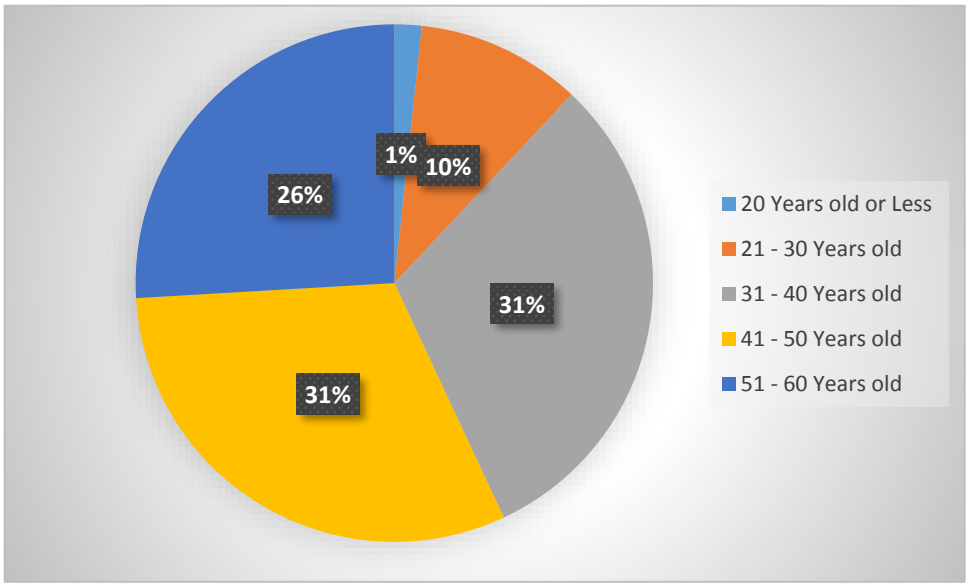


Figure (4-1): Percentage distribution of study participants age groups.

The researcher found that most of study participants were married n=56, 96.6% and about n=2, 3.4% were single. The researcher found that most of study participants were professionals n=25, 43.1% and about n=19, 32.8% were workers, n=8, 13.8% were engineers

and n=6,10.3% were guards.

Table (4-2): The frequency distribution of study respondents according to job education level, Years of experience, and working site (n=58).

Variable	Category	N	Percent %
Education Level	Less than Secondary	27	46.6
	Secondary certified	13	22.4
	Diploma	9	15.5
	Bachelor	5	8.6
	Master Degree or More	4	6.9
Years of Experience	1 - 5 Years	14	24.1
	6- 10 Years	8	13.8
	11 - 15 Years	7	12.1
	More than 15 Years	29	50.0
Station Type	Pump Station	28	48.3
	Treatment plant	30	51.7

From the table 4.2 the researcher found that study sample consists of 4 study respondents with master's degree, and 5 respondents with bachelor degree, the predominant group was worker with less than the secondary certificate representing 46.6%.

Regarding to the years of experience the predominant group was the more than 15 years' experience representing 50% of study sample and the lowest group was 11-15 years of experience representing 12.1% of study sample.

Regarding to station type the researcher found that n=28, 48.3% were working in pump station while the rest of study sample n=30, 51.7% were working in the treatment plants.

Table (4-3): Frequency distribution of study participants according to chronic disease, type of health insurance, locality and smoking status.

Variable	Category	N	Percent %
Chronic Disease	Hypertension	3	5.2
	Hypertension and Diabetes mellites	1	1.7
	Free	54	93.1
Type of Health Insurance	Governmental	49	84.5
	Private	1	1.7
	UNRWA	1	1.7
	Don't Have	7	12.1
Work Place	North Gaza	17	29.3
	Gaza	28	48.3
	Middle Zone	1	1.7
	Khan Younis	4	6.9
	Rafah	8	13.8
Smoking Status	Smoker	28	48.3
	Non-Smoker	30	51.7

From the table above, the researcher categorized the study respondents according to chronic disease which revealed that n=54, 93.1% of study respondents were free from chronic disease, 3 respondents were with hypertension and 1 with hypertension and diabetes mellitus representing 5.2% and 1.7% respectively.

According to the health insurance type, the researcher found that the predominant group was study respondents have the governmental insurance as n=49, 84.55 of study respondents, the lowest group was UNRWA and Private insurance as each one n=1, 1.7% respectively and 7 of study respondents were have no health insurance representing 12.1% because they have private employment contracts that do not include health insurance.

Respondents were from Gaza city followed by group lived in the Gaza north n= 17, 29.3% and 1 study respondent lived in middle governate.

According to smoking status the researcher found that n=30, 51.7% of study respondents were non-smokers while the rest of study respondents were smokers n=28, 48.3%.the high percentage of smokers 48.3% is indicate that worker is in high risk of fire because workers may smokes near dangers area like fuel tanks or sludge.

Table (4-4): Frequency distribution of study participants according to blood pressure, heart rate and respiratory rate.

Variable	Category	N	Percent %
Blood Pressure	Prehypertension	14	24.1
	Normal 120/80	18	31.0
	Optimal > 110/70	26	44.8
Heart Rate	Normal	58	100.0
Respiratory Rate	Hyper Ventilation	2	3.4
	Normal	56	96.6

From the previous table the study revealed that respondents were categorized according to their blood pressure to three categories as shown above the predominant category was the optimal blood pressure from 110/70 mmHg to 119/79 mmHg which represent 44.8%of study respondents followed by the normal blood pressure category 120/80 mmHg representing 31% of study respondents and the prehypertension group up to130/90mmHg representing 24.1% of study respondents.

According to heart rate all study respondents were under the normal heart rate category.

According to respiratory rate the study respondents were divided into two categories the normal respiratory rate representing n=56, 96.6% and the hyperventilation group representing n= 2, 3.4% of study respondents.

4.2 Inferential Statistics

The researcher threw light on the study respondents' knowledge about the potential health risks among waste water pump and treatment plants under study settings

So different physical, biological, chemical, accidental and psychological risks among study respondents were presented as "Knowledge about risk domain" which is the first domain, the second domain was knowledge about safety measures and guidelines, the third domain was previous accidents and hazards history of study respondents which exposed to and the fourth domain was awareness of study respondents about hazards symbols.

4.2.1 Knowledge about different risk types

In this section the researcher tried to explain the different risk types and their mean, mean percentage.

The researcher classified the knowledge about risk into knowledge about subtypes of risk such as physical, biological, chemical, accidental, psychological and knowledge about guidelines and safety measures.

4.2.1.1 Knowledge about physical risk

Table (4-5): The mean, mean percentage and standard deviation

	Item	Mean	SD	Mean %
1	Exposure to excessive noise levels from mechanical equipment	2.17	0.881	72.41
2	Exposure vibration from power tools	2.12	0.895	70.69
3	Exposure to UV radiation	1.57	0.844	52.30
4	Exposure to dust	2.38	0.774	79.31
5	Exposure to bad odor	2.71	0.593	90.23
	Total domain	**2.19**		**72.99**

From the table shown above the study results revealed that the total domain mean percentage was perceived as excellent knowledge 72.99% from study respondents and the lowest item knowledge about UV radiation 52.3% while the highest item was exposure to bad odor 90.23%.

The researcher interpreted the knowledge about bad odor exposure to be perceived with 90.23% as the study sample consisted of less educated workers who can smell bad odor as daily exposure but may do not know well about UV radiation as type of physical risk.

4.2.1.2 Knowledge about biological risk

Table (4-6): The mean, mean percentage and standard deviation

	Item	Mean	SD	Mean %
6	Diseases caused by infectious agents present in the raw domestic wastewater	2.14	0.862	71.26
7	Diseases caused by insects or rodents proliferating in the sludge drying beds	2.21	0.846	73.56
	Total domain	**2.17**		**72.41**

As shown in the table 4.6 the biological risk knowledge consisted of two items both of them perceived as excellent with total domain mean 2.17, which indicated the well knowledge from study participants point of view.

In Egypt Foad M F estimate the prevalence of H.Pylori and assessed the gastrointestinal symptoms among sewage workers ,the prevalence of H.Pylori in sewage workers was 56.7%, 43.3% of workers has heartburn .(Awadalla, 2011).

In study of Heldal exposure symptoms and air way inflammation among sewage workers, workers handling dry sludge were exposed to higher levels of endotoxins ,systematic inflammatory was elevated among the workers compered to controls indicated by higher CRP (C-reactive protein).(Heldal, 2010)

4.2.1.3 Knowledge about chemical risk

Table (4-7): The mean, mean percentage and standard deviation

Item		Mean	SD	Mean %
8	Chronic poisoning by inhalation of chemicals used in waste – water treatment	2.16	0.909	71.84
9	Dermatoses caused by exposure of the skin to waste waters	2.17	0.875	72.41
10	Dermatoses caused by exposure of the skin to chemical agent	2.10	0.881	70.11
11	Irritation of mucous membranes by inhalation bad Oder	2.19	0.846	72.99
12	Irritation of mucous membranes by inhalation hydrogen sulfide	2.19	0.881	72.99
13	Latex allergy caused by the use of latex gloves	2.00	0.896	66.67
	Total domain	**2.14**		**71.17**

As shown in table 4.7 all study respondents knowledge about chemical risk was excellent so they perceived the chemical hazard with caution due to its hazardous effect.

The highest item was about dermatoses and irritation of mucous membrane due to exposure of chemical substances by the 2.19, 72.99% mean percentage, and the lowest item was latex allergy caused by the use of latex gloves by the mean 2.0, 66.67%.

In the study of (Basu, R.2014) genotoxicity in the blood cells of workers exposed to sewage water specially lead and cadmium, occupational exposure sewage workers have high blood lead and cadmium level that may has responsible for DNA damage.(Basu, R,2014)

4.2.1.4 Knowledge about Accident hazards

Table (4-8) The mean, mean percentage and standard deviation

Item		Mean	SD	Mean %
14	Slips on floors made by liquids	2.40	0.799	79.89
15	Blows caused by falling heavy articles,	2.24	0.851	74.71
16	Injuries by machinery parts of moving equipment	2.16	0.841	71.84
17	Falls into ponds causing drowning	2.33	0.848	77.59
18	Falls from ladders during operating equipment	2.34	0.793	78.16
19	Falls from ladders during maintaining equipment	2.38	0.796	79.31
20	Electric shock	2.38	0.837	79.31
21	Injuries caused by sharp objects	2.33	0.855	77.59
22	Acute poisoning caused by various chemicals present in the wastewater,	2.31	0.783	77.01
	Total domain	**2.32**		**77.27**

The researcher study results found that mean knowledge about accident risk domain was 2.32 with mean percentage 77.27%, the lowest item was blows caused by falling heavy articles with 2.24, 74.71%mean and mean percentage respectively and the highest item was falls from ladders during maintaining equipment, Electric shock with 2.38,79.31% mean and mean percentage respectively.

4.2.1.5 Knowledge about psychological risk and agronomic risks.

Table (4-9): The mean, mean percentage and standard deviation.

Item		Mean	SD	Mean %
23	Musculoskeletal injuries caused by handling heavy loads	2.28	0.891	75.86
24	Musculoskeletal injuries caused by long standing	2.21	0.818	73.56
25	Musculoskeletal injuries caused by frequent bending	2.16	0.826	71.84
26	Discomfort related to prolonged wear of protective clothing	2.34	0.793	78.16
27	Familiar to bad smell	2.31	0.783	77.01
28	Familiar to work in station	2.55	0.758	85.06
	Total domain	**2.31**		**76.92**

From table 4.9 the study results revealed that the knowledge about the psychological risk was excellent wither total domain mean and mean percentage 2.31, 76.92% respectively.

As the lowest item in this domain was musculoskeletal injuries caused by frequent bending with mean and mean percentage 2.16, 71.84% respectively and the highest item was familiar to bad smell with mean and mean percentage 2.55, 85.06% respectively.

In study of A.Giri A study on morbidity profile of sewage workers in Mumbai city ,eye problems 70.6% and muscle skeletal problems 68% and 58% with gastrointestinal , 52.6% with respiratory problems , while 26% of workers had minor injury such as cuts , abrasions and laceration .(Giri, 2012) .

4.2.2 **Knowledge about safety measures and guidelines.**

Table (4-10) The mean, mean percentage and standard deviation .

	Item	Mean	SD	Mean %
29	I received training on safety procedures	1.66	0.917	55.17
30	I got a first aid course and evacuation process	1.72	0.842	57.47
31	I have received training courses in dealing with hazardous materials	1.60	0.855	53.45
32	I got a fire training course	1.66	0.739	55.17
33	I have knowledge of the criteria for applying safety procedures at the station	2.22	0.804	74.14
34	Participated in the development of safety and emergency procedures at the station	1.60	0.781	53.22
35	Attend regular health and safety meetings	1.47	0.887	48.85
36	Use personal protective tools for the eye such as (protective glasses)	1.76	0.826	58.62
37	Wear weatherproof clothing / ambient environment / work activities	2.17	0.726	72.41
38	Personal protective shoes for feet (shoe)	2.36	0.923	78.74
39	Use personal protective tools for the head (Hat)	1.91	0.906	63.79
40	Using personal protective devices for ears (earphones)	1.69	0.755	56.32
41	I am aware of the risks surrounding my work	2.28	0.734	75.86
42	Find out who should call in an emergency	2.52	0.834	83.91
43	Know how to use a fire extinguisher	2.24	0.862	74.71
44	Know how to handle hazardous material leaks	1.84	0.917	61.49
	Total domain	**1.92**		**63.96**

Table 4.10 explained the knowledge about safety measures and guidelines of study respondents with total mean 1.92 and mean percentage 63.96 with perceived as good. The lowest item in this domain was Attend regular health and safety meetings with mean 1.47, mean percentage 48.85% and categorized as good while the highest item

was find out who should call in an emergency with mean 2.52 and mean percentage 83.91%.

From study respondents point of view, the wear weatherproof clothing / ambient environment / work activities, I have knowledge of the criteria for applying safety procedures at the station, know how to use a fire extinguisher, I am aware of the risks surrounding my work and personal protective shoes for feet (shoe) were the items considered as important and the knowledge about them were excellent category while other items were in good category.

From table 4.10 the study show that about 60.3% of worker don't receive any courses on safety procedures and 56.9% of workers don't get first aid course and evacuation process ,finally 62% of workers don't receive any course in dealing with hazardous material .

4.2.3 **Previous accidents and hazard history.**

Table (4-11) The mean, mean percentage and standard deviation.

Item		Mean	SD	Mean %
1	I am exposed to high noise levels of equipment	1.57	0.728	52.30
2	It is exposed to vibration from the surfaces	1.81	0.917	60.34
3	Exposure to dust	1.86	0.746	62.07
4	Have been infected with microbes in the wastewater	2.28	0.861	75.86
5	Was poisoned as a result of inhalation of materials used in wastewater treatment	2.36	0.867	78.74
6	You have been infected with skin diseases due to skin exposure to sewage	2.28	0.921	75.86
7	I have a sensitivity of using gloves	2.53	0.788	84.48
8	I have difficulty breathing as a result of inhaling hydrogen sulfide gas (smell of rotten eggs)	1.93	0.923	64.37
9	Sliding on floors	2.03	0.944	67.82
10	Fell from the stairs	2.47	0.847	82.18
11	Electric shocks	2.40	0.885	79.89
12	Exposure to cuts from sharp edges	2.14	0.949	71.26

13	Suffer from low back pain as a result of carrying heavy materials	2.26	0.881	75.29
14	Suffer from low back pain due to long standing	2.31	0.805	77.01
15	Burns from hot materials	2.69	0.711	89.66
	Total domain	**2.19**		**73.14**

From table 4.11, the researcher found that study respondents were exposed to different types of accidents and hazards which differed in its frequency and extremity.

The total domain mean was 2.19, mean percentage 73.14% which mean that the frequency was high, the highest item was burn from hot materials with mean percentage 89.66% followed by having sensitivity to latex gloves with mean percentage 84.48% while the lowest item was I am exposed to high noise levels of equipment with mean 1.57 and mean percentage 52.3%. followed by exposure to vibration from the surfaces with mean 1.81 and mean percentage 60.34%.

This domain contained other complexed questions the researcher analyzed them as explained down in table inserted as crosstabulation, when the researcher asked about unmentioned incidences the answers were yes or now and if yes, the study participant should explain what type of incidence he experienced.

Table (4-12) Crosstabulation of study respondents according to type of not mentioned incidence during work.

Question		If yes, please write incidents			Total
		Fracture	Hernia	Fall Down	
Have you experienced any other incidents not mentioned above	YES	1	3	4	8
	NO	0	0	0	50
Total		**1**	**3**	**4**	**58**

From table 4.12 the researcher found that 50 from 58 study participants answered with no but 8 of them answered with yes and their answers were 1 case of fracture, 3 cases of hernia and 4 cases of fall down.

The researcher test correlation by Chi-square test which resulted with a statistically significant relationship between incidence type and unmentioned incidence.

Table (4-13) Chi-Square Tests for correlation between type of incidence and unmentioned incidence.

Chi-Square Tests			
Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.000	3	.000

From the above table 4.13 the study revealed that there was a statistically relationship between incidence type and unmentioned incidence at *P*-value .000.

Table(4-14): Crosstabulation of study respondents knowledge about disease and type of disease.

Question		If yes, what are these diseases					**Total**
		Fever	**Hepatitis**	**Low Back Pain**	**Gastroenteritis**	**Cancer**	
Do you know what diseases are caused by microbes present in wastewater	YES	3	11	1	7	3	25
	NO	0	0	0	0	0	33
Total		**3**	**11**	**1**	**7**	**3**	**58**

From table 4.14 the researcher found that 33 from 58 study participants answered with no but 25 of them answered with yes and their answers were 3 cases of fever, 11 cases of Hepatitis, 1 case low back pain, 7 cases of Gastroenteritis and 3 cases of cancer.

The study shows that about 56.9% of workers don't have any knowledge about what disease are caused by microbes in wastewater.

Table (4-15): Chi-Square Tests for correlation between worker knowledge of disease and type of disease.

Chi-Square Tests			
Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.000	5	.000
Likelihood Ratio	79.298	5	.000
N of Valid Cases	58		

From the above table 4.15 the study revealed that there was a statistically relationship between worker knowledge of disease and type of disease at P-value .000.

Table (4-16): Crosstabulation of periodic infection checkup and type of test.

		If yes, what are the tests				Total
		Hepatitis	**Dermatitis**	**Vaccine**	**Gastroenteritis**	
Does your institution / municipality provide periodic medical checkups	YES	15	2	10	1	28
	NO	0	0	0	0	30
Total		**15**	**2**	**10**	**1**	**58**

The table 4.16, explained the types of different test done by the institution or municipality periodically, showing that there were four test types which done for sewage water workers which reflect that those workers do not know the difference between periodic test and type of test another note the researcher found that more than the half of worker said that the municipality do not performed periodic tests. From the table 4.14 the study shows that 51.7% of workers don't receive periodic medical checkups.

Table (4-17): Chi-Square Tests for correlation between municipality periodic checkup and type of test.

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	58.000	4	.000
Likelihood Ratio	80.336	4	.000
N of Valid Cases	58		

From the above table 4.17 the study revealed that there was a statistically relationship between periodic checkup and type of test at P-value .000.

Table (4-18): Crosstabulation of study respondents locality and receiving some drink.

	Do you have some special drinks (milk - juice)		**Total**
	Yes (%)	**No (%)**	
North Gaza	0 (0)	17 (29.3)	17 (29.3)
Gaza	0 (0)	28 (48.3)	28 (48.3)
Middle Zone	0 (0)	1 (1.7)	1 (1.7)
Khan Younis	0 (0)	4(6.9)	4(6.9)
Rafah	8 (13.8)	0 (0)	8 (13.8)
Total	**8 (13.8)**	**50 (86.2)**	**58 (100)**

From table 4.18, the researcher found that just the workers who lived in Rafah agreed that they receive milk or juice drink from their institution or municipality which the researcher interpreted it due to that Rafah is under coastal municipalities water utility supervision and management while other regions under municipals control.

4.2.4 **Study respondents' awareness about caution symbols.**

In this section the researcher coded the answers of study respondents into three categories yes, no and do not know, by performing a frequency test the study shown some results explained in the following table 4.19.

Table (4-19): frequency distribution of study respondents according to their answers.

Symbol	True (%)	False (%)	Don't Know (%)
Flammable Substance sign	55 (94.8)	2 (3.4)	1 (1.7)
Toxic Substance sign	51 (87.9)	5 (8.6)	2 (3.4)
Carcinogens Substance sign	33 (56.9)	12 (20.7)	13 9(22.4)
Corrosive Substance sign	35 (60.3)	8 (13.8)	15 (25.9)
Environmental hazardous Substance sign	36 (62.1)	10 (17.2)	12 (20.7)

From table 4.19, most of study respondents know the signs which indicated to flammable sign and toxic substance sign, but carcinogenic sign n= 33, 56.9% knew the sign while 43.1% of study respondents do not know the what the sign meant.

The corrosive substance sign n=35,60.3% knew the sign meaning but the rest 39.7% don't knew the sign meaning and the environmental hazardous substances sign n=36, 62.1% knew the sign meaning while the rest 37.9% don't knew the sign meaning.

Despite the worker has good knowledge about symbols the researcher doesn't find any nameplate in any site was visited.

4.2.5 **Study respondents' vital signs**

In this section the researcher took vital signs for study respondents as blood pressure, heart rate and respiratory rate in order to correlate them with study variables.

Table (4-20): Frequency and percent distribution of vital signs categories of study respondents.

Vital sign	Category	Frequency	Percent %as
Blood Pressure categories	Prehypertension ≤ 130/90	14	24.14
	Normal = 120/80	18	31.03
	Optimal ≥ 110/70	26	44.83
Heart rate categories	**Normal**	**58**	**100**
Respiratory rate Categories	Hyper Ventilation	2	3.4
	Normal	56	96.6

From table 4.20, the study revealed that all study respondents were under normal range of vital signs as example n=44, 75.86 of study respondents were in normal to optimal rang od blood pressure even the rest of study respondents were in the prehypertension category which cannot be categorized as hypertensive patients, according to heart rate all study respondents were in the normal range of heart rate and according to respiratory rate n=56, 96.6% of study respondents were in normal range of respiratory rate, while n=2,3.4% of study respondents were hyperventilated.

4.3 Knowledge Domain Analysis.

In this section the researcher demonstrated relationships between different type of physical, biological, chemical, accidents and psychological risks according to study variables.

4.3.1 **Comparing study domains means according to smoking status .**

Table (4-21): Independent sample T-test for comparing study domains means according to smoking status

Smoking status		N	Mean	SD	F	t	Sig.
Physical domain score	Smoker	28	10.39	2.63	2.161	-1.425	0.160
	Non-smoker	30	11.47	3.10			
Biological domain score	Smoker	28	4.29	1.70	0.024	-0.260	0.796
	Non-smoker	30	4.40	1.65			
Chemical domain score	Smoker	28	12.25	4.41	0.029	-0.943	0.350
	Non-smoker	30	13.33	4.33			
Accident risk domain Score	Smoker	28	20.29	5.97	0.007	-0.715	0.478
	Non-smoker	30	21.40	5.89			
Psychological risk domain score	Smoker	28	13.82	3.72	0.099	-0.045	0.964
	Non-smoker	30	13.87	3.91			

From table 4.21, the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level.

4.3.2 **Comparing study domains means according.to station type.**

Type of station		N	Mean	SD	F	t	Sig.
Physical domain score	Pump Station	28	11.25	2.59	1.512	0.760	0.447
	Treatment plants	30	10.67	3.20			
Biological domain score	Pump Station	28	3.96	1.71	0.108	-1.715	0.093
	Treatment plants	30	4.70	1.56			
Chemical domain score	Pump Station	28	12.96	4.08	3.281	0.257	0.797
	Treatment plants	30	12.67	4.69			
Accident risk domain score	Pump Station	28	21.32	6.02	0.002	0.569	0.572
	Treatment plants	30	20.43	5.86			
Psychological risk domain score	Pump Station	28	14.54	3.98	0.496	1.346	0.184
	Treatment plants	30	13.20	3.55			

From table 4.22; the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level.

4.3.3 **Comparing study domains means according to respiratory rate.**

Table (4-22): Independent sample T-test for comparing study domains means according to respiratory rate.

Respiratory rate Categories		N	Mean	SD	F	t	Sig.
Physical domain score	Hyper Ventilation	2	10.00	4.24	0.22	-0.47	0.643
	Normal	56	10.98	2.90			
Biological domain score	Hyper Ventilation	2	2.00	0.00	10.24	-2.09	**0.000**
	Normal	56	4.43	1.63			
Chemical domain score	Hyper Ventilation	2	9.50	0.71	9.00	-1.09	**0.005**
	Normal	56	12.93	4.40			
Accident risk domain score	Hyper Ventilation	2	24.00	4.24	0.67	0.76	0.449
	Normal	56	20.75	5.96			
Psychological risk domain score	Hyper Ventilation	2	15.00	4.24	0.02	0.44	0.665
	Normal	56	13.80	3.81			

From table 4.23; the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level in the physical risk domain score, accident risk domain score and psychological risk domain score.

The researcher study results revealed that there were statistically significant relationships between respiratory rate and the biological risk domain score and chemical domain score.

4.3.4 **Comparing study respondents means with different risk domains according to type of occupation.**

Table (4-23): One-way ANOVA test for comparing study respondents means with different risk domains according to type of occupation.

Domain	Category	N	Mean	SD	F	Sig
Physical domain score	Engineer	8	12.38	3.66	1.005	0.398
	Worker	19	10.32	2.83		
	Guard	6	10.50	3.62		
	Professional	25	11.08	2.53		
	Total	58	10.95	2.91		
Biological domain score	Engineer	8	5.25	1.04	1.432	0.244
	Worker	19	3.89	1.91		
	Guard	6	4.00	1.79		
	Professional	25	4.48	1.53		
	Total	58	4.34	1.66		
Chemical domain score	Engineer	8	14.00	4.87	0.389	0.761
	Worker	19	12.05	4.42		
	Guard	6	13.00	5.14		
	Professional	25	12.96	4.16		
	Total	58	12.81	4.37		
Accident risk domain score	Engineer	8	23.50	6.46	0.608	0.613
	Worker	19	20.37	5.07		
	Guard	6	20.67	5.99		
	Professional	25	20.44	6.42		
	Total	58	20.86	5.91		
Psychological risk domain score	Engineer	8	13.88	5.25	0.243	0.866
	Worker	19	14.21	3.55		
	Guard	6	12.67	3.67		
	Professional	25	13.84	3.65		
	Total	58	13.84	3.79		

From table 4.24; the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level but the researcher found that the mean knowledge of engineer's answers was the highest in all risk domains which reflected their knowledge about different types of risk due to their knowledge and education

4.3.5 **Comparing study respondents means with different risk domains according to age group.**

Table (4-24): One-way ANOVA test for comparing study respondents means with different risk domains according to age group

Domain	Category	N	Mean	SD	F	Sig.
Physical domain score	Less than 20 Years	1	9.00		0.828	0.513
	20 - 30 Years	6	9.17	2.99		
	31- 40 Years	18	11.28	3.01		
	41 - 50 Years	18	11.39	2.83		
	51 - 60 Years	15	10.87	2.92		
	Total	58	10.95	2.91		
Biological domain score	Less than 20 Years	1	4.00		1.205	0.320
	20 - 30 Years	6	4.33	1.97		
	31- 40 Years	18	4.00	1.78		
	41 - 50 Years	18	4.06	1.66		
	51 - 60 Years	15	5.13	1.30		
	Total	58	4.34	1.66		
Chemical domain score	Less than 20 Years	1	10.00		1.055	0.388
	20 - 30 Years	6	15.00	3.58		
	31- 40 Years	18	11.94	4.93		
	41 - 50 Years	18	12.11	4.51		
	51 - 60 Years	15	14.00	3.63		
	Total	58	12.81	4.37		
Accident risk domain score	Less than 20 Years	1	26.00		0.362	0.834
	20 - 30 Years	6	21.67	3.88		
	31- 40 Years	18	20.56	6.75		
	41 - 50 Years	18	21.44	5.73		
	51 - 60 Years	15	19.87	6.14		
	Total	58	20.86	5.91		
Psychological risk domain score	Less than 20 Years	1	12.00		0.179	0.948
	20 - 30 Years	6	14.67	2.94		
	31- 40 Years	18	13.78	4.12		
	41 - 50 Years	18	13.50	4.12		
	51 - 60 Years	15	14.13	3.64		
	Total	58	13.84	3.79		

From table 4.25; the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level but the researcher found that the mean knowledge of 20-30 years old as age group was the highest in all

risk domains except in the accident risk domain the age group less than 20 years was the highest group mean.

4.3.6 **Comparing study respondents means with different risk domains according to marital status.**

Table (4-25): One-way ANOVA test for comparing study respondents means with different risk domains according to marital status.

Domain	Category	N	Mean	SD	F	Sig
Physical domain score	Single	2	8.50	4.95	1.48	0.229
	Married	56	11.04	2.85		
	Total	58	10.95	2.91		
Biological domain score	Single	2	3.00	1.41	1.37	0.247
	Married	56	4.39	1.66		
	Total	58	4.34	1.66		
Chemical domain score	Single	2	12.00	5.66	0.07	0.792
	Married	56	12.84	4.38		
	Total	58	12.81	4.37		
Accident risk domain score	Single	2	21.50	7.78	0.02	0.878
	Married	56	20.84	5.92		
	Total	58	20.86	5.91		
Psychological risk domain score	Single	2	13.50	4.95	0.02	0.897
	Married	56	13.86	3.80		
	Total	58	13.84	3.79		

From table 4.26, the researcher didn't find statistically significant relationship between different types of risk and marital status which meant that there were differences in mean between single and married respondents under study setting but it didn't reach a statistically significance level.

The researcher interpreted that due to the number of single respondent were two respondents not more which could affect the test results.

The researcher divided the marital status into single, married, divorced and widow but the single and married categories were the more frequent among study respondents

4.3.7 **Comparing study respondents means with different risk domains according to years of experience.**

Table (4-26): One-way ANOVA test for comparing study respondents means with different risk domains according to years of experience.

Domain	Category	N	Mean	SD	F	Sig.
Physical domain score	1 - 5 Years	14	10.00	2.54	1.31	0.281
	6 - 10 Years	8	12.50	2.73		
	11 - 15 Years	7	11.29	2.43		
	More than 15 Years	29	10.90	3.15		
	Total	58	10.95	2.91		
Biological domain score	1 - 5 Years	14	3.36	1.65	2.40	0.078
	6 - 10 Years	8	4.88	1.64		
	11 - 15 Years	7	4.57	1.62		
	More than 15 Years	29	4.62	1.57		
	Total	58	4.34	1.66		
Chemical domain score	1 - 5 Years	14	11.86	4.91	0.44	0.728
	6 - 10 Years	8	13.63	3.85		
	11 - 15 Years	7	12.14	5.21		
	More than 15 Years	29	13.21	4.14		
	Total	58	12.81	4.37		
Accident risk domain score	1 - 5 Years	14	20.86	6.26	0.20	0.894
	6 - 10 Years	8	19.38	6.86		
	11 - 15 Years	7	21.43	6.53		
	More than 15 Years	29	21.14	5.58		
	Total	58	20.86	5.91		
Psychological risk domain score	1 - 5 Years	14	13.86	4.38	0.24	0.866
	6 - 10 Years	8	13.88	3.14		
	11 - 15 Years	7	12.71	4.72		
	More than 15 Years	29	14.10	3.56		
	Total	58	13.84	3.79		

From table 4.27, the researcher didn't find statistically significant relationship between different types of risk and years of experience which meant that there were differences in mean between study respondents answers regarding the knowledge about different types of risk according to years of experience categories of respondents under study setting.

4.3.8 **Comparing study respondents means with different risk domains according to level of education.**

Table (4-27): One-way ANOVA test for comparing study respondents means with different risk domains according to level of education.

Domain	Category	N	Mean	SD	F	Sig.
Physical Domain Score	Less than Secondary	27	10.30	2.60	1.86	0.131
	Secondary certified	13	11.00	2.94		
	Diploma	9	10.56	2.70		
	Bachelor	5	13.20	3.49		
	Master or More	4	13.25	3.50		
	Total	58	10.95	2.91		
Biological Domain Score	Less than Secondary	27	3.33	1.57	6.88	**0.000**
	Secondary certified	13	5.23	1.24		
	Diploma	9	4.89	1.36		
	Bachelor	5	5.60	0.89		
	Master or More	4	5.50	1.00		
	Total	58	4.34	1.66		
Chemical Domain Score	Less than Secondary	27	11.37	4.03	1.91	0.123
	Secondary certified	13	14.00	4.32		
	Diploma	9	12.89	4.23		
	Bachelor	5	16.00	3.94		
	Master or More	4	14.50	5.74		
	Total	58	12.81	4.37		
Accident risk Domain Score	Less than Secondary	27	20.15	6.05	0.92	0.461
	Secondary certified	13	20.31	4.89		
	Diploma	9	20.67	6.48		
	Bachelor	5	25.40	3.58		
	Master or More	4	22.25	8.85		
	Total	58	20.86	5.91		
Psychological risk Domain Score	Less than Secondary	27	13.48	4.02	0.25	0.906
	Secondary certified	13	14.23	3.09		
	Diploma	9	13.44	2.83		
	Bachelor	5	15.00	5.10		
	Master or More	4	14.50	5.74		
	Total	58	13.84	3.79		

From table 4.28, the researcher didn't find statistically significant relationship between different types of risk and years of experience which meant that there were differences in mean among study respondents answers according to the level of education

categories for respondents under study setting but did not reach statically significant level except the biological risk domain which have a statistically relationship at *P*-value 0.000.

4.3.9 **Comparing study respondents means with different risk domains according to chronic disease status.**

Table (4-28): One-way ANOVA test for comparing study respondents means with different risk domains according to chronic disease status.

Domain	Category	N	Mean	SD	F	Sig.
Physical Domain Score	Hypertension	3	9.67	0.58	0.25	0.667
	Hypertension and Diabetes mellitus	1	10.00			
	Total	4	9.75	0.50		
Biological Domain Score	Hypertension	3	4.00	2.00	0.75	0.478
	Hypertension and Diabetes mellitus	1	6.00			
	Total	4	4.50	1.91		
Chemical Domain Score	Hypertension	3	9.67	1.53	12.89	0.070
	Hypertension and Diabetes mellitus	1	16.00			
	Total	4	11.25	3.40		
Accident risk Domain Score	Hypertension	3	20.33	6.51	0.03	0.875
	Hypertension and Diabetes mellitus	1	19.00			
	Total	4	20.00	5.35		
Psychological risk Domain Score	Hypertension	3	11.33	2.08	1.23	0.383
	Hypertension and Diabetes mellitus	1	14.00			
	Total	4	12.00	2.16		

From table 4.29, the researcher didn't find statistically significant relationship between different types of risk and chronic disease status which meant that there were differences in mean among study respondents abut it didn't reach a statistically significant level between different chronic disease categories of respondents under study setting which the researcher explained it due to the small number of respondents with chronic disease reflecting the healthy status of respondents under study setting.

The researcher divided the chronic disease into hypertension, Diabetes Mellitus, Hypertension and Diabetes Mellitus, Bronchial Asthma and others categories but the

Hypertension and hypertension and Diabetes Mellitus were the more frequent two categories among study respondents.

4.3.10 **Comparing study respondents means with different risk domains according to health insurance type.**

Table (4-29): One-way ANOVA test for comparing study respondents means with different risk domains according to health insurance type.

Domain	Category	N	Mean	SD	F	Sig.
Physical Domain Score	Governmental	49	11.02	2.85	1.13	0.347
	Private	1	15.00			
	UNRWA	1	8.00			
	Don't Have	7	10.29	3.30		
	Total	58	10.95	2.91		
Biological Domain Score	Governmental	49	4.49	1.63	1.76	0.166
	Private	1	6.00			
	UNRWA	1	4.00			
	Don't Have	7	3.14	1.57		
	Total	58	4.34	1.66		
Chemical Domain Score	Governmental	49	13.00	4.33	1.04	0.381
	Private	1	18.00			
	UNRWA	1	9.00			
	Don't Have	7	11.29	4.61		
	Total	58	12.81	4.37		
Accident risk Domain Score	Governmental	49	20.67	6.00	1.35	0.269
	Private	1	27.00			
	UNRWA	1	12.00			
	Don't Have	7	22.57	4.54		
	Total	58	20.86	5.91		
Psychological risk Domain Score	Governmental	49	13.82	3.90	0.47	0.704
	Private	1	16.00			
	UNRWA	1	10.00			
	Don't Have	7	14.29	3.30		
	Total	58	13.84	3.79		

From table 4.30, the researcher didn't find statistically significant relationship between different types of risk and health insurance type status which meant that there were differences in mean among study respondents but didn't reach a statistically significant level according to health insurance type categories of respondents under study setting.

The researcher divided the health insurance into governmental, private, UNRWA, and don't have insurance category.

4.3.11 Comparing study respondents means with different risk domains according to study respondent locality

Table (4-30): One-way ANOVA test for comparing study respondents means with different risk domains according to study respondent locality.

Domain	Category	N	Mean	SD	F	Sig.
Physical Domain Score	North Gaza	17	11.06	2.86	0.28	0.888
	Gaza	28	11.04	2.87		
	Middle Zone	1	13.00			
	Khan Younis	4	11.00	2.71		
	Rafah	8	10.13	3.72		
	Total	58	10.95	2.91		
Biological Domain Score	North Gaza	17	4.65	1.62	1.66	0.173
	Gaza	28	4.57	1.60		
	Middle Zone	1	2.00			
	Khan Younis	4	3.00	1.15		
	Rafah	8	3.88	1.89		
	Total	58	4.34	1.66		
Chemical Domain Score	North Gaza	17	13.00	4.29	0.50	0.739
	Gaza	28	13.04	4.61		
	Middle Zone	1	16.00			
	Khan Younis	4	13.25	4.43		
	Rafah	8	11.00	4.17		
	Total	58	12.81	4.37		
Accident risk Domain Score	North Gaza	17	20.06	6.74	0.69	0.603
	Gaza	28	20.71	5.58		
	Middle Zone	1	25.00			
	Khan Younis	4	25.00	4.00		
	Rafah	8	20.50	6.26		
	Total	58	20.86	5.91		
Psychological risk Domain Score	North Gaza	17	14.00	3.82	0.65	0.629
	Gaza	28	13.89	3.48		
	Middle Zone	1	18.00			
	Khan Younis	4	14.75	5.85		
	Rafah	8	12.38	4.07		
	Total	58	13.84	3.79		

From table 4.31, the researcher didn't find statistically significant relationship between different types of risk and respondent locality status which meant that there were differences in mean among study respondents according to different locality categories of respondents under study setting but didn't reach a statistically significant level. The researcher divided the into five localities; North Gaza, Gaza, Muddle zone, Khan Younis and Rafah.

4.3.12 **Comparing study respondents means with different risk domains according to blood pressure.**

Table (4-31): One-way ANOVA test for comparing study respondents means with different risk domains according to blood pressure.

Domain	Category	N	Mean	SD	F	Sig.
Physical Domain Score	Pre-hypertension ≤130/90	14	11.29	2.64	0.21	0.809
	Normal 120/80	18	10.61	3.18		
	Optimal ≥ 110/70	26	11.00	2.94		
	Total	58	10.95	2.91		
Biological Domain Score	Pre-hypertension ≤130/90	14	4.36	1.69	0.63	0.534
	Normal 120/80	18	4.00	1.64		
	Optimal ≥ 110/70	26	4.58	1.68		
	Total	58	4.34	1.66		
Chemical Domain Score	Pre-hypertension ≤130/90	14	12.21	4.34	1.06	0.352
	Normal 120/80	18	11.94	4.36		
	Optimal ≥ 110/70	26	13.73	4.38		
	Total	58	12.81	4.37		
Accident risk Domain Score	Pre-hypertension ≤130/90	14	21.14	6.25	0.05	0.948
	Normal 120/80	18	21.06	6.02		
	Optimal ≥ 110/70	26	20.58	5.87		
	Total	58	20.86	5.91		
Psychological risk Domain Score	Pre-hypertension ≤130/90	14	12.64	4.43	1.01	0.371
	Normal 120/80	18	14.50	3.40		
	Optimal ≥ 110/70	26	14.04	3.67		
	Total	58	13.84	3.79		

From table 4.32, the researcher didn't find statistically significant relationship between different types of risk and respondent blood pressure status which meant that there were differences in mean between different blood pressure categories of respondents

under study setting but didn't reach a statically significant level. The researcher explained this statistical insignificance relationship due to healthy status of study respondents as they were under the umbrella of healthy status because all of them don't reach hypertension category more than 130/90mHg.

4.3.13 **Correlation test between respondent's knowledge about different types of risk domains**

Table (4-32): correlation test between respondent's knowledge about different types of risk domains, n=58

Study domains	Mean	Pearson Correlation	Sig. (2-tailed)
Physical Domain Knowledge * Biological Domain Knowledge	10.95 4.34	.381**	**.003**
Physical Domain Knowledge * Chemical Domain Knowledge	10.95 12.81	.597**	**.000**
Physical Domain Knowledge * Accident Risk Domain Knowledge	10.95 20.86	.464**	**.000**
Physical Domain Knowledge * Psychological Risk Domain	10.95 13.84	.466**	**.000**
Biological Domain Knowledge * Chemical Domain Knowledge	4.34 12.81	.680**	**.000**
Biological Domain Knowledge * Accident Risk Domain Knowledge	4.34 20.86	.243	.066
Biological Domain Knowledge* Psychological Risk Domain Knowledge	4.34 13.84	.371**	**.004**
Chemical Domain Knowledge * Accident Risk Domain Knowledge	12.81 20.86	.543**	**.000**
Chemical Domain Knowledge * Psychological Risk Domain Knowledge	12.81 13.84	.706**	**.000**
Accident Risk Domain Knowledge * Psychological Risk Domain Knowledge	20.86 13.84	.731**	**.000**

From table 4.33, the researcher study results revealed that there was a statistically significant relationship between all study domains about the knowledge of different types of risks, except the biological domain knowledge with accident risk knowledge domain was a positive weak statistically insignificant relationship.

The knowledge about (Physical * Chemical Domain), (Biological * Chemical), (Chemical *Accident Risk), (Chemical* Psychological) and (Accident domain * Psychological) was a positive strong statistically significant relationship.

The knowledge about (Physical* Biological), (Physical * Accidents) and (Physical * Psychological) domains was a positive weak statistically significant relationship.

4.4 Safety Measures and Guidelines Domain.

In this section the researcher thrown light on safety measures and guidelines instructions follow up from worker under study setting.

4.4.1 **comparing study domains means according to smoking status, type of station and respiratory rate**

Table (4-33): Independent sample T-test for comparing study domains means according to smoking status, type of station and respiratory rate.

Variable	Category	N	Mean	SD	SE	t	Sig.
Smoking Status	Smoker	28	29.04	7.61	1.47	-1.53	.132
	Non-Smoker	30	32.17	7.82	1.43		
Type of Station	Pump Station	28	32.78	7.16	1.38	1.967	0.053
	Treatment Planet	30	28.80	8.01	1.46		
Respiratory Rate Categories	Hyper Ventilation	2	30.50	6.36	4.50	-0.034	0.973
	Normal	56	30.69	7.91	1.07		

From table 4.34, the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level which meant that there were no differences in mean between smoking status, type of station and respiratory rate categories of respondents under study setting.

4.4.2 **Comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience.**

Table (4-34): One-way ANOVA test for comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience.

Variable	Category	N	Mean	SD	SE	F	Sig.
Occupation	Engineer	8	31.50	6.70	2.37	1.228	.309
	Worker	19	30.58	8.90	2.04		
	Guard	6	25.17	3.76	1.54		
	Professional	25	31.88	7.77	1.59		
	Total	58	30.68	7.82	1.04		
Age Group	Less than 20 Years	1	23.00			1.424	0.239
	20 - 30 Years	6	28.67	11.27	4.60		
	31- 40 Years	18	29.50	6.74	1.59		
	41 - 50 Years	18	29.76	7.01	1.70		
	51 - 60 Years	15	34.47	7.96	2.06		
	Total	58	30.68	7.82	1.04		
Marital Status	Single	2	26.50	7.78	5.50	0.590	0.446
	Married	56	30.84	7.85	1.06		
	Total	57	30.68	7.82	1.04		
Years of Experience	1 - 5 Years	14	29.21	7.26	1.94	0.298	0.827
	6 - 10 Years	8	30.13	8.61	3.04		
	11 - 15 Years	7	30.57	8.42	3.18		
	More than 15 Years	29	31.61	8.02	1.51		
	Total	58	30.68	7.82	1.04		

From table 4.35, the researcher found differences in mean among study respondent in different risk domains according to occupation, age group, marital status and years of experience but it didn't reach statistically significant relationship.

4.4.3 **comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type.**

Table (4-35): One-way ANOVA test for comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type.

Variable	Category	N	Mean	SD	SE	F	Sig.
Education Level	Less than Secondary	28	30.74	7.59	1.46	0.645	0.633
	Secondary certified	13	28.00	9.16	2.54		
	Diploma	8	32.25	8.56	3.03		
	Bachelor	5	33.00	7.18	3.21		
	Master or More	4	33.00	3.46	1.73		
	Total	58	30.68	7.82	1.04		
Chronic Disease	Hypertension	3	26.33	4.04	2.33	16.00	0.057
	Hypertension and Diabetes mellitus	1	45.00				
	Total	4	31.00	9.90	4.95		
Blood Pressure	Pre-hypertension 130/90	14	30.79	8.79	2.35	0.757	0.474
	Normal 120/80	18	32.47	7.35	1.78		
	Optimal > 110/70	26	29.46	7.64	1.50		
	Total	58	30.68	7.82	1.04		
Locality	North Gaza	17	34.53	7.76	1.88	1.815	0.140
	Gaza	28	28.26	7.16	1.38		
	Middle Zone	1	32.00				
	Khan Younis	4	29.50	6.03	3.01		
	Rafah	8	31.13	9.22	3.26		
	Total	58	30.68	7.82	1.04		
Health Insurance Type	Governmental	49	30.58	7.75	1.12	0.121	0.847
	Private	1	32.00				
	UNRWA	1	27.00				
	Don't Have	7	31.71	9.76	3.69		
	Total	58	30.68	7.82	1.04		

From table 4.36, the researcher found differences in mean among study respondent in different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type but it didn't reach statistically significant level.

4.5 Accident History Domain.

4.5.1 Comparing study domain means according to smoking status, type of station and respiratory rate.

Table (4-36): Independent sample T-test for comparing study domain means according to smoking status, type of station and respiratory rate.

Variable	Category	N	Mean	SD	SE	t	Sig.
Smoking Status	Smoker	28	18.46	4.83	.914	-0.516	0.608
	Non-Smoker	30	19.07	3.86	.743		
Station Type	Pump Station	28	19.08	4.31	0.84	0.502	0.617
	Treatment plants	30	18.48	4.45	0.83		
Respiratory Rate	Hyper Ventilation	2	21.50	2.12	1.50	0.904	0.370
	Normal	56	18.66	4.39	0.60		

From table 4.37, the researcher found that there was difference in study respondents answers mean smoking status, type of station and respiratory rate categories of respondents under study setting but didn't reached a statically significance level.

4.5.2 **Comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience.**

Table (4-37): One-way ANOVA test for comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience.

Variable	Category	N	Mean	SD	SE	F	Sig.
Occupation	Engineer	8	38.75	6.16	2.18	2.479	0.71
	Worker	19	33.05	6.98	1.60		
	Guard	6	38.67	4.76	1.94		
	Professional	25	32.32	8.25	1.65		
	Total	58	34.10	7.60	1.00		
Age Group	Less than 20 Years	1	43.00			1.351	0.263
	20 - 30 Years	6	30.67	6.59	2.69		
	31- 40 Years	18	35.89	6.43	1.51		
	41 - 50 Years	18	34.94	7.57	1.78		
	51 - 60 Years	15	31.73	8.84	2.28		
	Total	58	34.10	7.60	1.00		
Marital Status	Single	2	35.00	8.49	6.00	0.28	867
	Married	56	34.07	7.65	1.02		
	Total	58	34.10	7.60	1.00		
Years of Experience	1 - 5 Years	14	35.79	7.27	1.94	0.693	0.561
	6 - 10 Years	8	35.75	6.78	2.40		
	11 - 15 Years	7	34.71	7.87	2.97		
	More than 15 Years	29	32.69	7.99	1.48		
	Total	58	34.10	7.60	1.00		

From table 4.38, the researcher found differences in mean among study respondent in different risk domains according to occupation, age group, marital status and years of experience but it didn't reach statistically significant level.

4.5.3 **comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type.**

Table (4-38): One-way ANOVA test for comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type.

Variable	Category	N	Mean	SD	SE	F	Sig.
Education Level	Less than Secondary	27	35.67	6.50	1.25	2.38	0.064
	Secondary certified	13	30.92	7.01	1.94		
	Diploma	9	30.33	10.64	3.55		
	Bachelor	5	35.60	6.35	2.84		
	Master or More	4	40.50	3.42	1.71		
	Total	58	34.10	7.60	1.00		
Chronic Disease	Hypertension	3	32.67	3.21	1.86	0.13	0.754
	Hypertension and Diabetes mellitus	1	34.00				
	Total	4	33.00	2.71	1.35		
Blood Pressure	Pre-hypertension 130/90	14	35.00	8.69	2.32	0.45	0.637
	Normal 120/80	18	34.94	7.41	1.75		
	Optimal > 110/70	26	33.04	7.27	1.43		
	Total	58	34.10	7.60	1.00		
Locality	North Gaza	17	35.59	6.59	1.60	0.58	0.685
	Gaza	28	32.61	8.02	1.51		
	Middle Zone	1	36.00				
	Khan Younis	4	33.75	8.46	4.23		
	Rafah	8	36.13	8.53	3.01		
	Total	58	34.10	7.60	1.00		
Health Insurance Type	Governmental	49	33.51	7.92	1.13	0.68	0.566
	Private	1	36.00				
	UNRWA	1	40.00				
	Don't Have	7	37.14	5.15	1.94		
	Total	58	34.10	7.60	1.00		

From table 4.39, the researcher found differences in mean among study respondent in different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type but it didn't reach statistically significant level.

4.6 Awareness About Caution Symbols Domain.

4.6.1 **Comparing study domain means according to smoking status, type of station and respiratory rate.**

Variable	Category	N	Mean	SD	SE	t	Sig.
Smoking status	Smoker	28	7.25	2.14	0.40	0.392	0.696
	Non-Smoker	30	7.00	2.67	0.49		
Station type	Pump Station	28	7.89	2.73	0.52	2.463	**0.017**
	Treatment plants	30	6.40	1.83	0.33		
Respiratory Rate	Hyper Ventilation	2	10.00	1.41	1.00	1.753	0.085
	Normal	56	7.02	2.38	0.32		

Table (4-39): Independent sample T-test for comparing study domain means according to smoking status, type of station and respiratory rate.

From table 4.40, the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level according to smoking status and respiratory rate. The researcher found a statically significant relationship between study respondent answer regarding station type.

Comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience

Table (4-40): One-way ANOVA test for comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience

Variable	Category	N	Mean	SD	SE	F	Sig.
Occupation	Engineer	8	6.00	1.41	0.50	3.817	**0.015**
	Worker	19	8.53	2.76	0.63		
	Guard	6	6.50	2.35	0.96		
	Professional	25	6.56	1.98	0.40		
	Total	58	7.12	2.41	0.32		
Age group	Less than 20 Years	1	8.00			0.176	0.95
	20 - 30 Years	6	7.50	1.87	0.76		
	31- 40 Years	18	7.28	2.32	0.55		
	41 - 50 Years	18	7.11	2.72	0.64		
	51 - 60 Years	15	6.73	2.55	0.66		
	Total	58	7.12	2.41	0.32		
Marital Status	Single	2	7.00	2.83	2.00	0.005	0.943
	Married	56	7.13	2.42	0.32		
	Total	58	7.12	2.41	0.32		
Years of Experience	1 - 5 Years	14	6.79	1.89	0.50	0.854	0.471
	6 - 10 Years	8	8.38	2.00	0.71		
	11 - 15 Years	7	7.00	3.65	1.38		
	More than 15 Years	29	6.97	2.40	0.45		
	Total	58	7.12	2.41	0.32		

From table 4.41, the researcher found differences in mean among study respondent in different risk domains according to age group, marital status and years of experience but it didn't reach statistically significant level.

the researcher found differences in mean among study respondent in different risk domains according to occupation with statistically significant level.

4.6.3 **Comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type.**

Table (4-41): One-way ANOVA test for comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type

Variable	Category	N	Mean	SD	SE	F	Sig.
Education Level	Less than Secondary	27	8.33	2.81	0.54	4.101	**0.006**
	Secondary certified	13	6.15	1.52	0.42		
	Diploma	9	6.44	1.01	0.34		
	Bachelor	5	5.60	1.34	0.60		
	Master or More	4	5.50	1.00	0.50		
	Total	58	7.12	2.41	0.32		
Chronic Disease	Hypertension	3	6.33	2.31	1.33	0.25	0.667
	Hypertension and Diabetes mellitus	1	5.00				
	Total	4	6.00	2.00	1.00		
Blood Pressure	Pre-hypertension 130/90	14	7.07	2.64	0.71	3.762	**0.029**
	Normal 120/80	18	8.28	2.70	0.64		
	Optimal > 110/70	26	6.35	1.74	0.34		
	Total	58	7.12	2.41	0.32		
Locality	North Gaza	17	8.24	2.75	0.67	2.351	0.066
	Gaza	28	6.21	1.50	0.28		
	Middle Zone	1	7.00				
	Khan Younis	4	8.25	2.50	1.25		
	Rafah	8	7.38	3.38	1.19		
	Total	58	7.12	2.41	0.32		
Health Insurance Type	Governmental	49	7.06	2.42	0.35	1.155	0.335
	Private	1	5.00				
	UNRWA	1	11.00				
	Don't Have	7	7.29	2.21	0.84		
	Total	58	7.12	2.41	0.32		

From table 4.42, the researcher found differences in mean among study respondent in different risk domains according to chronic disease, locality and health insurance type but it didn't reach statistically significant level.

The researcher found differences in mean among study respondent in different risk domains according to education level and blood pressure with a statistically significant level.

4.7 Vital Signs Domain.

4.7.1 Comparing study domain means according to smoking status, type of station and respiratory rate.

Table (4-42): Independent sample T-test for comparing study domain means according to smoking status, type of station and respiratory rate.

Variable	Category	N	Mean	SD	SE	t	Sig.
Smoking Status	Smoker	28	2.93	0.26	0.05	-1.493	0.141
	Non-Smoker	30	3.00	0.00	0.00		
Station Type	Pump Station	28	2.93	0.26	0.05	-1.493	0.141
	Treatment Plant	30	3.00	0.00	0.00		

From table 4.43, the researcher found that there was difference in study respondents answers mean but didn't reached a statically significance level according to smoking status and station type.

4.7.2 Comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience

Table (4-43): One-way ANOVA test for comparing study respondents means with different risk domains according to occupation, age group, marital status and years of experience

Variable	Category	N	Mean	SD	SE	F	Sig.
Occupation	Engineer	8	3.00	0.00	0.00	1.424	0.246
	Worker	19	2.89	0.32	0.07		
	Guard	6	3.00	0.00	0.00		
	Professional	25	3.00	0.00	0.00		
	Total	58	2.97	0.18	0.02		
Age Group	Less than 20 Years	1	3.00			2.96	0.88
	20 - 30 Years	6	3.00	0.00	0.00		
	31- 40 Years	18	2.94	0.24	0.06		
	41 - 50 Years	18	2.94	0.24	0.06		
	51 - 60 Years	15	3.00	0.00	0.00		
	Total	58	2.97	0.18	0.02		
Marital Status	Single	2	3.00	0.00	0.00	0.072	0.79
	Married	56	2.96	0.19	0.03		

	Total	58	2.97	0.18	0.02		
Years of Experience	1 - 5 Years	14	3.00	0.00	0.00	0.885	0.455
	6 - 10 Years	8	2.88	0.35	0.13		
	11 - 15 Years	7	3.00	0.00	0.00		
	More than 15 Years	29	2.97	0.19	0.03		
	Total	58	2.97	0.18	0.02		

From table 4.44, the researcher found differences in mean among study respondent in different risk domains according to occupation, age group, marital status and years of experience but it didn't reach statistically significant level.

4.7.3 **Comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type**

Table (4-44): One-way ANOVA test for comparing study respondents means with different risk domains according to education level, chronic disease, blood pressure, locality and health insurance type

Variable	Category	N	Mean	SD	SE	F	Sig.
Education Level	Less than Secondary	27	2.93	0.27	0.05	0.567	0.688
	Secondary certified	13	3.00	0.00	0.00		
	Diploma	9	3.00	0.00	0.00		
	Bachelor	5	3.00	0.00	0.00		
	Master or More	4	3.00	0.00	0.00		
	Total	58	2.97	0.18	0.02		
Blood Pressure	Pre-hypertension 130/90	14	3.00	0.00	0.00	2.371	0.103
	Normal 120/80	18	2.89	0.32	0.08		
	Optimal > 110/70	26	3.00	0.00	0.00		
	Total	58	2.97	0.18	0.02		
Locality	North Gaza	17	3.00	0.00	0.00	2.495	0.054
	Gaza	28	3.00	0.00	0.00		
	Middle Zone	1	3.00				
	Khan Younis	4	2.75	0.50	0.25		
	Rafah	8	2.88	0.35	0.13		
	Total	58	2.97	0.18	0.02		
Health Insurance Type	Governmental	49	2.96	0.20	0.03	0.119	0.949
	Private	1	3.00				
	UNRWA	1	3.00				
	Don't Have	7	3.00	0.00	0.00		
	Total	58	2.97	0.18	0.02		

From table 4.45, the researcher found differences in mean among study respondent in different risk domains according to education level, blood pressure, locality and health insurance type but it didn't reach statistically significant level.

4.7.4 **Correlation test between respondent's knowledge about different types of risk domains.**

Table(4-45): correlation test between respondent's knowledge about different types of risk domains.

Study domains	Mean	Pearson Correlation	Sig. (2-tailed)	N	Strength
Total Knowledge Domain * Safety measures and guidelines Domain	62.81 30.68	.376**	**0.004**	57	Weak
Total Knowledge Domain * History of Accidents Domain	62.81 34.10	0.111	0.408	58	Weak
Total Knowledge Domain * Caution symbols Domain	62.81 7.12	-0.173	0.194	58	Weak
Total Knowledge Domain * Vital signs Domain	62.81 2.97	0.029	0.828	58	Weak
Safety measures and guidelines Domain* History of Accidents Domain	30.68 34.10	0.092	0.494	57	Weak
Safety measures and guidelines Domain* Vital signs Domain	30.68 2.97	0.005	0.973	57	Weak
History of Accidents Domain Score* Vital signs Domain	34.10 2.97	-0.098	0.465	58	Weak
Caution symbols Domain Score* Vital signs Domain	7.12 2.97	-0.228	0.085	58	Weak

From table 4.46, the researcher study results revealed that there was no statistically significant relationship between all study domains about the knowledge of different types of risks, except the knowledge domain and Safety measures and guidelines Domain was a positive weak statistically significant relationship.

The (Total knowledge * history of accidents domain), (Total Knowledge Domain * Vital signs Domain), (Safety measures and guidelines Domain * History of Accidents Domain) and (Safety measures and guidelines Domain * Vital signs Domain) was a weak positive statistically insignificant relationship.

The (Total Knowledge Domain * Caution symbols Domain), (History of Accidents Domain Score * Vital signs Domain) and (Caution symbols Domain Score * Vital signs Domain) was a negative weak statistically significant relationship.

Chapter Five

Conclusion and Recommendation

CHAPTER 5 : Conclusion and Recommendation

This chapter represents the conclusion of findings and results which were clarified previously from both the quantitative and qualitative analysis. Also, this chapter includes recommendations that could contribute in improving the future planning WWTP and pumping station to reduce the risk levels.

5.1 Conclusion

The general objective of this study is to assess health and safety risks among workers in wastewater treatment planet. Analytical cross-sectional design was used in this study to assess health and safety risks among workers groups.

The all of study participants are males. Most of them aged (40 – 50) years. More than half percent of participants have (6-10) years of experience.

The study showed that 51.7% of workers don't receive periodic medical checkups, and 48.3% of working smoke in work area, that may be lead to high risk fire in station specially every station has generator and fuel tank ,but The study showed that just 13.8% of workers receive milk, workers from Rafah area.

Regarding the knowledge about biological risk among workers, the study shows that total domain mean percentage was perceived knowledge 72.41%. while about 56.9% of workers don't have any knowledge about what disease are caused by microbes in wastewater.

Regarding the Knowledge about Accident hazards among workers, the study shows that total domain mean percentage was perceived knowledge 77.27%, on another hand the study shows that about 60.3% of worker don't receive any courses on safety procedures and 56.9% of workers don't get first aid course and evacuation process.

Regarding the knowledge about physical risks among workers, the study results revealed that the total domain mean percentage was perceived knowledge 72.99%. and the knowledge about biological risk among workers, the study shows that total domain

mean percentage was perceived knowledge 72.41%. and the Knowledge about chemical risk among workers, the study shows that total domain mean percentage was perceived knowledge 71.17%. and the Knowledge about psychological risk and agronomic risks among workers, the study results revealed that the knowledge about the psychological risk was percentage 76.92% respectively

Regarding the Knowledge about safety measures and guidelines among workers, the results showed that (45.83%) of workers reported that they don't received training on safety procedures, and (47.55%) of workers don't received training courses in dealing with hazardous materials. Despite the worker has good knowledge about symbols the researcher doesn't find any nameplate in any site was visited.

Regarding the Previous accidents and hazard history among workers, the study shows the highest item was burn from hot materials with mean percentage 89.66% followed by having sensitivity to latex gloves with mean percentage 84.48%.
Regarding Study respondents' awareness about caution symbols, most of study respondents know the signs which indicated to flammable sign and toxic substance sign (94.8%), but carcinogenic sign, 56.9% knew the sign while 43.1% of study respondents do not know the what the sign meant.

Regarding vital signs measurement among workers, the study showed that all study respondents were under normal range of vital signs as example n=44, 75.86 of study respondents were in normal to optimal rang od blood pressure even the rest of study respondents were in the prehypertension category which cannot be categorized as hypertensive patients, according to heart rate all study respondents were in the normal range of heart rate and according to respiratory rate n=56, 96.6% of study respondents were in normal range of respiratory rate, while n=2,3.4% of study respondents were hyperventilated.

The results of this study showed that there is no significant association between the knowledge risk of physical and biological risks and chemical and psychological risk the (smoking , gender, age group, experience and station type and chronic status and

insurance and work area and blood pressure) at WWTP ($p>0.05$), while there is a significant association between knowledge about chemical and biological risks and the respiratory rate ($p=0.005$), there is a significant association between knowledge about biological risks and level of education ($p=0.000$).

5.2 Recommendation

The following recommendations are proposed for related authority or operator in order to improve the work place conditions which will lead to reduce the risk levels. The study gives recommendations for further researches and studies in the files.

1. Adopting and implementing a work place ergonomics program by the authority to identify and prevent health and safety risks (This program should include management support, employee involvement, identification of risks, implementation of solutions, review of injury reports, training and evaluation of the program's effect)
2. Training the workers to do their job properly and in the best way.
3. Designing health care organizations based on occupational health and safety measures.
4. The municipals of Gaza showed provide the infection preventive measures such as gloves, head cap, closed shoes, work suit and doing frequent medical investigation for infectious diseases such as AIDS and hepatitis.
5. Offering numerous recommended solutions to minimize or eliminate manual lifting and proper working position
6. Conducting further studies regarding respiratory system assessment among sewage workers, gastrointestinal symptoms among sewage worker.

REFERENCES

Albatanony, M. A., & El-Shafie, M. K. (2011). Work-related health effects among wastewater treatment plants workers. The International Journal of Occupational and Environmental Medicine, vol(2), pages(237-44).

Alli, B. O. (2008). Fundamental Principles of Occupational Health and Safety Second edition. Geneva, International Labor Organization.

Applied Research Institute – Jerusalem, Status of the Environment in the State of Palestine – 2015.

Awadalla, N. J. (2011). Prevalence and Risk Factors of Helicobacter Pylori and Intestinal Protozoal Infections among Sewage Workers in Mansoura, Egypt. Egyptian Journal of Occupational Medicine, vol(35), pages(67-81).

Basu, R., Talapatra, S. N., Mukhopadhyay, A., Roy Goswami, M., Ray, S. S., Chakrabarti, P., ... & Ghosh, U. C. (2014). Genotoxicity Study with Special Reference to Comet Test in the Blood Cells of Workers Exposed to Sewage Water. Advances in Toxicology, vol (2014), Article ID 251812, 7 pages.

Brown, N. J. (1997). Health hazard manual: Wastewater treatment plant and sewer workers. Manuals and User Guides.

Bureau of Labor Statistics. (2010). Workplace injuries and illnesses, Annual report. Washington, DC: United States Department of Labor.

Carlsen, H. K., Zoëga, H., Valdimarsdóttir, U., Gíslason, T., & Hrafnkelsson, B. (2012). Hydrogen sulfide and particle matter levels associated with increased dispensing of anti-asthma drugs in Iceland's capital. Environmental Research, vol (113), pages (33-39).

Cyprowski, M., Sobala, W., Buczynska, A., & Szadkowska-Stanczyk, I. (2015). Endotoxin exposure and changes in short-term pulmonary function among sewage workers. International Journal of Occupational Medicine and Environmental Health, vol (28), pages (803–811)

European Agency for Safety and Health at Work , annual report 2007.

Farahat SA, Kishk NA. Cognitive functions changes among Egyptian sewage network workers. Toxicol and Health. 2010; vol (26):pages (229–38).

Fiedler N, Kipen H, Ohman-Strickland P, Zhang J, Weisel C, Laumbach R, et al. Sensory and cognitive effects of acute exposure to hydrogen sulfide. Environmental Health Perspect,2008;vol(116):pages(78–85).

Gatchel, R. J., & Schultz, I. Z. (Eds.). (2012). Handbook of occupational health and wellness. Springer Science & Business Media

.

Giri, P. A., Kasbe, A. M., & Aras, R. Y. (2010). A study on morbidity profile of sewage workers in Mumbai city. International Journal of Collaborative Research on Internal Medicine & Public Health, vol (2) ,pages(450-463).

Guidotti, T. L. (2010). Hydrogen sulfide: advances in understanding human toxicity. International Journal of Toxicology, vol (29), pages (569-581).

Guo, X., Wu, P., Ding, W., Zhang, W., & Li, L. (2014). Reduction and characterization of bioaerosols in a wastewater treatment station via ventilation. Journal of Environmental Sciences, vol (26), pages(1575-1583).

Heldal, K. K., Madso, L., Huser, P. O., & Eduard, W. (2010). Exposure, symptoms and airway inflammation among sewage workers. Annals of Agricultural and Environmental Medicine, vol (17), pages (263-268).

Hendrickson RG, Chang A, Hamilton RJ. (2004) Co-worker fatalities from hydrogen sulfide. Am J Ind Med; vol (45), pages(346–50).

Inserra SG, Phifer BL, Anger WK, Lewin M, Hilsdon R, White MC. (2004) Neurobehavioral evaluation for a community with chronic exposure to hydrogen sulfde gas. Environmental Research. vol (95),pages (53–61).

International Labour Office, Geneva (Switzerland). (1995). World Employment, An ILO Report. Geneva: ILO Publications

Jaremków, A., Szałata, Ł., Kołwzan, B., Sówka, I., Zwoździak, J., & Pawlas, K. (2017). Impact of a Sewage Treatment Plant on Health of Local Residents: Gastrointestinal System Symptoms. Polish Journal of Environmental Studies, vol (26), pages (127-136).

Kibe, K. N. A. A(2016). Assessment of health and safety management on construction sites in Kenya: a case of construction projects in Nairobi County.

Kvernberg, E. B. (2012). Performance assessment of a wastewater treatment plant in Kumasi, Ghana (Master's thesis, Norwegian University of Life Sciences).

Larcher, P., & Sohail, M. (1999). Review of Safety in Construction and Operation for the WS & S Sector-Part I Task No 166.

Metcalf, E. E., & Eddy, H. (2003). Wastewater Engineer Treatment Disposal, Reuse. New York: Mcgraw.

Milczarek, M., Brun, E., Houtman, I., Goudswaard, A., Evers, M., Bovenkamp, M., ... & Morvan, E. (2007). Expert forecast on emerging psychosocial risks related to occupational safety and health. European Agency for Safety and Health at Work.

Morgan, R. L., Thayer, K. A., Bero, L., Bruce, N., Falck-Ytter, Y., Ghersi, D and Mustafa, R. A. (2016). GRADE: Assessing the quality of evidence in environmental and occupational health. Environment International, vol (92), pages (611-616).

National Institute of Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services. (1997). Musculoskeletal disorders and workplace factors. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back (DHHS[NIOSH] Publication No. (141).

National Institute of Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention, Public Health Service, U.S. Department of Health and Human Services. (2001). National occupational research agenda: Research Topics for the Next Decade (DHHS [NIOSH] Publication No. (117).pages(1-33)

Reed, B. R., Crane, J., Garrett, N., Woods, D. L., & Bates, M. N. (2014). Chronic ambient hydrogen sulfide exposure and cognitive function. Neurotoxicology and Teratology ,vol(42), pages (68-76).

Robson, L. S., Clarke, J. A., Cullen, K., Bielecky, A., Severin, C., Bigelow, P. L., ... & Mahood, Q. (2007). The effectiveness of occupational health and safety management system interventions: a systematic review. Safety Science, vol (45), pages (329-353).

Roger, V. L., Go, A. S., Lloyd-Jones, D. M., Adams, R. J., Berry, J. D., Brown, T. M., ... & Fox, C. S. (2011). Heart disease and stroke statistics—2011 update: a report from the American Heart Association. Circulation, vol (123), pages (18-209).

Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, Morland KB. (2011) Air pollution, lung function, and physical symptoms in communities near concentrated Swine feeding operations. Epidemiology; vol(22):pages (208–15).

Talebizadeh, M., Belia, E., & Vanrolleghem, P. A. (2014). Probability-based design of wastewater treatment plants. In Proceedings International Congress on Environmental Modelling and Software (IEMSs2014). San Diego, California USA, 15th-19th June .

World Health Organization. (2002). Occupational health: a manual for primary health care workers.

Zodpey, S. P., Negandhi, H., & Tiwari, R. R. (2009). Mapping 'Occupational Health'courses in India: a systematic review. Indian Journal of Occupational and Environmental Medicine, vol(13),pages (135-140).

APPENDIX (1): QUESTIONNAIRE

بسم الله الرحمن الرحيم

The Islamic University–Gaza
Deanship of Graduate Studies
Faculty of Science
Master of Environmental Science
Environmental Monitoring and and Management

الجامعة الإسلامية – غزة
عمادة الدراسات العليا
كلية العلوم
برنامج ماجستير العلوم البيئة
الإدارة والمراقة البيئية

استبانة

تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة قطاع غزة، فلسطين

الأخ الموظف المحترم/

أود اعلام سيادتكم انه قد تم اختياركم في الدراسة البحثية بعنوان (تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة في قطاع غزة، فلسطين) كجزء من متطلب برنامج الماجستير العلوم البيئية -الجامعة الإسلامية.

تهدف هذه الدراسة إلى تقييم المخاطر الصحية لدى العاملين في محطات معالجة المياه العادمة في قطاع غزة، بالإضافة إلى تحديد مدى معرفة العاملين بإرشادات الصحة والسلامة المهنية في مكان عملهم والأخطار التي ممكن أن تؤثر عليهم.

لذا أرجو من سيادتكم تعبئة الاستبانة بأمانة وموضوعية لتحقيق الفائدة بما يخدم الموظف في موضوع الصحة والسلامة المهنية، مع العلم أن هذه الاستبانة تستغرق عشرين دقيقيه لاستكمالها.

توقيع بالموافقة على المشاركة..... التاريخ: -.....

شكرا لحسن تعاونكم

الباحث

محمد مصطفى البهنساوي

٠٥٩٩٨١١٠٦٣

- ***أقدر لكم عاليا مشاركتكم في هذه الاستبانة ونذكركم بأن جميع البيانات التي سيتم الحصول عليها هي خاصة بالبحث العلمي فقط وستكون في سرية تامة، مشاركتكم في هذا البحث مهمة وأي معلومات ستدلون بها لن تلحق بكم الضرر مطلقا ولن يتم اطلاع أي جهات أخرى عليها .***

الجزء الأول :-

نود من سيادتك الإجابة على بعض الأسئلة العامة عن نفسك وذلك بوضع إشارة × على الإجابة الصحيحة في المربع☒

البيانات الشخصية: -

-الجنس ☐ ذكر ☐ أنثى

-المهنة ☐ مهندس ☐ عامل ☐ حارس ☐ فني

-العمر ☐ اقل من ٢٠ ☐ ٢٠-٣٠ ☐ ٣١-٤٠ ☐ ٤١-٥٠ ☐ ٥١-٦٠

-الحالة الاجتماعية ☐ أعزب ☐ متزوج ☐ مطلق ☐ ارمل

-سنوات الخبرة ☐ ١-٥ ☐ ٦-١٠ ☐ ١١-١٥ ☐ أكثر من ١٥

-المستوي التعليمي ☐ أقل من الثانوية ☐ ثانوية عامة ☐ دبلوم ☐ بكالوريوس ☐ دراسات عليا

-التدخين ☐ مدخن ☐ غير مدخن

-الامراض المزمنة ☐ ضغط ☐ سكري ☐ ضغط +سكري ☐ أزمة ☐ غير ذلك.....

-التامين الصحي ☐ حكومي ☐ خاص ☐ وكالة غوث ☐ لا يوجد

اقلب الصفحة

الجزء الثاني :-

نود من سيادتك إجابة الأسئلة التي تبرز معرفتك عن معايير الصحة والسلامة ومدى ادراكك للمخاطر المحيطة بك في مكان عملك.

١-المعرفة بالمخاطر

	المخاطر الفيزيائية//هل انت مدرك لمخاطر	ضعيف	جيد	ممتاز
١	التعرض لمستويات الضوضاء العالية من المعدات الميكانيكية			
٢	التعرض لاهتزازات من الالات			
٣	التعرض للأشعة فوق البنفسجية			
٤	التعرض للغبار			
٥	التعرض للرائحة الكريهة			
	المخاطر البيولوجية/هل انت مدرك لمخاطر	ضعيف	جيد	ممتاز
٦	الامراض التي تسببها الميكروبات الموجودة في مياه الصرف الصحي			
٧	الامراض التي تسببها الحشرات والقوارض التي تتكاثر في الحمأة			
	المخاطر الكيميائية / هل انت مدرك لمخاطر	ضعيف	جيد	ممتاز
٨	التسمم عن طريق استنشاق المواد المستخدمة في معالجة مياه الصرف الصحي			
٩	الأمراض الجلدية الناتجة عن تعرض الجلد لمياه الصرف الصحي			
١٠	الأمراض الجلدية الناتجة من تعرض الجلد للمركبات الكيميائية			
١١	تهيج الاغشية المخاطية نتيجة استنشاق الرائحة الكريهة			
١٢	تهيج الاغشية المخاطية نتيجة استنشاق غاز كبريتيد الهيدروجين (رائحة البيض الفاسد)			
١٣	الحساسية الناتجة عن استخدام القفازات			
	مخاطر الحوادث/ هل انت مدرك لمخاطر الحوادث الناتجة من	ضعيف	جيد	ممتاز
١٤	الانزلاق على الارضيات بسبب السوائل			
١٥	الكدمات الناتجة عن سقوط الأشياء الثقيلة .			
١٦	الإصابة بأجزاء من الآلات المتحركة			
١٧	الغرق بسب الوقوع في الاحواض			
١٨	السقوط من السلالم خلال تشغيل المعدات .			
١٩	السقوط من السلالم خلال صيانة المعدات			
٢٠	الصعقات الكهربائية			
٢١	الجروح بواسطة الحواف الحادة			
٢٢	التسمم الناتج عن المواد الكيميائية الطبيعية الموجودة في مياه الصرف الصحي			

اقلب الصفحة

	المخاطر النفسية والاجتماعية وطبيعة العمل / هل انت مدرك للمخاطر المتعلقة ب	ضعيف	جيد	ممتاز
٢٣	إصابات العضلات الناتجة من الإفراط في حمل المواد الثقيلة			
٢٤	إصابات العضلات الناتجة من الوقوف الطويل			
٢٥	إصابات العضلات الناتج من الانحناء المتكرر			
٢٦	عدم الراحة بارتداء الملابس الواقية لفترات طويلة			
٢٧	متأقلم مع الروائح الكريهة			
٢٨	متأقلم مع العمل في المحطة			

٢-المعرفة بإجراءات السلامة وتطبيقها:-

		ضعيف	جيد	ممتاز
٢٩	تلقيت التدريب على إجراءات السلامة			
٣٠	حصلت على دورة اسعافات أولية وعملية الاخلاء			
٣١	تلقيت دورات تدريبية في التعامل مع المواد الخطرة			
٣٢	حصلت على دورة تدريبية في إطفاء الحرائق			
٣٣	لدي معرفة بمعايير تطبيق إجراءات السلامة في المحطة			
٣٤	شاركت في تطوير اجراءات السلامة والطوارئ في المحطة			
٣٥	أحضر اجتماعات الصحة والسلامة الاعتيادية			
٣٦	تستخدم الأدوات الشخصية الواقية للعين مثل (النظارات الواقية)			
٣٧	ترتدي الملابس الواقية من الطقس /البيئة المحيطة /نشاطات العمل.			
٣٨	تستخدم الأدوات الشخصية الواقية للقدمين (الحذاء)			
٣٩	تستخدم الأدوات الشخصية الواقية للرأس(القبعة)			
٤٠	تستخدم الأدوات الشخصية الواقية للاذنين (سماعات الاذن)			
٤١	ادرك لما يحيط بي من المخاطر في العمل			
٤٢	تعرف على من يجب الاتصال في حالات الطوارىء			
٤٣	تعرف كيفية استخدام طفاية الحريق			
٤٤	تعرف كيفية التعامل مع تسرب المواد الخطرة			

اقلب الصفحة

الجزء الثالث:-

نود من سيادتك الإجابة على الأسئلة المتعلقة ببعض الحوادث التي حدثت معك خلال عملك بالمحطة.

	المخاطر	قليلا	دائما	لم يحدث
١	أتعرض لمستويات الضوضاء العالية من المعدات			
٢	اتعرض للأهتزازت من الاسطح			
٣	أتعرض للغبار			
٤	أصبت بعدوى من الميكروبات الموجودة في مياه الصرف الصحي			
٥	تعرضت للتسمم نتيجة استنشاق المواد المستخدمة في معالجة المياه الصرف الصحي			
٦	أصبت بأمراض جلدية نتيجة تعرض الجلد لمياه الصرف الصحي			
٧	لدي حساسية من استخدام القفازات			
٨	لدي صعوبة في التنفس نتيجة استنشاق غاز كبريتيد الهيدروجين (رائحة البيض الفاسد)			
٩	تعرضت للانزلاق على الأرضيات			
١٠	تعرضت للسقوط من السلالم			
١١	تعرضت لصعقات كهربائية			
١٢	تعرض للجروح من الحواف الحادة			
١٣	أعاني من ألام أسفل الظهر نتيجة حمل المواد الثقيلة			
١٤	أعاني من ألام اسفل الظهر نتيجة الوقوف الطويل			
١٥	تعرضت للإصابة بالحروق من المواد الساخنة			

-هل تعرضت لأي حوادث أخرى غير مذكورة أعلاه ☐ نعم ☐ لا

إذا كانت الإجابة نعم يرجى كتابة الحوادث .....

-هل تسبب لك عملك بالمحطة بحوادث ☐ نعم ☐ لا

-إذا كانت الإجابة نعم فماهي الحوادث.....

-هل تعرف ماهي الامراض التي تسببها الميكروبات الموجودة في مياه الصرف الصحي ☐ نعم ☐ لا

اذا كانت الإجابة نعم فما هي هذه الامراض .....

-هل تقدم المؤسسة /البلدية التي تعمل فيها بإجراء فحوصات طبية دورية ☐ نعم ☐ لا

اذا كانت الإجابة نعم فما هي الفحوصات .....

-هل يتم توفير بعض المشروبات الخاصة (الحليب -العصير) ☐ نعم ☐ لا

اقلب الصفحة

الجزء الرابع :-

الرجاء توصيل الرمز إلى مايشير إليه من معنى .

١		-المواد القابلة للاشتعال - المواد السامة -المواد الخطرة على البيئة -المواد التي تسبب التاكل - المواد المسرطنة
٢		-المواد القابلة للاشتعال - المواد السامة -المواد الخطرة على البيئة -المواد التي تسبب التاكل - المواد المسرطنة
٣		-المواد القابلة للاشتعال - المواد السامة -المواد الخطرة على البيئة -المواد التي تسبب التاكل - المواد المسرطنة
٤		-المواد القابلة للاشتعال - المواد السامة -المواد الخطرة على البيئة -المواد التي تسبب التاكل - المواد المسرطنة
٥		-المواد القابلة للاشتعال - المواد السامة -المواد الخطرة على البيئة -المواد التي تسبب التاكل - المواد المسرطنة

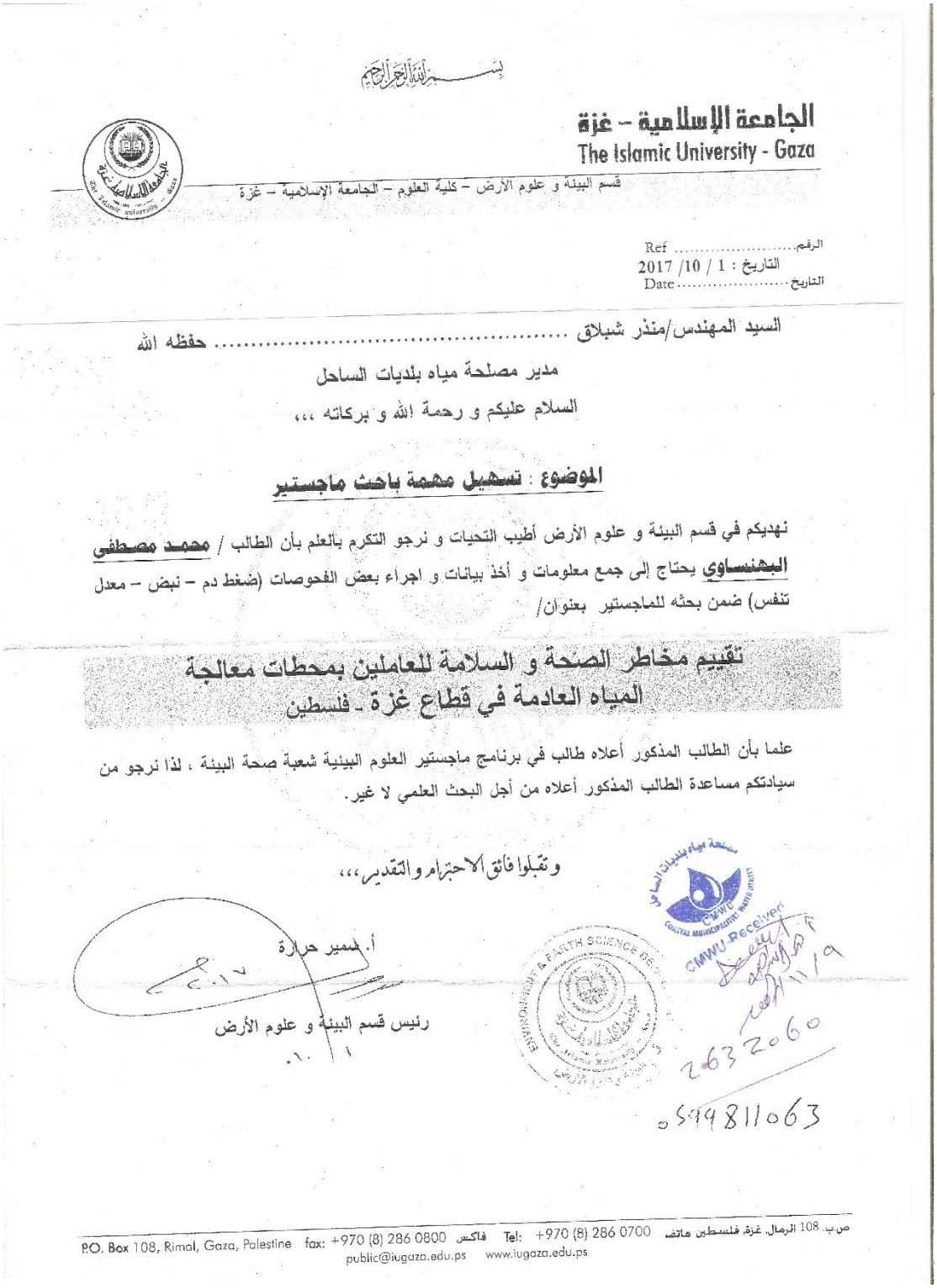
وشكرا

APPENDIX (2): CONTROL PANEL

No	Name	Work Setting
1-	Pro. Yunes Khalil Mogheir	Islamic University- Gaza
2-	Dr. Fahid Rabah	Islamic University- Gaza
3-	Dr. Zeyad Abu Heen	Islamic University- Gaza
4-	Dr.Yasser Nahal	Islamic University- Gaza
5-	Dr. Abdel Fattah Abd Rabou	Islamic University- Gaza

APPENDIX (3): APPROVAL LETTERS

1.



بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم Ref .....
التاريخ : 1 / 10/ 2017
التاريخ Date .....

السيد المهندس/منذر شبلاق ..... حفظه الله
مدير مصلحة مياه بلديات الساحل
السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات و اجراء بعض الفحوصات (ضغط دم – نبض – معدل تنفس) ضمن بحثه للماجستير بعنوان/

تقييم مخاطر الصحة و السلامة للعاملين بمحطات معالجة المياه العادمة في قطاع غزة - فلسطين

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة ، لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

وتقبلوا فائق الاحترام والتقدير،،،

أ. لمير حرارة
رئيس قسم البيئة و علوم الأرض

CMWU-Received

0599811063

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب 108 الرمال، غزة، فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم..... Ref

التاريخ..التاريخ : 23 / 12 / 2017 Date

السيد الاستاذ/سعيد أحمد نصار..... حفظه الله

رئيس دير البلح

السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات ضمن بحث ماجستير حول

تقييم مخاطر الصحة و السلامة للعاملين بمحطات ضخ المياه العادمة في قطاع غزة

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة ، لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

وتقبلوا فائق الاحترام والتقدير،،،

أ. سمير حرارة

رئيس قسم البيئة و علوم الأرض

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب. 108 الرمال، غزة، فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم Ref .....
التاريخ Date 2017 / 10 / 1

السيد المهندس/نزار هاشم حجازي ..... حفظه الله
رئيس بلدية غزة
السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات و اجراء بعض الفحوصات (ضغط دم – نبض – معدل تنفس) ضمن بحثه للماجستير بعنوان/

تقييم مخاطر الصحة و السلامة للعاملين بمحطات معالجة المياه العادمة في قطاع غزة - فلسطين

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة . لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

و تقبلوا فائق الاحترام و التقدير،،،

أ. سمير حرارة
رئيس قسم البيئة و علوم الأرض

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب 108 الرمال، غزة فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم..... Ref
التاريخ : 23 / 12 / 2017
التاريخ..... Date

السيد المهندس/ يحيى محي الدين الأسطل..... حفظه الله
رئيس بلدية خانيونس
السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات ضمن بحث ماجستير حول

تقييم مخاطر الصحة و السلامة للعاملين بمحطات ضخ المياه العادمة في قطاع غزة

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة ، لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

وتقبلوا فائق الاحترام والتقدير،،،

أ. سمير حرارة
رئيس قسم البيئة و علوم الأرض

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب. 108 الرمال، غزة، فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم..... Ref
التاريخ : 23 / 12 / 2017
التاريخ..... Date

السيد الأستاذ/ عز الدين الدحنون..... حفظه الله

رئيس بلدية بيت لاهيا

السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات ضمن بحث ماجستير حول

تقييم مخاطر الصحة و السلامة للعاملين بمحطات ضخ المياه العادمة في قطاع غزة

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة ، لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

وتقبلوا فائق الاحترام والتقدير،،،

أ.د.سمير حرارة
رئيس قسم البيئة و علوم الأرض

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب. 108 الرمال، غزة فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza
قسم البيئة و علوم الأرض – كلية العلوم – الجامعة الإسلامية – غزة

الرقم ..... Ref
التاريخ : 23 / 12 / 2017
التاريخ ..... Date

السيد الدكتور/ محمد نازك الكفارنة..... حفظه الله

رئيس بلدية بيت حانون

السلام عليكم و رحمة الله و بركاته ،،،

الموضوع : تسهيل مهمة باحث ماجستير

نهديكم في قسم البيئة و علوم الأرض أطيب التحيات و نرجو التكرم بالعلم بأن الطالب / **محمد مصطفى البهنساوي** يحتاج إلى جمع معلومات و أخذ بيانات ضمن بحث ماجستير حول

تقييم مخاطر الصحة و السلامة للعاملين بمحطات ضخ المياه العادمة في قطاع غزة

علما بأن الطالب المذكور أعلاه طالب في برنامج ماجستير العلوم البيئية شعبة صحة البيئة ، لذا نرجو من سيادتكم مساعدة الطالب المذكور أعلاه من أجل البحث العلمي لا غير.

وتقبلوا فائق الاحترام والتقدير،،،

أ. سمير حرارة
رئيس قسم البيئة و علوم الأرض

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 ص.ب 108 الرمال غزة فلسطين هاتف
public@iugaza.edu.ps www.iugaza.edu.ps

APPENDIX (4): FREQUENCY TABLES

		Fair	Good	Excellent
1	Exposure to excessive noise levels from mechanical equipment	18 (31)	12 (20.7)	28 (48.3)
2	Exposure vibration from power tools	19 (32.8)	11 (19)	27 (46.6)
3	Exposure to UV radiation	37 (63.8)	7 (12.1)	13 (22.4)
4	Exposure to dust	10 (17.2)	15 (25.9)	32 (55.2)
5	Exposure to bad odor	4 (6.9)	9 (15.5)	45 (77.6)
6	Diseases caused by infectious agents present in the raw domestic wastewater	17 (29.3)	14 (24.1)	26 (44.80
7	Diseases caused by insects or rodents proliferating in the sludge drying beds	15 (25.9)	15 (25.9)	27 (46.6)
8	Chronic poisoning by inhalation of chemicals used in waste – water treatment	19 (32.8)	9 (15.5)	29 (50)
9	Dermatoses caused by exposure of the skin to waste waters	17 (29.3)	12 (20.70	28 (48.3)
10	Dermatoses caused by exposure of the skin to chemical agent	19 (32.8)	13 (22.4)	25 (43.1)
11	Irritation of mucous membranes by inhalation bad Oder	15 (25.9)	15 (25.9)	27 (46.6)
12	Irritation of mucous membranes by inhalation hydrogen sulfide	17 (29.3)	11 (19)	29 (50)
13	Latex allergy caused by the use of latex gloves	22 (37.9)	12 (20.7)	23 (39.7)
14	Slips on floors made by liquids	11 (19)	12 (20.7)	34 (58.6)
15	Blows caused by falling heavy articles,	15 (25.9)	13 (22.4)	29 (50)
16	Injuries by machinery parts of moving equipment	16 (27.6)	16 (27.6)	25 (43.1)
17	Falls into ponds causing drowning	(14 (24.1)	11 (19)	32 (55.2)
18	Falls from ladders during operating equipment	11 (19)	15 (25.9)	31 (53.4)
19	Falls from ladders during maintaining equipment	11 (19)	13 (22.4)	33 (56.9)
20	Electric shock	13 (22.4)	10 (17.2)	34 (58.6)
21	Injuries caused by sharp objects	14 (24.1)	9 (15.5)	34 (58.6)

		Fair	Good	Excellent
22	Acute poisoning caused by various chemicals present in the wastewater,	11 (19)	17 (29.3)	29 (50)
23	Musculoskeletal injuries caused by handling heavy loads	14 (24.1)	13 (22.4)	30 (51.7)
24	Musculoskeletal injuries caused by long standing	14 (24.1)	17 (29.3)	26 (44.8)
25	Musculoskeletal injuries caused by frequent bending	15 (25.9)	17 (29.3)	25 (43.1)
26	Discomfort related to prolonged wear of protective clothing	11 (19)	15 (25.9)	31 (53.4)
27	Familiar to bad smell	11 (19)	17 (29.3)	29 (50)
28	Familiar to bad smell	9 (15.5)	8 (13.8)	40 (69)
29	I received training on safety procedures	35 (60.3)	6 (10.3)	17 (29.3)
30	I got a first aid course and evacuation process	33 (56.9)	6 (10.3)	18 (31)
31	I have received training courses in dealing with hazardous materials	36 (62.1)	8 (13.8)	13 (22.4)
32	I got a fire training course	34 (58.6)	9 (15.5)	14 (24.1)
33	I have knowledge of the criteria for applying safety procedures at the station	10 (17.2)	23 (39.7)	24 (41.4)
34	Participated in the development of safety and emergency procedures at the station	34 (58.6)	11 (19)	11 (19)
35	Attend regular health and safety meetings	41 (70.7)	6 (10.3)	10 (17.2)
36	Use personal protective tools for the eye such as (protective glasses)	30 (51.7)	10 (17.2)	17 (29.3)
37	Wear weatherproof clothing / ambient environment / work activities	15 (25.9)	17 (29.3)	25 (43.1)
38	Personal protective shoes for feet (shoe)	8 (13.8)	19 (32.8)	30 (51.7)
39	Use personal protective tools for the head (Hat)	27 (46.6)	9 (15.5)	22 (37.9)
40	Using personal protective devices for ears (earphones)	34 (58.6)	6 (10.3)	17 (29.3)
41	I am aware of the risks surrounding my work	10 (17.2)	20 (34.5)	27 (46.6)
42	Find out who should call in an emergency	8 (13.8)	11 (19)	38 (65.5)
43	Know how to use a fire extinguisher	14 (24.1)	15 (25.9)	28 (48.3)
44	Know how to handle hazardous material leaks	26 (44.8)	14 (24.1)	17 (29.3)