



**Proposed Guidelines for Environmentally Friendly Petrol
Stations Based on the Current Status of Stations in Hebron
District: Descriptive and experimental study**

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الاهداء

إلى جنتي وغربتي ومنفائي وحقي المسلوب .. فلسطين الحبيبة

إلى من غابت أجسادهم وبقيت أرواحهم .. الشهداء رحمهم الله واسكنهم الفردوس الأعلى

إلى رجال لم يهتمهم الموت ولا الأسر طالما أن فيه حياة أمة .. الأسرى

إلى أهل القرآن الذين يعملون به، جمعوه في صدورهم حفظاً وتمثلوا تعاليمه فكراً وسلوكاً وقرؤوا آياته فهماً وتدبراً

إلى مصنع الأبطال وقادة المستقبل .. جامعة بولتكك فلسطين

إلى التي ما هدا قلبها يوماً خوفاً وحرصاً، محبةً وعطفاً، حناناً ورحمةً

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Abbreviation

VOCs: Volatile Organic Compounds
Pb: lead
Cu: Copper
MTBE: Methyl Tert-Butyl Ether
EDC: Ethylene Dichloride
PNA: Palestinian National Authority
CBC: Complete Blood Count
LPG: Liquefied Petroleum Gases
EPA: Environmental Protection Agency
CNS: Central Nervous System
U.S: United State
CO: Carbon Monoxide
NO and/or NO₂(NO_X): Nitrogen Oxides
SO₂: Sulfur Dioxide
O₃: Ground-Level Ozone
IRIS: Integrated Risk Information System
NIOSH: National Institute for Occupational Safety and Health
REL: Recommended Exposure Limit
RBC: Red Blood Cells
WBC: White Blood Cells
PPE: Personal Protective Equipment
HGB: Hemoglobin or Hemoglobin count
EIA: Environment Impact Assessment
TB: Boiling Temperature

Abstract

The production and consumption of oil is vital to international relations and has frequently been a decisive factor in the determination of foreign policy. We aimed to investigate the current situation of petrol stations in Hebron District and its adverse effects on human and environment leading to develop a guideline for petrol stations to be environmentally friendly. This study was conducted using three kinds of interview questionnaires for workers, stations' owners and the neighborhoods. Biomarkers (blood samples) were tested for different metals including Lead and Cu. Emission of some gases like CO, NO₂, NH₃, SO₂, H₂S, and VOCs had been tested using multi-gas analyzer. All collected data were analyzed by using the Statistical Package for Social Science (SPSS). Results showed that all studied stations were licensed as individually ownership and most of them are classified as class A and located in populated area. Some of them(50%) were established for >20 years ago without any rehabilitation for fuel tanks. It was found that workers were at risk to adverse effects in relation to work load. It seems that the current status of the studied stations is acceptable and can be improved in some areas including; worker and indoor safety, decreasing emission, waste management and emergency action plan through following a standard criteria which could be presented in our proposed environmentally friendship guideline.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Use of refined oil primarily for illumination ceased to be of primary importance. With the advent of industrial revolution came the demand for a better source of energy which in previous times were being provided by human and animal muscle and later by the combustion of solid fuels such as wood, peat and coal. One problem associated with the use of these solid fuels is the amount of effort geared towards harnessing the energy. Petroleum on the other hand proved to be a cheaper source of energy.

Oil was a much more concentrated and flexible source of energy than anything that was previously available. At the beginning of the 20th century the industrial revolution has progressed to the extent the oil industry became a major supplier of energy largely because of the advent of the automobile industry. Although oil constitutes a major petrochemical feedstock, its primary importance can be seen in the fact that it is an energy source on which the world economy depends.

The production and consumption of oil is vital to international relations and has frequently been a decisive factor in the determination of foreign policy. From the above fact, one can see how oil has played a major role in the advancement of technology in our time. But just like every other technology, oil discovery has come with some of its disadvantages. One of such disadvantage is its negative impact on the earth's biosphere releasing pollutants and greenhouse gases into the environment and damaging ecosystem through events such as oil spillage. This situation has resulted and make the developed countries to emphasize on a cleaner and a more environmentally friendly energy source.

Palestine as like other parts of the world in which the population naturally is increased constituted about 4 millions in West Bank, Gaza Strip and East Jerusalem in addition to about 8 million abroad[1]. The wide expansion and accelerated development of Hebron district about 706 thousand inhabitants[1] had led to an increase in demanding and consumption of petroleum products. Hebron district like other parts of West Bank is

still under Israeli occupation and most of life requirements including petroleum products are coming and purchased from Israel by Palestinian agents and distributed to different several local filling petrol stations. Here, more filling stations are being built in order to meet with the increasing demand for fuel. The situation is such that it is becoming very common to see filling stations located in and between and very close to residential areas.

The disadvantage seen from this development is the increased pollution of the atmosphere and health risk to the employees caused by the continued emission of toxic gases into the air. These emissions originate from the following sources: gasoline delivery to the stations, tank breathing (i.e., vaporization) which occurs due to temperature and pressure changes, during vehicle refueling, emissions from loosely closed tanks and mishandling of the petroleum leading to spillage. There is also the emission of combustion products from vehicle engines present in the station. These gases that are being emitted into the atmosphere are hazardous to human health.

One of the most prominent of these gases is the volatile organic compounds (VOCs) which are reported by the world health organization as the major cause of cancer in humans. Numerous studies found that all types of air pollutants at high concentration can affect the airways, nevertheless, similar effects are also observed with long term exposure to lower pollutants concentrations. Symptoms such as nose and throat irritation, followed by bronchoconstriction and dyspnea especially in asthmatic individual are usually experienced after exposure to increased level of Sulptur dioxide and nitrogen and certain heavy metals such as arsenic or vanadium. In addition particulate matter that penetrates the alveolar epithelium and initiate lung inflammation in patients with lung lesions or lung diseases. Moreover, air pollutants such as nitrogen oxide increase the susceptibility to respiratory infections [1].

1.2 Background

A reviewing of the literature revealed that, it is important to taking into account some characteristic of design petrol station such as location, it is required to make

distance from buildings, markets, schools, hospitals and any places of public assembly. The safety rules approved that the distance between two nearest petrol stations should be 400m, and between a petrol station to the nearest residential building should not be less than 50m to avoid risks [2].

The usual contaminants emitted in the environment from petrol stations are complex mixture volatile organic compounds and others, the main compounds raising pollution problems associated with petrol stations are the following: Benzene, Toluene, Ethyl benzene, Xylenes, Pb, MTBE(methyl tert-butyl ether), Ethylene dichloride (EDC) and Naphthalene[3].

According to previous study, the main type of risks is: fuel storage, hazardous substances, manual handling, slips, trips and falls, electricity, fire risks, violence to staff, compressed air systems[3].

1.3 Problem Statement

Due to increase in population which ultimately leading to increase in the number of transportation means (28,632 licensed vehicles in Hebron Governorate, according to Palestinian Central Bureau of Statistics in 2014) which means increasing in fuel and petrol consumption.

This is an ordinal chain increasing number of population leading to increase in energy consumption. Fuel in Palestinian area is imported from Israel and distributed to different petrol stations located in each district.

Distribution and location of these stations could and/or could not follow the standard conditions and regulations and this due to many of these stations are existed before the Palestinian National Authority (PNA) has been established.

Therefore we decided to study this potential environmental problem in order to make evidence based on the current status of these petrol stations in relation to the

environment. Based on this current status we will try to design an environmentally friendly guideline for petrol stations.

In designing and constructing petrol stations, it is important to take some precautionary measures like: suitable and required distance between the location of petrol station and buildings; places of public assembly such as markets, hospitals and schools and areas of high traffic congestions and residential buildings.

This should be in accordance with the guidelines provided by the Department of Petroleum Resources and Fire service safety rules in which the distance between two nearest petrol stations should be 400m and between a petrol station to the nearest residential building should not be less than 50m to avoid possible hazards[2].

Unfortunately in Hebron city in the recent years, these guidelines have not been 100% followed. As a result, there have been petrol stations that are located close to residential areas. This might have constituted serious hazards to residence in close proximity to such petrol stations[2].

Furthermore, we also concerned about the indoor environment of the studied petrol station including all the occupational safety regulations and measurements related to the workers' health which seems that there is shortage or weaknesses in implementing and following the guidelines provided by the Department of Petroleum Resources and Fire service safety rules.

In addition we also will investigate the effects of these gas stations on the outdoor environment including soil, agriculture, water, and the possible human health hazards associated with their locations in the Hebron district.

1.4 Research questions

This study will answer the following research questions:

- Are there any authorized regulations and standards (legislated by laws) for managing and monitoring the petrol stations in the Palestinian territory?

- What are the main components of these standards?
- To what extent these regulations are followed in designing, constructing and running the petrol stations in the Palestinian territory?
- To what extent that the petrol stations in Hebron District implement and follow the human health and environmental requirements and regulation standards?
- Did they apply the health and environment requirement, i.e., meets the environmental impact assessment requirements (i.e., outdoor environment)?
- To what extent existing of petrol stations near or between residential areas is safe?
- What are the gases emitted from petrol station and what environmental impact?
- Is there an effect of petrol station on workers and neighboring residents?
- Is there an effect of petrol station on soil contamination?
- What are the common characteristics of currently petrol stations in Hebron District (i.e., indoor environment and occupational safety)?

1.5 Objectives

The main objectives:

The overall aim of this project is to study of the current status of the petrol stations in Hebron District from an environmental point of view and to visualize health and environmental requirements guideline for these stations to become environmentally friendly including human as one of the components of that environment.

Sub main objectives:

1. To study the current status of the petrol stations in Hebron district including all possible factors and characteristics that should be included in the proposed

- guideline (i.e., location, building, wastes, fuel tanks, occupational and public safety requirements...etc) (questionnaire 1).
2. To study the potential health effects among workers that could be resulted due to work in these petrol stations (questionnaire 2).
 3. To study the potential effects of petrol stations on the environment (questionnaire 3).
 4. To design a proposed guideline covering all environmental requirements in order to make petrol stations environmentally friendly and decrease the adverse effects that could threaten the environment.
 5. To identify the administrative measures taken by the competent authority to the offending stations to the conditions and the establishment of petrol stations that cause pollution of the environment

1.6 Significance of study

Despite the importance of the petrol stations in the distribution fuel transportation in the Hebron District. Petrol stations contain a lot of activities that pose a threat to the safety of public citizens, people working in these stations, as well as the outdoor environment.

As we expected, the outcome of this study will serve as an additional source and guideline by which human and environmental health aspects (i.e., workers, neighborhoods, water sources, soil, and atmosphere) will be considered in establishing new petrol stations. Furthermore, old and existed petrol stations could be modified and rehabilitated according to the proposed guideline.

1.7 Budget

The total estimated cost for Biomarkers (CBC) and(Lead ,Copper blood level) among 10 workers is estimated to be 2500 ILS.

Definition of tests :

- ✓ Complete Blood Count (CBC): is a blood test used to evaluate your overall health and detect a wide range of disorders, including anemia, infection and leukemia.

A complete blood count test measures several components and features of your blood, including:

- Red blood cells, which carry oxygen
- White blood cells, which fight infection
- Hemoglobin, the oxygen-carrying protein in red blood cells
- Hematocrit, the proportion of red blood cells to the fluid component, or plasma, in your blood
- Platelets, which help with blood clotting

- ✓ Blood Lead Levels Test(Pb)Test: A blood test measures the lead levels in your body. A high level of lead in the body indicates lead poisoning.

Children and adults who have been exposed to lead should have their lead levels tested. Lead is especially harmful to children. It can damage their developing brains, leading to problems with their mental development. It can also cause organ damage.

- ✓ Copper Blood Test (Cu) Test: This test measures the total amount of copper in your blood. Normally most of the copper in your blood is carried by a protein called ceruloplasmin. Adults have 50 and 80 milligrams (mg) of copper in their body, mostly in muscle and the liver. Copper helps make melanin, bone, and connective tissue.

1.8 Action plan

The action plan for this study during the first semester is shown in Table 1.1, and the action plan for the next semester is shown in Table 1.2.

Table 1.1:Plane of Action for First Semester.

Days \ Tasks	1st month				2nd month				3rd month				4th month			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Identification of on project idea																
Writing an introduction to the project																
Literature review																
Writing the most important studies that are related to environmental risk in petrol stations																
Writing the methodology and expected result																
Modification and coordination and preparation of presentation																

Table 1.2:Plane of Action for Second Semester.

Days Tasks	1st month				2nd month				3rd month				4th month			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Questionnaire and interview																
Measurement (tests)																
Analysis data and writing result																
Check and final editing of project																
Project delivery and prepare presentation																

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Petrol stations have become an integral part in our daily life, because of the increasing in population and the spread of cars everywhere, but petrol stations are associated mainly with health and environmental risks, which are not reported or underestimated leading to increased environment damage and pollution.

There are several studies conducted in Nigeria and India focused on a variety of topics includes emissions emerging from petrol stations and their impact on the quality of the air[2,4]. They measured some gases such as VOCs ,CH₄, SO₂ , NO₂ and investigated the conducting the environmental impact assessment projects before the construction of the station and focused on health risk assessment[2].

To our knowledge, there are a few studies in Arab countries including Iraq, Lebanon, and Gaza Strip [17] focused on the health impact of working in gas stations on workers' health and on safety and occupational health conditions.

All preliminary data and background for the current study were obtained from the Palestinian Civil Defense and Petroleum Directorate in Hebron. These data included the standards and conditions requested by the petrol stations' owners in relating to workers health, indoor environment, and outdoor environment.

Our study will end up by developing a proposed guideline that will include the followings:

- Legislated standards by the responsible bodies (i.e., governmental bodies) to get the permission (license issues).
- Human health requirements that imply the human health impact assessment (HEHIA) that could be resulted from working in these stations and/or due to existence in populated area.
- Environmental health requirements (outdoor environment) that imply the human health impact assessment (EIA) that could be resulted from the existence in

populated area and affecting surrounded environment components such as air, water and soil.

- Instructions on reducing and/or eliminating emissions resulting from the petrol stations.
- Instructions on avoiding fire explosion resulting from the petrol stations.
- Instruction for emergence circumstances.

2.2 Scientific Facts

Before going in deep discussion there are some facts on petrol stations to be kept in mind. These facts including, location of the station, fuel composition and characteristics.

2.2.1 Fuel Composition

Fuel is a substance that react and burn with air (quickly reaction with oxygen and substance that emits heat and light in form of flame, this have effect in people and environmental health.

The types of fuel are divided into several sections according to the physical situation, source, period of natural renovation and markets.

- Physical state of fuel: solids as coal (mineral), liquids as crude-oil and gas as natural gas, acetylene.
- Period of natural renovation: fossil fuels as coal, crude-oil and natural gas, renewable fuels (biomass).
- Resource of fuel: natural or primary fuels: as fossil fuel, artificial or secondary as Exotic fuel.
- Markets: commercial as coal, and petroleum, non- commercial as biomass material [4,5].

Table 2.1 shows the main commercial fuels derivatives from crude-oil, and their main averaged properties[4].

Table 2.1:Main Commercial Fuels

	Boiling Range T _b [K]	Boiling Range T _b [°C]	Carbon chain range	Density (liquid at 15 °C) ρ[kg/m ³]	Viscosity at 40 °C ν·10 ⁶ [m ²	Flash point T _{flash}	Main use
Liquefied petroleum gases (LPG)	<300	<30	1..4	580	0.5	-100	Domestic heating, cars
Gasoline	300..500	30..200	4..12	730..760	0.5	-30	Cars
Kerosene	450..650	150..350	10..14	780..850	3	40	aircrafts
Diesel	500..600	200..300	10..20	820..880	3	40	cars, lorries, boats, heaters
Fuel oil Distillate	600..800	300..500	15..30	840..930	10	60	industry, ships
Fuel oil Residue	>800	>500	20..40	930.1010	500	100	industry, ships. Must be heated

2.2.2 Gasoline composition

Gasoline is a complex artificial mixture that doesn't presence in environment naturally, the chemical component of gasoline presents in many physical state (liquid, gas, and other).

The component of gasoline is more than 70 hydrocarbons, the mixture mainly consist of paraffin's, naphthenic, and olefins. Gasoline can be produced from petroleum in refining process , gasoline used in as a fuel in vehicles , cars and other transport uses the most important characteristic of gasoline less dense than water, that is potentially contaminate ground water and soil from underground tank storage [6].

2.2.3 Characteristics of Gasoline

- **Physical and chemical properties:**

Table 2.2 illustrate the chemical and physical properties of gasoline such as physical state, Color, Odor, pH, etc[7].

Table 2.2: Physical and Chemical Properties of gasoline

NO	Properties	Description
1.	Physical State:	Liquid.
2.	Color:	Transparent, clear to amber liquid.
3.	Odor:	Strong. Characteristic gasoline odor.
4.	pH:	Not applicable
5.	Boiling Point:	>26 °C (>78 °F)
6.	Melting Point:	Not applicable.
7.	Specific gravity:	0.66 to 0.75 (Water = 1)
8.	Vapor density:	3 to 4 (Air = 1)
9.	Vapor pressure:	220-450 mm Hg at 20°C (68°F) / 6-15 Reid-psi at 37.8°C (100°F)
10.	Volatility:	720 – 770 g/l VOC (w/v)
11.	Viscosity (at 40°C):	< 1
12.	Flash Point:	< -45 °F / < 43°C
13.	Bulk Density:	6.0 – 6.4 lbs/gal
14.	Solubility in water:	Negligible
15.	Stability:	Stable. Extremely flammable liquid and vapor. Vapor can cause fire.
16.	Conditions to avoid:	Keep away from heat, flame and all other possible sources of ignition.
17.	Materials to avoid:	Keep away from strong oxidizing agents such as acids, chlorine, hydrogen peroxide and oxygen

Toxicology Information

Toxicology information of gasoline is [7]:

- Oral toxicity: Almost non-toxic. LD 50: > 2000 mg/kg (species: rats)
- Dermal toxicity: Almost non-toxic. LD 50: > 2000 mg/kg (species: rabbits)
- Inhalation toxicity: Almost non-toxic. LD 50: > 5 mg/l (species: rats)
- Eye irritation: Almost non-irritating. Draize score: > 6 and < 15 (species: rabbits)
- Skin irritation: Irritant. Primary irritation index: > 3 and < 5 (species: rabbits)
- Other data: Inhalation of high concentrations of vapors or mists may cause respiratory system irritation and damage. It may also result in the damage and depression of the central nervous system and may cause death. Prolonged contact with the material may cause severe skin irritation.
- Subchronic toxicity: Dermal studies resulted in significant irritation but not systematic toxicity (species: rabbits). Inhalation exposures (90 day, approximately 1500 ppm vapor) produced light hydrocarbon nephropathy but no significant systemic toxicity (species: rats).
- Neurotoxicity: Repeated and prolonged exposures to high concentrations of vapor have been reported to result in central nervous system damage and eventually, death. In a study in which ten human volunteers were exposed for 30 minutes to approximately 200, 500 or 1000 ppm concentrations of gasoline vapor, irritation of the eyes was the only significant effect observed, based on both subjective and objective assessments. However, no persistent neurotoxic effects were observed in subchronic inhalation studies of gasoline.
- Reproductive toxicity: An inhalation study with rats exposed to 0, 400 and 1600 ppm of wholly vaporized unleaded gasoline, 6 hours per day on day, 6-16 of gestation showed no teratogenic effects nor indication of toxicity to either the mother or the fetus. Another inhalation study in rats exposed to 3000, 6000, or 9000 ppm of gasoline vapor, 6 hours per day, 6-20 of gestation, also showed no teratogenic effects nor indications of toxicity to either the mother or the fetus.
- Chronic toxicity: A lifetime mouse skin painting study of unleaded gasoline applied at 50 microliters, three times weekly, resulted in some severe skin irritation and changes,

but no statistically significant increase in skin cancer or cancer to any other organ. Lifetime inhalation of wholly vaporized unleaded gasoline over 2000 ppm has caused increased liver tumors in female mice and increased kidney tumors in male rats. The Environmental Protection Agency (EPA) has concluded that mechanism by which wholly vaporized unleaded gasoline causes kidney damage is unique to the male rat. The effects in that species (kidney damage and cancer) should not be used in human risk assessment.

- Other toxic effects extremely hazardous in case of ingestion. On humans very hazardous in case of eye contact. Hazardous in case of skin contact. Slightly hazardous in case of inhalation.
- Carcinogenic effects: contains material that may cause cancer depending on the level and duration of exposure.
- Target organs: contains material that may cause damage to humans organs such as (but not limited to) blood, kidneys, lungs, liver, eye, skin, nervous system and upper respiratory tract.

Table 2.3 and Table 2.4 shows the standard defining the Characteristics of Automotive Gasoline 95 Octane and Gasoline 98 Octane respectively [6].

Table 2.3: Standards Defining the Characteristics of Automotive Gasoline 95 Octane [6]

Properties	Limit for gasoline 95
Research Octane Number	Min. 95
Motor Octane Number	Min. 85
Lead, g/L	Max. 0.013
Benzene, %v/v	Max. 5.0
Methanol, %v/v	Max. 3.0
MTBE %	Max 10.0
Total Organic Oxygen %m/m	Max. 2.5
Sulfur % m/m	Max. 0.05

Distillation at 760 mm Hg evaporated At 70°C, % v/v At 100°C, % v/v At 180°C, % v/v Final boiling point °C Residue, % v/v	Min 10 40-70 Min.85 Max. 215 Max.2	
Reid Vapor pressure at 37.8°C, kPa	Summer (April-October inclusive) Max 65	Winter (November & March inclusive) Max 80
Copper corrosion, (3hrs @ 50°C)	Max 1	
Existent gum, mg/100 ml	Max 5	
Oxidation stability, minutes	Min. 360	
Color	Light green	
Density at 15°C, Kg/L	0.730- 0.780	

Table 2.4: Standards Defining the Characteristics of Automotive Gasoline 98 Octane.[6]

Properties	Limit for gasoline 98
Research Octane Number	Min. 98
Motor Octane Number	Min. 87
Lead, g/L	Max. 0.005
Benzene, %v/v	Max. 5.0
Methanol, %v/v	Max. 3.0
Ethanol, %v/v	Max. 5.0
Isopropyl Alcohol % v/v	Max. 5.0
Tertiary Butyl Alcohol % v/v	Max7.0
Ethers containing five or more C atoms % v/v	Max. 10.0
Other Organic Oxygenates % v/v	Max. 7.0
MTBE %	Max 10.0
Total Organic Oxygen %m/m	Max. 2.5
Sulfur % m/m	Max. 0.05

Distillation at 760 mm Hg evaporated At 70°C, % v/v	10-45	
Final boiling point °C	Max. 215	
Residue, % v/v	Max.2	
Reid Vapor pressure at 37.8°C, kPa	Summer (April- October inclusive) Max 65	Winter (November - & March inclusive) Max 80
Volatility (10VP + 7 evaporated 70)	Summer (April - October) Max 965	Winter (November - March) Max 1115
Copper corrosion, (3hrs @ 50°C)	Max 1	
Existent gum, mg/100 ml	Max 5	
Oxidation stability, minutes	Min. 360	
Color	Light blue	
Density at 15°C, kg/L	Min. 720	

2.2.4 Diesel composition

Diesel is fuel used in diesel engines, and present in liquid state and produced from crude-oil distillation. Diesel includes different types: type 1 for road vehicles, 2nd one for industries (agriculture, fishing, etc), and the 3rd one for heating (not for engines; blue-colored).

Saturated hydrocarbons allocated about 75% of Diesel component which contains many toxic chemicals including Ethyl benzene, Benzene and Toluene, toxic chemicals lead to case cancers [4], Table 2.5 illustrate Standards defining the Characteristics of Diesel Fuel composition to be used as Automotive Fuel[6].

Table 2.5: Standards Defining the Characteristics of Diesel Fuel Composition to be Used as Automotive Fuel.[6]

Properties	Limits for diesel fuel
Flash Point Pensky Martens, °C	Min 55
Water and sediment by centrifuge % vol	Max 0.05
Cold Filter Plugging point , °C	Max -5 (Nov- March inclusive) Max 0 (April-October inclusive)
Distillation temperature, at 760 mm Hg, recovered: At 250 °C vol% At 350 °C vol% At 370 °C vol%	Max 65 Min 85 Min 95
Kinematic Viscosity at 40°C, cSt	Min 2.00 Max 4.50
Color	Orange (actually it is green)
Ash % Mass	Max 0.01
Sulfur % Mass	Max 0.035
Corrosion, copper strip (3 hrs at 50 °C)	Max 1
Cetane Number	Min 49
Cetane Index	Min 46
Mamsbottom Carbon Residue (on 10% residuum), % wt	Max 0.3
Density at 15°C, Kg/m	820-860
Oxidation stability g/m3	Max 25

2.2.5 Diesel Characteristics

- **Physical and chemical properties** :Table 2.6 illustrate the chemical and physical properties of gasoline such as physical state, boiling point, freezing point, etc [8].

Table 2.6:Physical and Chemical Properties diesel

NO	Properties	Description
1.	Physical State :	Liquid
2.	Appearance and Odor :	Straw yellow or dark yellow liquid. Characteristic hydrocarbon like odor
3.	Vapor Pressure :	0.5 mm of HG AT 38 OC (RVP)
4.	Specific Gravity :	0.82 to 0.86 gm/ cc
5.	Water Solubility :	Insoluble
6.	Boiling Point :	110 oC to 375 Oc
7.	Freezing Point :	< 15 Oc
8.	Vapor Density :	3 to 5 (Air = 1)
9.	Sulphur Content :	50 ppm(BS-IV) to 350(BS-III) ppm and < 0.2% for HF HSD
10.	Stability :	Chemically stable.
11.	Chemical Incompatibilities :	Incompatible with oxidizing agents & chlorine. Reacts vigorously with oxidizing
12.	Hazardous Decomposition:	Carbon dioxide, carbon mono oxide.

Toxicology Information

Toxicology information of gasoline is [8]:

- Routes of entry: skin contact, eye contact, inhalation, and ingestion. Acute Lethality: Acute oral toxicity (LD50): 7500 mg/kg .
- Dermal route: skin contact may cause moderate to severe irritation. Repeated exposure would produce drying and cracking or defatting dermatitis.
- Inhalation route: inhalation of vapors can cause CNS depression with symptoms of nausea, headaches, vomiting, dizziness, fatigue, light-headedness, reduced coordination,

unconsciousness and possibly death. Inhalation can also cause irritation of nose and throat.

- Oral route: aspiration of liquid drops into the lungs may produce potentially fatal chemical pneumonitis (fluid in the lungs), severe lung damage, or respiratory failure.
- Eye irritation/inflammation: eye contact may cause mild irritation, but no permanent damage.
- Skin sensitization: this product is not expected to be a skin sensitizer, based on the available data and the known hazards of the components.
- Respiratory tract sensitization: this product is not expected to be a respiratory tract sensitizer, based on the available data and the known hazards of the components
- Mutagenic: this product is not expected to be a mutagen, based on the available data and the known hazards of the components.
- Reproductive toxicity: this product is not expected to be a reproductive hazard, based on the available data and the known hazards of the components.
- Teratogenicity/Embryo toxicity: this product is not expected to be a teratogen or an embryo toxin, based on the available data and the known hazards of the components.
- Carcinogenicity: this product is not known to contain any chemicals at reportable quantities that are listed as carcinogens, Contains material which may cause cancer, based on animal data. Risk of cancer depends on duration and level of exposure.

2.3 Environmental risks

In urban area it is common to see the petrol stations in between buildings. This situation might lead to environmental adverse effects.

Some studies shown that the air in surroundings (i.e., atmosphere) is polluted by the emissions produced from fuel vehicles and volatile materials. Leaking fuel may pollute ground water and soil, so that environmental impact assessment and risk analysis are needed before proceeding in gas station construction and establishing.

Furthermore, human health needs are very important in forming the instructions guideline that we are going to develop including occupational and health safety requirements. In the next sections, we will discuss the role of gas stations in air, water (surface and ground), and soil pollution and contamination.

Figure 2.1 shows how petrol stations are embedded into the natural environment and can consequently release pollutants to the atmosphere, the subsurface including soil and groundwater, and surface water[9].

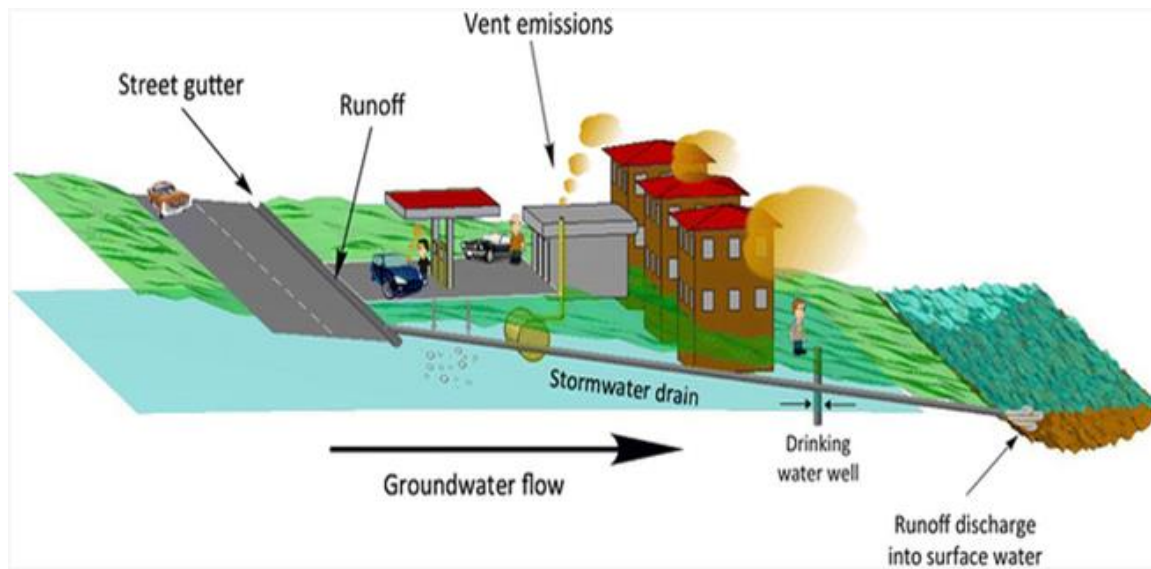


Figure2.1 :Impact of Petrol Station on Environment.

2.3.1 Air pollution

Air pollution defined as any substance impurities in air such as volatile organic compound (VOC), dust, smoke, gases and small particles of any kind.

The U.S. Environmental Protection Agency (EPA) designates six criteria pollutants for determining air quality. These are: carbon monoxide , nitrogen oxides and/or NO₂, usually referred to as , sulfur dioxide , ground-level ozone , particulate matter (including things like soot, dust, asbestos fibers, pesticides, and metals), and lead [5].

The main source of air pollution is hydrocarbons gaseous : VOCs is the main emission to air, fuel that have quick evaporation in air during to liquid fuel spills, because of density of air is less than density of gasoline, saturated gasoline is vapor to air quickly, we can reduce the VOCs emission by using “special fuel filter nozzles incorporating vapor recovery systems”[10].

In the study of the air pollution and hydrocarbon released in, measuring the VOCs and other gases and study the relationship between various distances. The study concluded that when you are near petrol station the concentration of gases is high but when you far from station the concentration of gases is acceptable [11].

2.3.2 Water pollution

In petrol station there are many pollutant such as oil , detergents, greases , and petroleum product that have potentially contaminate ground water and surface water , and contaminate food through water cycle .

Figure2.2 shows Contamination of groundwater due to improper fuel storage and transfer [9] , this lead to health impact on humans and living organisms .

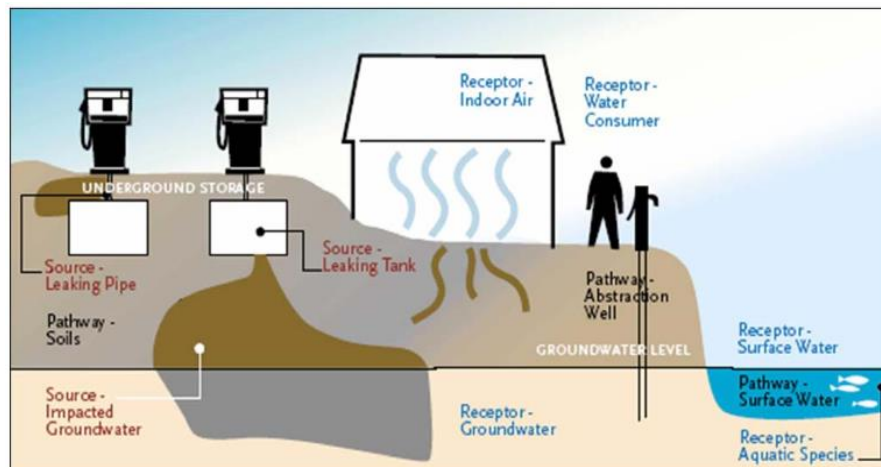


Figure2.2:Contamination of Groundwater Due to Improper Fuel Storage and Transfer .

One of the reasons to contaminate surface and ground water is oil spilling during vehicles filling and spilling during delivery. *Firstly*, when you fill car and vehicles oil leak to surface and contaminate it. *Secondly*, when delivery tank reach fuel station to fill tank underground spill have occurred , runoff water from both rain or washing pavement with react with hydrocarbons and spill leading to pollute surface and ground water. *In addition*, traffic accidents with tanks and vehicles have large quantities of petroleum infiltrate to ground water and pollute surface water (aquatic system).

The main important reason for ground water and soil pollution is the leakage occurred from storage tank which have massive amount of petrol product and will reach ground water quickly [10], when water is polluted with petroleum product we can't detect by smell or taste.

2.4 Impact on human (workers in station)

Petrol station has found in a community near residential buildings and public assembly such as schools and hospitals, as a result, populations may be exposed to gas emission through operation of petrol station. And it can be grouped in three groups: *first group*; people who work in petrol stations, and exist in petrol station daily, *second group*: people who work near petrol station such as who study in school, work in bank, work in company near station, and *third group*: customers who came to station to take advantage from various services and bay money.

The exposure of petroleum production through gas emissions or liquid spills have based on several factors including size of station and capacity, climate, concentration of pollutants in air, meteorological conditions, physiological characteristics, technology used to prevent pollution.

People who work in petrol station is highly exposed to petroleum production origination from petrol station due of to work load more than 40 hours per week. Because of petrol contains volatile vapor (hydrocarbon chemicals) that is entering body quickly [9].

The (EPA) Integrated Risk Information System has published a reference concentration of 0.03 mg/m^3 (about 9.4 ppb), corresponding to decreased lymphocyte counts, whereas the National Institute for (NIOSH) Recommended Exposure Limit is a time-weighted average concentration (for up to a 10-hour workday during a 40-hour workweek) of 0.319 mg/m^3 (about 100 ppb) [9].

2.4.1 How can gasoline enter and leave human body?

When breathing or drinking water that are contaminated with benzene or gasoline it can easy this contaminants enter your body, benzene are easily to penetrate the skin more than other chemicals in station, when you breath this chemical it enter the body quickly through blood and reach livers, if this happen, the chemical of gasoline change in to new substance and the new substance reach kidney not all chemical leave in urea but some of chemical stay in body and leave body after long period [12].

The harmful effect of chemical such as benzene and leads etc, through breathing and inhaling large dosage of gasoline, if dosage is above the threshold it can lead to death, The levels of gasoline that killed people are about 10,000–20,000 ppm when breathed[12].

2.4.2 Effect of lead on body

The most important problems faced by the working group in the station is exposure to lead, where the estimations indicate that the 143000 deaths annually according to EPA[13].

Lead move from the surrounding environment to the blood of rights through inhalation of air and by drinking contaminated waterleaf is a cumulative toxicant that affects multiple body systems, including the neurological, hematological, gastrointestinal, cardiovascular and renal systems. And increased risk for hypertension, significant residual damage to the central nervous system and delayed sexual maturation, increased incidences of depression, aggressive behavior [13].

2.4.3 Effect of chronic inhalation and exposure

Other harmful effect on nervous system when you breathe large amount in short time include, dizziness and headaches, and sometime include coma. Harmful effect on lung through breathing large amount of chemical and in short time, the effect in long term can cause cancer on lung or on stomach [14].

The study of Effect of chronic inhalation of petroleum products was found that the trivial changes in hemoglobin level were observed as compared with people who are not exposed to workplace, the exposure to petrol station have change exposure may be primarily related to the impairment of the hematopoietic system with bone marrow depression [12] Figure2.3 shows several sources of chronic release of unburned fuel at petrol stations on workers[9].

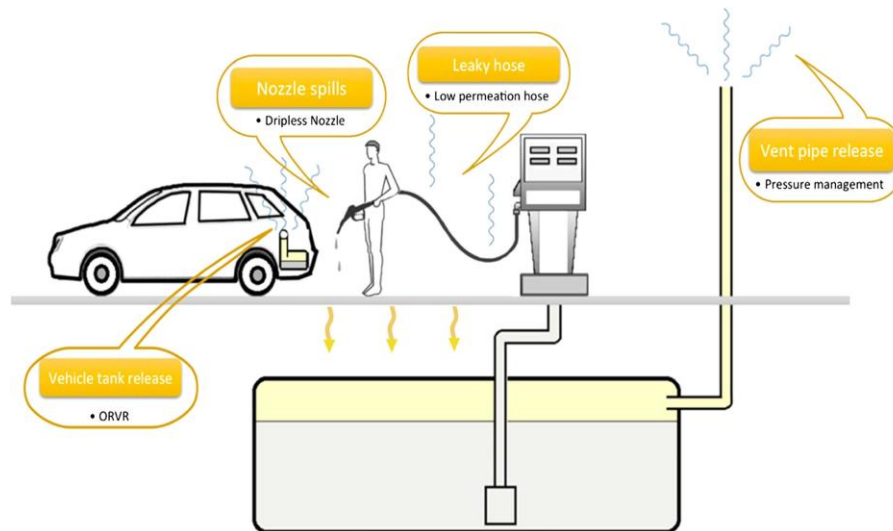


Figure2.3:Several Sources of Chronic Release of Unburned Fuel at Petrol Stations on Workers.

According to laboratory test method you can measure the concentration of gasoline, benzene, lead and other substance through blood or urine (i.e., biomarkers), and indicate the background levels and levels when health effects may occur [14].

2.4.4 Effect of using mobile phone in station

Often when entering the petrol station forget turn off mobile phone, lights, radio, according to the traffic rules of the General Assembly, which provided that the closure of the things that radiate electromagnetic radiation during the operating. But for the moment there is no full consideration confirms that there is a link between mobile phone use at the petrol station and the risk of explosion and because the outgoing radiation from the phone less than 1 W/cm^2 and it is a very small proportion [15].

CHAPTER THREE

METHODOLOGY

3.1 Study area

The study area in the Hebron Governorate which is located in the southern part of the West Bank; about thirty kilometers south of Jerusalem, at an altitude between 900-950 m above sea level, stretching between the two series of green hills in the northern extension Top of the valley of Hebron , Where is located between Latitude: 12° 30' 31' north, longitude: 52° 34' 35' east, With an estimated population in 2014 of approximately 200000 inhabitants and an area of 42 km².

Hebron district is characterized by the presence of many settlements around and in-between Palestinian areas. Hebron city in contradict to all cities; settlements are located inside it in area which is known as H2 according to Oslo agreement, figure 3.1 shows location of Hebron in Palestine map[16]



Figure3.1: Palestine map.

3.2 Study Population

Study population of our research is the petrol stations in Hebron governorate. A total number of 31 existed petrol stations, which are distributed among the populated area overall Hebron Governorate of which 12 stations are located in Hebron City. Each station has approximately 10 workers, 3 in the administration and 7 working in filling petrol.

3.3 Study Sample and Sampling Procedure

In this project and based on the size of the petrol station, 10 petrol stations in Hebron Governorate have been selected as follow:

Zaid station, Al- Salam station, Al-Nukhba station, Al-Amal station, Al -Janoub station, Al-Ansar station, Hassona station, Saer station, Al-sahem station, Maka station

In addition, all workers have been included in the current study who are directly exposed to petrol emissions. And For emission tests we selected only 5 stations to measure some emission include CO, VOC, SO₂, NO₂, H₂S, NH₃

3.4 Research Instruments

- a) Questionnaire and interviews
- b) Experimental data (i.e., biomarker test for emission measurements)
- c) Observations
- d) Data base registry

3.5 Data Collection

All data required for answering the research questions have been collected by using the following instruments:

1. Questionnaire and interviews (appendix 1) show the questionnaire for the station current situation, the workers, and the neighborhoods and environment.
2. Data base registry from the authorized bodies including civil defense and petroleum committee.
3. Experimental data (i.e., biomarker tests for lead and copper levels in blood samples from workers. Also emissions were measured for some gases in the stations environment including volatile organic compounds (VOC), CO, SO₂, H₂S, NH₃ and NO₂
4. Observations.

An individual interview conducted with the General Directorate of Petroleum and Palestinian Civil Defense in order to collect all information related to number and distribution of petrol stations in Hebron District. In addition, all regulations, legislations, and standards that regulate this craft have been collected (appendix 2).

Structured interviews have been conducted by researchers themselves to obtain all information required from petrol stations' owners, and workers. The questionnaires included the following components:

A. The station current situation questionnaire including these information:

- Characteristic of Station ownership, history, classification, location, and activities
- Establishing petrol stations and license
- Wastes of the stations
- The station Ground Tanks.

B. The workers questionnaire included:

- Socio-demographic variables
- Work conditions
- Medical history
- Occupational health and safety standard
- Outdoor environment

C. The neighborhoods and environment questionnaire included:

- Outdoor environment
- Occupational health and safety standard

3.6 Data Analysis

All collected data have been analyzed by using the Social Statistical Package for Social Sciences (SPSS, V.21). Percentage and frequencies, distribution and association between variables were tested by using cross-tabulation tests.

CHAPTER FOUT

RESULT

4.1 Introduction

In this chapter we will present our main findings related to our research questions and research goals. This chapter will present results in a way with relation to each part of the study. The study consisted of 2 main parts as the followings: 1) the questionnaire and 2) the experimental parts. The questionnaire part includes: the current situation of the petrol stations, the workers questionnaire, and the surrounded environment and neighborhoods. The experimental part includes biomarkers and emission investigations. The biomarkers investigations related to concentrations of some metals (i.e., Lead and Copper) in the blood samples from the workers. The emission investigations were related to measure the concentration of some gases emitted to the environment in the stations including (VOC), CO, SO₂, H₂S, NH₃ and NO₂.

4.2 Analyzing data

4.2.A The questionnaire

4.2.A.1 The station questionnaire

4.2.A.1.1 Station ownership, history, classification, location, and activities.

Results show that 60.0% of the studies stations (n=10) were owned individually and 40% by local companies. Both individually and company ownership of the stations belong to local companies. This means that all owners of these stations responsible for all activities of these stations and for all environmental and human health aspects.

A total of 80% of the studied stations were located in populated area (among population), one in industrial zone, and one on high way road, according to the conditions

required by the Civil Defense and Palestinian Petrol Committee it seems that those 80% of the studied stations do not form any risk to people and always they monitored and controlled by these two authorities and other governmental bodies.

All studied stations provided different activities, 60% of them just provide Petrol filling and the other 40% provided different activities including Petrol filling, car washing and lubrication, this situation depends on the classification of these stations.

Three of ten stations (30%) were established during the last 10 years, while the other 6 stations (60%) were existed for more than 20 years. And one is existed for 61 years ago, these findings showed an alarm relating to the lifetime of the ground tanks because most of them exceeds the hypnotized lifetime of these tanks which is 15 years (www.egalibya.org.com). It was found that all stations did not replace the oldest tank with new, what they did is to rehabilitate or just make some maintenance for these tanks and here some kind of risks could be existed.

There are two principal forms of petrol station ownership - company owned and independent. 6 of 10 (60%) studied petrol stations are independent owned individually and 40% were owned by company.

When age of station infrastructure was considered, as shown in table 2 it was found that the minimum age of the station is 2 years while the maximum is 61 years old. The mean age of the studied stations is 21.3 years. Five out of 10 stations (50%) were existed for more than 20 years.

A total of 7 out of 10 petrol stations (70%) are with class A classification based mainly on the size of the station. (see appendix 1).

A total of 8 out of 10 petrol stations (80%) are located among populated and commercial area.

A total of 6 out of 10 petrol stations (60%) providing only petrol filling while 4 providing several services including petrol filling, maintenance workshop, car washing and lubrication, the station activities .

4.2.A.1.2 Establishing petrol stations and license provider.

- A total of 9 out of 10 petrol stations (90%) were supervised by engineering team while and during construction and establishing, a total of 8 out of 10 petrol stations (80%) were environmentally assessed through the EIA requirement requested by the authorization body. The main governmental licensing provider is the Civil Defense committee which issued 8 of 10 licensees for the studied stations. Tables 4.6-4.8 are describing information related to establishing petrol stations and license from Civil Defense and the Petroleum Authority.
- A total of 9 out of 10 petrol stations (90%) were supervised by engineering team while and during construction and establishing
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4.2.A.1.3 Wastes of the stations.

4.2.A.1.3.1 Solid wastes (types, quantities, segregation, and disposal.

The main kinds of solid wastes produced by the studied stations are Tires and empty cans; the quantity of solid wastes produced by the studied stations is ranged from 0.5 kg to 30 kg per day, the mean of this quantity for all these stations was 9.07 kg/day. Most of the studied stations do not segregate the solid wastes, all wastes gathered and

collected without any segregation, most of the studied stations dispose the solid wastes by Municipal Waste Vehicles, some of these wastes were sold to wastes collectors.

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- Most of the studied stations dispose the solid wastes by Municipal Waste Vehicles. Some of these wastes were sold to wastes collectors.

4.2.A.1.3.2 Liquid wastes (types, quantities, segregation, and disposal)

It seems that all studied stations produced different kinds of liquid wastes including used car oil, car washing water, and lubricant oils. The quantity of liquid wastes produced by the studied stations is ranged from 0.0 L to 500 L per day; the mean of this quantity for all these stations was 99.7 lt/day.

Results show that 9 of 10 (90%) of the studied stations have a sewage network, 50% of the studied stations have filters for oil before releasing wastes to the network, 30% of the studied stations have special tanks for gathering oil wastes, 60% of the studied stations dispose the liquid wastes to the sewage network, and 20% sell these wastes mainly the used oils

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- The quantity of liquid wastes produced by the studied stations is ranged from 0.0 kg to 500 lit per day. The mean of this quantity for all these stations was 99.7 lit/day.
- Nine of 10 of the studied stations have a sewage network.
- 50% of the studied stations have filters for oil before releasing wastes to the network.
- 30% of the studied stations have special tanks for gathering oil wastes.
- 60% of the studied stations dispose the liquid wastes to the sewage network, and 20% sell these wastes mainly the used oils.

4.2.A.1.4 The station Ground Tanks

A total of 40% of the studied stations have 2 ground tanks, 40% have 3 ground tanks for benzene. The size of Benzene tanks ranged from 20 to 60,000 liter with mean of 25550 liter. 40% of the studied stations have benzene tanks that made of iron steel and 20% made of concrete surrounded with sand, also 20% of these tanks made of Galvanized iron. 60% of the studied stations have tubes connecting the stations with the tanks which made of galvanized iron and 20% have metal tubes or pipes. 30% of the studied stations have 5 ground tanks, and 30% have 2 ground tanks for diesel.

Results show that the size of Diesel tanks ranged from 20 to 150,000 liter with mean of 39500 liter. 40% of the studied stations have Diesel tanks that made of iron steel and 20% made of concrete surrounded with sand, only 20% of these tanks made of Galvanized iron, also 50% of the studied stations have pipes connecting the stations with the tanks which made of galvanized iron and 20% have metal tubes or pipes.

The mean of depth for Benzene tanks in the ground was 6.95 meter, and the mean of depth for Gasoline tanks in the ground was 6.95 meter. A total of 70% of the studied stations have Gasoline tanks buried in concrete rooms, while 70% of the studied stations

have diesel tanks buried in concrete rooms. 80% of the studied stations have petrol tank control system. A total of 80% of the studied stations running leakage detection test. But 80% of the studied stations running leakage detection test in petrol delivery networks from ground tanks.

100% all of the studied stations running regular maintenance programs to detect tanks. Just 20% of the studied stations had a fire accident, also just 30% of the studied stations had a leakage in the ground tanks, while just 20% of the studied stations had a petrol leak while unloading it in the ground tanks, and only 10% of the studied stations had a leakage of petrol from ground pumps while filling vehicles.

- The mean of the distance between the petrol tanks and the drinking water network was 376.67 m with range of 20 to 2000m, 50% of the studied stations among 20-30 meters distance.
- Results show that no change in taste, color or smell of drinking water had been noticed in all studied stations
- 40% of the studied stations have 2 ground tanks, and 40% have 3 ground tanks for benzene.
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- 70% of the studied stations have Gasoline tanks buried in concrete rooms.
- 70% of the studied stations have diesel tanks buried in concrete rooms.
- 80% of the studied stations have petrol tank control system.
- 80% of the studied stations running leakage detection test.
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- 100% all of the studied stations running regular maintenance programs to detect tanks.
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- The mean of the distance between the petrol tanks and the drinking water network was 376.67 m with range of 20 to 2000m. 50% of the studied stations among 20-30 meters distance.
- No change in taste, color or smell of drinking water had been noticed in all studied stations.

4.2.A.2 Workers Questionnaire

4.2.A.2.1 Characteristics of workers petrol station

Results show that the majority (63.4%) of workers in the studied petrol stations were aged between 21-40 years, 19.5% of workers were less than 20 years old. The majority (65.9%) of workers in the studied petrol stations were from city, also 31.7% of workers were from villages and only 2.4% from camps.

- A total of 46.3% of workers filling 101-200 vehicles per/day and 26.8% filling > 200 vehicles/day with mean of 198.4 vehicles ranged from 55-700. The mean of working hours/day was 8.98 hours ranged from 7-12 hours/day, 48.8% of workers were working for more than 8 hours/day, 63.4% of workers expend 3-5 minutes for filling vehicle with petrol.
- The majority (63.4%) of workers in the studied petrol stations were aged between 21-40 years. 19.5% of workers were less than 20 years old.
- The majority (65.9%) of workers in the studied petrol stations were from city. 31.7% of workers were from villages and only 2.4% from camps.

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- 63.4% of workers expend 3-5 minutes for filling vehicle with petrol.

4.2.A.2.2 Health effects of workers in petrol station.

Results show that 43.9% of workers were suffering or had been suffered from breathing problem (tight breathing). A total of 31.7% of workers have suffered from nasal mucous membrane inflammation (dryness or closure of the respiratory tract). Also a total of 26.8% of workers have suffered from a chest allergy. Only 12.2% of workers suffer or have health problems in your skin. A total 31.7% of workers suffer or suffer from excessive sweating. 51.2% of workers suffer or have suffered from laziness or inactivity.

Results show 22.0% of workers suffer or have health problems in your stomach (high acidity, inflammation, heartburn). A total of 41.5% of workers suffer or suffer from excessive stress . A total of 39.0% of workers suffer or have suffered from dizziness. Only 14.6% of workers suffer or have cramps or jaundice. While 34.1% of workers suffer or have a rapid heartbeat.

Results show that 75.6% of workers suffer or have trouble sleeping. 53.7% of workers feel addicted to the smell of petrol. A total of 90.2% of workers reported that the station staff (workers) are not periodically inspected

- 43.9% of workers were suffering or had been suffered from breathing problem (tight breathing)
- 12.2% of workers suffer or have health problems in your skin.

- 31.7% of workers suffer or suffer from excessive sweating.
- 51.2% of workers suffer or have suffered from laziness or inactivity.
- 22.0% of workers suffer or have health problems in your stomach (high acidity, inflammation, heartburn).
- 41.5% of workers suffer or suffer from excessive stress.
- 39.0% of workers suffer or have suffered from dizziness.
- 14.6% of workers suffer or have cramps or jaundice
- 36.6% of workers suffer or have a blurred vision.
- 34.1% of workers suffer or have a rapid heartbeat
- 75.6% of workers suffer or have trouble sleeping.
- 53.7% of workers feel addicted to the smell of petrol.
- 90.2% of workers reported that the station staff (workers) are not periodically inspected.

4.2.A.2.3 Relationship between adverse health effects and work load and circumstances

Our results show that workers at -:

- By 1.5 and 1.7 folds for suffering from nasal mucous membrane inflammation (dryness or closure of the respiratory tract) with increasing of working hours > 8 hours/day and with increasing of number of vehicles that filling daily 101-200vehicles/day respectively.
- By 1.66 and 1.27 folds for feeling addicted to the smell of petrol) with increasing of number of working hours daily >8 hours/day and with increasing of number of vehicles that filling daily 101-200 vehicles/day respectively.
- By 1.24 and 1.85 folds for suffer or have suffered from dizziness with increasing of number of vehicles that filling daily 101-200 vehicles/day, and with increasing of number of working hours daily >8hours/day respectively.
- By 1.71 and 1.51folds for suffer or have a rapid heartbeat with increasing of number of working hours daily >8hours/day and with increasing of number of vehicles that filling daily 101-200 vehicles/day respectively.
- By 1.9 and 1.36 folds for suffer or have a blurred vision with increasing of number of working hours daily >8hours/day, and with increasing of number of vehicles that filling daily 101-200 vehicles/day respectively.
- By 1.55 and 1.66folds for suffer or have a chest allergy with increasing of number of vehicles that filling daily 101-200 vehicles/day, and with increasing of number of working hours daily >8 hours/day respesively.
- By 1.50 folds for suffer or have trouble sleeping with increasing of number of working hours daily >8 hours/day.

Tables 4.1-4.13 are describing the relation between adverse health effects and work load and circumstances

Table 4.1 : Relation between working hours*suffered or suffered from nasal mucous membrane inflammation (dryness or closure of the respiratory tract)

عدد ساعات العمل يوميا * هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسي)؟

Cross tabulation

المجموع	هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟		عدد ساعات العمل يوميا 1-8 ساعات أكثر من 8 ساعات المجموع
	لا	نعم	
21	13	8	
20	15	5	
41	28	13	

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00) For cohort هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟ = نعم
Upper	Lower		
7.062	.483	1.846	For cohort هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟ = لا
3.880	.598	1.524	
1.257	.542	.825	
		41	N of Valid Cases

Table4.1 shows that workers at risk by 1.5 folds for suffering from nasal mucous membrane inflammation (dryness or closure of the respiratory tract) with increasing of working hours > 8 hours/day.

Table 4.2: Relation between Number of vehicles that filling daily *suffered or suffered from nasal mucous membrane inflammation (dryness or closure of the respiratory tract

Cross tabulation:؟ عدد المركبات التي تقوم بتعبئتها يوميا * هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟

المجموع	هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟		عدد المركبات التي تقوم بتعبئتها يوميا =<100 101-200 المجموع
	لا	نعم	
11	6	5	
30	22	8	
41	28	13	

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for عدد المركبات التي تقوم بتعبئتها يوميا (= <100 / 101-200) For cohort هل عانيت أو تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟ = نعم
Upper	Lower		
9.638	.545	2.292	
4.102	.708	1.705	

1.330	.416	.744	هل تعاني من التهاب الأغشية المخاطية للأنف (جفاف أو انغلاق المجاري التنفسية)؟ = لا
		41	N of Valid Cases

Table 4.2 shows that workers at risk by 1.7 folds for suffering from nasal mucous membrane inflammation (dryness or closure of the respiratory tract) with increasing of number of vehicles that filling daily 101-200vehicles/day.

Table 4.3 : Relation between working hours*feeling addicted to the smell of petrol

عدد ساعات العمل يوميا * هل تشعر بالإدمان على رائحة الوقود؟ Cross tabulation

المجموع	هل تشعر بالإدمان على رائحة الوقود؟		
	لا	نعم	
21	7	14	1-8 عدد ساعات العمل يوميا
20	12	8	اكتر من 8
41	19	22	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
10.727	.839	3.000	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00)
3.086	.900	1.667	هل تشعر بالإدمان على رائحة الوقود؟ = نعم For cohort
1.122	.275	.556	هل تشعر بالإدمان على رائحة الوقود؟ = لا For cohort
		41	N of Valid Cases

Table 4.3 shows that workers at risk by 1.66 folds for feeling addicted to the smell of petrol) with increasing of number of working hours daily >8 hours/day.

Table 4.4 : Relation between Number of vehicles that filling daily *feeling addicted to the smell of petrol

عدد المركبات التي تقوم بتعبئتها يوميا * هل تشعر بالإدمان على رائحة الوقود؟ Cross tabulation

المجموع	هل تشعر بالإدمان على رائحة الوقود؟		
	لا	نعم	
11	4	7	=<100 عدد المركبات التي تقوم بتعبئتها يوميا
30	15	15	101-200
41	19	22	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
7.253	.422	1.750	Odds Ratio for عدد المركبات التي تقوم بتعبئتها يوميا(= <100 / 101-200)
2.256	.718	1.273	For cohort هل تشعر بالإدمان على رائحة الوقود؟ = نعم
1.718	.308	.727	For cohort هل تشعر بالإدمان على رائحة الوقود؟ = لا
		41	N of Valid Cases

Table 4.4 shows that workers at risk by 1.27 folds for feeling addicted to the smell of petrol) with increasing of Number of vehicles that filling daily 101-200 vehicles/day.

Table 4.5: Relation between Number of vehicles that filling daily *suffer or have suffered from dizziness

Cross tabulation? عدد المركبات التي تقوم بتعبئتها يوميا * هل تعاني أو عانيت من دوخة (دوار)؟

المجموع	هل تعاني أو عانيت من دوخة (دوار)؟		
	لا	أحيانا	
11	6	5	=<100 عدد المركبات التي تقوم بتعبئتها يوميا
30	19	11	101-200
41	25	16	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
5.837	.355	1.439	Odds Ratio for عدد المركبات التي تقوم بتعبئتها يوميا(= <100 / 101-200)
2.759	.557	1.240	For cohort هل تعاني أو عانيت من دوخة (دوار)؟ = أحيانا
1.576	.471	.861	For cohort هل تعاني أو عانيت من دوخة (دوار)؟ = لا
		41	N of Valid Cases

Table 4.5 shows that workers at risk by 1.24 folds for suffer or have suffered from dizziness with increasing of Number of vehicles that filling daily 101-200 vehicles/day.

Table 4.6 : Relation between Number of working hours daily *suffer or have suffered from dizziness

Cross tabulation عدد ساعات العمل يوميا * هل تعاني أو عانيت من دوخة (دوار)؟

المجموع	هل تعاني أو عانيت من دوخة (دوار)؟		عدد ساعات العمل يوميا
	لا	أحيانا	
21	11	10	1-8
20	14	6	أكثر من 8
41	25	16	المجموع

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00) For cohort هل تعاني أو عانيت من دوخة (دوار)؟ = أحيانا For cohort هل تعاني أو عانيت من دوخة (دوار)؟ = لا
Upper	Lower		
7.658	.588	2.121	
3.553	.709	1.587	
1.232	.454	.748	
		41	N of Valid Cases

Table 4.6 shows that workers at risk by 1.58 folds for suffer or have suffered from dizziness with increasing of Number of working hours daily >8hours/day.

Table 4.7 : Relation between Number of working hours daily *suffer or have a rapid heartbeat

Cross tabulation عدد ساعات العمل يوميا * هل تعاني أو عانيت من سرعة ضربات القلب؟

المجموع	هل تعاني أو عانيت من سرعة ضربات القلب؟		عدد ساعات العمل يوميا
	لا	نعم	
21	12	9	1.00
20	15	5	2.00
41	27	14	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
8.515	.595	2.250	Odds Ratio for For cohort هل تعاني أو عانيت من سرعة ضربات القلب؟ = نعم For cohort هل تعاني أو عانيت من سرعة ضربات القلب؟ = لا N of Valid Cases
4.240	.693	1.714	
1.193	.487	.762	
		41	

Table 4.7 shows that workers at risk by 1.71 folds for suffer or have a rapid heartbeat with increasing of Number of working hours daily >8hours/day.

Table 4.8 : Relation between Number of vehicles that filling daily *suffer or have a rapid heartbeat

Cross tabulation عدد المركبات التي تقوم بتعبئتها يوميا * هل تعاني أو عانيت من سرعة ضربات القلب؟

المجموع	هل تعاني أو عانيت من سرعة ضربات القلب؟		
	لا	نعم	
11	6	5	=<100 عدد المركبات التي تقوم بتعبئتها يوميا
30	21	9	101-200
41	27	14	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
8.050	.470	1.944	Odds Ratio for For cohort هل تعاني أو عانيت من سرعة ضربات القلب؟ = نعم For cohort هل تعاني أو عانيت من سرعة ضربات القلب؟ = لا N of Valid Cases
3.535	.649	1.515	
1.403	.433	.779	
		41	

Table 4.8 shows that workers at risk by 1.51 folds for suffer or have a rapid heartbeat with increasing of Number of vehicles that filling daily 101-200 vehicles/day..

Table 4.9 : Relation between Number of working hours daily *suffer or have a blurred vision

عدد ساعات العمل يوميا * هل تعاني أو عانيت من غشاوة في البصر؟ Cross tabulation

المجموع	هل تعاني أو عانيت من غشاوة في البصر؟		عدد ساعات العمل يوميا 1-8 ساعات أكثر من 8 ساعات
	لا	نعم	
21	11	10	
20	15	5	
41	26	15	المجموع

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00) For cohort هل تعاني أو عانيت من غشاوة في البصر؟ =نعم For cohort هل تعاني أو عانيت من غشاوة في البصر؟ =لا N of Valid Cases
Upper	Lower		
10.269	.724	2.727	
4.600	.789	1.905	
1.129	.432	.698	
		41	

Table 4.9 shows that workers at risk by 1.9 folds for suffer or have a blurred vision with increasing of Number of working hours daily >8hours/day.

Table 4.10 : Relation between Number of vehicles that filling daily *suffer or have a blurred vision

عدد المركبات التي تقوم بتعبئتها يوميا * هل تعاني أو عانيت من غشاوة في البصر؟ Cross tabulation

المجموع	هل تعاني أو عانيت من غشاوة في البصر؟		عدد المركبات التي تقوم بتعبئتها يوميا =<100 101-200
	لا	نعم	
11	6	5	
30	20	10	
41	26	15	المجموع

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for عدد المركبات التي تقوم بتعبئتها يوميا (= <100 / 101-200) For cohort هل تعاني أو عانيت من غشاوة في البصر؟ = نعم For cohort هل تعاني أو عانيت من غشاوة في البصر؟ = لا N of Valid Cases
Upper	Lower		
6.818	.407	1.667	
3.101	.600	1.364	
1.485	.451	.818	
		41	

Table 4.10 shows that workers at risk by 1.36 folds for suffer or have a blurred vision with increasing of Number of vehicles that filling daily 101-200 vehicles/day.

Table 4.11: Relation between Number of vehicles that filling daily *suffer or have a chest allergy

Cross tabulation? عدد المركبات التي تقوم بتعبئتها يوميا * هل تعاني أو عانيت من غشاوة في البصر؟

المجموع	هل تعاني أو عانيت من غشاوة في البصر؟		عدد المركبات التي تقوم بتعبئتها يوميا
	لا	نعم	
11	7	4	=<100
30	23	7	101-200
41	30	11	المجموع

Risk Estimate

95% Confidence Interval		Value	Odds Ratio for (= <100 / 101-200)
Upper	Lower		
8.344	.422	1.878	For cohort هل تعاني أو عانيت من غشاوة في البصر؟ =نعم
4.304	.564	1.558	For cohort هل تعاني أو عانيت من غشاوة في البصر؟ =لا
1.353	.509	.830	N of Valid Cases
		41	

Table 4.11 shows that workers at risk by 1.55 folds for suffer or have a chest allergy with increasing of Number of vehicles that filling daily 101-200 vehicles/day

Table 4.12 : Relation between Number of working hours daily *suffer or have a chest allergy

Cross tabulation? عدد ساعات العمل يوميا * هل تعاني أو عانيت من غشاوة في البصر؟

المجموع	هل تعاني أو عانيت من غشاوة في البصر؟		عدد ساعات العمل يوميا
	لا	نعم	
21	14	7	1-8 ساعات
20	16	4	اكتر من 8 ساعات
41	30	11	المجموع

Risk Estimate

95% Confidence Interval	Value
-------------------------	-------

Upper	Lower		
8.295	.482	2.000	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00)
4.835	.575	1.667	هل تعاني أو عانيت من غشاوة في البصر؟ = نعم For cohort
1.211	.574	.833	هل تعاني أو عانيت من غشاوة في البصر؟ = لا For cohort
		41	N of Valid Cases

Table 4.12 shows that workers at risk by 1.66 folds for suffer or have a chest allergy with increasing of Number of working hours daily >8 hours/day.

Table 4.13: Relation between Number of working hours daily *suffer or have trouble sleeping

عدد ساعات العمل يوميا * هل تعاني أو عانيت من اضطرابات في النوم؟ Cross tabulation

المجموع	هل تعاني أو عانيت من اضطرابات في النوم؟		
	لا	نعم	
21	2	19	عدد ساعات العمل يوميا 1-8 ساعات
20	8	12	اكثر من 8 ساعات
41	10	31	المجموع

Risk Estimate

95% Confidence Interval		Value	
Upper	Lower		
35.008	1.146	6.333	Odds Ratio for عدد ساعات العمل يوميا (1.00 / 2.00)
2.213	1.027	1.508	هل تعاني أو عانيت من اضطرابات في النوم؟ = نعم For cohort
.988	.057	.238	هل تعاني أو عانيت من اضطرابات في النوم؟ = لا For cohort
		41	N of Valid Cases

Table 4.13 shows that workers at risk by 1.50 folds for suffer or have trouble sleeping with increasing of Number of working hours daily >8 hours/day.

4.2.A.3 Surrounding Environment Questionnaire

A total of 83.1% of neighborhood saying that the station is about less than 200 meters from their workplace or houses. Also 41.5% of neighborhood saying that they have complained about having a strong smell emitted from the station. While 41.5% of neighborhood saying that they have complained about having breathing problems. Also a total of 47.7% of neighborhood saying that they have been bothered by the proximity of the station .While 64.6% of neighborhood saying that they feel addicted to the smell of petrol.

- 83.1% of neighborhood saying that the station is about less than 200 meters from their workplace or houses.
- 41.5% of neighborhood saying that they have complained about having a strong smell emitted from the station.
- 41.5% of neighborhood saying that they have complained about having breathing problems.
- 47.7% of neighborhood saying that they have been bothered by the proximity of the station.
- 64.6% of neighborhood saying that they feel addicted to the smell of petrol.

4.b Experimental Part

4.b.1 Biomarkers

In this section we collected 10 blood samples from petrol stations distributed in Hebron District as a convenience sample. Small sample was due to the cost and in this manner we did this part as a pilot study in order to maximize it in the future. These samples were collected by an medical laboratory expert and transferred to Al-Khaldi Medical Center Laboratories-Jordan through a local Medical Laboratory (Al-Eman Specialized Medical Lab in Hebron. In appendix (4)

These blood samples were tested for: Hematology (CBC, WBC, RBC, HGB), Lead (Pb) (Blood Lead Level BLL, Whole Blood (Atomic Absorption)), and Copper (Cu) (Copper Serum Level). Results of these tests are described in table 4.79. It seems that all tests were in normal range of concentration levels.

Table 4.14: Biomarkers (CBC) and(Lead ,Copper blood level) among workers

Sample no.	Hematology									
	RBC*		WBC**		HGB***		LEAD****		COPPER****	
	Results	Normal	Results	Normal	Results	Normal	Results	Normal	Results	Normal
1	5.41	4.7-6.1	7.1	4.8-10.8	17.4	14-18	5.38	<25	138.6	65-165
2	5.2		8.9		16.3		1.08		94.1	
3	5.3		9.9		16.8		3.22		137.3	
4	2.2		9.2		17.1		2.47		70.60	
5	5.01		7.0		16.2		2.17		156.8	
6	5.2		7.3		16.7		2.94		66.70	
7	5.2		7.3		16.8		0.76		111.0	
8	4.94		8.2		14.8		1.79		95.4	
9	5.42		6.4		17.1		3.98		87.60	
10	5.05		8.9		16.0		4.78		61.40	

* 10⁶/ul
 ** 10³/ul
 *** g/dl
 **** µg/dl

4.b.2 Emission

In this section we conducted different emission measurements in selected 5 petrol stations. In cooperation with the Environmental Quality Authority experts two types of measurements have been conducted: 1) on the filling machine (while filling vehicles) and 2) environment of the station. Device that used is multiple gas analyzer. The gas that have been measured were NO₂, SO₂, H₂S, NH₃, VOC, and CO. Results of these tests are described in table 4.80. Based on (NIOSH) these results were in normal level.

Results:

Table4.15 : Concentration of Emissions in the studied stations

Station no.	Sampling location	Temp	Humidity	Time	NO ₂	SO ₂	H ₂ S	NH ₃	VOC	CO
1	On filling	25 C	32%	10:30 AM	0.0	0.0	0.0	0.0	8-10	15
	Environment				0.0	0.0	0.0	0.0	7	5
2	On filling	25 C	32%	10:49AM	0.0	0.0	0.0	0.0	100	5
	Environment				0.0	0.0	0.0	0.0	64	4
3	On filling1	27C	26%	11:05AM	0.0	0.0	0.0	0.0	113	61
	Environment				0.0	0.0	0.0	0.0	12	4
4	On filling	28C	29%	11:20AM	0.0	0.0	0.0	0.0	119	23
	Environment				0.0	0.0	0.0	0.0	8	11
5	On filling	19C	29%	11:30AM	0.0	0.0	0.0	0.0	2	5
	Environment				0.0	0.0	0.0	0.0	6	7

Standard gas emission based on (NIOSH) :

- ✓ CO:25 ppm
- ✓ NO₂:3 ppm
- ✓ SO₂:0.5 ppb
- ✓ H₂S:1 ppm
- ✓ NH₃:25 ppm
- ✓ VOC:<150 g/l

4.5 Observational Results

According to the research team observations during visiting the studied stations, some notes were reported as follows:

- Most station owners were less educated.
- Lack of the personal protective equipment (PPE). All workers were not wearing any of these PPEs including masks, gloves, goggles, etc.
- Lack of guidance signs including instructions for customers and workers.
- Some workers were in teenage (less than 18 years old) which is forbidden to work based on the ministry of labor law.
- Moderately emission odor was noticed in some stations due to work load and number of vehicles mainly in rush time. Firefighting equipment were found in all studied stations.

4.7 Proposed Guidelines for Environmentally Friendly Petrol Stations Based on the Current Status of Stations in Hebron District

(See Appendix 3)

CHAPTER FIVE

CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusion

As a result and interpretation of our findings, we can conclude that:

- The stations that have been studied in this study were in almost items in line with different standards and criteria which required by the Authorized governmental bodies including Civil Defense and Petroleum Committee and others. Most of these stations were established for a long time in period in which there was no authority or monitoring body. After the establishing the Palestinian Authority several laws and by laws had been created and by these laws and regulations many improvements have been occurred on the status of these stations.
- Almost all studied stations were located in populated area which could be to the absence of authority while establishing for the oldest ones and due to political obstacles by Israeli occupation which restrict the investment by dividing areas into A, B, and C areas according to Oslo accord.
- Appropriate management of different kinds of wastes was lacking due to poor infrastructure design which could be resulted due to the absence of special engineering supervision even in both design and design implementation. This is in contradicting to the finding that most of the studied stations (80%) had been environmentally assessed because most EIA was conducted by non-specialized engineer (i.e., not environmental technology or environment engineer).
- For fuel tanks it was found that the fuel tanks were appropriately designed and protected but needs more supervision.
- It was found that most stations running continuous inspection and detection for leakage and any other shortage. All stations running regular maintenance program to inspect the fuel tanks.
- 50% of the studied stations among 20-30 meters distance between fuel tanks and drinking water sources. This distance is enough to protect the drinking water sources due to the fact that all fuel tanks are completely isolated and protectedly inspected for leakage and other shortcomings.

- Workers are at risk to the adverse health effects when work load is more than 8 hours per day and more vehicles that filled by workers.
- Adverse health effects can be reduced by providing PPEs as noticed as there is a lacking in using these PPEs by workers.
- Due to shortage in personnel and more clear regulations, some stations still hiring workers out of the allowed age (i.e., in some stations it was noticed that some workers can be considered as children working on filling machine which put them at risk).
- According to these findings and observations taken by the researchers a guideline with standard criteria could improve the situation of currently existed petrol stations and the future newly ones before and during establishing. This study try to do this by proposing a guideline that consists of all criteria that making petrol stations are more environmentally friendly which was the ultimate goal of the current study.

5.2 Recommendations'

1. The necessity of obligating the stations to the guidelines of the Petroleum and Civil Defense Authority.
2. The need for a mechanism to monitor the work of petrol stations and the possible environmental problems that may result from their activities.
3. The competent authorities shall periodically inspect the stations and their tanks with the necessary equipment for detection.
4. Urge the authorized authorities not to renew the license for the station without accredited report from one of the specialized institutions in the examination of tanks and delivery pipes to ensure that they are free of leakage..
5. To oblige the stations and companies to conclude contracts with specialized companies for the disposal of solid and liquid wastes in proper ways.
6. It is preferable to use auto and electronic devices in detecting leakage of ground tanks.

7. The mechanism to reuse the water resulting from car wash after being treated in ways that are cheap instead of disposed it in the public network of sewage.
8. Separation of solid waste from each other and work on recycling, which will have good environmental and economic effects
9. Work to raise awareness of the staff of the station on how to get rid of solid and liquid wastes in proper ways.
10. Urge station owners to work to protect workers from the adverse effects of pollution and to examine them medically periodically.

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APPENDICES

Appendices

APPENDIX (1) :

According to the Palestinian Civil Defense and Petroleum Authority list of safety requirements and prevention should be available in gas and petrol stations including the followings:

1- The nature of the land of the station (site description station).

A- Invested a gas station by the municipality, provisions are determined government sites, according to its regulations and instructions and not inconsistent with the requirements of these regulations.

B- Application requirements for fuel stations located on the regional roads contained in this regulation on stretches of regional roads with towns, villages and hamlets, which are maintained by the Ministry of Communication and coordination with the management of roads and transport in the region before the completion of licensing procedures.

C- Take into account the establishment of petrol stations as far away as possible from the factories, schools, hospitals and banquet halls that separates the plant site for these facilities distance of at least 25 m of twenty-five meters, whether planned or street or other land.

2- Fuel stations are divided into three categories:

2.1 **Category (A):** Large equipped station to supply all types of vehicles of all types of fuels and oils and service lubricants and car wash and an emergency electrical maintenance and maintenance of tires and provide meals and soft drinks, should the available prevention requirements following safety:

1. Shall not be less space for the site 2500 m².
2. However, at least the main interface of the site 60 m.
3. Establish a fence around the site required specifications and conditions.

4. Is not less than the distance between the ventilation holes from the nearest building public or private, or any origin of any kind for thirty meters

2.2 **Category (B)** : intermediate station equipped to provide all sorts of mechanisms of various hydrocarbons and require that the available prevention and safety requirements of the following:

1. Area of not less than 1200 m².
2. The main facade of not less than 40 m in length.
3. Establish a fence around the site required specifications and conditions.
4. Not be less than the distance between the ventilation holes and the nearest building public or private, or any other origin of any kind for 15 m.

2.3 **Category(C)** : small station equipped to supply all the cars that do not weigh more than the 15 tons types and requires the prevention and safety requirements of the following:

1. That at least the site for area is 600 m².
2. That at least display interface for the site 20 longitudinally meters.
3. Establish a fence around the site to the required specifications and conditions.
4. Not be less than the distance between the ventilation holes and the nearest building public and private, or any other facility of any kind for 15 m

Fuel Tanks:

1. Should be fuel tanks manufactured hand knowledge of specialized technical licensed to it, and its products are approved by the Palestinian Authority for Standardization and Metrology.
2. Is the installation of reservoirs beneath the earth's surface above the base of reinforced concrete according to engineering specifications and technical sides of

- the tank are surrounded in the hole with concrete, sand or any other article against corrosion.
3. Reservoirs are painted with paint blocker to eat and against water before installation.
 4. The pipes bear temperatures during exposure to fire and be protected appropriate ways.

Fuel Pumps:

1. Should be the fuel pump technically designed so as to prevent the constant flow of fuel by more than 91 liters per operation.
2. Must work suitable to the floor of the work area streams with taking the necessary precautions to prevent the fuel leak in the drain pipes station

Electrical Arrangements:

1. Should be in conformity with the technical specifications of the Palestinian
2. Must be done to avoid contact between the wiring and electrical arrangements and any equipment or tubing used in the fuel transfer.
3. Be installed electrical wiring in several places to prevent exposure to mechanical or heat, and solvent effect of the damage.
4. Cables not placed inside the pipe passing through a wall or floor or break or the roof needs to be allocated to them to fill the hole for the passage of the pipe with concrete or any other material non-combustible.
5. To be lighting and ventilation Court.

Fire fighting and prevention and control: precautions against fire:

- A- 1. Put up signs warning banning smoking inside the station.**
2. The fuel is not used at all in the cleaning.
 3. Remove scattered fuel immediately.

4. Prevents the existence of the causes of the fire and flammable materials the station is also prohibited at all to do cutting or welding that may entail occurrence of sparks or electrical arc.

B- Means of warning:

1. Shall provide the terminal device automatic alarm linked with reagents especially in places that are determined by the General Directorate of Civil Defense.

General Requirements:-

Must be available methods for car fire extinguishers, and that the field is surrounded by reservoirs along the wall from the inside by way of the progress of the fire vehicles and corridors of the arrival of another crossing so that:

2. Not be less than a width of 3 m.
3. The durability suitable for all seasons of the year.
4. Enables the car approaching from a distance 30 m from the fuel tank.
5. Are the bays of the nearby parked cars for every 100 m.

Appendix(2):

الاستبيان



كلية الهندسة الميكانيكية / قسم هندسة تكنولوجيا البيئة

أخي/أختي

السلام عليكم ورحمة الله وبركاته وبعد،

تقوم الباحثات بإجراء دراسة بعنوان "تقييم أثر بيئي لمحطات الوقود واثارها على العاملين والسكان المجاورين في محافظة الخليل"، وذلك استكمالاً لمتطلبات الحصول على درجة البكالوريوس تخصص هندسة تكنولوجيا البيئة، لذا نرجو منك التكرم بالإجابة على فقرات هذا الاستبيان بما يتلاءم مع وجهة نظرك والباحثات إذ يشكرن لك جهودك لتؤكد لك أن هذه الدراسة ستستخدم لأغراض البحث العلمي فقط.

شكرا لكم حسن تعاونكم

الباحثات: اصالة العيايدة

جمانة الشرباتي

غدير الفقيه

المشرف : د. ياسر عيسى

القسم الأول: معلومات عامة

الرجاء وضع إشارة (✓) داخل مربع الإجابة الذي تراه مناسباً.

- الجنس ذكر أنثى
- العمر (20) سنة فأقل من (21-40) سنة من (41-50) سنة أكثر من (50) سنة
- مكان السكن قرية مخيم مدينة

القسم الثاني : معلومات عن محطة الوقود

- 1- تاريخ انشاء المحطة ؟ _____
- 2- لمن تتبع ملكية المحطة ؟ افراد شركات محلية
- 3- ما هو تصنيف المحطة ؟ أ ب ج
- 4- موقع المحطة ؟ سكني صناعي زراعي طريق سريع
- 5- ما هي نشاطات المحطة ؟ تعبئة وقود غيار اطارات غيار زيت
- ورشة صيانة غسيل وتشحيم سيارات جميع ما ذكر
- 6- هل تم انشاء المحطة بواسطة : مقال متخصص مقال عام
- اخرى حدد : _____
- 7- هل تم الاشراف على المحطة بواسطة مكتب هندسي متخصص ؟ نعم لا
- 8- هل تم عمل تقييم اثر بيئي للمحطة قبل الانشاء ؟ نعم لا
- 9- من اين تم الحصول على ترخيص وتصريح بإنشاء المحطة ؟ _____
- 10- بالنسبة للمسؤول والمشرف على المحطة .. ما هو المستوى التعليمي ؟ _____
- وعدد سنوات الخبرة ؟ _____

11- بالنسبة للعمال .. هل اتطلعتم على اللوائح والاشتراطات التي تخص محطات الوقود (الدفاع المدني وهيئة البترول

(؟ نعم لا

الجزء الثالث : نفايات المحطة (سائلة وصلبة)

1- ما هي انواع المخلفات الصلبة للمحطة ؟ اطارات بطاريات علب فارغة

قطع غيار تالفة كل ما ذكر

2- ما هي كمية المخلفات الصلبة (كغم / يوم) المنتجة بالمحطة تقريبا ؟ _____

3- هل يتم فصل المخلفات الصلبة في عبوات خاصة ؟ نعم لا

4- ما هي الطرق المتبعة للتخلص من هذه النفايات ؟ _____

5- ما هي انواع المخلفات السائلة للمحطة ؟ زيوت سيارات زيوت تشحيم مواد كيميائية

مياه غسل السيارات كل ما ذكر

6- ما هي كمية المخلفات السائلة (لتر / يوم) التي تنتجها المحطة تقريبا ؟ _____

7- هل توجد شبكة للصرف الصحي في المحطة ؟ نعم لا

8- هل توجد مصائد ومصفاة للزيوت قبل تصريفها بالشبكة ؟ نعم لا

9- هل توجد خزانات خاصة لتجميع مخلفات الزيوت ؟ نعم لا

10- ما هي الطرق المتبعة للتخلص من النفايات السائلة بالمحطة ؟ _____

الجزء الرابع : الخزانات الارضية بالمحطة

1- كم عدد الخزانات الارضية في المحطة ؟ البنزين _____ الديزل _____

2- ما هي سعة الخزانات الارضية (لتر) ؟ البنزين _____ الديزل _____

3- ما هي المواد المصنوع منها الخزان ؟ البنزين _____ الديزل _____

4- ما هي المواد المصنوع منها انابيب التوصيل بين المحطات والخزانات ؟

البنزين _____ الديزل _____

5- ما هي المواد التي تم بها طلاء الخزان من الداخل ؟ البنزين _____ الديزل _____

6- ما هو عمق دفن الخزان تحت الارض (م) ؟ البنزين _____ الديزل _____

7- هل الخزانات مدفونة في غرف خرسانية (نعم / لا) ؟ البنزين _____ الديزل _____

8- هل يتوفر لديكم نظام مراقبة لخزانات الوقود ؟ نعم لا

9- هل يتم الكشف عن تسرب بالخزانات ؟ نعم لا

10- من الذي يقوم بالكشف عن تسرب الخزانات ؟ _____

11- ما هي الطرق المتبعة بالكشف عن تسرب الخزانات ؟ _____

12- هل يتم الكشف عن وجود تسرب في شبكات توصيل الوقود من الخزانات الارضية ؟ نعم لا

13- هل يوجد برامج صيانة دورية للكشف عن الخزانات ؟ نعم لا

الجزء الخامس : أ) الناحية البيئية (داخل المحطة والعمال)

1- هل سبق وان حدث حريق في المحطة ؟ نعم لا

2- هل سبق ان حدث تسرب بالخزانات الارضية ؟ نعم لا

في حال حدث تسرب .. متى كان ؟ _____ وكيف

تمت معالجة المشكلة ؟ _____

3- هل سبق وان حدث تسرب للوقود اثناء تفريغه في الخزانات الارضية ؟ نعم لا

4- هل سبق ان حدث تسرب للوقود من المضخات الارضية اثناء تعبئة المركبات ؟ نعم لا

5- كم تبعد الخزانات عن شبكة مياه الشرب (م) ؟ _____

6- هل لاحظتم مره تغيرا في طعم او لون او رائحة مياه الشرب ؟ نعم لا

7- هل يتم مراقبة وقياس الابخرة المتصاعدة من الخزانات ومضخات الوقود ؟ نعم لا

8- هل يوجد نظام لسحب الابخرة المتصاعدة من الخزانات ومضخات الوقود ؟ نعم لا

العمال :

معلومات عامة

الرجاء وضع إشارة (✓) داخل مربع الإجابة الذي تراه مناسباً.

الجنس : ذكر أنثى

العمر : (20) سنة فأقل من (21-40) سنة من (41-50) سنة أكثر من (50) سنة

مكان السكن : قرية مخيم مدينة

1- تقريبا كم عدد المركبات التي يملأها كل عامل بالمحطة يوميا ؟ _____

2- ما هو عدد ساعات العمل يوميا _____

3- ما هي المدة التي تستغرقها تعبئة السيارة بالوقود: المعدل (..... دقيقة)

4- هل تعاني أو عانيت من مشكلة في التنفس (ضيق تنفس) ؟ نعم لا احيانا

5- هل عانيت أو تعاني من التهاب الاغشية المخاطية للأنف (جفاف او انغلاق المجاري التنفسية) ؟ نعم لا

احيانا

6- هل تعاني أو عانيت من حساسية في الصدر؟ نعم لا احيانا

7- هل عانيت أو تعاني من مشاكل صحية في الجلد؟ نعم لا احيانا

8- هل عانيت أو تعاني من التعرق الغزير؟ نعم لا احيانا

9- هل عانيت أو تعاني من الكسل أو الخمول؟ نعم لا احيانا

10- هل عانيت أو تعاني من مشاكل صحية في معدتك (حموضة مرتفعة، التهابات؛ حرقة)؟ نعم لا

11- هل عانيت أو تعاني من مشاكل صحية في الاثني عشر (التهابات)؟ نعم لا احيانا

12- هل عانيت أو تعاني من التوتر الزائد؟ نعم لا احيانا

- 13- هل تعاني او عانيت من مشاكل صحية في الكلى؟ نعم لا احيانا
- 14- هل عانيت او تعاني من مشاكل صحية في الكبد؟ نعم لا احيانا
- 15- هل عانيت او تعاني من مرض النقرس؟ نعم لا احيانا
- 16- هل عانيت او تعاني من ازمة او ربو؟ نعم لا احيانا
- 17- هل عانيت او تعاني من دوخة (دوار)؟ نعم لا احيانا
- 18- هل عانيت او تعاني من تشنجات او رعشة؟ نعم لا احيانا
- 19- هل عانيت او تعاني من غشاوة في البصر؟ نعم لا احيانا
- 20- هل عانيت او تعاني من سرعة ضربات القلب؟ نعم لا احيانا
- 21- هل عانيت او تعاني من اضطرابات في النوم؟ نعم لا احيانا
- 22- هل عانيت او تعاني من مشاكل في الانجاب؟ نعم لا احيانا
- 23- هل تشعر بالادمان على رائحة الوقود؟ نعم لا
- 24- هل يتم فحص دوري للعاملين بالمحطة؟ نعم لا

(ب) المجاورين (خارج المحطة)

معلومات عامة

الرجاء وضع إشارة (✓) داخل مربع الإجابة الذي تراه مناسباً.

الجنس : ذكر أنثى

العمر : (20) سنة فأقل من (21-40) سنة من (41-50) سنة أكثر من (50) سنة

مكان السكن : قرية مخيم مدينة

1. كم تبعد اقرب محطة عن مكان سكنك او عملك (م) ؟ _____
2. هل سبق ان اشتكيت على وجود رائحة قوية منبعثة من المحطة ؟ نعم لا
3. هل سبق وعانيت من مشكلة في التنفس ؟ نعم لا مشاكل صحية اخرى
4. هل سبق وعانيت من الازعاج بسبب قرب المحطة منك ؟ نعم لا
5. هل لاحظت مره تغيرا في طعم او لون او رائحة مياه الشرب الخاصة ببيتك او مكان عملك ؟ نعم لا
6. هل تشعر بالإدمان على رائحة الوقود ؟ نعم لا
7. هل شعرت بأن لون التربه المحيطة بك تغير لونها ؟ نعم لا

Appendix (3):

مقترح قواعد وإرشادات السلامة في محطات الوقود

تحتوي محطات الوقود على العديد بأنواع من السوائل القابلة للاشتعال التي تختلف درجة قابلية كل منها على الاشتعال، باختلاف نوع السائل وتركيبه.

لذلك تعتبر أماكن العمل بمحطات الوقود من الأماكن الشديدة الخطورة، وبالتالي فإنها تتطلب اهتماماً كبيراً ورعاية خاصة.

ولوقاية المنتجين وجميع العاملين بها من المخاطر والحوادث المحتملة، وللمحافظة على المال العام. لذلك يجب تطبيق جميع قواعد وإرشادات السلامة والصحة المهنية، ومتابعة ومراقبة ذلك، واتخاذ كافة الإجراءات الصارمة لتطبيق هذه القواعد .. وهي كالتالي :

البناء :

- 1- يجب عمل تقييم اثر بيئي للمحطة قبل الانشاء
- 2- يجب وضع جميع خزانات الوقود تحت الارض
- 3- يجب عمل طبقة واقية من الدهان لجميع الخزانات الارضية لحمايتها من التربة ومن التآكل ايضا
- 4- ينبغي عمل تحليل مسبق للتربة في الموقع لمعرفة كثافتها ومقاومتها للضغط وعمق اقرب مياه جوفيه للمحطة ايضا حتى يتم التأكد من بعد المياه الجوفيه عن الخزانات الارضية
- 5- التأكد من سلامة الانابيب والخزانات بعمل عدة اختبارات
- 6- بناء المحطة ضمن مقاييس عديده من حيث البعد عن المناطق السكنية وعن الشارع الرئيسي

الخزانات الارضية :

- 1- من الضروري أن تكون خزانات الوقود في المحطات مرخصة بحيث تتوافق مع المعايير التي تلبي السلامة المهنية والصحة وحماية البيئة.
- 2- يجب ان تكون الخزانات مصنعة بمعرفة جهة فنية متخصصة مرخصا لها بذلك ومعتمدة ايضا
- 3- يجب وضع خزان تحت الارض لكل منتج بترولي سعته على الاقل 5متر مكعب
- 4- طلاء الخزانات ولانابيب بمادة واقية من تأثير التربة
- 5- ان يكون للخزان فتحات للتهوية وللملء و التفريغ
- 6- يجب الاستعانة بمتخصصين لمراقبة هذه الخزانات باستمرار
- 7- ان يكون للخزان وسيلة لمعرفة كمية الوقود فيه
- 8- ان يكون لكل خزان رقم يميزه للتعرف عليه
- 9- اذا تعددت الخزانات , يجب ان تترك مسافة مناسبة بين كل خزان والاخر بمسافة لا تقل عن 1 متر
- 10- ان تكون المواد الداخلة في صناعة الخزان ملائمة لنوعية المادة البترولية التي ستوضع به
- 11- ان تكون ماسورة التهوية للخزان عالية , اعلى من أي مبنى مجاور لها

- 12- ان يتم تركيب الخزانات الارضية فوق قاعدة من الخرسانة المسلحة وفق المواصفات الهندسية وهذا ما تفتقده محطات الوقود في محافظة الخليل
- 13- الخزانات المصنوعة من الحديد والتي تكثر في محافظة الخليل , لا تجدد ولا يعمل لها صيانة بل يجب ان يتم تغييرها

حماية الخزانات الارضية :

- 1- يجب دهان الانابيب المعرضة للتآكل من الخارج
- 2- استخدام حديد ستانلس ستيل ولكن استخدامه قليل نظرا لأرتفاع تكاليفه
- 3- يردم حول الخزانات بالرمل التنظيف او الحصى الصغيره من جميع الجهات

فتحات التهوية :

- 1- يجب عمل فتحات تهوية بحجم مناسب
- 2- يجب ان تنتهي فتحات التهوية في الهواء الطلق أي في اماكن لا تسمح بتراكم الغازات القابلة للاشتعال

مكافحة الحريق :

- 1- يجب وضع طفايات حريق (chemical powder) بكميات مناسبة (تقريبا 9 كغم) , على مقربة من العمال ويسهل الوصول اليها في حال حدوث حريق
- 2- منع التدخين داخل المحطة سواء من العمال او من السائقين القادمين للمحطة
- 3- التقليل من استخدام الهاتف الخليوي , في حال الاضطرار لأستخدامه ان يتم استخدامه داخل المباني
- 4- يجب تخزين مياه وامدادات حريق بكميات كافية لمدة 6 ساعات على الاقل بحالة نشوب حريق بالمحطة
- 5- يجب تركيب نظام مزود للمياه حول المحطة حتى يسهل الوصول اليه في حالة نشوب حرائق

بيئيا :

- 1- عمل تقييم اثر بيئي للمحطة قبل البناء والترخيص
- 2- التأكد من بعد الابار الجوفيه عن اماكن دفن الخزانات الارضية
- 3- التأكد من سلامة الصهريج المزود للسيارات بالوقود لتلافي تسرب الوقود الى ارضية المحطة
- 4- يجب على صاحب المحطة اتخاذ التدابير اللازمة لضمان عدم تسرب او انبعاث ملوثات الهواء داخل اماكن العمل الا في حدود المقاييس البيئية المسموح بها
- 5- يجب عمل مراجعة بيئية دورية على الخزانات الارضية بأستمرار
- 6- تجنب تسرب الوقود الى شبكة المجاري
- 7- منع تسرب مواد خطيرة كالرصاص والمطاط الى التربة في حال وجود هذه المواد
- 8- منع تكديس المخلفات الصلبة داخل المحطة
- 9- منع تسرب مياه غسيل السيارات الى شبكة المجاري وارضية المحطة

- 10- يفضل زرع اشجار حول المحطة قدر الامكان حتى تحد من تركيز الانبعاثات الناتجة عن الوقود ولأهداف جمالية ايضا
- 11- منع تكدس علب الزيت الفارغة في المحطة وذلك لأضرارها البيئية الكبيره
- 12- يجب للاماكن المغلقة والشبه مغلقة ان تكون مستوفية لوسائل التهويه الكافيه

المخلفات :

أ- المخلفات الصلبة :

- 1- ان يقوم مدير المحطة بالتعاقد مع مقاول لجمع هذه المخلفات اما لإعادة استعمالها او لتدويرها
- 2- المخلفات الصلبة التي لا يمكن اعادة تدويرها فقد يقوم صاحب المحطة بالتخلص منها بنفسه بدفنها في مكبات او محارق معدة خصيصا لهذا الغرض
- 3- منع تكدس المخلفات الصلبة داخل المحطة والتخلص منها بانتظام وبشكل مستمر

ب- المخلفات السائلة :

- 1- التأكد من وجود مصائد لجمع المخلفات السائلة في خزانات مخصصة لذلك , من ثم التخلص منها عن طريق شركة خدمات بيئية متخصصة
- 2- عمل نظام فصل للزيوت قبل التخلص منها في شبكة المجاري العامة
- 3- تجنب تسرب مياه غسيل السيارات لأرضية المحطة والترتبة

العاملين :

- 1- عدم توظيف أي عامل قبل التأكد من حصوله على دوره في اعمال السلامة
- 2- توفير جميع وسائل الحماية والسلامة الخاصة بالعاملين داخل المحطة من واقى وجه و لباس خاص وغيره بحيث يحميهم من أي ضرر ممكن ان يتعرض له العامل
- 3- توفير عدة الاسعاف الاولي بمقربة من العمال في حال حدوث أي اصابة لأي عامل لا سمح الله