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**Assessment of Domestic Electricity Generators Hazards in
Jabalia Camp, Gaza Strip**

**Submitted by
Wael Abdul Majeed Okasha**

M.P.H Thesis

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Jabalia Camp, Gaza Strip**

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**Deanship Of Graduate Studies
Al-Quds University
School of Public Health**



Thesis Approval

**Assessment of Domestic Electricity Generators Hazards in Jabalia Camp,
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2012 / 1433

عن أبي سعيد الخدري رضي الله عنه أن رسول الله صلى الله عليه وسلم قال:

﴿ لا ضرر ولا ضرار ﴾

حديث حسن

Dedication

I dedicate this study to the memories of my parents, who scarified their lives for me.

To my wife for her endless patience and support during my study.

To my sons: Mohammed, Abdul Majeed and Bassam, who have been my largest source of inspiration.

To my brothers, sisters and their children for their unwavering support.

To my uncles and aunts.

Thank you all from the bottom of my heart. I express to you all my sincere love and appreciation.

Wael Abdul Majeed Okasha

Declaration

I certify that this thesis submitted for the degree of master is the result of my own research, except where otherwise acknowledged, and that this thesis or any of its parts has not been submitted for higher degree to any other university or institution.

Signed

Wael Abdul Majeed Okasha

Date: / /

Acknowledgment

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Wael Abdul Majeed Okasha

List of Abbreviations

ACGIH	The American Conference of Governmental Industrial Hygienists
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CPSC	Consumer Product Safety Commission
DB	Decibel
DEG	Domestic Electricity Generators
EPA	Environmental Protection Agency
GPP	Gaza Power Plant
GS	Gaza Strip
IAPA	Industrial Accident Prevention Association
IARC	The International Agency for Research on Cancer
JRC	Jabalia Refugee Camp
MOH	Ministry of Health
MW	Mega Watt
NIOSH	National Institute for Occupational Safety & Health
OHS	Occupational Health Safety
OSHA	Occupational Safety And Health Administration
PA	Palestinian Authority
PCBS	Palestinian Central Bureau of Statistics
PEL	Permissible Exposure Limit
PPM	Part Per Million
REL	Recommended Exposure Limit
TWA	Time Weighted Average
UNEP	United Nation Environment Program
UNRWA	United Nation Relief and Works Agency
UPS	Uninterruptible Power Supply
WB	West Bank
WHO	World Health Organization

Abstract

This study titled "Assessment of Domestic Electricity Generators Hazards in Jabalia Camp, Gaza Strip" was conducted in the year 2011 in Jabalia Camp. The domestic electricity generators has be come a cause for different health and environmental hazards in particular emission gases and noise pollution. The study aimed to assess the health/environmental hazards of domestic electricity generators on the population in Jabalia camp.

Methodology: *A descriptive analytic cross sectional study was conducted on the houses in Jabalia Refugee Camp that have electricity generators using face to face questionnaire. A total of 265 questionnaires were distributed to the study population using two stages sampling method (stratified then random) A sum of 260 questionnaires were received with a response rate of 98%. The researcher used the SPSS, processing and analyzing the data. The percentage of CO concentration in the air was measured about half meter away from the exhaust of the generator by Mini Worn device. Then, the noise pollution level was measured by Sound Level Meter device from the place where the family gathers.*

Results: *The results revealed that the percentage of the age of the person who operates the generator of the sample is 6.2% of less than 14 years; about 10.4% of the respondents place their generator inside the house. In addition, 7.7% had accidents caused by the generator at house, and 65% of the incidents were fires, 20% were explosions, and 15% were due to electric shocks. Also, one fatality case was reported. The complaints among the study population were as follow, nervousness 16.7%, headache 15.4%, breathing difficulty 13.7%, dizziness 12.4%, chest pain 12.1%, sleeping disturbances 9.3%, coughing 7.4%, tremor in extremities 7.0%, and loss of balance 6.0%. About 16.2% feel that they had negative changes in the hearing level for at least one family member in the last four years, and 96.5% of the study population think that noise pollution affects on their sleeping. The concentration level of CO as follow: 0.1% in the 42.3% of the study population, 0.05% in the 31.2% of them, and 0.01% in the 26.5% of the sample. Also, the noise pollution level in decibel were:61-90 db in 52.3% of the study population, and 31-60 db in 47.7% of the study population. The results showed that, there is statistically significant relationship between the carbon monoxide and the headache, with a p-value of 0.035, and between the noise pollution level and hearing problems due to the last four years, with a p-value of 0.049.*

Recommendations: *The study provided a set of recommendations such as authorities are urge to make the effort required to accelerate the process of solving the issue of power cuts in Gaza Strip as soon as possible, generators should placed as far as possible from the people, reduce number of operation hours, the age of the person who operates the generators should not be less than 20 years old. and conducting of educational extension programs.*

Table of Contents

No.	Subject	Page
	Dedication	V
	Declaration	VI
	Acknowledgement	VII
	List of Abbreviations	VIII
	Abstract in English	IX
	Table of Contents	X
	List of Tables	XIV
	List of Figures	XV
	List of Annexes	XVII
Chapter I : Introduction		
1.1	Research background	1
1.2	Problem statement	3
1.3	Justification of the study	4
1.4	Aim of the study	5
1.5	Specific objectives	5
1.6	Context of the study	5
1.6.1	Geographic & demographic context	5
1.6.2	Socioeconomic status	6
1.6.3	Health status	6
1.7	Operational definitions	7
Chapter 2 : Literature review		
2.1	Conceptual framework	9
2.1.1	Emissions	10
2.1.2	Misuses	10
2.1.3	Noise	10
2.2	Literature review	12
2.2.1	Portable generators hazards	12
2.2.2	Surviving with portable generators in Gaza	13
2.2.3	Carbon Monoxide	13
2.2.4	Sources of carbon monoxide in the environment	14
2.2.5	Health effects associated with carbon monoxide	15

No.	Subject	Page
2.2.6	Carbon monoxide exposure standards	16
2.2.7	Benzene	17
2.2.8	Health effects of benzene	17
2.2.9	Lead	18
2.2.10	Lead poisoning and its impact on public health & environment	18
2.2.11	The most common misuses of electricity generators in Gaza Strip	20
2.2.12	Misuse of portable generators can be deadly	20
2.2.13	Safety tips to prevent misuse of portable electricity generators	21
2.2.14	Noise pollution	22
2.2.15	Sources of noise pollution	22
2.2.16	The effects of noise pollution	22
2.2.17	Noise level standard	23
2.2.18	The use of electricity generators in Iraq	24
2.2.19	Portable generators related deaths in the United States	25
Chapter 3 : Methodology		
3.1	Study design	27
3.2	Study population	27
3.3	Sample size	27
3.4	Study settings	27
3.5	Period of the study	28
3.6	Eligibility	28
3.6.1	Selection criteria	28
3.6.1.1	Inclusion criteria	28
3.6.1.2	Exclusion criteria	28
3.7	Ethical & administrative considerations	28
3.8	Tools of the study	28
3.8.1	Devices were used	29
3.8.2	The questionnaire	29
3.8.2.1	Content validity	29
3.8.2.2	Pilot study	29
3.9	Data collection	30
3.10	Response rate	30
3.11	Data statistical analysis	30

No.	Subject	Page
3.12	Limitations of the study	30
Chapter 4 : Results and discussion		
4.1	Characteristics of the study population	31
4.1.1	Personal data	31
4.1.2	Housing conditions & environment	35
4.1.3.1	Awareness & knowledge of the dangers posed by the misuse of the generators	37
4.1.3.2	Awareness & knowledge of the dangers posed by the misuse of the generators	40
4.1.3.3	Awareness & knowledge of the dangers posed by the misuse of the generators	43
4.1.3.4	Awareness & knowledge of the dangers posed by the misuse of the generators	47
4.1.4.1	Health effects of emissions	49
4.1.4.2	Health effects of emissions	51
4.1.5	Health effects of noise pollution	53
4.1.6	Measurements	54
4.2	Analysis of the relationships between variables	55
4.2.1	The concentration level of CO and the capacity of the generator	55
4.2.2	The noise pollution level in db and the capacity of generator	55
4.2.3	The concentration level of CO and the working condition of the generator	56
4.2.4	The noise pollution level in db and the working condition of the generator	56
4.2.5	The concentration level of CO and the fetal deaths	57
4.2.6	The concentration level of CO and the chronic diseases	57
4.2.7	The concentration level of CO and the headache	58
4.2.8	The concentration level of CO and the dizziness	58
4.2.9	The concentration level of CO and the tremor in the extremities	59
4.2.10	The concentration level of CO and the loss of balance	59
4.2.11	The concentration level of CO and the nervousness	60
4.2.12	The concentration level of CO and the difficulty breathing	60
4.2.13	The concentration level of CO and the chest pain	61
4.2.14	The concentration level of CO and coughing	61
4.2.15	The concentration level of CO and sleep disorder	62
4.2.16	The concentration level of CO and the respiratory diseases	62
4.2.17	The concentration level of CO and the eye diseases	63
4.2.18	The concentration level of CO and the skin diseases	63
4.2.19	The noise pollution level in db and the hearing problems	64

No.	Subject	Page
4.2.20	The noise pollution level in db and the nervous/psychological tension	64
4.2.21	The noise pollution level in db and the sleeping patterns	65
4.2.22	Summary of the relationship between carbon monoxide and noise pollution with the health impact	65
4.3	Discussion	66
4.3.1	Characteristics of the study population- personal data	66
4.3.2	Housing conditions & environment	66
4.3.3	Awareness and knowledge of the dangers posed by the misuse of the generator	66
4.3.4	Measurements	69
Chapter 5 : Conclusions & recommendations		
5.1	Conclusions	71
5.2	Recommendations	74
	References	76
	Annexes	82

List of Tables

Table 2.2.1	Acute effects produced by CO in relation to ambient concentration in ppm	16
Table 2.2.2	The Palestinian standards for outdoor noise in the different areas	23
Table 4.1.1	Personal data	31
Table 4.1.2	Housing conditions & environment	35
Table 4.1.3.1	Awareness & knowledge of the dangers posed by the misuse of the generator	37
Table 4.1.3.2	Awareness & knowledge of the dangers posed by the misuse of the generator	40
Table 4.1.3.3	Awareness & knowledge of the dangers posed by the misuse of the generator	43
Table 4.1.3.4	Awareness & knowledge of the dangers posed by the misuse of the generator	47
Table 4.1.4.1	Health effects of emissions	49
Table 4.1.4.2	Health effects of emissions	51
Table 4.1.5	Health effects of noise pollution	53
Table 4.1.6	Measurements	54
Table 4.2.1	The concentration level of CO and the capacity of the generator	55
Table 4.2.2	The noise pollution level and the capacity of the generator	55
Table 4.2.3	The concentration level of CO and the working condition of the generator	56
Table 4.2.4	The noise pollution level and the working condition of the generator	56
Table 4.2.5	The concentration level of CO and the fetal deaths	57
Table 4.2.6	The concentration level of CO and the chronic diseases	57
Table 4.2.7	The concentration level of CO and the headache	58
Table 4.2.8	The concentration level of CO and the dizziness	58
Table 4.2.9	The concentration level of CO and the tremor in the extremities	59
Table 4.2.10	The concentration level of CO and the loss of balance	59
Table 4.2.11	The concentration level of CO and the nervousness	60
Table 4.2.12	The concentration level of CO and the difficulty breathing	60
Table 4.2.13	The concentration level of CO and the chest pain	61
Table 4.2.14	The concentration level of CO and coughing	61
Table 4.2.15	The concentration level of CO and sleep disorder	62
Table 4.2.16	The concentration level of CO and the respiratory diseases	62
Table 4.2.17	The concentration level of CO and the eye diseases	63
Table 4.2.18	The concentration level of CO and the skin diseases	63
Table 4.2.19	The noise pollution level and the hearing problems	64
Table 4.2.20	The noise pollution level and the nervous/psychological tension	64
Table 4.2.21	The noise pollution level and the sleeping patterns	65
Table 4.3.4.1	The results on the concentration of CO in ppm	69

List of Figures

Figure 2.1	Conceptual framework of the research study	9
Figure 4.1	Distribution of the study population according to gender	32
Figure 4.2	Distribution of the study population according to age group	32
Figure 4.3	Distribution of the study population according to monthly income	33
Figure 4.4	Distribution of the study population according to education level	33
Figure 4.5	Distribution of the study population according to family members	34
Figure 4.6	Distribution of the study Population according to the house type	36
Figure 4.7	Distribution of the study Population according to the status of house ventilation	36
Figure 4.8	Distribution of the study Population according to the age of the person who operates the generator	38
Figure 4.9	Distribution of the study Population according to the familiarity with operating the generator	39
Figure 4.10	Distribution of the study Population according to the location of the generator while it is running	41
Figure 4.11	Distribution of the study Population according to the fueling the generator while it is running	44
Figure 4.12	Distribution of the study Population according to the fueling the generator while smoking	44
Figure 4.13	Distribution of the study Population according to the location of fuel stored	45
Figure 4.14	Distribution of the study Population according to disconnecting the generator before switching it off	46
Figure 4.15	Distribution of the study Population according to the hands washing after fueling the generator	48
Figure 4.16	Distribution of the study Population according to the accidents caused by the generator	48
Figure 4.17	Distribution of chronic diseases among the study population	52

List of Annexes

Annex 1	Power Supply in Gaza Strip	82
Annex 2	Map of Palestine	83
Annex 3	Map of Gaza Strip	84
Annex 4	Approval from Helsinki	85
Annex 5	Approval from UNRWA	86
Annex 6	Approval from Ministry of Labor	87
Annex 7	Sound Level Meter	88
Annex 8	Questionnaire in Arabic	89
Annex 9	Questionnaire in English	94
Annex 10	Panel of experts	99
Annex 11	Questionnaire picture	100
Annex 12	Questionnaire picture	101
Annex 13	Questionnaire picture	102
Annex 14	Arabic abstract	103

Chapter 1: Introduction

1.1 Research Background

The United Nations Relief and Works Agency (UNRWA) reported that the crisis of power cuts has affected on all aspects of life in the Gaza Strip (GS) mainly household tasks, health services, education, and water and sanitation services. Since January 2010, there has been a serious decline in the supply of electricity in GS. The main reason is that Gaza's power plant (GPP) (Annex 1), is able to produce only half the electricity that it did prior to January 2010, due to a lack of funds needed to purchase the industrial fuel required to operate the plant.

As a result, almost all of the 1.6 million Palestinians residing in the GS, with the exception of those who live in the Rafah area, must cope with scheduled electricity cuts of 8-12 hours daily, compared to 6-8 hours prior to January 2010. These power cuts exacerbate the already difficult living conditions in Gaza and interrupt almost all aspects of daily life (OCHA, 2010).

The GPP now produces only 30 mega watt (MW) of electricity compared to an average of 120-140 MW in early 2006. The decline began in June 2006, when the Israeli Air Forces destroyed all six transformers at the GPP. Five months later, the power plant resumed production, but at a significantly reduced level of 65 MW, at peak production. Then there was the siege that Israeli occupation imposed in June 2007 following the Hamas take-over. The siege further tightened existing restrictions on imports, including spare parts and the amount of industrial fuel required for the plant's operations. Finally, in January 2010, the daily electricity deficit has increased further, following the expiration of the European Commission's direct subsidy to the fuel purchase for the GPP (OCHA, 2010).

People in GS started looking for ways to get through the prolonged hours without electricity, especially during evening blackouts. One of the solutions they found was the portable back-up electricity generators. These generators, which are smuggled mostly through the tunnels under Gaza's border with Egypt, can be unsafe, especially when used incorrectly. Moreover, accidents have happened as a result of poor usage, carbon monoxide (CO) poisoning, fires and explosions occurring when people attempt to fuel the generators by candle-light during a blackout (OCHA, 2010).

In the first quarter of 2010, 17 people were killed and 36 injured in accidents caused by the portable generators. Among the casualties were three children killed from CO poisoning and three other children killed when a fire broke out while pouring fuel into a generator (Hassaneen, 2010).

The suffering of people is going on as the crises of the interruption of the electricity supply which sometimes exceeds eight hours per day. The crisis is aggravated and its dangerous impacts becoming worse affecting the health, educational, and living sectors. Furthermore, this crisis which still exists until now, have affected the schools with its students, hospitals and patients and people with their needs. Therefore, portable electricity generators availability has become one of the essential needs for many people in the GS especially in the Jabalia Refugee Camp (JRC). This phenomenon has become widely spread since interruption of the electricity (OCHA, 2010).

Daily power cuts disrupt sewage treatment and hinder the completion of the treatment cycle, which requires 14 days of uninterrupted power supply. Partially treated and untreated sewage is then discharged into the environment. Gaza's water authorities release 60-80 million liters a day of raw and partially treated sewage into the Mediterranean Sea, in order to avoid sewage flooding residential areas. Water supply for domestic use is insufficient because the pumps cannot be operated continuously. Almost all the households receive water for only 5-7 hours a day which causes hygiene and health problems. Another area that is negatively affected by the power cuts is the educational environment, both at school and at home. Firstly, studying in darkened classrooms affects student's ability to concentrate as does the sound, smoke and smell from generators. Secondly, in schools without generators, students lose practical classes in science and technology, since computer labs are not functioning. Thirdly, power cuts also affect educational aids used for remedial classes, reducing the efficiency of remedial education, and in training sessions for teachers. Also, food for school canteens cannot be stored adequately as refrigeration cannot be maintained. Finally, water shortage in schools results in dirty latrines and a lack of water for hand washing (OCHA, 2010).

With the continuous electricity crisis affecting GS every day, the majority of Palestinians are using portable generators in their houses and at work to be able to go on living as normally as possible. On the other hand the misuse of generators has resulted in 75 deaths

last year according to Gaza's authorities and many seriously injuries. In the first two months of this year, 15 people died and 27 were injured (Schembri, 2010).

Portable generators can be hazardous but there are so many benefits for having portable generators. They are reliable power backups during any emergency. They also can be very useful for outdoor activities. In spite of all these advantages, the portable generators can be very unsafe and hazardous if not used correctly. People have to be very precautionous while they are operating a portable generator. Every year, a considerable number of deaths take place due to mishandling of portable generators (Uvios, 2007).

1.2 Problem statement

The on going power cut has its effects on all aspects of life in Gaza. It made the population look for alternatives to deal with the daily needs of their life. Most of the population are forced to use electricity generators in their houses and working places to enable them to live as normal life as possible.

The majority of the people use the generators to make up for the power cut that could continue up to eight hours or even more due to the malfunctioning of the sole power plant producing company in Gaza. Subsequently lots of generators in various sizes and prices were imported since there is no other ways to produce electricity despite the negative affect of these generators in the form of polluted and poisoned gases as well as the noise they produced.

The misuse of generators is becoming a big problem for the health of the population and hazardous affects on the environment. The population of JRC in particular is suffering immensely from the generators with the high noises and bad smells. Furthermore, few fatalities and fire caused by the explosion of some of the generators, following the misuse, bad storage of the fuel, carelessness in operating them plus the unavailability of spaces in the houses to place them. They are usually placed in a life threatening way and not far a way from children.

The danger is spreading all over the GS in such a way that even who don't have generators could be affected due to the over population and adjacent houses. The researcher is seeking to determine the main environmental and health hazards that caused by the generators.

The effects of the over use of the generators have not been fully determined, thus within this research study these effects would be investigated.

1.3 Justification of the study

Portable electricity generators use in GS especially in JRC is widely spreading after interruption of the electricity. This has lead to a remarkable increase of house accidents as a result of generators miss use. The number of affected cases has increased and the mortality rate has also increased and being aggravated by time. In addition to the human casualties a large number of people are suffering from this problem specially the medical teams at Al shifa hospital who are depressed from this miserable and terrible situation.

The media campaigns are very rare to provide people with awareness and knowledge of safety precautions they need to take and no follow-up or monitoring of governmental or nongovernmental organizations and what are the cause of this problem, how it can be solved and what actions need to be taken to protect the people from it.

Unfortunately, misuse of generators have resulted in many death cases and many more were seriously injured that could have been avoided if they had all the information on how to use their generators safely. Furthermore, suffocation cases caused by high levels of CO emissions which is considered a toxic, an odorless and invisible gas that can kill within minutes.

In addition to noise pollution caused by operating the generators that affect negatively on the hearing of population. The generators have become on of the main domestic equipments in all most Gaza houses with the current electricity crisis. So the electricity generators have become one of the main reasons of danger and death in GS but it is very important to shed some light on this problem to assess the effect and magnitude of this problem in JRC.

1.4 Aim of the study

The aim of the study is to assess the health/environmental hazards of domestic electricity generators on the population of Jabalia camp.

1.5 Specific objectives

1. To assess the public awareness towards the hazards of domestic electricity generators.
2. To explore the risk of misuse of domestic electricity generators on the population.
3. To find out the health impact of emission gases of domestic electricity generators on the population.
4. To assess the environmental impact of emission gases of domestic electricity generators.
5. To identify the health impact of noise of domestic electricity generators on the population.
6. To come out with recommendations and suggestions to deal with this issue.

1.6 Context of the study

1.6.1 Geographic and demographic context

The total area of Palestine is about 27000 square kilometers constitutes the southwestern part of Belad El-Sham which is eastern part of the Arab world, in addition to Palestine extends from Ras Al-Nakoura in the north to Rafah in the south. Palestine boarded by Lebanon in the north, Syria and Jordan in the east, the Gulf of Al-Aqaba in the south and by Egypt and Mediterranean Sea in the west but now Palestine is limited to two geographically separated areas, GS and West Bank (WB). The total area of both is 6257 km², which represents 23.17% of historical Palestine. The map of historical Palestine is presented in (Annex 2).

As per the end of the year 2009, approximately 11.5 million live in historical Palestine. The Jews population forms 49.4% of this total, taking advantage of 85% of the land of historical Palestine ((PCBS, 2011).

The GS is a densely populated narrow piece of land on the Mediterranean coast. More than 1.6 million people live in an area of just 378 square kilometers (UNEP, 2003). The map of GS is presented in (Annex 3). An estimated 1.1 million people, or three-quarters of the

entire population, are Palestine refugees registered with UNRWA. About half a million refugees live in Gaza's eight refugee camps (UNRWA, 2010).

The GS has eight refugee camps, the largest of which is JRC. It is located north of Gaza City, close to a town of the same name. After the Arab-Israeli war in 1948, 35,000 refugees have settled in the camp, most had fled from villages in southern Palestine. Today, approximately 108,000 refugees registered with UNRWA in north governorate, 41,933 live in the camp reside in 5,313 buildings within 13 blocks which covers an area of only 1.4 square kilometers. The camp has a very urban character and overcrowding is a key concern for its residents (PCBS, 2009).

Jabalia is the closest camp to Erez border crossing with Israel. According to OCHA, before the second Intifada, more than 21,000 Palestinians crossed Erez to work in Israel each day. Since 12 June 2007, the crossing has been closed to pedestrian traffic, with very limited exceptions made for medical and business cases (UNRWA, 2010).

1.6.2 Socioeconomic status

Unstable political condition negatively affects the socioeconomic status in Palestine. According to World Bank, 67% of Palestine households are living below the poverty level. Percentage of people who live in deep poverty had been gradually increase to reach 35% in GS, and 15% in WB, also the unemployment rate is increased to reach 28% in WB and 39% in GS (World Bank, 2008).

The years of blockade on the GS had a devastating effect on the JRC. It created an extremely difficult economic situation. The camp suffers from an extremely high unemployment rate of about 45% and a poverty rate of more than 80% (UNRWA, 2010).

1.6.3 Health status

The health sector in Palestine has faced many opsticals and problems in such away it has hinder the provision of crucial health services. The bad geographical distribution of hospitals in the WB & GS and the immense shortage of medical instruments, logistic support and the unavailability of vital health departments have led to the deterioration of

the health sector. In addition, the Israeli imposed blockade on the GS has caused more damage to the health sector.

The health situation in JRC has worsened especially after the Israeli aggression on the GS in December 2008 and January 2009. The use of portable generators made it even worse. The MOH expects an increase of mortality among ill people because of the imposed blockage and the increasing number of portable electric generators. One area of research can be the environmental and health hazards caused by use of generators in the densely populated and the fact that there are many adjacent houses in JRC (UNRWA, 2010).

1.7 Operational Definitions

Portable electricity generator

An electricity generator considers as a device that converts mechanical energy into electrical energy and the mechanical energy is provided through the means of an internal combustion engine (WordIQ, 2010).

Environmental Health

Environment health addresses all the physical, chemical and biological factors external to a person and all the related factors impacting behaviors. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments (WHO, 2008).

Environmental Pollution

Any direct or indirect changes in the characteristics of the environment, that may cause harm to any of its components or disrupts its natural balance (Palestinian Environmental Law, 1999).

Noise pollution

Defined as a form of air pollution that is an audible unwanted sound that poses a threat to a person's health and well being (Goines and Hagler, 2007).

Air pollution

Any change in the characteristics or components of the natural air, which may cause harm to the environment (Palestinian Environmental Law, 1999).

Mortality

The state of being mortal (destined to die). Mortality also refers to the death rate, or the number of deaths in a certain group of people in a certain period of time. Mortality may be reported for people who have a certain disease, live in one area of the country, or who are of a certain gender, age, or ethnic group (National Cancer Institute, 2010).

Disability

Defined as a contextual variable, dynamic over time and in relation to circumstances. One is more or less disabled based on the interaction between the person and the individual, institutional and social environments (Rolling Rains Report, 2007).

Assessment

Assessment defined as the systematic collection, review, and use of information about educational programs undertaken for the purpose of improving learning and development (Palomba and Banta, 1999).

Hazard

A hazard is a situation in the workplace that has the potential to harm the health and safety of people or to damage plant and equipment (OHS, 2007).

Chapter 2: Literature review

This chapter is divided into two parts, the first part is the conceptual framework of the study and the second part is the literature review.

2.1 Conceptual framework

To simplify the understanding and applying of the study, the researcher created a framework for the study. The conceptual framework guiding the study is shown in figure (2.1).

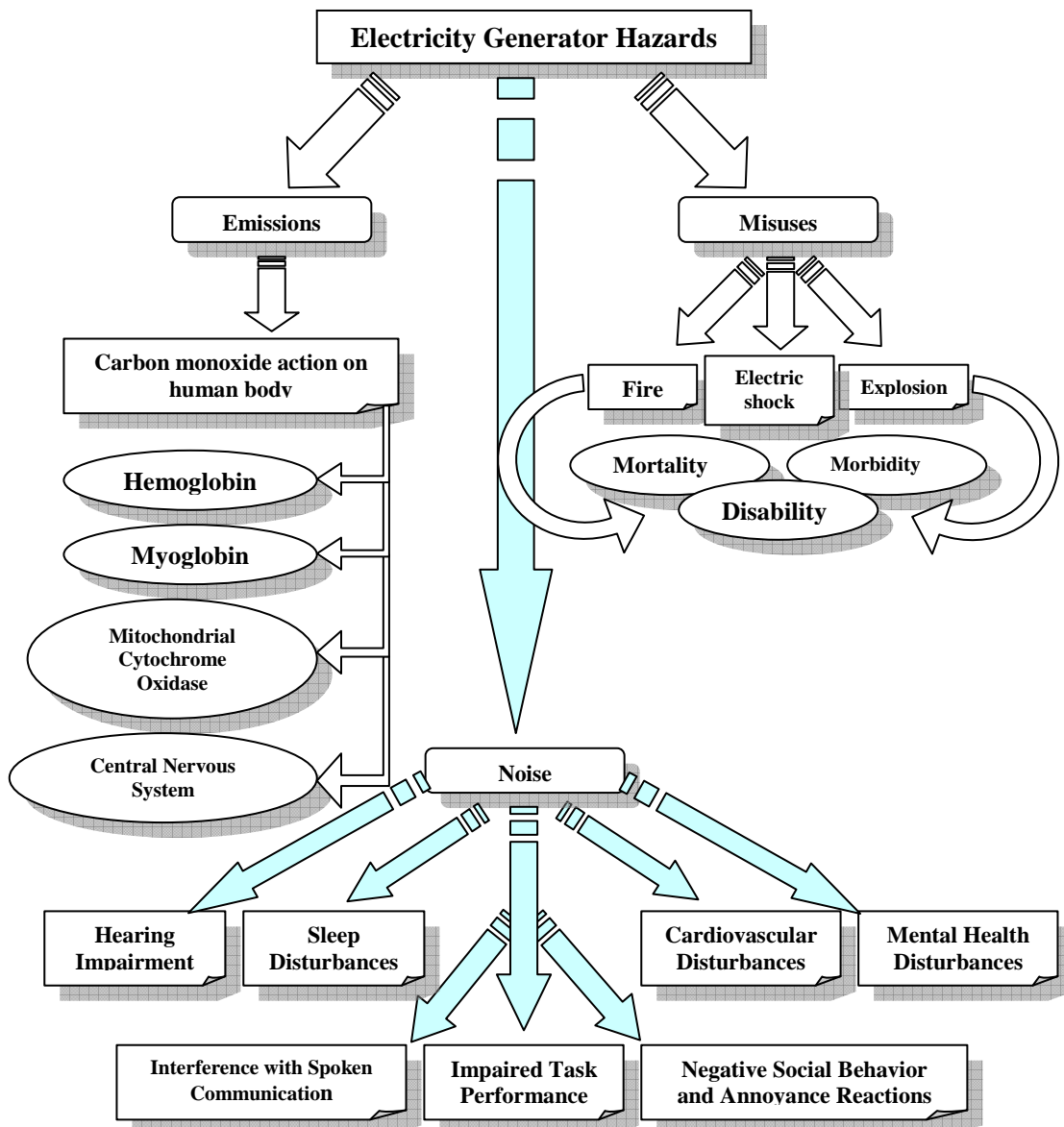


Figure 2.1: Conceptual framework of the research study.

Three major factors that illustrate the generator hazards were included in the research framework: emissions, misuses, and noise. These factors can be summarized as follows:

2.1.1 Emissions

It's one of the most important factors that are considered as risks of the generators where exhausts a toxic and deadly emissions where CO is considered as the most dangerous emissions that comes out from the generators because of its deadly toxic. Also, CO is the leading cause of deaths associated with incorrect usage of generators. Furthermore, the silent killer term is given because individuals simply do not realize they are being exposed to CO gas because the senses of the human body do not detect it. The impact of CO on humans can have deadly consequences if do not detect or treated in time. The most signs and symptoms of CO exposure are nonspecific and can be mistakenly attributed to other causes such as viral illnesses. However, undetected or unsuspected CO exposure can result in death. On the other hand, larger exposures can lead to significant toxicity of the central nervous system and heart, and even death. CO mainly causes adverse effects on human by combining with hemoglobin to form carboxyhaemoglobin (COHb) in the blood. This prevents oxygen binding to hemoglobin, reducing the oxygen carrying capacity of the blood where leading to hypoxia. Additionally, myoglobin and mitochondrial cytochrome oxidase are thought to be adversely affected. Finally, the benzene which used to fuel the generators and the lead contained in the fuel are poisonous (IAPA, 2008).

2.1.2 Misuses

Many common mistakes in mishandling of generators, negligence and lack of awareness that leads to frequent accidents. Moreover, few of them caused death and others led to serious injuries which caused disabilities or deformities. However, all these would have been avoided or prevented if generators were used properly. Also, fire or explosion can cause severe burns or death and failure to properly ground the generator can result in electric shock.

2.1.3 Noise

Generators are the source of many environmental pollutants with various health effects including noise pollution, where are the unwanted sounds coming from the generator when it runs. Additionally, this leads to serious health effects on human. The World Health

Organization (Hagler, 1995) has documented seven categories of adverse health effects of noise pollution on humans which are:

1-Hearing impairment

It's related to duration and intensity of noise exposure and occurs at level of 80 db or greater.

2-Interference with spoken communication

Noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, handicaps and behavioral changes.

3-Sleep disturbances

Noise pollution is a major cause of sleep disturbances. And, apart from various effects on sleep itself. Noise pollution during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, cardiac arrhythmias, and increased body movement.

4-Cardiovascular disturbances

A growing body of evidence suggests that noise pollution may be a risk factor for cardiovascular disease.

5-Disturbances in mental health

Noise pollution is assumed to accelerate and intensify the development of latent mental disorders. Also, noise pollution may cause or contribute to the following adverse effects such as: anxiety, stress, nervousness, nausea, headache, and emotional instability, changes in mood, increase in social conflicts, neurosis and hysteria.

6-Impaired task performance

Noise pollution impairs task performance, increases errors, and decreases motivation. In addition to reading attention, problem solving, and memory are most strongly affected by noise.

7-Negative social behavior and annoyance reactions

Annoyance is defined as a feeling of displeasure associated with any agent or condition believed by an individual to adversely affect him or her. Furthermore, annoyance increases significantly when noise is accompanied by vibration or by low frequency components (Hagler, 1995).

2.2 Literature review

2.2.1 Portable generators hazards

Portable generators are useful when temporary or remote electric power is needed. However, they also can be hazardous if used improperly. The main hazards to avoid when using a portable generator are CO poisoning from the toxic engine exhaust, electric shock or electrocution, fire and burns. In addition to the generators accidents can be fatal (CPSC,2007).

There is an increase in suffocation cases due to inhalation of exhaust fumes and emissions from the small electricity generators that many Palestinian families in Gaza depend on because of the frequent power outages caused by the unjust Israeli blockade. Moreover, hospitals have received many suffocation as well as burn fatalities caused by fires in these generators which Gaza residents see as the only alternative they have to solve their electricity problems.

However, these generators create many dangers with the toxic gases coming out of their motors which caused many cases of suffocation among the residents of Gaza, not to mention the many incidents of fires and explosions of these generators. According to the Palestinian medical sources 87 Palestinians in Gaza were killed last year because of fires caused by generators or poisoned by carbon monoxide fumes emitted by the generators and 23 people were killed in the first four months of this year (Syrian Arab News Agency, 2010).

Also, GS suffers from frequent power outages due to the lack of fuel sufficient to run the only power plant in Gaza forcing the residents to use small generators that run on gas or other oil products to get the electricity necessary to provide heat, light and other needs of daily life.

Hospitals and clinics suffered a great deal because of the daily power interruptions. They became heavily dependent on the use of back-up generators, which are not designed to function for prolonged periods and are often damaged as a result. Additionally, replacement parts needed to repair them are frequently unavailable. Doctors had to delay some elective surgeries in order to reduce the risk to patients. Given the limited reliability of generators, hospitals also use Uninterruptible Power Supply (UPS) devices to minimize the damage of power cuts and fluctuations in power to sensitive medical equipment. The effectiveness of the UPS use has been undermined due to the Israeli restrictions on the import of the batteries needed to operate them. Electricity cuts also affect refrigeration in clinics, causing risks to the quality of vaccines (OCHA, 2010).

2.2.2 Surviving with portable generators in Gaza

The only power plant in Gaza shuts down temporarily on June 25, 2010, as fuel ran out due to a payment dispute between Hamas and The Palestinian Authority (PA) in Ramallah. Moreover, the residents of Gaza are now suffering from power cuts for eight or more hours a day, and have been forced to depend even more on generators. In 2006 The Israeli Air Force bombed The Gaza Power Plant (GPP), and since that time it has operated to reduce capacity, a situation exacerbated by the imposition of the blockade on Gaza in 2007. Generators have become an essential part of life in Gaza. However, more than 100 people are known to have died from fires or CO poisoning caused by generators (Saldanha, 2010).

2.2.3 Carbon Monoxide (CO)

Carbon monoxide has many characteristics such as an odorless, colorless and toxic gas. Additionally, it can't be seen, tasted or smelled the toxic exhausts. CO can kill when there is no awareness at house. At lower levels of exposure, CO causes mild effects that are often mistaken for the flu. The effects of CO exposure can vary greatly from person to person depending on age, overall health and the concentration and time of exposure (Sorel, 2008).

As mentioned above characteristics of CO has no detectable odor. Also, CO produced by the incomplete burning of any material containing carbon such as fuel, coal or wood. Furthermore, it is harmful when breathed because it displaces Oxygen in the blood and

deprives the heart, brain and other vital organs of Oxygen. Therefore, CO is one of the leading causes of poisoning by toxic inhalation (OSHA, 2005).

It is a toxic gas and not irritating which makes it difficult for human to detect, and CO poisoning occurs after enough inhalation of it where CO considers easily absorbed through the lung. Even inhalation of small amounts of the gas can lead to hypoxic injury, neurological damage, and death may occur. However, exposures at 100 ppm or greater can be dangerous to human health. In the United States, the OSHA limits long – term workplace exposure levels to less than 50 ppm averaged over an eight hours period (Ernst and Zibrak, 1998).

Exposure to CO should be controlled to sustain a carboxyhaemoglobin (COHb) level below 3.5% (The Biological Exposure Index for CO). Carboxyhaemoglobin level considers as a good indicator of the level of CO presents in the bloodstream. Moreover, it is formed when haemoglobin binds preferentially to CO instead of oxygen, which can severely reduce the delivery of oxygen to various parts of the body. Under most conditions, this will be achieved if the average level over an eight-hour day does not exceed 25ppm, but there is also a need to control brief periods of high CO exposure (Department of Labor, 2011).

2.2.4 Sources of CO in the environment

Carbon monoxide is produced by both natural and anthropogenic processes. About half of the carbon monoxide is released at the Earth's surface, and the rest is produced in the atmosphere. Many papers on the global sources of carbon monoxide have been published over the last 20 years, whether most of the carbon monoxide in the atmosphere is from human activities or from natural processes has been debated for nearly as long. Carbon monoxide is produced in the atmosphere by reactions of hydroxyl radicals with methane and other hydrocarbons. Carbon monoxide is also produced at the Earth's surface during the combustion of fuels. The burning of any carbonaceous fuel produces two primary products: carbon dioxide and carbon monoxide (WHO, 1999).

Un-vented kerosene and gas space heaters; leaking chimneys and furnaces, back-drafting from furnaces, gas water heaters, wood stoves, and fireplaces, gas stoves, generators and other gasoline powered equipment, automobile exhaust from attached garages, and tobacco

smoke. Moreover, incomplete oxidation during combustion in gas ranges and un-vented gas or kerosene heaters can cause high concentrations of CO in indoor air. Worn or poorly adjusted and maintained combustion devices (e.g., boilers, furnaces) can be significant sources, or if the flue is improperly sized, blocked, disconnected, or is leaking. Auto, truck, or bus exhaust from attached garages, nearby roads, or parking areas can also be a source (U.S. EPA, 2000).

2.2.5 Health effects associated with CO

The health effects at low concentrations of exposure to CO such as fatigue in healthy people and chest pain in people with heart disease. Also, at higher concentrations, impaired vision and coordination, headaches, dizziness, confusion and nausea can cause flu-like symptoms that clear up after leaving home. However, fatal events can be happened at very high concentrations. Furthermore, acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake. At moderate concentrations, angina, impaired vision, and reduced brain function may result. At higher concentrations, CO exposure can be fatal (U.S.EPA, 2010).

Symptoms of mild acute poisoning include lightheadedness, confusion, headaches, vertigo and flu-like effect. Also, larger exposures can lead to significant toxicity of the central nervous system and heart, and even death. CO can also have severe effects on the fetus of pregnant women. On the other hand, chronic exposure to low levels of CO can lead to depression, confusion and memory loss. CO mainly causes adverse effects in human by combining with haemoglobin to form carboxyhaemoglobin (COHb) in the blood. This prevents oxygen binding to haemoglobin, reducing the oxygen carrying capacity of the blood where leading to hypoxia. Additionally, myoglobine and mitochondrial cytochrome oxidase are thought to be adversely affected. Carboxyhaemoglobin can revert to haemoglobin, but the recovery takes time because the COHb complex is fairly stable (Prockop and Chichkova, 2007).

Table 2.2.1: Acute effects produced by CO in relation to ambient concentration in ppm

Concentration	Symptoms
35 ppm (0.0035%)	headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%)	Slight headache in two to three hours
200 ppm (0.02%)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%)	Frontal headache within one to two hours
800 ppm (0.08%)	dizziness, nausea, and convulsions within 45 minutes, insensible within 2 hours
1600 ppm(0.16%)	headache, tachycardia, dizziness, and nausea within 20 minutes; death in less than two hours
3200 ppm (0.32%)	headache, dizziness and nausea in five to ten minutes. Death within 30 minutes
6400 ppm (0.64%)	headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death in less than 20 minutes
12800 ppm (1.28%),	Unconsciousness after 2-3 breaths. Death in less than three minutes

Source: (Goldstein, 2008).

2.2.6 CO exposure standards

The Palestinian standard of carbon monoxide for air pollution emissions from stationary sources is 500 mg/m³ and 250 mg/m³, from existing and new sources respectively (Ministry of Environmental Affairs, 2002).

The Palestinian standard of carbon monoxide for ambient air is 10,000 µg/m³ during an eight hour time period and 30,000 µg/m³ during hour time period (Ministry of Environmental Affairs, 2001).

The 8 -hour time weighted average (TWA) occupational exposure standard for CO is 30 ppm and higher exposure are permitted for short periods of time, provided the average exposure does not exceed 30 ppm (OSHA, 2008).

The National Institute for Occupational Safety & Health (NIOSH) has established a recommended exposure limit (REL) for CO of 35 ppm as an 8 –hour time- weighted

average (NIOSH, 1992). The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned CO a threshold limit value of 25 ppm as a TWA for a normal 8 – hour workday and 40 – hour workweek . The OSHA permissible exposure limit (PEL) is 50 ppm. Also, OSHA standards disallow worker exposure to more than 50 parts of the gas per million parts of air averaged during an 8-hour time period. The 8-hour PEL for CO in maritime operations is also 50 ppm. Maritime workers, however, must be removed from exposure if the CO concentration in the atmosphere exceeds 100 ppm. The peak CO level for employees engaged in roll-on roll-off operations during cargo loading and unloading is 200 ppm (OSHA, 2002).

2.2.7 Benzene (C₆H₆)

Benzene is considered as the most common use fuel with the generators. It is a colorless liquid with a sweet odor and crude oil is the largest natural source of it as well as refined gasoline. Furthermore, benzene is widely used by industry in the manufacture of many products including plastics, synthetic rubber, glues, paints, furniture wax, lubricants, dyes, detergents, pesticides and some pharmaceuticals. Also, benzene is present in tobacco smoke. But, the chemical is a carcinogen, and exposure occurs at gas station pumps and through secondhand tobacco smoke (U.S.EPA, 2006).

2.2.8 Health effects of benzene

The effects on human health depend on many factors such as the duration of exposure, concentration of benzene in air, soil or water, and the health and age of the affected individual. Also, people who inhale benzene for long periods time at high enough levels may experience harmful effects in the tissues that form blood cells, particularly the bone marrow. However, lower levels may cause drowsiness, dizziness, rapid heart rate, headache, tremors, confusion and unconsciousness. In addition, The International Agency for Research on Cancer (IARC) has established that benzene is a human carcinogen. On the other hand, it is concluded that the health effects on human being as follow:

Eyes

Contact with the liquid or vapor causes eye irritation, and the symptoms of eye irritation may include: pain, tearing, reddening, swelling and impaired vision. Also, corneal injury may result from contact with the liquid.

Skin

Benzene may be absorbed through the skin that lead to skin irritation and the symptoms of skin irritation may include pain, redness, swelling and blistering. Furthermore, prolonged or repeated contact may cause skin dry and cracked, and produce a rash.

Ingestion

Ingestion is harmful or fatal if swallowed and, can irritate the stomach, causing vomiting and diarrhea as a result of its low viscosity. Moreover, benzene can be sucked into the lung when swallowing or vomiting. But, once in the lungs, removal is very difficult and even small amounts can cause severe respiratory tract injury or death.

Inhalation

Inhalation of benzene should be avoided because it causes many health problems such as: dizziness, confusion, drowsiness, heart rate increase, tremors and may produce blood disorders (anemia). Also, exposure to more benzene may produce respiratory depression, convulsion, and loss of consciousness, coma or death (Sunoco, 2006).

2.2.9 Lead (Pb)

Lead is a colorless, tasteless, and odorless metal. Also, lead became essential in manufacturing ammunition, batteries, chemical compounds, explosives, glass ware, metal products, gasoline, and paint. However, lead poisoning may occur when people are exposed to lead compounds through inhalation, swallowing, and rarely through the skin. Additionally, childhood lead poisoning is a preventable environmental health problem, and all children between six months and three years of age should be screened for lead poisoning (OSHA, 2007).

2.2.10 Lead poisoning and its impact on Public health and the environment

Lead has been demonstrated to be toxic to organs of human. Furthermore, The US EPA has classified lead as a possible human carcinogen and, the IARC has believed it as a probably carcinogenic to humans. Here, it is concluded that many different health effects in both children and adults. The air polluted by generator emissions is very dangerous to public health and the environment, and lead is the most dangerous of those emissions.

The use of leaded gasoline is one of the most important sources of this element in the ambient air as it constitutes 80% of the lead in the air. Here lies the gravity of the danger and its direct impact on the health of the individual and the environment. It affects directly or indirectly on the construction of hemoglobin leading to anemia, poor concentration and low mental capacity in children in the long run (U.S.EPA, 2009).

It also increases the amount of ozone gas in the atmosphere causing serious damage to plants as it works to lower productivity compared to other places with cleaner air. Thus, it appears that the use of leaded gasoline is the main factor in air contamination with this element and therefore the global trend towards the use of unleaded gasoline is inevitable, where there are many countries such as United States, Japan, Brazil, Austria, Sweden and others have begun using unleaded gasoline years ago. Also the World Summit on Development in Johannesburg in the summer of 2002 has adopted a resolution on the gradual reduction of lead in paints containing it, as well as the reduction in the use of unleaded gasoline.

Many countries work to replace lead in gasoline with other substances less harmful to the environment and therefore less harmful to humans where lead can penetrate the body through the respiratory system with breathing and through the digestive tract with food and drink and into the blood where it usually reaches the brain and is deposited in bones and teeth (U.S.EPA, 2009).

Lead is poisonous to many organs of the body where high levels can cause anemia. It may also cause severe damage to the kidneys, liver, brain and central nervous system. Lead poisoning is also associated with cramps in the abdomen accompanied by severe pain, renal colic, difficulty in getting rid of uric acid, and the occurrence of gout. Also chronic inflammation of the kidneys may occur and result in kidney failure which becomes increasingly apparent with the existence of gout. As for the liver, the lead may cause inflammation of the liver that may lead to cirrhosis of the liver. As for the nervous system, there may be a sense of fatigue, lethargy and extra tension. Lead may irritate the membranes of the airways and sometimes fibrosis of the heart. Finally, people differ in their vulnerability to contamination with lead. Mostly affected are the young children and pregnant women due to their high susceptibility to lead absorption (U.S.EPA, 2009).

2.2.11 The most common misuses of electricity generators in Gaza Strip

People in GS face the potential of death and severe burns as a result of many mistakes of electricity generators uses that caused many incidents resulted to negligence or lack of awareness which caused serious injuries and some led to deaths because of an explosion or fire. However, the proper use of generator can avoid the danger and many accidents may occur.

Some examples of how residents mishandle the generators such as adding fuel while the generators are operating. In addition to smoking a cigarette while adding fuel, carrying something such as candles or matches that is burning to light the way when the check fuel level in those generators (Schembri, 2010).

Moreover, one of the biggest risks which are usually ignored the storing of large amounts of fuel often in close proximity to places of generators operation. This constitutes a major threat to the residents of the house and those around them. Also, the lack concerns when keeping the generators in safe places and far from abusers and children is a major threat to their lives. Finally, some people keep the generators in the bedroom that would be harmful. Others put them in dark areas in the street caring less about the people who use the street (Schembri, 2010).

2.2.12 Misuse of portable generators can be deadly

Portable generators are useful in an emergency when power cuts occur affecting your house or your business. However, safety measures must be taken when using portable generators to avoid the risk of them. According to the National Fire Protection Association in the USA, common dangers associated with the use of portable generators are CO poisoning, electrical shock or electrocution and fire hazards.

On the other hand, many reports in the USA indicate that the majority of house fires and deaths from CO poisoning occur when portable generators are used incorrectly. Moreover, portable generators are powered by gasoline which emits CO, This is exceedingly hazardous due to CO being odorless, colorless and poisonous. If the generator is not positioned or not functioning correctly, individuals risk CO poisoning (Hylander, 2010).

A lot of reports in the USA indicated that between 1999 and 2007, there are 327 deaths of generators related non-fire CO poisoning occurred (CPSC, 2007). Also, portable generators use near doors and windows which allow CO to enter the house and store fuels inside living areas, touch the generator with wet hands, connect generators to other power sources. Lastly, refuel the generator while it is running or when hot (Hylander, 2010).

2.2.13 Safety tips to prevent misuse of portable electricity generators

CPSC in 2007 had issued instructions that have the following points:

Generators pose a risk of shock and electrocution, particularly if they are operated in wet situations. If you have to use the generator when it is wet outside, protect the generator from moisture to avoid the shock or electrocution hazard. However, generator indoors or near openings to any building that can be occupied that avoid the CO hazard and dry your hands if wet before touching the generator.

Connect devices to the generator using heavy – duty extension cords that are especially designed for outdoor use. Therefore, never try to power the house wiring by plugging the generator into a wall outlet. This is very risky and presents an electrocution risk to utility workers and neighbors served by the same utility transformer. Before refueling the generator turn it off and let it cool down. On the other hand, always store fuel outside of living areas in properly labeled, non- glass containers. But it should be stored away from any fuel burning appliance to avoid fire hazard (CPSC, 2007).

The OSHA in 2005 had issued a set of safety tips that should be followed when using portable generators to prevent misuse of it. In the beginning, follow manufacturer's instructions and make sure the generator is properly grounded. But, never use generators inside houses, garages or other enclosed or partially enclosed areas even with ventilation.

Deadly levels of carbon monoxide can quickly build up in these areas and can remain for hours, even after the generator has shut off. Therefore, place them far from doors, windows, and vents that could allow CO to come indoors. Then, install battery-operated CO alarms or plug-in CO alarms with battery back-up in the house and batteries tested should be done monthly. Also, do not overload the generator by operating more appliances

and equipment than the generator can handle. The generator should be kept dry and never plug the generators into a wall outlet which can create a reverse flow of electricity and electrocute a utility worker. Additionally, do not refuel the generator while it is running and let it cool before refueling. On the other hand, do not store fuel inside of living areas and away from heat sources. Finally, turn off all equipment powered by the generator before shutting it down and keep children away from generators (OSHA, 2005).

2.2.14 Noise pollution

Noise has always been an important environmental problem for human being. Furthermore, in ancient Rome, rules existed as to the noise emitted from the ironed wheels of wagons which causing sleep disturbance and aggravation to the Romans. Also, horse carriages and horse back riding were not allowed in Medieval Europe during night time in certain cities to ensure a peaceful sleep for the habitants. Noise pollution is one of the main pollution of the environmental causing various hazardous consequences for human life. Therefore, WHO stated that noise must be recognized as a major threat to human well-being (Berglund, Lindvall and Schwela, 1999).

2.2.15 Sources of noise pollution

The main source of noise pollution is transportation system in urban areas. Also, there are another sources include construction of buildings, highways, and streets cause a lot of noise, due to the usage of air compressors, bulldozers, loaders, dump trucks, pavement breakers, generators, loud speakers, boilers, air conditioners, fans, and vacuum cleaners. Furthermore, the source of noise may be domestic such as movement of utensils, cutting and peeling of fruits or vegetables (Goines and Hagler, 2007).

2.2.16 The effects of noise pollution

There are a lot of harm effects of noise pollution in particular on hearing power of the human beings, and the continuous noise in high intensity can cause injury to the ears which may lead to the permanent loss of hearing, anxiety and stress which can lead to the fright . In addition to it causes the disturbance in nervous systems of urban babies which may cause the emotional disturbances along with abnormal behavior. Also, it may increase the heart rate and impaired vision (Rabinowitz, 2000).

There is no doubt that noise affects human health adversely. Health effects of noise include both the auditory as well as non-auditory effects. It results in loss of hearing, stress, high-blood pressure, disturbances of sleep, distraction affecting productivity and a general reduction in the quality of life (Stansfeld and Matheson, 2003).

The National Institutes of Health estimate that 15% of Americans ages 20-69 have suffered hearing loss due to excessive noise. The WHO recently declared noise pollution the biggest nuisance facing Europe and recommended that communities cap night noise at 40 decibels. Prolonged exposure to sound of 85 decibels or higher can harm hearing, but little has been done globally to prevent excessive noise from impacting quality of life. In the U.S., federal legislation like the Noise Control Act of 1972 and the Quiet Communities Act of 1978 are on the books but unfunded and unendorsed (Rabinowitz, 2000)

2.2.17 Noise level standard

The Ministry of Environmental Affairs in Palestine in 2001 had drafted standards of the outdoor noise within different areas in decibel as follow:

Table 2.2.2: The Palestinian standard for outdoor noise in the different areas

Type of area	Peak time morning (db) 7 am- 20:00 pm	Peak time evening (db) 20:00 pm- 7 am
Rural residential areas, Recreational areas, Schools, Hospitals	40	30
Ordinary residential areas	50	40
Semi residential areas (contains few workshops, commercial business)	55	45
Commercial areas	65	50
Industrial areas	75	65
Festivals, celebrations	85	75

Source: (Ministry of Environmental Affairs, 2001)

Consequently, national standards have been adopted by many countries laying down maximum permissible noise level for environment and occupational noise exposure to give relief to the people working or living in those environments. These standards vary from country to another and have been laid in the form of recommendations, guidelines or

statutory requirements as per the economic conditions, advancement of technology and burden on industry (Pak-EPA, 2005).

2.2.18 The use of electricity generators in Iraq

A previous study recently conducted by the Ministry of Science and Technology in cooperation with the Ministry of Higher Education and Scientific Research and the Ministry of Environment in Iraq in 2008. The main focus of the study was the exposure of residents to CO gas emanated from the electricity generators. In this study it was confirmed that:

The use of electricity generators became widespread in Iraq due to the shortage in power supply. It increased the exposure of residents to the harmful pollutants such as the gas CO. A high level of CO exposure can decrease the ability of the body to transport oxygen to the blood cells. CO is combined with Hemoglobin (more easily than Oxygen) to form a compound known as Carboxyhemoglobin (COHb). This hinders the delivery of oxygen to the body and hence affects the function of the brain and increases the heart rate. Nabil Jasem who participates in this study explains that the concentration of COHb in the blood depends on three factors: CO concentration, length of exposure and rate of inhalation. He adds that those who have heart disease suffer the most because the heart has to work harder to compensate for the decrease in the amount of oxygen in the cells. Previous studies show that those who have asthma suffer more when the level of COHb reaches 2% and those who have heart disease suffer from fatigue when level of COHb reaches 5% and almost everybody experience headache and dizziness when the level reaches 10% and death occurs when the level reaches beyond 50% (Argaam Business Info, 2008).

The usual level of CO in the residential areas is between 5 to 50 ppm. Whereas, the study shows, this level becomes higher in the areas where electricity generators are used. The researcher concludes that these generators should be operated in open areas to decrease the level of the pollutants emanated from these generators and increase the level of oxygen which makes the nonpoisonous CO₂ instead of CO. It was also shown that the large generators are less harmful than the small generators simply because the large generators are usually used outdoors whereas the small generators are usually used indoors. Also data shows that the generators that run on gasoline are less harmful than those that run on gasoline mixed with engine oil (Argaam Business Info, 2008) .

2.2.19 Portable generators related deaths in the United States

The statistics on CO poisoning in the United States are well documented. In previous study, it was found that CO is responsible for more fatalities in the U.S.A each year than any toxicant (Cobb and Etzel, 1991). In another study an estimated 15200 people report to hospital emergency rooms each year for CO poisoning. In addition, during 2001-2002, an average of 480 persons died annually from non-fire related CO poisoning (Dunne, 2003).

In report regarding portable generators found the number of generator – related CO poisoning deaths doubled from 18 deaths in 2001 to 36 deaths in 2003 (CPSC, 2004). In another report by CPSC shows CO poisoning from generators in 2005 caused a record 58 deaths (O' Donnell, 2006). Every year, people die in accidents related to portable generator use. Most deaths involve CO poisoning from portable generators used indoors or in partially enclosed spaces. In previous reports showed that portable generators caused 351 CO poisoning deaths in the United States within the period 1990 to 2005 (CPSC, 2007).

The U.S. Consumer Product Safety Commission estimates that each year, about 4000 injuries associated with electric extension cords are treated in hospital emergency rooms. Moreover, 13% of the injuries involve children. Also, CPSC estimates that about 3300 residential fires originate in extension cords each year, killing 50 people and injuring about 270 others (CPSC, 2007) .

Finally, it could be concluded from the previous statistics that the generators must be used properly because they can be hazardous and placed outside the houses or open areas. In order to avoid suffocation that sometimes leads to human fatalities.

People work and live under different types of environmental noise and today most of the countries of the world are aware of the impact of noise on human, therefore they try to protect humans from the hazard as also for their comfort and convenience. Many countries of the world have carried out the exercise of finding out the most suitable environmental noise levels to which a human being can be exposed with the least harm in that particular environment.

Moreover, at the time while the world concern about the noise pollution is increasing with its negative effects on human health, and noise pollution is one of the most important environmental problems of the world. The GS in general and JRC in particular are facing the aspects of the domestic electricity generators with all sizes and very annoying noises as they are spreading all over the GS.

There are many health hazards associated with the residential use of the generators. The U.S. Environmental Protection Agency and the World Health Organization (WHO) say that noise pollution can cause everything from irritation and lost work productivity to high blood pressure and cardiovascular disease.

Chapter 3: Methodology

This chapter illustrates the research methodology that was used to conduct this study. It includes the study design, study population and ethical consideration. Also, it illustrates the tools and instruments that were used in addition to its validity, reliability, piloting, data collection and analysis process. Finally, it presents selection criteria and the limitation of the study.

3.1 Study design

The design of this study is a cross-sectional descriptive analytic one. This type of design was selected because it enables the researcher to meet the study objectives efficiently; it is quick and saves time and money.

3.2 Study population

The population of this study included the houses where electricity generators are used for domestic purposes. The total houses in JRC are 5313 buildings (PCBS, 2009) distributed in 13 blocks.

3.3 Sample size

Stratified random sample of 265 houses (more than 5% of total houses) were chosen from the study population which use electricity generators for domestic purposes (some blocks 20 houses and others 21 houses were chosen).

3.4 Study settings

The study was conducted in JRC located in North Gaza governorate and distributed among thirteen blocks. The camp was selected since it is the largest refugee camp in the GS and it is arguably the most crowded camps in GS and due to the fact that the researcher reside in the camp and personally noticed the very high number of used generators.

3.5 Period of the study

The study was conducted at the beginning of year 2011. The proposal was approved by the School of Public Health-Al Quds University in January 2011. The measurements of CO and noise levels were collected from 10-5-2011 to 10-8-2011.

3.6 Eligibility

3.6.1 Selection criteria

3.6.1.1 Inclusion criteria

The houses in JRC that have electricity generators were included in the study.

3.6.1.2 Exclusion criteria

The houses that own malfunctioning generator or rely on their neighbors generator were excluded from the study.

3.7 Ethical and administrative considerations

The researcher was committed to submit with all the ethical and administrative considerations needed in research. First, the approval was obtained from Helsinki Committee to conduct this study (Annex 4). Second, the Approval letter was obtained from UNRWA Gaza College for using the noise measurement device (Annex 5). Third, the Approval letter was obtained from The Ministry of Labor for using the carbon monoxide measurement device, however, it was found malfunctioning. Another device was provided by Almadina consultants for environmental management and urban planning (Annex 6). In addition to Confidentiality and the privacy of the participant will be respected during the study period and every one will receive the explanation and illustration of the purpose of the study.

3.8 Tools of the study

In this study two instruments were used. These instruments are:

1. Questionnaire.
2. Different measurement devices used to measure the emissions and noise of the generator.

3.8.1 Devices were used

These devices are:

- Mini Worn device to measure the percentage of CO concentration in the air.
- Sound Level Meter device to measure the noise pollution level (Annex 7).
- Digital Camera device.

3.8.2 The questionnaire

Face to face interview questionnaire was constructed in Arabic language (Annex 8) and translated into English language (Annex 9). The questionnaire was divided into six parts and contains seventy seven items. The six parts of the questionnaire as the following:

Part 1: Personal data covered by 8 questions.

Part 2: Housing conditions and environment covered by 7 questions.

Part 3: Awareness and knowledge of the degree posed by the misuse of the generator covered by 34 questions.

Part 4: Health effects of emissions covered by 19 questions.

Part 5: Health effects of noise pollution covered by 6 questions.

Part 6: Measurements and observations covered by 2 questions. .

3.8.2.1 Content validity

The validity of the questionnaire has been evaluated by six different experts (Annex 10) who have a good experience in public health, environmental science and research methodology; the researcher sent it to the experts by email with the objectives of the study. They were asked to add their suggested modifications that could improve and support the questionnaire. All the notes of the experts were taken into consideration and modifications were applied as per their request.

3.8.2.2 Pilot study

A pilot study was done for ten houses and conducted as pretest in order to examine the suitability of the questionnaire items before starting data collection. In addition to identify any weakness points in its components and because of the ambiguity of the questionnaire regarding repeated and identical items. However, the researcher has modified a few questionnaire items.

3.9 Data collection

A face to face interview of closed ended questionnaire with the measurements of concentration level of CO and noise levels as the tools of the study. The data of the questionnaire was collected by the researcher himself and the measurements were collected by the researcher and his assistants (3 persons). Unannounced visits to the houses were conducted by the researcher followed by questionnaire filling meetings with family heads.

The measurements were carried out during four days per week which distributed among thirteen blocks and were taken while there is a power cut in the evening hours and while the generators is operating. The percentage of CO concentration in the air was measured about half meter away from the exhaust of the generator by Mini Worn device. Then, the noise pollution level was measured by Sound Level Meter device from the place where the family gathers.

3.10 Response rate

The total number of the houses who were visited by the researcher was 265, five of them refused and 260 had been agreed to make the interview which have reflected very high percentage. This means that, the response rate was 98.1%.

3.11 Data statistical analysis

Data were computer analyzed using SPSS (Statistical Package for the Social Science) program for data coding, choosing data entry mode, data entry, data cleaning, frequency table for all study variables, defining and recoding of certain variables. Simple distributions of the study variables and cross tabulation were applied. Chi- square (χ^2) was used to identify the significance of the relations and associations among various variables. In addition to the graphs used such as columns bar and the circle pie-plot.

3.12 Limitations of the study

- Limited scientific resources like books and journals.
- Limited local and in globally data on the subject.
- Absence of information system in the places which the researcher visited.
- The measurement time was in the evening only while morning and afternoon time was excluded.

Chapter 4: Results and discussion

Two hundred sixty five questionnaires were distributed among thirteen blocks in Jabalia camp. Two hundred sixty questionnaires had positively responded, giving a response rate of 98.1% and six questionnaires had been rejected. This means that about 98 % of the responding forms had been accepted.

4.1 Characteristics of the study population

Table 4.1.1: Personal data

Variables	Frequency	Percent %
Gender		
Male	259	99.6
Female	1	0.4
Total	260	100.0
Age group		
15-29	87	33.5
30-44	104	40.0
45 or more	69	26.5
Total	260	100.0
Monthly income in Shekel		
Less than 1000	60	23.1
1000-2500	121	46.5
More than 2500	79	30.4
Total	260	100.0
Level of Education		
Primary	29	11.2
Preparatory	50	19.2
Secondary	88	33.8
University	93	35.8
Total	260	100.0
Number of family members		
2-5	82	31.6
6-8	82	31.6
9 or more	96	36.8
Total	260	100.0
Occupation		
None	65	25.0
Agriculture	3	1.2
Industry	5	1.9
Commerce	25	9.6
General employees	136	52.3
Professional	24	9.2
Other	2	0.8
Total	260	100.0
Smoking		
Yes	113	43.5
No	147	56.5
Total	260	100.0
If the answer is yes, numbers of smoking years		
Less than 5	9	8.0
5-14	47	41.6
15 or more	57	50.4
Total	113	100.0

Table 4.1.1 shows the personal data about the families who participated in the study with regard to sex, age and other information shown in the table.

Gender

Figure 4.1 shows that the majority (about 99.6%) of the sample are male and 0.4% female. This reflects the usual Palestinians traditions, that the male is the head of the family.

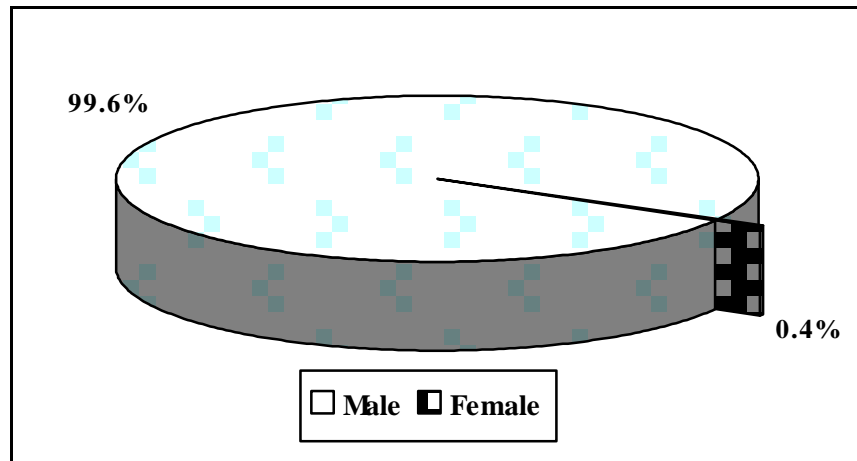


Figure 4.1. Distribution of the study population according to gender

Age group

The following figure 4.2 shows that about 40.0% of the respondents from 30 to 44 years of the age group, 33.5% from 15 to 29 years, and 26.5% are more than 45 years.

More than two third the sample are within the age group (15-29 years). This conform with the data published by the PCBS (29.4%) of the population are within the youth age group 15-29 years.

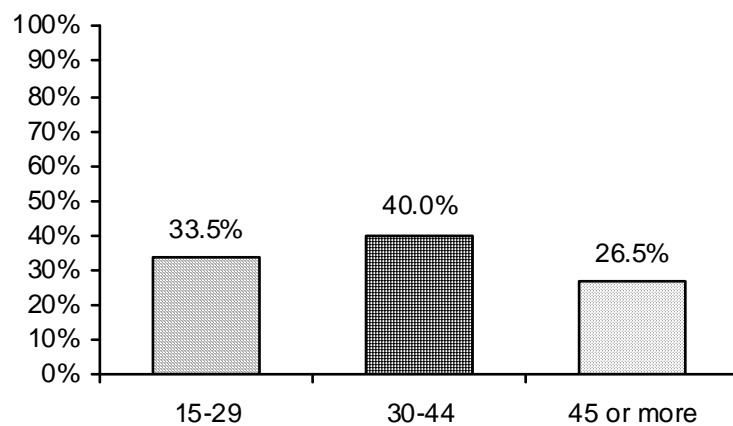


Figure 4.2. Distribution of the study population according to age group

Monthly income in Shekel

Figure 4.3 shows that the monthly income among the study population was 46.5% for who received salary within the range from 1000-2500, 30.4% for more than 2500, and 23.1% for less than 1000. This points to the fact that the monthly income of 70% is less than 2500 while they own generator. With mean the possession of the generator is a necessity despite the low come.

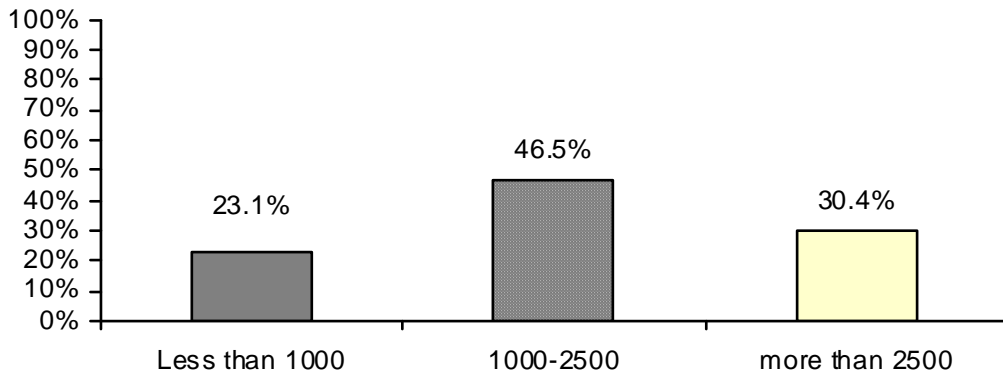


Figure 4.3. Distribution of the study population according to monthly income.

Level of education

Figure 4.4 shows that 35.8% of the sample have a university level of education, 33.8% secondary education, 19.2% preparatory, and 11.2% have a primary education. This shows that the majority (69.6%) of the study population is educated secondary and university which is good for questionnaire understanding. The degree of awareness in handling the generator among people is connected to the level of education.

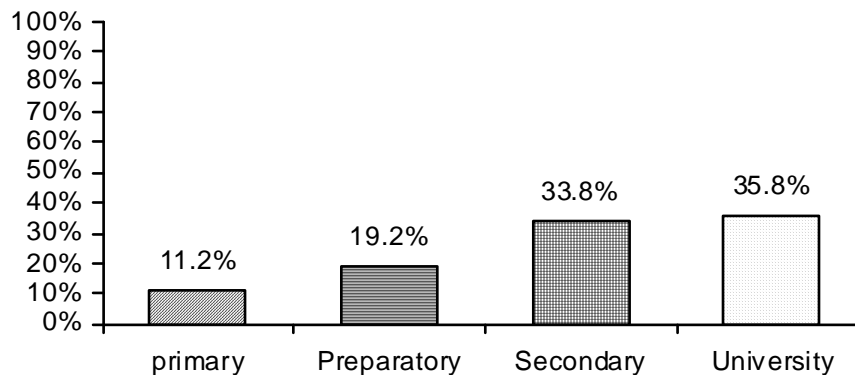


Figure 4.4. Distribution of the study population according to education level

Number of family members

Figure 4.5 shows that 36.8% of the sample family members are more than 9, 31.6% are 6-8, and 31.6% are 2-5. As shown in this figure, 36.8% of the sample family members are more than 9 which have reflected the severe danger in case of accidents of the generator.

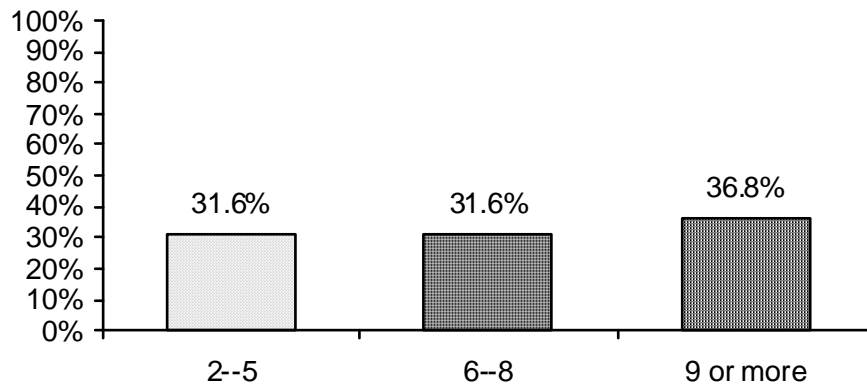


Figure 4.5. Distribution of the study population according to family members

Table 4.1.2: Housing conditions & environment

Variables	Frequency	Percent %
Length of stay at the Permanent address in years		
Less than 5	16	6.2
5-14	68	26.2
15 or more	176	67.7
Total	260	100.0
Type of house		
Concrete	104	40.0
Asbestos	152	58.5
Others	4	1.5
Total	260	100.0
Number of rooms in the house		
1-2	65	25.0
3-4	140	53.8
5 or more	55	21.2
Total	260	100.0
Number of Floors		
1-2	242	93.1
3-4	16	6.2
5 or more	2	0.8
Total	260	100.0
The status of ventilation in the house		
Poor	62	23.8
Average	81	31.2
Good	117	45.0
Total	260	100.0
The status of sunlight in the house		
Poor	59	22.7
Average	77	29.6
Good	124	47.7
Total	260	100.0

Table 4.1.2 shows that the housing conditions of the families who are living in the thirteen blocks such as, the permanent address, Length of stay at the Permanent address in years, type of the house and the number of rooms and floors. Moreover, the degree of house ventilation and its sunlight condition.

Type of house

Figure 4.6. Shows that 58.5% have been living in asbestos houses, 40.0% in concrete houses and, 1.5% others mixer between them.

More than 58% live in asbestos roof houses which explain the unsafe environmental living conditions that made them more prone to diseases in particular respiratory diseases.

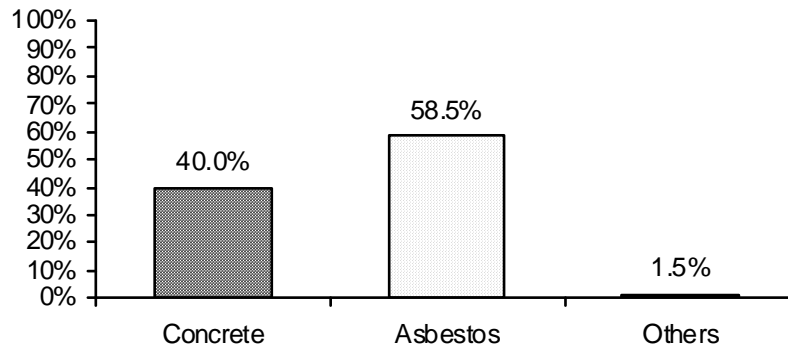


Figure 4.6. Distribution of the study Population according to the house type

The status of house ventilation

As shown in figure 4.7, 45% of the houses are good ventilation. While average ventilation with a percentage of 31.2% in their houses, and 23.8% are poor ventilation.

Approximately quarter of the sample are living in poor ventilated houses which reflects the poor health status specially who suffer from the respiratory diseases.

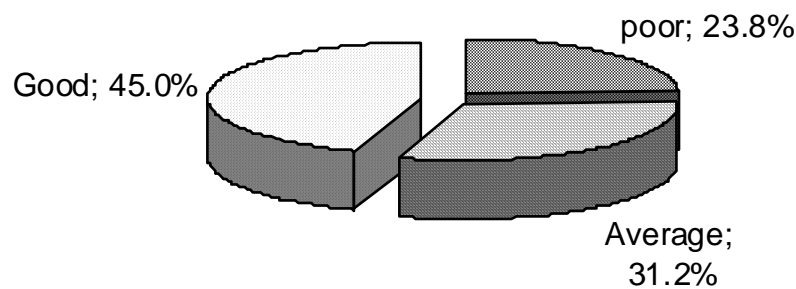


Figure 4.7. Distribution of the study Population according to the status of house ventilation

Table 4.1.3.1: Awareness and knowledge of the dangers posed by the misuse of the generator

Variables	Frequency	Percent %
The capacity of generator in the house		
1 KVA	118	45.4
2 KVA	5	1.9
3 KVA	44	16.9
4 KVA	4	1.5
5 KVA or more	89	34.2
Total	260	100.0
The type of fuel used in the generator		
Gasoline	260	100
Total	260	100.0
The working condition of the generator		
Acceptable	47	18.1
Good	186	71.5
Excellent	27	10.4
Total	260	100.0
The age of the person who operates the generator		
Less than 14 years	16	6.2
14-20 years	112	43.1
21 years or more	132	50.7
Total	260	100.0
The familiarity with operating the generator		
Yes	247	95.0
No	13	5.0
Total	260	100.0
Purchasing generator with the operating manual		
Yes	91	35.0
No	169	65.0
Total	260	100.0
If the answer is yes, the following instructions		
Yes	59	64.8
No	32	35.2
Total	91	100.0

The type of fuel used in the generator

100.0% of the sample were used gasoline as a fuel for the generator. However, the use of diesel less dangerous since it is less inflammable and volatile.

The age of the person who operates the generator

As shown in figure 4.8, 50.7% of the generator operators are over 21 years old, 43.1% are from 14-20 years old and, 6.2% are less than 14 years old.

This means that about 50% of the generator operators are children. The definition of the child in accordance with the Palestinian law as: Each human being who is not over the age of eighteen (Public Health Law, 2004).

This increases the risk levels of the generators as this age group is considered young and lack experience and well judgment. These factors put them in danger from handling the generators.

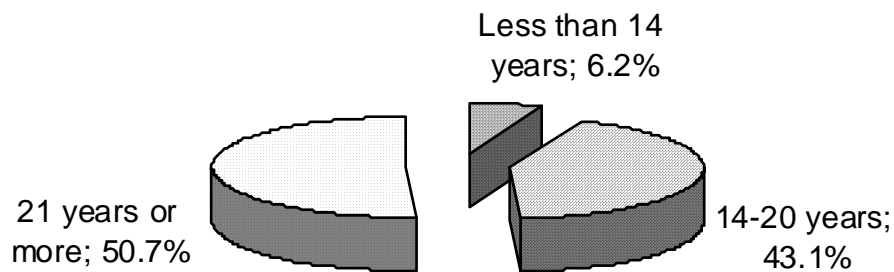


Figure 4.8. Distribution of the study Population according to the age of the person who operates the generator

The familiarity with operating the generator

Figure 4.9, shows that great majority of the sample (95%) have learned how to run the generator and only 5% did not. This means how much people estimate the dangers of misusing the generator.

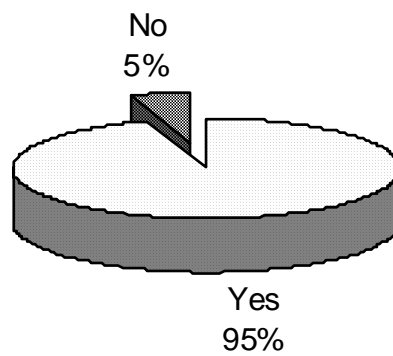


Figure 4.9. Distribution of the study Population according to the familiarity with operating the generator

Table 4.1.3.2: Awareness and knowledge of the dangers posed by the misuse of the generator

Variables	Frequency	Percent %
Knowledge about the risk of the electricity generators		
Yes	225	86.5
No	35	13.5
Total	260	100.0
Participation in related workshops		
No	260	100
Total	260	100.0
The family education about the dangers of generators		
Yes	258	99.2
No	2	0.8
Total	260	100.0
The location of the generator while it is running		
In the street	110	42.3
Inside the house	27	10.4
In the balcony	2	0.8
On the roof	109	41.9
Others	12	4.6
Total	260	100.0
The operating hours per day		
3-6	257	98.8
7-10	3	1.2
Total	260	100.0
The operating days per week		
1	1	0.4
2	7	2.7
3	252	96.9
Total	260	100.0
Generators placed close to neighbors houses		
Yes	259	99.6
No	1	0.4
Total	260	100.0
If the answer is yes, the distance away (in meters)		
3-6	165	63.7
7-10	55	21.2
11 or more	39	15.1
Total	259	100.0

The participation in awareness workshops on handling the generators

As shown in table 4.1.3.2. shows that 100.0% of the sample never attended any seminars on the dangers of generators. This means that a major failure of governmental and nongovernmental institutions in spreading knowledge of how to handle the generator particularly in holding workshops and producing leaflets in relation to generators hazards.

The location of the generator while it is running

42.3% of the respondents place their generator, while it is running, on the street, 41.9% place it on the roof of the house, 10.4% inside the house, 4.6% place it on other places, and only 0.8% on the balcony.

One can conclude that a large portion of users of generators place the generator on the street, due to the small size of their houses and the lack of alternative sites, which creates a major threat to pedestrians on the streets especially children. These pedestrians may stumble into the generators that are usually placed on dark and narrow streets. In contrast, the percentage of placing generators on the roofs is close to those who place them on the street, and this is less harmful than placing the generators on other places.

The percentage of placing the generator inside the house and on the balcony is not small. This might be equivalent to putting ticking bombs inside their houses that might explode at any time causing explosion or fire resulting in deaths in many cases, or suffocation because of carbon monoxide.

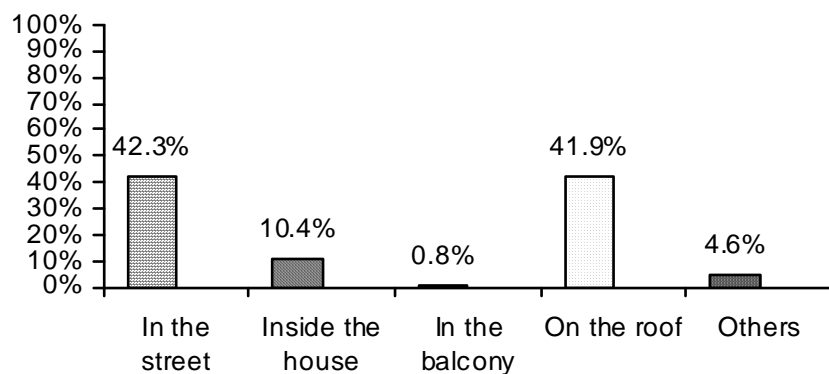


Figure 4.10. Distribution of the study Population according to the location of the generator while it is running

The operating hours daily & operating days weekly

98.8% of the respondents use their generator between 3-6 hours, and 1.2% of them use it for 7-10 hours in a day when there is no electricity. It is clear from these percentages that the number of hours of operation of generators is very high especially in the peak hours that are in the evening when there is an urgent need for lighting. It shows that 96.9% use the generator 3 days per week while 2.7% use it for two days a week and only 0.4% use it one day a week. This can be interpreted by the precise system to distribute the electricity outage among the 13 blocks of JRC equally and hence each block gets the same number of days of power outage. This means that some people run their generator for up to 72 hours per month with indifference towards the passers-by and neighbors who are affected by the sounds, noise, and thick black smoke which might be a major cause of pollution in the environment and cause negative impact on public health.

Table 4.1.3.3: Awareness and knowledge of the dangers posed by the misuse of the generator

Variables	Frequency	Percent %
The fueling the generator while it is running		
Yes	58	22.3
No	202	77.7
Total	260	100.0
The fueling the generator while smoking		
Yes	21	8.1
No	239	91.9
Total	260	100.0
The lighting device used to check the fuel level at night		
Battery-operated objects	260	100
Total	260	100.0
The storage of fuel at house		
Yes	133	51.2
No	127	48.8
Total	260	100.0
If the answer is yes, the amount of fuel stored		
Less than 5 liters	19	14.3
5-10 liters	25	18.8
11-16 liters	42	31.6
17 or more	47	35.3
Total	133	100.0
The location of fuel stored		
Near the generator	17	12.8
On the roof of the house	49	36.8
Designated place	67	50.4
Total	133	100.0
Closing the fuel tank after turning off the generator		
Yes	186	71.5
No	74	28.5
Total	260	100.0
Disconnecting the generator before switching it off		
Yes	230	88.5
No	30	11.5
Total	260	100.0
Keeping the children away from the generator		
Yes	256	98.5
No	4	1.5
Total	260	100.0

The fueling the generator while it is running

Figure 4.11, shows that 77.7% of the sample do not add fuel to the generator while it is running and 22.3% do so, it means that the major negligence of people who do that.

This means that a significant number of people are unaware of the seriousness of what they are doing and they were risking their lives and the lives of others.

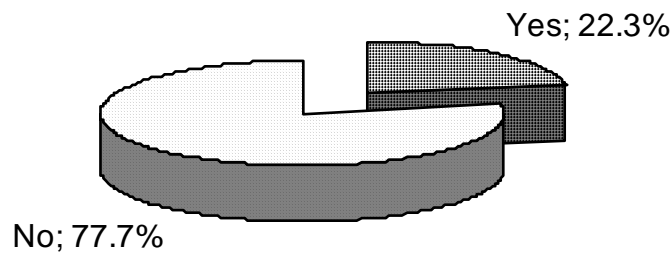


Figure 4.11. Distribution of the study Population according to the fueling the generator while it is running

The fueling the generator while smoking

Figure 4.12, shows that 91.9% of the sample does not add fuel while they are smoking and 8.1% of the sample added fuel to the generator while they are smoking.

This percentage is higher in the positive side, the percent of people who add fuel while smoking a cigarette is significant because of the tremendous risk in doing that.

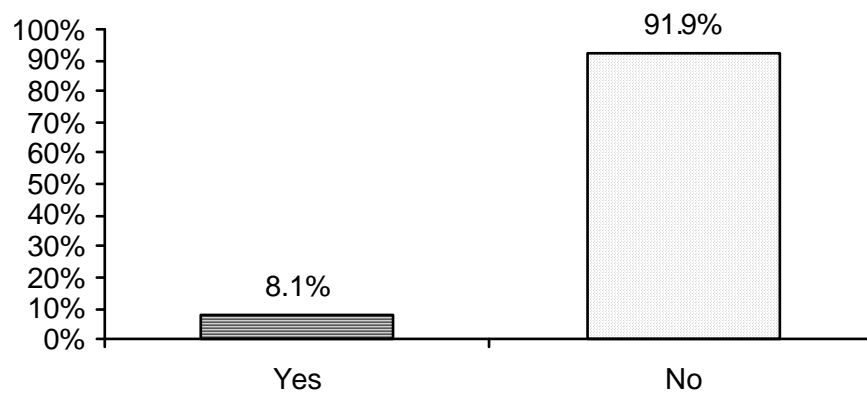


Figure 4.12. Distribution of the study Population according to the fueling the generator while smoking

The location of fuel stored

Figure 4.13, shows that 50.4% are storing fuel in a designated place, 36.8% on the roof of the house, and 12.8% near the generator, this points to the possibility of facing great danger to the people who stores fuel closed to the generator.

This means that the percentage of those who store fuel in a special place is acceptable, but the percentage of those who store fuel near the generator is high and this poses a significant risk that many people do not realize.

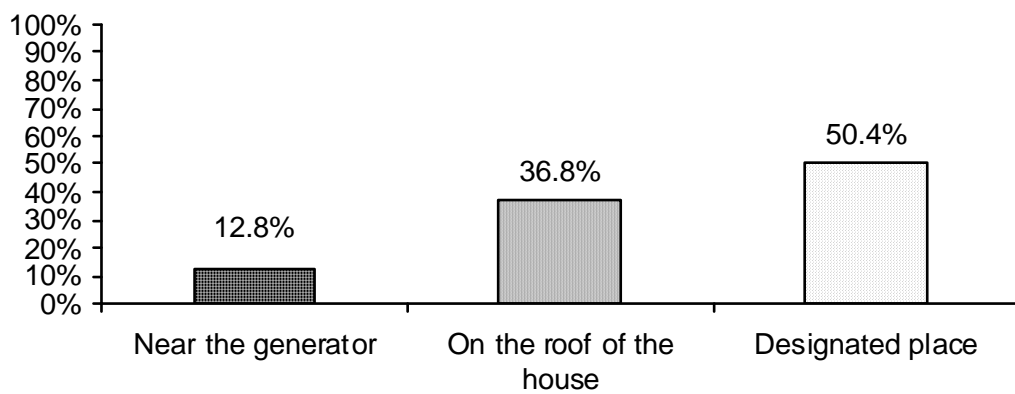


Figure 4.13. Distribution of the study Population according to the location of fuel stored

Disconnecting the generator before switching it off

Figure 4.14, shows that 88.5% are removing the cable connected to the house electrical network before the generator is off and 11.5% are not.

The percentage of those who are not keen on that is small but significant especially since many of the incidents occurred as a result of that were with the children. Data shows that 13 children arrived at the Department of Burns in the Dar al-Shifa hospital in just two weeks in 2010 and had their fingers amputated as a result of deep burns caused by carelessness in removing the plugs safely (Abu Shaaban, 2011).

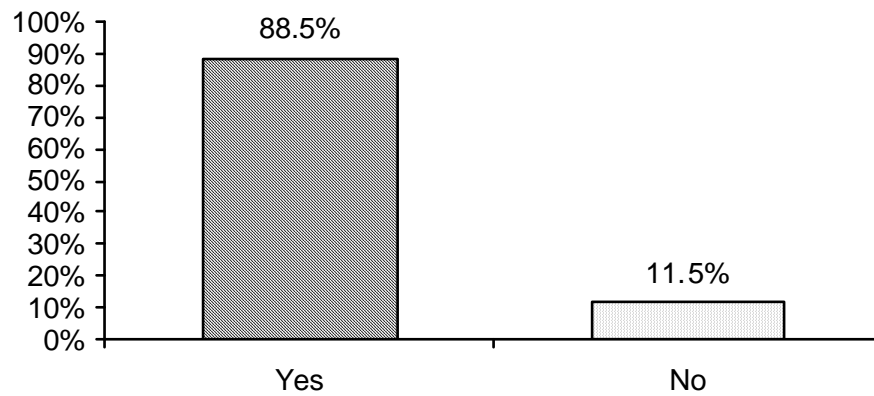


Figure 4.14. Distribution of the study Population according to disconnecting the generator before switching it off

Table 4.1.3.4: Awareness and knowledge of the dangers posed by the misuse of the generator

Variables	Frequency	Percent %
The sleeping next to the operating generator		
No	260	100
Total	260	100.0
Wearing gloves when fueling the generator		
Yes	4	1.5
No	256	98.5
Total	260	100.0
Wearing mask when fueling the generator		
No	260	100
Total	260	100.0
Washing hands after fueling the generator		
Yes	211	81.2
No	49	18.8
Total	260	100.0
The accidents caused by the generator		
Yes	20	7.7
No	240	92.3
Total	260	100.0
If the answer is yes, the type of accident		
Explosion	4	20.0
Fire	13	65.0
Electric shock	3	15.0
Total	20	100.0
The injuries or deaths as a result of the accident		
Yes	10	50.0
No	10	50.0
Total	20	100.0
If the answer is yes, type of it		
Injury	9	90.0
Death	1	10.0
Total	10	100.0
The fire extinguisher in the house		
Yes	6	2.3
No	254	97.7
Total	260	100.0

Washing hands after fueling the generator

Figure 4.15, shows that 81.2% of the respondents wash their hands after they are adding the fuel and 18.8% do not wash their hands.

The large percentage of those who do not wash their hands is very significant given the danger in being in contact with the fuel. The researcher can deduce from that the recklessness of some people since hand washing not only does not cost them anything but protects them and keeps them healthy.

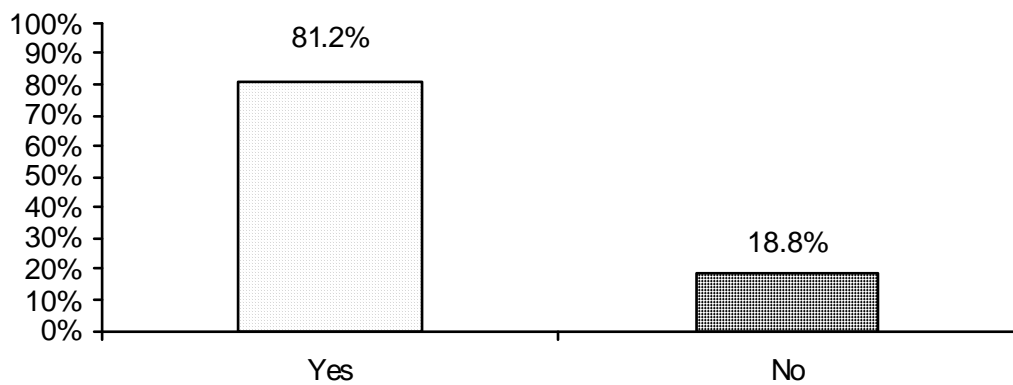


Figure 4.15. Distribution of the study Population according to the hands washing after fueling the generator

The accidents caused by the generator

Figure 4.16, shows that 92.3% did not have any accidents caused by the generator and 7.7% had accidents. The non-accidents percentage is very high but also the percentage of accidents is significant which can be minimized if all safety measures are taken when running the generator to maintain the safety of citizens.

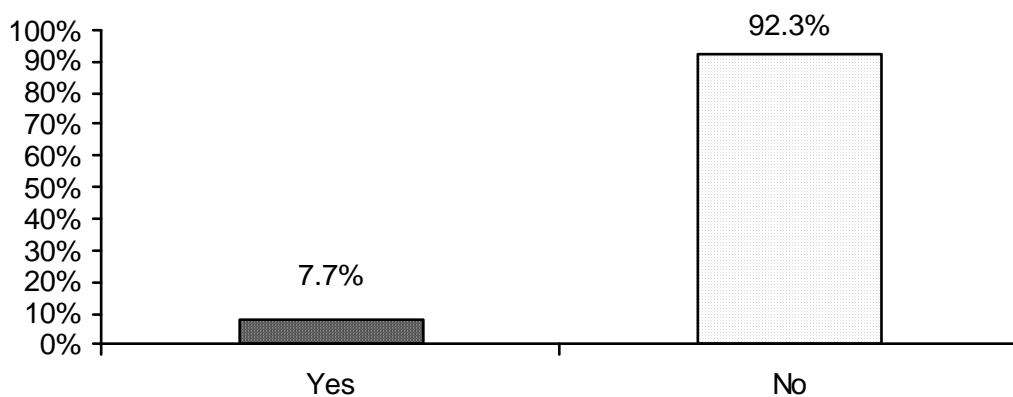


Figure 4.16. Distribution of the study Population according to the accidents caused by the generator

Table 4.1.4.1: Health effects of emissions

Variables	Frequency	Percent %
Odors or gaseous emissions from the generator in the place of residence		
Yes	177	68.1
No	83	31.9
Total	260	100.0
If the answer is yes, the peak time of the emissions		
Morning	1	0.6
Evening	176	99.4
Total	177	100.0
The cause of emissions		
Gases produced by the generator	176	99.4
Car exhaust emissions	1	0.6
Total	177	100.0
The intensity of emissions		
Low	26	14.7
Moderate	126	71.2
High	25	14.1
Total	177	100.0
The emissions and odors may cause illness		
Yes	175	98.9
No	2	1.1
Total	177	100.0
The fetal deaths		
Yes	18	6.9
No	242	93.1
Total	260	100.0
The infant deaths		
No	260	100
Total	260	100.0
The children with congenital malformation		
No	260	100
Total	260	100.0

The exposure to odors or emission from generator and the time of it

As shown in table 4.1.4.1. that 68.1% expose to odors and emissions from the generator in the place of residence and 31.9% do not.

This shows the magnitude of the environmental disaster that JRC is suffering because of the emission of toxic gases from the generators, as well as cars, where the environmental pollution exist in every area of the camp and negatively affects the health of residents and the environment.

Also, it was found that 99.4% of the emission happens at night, and only 0.6% in the morning, and this confirms that the peak time in the operation of the generators is in the evening hours, a time of urgent need for electricity.

The intensity of emission produced by the generator

As far as the intensity of the emissions, 71.2% of the respondents are moderate, while 14.7% is little and 14.1% is strong. The high percentage of those who believe that the intensity of emission is moderate is due to the fact that most of the respondents live in open houses which are the majority of houses in Jabalia camp. These houses are susceptible to air currents transporting these emissions.

Table 4.1.4.2: Health effects of emissions

Variables	Frequency	Percent %
The chronic diseases		
Yes	98	37.7
No	162	62.3
Total	260	100.0
If the answer is yes, the disease is (choose all that apply)		
Diabetes	60	34.1
Hypertension	78	44.3
Heart disease	25	14.2
Asthma	10	5.7
Cancer	1	0.6
Other	2	1.1
Total	176	100.0
The family members who suffer from the central nervous system		
Headache	126	15.4
Dizziness	101	12.4
Tremor in the extremities	57	7.0
Loss of balance	49	6.0
Nervousness	136	16.7
Difficulty breathing	112	13.7
Chest pain	99	12.1
Coughing	60	7.4
Sleep disorder	76	9.3
Total	816	100.0
The family members who suffer from the respiratory diseases		
Yes	15	5.8
No	245	94.2
Total	260	100.0
If the answer is yes, the disease is		
Bronchitis	2	13.3
Asthma	13	86.7
Total	15	100.0
The family members infected with eye diseases		
Yes	49	18.8
No	211	81.2
Total	260	100.0
If the answer is yes, the diseases is		
Redness	19	38.8
Allergy and irritation	23	46.9
Increase in the production of tears	1	2.0
Blurry vision.	6	12.2
Total	49	100.0
The family members infected with skin diseases		
Yes	30	11.5
No	230	88.5
Total	260	100.0

The chronic diseases among the study population

According to the study results, the most common chronic disease found in the study population was hypertension with 44.3%. Next comes diabetes with 34.1%, 14.2% is heart diseases, 5.7% is asthma, then 1.1% others and 0.6% is cancer. However, the use of domestic electricity generators might have negative effects on the people who suffer from the chronic diseases particularly hypertension, an asthmatic patients and heart diseases due to the lack of oxygen in the areas where the generators are operating since the heart with need to exert more effort to make up for the decrease in oxygen.

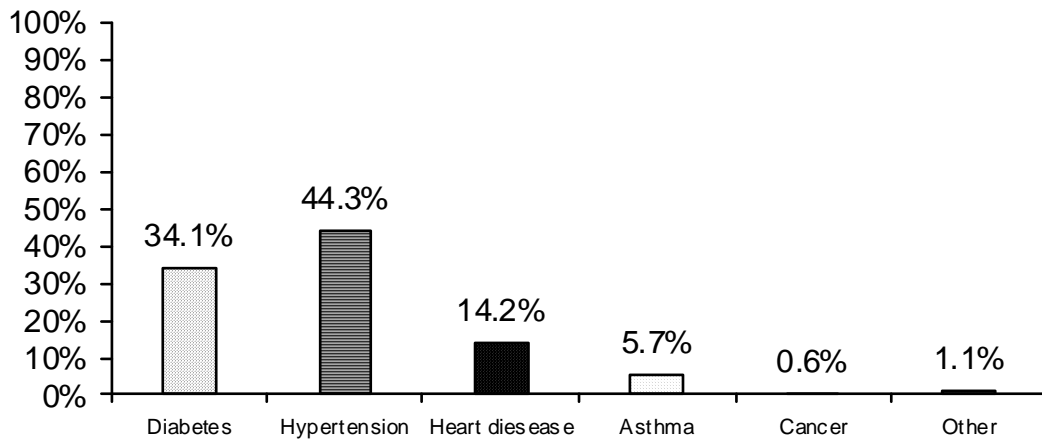


Figure 4.17. Distribution of chronic diseases among the study population

Table 4.1.5: Health effects of noise pollution

Variables	Frequency	Percent%
The annoyance level of generator sound		
Yes	244	93.8
No	16	6.2
Total	260	100.0
If the answer is yes, the level of annoyance is		
Little	3	1.2
Moderate	91	37.3
High	116	47.5
Very high	34	13.9
Total	244	100.0
The negative changes of hearing		
Yes	42	16.2
No	218	83.8
Total	260	100.0
The family members who suffer from nervous/psychological tension		
Yes	25	9.6
No	235	90.4
Total	260	100.0
Raising voice during discussion		
Yes	32	12.3
No	228	87.7
Total	260	100.0
The noise pollution affects on sleeping patterns		
Yes	251	96.5
No	9	3.5
Total	260	100.0

In the table 4.1.5 regarding the health impacts of noise pollution, the results showed that the vast majority (93.8%) of the study population are annoyed by the sound of generator, while 6.2% of the sample is not. Also, the results showed that the level of annoyance as follows: high 47.5%, moderate 37.3%, very high 13.9%, and little 1.2%. Moreover, regarding the negative impacts on the hearing, 83.8% of them do not feel that they had negative changes in the hearing level for at least one family member in the last four years, while 16.2% do that. Also, according to the results that, 90.4% of the study population, no family members complain of nervous/psychological tension in the last four years, while 9.6% of them said that there is complaining of it. The results show that 87.7% of the respondents do not ask others to speak loudly, while 12.3% of them ask others to speak loudly. Finally, the results showed that the majority (96.5%) of the study population think that noise pollution affects on the sleeping, and only 3.5% of them do not think that.

Table 4.1.6: Measurements:

Variables	Frequency	Percent %
Concentration level of CO is:		
% 0.01	69	26.5
% 0.05	81	31.2
% 0.1	110	42.3
Total	260	100.0
Noise Pollution level in decibel is:		
31-60	124	47.7
61-90	136	52.3
Total	260	100.0

From table 4.1.6 above, it is shown that the concentration level of CO as follows: 0.1% in the 42.3% of the study population, 0.05% in the 31.2% of them, and 0.01% in the 26.5% of the sample.

Also, the table 4.1.6 shows that the noise pollution level in decibel. The results were: in 52.3% of the study population, the noise levels were between 61-90 db, and in 47.7% were 31-60 db.

4.2: Analysis of the relationships between variables

The researcher used Chi- square (χ^2) test to test the relationship between carbon monoxide and noise pollution level with the health impact as both are categorical variables, P-value less than 0.05 considers statistically significant.

4.2.1: The concentration level of CO and the capacity of the generator

Table 4.2.1: Show the relationship between the concentration level of carbon monoxide and the capacity of the domestic electricity generator.

		Concentration level of CO			P- value
		0.01 %	0.05 %	0.1 %	
The capacity of the generator	1 KVA	25.6%	35.9%	38.5%	0.089
	2 KVA	80.0%	20.0%		
	3 KVA	31.8%	27.3%	40.9%	
	4 KVA	25.0%	50.0%	25.0%	
	5 KVA or more	21.3%	27.0%	51.7%	
Total		26.3%	31.3%	42.5%	

As shown in table 4.2.1, it is clear from the study that there is no statistically significant relationship between the CO concentration in ambient air and the capacity of generator, with P-value of 0.089 which is greater than 0.05.

4.2.2: The noise pollution level in db and the capacity of generator

Table 4.2.2: illustrates the relationship between the noise pollution level and the capacity of the generator.

		Noise Pollution level in decibel		P- value
		31 – 60	61 – 90	
The capacity of the generator	1 KVA	47.0%	53.0%	0.695
	2 KVA	60.0%	40.0%	
	3 KVA	40.9%	59.1%	
	4 KVA	25.0%	75.0%	
	5 KVA or more	50.6%	49.4%	
Total		47.1%	52.9%	

The results in table 4.2.2, showed that, it was seemed clear from the study that there is no statistically significant relationship between the noise pollution and the capacity of the domestic electricity generator, with a p-value of 0.695 which is greater than 0.05.

4.2.3: The concentration level of CO and the working condition of the generator

Table 4.2.3: shows the relationship between the concentration level of carbon monoxide and the working condition of the domestic electricity generator.

		Concentration level of CO			P- value
		0.01 %	0.05 %	0.1 %	
The working condition of the generator	Acceptable	25.5%	36.2%	38.3%	0.340
	Good	24.9%	32.4%	42.7%	
	Excellent	37.0%	14.8%	48.1%	
Total		26.3%	31.3%	42.5%	

As shown in table 4.2.3, that there is no statistically significant relationship between the CO concentration in ambient air and the working condition of the generator, with P-value of 0.340 which is greater than 0.05.

4.2.4: The noise pollution level in db and the working condition of the generator

Table 4.2.4: Show the relationship between the noise pollution level and the working condition of the generator.

		Noise Pollution level in decibel		P- value
		31 – 60	61 – 90	
The working condition of the generator	Acceptable	48.9%	51.1%	0.950
	Good	46.5%	53.5%	
	Excellent	48.1%	51.9%	
Total		47.1%	52.9%	

The results in table 4.2.4, showed that, it was seemed clear from the study that there is no statistically significant relationship between the noise pollution and the working condition of the generator, with a p-value of 0.950 which is greater than 0.05.

4.2.5: The concentration level of CO and the fetal deaths

Table 4.2.5: shows the relationship between the concentration level of carbon monoxide and the fetal deaths in the last four years.

		The fetal deaths		P- value
		Yes	No	
Concentration level of CO	0.01 %	5.9%	94.1%	0.797
	0.05 %	6.2%	93.8%	
	0.1 %	8.2%	91.8%	
Total		6.9%	93.1%	

As shown in table 4.2.5, that there is no statistically significant relationship between the CO concentration level and the fetal deaths in the last four years, with P-value of 0.797 which is greater than 0.05.

4.2.6: The concentration level of CO and the chronic diseases

Table 4.2.6: shows the relationship between the concentration level of carbon monoxide and the chronic diseases.

		Chronic diseases		P- value
		Yes	No	
Concentration level of CO	0.01 %	33.8%	66.2%	0.445
	0.05 %	33.3%	66.7%	
	0.1 %	41.3%	58.7%	
Total		36.8%	63.2%	

As shown in table 4.2.6, it is clear from the study that there is no statistically significant relationship between the CO concentration in ambient air and the chronic diseases, with P-value of 0.445 which is greater than 0.05.

4.2.7: The concentration level of CO and the headache

Table 4.2.7: shows the relationship between the concentration level of carbon monoxide and the headache.

		Headache		P- value
		Yes	No	
Concentration level of CO	0.01 %	57.4%	42.6%	0.035
	0.05 %	53.1%	46.9%	
	0.1 %	39.1%	60.9%	
Total		48.3%	51.7%	

The results in table 4.2.7, showed that, it was seemed clear from the study that there is statistically significant relationship between the carbon monoxide and the headache, with a p-value of 0.035 which is less than 0.05.

4.2.8: The concentration level of CO and the dizziness

Table 4.2.8: shows the relationship between the concentration level of carbon monoxide and the dizziness.

		Dizziness		P- value
		Yes	No	
Concentration level of CO	0.01 %	42.6%	57.4%	0.596
	0.05 %	34.6%	65.4%	
	0.1 %	39.1%	60.9%	
Total		38.6%	61.4%	

As shown in table 4.2.8, that there is no statistically significant relationship between the CO concentration in ambient air and the dizziness, with P-value of 0.596 which is greater than 0.05.

4.2.9: The concentration level of CO and the tremor in the extremities

Table 4.2.9: The relationship between the concentrations level of carbon monoxide and the tremor in the limbs.

		Tremor in the extremities		P- value
		Yes	No	
Concentration level of CO	0.01 %	22.1%	77.9%	0.694
	0.05 %	18.5%	81.5%	
	0.1 %	23.6%	76.4%	
Total		21.6%	78.4%	

As shown in table 4.2.9, that there is no statistically significant relationship between the CO concentration in ambient air and the tremor in the limbs, with P-value of 0.694 which is greater than 0.05.

4.2.10: The concentration level of CO and the loss of balance

Table 4.2.10: Show that the relationship between the concentrations level of carbon monoxide and the loss of balance.

		Loss of balance		P- value
		Yes	No	
Concentration level of CO	0.01 %	14.7%	85.3%	0.192
	0.05 %	14.8%	85.2%	
	0.1 %	23.6%	76.4%	
Total		18.5%	81.5%	

As shown in table 4.2.10, that there is no statistically significant relationship between the CO concentration in ambient air and the loss of balance, with P-value of 0.192 which is greater than 0.05.

4.2.11: The concentration level of CO and the nervousness

Table 4.2.11: The relationship between the concentration level of carbon monoxide and the nervousness.

		Nervousness		P- value
		Yes	No	
Concentration level of CO	0.01 %	52.9%	45.6%	0.520
	0.05 %	49.4%	50.6%	
	0.1 %	53.6%	46.4%	
Total		52.1%	47.5%	

The results in table 4.2.11, showed that, it was seemed clear from the study that there is no statistically significant relationship between the carbon monoxide and the nervousness, with a p-value of 0.520 which is greater than 0.05.

4.2.12: The concentration level of CO and the difficulty breathing

Table 4.2.12: The relationship between the concentration level of carbon monoxide and the difficulty breathing.

		Difficulty breathing		P- value
		Yes	No	
Concentration level of CO	0.01 %	42.6%	57.4%	0.660
	0.05 %	40.7%	58.0%	
	0.1 %	44.5%	55.5%	
Total		42.9%	56.8%	

As shown in table 4.2.12, that there is no statistically significant relationship between the CO concentration in ambient air and the difficulty breathing, with P-value of 0.660 which is greater than 0.05.

4.2.13: The concentration level of CO and the chest pain

Table 4.2.13: The relationship between the concentration level of carbon monoxide and the chest pain.

		Chest pain		P- value
		Yes	No	
Concentration level of CO	0.01 %	39.7%	60.3%	0.901
	0.05 %	38.3%	61.7%	
	0.1 %	36.4%	63.6%	
Total		37.8%	62.2%	

As shown in table 4.2.13, that there is no statistically significant relationship between the CO concentration in ambient air and the chest pain, with P-value of 0.901 which is greater than 0.05.

4.2.14: The concentration level of CO and coughing

Table 4.2.14: The relationship between the concentration level of carbon monoxide and coughing.

		Coughing		P- value
		Yes	No	
Concentration level of CO	0.01 %	23.5%	76.5%	0.521
	0.05 %	18.5%	81.5%	
	0.1 %	25.5%	74.5%	
Total		22.8%	77.2%	

As shown in table 4.2.14, that there is no statistically significant relationship between the CO concentration in ambient air and coughing, with P-value of 0.521 which is greater than 0.05.

4.2.15: The concentration level of CO and sleep disorder

Table 4.2.15: The relationship between the concentration level of carbon monoxide and sleep disorder.

		Sleep disorder		P- value
		Yes	No	
Concentration level of CO	0.01 %	35.3%	64.7%	0.540
	0.05 %	27.2%	72.8%	
	0.1 %	26.7%	72.7%	
Total		29.3%	70.7%	

As shown in table 4.2.15, that there is no statistically significant relationship between the CO concentration in ambient air and sleep disorder, with P-value of 0.540 which is greater than 0.05.

4.2.16: The concentration level of CO and the respiratory diseases

Table 4.2.16: The relationship between the concentration level of carbon monoxide and the respiratory diseases.

		Respiratory diseases		P- value
		Yes	No	
Concentration level of CO	0.01 %	7.4%	92.6%	0.50
	0.05 %	6.2%	93.8%	
	0.1 %	4.5%	93.6%	
Total		5.8%	93.4%	

As shown in table 4.2.16, that there is no statistically significant relationship between the CO concentration in ambient air and the respiratory diseases, with P-value of 0.50 which is greater than 0.05.

4.2.17: The concentration level of CO and the eye diseases

Table 4.2.17: Show the relationship between the concentration level of carbon monoxide and the eye diseases.

		Eye diseases		P- value
		Yes	No	
Concentration level of CO	0.01 %	16.2%	83.8%	0.529
	0.05 %	22.2%	77.8%	
	0.1 %	16.5%	83.5%	
Total		18.2%	81.8%	

As shown in table 4.2.17, that there is no statistically significant relationship between the CO concentration in ambient air and the eye diseases, with P-value of 0.529 which is greater than 0.05.

4.2.18: The concentration level of CO and the skin diseases

Table 4.2.18: Show the relationship between the concentration level of carbon monoxide and the skin diseases.

		Skin diseases		P- value
		Yes	No	
Concentration level of CO	0.01 %	11.8%	88.2%	0.190
	0.05 %	6.2%	93.8%	
	0.1 %	14.5%	85.5%	
Total		11.2%	88.8%	

As shown in table 4.2.18, that there is no statistically significant relationship between the CO concentration in ambient air and the skin diseases, with P-value of 0.190 which is greater than 0.05.

4.2.19: The noise pollution level in db and the hearing problems

Table 4.2.19: Show the relationship between the noise pollution level and the hearing problems.

		Hearing problems		P- value
		Yes	No	
Noise Pollution level in decibel	31 – 60	20.5%	79.5%	0.049
	61 – 90	11.7%	88.3%	
Total		15.8%	84.2%	

As shown in table 4.2.19, that there is statistically significant relationship between the noise pollution and the hearing problems due to the last four years, with P-value of 0.049 which is less than 0.05.

4.2.20: The noise pollution level in db and the nervous/psychological tension

Table 4.2.20: Show the relationship between the noise pollution level and the nervous/psychological tension.

		Nervous/psychological tension		P- value
		Yes	No	
Noise Pollution level in decibel	31 – 60	12.3%	87.7%	0.113
	61 – 90	6.6%	93.4%	
Total		9.3%	90.7%	

As shown in table 4.2.20, that there is no statistically significant relationship between the noise pollution and the nervous/psychological tension., with P-value of 0.113 which is greater than 0.05.

4.2.21: The noise pollution level in db and the sleeping patterns

Table 4.2.21: Show the relationship between the noise pollution level and the sleeping patterns.

		Sleeping patterns		P- value
		Yes	No	
Noise Pollution level in decibel	31 – 60	96.7%	3.3%	0.630
	61 – 90	95.6%	3.6%	
Total		96.1%	3.5%	

As shown in table 4.2.21, that there is no statistically significant relationship between the noise pollution and the sleeping patterns., with P-value of 0.630 which is greater than 0.05.

4.2.22: Summary of the relationship between carbon monoxide and noise pollution with the health impact

The researcher used Chi- square test to test these relationship, it shows that there is a positive relationship between the concentration level of CO and development of headache as P-value was 0.035 (less than 0.05). Other variables of health that have been studied showed that there is no relationship between them and the level of CO, as P-value ranged from 0.190 for skin disease, 0.192 for loss of balance, 0.445 for chronic diseases, 0.50 for respiratory diseases, 0.520 for nervousness, 0.521 for coughing, 0.529 for eye diseases, 0.540 for sleep disorders, 0.596 for dizziness, 0.660 for difficulty breathing, 0.694 for tremor in the extremities, 0.797 for fetal death, and 0.901 for chest pain.

For the relationship between noise pollution and health impact there was a statistically significant relationship between noise pollution and hearing problem as P- value was 0.049 which is less than 0.05. but there was no relationship between noise pollution and nervous/psychological tension as P-value was 0.113 and sleeping patterns as P-value was 0.63.

4.3: Discussion

4.3.1: Characteristics of the study population- personal data

Gender

Within the sample it was only one female was interviewed as the family head. This reflects our known traditions.

Age group

More than two third the sample are within the age group (15-29 years). This conform with the data published by the PCBS (29.4%) of the population are within the youth age group 15-29 years.

Monthly income

The domestic generators is becoming crucial in the house despite the low income. The income of 70% are less than 2500 Shekel. However, the possession of the generator with all its requirements such as fuel and maintenance is still unavoidable.

4.3.2: Housing conditions & environment

Type of house

Around two third live in asbestos roof houses, that have the affect of contamination of asbestosis disease. The more exposure to the asbestos the more inhalation of asbestos fibres.

4.3.3: Awareness and knowledge of the dangers posed by the misuse of the generator

The type of fuel used in the generator

It was noticed that all of the sample use gasoline as fuel for the generator. Although, the gasoline is much more inflammable than diesel and more skin penetrating.

The age of the person who operates the generator

It was clear that half of the sample of whom operate the generator are less than 20 years old. This age group is considered a child under the Palestinian laws. They would be ignorant of the risk and danger of handling the generator.

Purchasing generator with the operating manual

When the generator was purchased more than two third of the sample were not provided with the operating manual. This might be due to the fact that most generators were smuggled through the tunnels from Egypt. The operating manual usually explain the best instructions on how to operate the generator and to avoid any risk involved.

Participation in related workshops

It was found that all the respondents did not attend workshops related to the generators. This reflects the negligence of governmental and nongovernmental institutions in spreading knowledge about handling the generators.

Generators placed close to neighbors houses

It was found that the majority (99.6%) of the neighbors own generators while only 0.4% does not. This percentage shows the magnitude of the environmental problems that JRC might faces every time there is a power outage. Those percentages also show that Jabalia is mired in a sea of toxic gases and noise pollution when there is a power outage.

This shows the status of overcrowding experienced by the residents of Jabalia camp, houses are mostly adjacent to each other, and if there is a small gap between each two houses, it is just a narrow street that does not exceed two meters in width.

Storage of fuel in houses

It was reported that more than half of the sample store fuel inside houses. This result **from** none awareness of the danger in doing that. Particularly in case of fire while the fuel **is** stored close to the running generator.

Precautions while fueling the generator

only 1.5% of the respondents do wear gloves when they perform that task. The reason behind that may be lack of awareness of the seriousness of the skin contact with the fuel and the harmful impact, or due to the time factor, where often people believed that the safety measures need time and effort to apply. However, it turns out that all members of the sample do not wear a mask when fueling the generator and that is due to the lack of knowledge about hazardous substances that pose a threat to their safety.

Generators accidents related

In addition, it shows that 92.3% did not have any accidents caused by the generator and 7.7% had accidents caused by the generator at house. The non-accidents percentage is very high but also the percentage of accidents is significant which can be minimized if all safety measures are taken when running the generator to maintain the safety of citizens.

One fatality accident plus 9 injuries accidents were reported. Two third of these accidents were caused by fire. It is noted here that the rate of accidents that occurred as a result of fire is high compared with other causes. This is due to poor handling of fuel whether while fueling.

Possession of fire extinguisher

It is noted here that the percentage of those who do not have the means to extinguish the fire is very high which is due to the lack of awareness of the importance of this issue and the failure of authorities to urge the residents or even force them to have it.

Chronic diseases in families

The study results show that 62.3% of the study population , do not complain of any chronic diseases , while in 37.7% of the sample , suffer from chronic diseases. Also, the chronic diseases are the main cause of death all over the world and their effects are still increasing. Approximately 17 million are dying every year as a result of these diseases. Moreover, in Palestine the effects of these diseases are increasing on the Palestinian society in particular diabetes, hypertension, heart diseases and cancer. It known fact and according to the MOH in 2009, about 10% of the Palestinian people have at least one family member suffering from diagnosed chronic diseases (MOH, 2009).

4.3.4: Measurements

The researcher has taken the measurements during four days per week which distributed among thirteen blocks and were taken while there is a power cut in the evening hours and while the generators are running. The percentage of CO concentration in the air was measured about half meter away from the exhaust of the generator by Mini Worn device. Then, the noise pollution level was measured by Sound Level Meter device from the place where the family gathers. The results on the concentration of carbon monoxide in ppm as follow:

Table 4.3.4.1: The results on the concentration of carbon monoxide in ppm

Concentration	Size of the sample
150-499 ppm (0.01%)	26.5%
500-999 ppm (0.05%)	31.2%
1000 ppm and more (0.1%)	42.3%

These measurements are considerably high comparing with measurements taken in Iraq in 2008 which shown under the literatures. This might be due to the bad quality of generators used in Gaza and not conducting regular maintenance for the generator. This high ratio of emitted gases cause negative health impact such as headache which was noticed by the researcher. Other symptomatic such as dizziness, nausea, tachycardia were noticed in previous studies.

The effects of CO exposure can vary greatly from person to person depending on age, overall health and the concentration and time of exposure.

Also, the study results showed that the complaints among the study population were as follow, nervousness 16.7%, headache 15.4%, breathing difficulty 13.7%, dizziness 12.4%, and chest pain 12.1%, sleeping disturbances 9.3%, coughing 7.4%, tremor in extremities 7.0%, and loss of balance 6.0%. The family members complain of more than one of these complaints in most of the study population, and the previous complaints are the most common side effects, or health impacts of the electricity generators (U.S.EPA, 2010).

Noise pollution measurements were relatively high as follow 47.7% were within the range 31-60 decibel and 52.3% were within the range 61-90 decibel. These are much higher than the tolerated measurements.

In comparing between the tolerated level of the noise pollution in residential areas and the results that the researcher has reached in measuring the level of noise in the houses that where visited. It was notices that the result much higher than the tolerated level according to the Palestinian regulations for environment. Since the tolerated levels for the residential areas are 50 decibel for morning time and 40 decibel for evening time. The taken measurements are more than tolerated in industrial and commercial areas as shown in the literatures.

Chapter 5: Conclusions and recommendations

5.1 Conclusions

This chapter presents the main conclusions of this study, as well as provides few recommendations for decision makers and public that may help to reduce the hazard of these generators. This issue needs more effort to be exerted by all health sectors, civil defense and all concerned in the GS. However, it is known that researchers in science and other fields need to refer to previous studies and statistics related to their research in order to support them with confirmed and documented statistics. The researcher resorts to the sources of these statistics, such as official governmental institutions and civil society organizations that deal with his field of study. Therefore, the monitoring and follow up on generators issue are insufficient.

In this study, the researcher sought to obtain statistics that could be help in the study. However, the researcher found many difficulties mainly in the nonexistence of official statistics on the number of accidents and the number of deaths and injuries caused by electricity generator. Since the start of the study, the researcher approached various concerned institutions hoping to find trusted data to refer to during the research. Unfortunately, the researcher could not find sufficient data or statistics that could be that could strengthen this study.

Furthermore, having such important data enables decision makers to make the right decisions. Also, here it is noticed the absence of the role of these institutions in educating the citizens about the dangers of these generators where there is no bulletins, seminars, radio or television programs to a degree equivalent to the size of the problem to raise environmental and health awareness among the citizens and show them the negative effects of the generators on human health and the environment.

This study was conducted in the period between May and October 2011, at the thirteen blocks in Jabalia camp. The sample was 265 houses, with 260 (98.1%) response rates. The results of this study revealed that the smokers represent among the study population were 43.5%. 100.0% of the sample was used gasoline as a fuel for the generator. Regarding to the age of the person who operates the generator, 43.1% are from 14-20 years old and,

6.2% are less than 14 years old. 65% of the respondents were not provided with the knowledge on how to use the generator while 35.2% did not apply the proper guidelines.

The entire sample never attended any workshops on the generators. Also, 42.3% of the respondents place their generator on the street, while it is running, 41.9% place it on the roof of the house, and 10.4% inside the house. In addition to that 98.8% of the sample use their generator between 3-6 hours in a day when there is no electricity, while 96.9% use the generator 3 days per week. 99.6% of the neighbors own generators. Moreover, 22.3% of the sample adds fuel to the generator while it is running, and 8.1% add fuel to the generator while smoking a cigarette.

51.2% of the study population store fuel at house, while 35.3% of those store more than 17 liters. Additionally, 50.4% of sample is storing fuel in a special place, 36.8% on the roof of the house, and 12.8% near the generator. 28.5% are not keen to close the fuel tank after switching off the generator, and 11.5% are not keen to turn off the generator before removing the plug from the house electricity grid. 98.5% of the study population does not wear gloves when adding fuel to the tank of the generator. However, it turns out that all of the sample does not wear a mask when adding fuel into the generator. 18.8% do not wash their hands thoroughly after adding the fuel.

In addition to, 7.7% had accidents caused by the domestic generators. 65% of the incidents caused by the generator were fires, 20% were explosions, and 15% were due to electric shocks. Also, 50% of these incidents resulted in casualties of which 90% were injuries and one case of death was reported. 97.7% of the respondents have no means to extinguish the fire at house. Those who smell unpleasant odors and emissions from the generator in their place of residence account for 68.1%. From all participants 99.4% said that these bad smell are from the generator. About 99.4% of the sample claim that the peak of these smells happen at night.

But, the fetal deaths of the sample had a percentage of 6.9%. Also, no respondents have infant deaths and no one has any children born with congenital malformation in the last four years. Chronic diseases represent about 37.7% and it represents the following: hypertension represent about 44.3%, diabetes mellitus represent about 34.1%, heart diseases 14.2%, asthma 5.7%, then 1.1% others and 0.6% cancer. The complaints among

the study population were as follow, nervousness 16.7%, headache 15.4%, breathing difficulty 13.7%, dizziness 12.4%, and chest pain 12.1%, sleeping disturbances 9.3%, coughing 7.4%, tremor in extremities 7.0%, and loss of balance 6.0%.

Respiratory diseases were 5.8% of the surveyed population, bronchial asthma accounts for 86.7% and chronic bronchitis 13.3%. Eye diseases represent 18.8% of all study population. From all cases affected with eye diseases 46.9% suffered from allergy and irritation, 38.8% redness, 12.2% blurry vision and 2.0% increase eye secretion. Furthermore, skin diseases represent 11.5% of the study population. About 16.2% of the sample feels that they had negative changes in the hearing level in the last four years. Also, according to the results that, 9.6% of the study population, complain of nervous/psychological tension in the last four years. About 96.5% of the study population thinks that noise pollution affects on their sleeping.

The concentration level of CO as follow: 0.1% in the 42.3% of the study population, 0.05% in the 31.2% of them, and 0.01% in the 26.5% of the sample. Finally, the noise pollution level in decibel, the results were: in 52.3% of the study population, the noise level were between 61-90 db, and in 47.7% were 31-60 db.

The relationships between variables show that there are no statistically relationships between the CO concentration in ambient air and the capacity of generator (P-value of 0.089), and also with the type of fuel that used in the generator (P-value of 0.258), and the same with the working condition of the generator (P-value of 0.340), and also with the fetal death in the last four years (P-value of 0.797). Moreover, the study shows that there is no statistically significant relationship between the CO concentration level and the infant deaths due to the last four years (P-value of 0.462), and also with the children with congenital malformation due to the last four years (P-value of 0.368), and the same with the chronic diseases (P-value of 0.445).

However, it was seemed clear from the study that there is statistically significant relationship between the carbon monoxide and the headache (p-value of 0.035). Also, there is no statistically significant relationship between the CO concentration in ambient air and the dizziness (P-value of 0.596), and also with the tremor in the limbs (P-value of 0.694), and the same with the loss of balance (P-value of 0.192), and with the nervousness in which the p-value equal 0.520. There is no statistically significant relationship between the

CO concentration in ambient air and the difficulty breathing (P-value of 0.660), and also with the chest pain (P-value of 0.901) and the same with coughing (P-value of 0.521).

Moreover, there is no statistically significant relationship between the CO concentration in ambient air and sleep disorder (P-value of 0.540), and with the chest diseases (P-value of 0.50), and also with the eye diseases (P-value of 0.529), and the same with the skin diseases (P-value of 0.190).

From the results shows that there is no statistically significant relationship between the noise pollution and the capacity of the domestic electricity generator (P-value of 0.695), and also with the type of the fuel that used in the domestic electricity generator (P-value of 0.930), and the same with the working condition of the generator (P-value of 0.950).

The study shows that there is statistically significant relationship between the noise pollution and the hearing problems due to the last four years (P-value of 0.049). However, there is no statistically significant relationship between the noise pollution and the nervous/psychological tension (P-value of 0.113). Finally, there is no statistically significant relationship between the noise pollution and the sleeping patterns (P-value of 0.630).

5.2 Recommendations

The people of Gaza who are suffering from power cuts for long periods of time turn to the cheap Chinese-made generators, which plunged many families in the darkness of grief. These generators turned out to be a constant threat to their lives due to their misuse. The following recommendations would reduce the magnitude of the problem and reduce the risk of using the generators:

- Authorities are urge to make the effort required to accelerate the process of solving the issue of power cuts in GS as soon as possible.
- Generators should be placed as far as possible from the people taking into account the wind direction to prevent the inhalation of combustion and reduce the noise level.

- The generators should be operated in reasonably ventilated places.
- Regular maintenance including lubrication of the generators is required to ensure the most efficient operation.
- Proper handling and storing of fuel far away from the generators.
- Making sure that the spilled fuel and oil do not reach the soil and the sewage systems.
- Reduce number of operation hours to 3-6 hrs daily in order to minimize bad effects on health and environment .
- Encourage households to keep fire extinguisher in each house.
- Governments should include noise as an important public health issue in environmental impact assessment.
- Conducting of educational extension programs on how to deal with the generators to decrease the hazards of it.
- Governments should conduct field investigation / inspection visits and apply related quality control procedures.
- Replacing gasoline by diesel in operating the generators since it is less dangerous and harm.
- The age of the person who operates the generators should not be less than 20 years old.
- The sail of the generators should be equipped with its manual as per imposed government regulations and laws.

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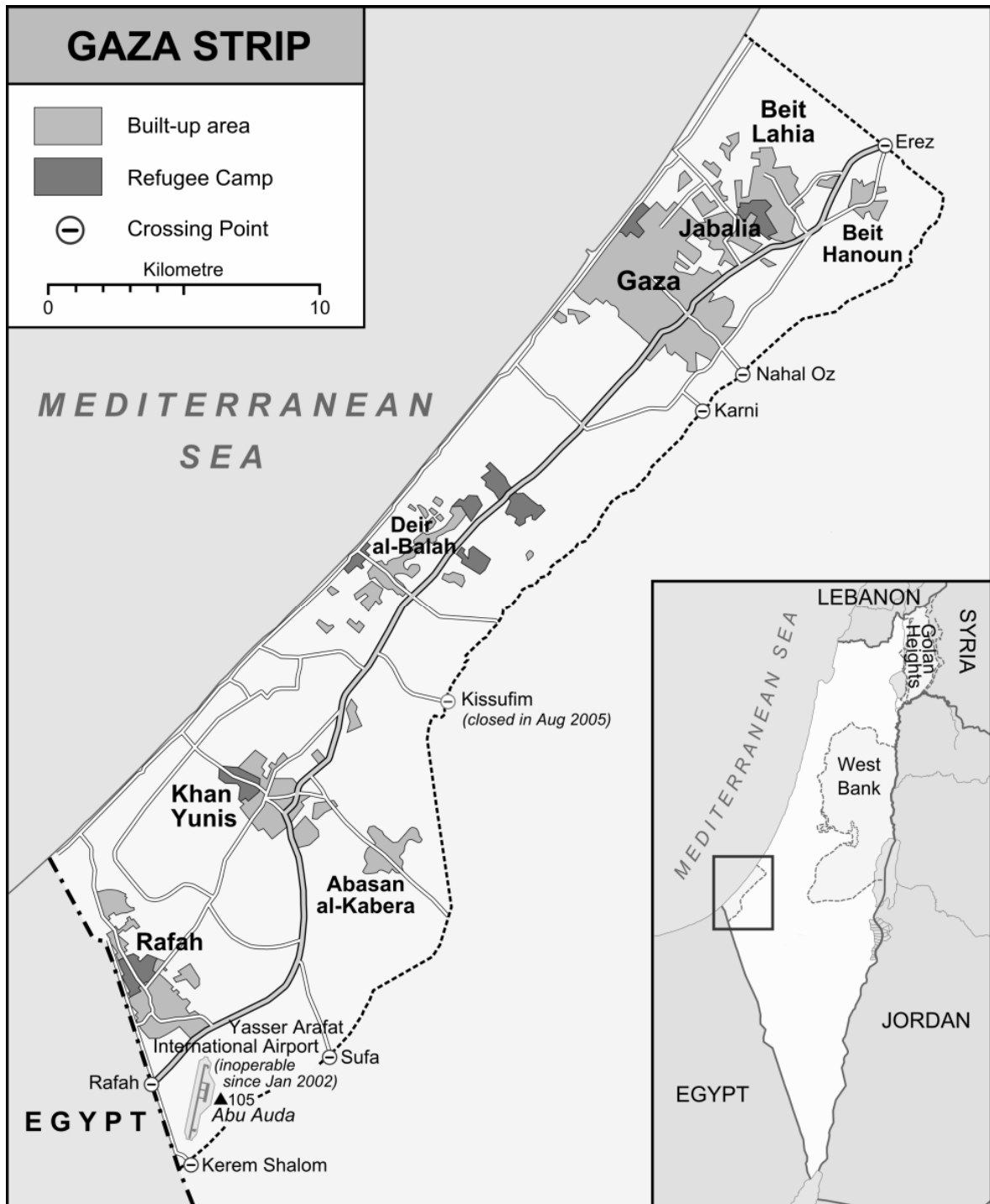
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Annex (2): Map of Palestine



Annex (3): Map of Gaza Strip



Source: <http://www.marefa.org/index.php>

Annex (4): Approval from Helsinki

**Palestinian National Authority
Ministry of Health
Helsinki Committee**



**السلطة الوطنية الفلسطينية
وزارة الصحة
لجنة هلسنكي**

التاريخ: 07/03/2011

Name: **Wael Okasha**

الاسم: وائل عكاشة

I would like to inform you that the committee has discussed your application about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم

حول:-

"Assessment of Domestic Electricity Generators Hazards in Jabalia Camp, Gaza Strip".

In its meeting on March 2011

و ذلك في جلستها المنعقدة لشهر 3 2011

and decided the Following:-

و قد قررت ما يلي:-

To approve the above mention research study.

الموافقة على البحث المذكور عاليه.



Signature

توقيع

Member

Member

Chairperson

عضو

عضو

Conditions:-

- ❖ Valid for 2 years from the date of approval to start.
- ❖ It is necessary to notify the committee in any change in the admitted study protocol.
- ❖ The committee appreciate receiving one copy of your final research when it is completed.

Annex (5): Approval from UNRWA

Al-Quds University

Jerusalem

School of Public Health

2011/3/6



جامعة القدس

القدس

كلية الصحة العامة

الأخ الاستاذ/ جميل حمد المحترم

مدير تدريب كلية مجتمع غزة - وكالة الغوث

تحية طيبة وبعد،،،

الموضوع: مساعدة الطالب/ وائل عبدالمجيد عكاشة

ضمن برنامج ماجستير الصحة العامة/ بكلية الصحة العامة - جامعة القدس يقوم الطالب المذكور أعلاه بإجراء بحث بعنوان:

"Assessment of Domestic Electricity Generators Hazards in Jabalia Camp, Gaza Strip"

و ذلك كمتطلب للحصول على درجة الماجستير في الصحة العامة-مسار صحة البيئة و عليه نرجو التكرم بالموافقة و الإعاز لمن ترونه مناسب للسماح للطالب باستخدام جهاز قياس التلوث الضوضائي.
حيث أن الطالب حاصل على موافقة أخلاقية (لجنة هلسنكي، و وزارة الصحة) لإجراء البحث.
علماً بأن المعلومات ستكون متوفرة لدى الباحث و الجامعة فقط.

و اقبلوا فائق التحية و الاحترام،،،



د. بسام أبو حمد

منسق عام برامج الصحة العامة

نسخة:

- الملف

Annex (6): Approval from Ministry of Labor

Al-Quds University

Jerusalem

School of Public Health

2011/3/6



جامعة القدس

القدس

كلية الصحة العامة

الأخ الاستاذ/ عبدالله كلاب المحترم

مدير عام التفتيش و حماية العمل -وزارة العمل

تحية طيبة وبعد،،،

الموضوع: مساعدة الطالب/ وائل عبدالمجيد عكاشة

ضمن برنامج ماجستير الصحة العامة/بكلية الصحة العامة -جامعة القدس يقوم الطالب المذكور أعلاه بإجراء بحث بعنوان:

"Assessment of Domestic Electricity Generators Hazards in Jabalia Camp, Gaza Strip"

و ذلك كمتطلب للحصول على درجة الماجستير في الصحة العامة-مسار صحة البيئة و عليه نرجو التكرم بالموافقة و الإعياز لمن ترونه مناسب للسماح للطالب باستخدام جهاز قياس تركيز غاز أول أكسيد الكربون في الهواء. حيث أن الطالب حاصل على موافقة أخلاقية (لجنة هلسنكي، و وزارة الصحة) لإجراء البحث. علماً بأن المعلومات ستكون متوفرة لدى الباحث و الجامعة فقط.

و اقبلوا فائق التحية و الاحترام،،،



د. بسام أبو حمد

منسق عام برامج الصحة العامة

نسخة:

- الملف

Annex (7): Sound Level Meter



Annex (8): Questionnaire in Arabic

استبانة

التاريخ: 2011/ /

الرقم التسلسلي ()

"تقييم مخاطر المولدات الكهربائية المنزلية في معسكر جباليا، قطاع غزة

من فضلك ضع علامة (X) قبل الإجابة المناسبة :

الجزء الأول: البيانات الشخصية	
1.	الجنس: <input type="checkbox"/> 1. ذكر <input type="checkbox"/> 2. أنثى
2.	العمر: <input type="checkbox"/> 1. 15-29 <input type="checkbox"/> 2. 30-44 <input type="checkbox"/> 3. 45 فأكثر
3.	الدخل الشهري بالشيكل: <input type="checkbox"/> 1. أقل من 1000 <input type="checkbox"/> 2. 1000-2500 <input type="checkbox"/> 3. 2500 فأكثر
4.	مستوى التعليم: <input type="checkbox"/> 1. ابتدائي <input type="checkbox"/> 2. إعدادي <input type="checkbox"/> 3. ثانوي <input type="checkbox"/> 4. جامعي
5.	عدد أفراد الأسرة: <input type="checkbox"/> 1. 2-5 <input type="checkbox"/> 2. 6-8 <input type="checkbox"/> 3. 9 فأكثر
6.	العمل: <input type="checkbox"/> 1. بدون <input type="checkbox"/> 2. زراعة <input type="checkbox"/> 3. صناعة <input type="checkbox"/> 4. تجارة <input type="checkbox"/> 5. وظيفة عامة <input type="checkbox"/> 6. مهني <input type="checkbox"/> 7. أخرى
7.	هل أنت مدخن: <input type="checkbox"/> 1. نعم <input type="checkbox"/> 2. لا
8.	إذا كانت الإجابة (نعم) ما هو عدد سنوات التدخين؟ <input type="checkbox"/> 1. أقل من 5 <input type="checkbox"/> 2. 5-14 <input type="checkbox"/> 3. 15 فأكثر
الجزء الثاني: ظروف وبيئة المسكن:	
9.	مكان الإقامة الدائم في: <input type="checkbox"/> 1. بلوك 1 <input type="checkbox"/> 2. بلوك 2 <input type="checkbox"/> 3. بلوك 3 <input type="checkbox"/> 4. بلوك 4 <input type="checkbox"/> 5. بلوك 6 <input type="checkbox"/> 6. بلوك 7 <input type="checkbox"/> 8. بلوك 8 <input type="checkbox"/> 9. بلوك 9 <input type="checkbox"/> 10. بلوك 10 <input type="checkbox"/> 11. بلوك 11 <input type="checkbox"/> 12. بلوك 12 <input type="checkbox"/> 13. بلوك 13
10.	مدة السكن في هذا المكان بالسنوات: <input type="checkbox"/> 1. أقل من 5 <input type="checkbox"/> 2. 5-14 <input type="checkbox"/> 3. 15 فأكثر
11.	نوع المنزل الذي تعيش فيه العائلة: <input type="checkbox"/> 1. الباطون <input type="checkbox"/> 2. الاسبست <input type="checkbox"/> 3. غير ذلك
12.	كم عدد غرف المنزل؟ <input type="checkbox"/> 1. 1-2 <input type="checkbox"/> 2. 3-4 <input type="checkbox"/> 3. 5 فأكثر
13.	كم عدد طوابق المنزل؟ <input type="checkbox"/> 1. 1-2 <input type="checkbox"/> 2. 3-4 <input type="checkbox"/> 3. 5 فأكثر
14.	هل التهوية في المنزل؟ <input type="checkbox"/> 1. رديئة <input type="checkbox"/> 2. متوسطة <input type="checkbox"/> 3. جيدة
15.	هل تدخل الشمس في المنزل بصورة؟ <input type="checkbox"/> 1. رديئة <input type="checkbox"/> 2. متوسطة <input type="checkbox"/> 3. جيدة

الجزء الثالث: الوعي والمعرفة للأخطار الناجمة عن الاستخدام السيئ للمولد:	
16.	ما هو حجم المولد الموجود في المنزل؟ 1. 1KVA <input type="checkbox"/> 2. 2 KVA <input type="checkbox"/> 3. 3 KVA <input type="checkbox"/> 4. 4 KVA <input type="checkbox"/> 5. 5 KVA فأكثر <input type="checkbox"/>
17.	ما نوع الوقود المستخدم في المولد؟ 1. <input type="checkbox"/> بنزين 2. <input type="checkbox"/> سولار
18.	ما هي درجة كفاءة عمل المولد؟ 1. <input type="checkbox"/> مقبولة 2. <input type="checkbox"/> جيدة 3. <input type="checkbox"/> ممتازة
19.	كم يبلغ عمر الشخص الذي يقوم بتشغيل المولد الكهربائي؟ 1. <input type="checkbox"/> أقل من 10 سنوات 2. <input type="checkbox"/> 11-20 3. <input type="checkbox"/> 21 فأكثر
20.	هل تعلمت كيفية تشغيل المولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
21.	هل تم تزويدك بكتيب حول كيفية الاستعمال الصحيح للمولد عند شراءه؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
22.	إذا كانت الإجابة (نعم) هل قمت بتطبيق التعليمات حسب الكتيب؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
23.	هل سبق أن قرأت/شاهدت/استمعت لأي مادة إعلامية هدفها توعيتكم بمخاطر المولدات الكهربائية؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
24.	هل شاركت في حضور ندوات تهتم بالتوعية بأخطار المولدات الكهربائية؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
25.	هل تقوم بتوعية أفراد أسرتك لمخاطر المولدات الكهربائية؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
26.	أين تضع المولد أثناء تشغيله عادةً؟ 1. <input type="checkbox"/> في الشارع 2. <input type="checkbox"/> داخل المنزل 3. <input type="checkbox"/> في البلكونة 4. <input type="checkbox"/> على سطح المنزل 5. <input type="checkbox"/> غير ذلك، حدد _____
27.	كم ساعة يعمل المولد في اليوم؟ 1. <input type="checkbox"/> أقل من 3 2. <input type="checkbox"/> 3-6 3. <input type="checkbox"/> 7-10 4. <input type="checkbox"/> 11 فأكثر
28.	كم يوم يعمل المولد خلال الاسبوع؟ 1. <input type="checkbox"/> 1 2. <input type="checkbox"/> 2 3. <input type="checkbox"/> 3 4. <input type="checkbox"/> 4 5. <input type="checkbox"/> 5 6. <input type="checkbox"/> 6 7. <input type="checkbox"/> 7
29.	هل يوجد مولدات أخرى حول المنزل؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
30.	إذا كانت الإجابة (نعم) فكم يبعد أقرب مولد من المنزل بالمتري تقريباً؟ 1. <input type="checkbox"/> 3-6 2. <input type="checkbox"/> 7-10 3. <input type="checkbox"/> 11 فأكثر
31.	هل سبق أن قمت بإضافة الوقود إلى خزان الوقود الخاص بالمولد أثناء عمله؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
32.	هل سبق أن قمت بإضافة الوقود الخاص بالمولد وفي فمك سيجارة؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
33.	عند فحصك لمستوى الوقود الموجود في الخزان ليلاً، ما هي وسيلة الإضاءة التي تستخدمها؟ 1. <input type="checkbox"/> وسيلة مشتعلة 2. <input type="checkbox"/> وسيلة تعمل بالبطاريات
34.	هل تقوم بتخزين كميات من الوقود؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
35.	إذا كانت الإجابة (نعم) اذكر الكمية التي تقوم بتخزينها عادةً. 1. <input type="checkbox"/> أقل من 5 لتر 2. <input type="checkbox"/> 5-10 لتر 3. <input type="checkbox"/> 11-16 لتر 4. <input type="checkbox"/> 17 فأكثر

36.	أين تقوم بتخزين تلك الكمية عادةً؟ 1. <input type="checkbox"/> بالقرب من المولد 2. <input type="checkbox"/> على سطح المنزل 3. <input type="checkbox"/> مكان خاص
37.	هل تحرص على إغلاق محبس خزان الوقود بعد إطفاء المولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
38.	هل تحرص على إطفاء المولد قبل نزع الفيش المغذي لشبكة الكهرباء المنزلية؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
39.	هل تحرص على إبعاد الأطفال عن مكان وجود المولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
40.	هل سبق أن نمت في مكان وجود المولد أثناء عمله؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
41.	إذا كانت الإجابة (نعم) هل شعرت بتغيرات صحية سيئة؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
42.	هل ترتدي القفازات عند إضافة الوقود إلى خزان الوقود الخاص بالمولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
43.	هل ترتدي الكمامة عند إضافة الوقود إلى خزان الوقود الخاص بالمولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
44.	هل تغسل يديك جيداً بعد انتهاءك من وضع الوقود الخاص بالمولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
45.	هل وقع حادث في المنزل بسبب المولد؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
46.	إذا كانت الإجابة (نعم) فما نوع الحادث؟ 1. <input type="checkbox"/> انفجار 2. <input type="checkbox"/> حريق 3. <input type="checkbox"/> صعقة كهربائية 4. <input type="checkbox"/> اختناق
47.	هل وقعت إصابات أو حالات وفاة نتيجة لتلك الحوادث؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
48.	إذا كانت الإجابة (نعم) فما نوعها؟ 1. <input type="checkbox"/> إصابة 2. <input type="checkbox"/> وفاة
49.	هل يوجد مطفئة حريق في المنزل؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
رابعاً: التأثيرات الصحية للانبعاثات:	
50.	هل تشعرون بروائح وانبعاثات في مكان سكنكم؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
51.	إذا كانت الإجابة (نعم) في أي وقت تكون نروتها؟ 1. <input type="checkbox"/> الصباح 2. <input type="checkbox"/> الظهر 3. <input type="checkbox"/> المساء 4. <input type="checkbox"/> جميع الأوقات 5. <input type="checkbox"/> لا اعلم
52.	ما هو سبب تلك الروائح باعتقادكم؟ 1. <input type="checkbox"/> غازات منبعثة من المولدات 2. <input type="checkbox"/> انبعاثات من عوادم السيارات 3. <input type="checkbox"/> لا أعلم
53.	هل هذه الروائح والانبعاثات حسب رأيكم؟ 1. <input type="checkbox"/> قليلة 2. <input type="checkbox"/> متوسطة 3. <input type="checkbox"/> كثيرة
54.	هل باعتقادكم أن هذه الانبعاثات والروائح تعمل على تهيج وزيادة المرض؟ 1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا

55.	هل توفي لكم أطفال قبل الولادة خلال الأربع سنوات الأخيرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
56.	هل توفي أي من أطفالكم بعد الولادة خلال الأربع سنوات الأخيرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
57.	إذا كانت الإجابة (نعم) كم كان عمر الطفل المتوفى؟ _____
58.	ما هو سبب الوفاة؟ _____
59.	هل تم إنجاب أطفال مصابين بتشوهات خلقية خلال الأربع سنوات الأخيرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
60.	هل التشوهات ظاهرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
61.	هل يعاني أحد أفراد الأسرة من أي مرض مزمن؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
62.	إذا كانت الإجابة (نعم) فما هو المرض؟ (ممكن اختيار أكثر من إجابة) <input type="checkbox"/> .1 السكري <input type="checkbox"/> .2 الضغط <input type="checkbox"/> .3 القلب <input type="checkbox"/> .4 الأزمة <input type="checkbox"/> .5 السرطان <input type="checkbox"/> .6 أمراض مزمنة أخرى (أذكرها) _____
63.	هل تعاني أو تشكو من أحد أو أكثر من الأعراض الآتية: • صداع في الرأس <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • دوار أو دوخة <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • رعشة في الأطراف <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • خلل في التوازن <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • العصبية <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • ضيق في التنفس <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • ألآم في الصدر <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • سعال <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا • انزعاج أو اضطرابات أثناء النوم <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
64.	هل تعاني من أمراض صدرية أخرى؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
65.	إذا كانت الإجابة (نعم) هل المرض هو: <input type="checkbox"/> .1 ربو شعبي <input type="checkbox"/> .2 التهاب الشعب الهوائية المزمن <input type="checkbox"/> .3 احتقان الرئتين <input type="checkbox"/> .4 حساسية
66.	هل أصيب احد أفراد الأسرة بأمراض العيون خلال الأربع سنوات الأخيرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا
67.	إذا كانت الإجابة (نعم) فهل أعراض المرض؟ <input type="checkbox"/> .1 احمرار <input type="checkbox"/> .2 حساسية وتهيج <input type="checkbox"/> .3 زيادة في إفراز الدمع <input type="checkbox"/> .4 غباشة في النظر
68.	هل عانى أو يعاني أحد أفراد الأسرة من أي أمراض جلدية خلال الأربع سنوات الأخيرة؟ <input type="checkbox"/> .1 نعم <input type="checkbox"/> .2 لا

خامساً: التأثيرات الصحية المتعلقة بالازعاج:	
هل صوت المولد الكهربائي يسبب لك انزعاجاً؟	1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
إذا كانت الإجابة (نعم) فهل درجة الانزعاج؟	1. <input type="checkbox"/> قليلة 2. <input type="checkbox"/> متوسطة 3. <input type="checkbox"/> كبيرة 4. <input type="checkbox"/> كبيرة جداً
هل تشعر بأن هناك تغير سلبي في مستوى السمع لدى أحد أفراد الأسرة خلال الأربع سنوات الأخيرة؟	1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
هل عانى أو يعاني أحد أفراد الأسرة من التوتر العصبي / النفسي خلال الأربع سنوات الأخيرة؟	1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
عندما تتحدث مع أي شخص هل تطلب منه رفع صوته حتى تسمعه جيداً؟	1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا 3. <input type="checkbox"/> أحياناً
هل تعتقد أن التلوث الضوضائي يؤثر على طبيعة نومك؟	1. <input type="checkbox"/> نعم 2. <input type="checkbox"/> لا
سادساً: القياسات / المشاهدات:	
مستوى تركيز غاز أول أكسيد الكربون هو:	1. <input type="checkbox"/> 0.01 % 2. <input type="checkbox"/> 0.05 % 3. <input type="checkbox"/> 0.1 %
مستوى التلوث الضوضائي بالديسبل هو:	1. <input type="checkbox"/> صفر - 30 2. <input type="checkbox"/> 31 - 60 3. <input type="checkbox"/> 61 - 90 4. <input type="checkbox"/> 91 - 120
رقم الصورة _____	77

Annex (9): Questionnaire in English**Questionnaire**

Date: / /2011

Serial Number ()

Assessment of Domestic Electricity Generators Hazards in Jabalia Camp, Gaza Strip**Please place (x) next to the appropriate answer:**

Part 1: Personal Data	
1.	Gender: 1. <input type="checkbox"/> Male 2. <input type="checkbox"/> Female
2.	Age: 1. <input type="checkbox"/> 15-29 2. <input type="checkbox"/> 30-44 3. <input type="checkbox"/> 45 or more
3.	Monthly income in Shekel: 1. <input type="checkbox"/> Less than 1000 2. <input type="checkbox"/> 1000-2500 3. <input type="checkbox"/> More than 2500
4.	Level of Education: 1. <input type="checkbox"/> primary 2. <input type="checkbox"/> Preparatory 3. <input type="checkbox"/> Secondary 4. <input type="checkbox"/> University
5.	Number of family members: 1. <input type="checkbox"/> 2-5 2. <input type="checkbox"/> 6-8 3. <input type="checkbox"/> 9 or more
6.	Occupation: 1. <input type="checkbox"/> None 2. <input type="checkbox"/> Agriculture 3. <input type="checkbox"/> Industry 4. <input type="checkbox"/> Commerce 5. <input type="checkbox"/> General Employees 6. <input type="checkbox"/> Professional 7. <input type="checkbox"/> Other
7.	Are you Smoker? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
8.	If the answer is yes, how long have you been smoking? 1. <input type="checkbox"/> Less than 5 2. <input type="checkbox"/> 5-14 3. <input type="checkbox"/> 15 or more
Part 2: Housing Conditions & Environment:	
9.	Permanent address: 1. <input type="checkbox"/> Block 1 2. <input type="checkbox"/> Block 2 3. <input type="checkbox"/> Block 3 4. <input type="checkbox"/> Block 4 5. <input type="checkbox"/> Block 5 6. <input type="checkbox"/> Block 6 7. <input type="checkbox"/> Block 7 8. <input type="checkbox"/> Block 8 9. <input type="checkbox"/> Block 9 10. <input type="checkbox"/> Block 10 11. <input type="checkbox"/> Block 11 12. <input type="checkbox"/> Block 12 13. <input type="checkbox"/> Block 13
10.	Length of stay at the Permanent address in years: 1. <input type="checkbox"/> Less than 5 2. <input type="checkbox"/> 5-14 3. <input type="checkbox"/> 15 or more
11.	Type of house you live in with the family: 1. <input type="checkbox"/> Concrete 2. <input type="checkbox"/> Asbestos 3. <input type="checkbox"/> Others
12.	Number of rooms in the house: 1. <input type="checkbox"/> 1-2 2. <input type="checkbox"/> 3-4 3. <input type="checkbox"/> 5 or more
13.	Number of Floors : 1. <input type="checkbox"/> 1-2 2. <input type="checkbox"/> 3-4 3. <input type="checkbox"/> 5 or more
14.	Are there ventilation in the house? 1. <input type="checkbox"/> Poor 2. <input type="checkbox"/> Average 3. <input type="checkbox"/> Good
15.	How is the sunlight in the house? 1. <input type="checkbox"/> Poor 2. <input type="checkbox"/> Average 3. <input type="checkbox"/> Good

Part 3: Awareness and knowledge of the dangers posed by the misuse of the generator:

16.	What is the capacity of generator in the house? 1. <input type="checkbox"/> 1 KVA 2. <input type="checkbox"/> 2KVA 3. <input type="checkbox"/> 3KVA 4. <input type="checkbox"/> 4KVA 5. <input type="checkbox"/> 5 KVA or more
17.	What is the type of fuel used in the generator? 1. <input type="checkbox"/> Gasoline 2. <input type="checkbox"/> Diesel
18.	What is the working condition of the generator? 1. <input type="checkbox"/> Acceptable 2. <input type="checkbox"/> Good 3. <input type="checkbox"/> Excellent
19.	How old is the person who operates the generator? 1. <input type="checkbox"/> Less than 14 years 2. <input type="checkbox"/> 15-20 years 3. <input type="checkbox"/> 21 years or more
20.	Did you learn how to operate the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
21.	Were you given a manual with instructions on how to operate the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
22.	If the answer is yes, did you follow the instructions? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
23.	Have you ever read/ seen/ heard any information material about the risk of the electricity generators? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
24.	Have you participated in sessions concerned about educating people of dangers of electricity generators? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
25.	Did you educate your family about the dangers of generators? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
26.	Where do you place the generator usually while it is running? 1. <input type="checkbox"/> In the street 2. <input type="checkbox"/> Inside the house 3. <input type="checkbox"/> In the balcony 4. <input type="checkbox"/> On the roof 5. <input type="checkbox"/> Others (specify)_____
27.	How many hours per day do you operate the generator? 1. <input type="checkbox"/> Less than 3 2. <input type="checkbox"/> 3-6 3. <input type="checkbox"/> 7-10 4. <input type="checkbox"/> 11 or more
28.	How many days per week do you operate the generator? 1. <input type="checkbox"/> 1 2. <input type="checkbox"/> 2 3. <input type="checkbox"/> 3 4. <input type="checkbox"/> 4 5. <input type="checkbox"/> 5 6. <input type="checkbox"/> 6 7. <input type="checkbox"/> 7
29.	Are there other generators near your house? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
30.	If the answer is yes, How far (in meters) from your house? 1. <input type="checkbox"/> 3-6 2. <input type="checkbox"/> 7-10 3. <input type="checkbox"/> 11 or more
31.	Have you ever added fuel in the fuel tank while the generator is running? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
32.	Have you ever added fuel while you are smoking a cigarette? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
33.	What do you use for light to check the fuel level at night? 1. <input type="checkbox"/> A burning torch 2. <input type="checkbox"/> Battery-operated objects
34.	Do you store any fuel in the house? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No

35.	If the answer is yes, how much? 1. <input type="checkbox"/> Less than 5 liters 2. <input type="checkbox"/> 5-10 liters 3. <input type="checkbox"/> 11-16 liters 4. <input type="checkbox"/> 17 or more
36.	Where do you store the fuel usually? 1. <input type="checkbox"/> Near the generator 2. <input type="checkbox"/> On the roof of the house 3. <input type="checkbox"/> Designated place
37.	Do you make sure you close the fuel tank after you turn off the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
38.	Do you make sure the generator is off before removing the cable connected to the house electrical network? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
39.	Do you make sure the children are kept away from the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
40.	Have you ever slept next to the generator while it is operating? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
41.	If the answer is yes, did you notice any changes in your health? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
42.	Do you wear gloves when adding fuel in the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
43.	Do you wear a mask when adding fuel in the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
44.	Do you wash your hands after adding fuel in the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
45.	Have had any accidents caused by the generator? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
46.	If the answer is yes, what type of accident? 1. <input type="checkbox"/> Explosion 2. <input type="checkbox"/> Fire 3. <input type="checkbox"/> Electric shock 4. <input type="checkbox"/> Suffocation
47.	Were there any injuries or deaths as a result of the accident? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
48.	If the answer is yes, which is it? 1. <input type="checkbox"/> Injury 2. <input type="checkbox"/> Death
49.	Is there fire extinguisher in the house ? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
Part 4: Health Effects of Emissions:	
50.	Do you smell odors or gaseous emissions at your residence area? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
51.	If the answer is yes, when do you feel it the most? 1. <input type="checkbox"/> Morning 2. <input type="checkbox"/> Afternoon 3. <input type="checkbox"/> Evening 4. <input type="checkbox"/> All the time 5. <input type="checkbox"/> Don't know
52.	What do you think the cause of these odors? 1. <input type="checkbox"/> Gases produced by the generator 2. <input type="checkbox"/> Car exhaust emissions 3. <input type="checkbox"/> Don't know
53.	Are these emissions and odors as you think? 1. <input type="checkbox"/> Low 2. <input type="checkbox"/> Moderate 3. <input type="checkbox"/> High

54.	Do you think these emissions and odors increase or exasperate the disease? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
55.	Did you have fetal deaths in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
56.	Did you have infant deaths in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
57.	If the answer is yes, how old was the born- baby? -----																											
58.	What was the cause of death? -----																											
59.	Did you have any children born with congenital malformation in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
60.	Are these malformations apparent and clearly manifested? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
61.	Does any member of your family have a chronic disease? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
62.	If the answer is yes, what is the disease? (Choose all that apply) 1. <input type="checkbox"/> Diabetes 2. <input type="checkbox"/> Hypertension 3. <input type="checkbox"/> Heart disease 4. <input type="checkbox"/> Asthma 5. <input type="checkbox"/> Cancer 6. <input type="checkbox"/> Others (Specify)----- --																											
63.	Do you suffer or complain from any of the following? <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. Headache</td> <td style="width: 25%;">1. <input type="checkbox"/> Yes</td> <td style="width: 25%;">2. <input type="checkbox"/> No</td> </tr> <tr> <td>2. Dizziness</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>3. Tremor in the extremities</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>4. Loss of balance</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>5. Nervousness</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>6. Difficulty breathing</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>7. Chest pain</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>8. Coughing</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> <tr> <td>9. Sleep disorder</td> <td>1. <input type="checkbox"/> Yes</td> <td>2. <input type="checkbox"/> No</td> </tr> </table>	1. Headache	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	2. Dizziness	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	3. Tremor in the extremities	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	4. Loss of balance	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	5. Nervousness	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	6. Difficulty breathing	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	7. Chest pain	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	8. Coughing	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No	9. Sleep disorder	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No
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7. Chest pain	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No																										
8. Coughing	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No																										
9. Sleep disorder	1. <input type="checkbox"/> Yes	2. <input type="checkbox"/> No																										
64.	Do you suffer from any respiratory diseases? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
65.	If the answer is yes, what is the disease? 1. <input type="checkbox"/> Asthmatic bronchitis 2. <input type="checkbox"/> Bronchial inflammation 3. <input type="checkbox"/> Lung congestion 4. <input type="checkbox"/> Allergy																											
66.	Did any of your family members infected with eye diseases in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											
67.	If the answer is yes, the diseases are: 1. <input type="checkbox"/> Redness 2. <input type="checkbox"/> Allergy and irritation 3. <input type="checkbox"/> Increase in the production of tears 4. <input type="checkbox"/> Blurry vision.																											
68.	Has any member of your family infected with skin diseases in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No																											

Part 5: Health Effects Of Noise Pollution:	
69.	Does the sound of the generator too noisy for you? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
70.	If the answer is yes, what is the level of annoyance? 1. <input type="checkbox"/> Low 2. <input type="checkbox"/> Moderate 3. <input type="checkbox"/> High 4. <input type="checkbox"/> Very high
71.	Are you aware of any changes in hearing with any member of your family in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
72.	Has any member of your family suffered from nervous/psychological tension in the last four years? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
73.	When you are talking to someone , are you asking him to raise his voice in order to get him? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No 3. <input type="checkbox"/> Sometimes
74.	Do you think that noise pollution may affect your sleeping patterns? 1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
Part 6: Measurements / Observations:	
75.	Concentration level of CO is: 1. <input type="checkbox"/> 0.01% 2. <input type="checkbox"/> 0.05% 3. <input type="checkbox"/> 0.1%
76.	Noise Pollution level in decibel is: 1. <input type="checkbox"/> 0 - 30 2. <input type="checkbox"/> 31 - 60 3. <input type="checkbox"/> 61 – 90 4. <input type="checkbox"/> 91 - 120
77.	Picture number:

Annex (10): Panel of experts

Name of experts	Place of work
1. Dr. Yehia Abed	AlQuds University
2. Dr. Yousef Abu Safieh	AlQuds University
3. Dr. Bassam Abu Hamad.	AlQuds University
4. Dr. Mohammed Eila.	Environmental Quality Authority
5. Dr. Khamis El Mahalawi.	Environmental Quality Authority
6. Dr. Said Ghabayen.	Islamic University

Annex (11): Questionnaire pictures



Annex (12) Questionnaire pictures



Annex (13): Questionnaire pictures



Annex (14): Arabic abstract

ملخص الرسالة

" تقييم مخاطر المولدات الكهربائية المنزلية في مخيم جباليا - قطاع غزة "

يعتبر المولد الكهربائي سبباً للعديد من المشكلات الصحية والبيئية، كونه مصدراً للغازات السامة مثل أول أكسيد الكربون ومصدراً للتلوث الضوضائي، حيث يعتبر ذلك سبباً في العديد من الأمراض. إن هذه الدراسة تهدف إلى تقييم مخاطر المولدات الكهربائية المنزلية في معسكر جباليا. حيث أجريت عام 2011 في مخيم جباليا. وهي دراسة مقطعية وصفية تحليلية، وكان حجم العينة 260 منزلاً (5% من إجمالي منازل معسكر جباليا والبالغ عددها 5313 منزلاً) يستخدمون المولدات الكهربائية، وتم اختيارها على مرحلتين، مرحلة أولى طبقية تم تقسيم المخيم إلى بلوكات والبالغ عددها 13 بلوك، ومرحلة ثانية عشوائية تم اختيار 20 منزل من كل بلوك. ولتحقيق أهداف الدراسة قام الباحث باستخدام نوعين من أدوات البحث وهما: قياس تركيز أول أكسيد الكربون ومستوى الضوضاء بواسطة أجهزة قياس لكل منهما، واستبانته لتحديد مستوى الوعي والأضرار الصحية، حيث تم تصميمها من قبل الباحث، وشملت ثلاثة محاور رئيسية وهي: الأخطاء الشائعة في استخدام المولدات، الغازات المنبعثة من تلك المولدات، والتلوث الضوضائي الصادر عنها، وتم توزيع الاستبانات باللغة العربية على العينة وكانت نسبة الاستجابة 98.1% (260 من 265).

أما بالنسبة للنتائج فكانت فيما يتعلق بعمر الشخص الذي يقوم بتشغيل المولد فكانت نسبة 6.2% أقل من 14 سنة وأن 10.4% يضعون المولد داخل المنزل، وتبين بأن 7.7% وقع عندهم حادث بالمنزل بسبب المولد، ونوعه حريق بنسبة 65%، 20% انفجار، 15% صعقة كهربائية. وتبين أن 50% وقعت إصابات بسبب ذلك الحادث، وتبين أنه قد وقعت حالة وفاة واحدة. وتبين أنه من يشكو العصبية 16.7%، الصداع 15.4%، ضيق في النفس 13.7%، دوار 12.4%، وآلام في الصدر 12.1%، اضطراب أثناء النوم 9.3%، سعال 7.4%، رعشة في الأطراف 7%، وخلل في التوازن 6%، بينما 16.2% يشعرون بتغير سلبي في السمع. وتبين أن 96.5% يعتقدون أن التلوث الضوضائي يؤثر على طبيعة نومهم. وأن 42.3% من مستوى التركيز لغاز أول أكسيد الكربون هو 0.1%، بينما 31.2% هو 0.05%، و26.5% كان 0.01%. وتبين أن 52.3% مستوى التلوث الضوضائي بالديسبل هو من 61-90، و47.7% مستوى التلوث الضوضائي بالديسبل هو من 31-60. ووجد من خلال الدراسة بأن هناك علاقة ذات دلالة إحصائية بين تركيز أول أكسيد الكربون المنبعث من المولد والصداع، وكذلك بين مستوى التلوث الضوضائي ومشاكل السمع خلال الأربع سنوات الأخيرة.

وأهم التوصيات التي خرجت بها الدراسة هي إسراع السلطات ببذل المزيد من الجهود لإيجاد حل لمشكلة الكهرباء في قطاع غزة، تقليص عدد ساعات تشغيل المولد وإبعاده أقصى ما يمكن عن أماكن تواجد المواطنين، ألا يتجاوز سن الذي يقوم بتشغيل المولد الـ 20 عاماً وعقد ندوات توعية للحد من مخاطر المولدات.