The Islamic University–Gaza
Deanery of Graduate Studies
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الجـــامعـــة الإســـلاميـــــة ـ غـــزة
عمـــــــادة الدراســـــــات العليـــــا
كـليـــــــــــةالهندســـــــــــــة
إدارة المشـــــروعات الهندســـــية

Improving the Environmental Practices of Concrete Factories in Gaza Strip

تحسين الممارسات البيئية لمصانع الخرسانة في قطاع غزة

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A thesis is submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Management

February/2017

إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Improving the Environmental Practices of Concrete Factories in Gaza Strip

تحسين الممارساتالبيئية لمصانع الخرسانة في قطاع غزة

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مكتب نائب الرئيس للبحث العلمي والدراسات العليا هاتف داخلي 1150

Ref: الرقم: ج س غ/35/

Date: التاريخ: 2017/04/10م

نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ **صلاح الدين عوني صادق المزيني** لنيل درجة الماجستير في **كلية *الهندسة*** / قسم الهندسة المدنية – إدارة المشروعات الهندسية وموضوعها:

تحسين الممارسات البيئية لمصانع الخرسانة في قطاع غزة

Improving the Environmental Practices of Concrete Factories in Gaza Strip

وبعد المناقشة التي تمت اليوم الاثنين 13 رجب 1438هـ، الموافق 2017/04/10م الساعة الحادية عشر صباحاً، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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د. خالد عبد الرؤوف الحلاق	مناقشاً داخلياً	....
د. إياد عبد القادر الحداد	مناقشاً خارجياً	....

وبعد المداولة أوصت اللجنة بمنح الباحث درجة الماجستير في **كلية *الهندسة* / قسم الهندسة المدنية- إدارة المشروعات الهندسية**.

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

والله ولي التوفيق ،،،

نائب الرئيس لشئون البحث العلمي والدراسات العليا

أ.د. عبدالرؤوف علي المناعمة

Abstract

The research highlights the environmental practices of concrete factories in Gaza Strip and the activities that harm the environment by these factories. The aim of the research isto define and measure the compatibility of these factories to environment protection aspects.It study any opportunity of developing and improving factories environmental practices in order to limit or minimize the harms on the environment. The research focused on several factors for evaluating concrete factories environmental situation including factory location selection, culture of factory stuff, factory water management, factory solid waste management, factory noise management, dust minimizing in the factory, materials and chemicals saving and storing, and environmental management system in the factory.

The study carried out a survey based on a questionnaire to collect the needed data. The population and the study sample were 35concrete factories in the Gaza Strip.

Research results showed a deteriorated situation regarding the environmental protection practices in the Gaza Strip's concrete factories.

The research recommended that the current environmental practices of the Gaza Strip's concrete factories should be developed in order to minimize the negative impact of these factories on their staff, factories neighbors, and on the surrounding environment, to ensure better environmental conditions and better use of the available resources.

Abstract

هذه الدراسة تسلط الضوء على الممارسات البيئية لمصانع الخرسانة في قطاع غزة و التي تعود بالضرر الكبير على العاملين في المصنع، جيران المصنع، و البيئةاالمحيطة. يهدف البحث إلى دراسة وتقييم مدى تطبيق المعايير الخاصة بحماية البيئةمن قبل مصانع الخرسانة في قطاع غزة. كما و يدرس البحث أي فرصة لتطوير و تحسين الممارسات البيئية لمصانع الخرسانة للحد من الأثر البيئيلهذه المصانع. ركز البحث على عدة معايير لتقييم الأداء البيئيلمصانع الخرسانة في قطاع غزة: إختيار موقع المصنع، درجة ثقافة العاملين بالمصنع، إدارة و جودة المياه في المصنع، إدارة النفايات الصلبة في المصنع، إدارة الضوضاء الناتجة عن المصنع، تقليل الغبار الناتج عن نقل المواد و حركة الآليات، آلية حفظ المواد و الكيماويات داخل المصنع، نظام إدارةالبيئة في المصنع.

تم إعتماد الإستبانة كمنهجية للبحث لجمع البيانات اللازمة، حيث تمثل مجتمع الدراسة و العينةمن35 مصنع خرسانة في قطاع غزة.

بينت نتائج البحث الحالة المزرية للممارسات البيئية و معايير حمايةالبيئة لدى مصانع الخرسانة في قطاع غزة.

أوصت الدراسة بضرورة تطوير و تحسين الأداء البيئي و الممارسات البيئية لمصانع الخرسانة في قطاع غزة و ذلك لتقليل الأثر البيئي الناتج عن المصانع على طاقم العاملين في المصنع و الجيران و البيئةالمحيطة للوصول إلى ظروفبيئية أفضل و إستغلال أفضل للموارد المتاحة.

Dedication

Every challenging work needs self-efforts as well as guidance of eldersespecially those who were very close to our heart.

My humble effort I dedicate to my sweet and loving

Father & Mother,

Whose affection, love, encouragement and prays of day and night make meable to get such success and honor,

To my wife Marian for her great support,

To my sisters, brothers and all my friends,

To Dr. Nabil for standing by my side completing this thesis,

To all hard working and respected teachers

Thank you ☺

Acknowledgment

I would first like to thank my thesis supervisor Dr. Nabil El-Sawalhi. The door to Dr. Nabil office was always open whenever I ran into a trouble spot or had a question about my research or writing. He consistently allowed this paper to be my own work, but steered me in the right direction whenever he thought I needed it.

I would also like to thank the experts who were involved in the validation survey for this research project. Without their passionate participation and input, the validation survey could not have been successfully conducted.

I would also like to acknowledge the dissertation committee "the second reader of this thesis", and I am gratefully indebted to them for the very valuable comments on this thesis.

I would also like to thank all those people who have helped me complete this thesis.

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List of Abbreviations

ANOVA	Analysis Of Variance
EMS	Environmental Management System
FFDC	Fabric Filter Dust Collector
PCBS	Palestinian Central Bureau of Statistics
PH	Potential of Hydrogen
PDCA	Plan Do Check Act
SPSS	Statistical Package for the Social Sciences
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
ISO	the International Organization for Standardization
SO2	Sulfur Dioxide
NO2	Nitric Dioxide
VOC	Volatile Organic Compounds

Chapter 1
Introduction

Chapter 1
Introduction

This chapter includes the problem statement and research justifications, research aim and objectives, research hypothesis, research methodology, research importance, research variables, and research structure.

1.1 Background

Construction projects pose enormous challenges not only to be finished within an owner's schedule and budget, but also to eliminate and minimize harmful impacts to the environment (Christini et al., 2004). Environmental issues are one of the most common "hot topics" in the world today's (INNO, 2003). Governments and businesses are under increasing pressure to minimize their bad impacts on the environment in order to ensure and promote sustainable development (NSAI, 2003).

Good environmental performance improve organization's image and mention better sales in addition that it increase its competitiveness; reducing pollution means increasing efficiency and wasting fewer resources, improved health and safety conditions result in a more productive workforce, supplying goods and services that respect the environment helps to expand markets and improve sales (GEMI, 1996).

Construction industry considers one of the most resources exhaustive and environmentally damaging industries in the world (Chan, 2011).Construction industry has significant impacts on the environment such as; dusts, harmful gases, noises, solid and liquid wastes, fallen objects, ground movements and others (*Zeng et al., 2003)*.

Environmental impacts of construction in some cases cause a health or environmental threat and lead to costly cleanup activities (Christini et al., 2004)**.** Shen and Tam (2001) mentioned that the five largest toxic air emissions from construction, including sulfur dioxide (SO2), nitric dioxide (NO2), volatile organic compounds (VOC), toxic releases to air, and hazardous waste generated.In order to reduce such impacts it's necessary to identify the company's activities and operations which generate these impacts (zeng et., al 2003).

1.2 Statement of the problem and justifications of research

The Gaza Strip suffers from a high population density and a lack of natural resources. According to PCBS (2015) the estimated population of Gaza Strip is 1.82 million .

Concrete factories in Gaza Strip have many different activities that harm the environment, these activities can affect labor in the factories, factories neighbors, the surrounding areas, and roads. In spite of there are some official bodies that enact legislations related to environmental issues (Ministry of National Economy and Environmental Quality Authority), there role has to be strengthened in order to improve the environmental practices of concrete factories.

In addition, the lack of environmental knowledge and the weak technical expertise in these issues can also be the reasons of bad environmental practices in Gaza Strip.

Concrete factory considers one of the facilities that depends mainly on natural resources, in order to improve environmental impacts of such factories it's necessary to study all opportunities that reduce, reuse such natural resources which are really scarce.

For the term of "improving factories' environmental practices", activities that affect the environment have to be identified and all possible amendments which improve factories environmental practices have to be mentioned.

1.3 Research aim and objectives

The research study aims to improve the environmental practices of concrete factories in Gaza Strip.

This would be achieved by the following objectives:

1. To identify the benefits gained from complying with environment protection aspects for concrete factories in Gaza Strip.
2. To identify the activities and operations performed by these factories and have a bad impact on the environment.
3. To identify the barriers that face concrete factories in Gaza Strip in developing their environment protection practices.
4. To suggest specific modification that can improve concrete factories environmental practices.

1.4 Research hypothesis

- **H.1:** There is a statistical evidence that factory location selection is taken into account for factories management at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.2:** There is a statistical evidence that culture of factory stuff is sufficient at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.3:** There is a statistical evidence that factory water management is satisfactory at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.4:** There is a statistical evidence that factory solid waste management is satisfactory at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.5:** There is a statistical evidence that factory noise management is satisfactory at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.

- **H.6:** There is a statistical evidence that dust minimizing in the factory is satisfactory at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.7:** There is a statistical evidence that materials and chemicals saving and storing mechanism is good at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.8:** There is a statistical evidence that environmental management systems are being taken into account for factories management at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.
- **H.9:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the factories environmental practices due to the age of the factory.
- **H.10:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee position.
- **H.11:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee qualification.
- **H.12:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee experience.

1.5 Research methodology

The methodology adopted to achieve objectives of this research consist of the following:

1.5.1 Literature Review: A comprehensive literature review will be mentioned to understand the activities, practices, impacts, and concerns related to environmental aspects and the Environmental Management Systems (EMS) used in concrete factories all over the world.

1.5.2 Structuring questionnaire: After understanding literature review, appropriate approach in structuring the questionnaire will be defined, the questionnaire will consisted of the factors affected environment in concrete factories.

A pilot study will be conducted to investigate the strength and weakness points in the questionnaire, to make necessary changes, and to insure valuable feedback.

1.5.3 Data Analysis: The returned questionnaires was analyzed and the results will be documented. By using SPSS program a statistical analysis and tests will be conducted.

1.4.4 Results and Discussion: The results will be discussed and analyzed to obtain the research aim and objectives.

1.5.5 Conclusions and Recommendation: Conclusions will be obtained and developed according to analysis of data and the recommendation that tends to improve factories environmental practices will be mentioned.

1.6 Research importance

Research can tends to improve factories image, competitiveness, and stakeholders trust,, in the addition to decrease the impact of these factories to the environment.

1.7 Research variables

1.7.1 Dependent variable:

The degree of commitment toenvironmental aspects in concrete factories in the Gaza Strip

1.7.2 Independent variables:

After reviewing papers and guidelines made to minimize the environmental impact of concrete factories, the independent variables can be defined as follows:

1. Factory location selection.
2. Culture of factory stuff.
3. Factory water management.
4. Factory solid waste management.
5. Factory noise management.
6. Dust minimizing in the factory.
7. Materials and chemicals saving and storing.
8. Environmental management system in the factory.

1.8 Structure of the research

In order to achieve the aim and objectives for the research and give a comprehensive study of the topic with its all sides, the research will be organized and divided into five chapters as follows:

- **Chapter 1 "Introduction":** Chapter 1 provides a background about the study, problem statement, aim and objectives of study, scope of the study, methodology of study, and structure of the research.
- **Chapter 2 "Literature review":** Chapter 2 highlights the environmental practices, impacts, guidelines, concerns, and Environmental Management Systems (EMS) used in concrete factories in different counties. The information and factors in this chapter will be used to design and develop the questionnaire of the study.
- **Chapter 3 "Methodology":** Chapter 3 includes the detailed research methodology, questionnaire survey design, and the various qualitative and quantitative analytical methods applied will be simply described.
- **Chapter 4 "Results, analysis, and discussion":** In Chapter 4, the data analyses and results of the contextual data collected will be shown, the findings from the questionnaire survey were validated.
- **Chapter 5 "Conclusion and recommendations":** In Chapter 5, the final framework results will also be discussed and the conclusion of the whole research study will be made.

Chapter 2
Literature Review

Chapter 2
Literature Review

This chapter highlights the environmental practices, impacts, guidelines, concerns, and Environmental Management Systems (EMS) used in concrete factories in different counties.

2.1 Introduction

The environment has become an important factor in the decision-making process of companies around the world as environmental issues are becoming more complex and interconnected (GEMI, 1996). A large quantity of activities that an organization does has some environmental impact, not only the pollution that its activities may cause, but also in the way it uses natural resources, manages its business and produces waste. (INNO, 2005). As competition increases within the expanding global market, environmental laws and regulations are setting new standards for business in every region of the world (GEMI, 1996).

Due to the development of legislations, economic policies and other measures that take into account environment protection, organizations today tend to improve their environmental performance and control the impact of their activities to the environment (ISO, 2004).

2.2 Concrete factories

Concrete batching consists of producing concrete or concrete products by mixing cement with sand, rock, aggregate or other similar materials. In a concrete batching plant, the raw materials are mixed using a front end loader or overhead bin concrete batching techniques (Queensland Government, 2014).

For front end loader plants, a front end loader is used to transport coarse and fine aggregates from a ground level storage bin to an aggregate weigh hopper. The aggregate is then added to an agitator. Cement and fly ash are weighed in a separate hopper and transferred to the agitator. Water is added to the agitator. The concrete is mixed, ready for final slumping, inspection and transportation to the customer/building site (Queensland Government, 2014).

For overhead bin batching plants, coarse and fine aggregates are stored in separate bins. Aggregates are transferred from the bins to a compartmentalized overhead storage hopper by conveyor belts. A weigh hopper is situated directly beneath the overhead storage hopper, where aggregate is weighed and transferred to the agitator. Cement and fly ash are stored in separate overhead silos. They are weighed in a separate hopper and dropped into the agitator. Water is added, along with any required admixtures and the concrete is mixed, ready for final slumping, inspection and transportation to the customer/building site (Queensland Government, 2014).

2.3 Environmental concerns and practices of concrete factories

2.3.1 Site location, operations and maintenance

Department of Environment and Lands (1992) mentioned some restrictions for the selection of concrete factories site locations taking into account the effects of both noise and dust on nearby populated areas and the potential impacts on vegetation, wildlife, and water quality:

- Site location shall be at least 1 km from any residential areas, recreational facilities, or commercial establishments, such as hotels or restaurants.
- Access to the site is not to be through residential areas.
- Outer boundaries of the site, are to be at least 300 meters from any body of water, such as streams or ponds.
- Site drainage shall, as much as possible, be away from water bodies.
- The operation is to be neither clearly visible from a provincial or municipal highway nor at an elevation that makes the operation visible to the surrounding area.

Pinellas County Department of Environmental Management (2005) guidelines for site location, operations, and maintenance can be summarized as follows:

- Concrete batch plants equipments, stockpiles, and vehicles should be located at least 25 feet from any property line.
- The maintenance of all plants' equipments should be according to manufacturers recommendations.
- Dust generating activities should be surrounded by a buffer zone.
- Stockpiles should be located in a buffer zone within three-walled bunkers which extend at least two feet above the top of the unload line.

According to Dubai municipality (2014) location of concrete factories must be selected with care taking into account some aspects such as:

- The required buffer zone for temporary concrete batching plant shall not be less than 500 meters from sensitive areas such as nearest residential areas, institutional zones and inhabited areas. However, it should be noted that the buffer distance is based on the assumption that good pollution control technologies are also being used and with best practices being implemented.
- Buffer zones should not be considered as a primary means of control, but as a means of providing an additional safeguard in the case of unintentional or accidental emissions.
- Permanent concrete batching plant shall be allowed only inside industrial areas.

2.3.2 Employees education

All employees have to be committed to minimize the waste produced from such concrete plants in order to make pollution prevention efforts more successful. Some points that can strengthen the involvement of employees in pollution prevention

can be summarized as follow (Pinellas County Department of Environmental Management
, 2005):

- Employees and staff should be understand the concepts of pollution prevention and waste minimization.
- Employees should be trained to recognize and minimize environmental hazards.
- Employees should be trained to handle/transfer raw materials (sand, sand, aggregate, cement, water) in a manner to reduce particulate emissions and wastewater runoff.
- Employees should be trained to clean equipment/vehicle in a manner to reduce airborne particles/wastewater runoff.
- Employees should be trained to use dry clean-up whenever possible.
- Employees should be trained to dispose of/recycle leftover cement properly.
- Incentives and awards should be given to employees those who practice proper or new pollution prevention techniques.
- Employees meetings should be held to discuss changes or on-going equipment practices and procedures.

2.3.3 Plant water management

One of the greatest concerns in concrete batch plants is water pollution as every concrete batch plant needs a great amount of water for its operation, Envirochem Special Projects Inc. (1993)estimates water use at batching plants at about 500 gallons per truck per day, and the alkalinity levels of washwater can be as high as pH 12 which considered toxic to fish and other aquatic life **(**BuildingGreen.com, 1993). Clean water in the world is getting more and more scarce every day, the percentage of clean water compared with the total quantity of water is 3% only, the remaining 97% is either locked up in fast-melting glaciers and ice caps, or is too deep in the earth to retrieve (Mehta, 2001).

When accessing a water body for any concrete plant water supply it's important to take into account that the impact on the water body should be as minimum as possible **(**Department of Environment and Lands, 1992). Storm and process water should be properly managed in such a way that prevent or minimize the release of contaminantsoffsite and including to ground water as pollutants from concrete batching operations can result in increasing soil and water pH affecting aquatic life, increasing the turbidity or cloudiness of waterways, destroying the functionality of wetlands and providing a medium for weeds to establish (Queensland Government, 2014). Effective water management can also help in improving plant efficiency and reducing costs (ERMCO, 1996). Water in concrete factories can be divided - according to its degree of contamination - to pH neutral, contaminated water, dirty water, and clean water; the definition of each type is as follows (Queensland Government, 2014);

- **PH neutral**: Water that falls in the range 6.5 to 8.5.

- **Contaminated water**: In the concrete batching industry, refers to water that has contacted alkaline materials used in batching, or originated from alkaline areas, and become alkaline (pH greater than 8.5). Examples of alkaline areas include cement and fly ash storage and loading, agitator truck loading, slumping and washing points, recycled water pits, slurry agitator pits, 'first-flush' collection pits and concrete waste drying and storage.
- **Dirty water**: In the concrete batching industry, refers to water that has contacted particulate materials such as sand and dirt and become laden with suspended solids. Dirty water originates from aggregate storage areas not affected by cementitious materials and sediment settling basins. Typically, but dependent upon approval conditions, water with greater than 50 mg/l suspended solids would be referred to as dirty.
- **Clean water**: Water that originates from areas not impacted by alkaline or dirty materials.

Department of Environment and Lands (1992) mentioned that if the effluent of concrete factories is to be discharged, it should meet the acceptable level of total suspended solids and pH which are:

- Total suspended solids $\leq$ 30.0 milligrams per liter (mg/l)
- $5.5 \leq \text{pH} \leq 9.0$

If unacceptable levels of pH and total suspended solids found in the discharge an investigation should be carried out to determine the causes and remedial actions should be identified and implemented (EPA Victoria, 1998). Wash water from equipment cleaning in concrete plants is often discharged into settling ponds in order to settle out the solids. Most plants are required to have process water discharge permits from state, federal, or provincial environmental agencies to dispose of wastewater from these settling ponds **(**BuildingGreen.com, 1993). The effluent - when meeting the acceptable level for total suspended solids and pH - may be discharged into a body of water such as a stream or pond provided the water body is not part of a protected watershed. The effluent may be pumped onto the ground or other surface leading to a water body but it must not cause erosion of that surface or pick up solids from that surface that may cause it to have a total suspended solids content greater than 30 mg/l. It's not permissible to discharge the effluent onto vegetated area as it considers as a intentional flooding and subject to action by the responsible bodies (Department of Environment and Lands,1992).

Wastewater in concrete plants can produced from their different processes such as; washing down the exterior of truck drums -both before and after delivery-, washing out the inside of truck drums at the end of the day and wastewater produced from other cleaning operations at the plant (ERMCO, 1996). In order to reduce the use of water, many newer concrete plants consider wastewater as a water resource for several processes in the plant **(**BuildingGreen.com, 1993). The optimum use of recycled water can also reduce the scale of problem of water disposal (ERMCO, 1996). ASTM specification C-94 permits the use of wash water from trucks washout operations in mixing concrete in the plant (Lobo and Mullings , 2003).

Pinellas County Department of Environmental Management (2005) put some instruction for wastewater/stormwater reuse as follows;

- Process water which fall in the range of pH 6-9 and 50-200 parts-per-million total suspended solids (TSS) is appropriate for reuse in batching, washing andrinsing.
- In order to weak wastewater/stormwater they can be use for trucks rinsing.
- Reuse water for drum and chute washing, and for slumping.
- Reuse water for plant and grounds wash-down and dust suppression.
- Recycling admixtures can be used to stabilize the concrete residues in mixers drums, only 40-50 gallons of fresh water can be used with the admixtures suggested dosage to rinse mixer drums, the resulting slurry can be held for eight hours and used for rinsing another batch.
- Clean storm water (e.g. roof run off) should be separated from contaminated areas and conserved properly in a well designed storm water discharge system.
- Berms and curbs should be used around truck loading areas, aggregate piles, truck washing stations, drum and cute wash-out areas, and chemical staging areas in order to capture contaminated storm water and process wastewater.
- Concrete plant paving should be porous in improve storm water handling from the site.
- A well designed wastewater collection and recycling system should be produced to collect contaminated water from: agitator washout, truck washing, yard wash down, contaminated storm water, concrete batching area, slump stand and any other wastewater from the batching plant operation.
- Concrete plant should contain settling pond or series of ponds to direct and treat process wastewater and contaminated storm water for reuse purposes.
- Protect storm drain inlets from waste concrete/dust runoff.
- A routine yard and equipments maintenance program should be considered in order to reduce the potential for discharge of sediment to your wastewater collection and recycling system.
- Sediment traps should be installed and inspected in a regular manner within the boundaries of the site in order to avoid discharges of contaminated water from the site .
- Underground storage tanks should be tested regularly to prevent leaks.

EPA Victoria (1998) put some specifications for wastewater recycling system as follows:

- The capacity of the storage system must be sufficient to handle the runoff from bunded areas generated by 20 mm rain in 24 hours.
- Water captured by the bunds should be diverted to a collection pit and then pumped to a storage tank for recycling.

- An outlet (overflow drain) in the bund, one metre upstream of the collection pit, should divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).
- Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.
- Wastewater should be pumped from the collection pit to a recycling tank. The pit should have an primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.
- Collection pits should be provided with two visual alarms. The first should activate when the primary pump fails. The second should activate when water reaches the high level mark in the pit. Both alarms should activate warning devices on the operator's console.

According to Dubai Municipality (2014) there are some control measures that can be applied to prevent land/ground contamination from waste water as wastewater generated from batching plants contains high chromium concentration, these control measures can be summarized as follows:

- Designation and use of proper transit mixers washing area which must be paved; and shall be equipped with at least 3-chamber sedimentation tank of adequate capacity to accommodate wastewater based on the rate of generation or in case emergency situations.
- Not allowing in any way the washing of transit mixer outside the designated washing area especially on unpaved ground.
- Installation of a wastewater chromium removal, PH corrector &Total Dissolved Solids (TDS) concentration reducer plant prior to the commissioning of a new concrete batching plant and the same shall be operational once the batching plant is already operational.
- It's highly recommended to re- used the treated wastewater effluent for other purpose like production process (if possible), transit mixers washing, irrigation, dust suppression…ect.
- A permit to re-use the treated wastewater shall be obtained from Environment Department if the company intends to use the treated effluent for irrigation, dust suppression and others.
- Untreated or partially treated wastewater with quality exceeding the standards shall not be used for any other purposed such as for irrigation and dust suppression, likewise it should be disposed in a correct manner.

This research focuses on Gazan concrete factories water consumption, resources, treatment and disposal.

2.3.4 Solid waste management

Concrete plants solid waste here can be defined as the waste of fresh concrete produced from the factories.

Concrete plants solid waste production must be as minimum as possible in order to prevent environmental harms. There are significant environmental impacts connected to waste disposal from transporting the waste for disposal, to potential leachate, odor and greenhouse gas emission impacts (Queensland Government, 2014).

Applying good practices of waste management can maximize cost savings (Brisbane City Council, 2015). Waste management practices should follow the legislated waste management hierarchy. These are prioritized below from the most preferred to least preferred options (Queensland Government, 2014):

- Avoid producing any waste.
- Reduce the generation of waste.
- Reuse as much as possible.
- Recycle as much as possible.
- Disposal of waste

Concrete plants nowadays have come up with many innovative solutions that tend to minimize and avoid waste generation. BuildingGreen.com (1993) summarizes some of these innovative solutions:

- Using return concrete loads to produce concrete retaining wall blocks or highway dividers.
- Washing the unset concrete to recover the coarse aggregate for reuse.
- Using concrete admixtures that help to retard the setting of concrete in order to effectively utilize the return concrete loads.
- Using pre-cast concrete instead of poured concrete because of the great advantages of pre-cast concrete related to waste generation as material quantities can be estimated more precisely and excess material can be utilized.

This research focuses on the ways that concrete factories deal with, minimize, dispose solid waste in the Gaza Strip.

2.3.5 Noise management

Noise in concrete plants can be generated by the movement of mobile equipment on site, a crushing operation, quarrying and the transferring of cement to a storage silo **(**Department of Environment and Lands, 1992). According to Queensland Government (2014) there are several sources of noise from concrete plants such as:

- Truck and front end loader engine noise.
- reverse warning devices.
- Truck air brakes.
- Aggregate delivery to bunkers and hoppers.
- Swinging, scraping, loading devices.
- Hydraulic pumps.
- Conveyor belts.
- Compressors.
- Air valves.

- Filters.
- Opening and closing gates.
- Radios.
- Alarms.
- Amplified telephones.
- Public address system.

Noise from concrete batching operations can cause conflict between operators and the community (Queensland Government, 2014). Proper selection of site location - away from human activities - and vegetation screens can be good practices of noise management and reduction **(**Department of Environment and Lands, 1992). Brisbane City Council (2015) suggested some practices that help managing noise from concrete plants as follows:

- Noise must be limited at night and in the early morning.
- Use broadband reversing alarms on trucks and front-end loaders.
- Enclose stationary noise sources such as compressors, motors and pumps.
- Use acoustic screens or barriers around noise sources such as aggregate loading bins, truck loading bays or slumping stands.

Queensland Government (2014) noise control measures can be Ensure that noise emissions from noisy equipment are managed appropriately, including using measures such as acoustic shielding or enclosures, and silencers.

- Ensure that reversing alarms are of the squawker type rather than beepers.
- Only operate within your approved operating hours.
- When operating outside of normal operating hours, consider consulting with your neighbors to avoid complaints.
- Limit where practicable the operation of trucks and other heavy machinery to appropriate hours.
- Ensure that all equipment and vehicles are adequately maintained.
- Locate your plant in an appropriately zoned industrial area and away from sensitive noise receptors.
- Use the layout of buildings and natural topography as noise barriers where possible.
- Fencing and mounds can be implemented to reduce noise emissions and therefore the potential for complaints.

2.3.6 Dust generation

Dust generated from concrete plants activities can cause nuisance and result in complaints from neighboring properties (Queensland Government, 2014). There are several sources of dust such as: sandand aggregate mining, material transfer, storage (wind erosion from piles), mixer loading, and concrete delivery (dust from unpaved roads) **(**BuildingGreen.com, 1993). Cyberport development (ND) mentioned that dust emissions from concrete factories can be resulted from:

- Emissions from the dust collectors;
- Emissions for unloading of materials to receiving hopper;
- Emissions from aggregate stockpile; and
- Emissions from paved access road.

Selecting a site that is remote from other human activities allows dust in the air to settle out or disperse so that upon reaching human activity its impact is minimal **(**Department of Environment and Lands, 1992). In order to control dust generation of concrete plants Department of Environment and Lands (1992) suggested some control measures as follows:

- Enclosing the conveyor belts.
- The use of dust suppressants (such as water but not hydrocarbons) on site roadways and conveyor belt drop offs.
- Capturing of particulate before air is exhausted during cement unloading.
- Using a water spray to reduce dust associated with the crusher.

According to Queensland Government (2014) the suggested dust generation control measures are as follows:

- Incoming and outgoing truckloads of sand, aggregate and concrete wash out must be covered during transport to permit dust emission.
- Trucks leaving the premises must be clean specially from there openings (draw bars and tail gates) to prevent material causing dust nuisance and being tracked onto external roads.
- Sand and aggregate stockpiles must be watered regularly to keep down dust emissions.
- Enclose stockpiles on three sides and keep storage levels at least 0.5 meters below the tops of the walls and at least 0.5 meters inside the open ends of the enclosures; or use other measures such as screening or roofing to minimize dust emissions.
- Ensure that cement and fly ash silos are fitted with overfill protection and dust filtration systems, and properly maintain the systems and filters according to manufactures instructions.
- Use a burst bag detector system that has ducting to 1 m of ground level adjacent to the silo-filling pipe.
- All elevated hoppers, conveyors and dusty transfer points shall be sheltered from the wind.
- Prevent and clean up any spillages or dust accumulation on driveways or sealed roads.
- Regularly water or otherwise maintain unsealed roads to minimize dust emissions to prevent nuisance from traffic movements. Care should be taken to prevent material being tracked onto roadways.
- Roof and enclose truck loading bays.

- Use water sprays or filtered dust extraction systems around gob hoppers and across open sides of enclosures.
- Ensure any emission control equipment is regularly maintained.

Cement storage silos need to be fitted with equipment to minimize dust emissions from the silo. A reverse pulse fabric filter dust collector (FFDC) must be installed on silos, FFDC needs to be maintained in accordance with the manufacturer's instructions to ensure adequate and efficient performance. Maintenance procedures and schedules should be documented for the site. Actions that can be taken to ensure the effective dust control performance of FFDCs are (Brisbane City Council, 2015):

- The FFDC should be sized so that the dust collector bags are not subject to clogging. An appropriately sized multibag reverse pulse jet filter should be installed in the silo, fitted and used in accordance with the manufacturer's recommendations. The cloth area of the filter needs to be adequate for the displaced air volume.
- The FFDC should be completely protected from the weather.
- The FFDC should be made of a material that can withstand continuous exposure to cement.
- The filter elements should be cleaned automatically at the end of the silo filling cycle.
- A source of high-pressure air, free of moisture and oil, is required to operate the filters effectively.
- The FFDC should be able to withstand the maximum pressure differential that may be encountered. A differential pressure indicator should be fitted to an alarm to indicate bag filter pressure according to manufacturer's specifications.
- Silos should be protected against internal pressures exceeding the design pressure. Positive relief valves or similar, set at appropriate pressures, should be installed. The relief valve should be ducted to a container on the ground that is able to collect dust particles.
- The exhaust air from the silo filters should be ducted to a dust collection container on the ground. Ensure the exhaust discharge points are visible and can be monitored by the driver during silo filling operations. If dust is discharged from the duct work, the driver mustimmediately stop filling thesilo. This procedure shouldbe documented for the site.
- Burst bag detectors are recommended to reduce dust emissions from silos. Burst bag detectors may be connected to an automatic silo overfill protection circuit to stop the flow of cement if a filter bag bursts.
- The FFDC should be visually inspected at least once a week and any necessary repairs carried out immediately. This procedure should be documented for the site.

2.3.7 Materials and chemicals storage and handling

Brisbane City Council (2015) mentioned that cement and fly ash contaminate waterways because they:

- Have a high pH.
- Contain a range of toxic heavy metals.
- Create a fine, suffocating layer of sediment on the banks or beds of waterways.
- Increase the turbidity – or cloudiness – of waterways.

2.3.7.1 Cement and fly ash handling

In order to handle cement and fly ash in a good manner there are some guidelines that can be summarized in the following points (Brisbane City Council, 2015):

- Keep cement and fly ash out of storm water drains and waterways.
- Prevent storage silos from overfilling with an automatic shutdown switch.
- Use equipment such as a reverse pulse filter to control dust from storage silos.
- Install an emergency shutdown on storage silos to prevent spills.

Concrete batching plants must be designed and operated to prevent cement and fly ash from being blown, swept, hosed or left to be washed by rain into gutters or the storm water systems. Wind-blown cement and fly ash can cause an environmental (dust) nuisance by affecting the health and well-being of residents and damaging property such as vehicles.

2.3.7.2 Cement and fly ash delivery

The delivery of cement and fly ash must be done with care taking in consideration several issues as follows (Brisbane City Council, 2015):

- Cement and fly ash needs to be stored in sealed, dust-tight silos. All hatches, inspection points and duct work should be dust-tight.
- Cement and fly ash should be delivered in sealed vehicles equipped for pneumatic transfer to the storage silos.
- The silo delivery pipes need to be made of material able to withstand the effects of cement and fly ash.
- The pipes should be clearly labelled
- with the silo identification and material stored inside the silo.
- Pipes should be kept locked (except when a delivery is in progress) to prevent the accidental spillage of cement or fly ash.
- The silo delivery pipe should be fitted with a butterfly or pinch valve, or similar, that enables 'tight shutoff' to prevent cement or fly ash dust escaping.
- The valve should be made of wear-resistant materials and be able to withstand products delivered at a high velocity.
- The valve should be less than one meter above the fill point to minimize the spillage of cement or fly ash.

- Any cement or fly ash spills during delivery need to be cleaned up as soon as possible to minimize the risk of water contamination and dust emissions. This should be documented in spill clean-up procedures. Collecting and recycling the spilt cement and fly ash for re-use can reduce waste.

2.3.7.3 Silo overfill protection

Overfilling a cement or fly ash silo can release large volumes of dust into the air, which can affect properties significant distances from the site. Storage silos should be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent the silo from overfilling. Ensure the high-level sensor alarm is set at a point that prevents the silo from overfilling. The following points should be considered when setting the alarm: silo profile, maximum fill rate, response time of the shut-down system, and volume of delivery vehicles (Brisbane City Council, 2015).

2.3.7.4 Sand and aggregate handling

In order to minimize the dust emissions from sand and aggregate delivery, some guidelines must be followed (Brisbane City Council, 2015):

- Dampen materials being delivered to control dust.
- Shield stockpiles from the wind or store them in bins.
- Enclose or cover conveyors and fit them with belt cleaners.
- Clean up spilt material immediately to prevent contamination of waterways.

2.3.7.5 Storage of chemicals

Brisbane City Council (2015) set some guidelines for the safe handle and storing of chemicals in concrete factories:

- Order and store chemicals in the smallest quantities possible.
- Store chemicals (including admixtures) and fuel within a bunded, covered and signed area.
- Always clearly label all chemicals and keep safety data sheets.
- Prepare a spill response plan and keep clean-up equipment close to chemical and fuel storage areas.

2.3.8 Environmental management systems (EMS)

2.3.8.1 Overview about ISO 14001

The first and most important of the ISO 1400 series was adopted by the international organization for standardization (ISO) in 1996. The series standards apply a management systems approach to an organization's environmental issues (The Lexington Group Lexington, MA, ND). The ISO 14001 is now becoming the dominant international standard for assessing environmental management processes all over the world (INNO, 2005).A unique aspect of the system is that it is designed to be appropriate for any company, regardless of industry, size, location, and the level of their environmental responsibilities (Christini et al., 2004).

The ISO 14001 standard defines an EMS as ‘‘a management tool enabling an organization of any size or type to control the impact of its activities, products or services on the environment’’ (Christini et al., 2004).The EMS provides a standard framework that includes environmental policy, planning, implementation and operation, checking and corrective action, and measurement review and improvement (Shen and Tam, 2001).ISO 14001 provides an objective that understand the environmental aspects and impacts of organization's activities, It helps in defining environmental goals, objectives and methods tend to achieve these goals and objectives (Šelih, 2007).

ISO 14001 international standard is based on the methodology known as Plan-Do-Check-Act (PDCA) (ISO, 2004). Figure 2.1. summarizes the environmental management system model for 14001 international standard.

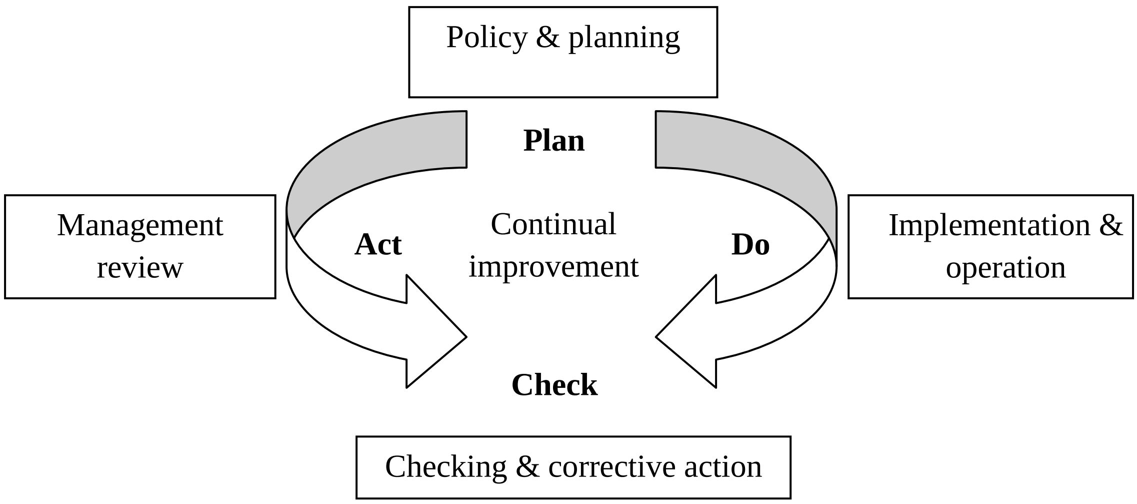

Figure (2.1) The environmental management safety model for ISO 14001 international standard. Source: INNO (2005) 9780387

According to this model the EMS can be divided into the four stages: plan, do, check and act, the main concepts of each stage can be summarized as follow (INNO, 2005):

1. **Plan:** identifying environmental problems and activities that have impacts to the environment, establishing goals, aims and environmental policy for the purpose of improving organization's environmental performance and eliminate or reduce the environmental impact of its activities. When drafting a plan, different aspects should be considered:
   - Technological options;
   - Financial, operational and business requirements;
   - Views of interested parties;
   - Significant environmental aspects, environmental policy.

Organization's top management should establish environmental policy document which identify organization's priorities according to the environment and take into account the applicable legal and other requirements of environmental relevance.

2. **Do:** refers to the implementation of plans. An organization must establish the procedures required for the plans implementation in order to improve its environmental performance. Several aspects should be considered in this stage:
    - Responsibilities should be defined;
    - Documentation and good communication between employees should be established;
    - Environmental training programs should be carried out among all employees that have a significant impact on the environment in their work;
    - Procedures to identify possible accidents and emergency situations and emergency preparedness are required.
3. **Check:** this stage includes monitoring, measurements, and EMS performance evaluation. Procedures required for performance evaluation and weaknesses strengthening must be identified.

    Checking must be carried out on a regular basis for the purpose of identifying errors and required corrective and preventive actions. There are three types of audits according to the party who carry out such audits:
    - First party audits: audits carried out by members of the company or environmental consultants;
    - Second party audits: audits carried out by a closely related company, for example asupplier;
    - Third party audits/external audits: audits carried out be independent auditors.
4. **Act:** includes staff and top management reviews. It's important to review the management system periodically (once a year) based on information from measurements, monitoring and audits in order to make changes when required.

Plan-Do-Check-Act steps of EMS should be linked together into a process in order to gain better results and assure goals and objectives meeting (INNO, 2005). The concept of continual improvement is a key component of the environmental management system by completing the cycle (INNO, 2005). The success of the system require a commitment from all levels and functions of the organization, especially from top management (ISO, 2004).

2.3.8.2 Benefits of certifying ISO 14001 EMS

The reason why organizations tend to certified ISO 14001 certification is that the benefits reflected on the organization are greatly larger than the reflected barriers (Šelih, 2007). Experience proved that implementing EMS in an organization not only benefits the organization itself, but also the whole surrounding environment (Matuszak-Flejszman, 2009).

Edwards (2004) summarized the reasons why every organization should take environmental factors into account in its management processes as follows:

- **Ethical:** as human beings we have a duty to look after the world in which we live and to hand it on to our children;
- **Economic:** cost saving can be assured by reducing the produced waste and the consumed energy;
- **Legal:** governments nowadays enact laws that take into account the interaction of each organization with the environment;
- **Commercial:** a lot of large organizations nowadays are taking control of their environmental responsibilities and they expect their partners to do the same.

University of North Carolina at Chapel Hill*et al*(2001) mentioned several drivers of environmental management systems:

- **Corporate policies:** many companies are encouraged to adopt an EMS by their parent organizations;
- **Regulatory expectations:** one of the strongest external drivers;
- **Market forces:** adopting EMS improve the company image for both customers and public sector;
- **Government assistance:** some governments encourage and help organizations tend to adopt EMS by providing financial or expert support during the EMS implementation;
- **Cost reduction:** cost reduction can be assured by reducing the potential for pollution occurrence;
- **Organizationalculture:** if it is positive against the environmental issues, it can encourage the management to initiate the EMS implementation.

According to Beng *et al.* (2010) applying ISO 14000 EMS has a great benefits such as:

- Money savingbecause of energy saving and waste minimizing;
- Encourages healthy competition;
- Reduces the amount of chemicals and hazardous waste on-site, and as a result the number of injured employees from such chemicals and hazardous waste ;
- Reduces insurance premium due to the lower environmental liability and risk;
- Improves upper management attention and their appreciation of environmental management.

2.4 Current environmental requirements for concrete factories in Gaza Strip

In order to control the environmental practices of concrete factories in Gaza Strip, EQA was issued some environmental requirements that can be chicken when issuing factories licenses such as (EQA, ND):

- Surrounding the factory's boundaries with at least 4 meters height wall.
- Installing sprinklers network on the top of materials storing tanks and around the factory's boundaries.
- Spraying materials (aggregate and sand) trucks with water before unloading.
- Factory floors must be completely paved with concrete.
- Maintaining cleanliness of the factory and its surroundings, and identifying industrial waste collection areas in the factory in order to transfer the waste into sites previously identified by official bodies.
- Planting height trees around factory boundaries (Cypress trees).
- Complying with any future environmental requirements of Environment Quality Authority.

Ministry of Local Government (2011) issued a publication for the regulatory requirements of concrete and blocks factories in Gaza Strip prohibited theconstruction of concrete and blocks factories in residential and commercial areas, the rest of requirements for concrete factories can be summarized as follows:

- The factory's area must not be less than 3,000 m2, and factory interface must not be less than 30 meter.
- The road width where factory lies beside must not be less than 20 meter, it must be already opened with the same width.
- According to factories on road number 4, buildings (except managerial buildings) 30 meters at least away from the road.
- Factories walls height must not be less than 9 meters (4 meters blocks and 5 meters steel or polycarbonate sheets)
- Factory boundaries must be 50 meters at least away from any residential buildings.
- High trees must be planted around factory boundaries.
- Water sprinklers must be installed on the top of materials storing areas.
- The approval of all official bodies before granting a license.
- The obligation to exercise all types of works within factory's boundaries.
- Factories those contain gravel crushers must committed to stipulations of crushers system that published in Palestinian sheets.
- The factory must bring a commitment to move into industrial zone when asked to do so by the central committee.

* A copy of the publication can be found in Appendix (C).

Chapter 3
Methodology

Chapter 3
Methodology

This chapter presents the methodology of the study including research methodology, research population, the questionnaire that was used in the study and the way it was designed, data collection, and descriptive statistics and personal data analysis, content validity.

3.1 Research methodology

Descriptive analytical method was used by the researchers, the data was collected and analyzed to evaluate the environmental practices of concrete factories. The data was collected from the engineers and people work in concrete factories of Gaza Strip.

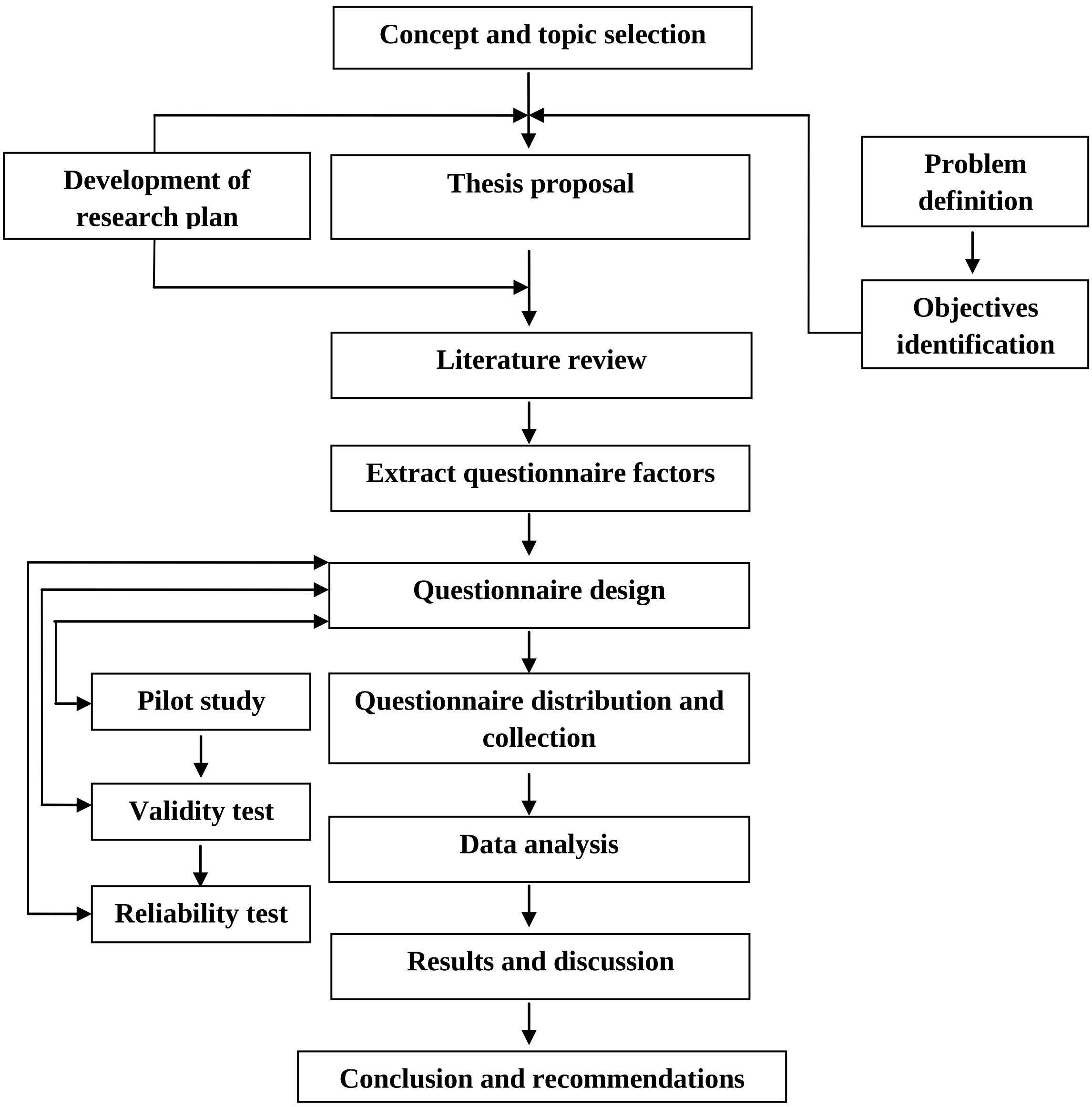

Figure (3.1) Methodology flew chart

3.1.1 Data Collection Methodology

This research aim is to define and measure how concrete factories in Gaza Strip are compatible with environment protection aspects. Thus, the data was collected using:

- **Secondary Data:**

Published data search, including books, papers, journals, internet, documents and other literature related to the research.

- **Primary Data:**

The primary source is mainly through using a questionnaire which was specifically designed for this study due to the type of data needed to define and measure how concrete factories in Gaza Strip are compatible with environment protection aspects. The questionnaire survey seems to be most appropriate tool to collect data in the current study due to its practicality, and scientifically analysis.

Research methodology depends on the analysis of data on the use of descriptive analysis, which depends on the poll and use the main program Statistical Program for Social Science (SPSS).

3.2 Population and sample size

The population of the study are 35 factories in Gaza Strip (all concrete factories in Gaza Strip), the study sample are 35 factories (all the population), there are no need to take a sample from the population due to its limited and small size. 85 questionnaires were distributed to concrete factories employees (managers and technical engineers) (two questionnaire for each factories) , the received questionnaires were 77.

3.3 The Questionnaire Design

Arabic language was used for designing the questionnaire's to be more understandable for targeted employees in the concrete factories. An English version and Arabic version were attached in Appendix (A) and Appendix (B).

A covering letter was provided with the designed questionnaire in order to explain the purpose of the study, the way of responding, the aim of the research and the confidentially of the information in order to encourage respondents.

A structured questionnaire was specially designed for the study and it consisted of three main sections:

1. The first section was a covering letter which explained the purpose and the aim of the study.
2. The second section was general information about respondents.
3. The third section was the main body of the questionnaire and it was divided into 8 fields as follows, the references for each factor are also mentioned;

1) **Factory location selection**, sources: (Department of Environment and Lands, 1992), (Pinellas County Department of Environmental Management, 2005), (Dubai municipality, 2014).
2) **Culture of factory stuff**, source: (Pinellas County Department of Environmental Management, 2005).
3) **Factory water management**, sources: (Envirochem Special Projects Inc., 1993), **(**BuildingGreen.com, 1993)., (Mehta, 2001)., **(**Department of Environment and Lands, 1992), (Queensland Government, 2014), (ERMCO, 1996), (EPA Victoria, 1998), (Lobo and Mullings , 2003), (Pinellas County Department of Environmental Management, 2005), (EPA Victoria, 1998), (Dubai Municipality, 2014).
4) **Factory solid waste management**, sources: (Queensland Government, 2014), (Brisbane City Council, 2015), (BuildingGreen.com, 1993).
5) **Factory noise management**, sources: **(**Department of Environment and Lands, 1992)., (Queensland Government, 2014), (Brisbane City Council, 2015),
6) **Dust minimizing in the factory**, sources: (Queensland Government, 2014), **(**BuildingGreen.com, 1993), (Cyberport development, ND), **(**Department of Environment and Lands, 1992), (Brisbane City Council, 2015),
7) **Materials and chemicals saving and storing**, sources: (Brisbane City Council, 2015),
8) **Environmental management system in the factory**, sources: (The Lexington Group Lexington, MA, ND), (INNO, 2005), (Christini et al., 2004), (Shen and Tam, 2001), (Šelih, 2007), (ISO, 2004), (Matuszak-Flejszman, 2009), (Edwards, 2004), (University of North Carolina at Chapel Hill*et al*, 2001), (Beng *et al*, 2010),

3.4Pilot study

Pre-testing the questionnaire was performed in order to make sure that the questionnaire is going to deliver the right data and to ensure the quality of the collected data. In other words, pre-testing the questionnaire was important and necessary step to find out if the survey has any logic problems, if the questions are too hard to understand, if the wording of the questionnaire is ambiguous, or if it has any response bias, etc. The questionnaire was tested by four professionals. The questionnaire was modified according to pre-testing results. Unnecessary personal data, complex and duplicated questions were avoided.

3.5 Data Measurement

The level of measurement must be understood in order to select the appropriate method of analysis. There is/are an appropriate method/s that can be applied for each type of measurement and not others. Ordinal scale was used here. Integers in ascending or descending order is used as a ranking or a rating data in ordinal scale. The numbers assigned to the importance (1, 2, 3, 4, 5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale we have the following shown in Table 3.1:

Table(3.1): Likert scale of the study

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Scale	5	4	3	2	1

3.6 Statistical analysis tools

The researcher would use data analysis both qualitative and quantitative data analysis methods. The data analysis made utilizing (SPSS 22). The researcher would utilize the following statistical tools:

1. Frequencies and Percentage.
2. Cronbach's Alpha for Reliability Statistics.
3. Person correlation for Validity.
4. One sample t test.

3.7 Validity of the research

Validity of an instrument can be defined as a determination of the extent to which the instrument actually reflects the abstract construct being examined. "Validity refers to the degree to which an instrument measures what it is supposed to be measuring (Golafshani, 2003).High validity means the absence of systematic errors in the measuring instrument. The instrument is valid when it truly reflects the concept it is supposed to measure. A care in the research design and sample selection is needed to achieve good validity. The procedure of questionnaire's questions and the method of analyzing was selected by the supervisor.

3.8 Statistical validity of the questionnaire

Two statistical tests should be applied to insure the validity of the questionnaire,. The first test is Criterion-related validity test (Pearson test) which measures the correlation coefficient between each item in the field and the whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

3.9 Criterion related validity

3.9.1Internal consistency

In order to calculate the correlation coefficients between each paragraph in one field and the whole field internal consistency was used. Tables 3.2 below show the correlation coefficient and p-value for each field items. As shown in the table the p- Values are less than 0.05 or 0.01,so the correlation coefficients of this field are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the paragraphs of this fields are consistent and valid to measure what it was set for.

Table (3.2) The correlation coefficient between each paragraph in the field and the whole field

Field	Pearson coefficient	p-value
1- Factory location selection		
1. Factory locates 1 km (at least) far from any residential facility	0.796	0.000
2. Roads tend to the factory don't pass residential facilities	0.681	0.000
3. Factory lies in industrial area	0.867	0.000
4. Management selects the new factories locations carefully	0.562	0.000
2- Culture of factory stuff	**Pearson coefficient**	**p-value**
1. All factory's stuff has a good background about the methods used to limit environment pollution	0.894	0.000
2. Stuff cares about the environment protection	0.810	0.001
3. Training courses is being given to factories workers to aware them about the methods used to limit environment pollution	0.857	0.000
4. Rewards are being given to distinct workers in the field of environment protection	0.855	0.000
5. Gloves, shoes are always worn by workers in the factory	0.656	0.000
3- Factory water management	**Pearson coefficient**	**p-value**
1. Factory follows wastewater treatment processes effectively, the treated wastewater is being used in factory various operations such as vehicles washing.	0.735	0.000
2. Clean water (such as storm water) is completely separated from contaminated water in factory	0.733	0.000
3. Factory's floors made with a high porosity to help storm water infiltration into aquifer	0.354	0.000
4. Sedimentation bonds are given a regular check and maintenance	0.739	0.000
5. Treated wastewater is being reused in different factory's operations	0.835	0.000
4- Factory solid waste management	**Pearson coefficient**	**p-value**
1. Concrete returned to the factory is being re-used in an efficient way	0.904	0.000
2. Course aggregate is being extracted from returned concrete	0.785	0.000

3. Add-mixtures are being added to concrete to delay its setting time in order to benefit from returned concrete	0.759	0.000
5- Factory noise management	**Pearson coefficient**	**p-value**
1. Factory follows specific methods to reduce noise resulted from factory's operation.	0.642	0.000
2. There are no noise resulted from the factory outside working hours	0.840	0.000
3. Neighbors approval is taken when the factory have to operate outside official working hours	0.687	0.000
4. Vehicles have a good and wide range reverse alarm devices.	0.434	0.000
5. Noise sources "such as pumps and generators" are placed in a closed areas.	0.783	0.000
6. Factory minimizes the working hours of vehicles, machines and other noise sources as possible.	0.625	0.000
7. Factory contains sounds screens and barriers before the access to noise areas	0.394	0.000
8. Factory coordinates with neighbors to identify operation hours to minimize noise (as possible) in the inappropriate times	0.553	0.000
6- Dust minimizing in the factory	**Pearson coefficient**	**p-value**
1. Factory follows a specific methods to minimize dust produced from operation and vehicles	0.892	0.000
2. Vehicles containers are strictly closed to prevent dust scattering	0.926	0.000
3. Vehicles working areas are usually sprayed with water to prevent dust scattering	0.757	0.000
7- Materials and chemicals saving and storing	**Pearson coefficient**	**p-value**
1. Chemicals are being saved and stored with care to prevent leaks	0.862	0.000
2. Factory deals with the leaked materials and chemicals with care that commensurate with each chemical separately	0.760	0.000
3. Chemicals are being saved in strictly closed containers to prevent the exposure to different weather conditions	0.752	0.000
4. There are a sufficient and good light near cement and other materials containers	0.796	0.000
5. Factory monitor and maintain materials containers in a usual manner	0.650	0.000
8- Environmental management system in the factory	**Pearson**	**p-**

	coefficient	value
1. Environment protection is one of the priorities of factory management	0.754	0.000
2. There are a clear and identified policies for dealing with environment risks.	0.604	0.000
3. There are an integrated plan for environment risks management in the factory.	0.670	0.000
4. Management benefits from feedback in environment risks management	0.589	0.000
5. Factory has all needed licenses related to the Environment protection	0.694	0.000
6. Management takes into consideration to issue the certificates related to environmental protection such as ISO14001	0.616	0.000
7. There are legislation bodies that give certifications for environment protection such as ISO14001 in Gaza strip.	0.749	0.000
8. Factory has applied for a certificate from the environmental quality authority	0.506	0.000
9. Factory is certified from the Environmental quality authority and Ministry of Housing	0.530	0.000

3.10 Structure Validity of the Questionnaire

In order to test the validity of the questionnaire structure, structure validity was used; its function is to test the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of likert scale.

As shown in Table 3.3, the significance values are less than 0.05 or 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study.

Table (3.3) Structure validity of the questionnaire

No.	Field	Pearsoncorrelation coefficient	p-value
1.	Factory location selection	0.523	0.000
2.	Culture of factory stuff	0.809	0.000
3.	Factory water management	0.395	0.000
4.	Factory solid waste management	0.352	0.000
5.	Factory noise management	0.628	0.000

6.	Dust minimizing in the factory	0.475	0.000
7.	Materials and chemicals saving and storing	0.486	0.000
8.	Environmental management system in the factory	0.851	0.000

3.11 Reliability of the research

In order to test if the used instrument really measure the attribute it is supposed to be measuring, reliability of the instrument was used. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient. For the most purposes reliability coefficient above 0.7 are considered satisfactory. Period of two weeks to a month is recommended between two tests, it was too difficult to ask them to responds to our questionnaire twice within short period. The statistician's explained that, overcoming the distribution of the questionnaire twice to measure the reliability can be achievedby using Cronbach Alpha coefficient and Half Split Method through the SPSS software.

3.12 Cronbach's Coefficient Alpha

Table 3.4 shows the values of Cronbach's Alpha for each filed of thequestionnaire and the entire questionnaire. For the fields, values of Cronbach'sAlpha were in the range from 0.732 and 0.871. This range is considered high; the result ensures the reliability of each field of the questionnaire. Cronbach's Alpha equals 0.885for the entire questionnaire which indicates an excellent reliability of the entire questionnaire.

Table (3.4) For Reliability Cronbachs Alpha

Field	Section	Cronbach's Alpha
Factory location selection	4	0.732
Culture of factory stuff	5	0.871
Factory water management	5	0.749
Factory solid waste management	3	0.752
Factory noise management	8	0.779
Dust minimizing in the factory	3	0.818
Materials and chemicals saving and storing	5	0.813
Environmental management system in the factory	9	0.806
Total	42	0.885

Chapter 4
Data analysis and discussion

Chapter 4
Data analysis and discussion

The aim of this chapter is to analyze the empirical data which were collected through the questionnaire survey in order to examine the environmental practices of concrete factories in Gaza Strip.

4.1Descriptive statistics

4.1.1 Factory date of establishment

Table 4.1 Shows that 46.8% of the factories were established from "Less than 10 years", 37.7% established from (10 to less than 20 years), and 15.6% established from (21- less than 30 years).

Table (4.1)Date of Establishment

Date of Establishment	Frequency	Percentages %
Less than 10 years	36	46.8
10- less than 20 years	29	37.7
21- less than 30 years	12	15.6
Total	77	100.0

4.1.2 Filler's qualification

Table 4.2 shows that 4% of the re spondents have "Master Degree", 70 % of the respondents have "Bachelor Degree", and 26 % of the respondents have "Diploma Degree.

Table (4.2)Qualification

Qualification	Frequency	Percentages %
Doctorate	0	0
Master	3	4
Bachelor	54	70
Diploma	20	26
Total	77	100.0

4.1.3Job title

Table 4.3shows that 66 % of the respondents are "Technical engineer", 16 % of the respondents are "Manager", and 18% of the respondents are "Other".

Table (4.3) Job title

Job title	Frequency	Percentages %
Technical engineer	51	66
Manager	12	16
Other	14	18
Total	77	100.0

4.1.4 Respondents years of experience

Table 4.4 shows that 9.1 % of the respondents years of experience are "Less than 5 years ", 31.2 % of the respondentsyears of experience are"5- less than 10 years ", 40.3 % of the respondentsyears of experience are"10- less than 15 years ", and 19.5% of the respondentsyears of experience are "More than 15 years ".

Table (4.4) Years Of Experience

Years of Experience	Frequency	Percentages %
Less than 5 years	7	9.1
5- less than 10 years	24	31.2
10- less than 15 years	31	40.3
More than 15 years	15	19.5
Total	77	100.0

4.2 Hypothesis

- **H.1:** There is a statistical evidence that factory location selection is taken into account for factories management at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.5,one sample t test was used is used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight of mean is more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight of mean is less than "60%" and the p-value less than 0.05).

Table (4.5) Factory location analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Factory locates 1 km (at least) far from any residential facility	3.60	71.95	1.30	4.03	0.00	2
2. Roads tend to the factory don't pass residential facilities	1.95	38.96	1.19	7.75−	0.00	4
3. Factory lies in industrial area	3.57	71.43	1.22	4.11	0.00	3
4. Management selects the new factories locations carefully	4.10	82.08	0.80	12.04	0.00	1
Average	3.31	66.10	0.84	3.19	0.00	

Results from Table 4.5:

- The mean of item #4"Management selects the new factories locations carefully" equals 4.10 (82.08%), Test-value=12.04, and P-value = 0.000. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph and this can be due to the importance of factories location as management select locations that help to facilitate concrete delivery for construction projects.
- The mean of item #2 "Roads tend to the factory don't pass residential facilities" equals 1.95 (38.96%), Test-value=-7.75, and P-value = 0.000 which is smaller than the level of significance α = 0.05. The sign of the test is negative, so the mean of this paragraph is significantly less than the hypothesized value 3.it is concluded that the respondents rejected this paragraph. This can be because of residential facilities in Gaza Strip are being built in a random manner.
- The mean of the field "Factory location selection" equals 3.31(66.10%), Test-value = 3.19, The mean of the field "Factory location selection" equals 3.31(66.10%), Test-value = 3.19, and P-value=0.000 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this factor..Factory location selection is taken into account by factories management. This result indicates the importance of factories locations for management as management select factories locations

with care to insure the ease of concrete delivery for construction projects in different areas in Gaza Strip.

- **H.2:** There is a statistical evidence that culture of factory stuff is sufficient at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.6one sample t test was used was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.6) Culture of factory stuff analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. All factory's stuff has a good background about the methods used to limit environment pollution	2.51	50.13	0.95	4.54−	0.00	2
2. Stuff cares about the environment protection	2.55	50.91	0.99	4.01−	0.00	1
3. Training courses is being given to factories workers to aware them about the methods used to limit environment pollution	1.88	37.66	1.00	9.80−	0.00	5
4. Rewards are being given to distinct workers in the field of environment protection	1.96	39.22	1.19	7.69−	0.00	4
5. Gloves, shoes are always worn by workers in the factory	2.90	57.92	0.99	0.92−	0.36	3
Average	2.36	47.17	0.84	6.73−	0.00	

Results from Table 4.6:

- The mean of item #2 “Stuff cares about the environment protection” equals 2.55 (50.91%), Test-value=4.01−, and P-value = 0.000 which is smaller than the level ofsignificance α = 0.05. The sign of the test is negative, so the mean of this paragraph is significantly less than the hypothesized value 3. It is concluded that the respondents rejected this paragraph. This can be due to the low level of environmental knowledge for factory stuff.
- The mean of item #3 “Training courses is being given to factories workers to aware them about the methods used to limit environment pollution” equals

1.88 (37.66%), Test-value=9.80−, and P-value = 0.000 which is smaller than the level of significance α = 0.05. The sign of the test is negative, so the mean of this paragraph is significantly less than the hypothesized value 3. is concluded that the respondents rejected to this paragraph. This be can due to the culture of management that considers these courses as a burden that increase the costs.

- The mean of the field "culture of factory stuff" equals 2.36(47.17%), Test-value = -6.73, and P-value=0.000 which is smaller than the level of significance α = 0.05,The sign of the test is negative, so the mean of this field is significantly less than the hypothesized value 3. It is conclude that the respondents rejected this field, therefore culture of factories stuff is not sufficient and need to be developed. This result can be because of the management always tends to minimize the costs and maximize the profit without taking into account environment protection and the development of the stuff in this field.

- **H.3:** There is a statistical evidence that factory water management is satisfactory at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In the following Table 4.7one sample t test was used is used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.7)Factory water management analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Factory follows wastewater treatment processes effectively, the treated wastewater is being used in factory various operations such asvehicles washing	3.42	68.31	1.13	3.23	0.00	1
2. Clean water (such as storm water) is completely separated from contaminated water in factory	2.01	40.26	0.87	10.00−	0.00	5
3. Factory's floors made with a high porosity to help storm water infiltration into aquifer	2.06	41.30	0.88	9.34−	0.00	4
4. Sedimentation bonds are given a regular check and	3.40	68.05	1.27	2.78	0.01	2

maintenance						
5. Treated wastewater is being reused in different factory's operations	3.13	62.60	1.23	0.93	0.36	3
Average	2.81	56.10	0.75	2.29-	0.02	

Results from Table 4.7:

- The mean of item #1 “Factory follows wastewater treatment processes effectively, the treated wastewater is being used in factory various operations such as vehicles washing” equals 4.32 (86.39%), Test-value=3.42, and P-value = 0.000 which is smaller than the level of significance α = 0.05.. The sign of the test is positive, Therefore, the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph, some factories apply some kinds of wastewater treatment and use the treated wastewater in vehicles washing in order to reduce the cost and dependency on fresh water.
- The mean of item #2 “Clean water (such as storm water) is completely separated from contaminated water in factory” equals 2.01 (40.26%), Test-value=-10, and P-value = 0.00 which is less than the level of significance α = 0.05., The sign of the test is negative, so the mean of this paragraph is significantly less than the hypothesized value 3. It is concluded that the respondents rejected this paragraph. The results can be interpreted that the factories don't contain any storm water collection systems.
- The mean of the field “Factory water management” equals 2.81(56.10%), Test-value = -2.29, and P-value=0.02 which is smaller than the level of significance α = 0.05 ., The sign of the test is negative, so the mean of this field is significantly less than the hypothesized value 3. It is concluded that the respondents rejected this field, factories water management is unsatisfactory. Proper water management require some developments to be done on concrete factories in addition to performing awareness campaigns to highlight the importance of applying such a water management in environment protection and costs savings.

- **H.4:** There is a statistical evidence that factory solid waste management is satisfactory at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In the following Table 4.8one sample t test was used was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.8) Factory solid waste management analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Concrete returned to the factory is being re-used in an efficient way	3.83	76.62	1.09	1.09	0.00	2
2. Course aggregate is being extracted from returned concrete	3.92	78.44	1.05	1.05	0.00	1
3. Add-mixtures are being added to concrete to delay its setting time in order to benefit from returned concrete	3.79	75.84	0.95	0.95	0.00	3
Average	3.85	76.97	0.84	0.84	0.00	

Results from Table 4.8:

- The mean of item #2 "Course aggregate is being extracted from returned concrete" equals 3.92 (78.44%), Test-value=1.05, and P-value = 0.000 which is smaller than the level of significance α = 0.05., The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph, some factories extracted the course aggregate from returned concrete in order to minimize the cost of buying and using new course aggregate in addition to the cost of returned concrete's course aggregate disposal.
- The mean of item #3 "Add-mixtures are being added to concrete to delay its setting time in order to benefit from returned concrete" equals 3.79 (75.84%), Test-value=0.95, and P-value = 0.00 which is less than the level of significance α = 0.05., The sign of the test is positive. As a result the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph. Management always aims to minimize the overall cost of concrete and minimize the returned quantity of concrete as possible. The returned concrete with active setting time can be redirected into another construction site.
- The mean of the field "Factory solid waste management" equals 3.85(76.97%), Test-value = 0.84, and P-value=0.000 which is smaller than the level of significance α = 0.05 .. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this field, factories solid waste management is satisfactory. This result can be due to the use of add-mixtures that delay concrete setting time, and course aggregate extracting mechanisms from

returned concrete, such these methods avoid the production of huge amount of solid waste.

- **H.5:** There is a statistical evidence that factory noise management is satisfactory at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.9one sample t test was used was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.9)Factory noise management analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Factory follows specific methods to reduce noise resulted from factory's operation.	3.16	63.12	1.01	1.35	0.18	1
2. There are no noise resulted from the factory outside working hours	2.91	58.18	1.19	0.67−	0.51	4
3. Neighbors approval is taken when the factory have to operate outside official working hours	2.26	45.19	1.02	6.38−	0.00	7
4. Vehicles have a good and wide range reverse alarm devices.	3.92	78.44	1.00	8.12	0.00	3
5. Noise sources "such as pumps and generators" are placed in a closed areas.	2.62	52.47	0.95	3.49−	0.00	5
6. Factory minimizes the working hours of vehicles, machines and other noise sources as possible.	3.05	61.04	0.81	0.56	0.57	2
7. Factory contains sounds screens and barriers before the access to noise areas	1.27	25.45	0.60	25.30−	0.00	8
8. Factory coordinates with neighbors to identify operation hours to minimize noise (as possible) in the	2.30	45.97	1.03	5.99−	0.00	6

inappropriate times						
Average	2.69	53.73	0.60	4.55-	0.00	

Results from Table 4.9:

- The mean of item #1 “Factory follows specific methods to reduce noise resulted from factory's operation.” equals 3.16 (63.12%), Test-value=1.35, and P-value = 0.000 which is smaller than the level of significance α = 0.05., The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph, this can be due to that there are almost no residential facilities adjacent to concrete factories and therefore no one can be affected by the noise resulted from such factories operations.
- The mean of item #7 “Factory contains sounds screens and barriers before the access to noise areas” equals 1.27 (25.45%), Test-value-25.30, and P-value = 0.00 which is less than the level of significance α = 0.05, the sign of the test is negative, so the mean of this paragraph is not significantly less than the hypothesized value 3. It is concluded that the respondents rejected to this paragraph, this can be because of concrete factories in Gaza Strip considered as small factories and therefore don't have this degree of development and arrangements.
- The mean of the field “Factory noise management” equals 2.69(53.73%), Test-value = -4.55, and P-value=0.000 which is smaller than the level of significance α = 0.05 The sign of the test is negative, so the mean of this field is significantly less than the hypothesized value 3. It is concluded that the respondents rejected this field, factories noise management is unsatisfactory. In order to perform a good noise management, factories require some specific developments which increase the undesirable costs to the management in the addition of the absence of legislation bodies supervision in this field.

- **H.6:** There is a statistical evidence that minimizing dust in the factory is satisfactory at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.10 one sample t test was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.10)Minimizingdust in factory analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Factory follows a specific methods to minimize dust produced from operation and vehicles.	3.87	77.40	0.80	9.54	0.00	2
2. Vehicles containers are strictly closed to prevent dust scattering	3.86	77.14	0.79	9.52	0.00	3
3. Vehicles working areas are usually sprayed with water to prevent dust scattering	4.04	80.78	0.83	10.93	0.00	1
Total	3.92	78.44	0.69	11.69	0.00	

Results from Table 4.10:

- The mean of item #3 "Vehicles working areas are usually sprayed with water to prevent dust scattering" equals 4.04 (80.78%), Test-value=10.93, and P-value = 0.000 which is smaller than the level of significance α = 0.05., The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph. Ministry of National Economy in Gaza Strip usually enacts laws to drive factories do such spraying vehicles working areas in order to protect employees health.
- The mean of item #2 "Vehicles containers are strictly closed to prevent dust scattering" equals 3.86 (77.14%), Test-value=9.52, and P-value = 0.00 which is less than the level of significance α = 0.05, the sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph. A lot of vehicles containers in Gaza strip can be closed with leather cover in order to prevent dust scattering in the roads and minimize the loss of delivered materials.
- The mean of the field "Dust minimizing in the factory" equals 3.92(78.44%), Test value = 11.69, and P-value=0.000 which is smaller than the level of significance α = 0.05. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this field, dust minimizing in the factory is satisfactory. This result can be due to covering vehicles that deliver materials to the factories which can result in dust scattering to the atmosphere in the addition

to the Ministry of National Economy conditions for concrete factories which drive them to spray sand and aggregate containers in a usual manner.

- **H.7:** There is a statistical evidence that materials and chemicals saving and storing mechanism is good at the level of $\alpha \leq 0.05$ in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.11 one sample t test was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.11)Materials and chemicals saving and storing mechanism analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Chemicals are being saved and stored with care to prevent leaks	4.44	88.83	0.53	24.07	0.00	1
2. Factory deals with the leaked materials and chemicals with care that commensurate with each chemical separately	4.36	87.27	0.63	19.10	0.00	3
3. Chemicals are being saved in strictly closed containers to prevent the exposure to different weather conditions.	4.27	85.45	0.55	20.18	0.00	4
4. There are a sufficient and good light near cement and other materials containers.	4.40	88.05	0.63	19.42	0.00	2
5. Factory monitor and maintain materials containers in a usual manner	4.18	83.64	0.66	15.63	0.00	5
Total Average	4.33	86.65	0.46	25.64	0.00	

Results from Table 4.11:

- The mean of item #1 “Chemicals are being saved and stored with care to prevent leaks” equals 4.44 (88.83%), Test-value=24.07, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$., The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph. Factories always tend to minimize any loss in chemicals or any kind of materials.

- The mean of item #5 "Factory monitor and maintain materials containers in a usual manner" equals 4.18 (83.64%), Test-value=15.63, and P-value = 0.00which is less than the level of significance α = 0.05, the sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph in order to minimize any loss resulted from delivering materials in completely filled containers.
- The mean of the field "Materials and chemicals saving and storing" equals 4.33(86.65%), Test-value = 25.64, and P-value=0.000 which is smaller than the level of significance α = 0.05 The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this field, materials and chemicals saving and storing mechanism is good. Any losses of materials can result in costs increasing which is undesirable to the management.

- **H.8:** There is a statistical evidence that environmental management systems are being taken into account for factories management at the level of α ≤ 0.05 in order to improve the environmental practices of concrete factories on the Gaza Strip.

In Table 4.12one sample t test was used to test this hypothesis, if the opinion of the respondents in the content of the sentences are positive (weight mean more than "60%" and the p-value less than 0.05) or the opinion of the respondent in the content of the sentences are negative (weight mean less than "60%" and the p-value less than 0.05).

Table (4.12)Environmental management systems analysis

Items	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Environment protection is one of the priorities of factory management	3.31	66.10	0.84	3.19	0.00	2
2. There are a clear and identified policies for dealing with environment risks.	2.78	55.58	0.88	2.19−	0.03	5
3. There are an integrated plan for environment risks management in the factory.	2.71	54.29	0.86	2.93−	0.00	6
4. Management benefits from feedback in environment risks management	3.01	60.26	0.98	0.12	0.91	4
5. Factory has all needed licenses related to the	3.73	74.55	1.11	5.76	0.00	1

Environment protection						
6. Management takes into consideration to issue the certificates related to environmental protection such as ISO14001	3.06	61.30	0.91	0.63	0.53	3
7. There are legislation bodies that give certifications for environment protection such as ISO14001 in Gaza strip.	1.95	38.96	1.19	7.75−	0.00	9
8. Factory has applied for a certificate from the environmental quality authority	2.61	52.21	1.29	2.65−	0.01	7
9. Factory is certified from the Environmental quality authority and Ministry of Housing	2.03	40.52	0.83	10.34−	0.00	8
Total Average	2.76	55.30	0.63	3.29−	0.00	

Results from Table 4.12:

- The mean of item #5 “Factory has all needed licenses related to the Environment protection” equals 3.73 (74.55%), Test-value=5.76, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$.. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this paragraph, this can be due to that factories are compatible (to some extent) with the current conditions of the Environment Quality Authority.
- The mean of item #7 “There are legislation bodies that give certifications for environment protection such as ISO14001 in Gaza strip” equals 1.95 (38.96%), Test-value=7.75−, and P-value = 0.00 which is less than the level of significance $\alpha = 0.05$, the sign of the test is negative, so the mean of this paragraph is significantly less than the hypothesized value 3 and this can be due to the siege and occupation in Gaza strip in addition to that the environmental awareness in not common.
- The mean of the field “Environmental management system in the factory” equals 2.76(55.30%), Test-value = 3.29−, and P-value=0.000 which is smaller than the level of significance $\alpha = 0.05$ The sign of the test is negative, so the mean of this field is significantly less than the hypothesized value 3. It is

concluded that the respondents rejected this field, environmental management systems are not being taken into account for factories management. This result can be due to the absence of legislation bodies that check the environmental status and enact laws related to environment protection in the addition to factories management considers applying such environmental management systems as a cost burden.

Table (4.13)Materials and chemicals saving and storing analysis

Fields	Mean	Weight mean	Standard deviation	t-value	P-value	Ranking
1. Factory location selection	3.31	66.10	0.84	3.19	0.00	4
2. Culture of factory stuff	2.36	47.17	0.84	6.73−	0.00	8
3. Factory water management	2.81	56.10	0.75	2.29−	0.02	5
4. Factory solid waste management	3.85	76.97	0.84	8.82	0.00	3
5. Factory noise management	2.69	53.73	0.60	4.55−	0.00	7
6. Dust minimizing in the factory	3.92	78.44	0.69	11.69	0.00	2
7. Materials and chemicals saving and storing	4.33	86.65	0.46	25.64	0.00	1
8. Environmental management system in the factory	2.76	55.30	0.63	3.29−	0.00	6
Average	3.10	62.09	0.41	2.25	0.03	

Table 4.13 shows that the mean of field #7 “Materials and chemicals saving andstoring” equals 4.33 (86.65%), Test-value=25.64, and P-value = 0.000 which is smaller than the level of significance α = 0.05..The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. It is concluded that the respondents agreed to this field, this can be due to that factories management usually avoid any loss in materials which results in undesirable additional costs.

The mean of field #2 “culture of factory stuff” equals2.36 (47.17%), Test-value=6.73−, and P-value = 0.00 which is less than the level of significance α = 0.05, the sign of the test is negative, so the mean of this field is significantly less than the hypothesized value 3, this can be due to the unawareness of management and stuff in the field of environment protection.

- **H.9:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the factories environmental practices due to the age of the factory.

To test the hypothesis we use One Way ANOVA test, and the result illustrated in Table 4.14which shows that the p-value for all fields and the entire of the questionnaire are greater than 0.05, that's means there were no statistically significant differences at the level of $\alpha \leq 0.05$ in the factories environmental practices due to the age of the factory, this can be due to the lack of environmental awareness for either the old and new factories.

Table (4.14) The relationship between factories environmental practices and the age of the factory

No	Fields	F-value	Sig.(P-Value)
1	Factory location selection	2.544	0.058
2	Culture of factory stuff	0.362	0.781
3	Factory water management	0.405	0.75
4	Factory solid waste management	0.034	0.991
5	Factory noise management	1.118	0.343
6	Dust minimizing in the factory	0.258	0.856
7	Materials and chemicals saving and storing	1.277	0.284
8	Environmental management system in the factory	1.83	0.143
	Total paragraphs of the questionnaire	0.648	0.585

* Significance level 0.05

- **H.10:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee position.

To test the hypothesis One Way ANOVA test was used, and the result illustrated in Table 4.15 which shows that the p-value for all fields and the entire of the questionnaire are greater than 0.05, that's means there were no statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee position, this can be due to that employees actually evaluate the current practices of concrete factories apart of their position.

Table (4.15) The relationship between factories environmental practicesand the employee position.

No	Fields	F-value	Sig.(P-Value)
1	Factory location selection	0.726	0.537
2	Culture of factory stuff	0.298	0.827
3	Factory water management	0.45	0.717
4	Factory solid waste management	0.804	0.493
5	Factory noise management	0.332	0.802

6	Dust minimizing in the factory	1.651	0.179
7	Materials and chemicals saving and storing	2.299	0.079
8	Environmental management system in the factory	0.833	0.478
	Total paragraphs of the questionnaire	1.457	0.228

* Significance level 0.05

- **H.11:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee qualification.

To test the hypothesis One Way ANOVA test was used, and the result illustrated in Table 4.16 which shows that the p-value for all fields and the entire of the questionnaire are greater than 0.05, that's means there were no statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee qualification, this can be due to that employees actually evaluate the current practices of concrete factories apart of their qualification.

Table (4.16)The relationship between factories environmental practices and the employee qualification

No	Fields	F-value	Sig.(P-Value)
1	Factory location selection	1.252	0.292
2	Culture of factory stuff	0.452	0.716
3	Factory water management	0.825	0.482
4	Factory solid waste management	2.058	0.107
5	Factory noise management	1.585	0.195
6	Dust minimizing in the factory	0.652	0.582
7	Materials and chemicals saving and storing	3.025	0.31
8	Environmental management system in the factory	2.345	0.074
	Total paragraphs of the questionnaire	1.915	0.129

* Significance level 0.05

- **H.12:** There are statistically significant differences at the level of $\alpha \leq 0.05$ in the evaluation of concrete factories environmental practices due to the employee experience.

To test the hypothesis One Way ANOVA test was used, and the result illustrated in Table 4.17 which shows that the p-value for all fields and the entire of the questionnaire are greater than 0.05, that's means there were no statistically significant differences at the level of $\alpha \leq 0.05$in the evaluation of concrete factories environmental practices due to the employee experience, this can be due to that employees actually evaluate the current practices of concrete factories apart of their experience.

Table (4.17) The relationship between factories environmental practices and the employee experience

No	Fields	F-value	Sig.(P-Value)
1	Factory location selection	1.618	0.122
2	Culture of factory stuff	0.464	0.880
3	Factory water management	1.468	0.172
4	Factory solid waste management	0.806	0.598
5	Factory noise management	0.162	0.995
6	Dust minimizing in the factory	1.699	0.101
7	Materials and chemicals saving and storing	1.350	0.222
8	Environmental management system in the factory	0.268	0.975
	Total paragraphs of the questionnaire	0.766	0.633

* Significance level 0.05

Chapter 5
Conclusion and recommendations

Chapter 5
Conclusion and recommendations

This chapter concludes the research with recommendations for development of the environmental practices of concrete factories in Gaza Strip and may help in future for new researches. The chapter is divided into two sections; the first section provides a conclusion of the whole research while the second section suggests the recommendations.

5.1 Conclusion

Research results can be concluded by comparing the objectives of research with the results as follows:

Objective 1: To identify the benefits gained from complying with environment protection aspects for concrete factories in Gaza Strip.

Benefits gained from complying with environmental protection aspects for concrete factories in Gaza Strip can be insured by making some improvements in several fields:

The proper selection of new factories locations helps in the ease of delivering concrete for construction projects and minimizing the costs of transportation as fuel consumption decrease. Improving stuff environmental culture and knowledge helps in minimizing the cost of operation, minimizing the number of injuries, and improving factory image and stakeholders trust. Improving factory water management helps in minimizing operation costs (the cost of using fresh water in factory operations) and improving factory image and stakeholders trust. Improving factory solid waste management helps in minimizing operation costs (when extracting aggregate from returned concrete), minimizing waste disposal cost, and improving factory image and stakeholders trust. Improving factory noise management helps in improving workers health and decreasing the number of complaints from neighbors and then improving factory image and stakeholders trust. Minimizing dust produced from factory operations and vehicles movements helps in improving health conditions for factory's workers and construction projects stuff and then improving factory image and stakeholders trust. Following a good mechanism for materials and chemicals saving and storing in the factory can help in minimizing the cost of materials and chemicals losses and avoiding spilling of hazardous materials. Applying environmental management system in the factory helps in setting up a strict environmental plan to deal with any aspect that can has a bad effect on the environment, in addition that is improve factory image and stakeholders trust.

Objective 2: To identify the activities and operations performed by these factories and have a bad impact on the environment.

From the results in chapter 4 we can conclude some of the activities of concrete factories in Gaza Strip and have a bad impact on the environment such as:

The poor environmental knowledge for factories stuff can result in a lot of activities with bad impact on the environment such as: wasting natural resources, wasting factories delivered materials, increasing solid waste production, increasing noise resulted from the factory, and increasing the produced dust. Poor water management can result in wasting and increasing the reliance on scarce fresh water in factories operations, and increasing the cost of waste water disposal**.** Poor noise management in concrete factories can result in bad health conditions for factories workers, and increasing numbers of neighbors complaints. Negligence of environmental management systems can result in the absence of environmental pan to deal with all environment protection practices in all times, in addition to weakening stakeholders trust and factory image.

Objective 3: To identify the barriers that face concrete factories in Gaza Strip in developing their environment protection practices.
Barriers that face concrete factories in Gaza Strip in developing their environment protection practices can be summarized as follows:

- The lack of environmental knowledge for factories management, in addition to the lack of qualified stuff in the field.
- The absence or weakness of laws and legislations that control, monitor factories environmental practices in Gaza Strip and criminalize uncommitted.
- The lack of official bodies that care and follow up environmental affairs of concrete factories in Gaza Strip.

Objective 4: To suggest specific modification that can improve concrete factories environmental practices.
This objective can be achieved by constructing some recommendations for concrete factories management and official bodies and stakeholders as follows in paragraph 5.2.

5.2 Recommendations

5.2.1 Recommendations for concrete factories management

1. To take in considerations environment protection aspects in management decisions and policies.
2. To construct an environment protection plan to deal with environmental aspects and to minimize factories environmental impact.
3. To select new factories locations with care to ensure concrete delivery to construction projects with lower cost of transportation and fuel consumption in the addition of minimizing the harmful impacts and complaints from factories' neighbors.
4. To strengthen stuff environmental knowledge in order to minimize injuries, harmful impacts on the environment, and to increase cost savings through conducting training sessions, workshops, environmental incentives and rewards for stuff.

5. To make all efforts in exploiting storm water and waste water produced from factories operations in order to minimize the reliance on fresh water by collecting storm water from buildings roofs and activating waste water treatment in the factory.
6. To construct solid waste management plan that ensure the benefit of all available resources (such as coarse aggregate from returned concrete) and minimize solid waste disposal costs.
7. To make all available efforts to decrease noise resulted from factories operations in order to improve workers health conditions and avoid neighbors complaints, examples: placing generators and all noise sources in closed areas and minimizing vehicles working hours as possible
8. To make all efforts in developing and maintaining vehicles, machines, and materials storage tanks in the addition of installing dust bosses, planting high trees and building high walls around the factory in order to minimize the production of dust that affect workers, neighbors, and public health.
9. To properly construct and maintain cement silos and materials storage tanks in order to save and store materials in a good manner that minimize any losses.
10. To define a good environmental management system in order ensure that there are no harmful impact of factories activities on the environment and improve factories image and stakeholders trust.

5.2.2 Recommendations for official bodies and stakeholders

1. To strengthen the role of Environment Quality Authority and all other related bodies in controlling concrete factories practices and activities "specially the activities that impact the environment".
2. To develop the current environment protection laws and regulations and the emphasis on the necessity of actual practice.
3. To take into account environment protection aspects when performing concrete factories licenses.
4. To impose sanctions and fines on concrete factories those violate environment relates laws and regulations.
5. To usual follow-up and control environmental practices of concrete factories.
6. To perform training courses and workshops for concrete factories management, stuff and all stakeholders to increase environmental awareness.
7. To help concrete factories in developing those stuff and components in order to improve the environmental practice.

5.2.3 Recommendations for further studies

1. To develop a comprehensive system for the official bodies to followin order to control the environmental practices of concrete factories.
2. To extensively study the ways and opportunities of overcoming the barriers that prevent the developing ofconcrete factories environmental practices.
3. To study the cost return that can be obtained for the concrete factories when developing their environmental practices.

4. To study the environmental practices of other kinds of factories in construction; blocks factories, asphalt factories, etc.

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Appendices

Appendix (A): The research questionnaire (in English language)

Dear colleagues/

Please devote part of your time to fill the following questionnaire in order to evaluate the environmental performance of concrete factories of Gaza Strip.

Research aim: to define and measure how concrete factories in Gaza Strip are compatible with environment protection aspects.

Target group: all factories stuff (managers and engineers).

Questionnaire aim: measuring how policies and capabilities of concrete factories in Gaza Strip are compatible with the given factors (in the questionnaire) which are related to environment protection and minimizing the environmental impact of such factories.

Questionnaire filling: please answer all the following questions (as much as possible). Add other factors you see important. Add appropriate comments and notes if any.

Please notify that all information in this questionnaire will be used for purposes of scientific research only.

Questionnaire sections:

Section 1: general information

Section 2: evaluating the degree of compliance with the given environmental aspects in the factory.

Section 1: general information						
1	**Works in the factory start since**	□Less than 10 years	□10 to 20 years	□21 to 30 years	□ more than 30 years	
2	**Questionnaire filler's position**	□Manager	□Technical engineer	□Other		
3	**Qualification**	□ Doctorate	□ Master degree	□ Bachelor degree	□ Diploma	□ Other
4	**Filler's years of experience**	□Less than 5 years	□ 5 to 10 years	□11 to 15 years	□More than 15 years	

Section 2: evaluate the degree of compliance with the given environmental aspects in the factory.

Please specify the degree of agreement on the given factors						
		(5) Yes	**(4) To some extent**	**(3) neutral**	**(2) No**	**(1) Never**
1- Factory location selection						
1	Factory locates 1 km (at least) far from any residential facility					
2	Roads tend to the factory don't pass residential facilities					
3	Factory lies in industrial area					
4	Management selects the new factories locations carefully					
2- Culture of factory stuff						
5	All factory's stuff has a good background about the methods used to limit environment pollution					
6	Stuff cares about the environment protection					
7	Training courses is being given to factories workers to aware them about the methods used to limit environment pollution					
8	Rewards are being given to distinct workers in the field of environment protection					

Please specify the degree of agreement on the given factors						
		(5) Yes	**(4) To some extent**	**(3) neutral**	**(2) No**	**(1) Never**
9	Gloves, shoes are always worn by workers in the factory					
3- Factory water management						
10	Factory follows wastewater treatment processes effectively, the treated wastewater is being used in factory various operations such as vehicles washing.					
11	Clean water (such as storm water) is completely separated from contaminated water in factory					
12	Factory's floors made with a high porosity to help storm water infiltration into aquifer					
13	Sedimentation bonds are given a regular check and maintenance					
14	Treated wastewater is being reused in different factory's operations					
4- Factory solid waste management						
15	Concrete returned to the factory is being re-used in an efficient way					
16	Course aggregate is being extracted from returned concrete					
17	Add-mixtures are being added to concrete to delay its setting time in order to benefit from returned concrete					
5- Factory noise management						
18	Factory follows specific methods to reduce noise resulted from factory's operation.					
19	There are no noise resulted from the factory outside working hours					
20	Neighbors approval is taken when the					

Please specify the degree of agreement on the given factors						
		(5) Yes	**(4) To some extent**	**(3) neutral**	**(2) No**	**(1) Never**
	factory have to operate outside official working hours					
21	Vehicles have a good and wide range reverse alarm devices.					
22	Noise sources "such as pumps and generators" are placed in a closed areas.					
23	Factory minimizes the working hours of vehicles, machines and other noise sources as possible.					
24	Factory contains sounds screens and barriers before the access to noise areas					
25	Factory coordinates with neighbors to identify operation hours to minimize noise (as possible) in the inappropriate times					
6- Dust minimizing in the factory						
26	Factory follows a specific methods to minimize dust produced from operation and vehicles.					
27	Vehicles containers are strictly closed to prevent dust scattering					
28	Vehicles working areas are usually sprayed with water to prevent dust scattering					
7- Materials and chemicals saving and storing						
29	Chemicals are being saved and stored with care to prevent leaks					
30	Factory deals with the leaked materials and chemicals with care that commensurate with each chemical separately					
31	Chemicals are being saved in strictly closed containers to prevent the exposure to different weather conditions.					
32	There are a sufficient and good light near cement and other materialscontainers.					
33	Factory monitor and maintain materials					

Please specify the degree of agreement on the given factors						
		(5) Yes	**(4) To some extent**	**(3) neutral**	**(2) No**	**(1) Never**
	containers in a usual manner					
8- Environmental management system in the factory						
34	Environment protection is one of the priorities of factory management					
35	There are a clear and identified policies for dealing with environment risks.					
36	There are an integrated plan for environment risks management in the factory.					
37	Management benefits from feedback in environment risks management					
38	Factory has all needed licenses related to the Environment protection					
39	Management takes into consideration to issue the certificates related to environmental protection such as ISO14001					
40	There are legislation bodies that give certifications for environment protection such as ISO14001 in Gaza strip.					
41	Factory has applied for a certificate from the environmental quality authority					
42	Factory is certified from the Environmental quality authority and Ministry of Housing					

Appendix (B): The research questionnaire (in Arabic language)

أعزائي الزملاء/
أرجو من حضرتكم التكرم بتخصيص جزء من وقتكم لتعبئة الإستبانة المرفقة أدناه و ذلك لتقييم الأداء البيئي لمصانع الخرسانة في قطاع غزة.

هدف البحث :تقييم الأداء البيئي لمصانع الخرسانة و معرفة جميع المخاطر البيئية الناتجة عنها بهدف الحد من التلوث البيئي الناتج عن هذه المصانع.

الفئة المستهدفة : جميع العاملين في مصانع الخرسانة من مهندسين و مدراء.

أهداف الإستبانة :قياس مدى توافق سياسات و إمكانيات مصانع الخرسانةمع المتطلبات و العوامل المختارة في الإستبانة و الخاصة بحماية البيئية من التلوث الناتج عن المصانع.

ملئ الإستبانة :يرجى من حضرتكم الإجابة على جميع الأسئلة ما أمكن. أضف متطلبات أخرى ترى أنها ضرورية. أضف التعليق المناسب عند اللزوم.

أجزاء الإستبانة:

أولا : المعلومات العامة

ثانيا : تحديد مدى توافق سياسات و إمكانيات المصانع مع العوامل المدروسة و الخاصة بحماية البيئة من التلوث.

الجزء الأول/ معلومات عامة						
1	تم بدء العمل في المصنع منذ	أقل من 10 □ سنوت	10-20 □ سنة	20-30 □ سنة	أكثر من □ 30 سنة	
2	وظيفة مالئالإستبانة	مدير □ المصنع	مهندس□	أخرى□		
3	المؤهل العلمي	دكتوراه□	ماجستير□	□ بكالوريوس	دبلوم□	□ أخرى
4	عدد سنوات الخبرة لمالئ الإستبانة	أقل من 5 □ سنوات	5-10 □ سنوات	10-15 □ سنة	أكثر من □ 15 سنة	

الجزء الثاني : تحديد مدى توافق سياسات و أمكانيات المصانع مع العوامل المدروسة و الخاصة بحماية البيئةمن التلوث

يرجى تحديد درجة الموافقة على العوامل المذكورة أدناه						
		(5) صحيح	(4) إلى حد ما	(3) محايد	(2) غير صحيح	(1) على الإطلاق
	أولاً : إختيار موقع المصنع					
1	موقع المصنع يبعد 1 كم على الأقل عن أقرب منشأة سكنية					
2	الطرق المؤدية إلى المصنع لا تمر بمنشأت سكنية					
3	يقع المصنع في منطقة صناعية					
4	يتم إختيار أماكن المصانع الجديدة بعناية					
	ثانياً : درجة ثقافة العاملين بالمصنع					
5	جميع طاقم العمل في المصنع على دراية بالطرق المستخدمة للحد من تلوث البيئة					
6	يهتم جميع طاقم العمل بالبيئة و حمايتها من التلوث					
7	يتم إعطاء دورات تدريبية لجميع العاملين تعني بالحد أو التقليل من تلوث البيئة					
8	يتم إعطاء مكافئات للعمال الفاعلين في تقليل تلوث البيئة					
9	يلتزم جميع العاملين بالمصنع بإرتدار الزي المناسب للعمل و القفازات و الأحذية					
	ثالثاً : إدارة و جودة المياه في المصنع					
10	يتبع المصنع آليات معينة لمعاجة المياه العادمة الناتجة و إستخدامها في العمليات المختلفة كالشطف و غسل السيارات					
11	يتم فصل المياه النظيفة (كمياه الأمطار) عن المياه الملوثة					
12	أرضية المصنع ذات نفاذية عالية لتسهيل تسريب مياه الأمطار للخزان الجوفي					
13	يتم فحص و صيانة برك الترسيب و الخزانات و المعدات بشكل دوري					

14	يتم الإستفادة من المياه المعاجة في عمليات المصنع المختلفة					
رابعاً : إدارة النفايات الصلبة في المصنع						
15	يتم الإستفادة من الخرسانة المعادة إلى المصنع بشكل جيد و عدم إهدارها					
16	يتم غسل الخرسانة التالفة لإستخلاص الركام الخشن (الحصمة) منها و إعادة استخدامها في خلطات أخرى					
17	يتم استخدام مواد مثبطة للخرسانة لتأخير زمن الشك للإستفادة من الخرسانة المعادة للمصنع					
خامساً : إدارة الضوضاء الناتجة عن المصنع						
18	يتم إتباع آليات معينة لتقليل الضوضاء الناتجة عن العمليات المختلفة في المصنع					
19	لا يوجد ضوضاء صادرة عن المصنع خارج أوقات الدوام الرسمي					
20	عند الإضطرار للعمل خارج أوقات الدوام الرسمي يتم أخذ موافقة الجيران لتجنب الشكاوى					
21	أجهزة الإنذار عند الرجوع للخلف في المركبات جيدة و ذات نطاق واسع					
22	مصادر الضوضاء كالمضخات و المولدات موجودة في أماكن مغلقة					
23	يتم تقليل عمل المركبات و الماكينات مصادر الضوضاء قدر الإمكان					
24	يوجد شاشات صوتية و حواجز قبل الدخول لأماكن الضوضاء في المصنع					
25	يتم التنسيق مع الجيران (قدر الإمكان) و تحديد ساعات عمل المصنع لتقليل الصوضاء الناتجة عن عمليات المصنع في الأوقات غيرالمناسبة					
سادساً : تقليل الغبار الناتج عن نقل المواد و حركة الآليات						
26	يتم إتباع آليات معينة لتقليل الغبار الناتج عن المصنع و مركباته في الطرقات					
27	يتم إغلاق صناديق النقل و التحميل في المركبات لمنع تناثر الغبار					
28	يتم رش المياه في أماكن عمل المركبات لمنع تناثر الغبار في الجو					
سابعاً : آلية حفظ المواد و الكيماويات داخل المصنع						
29	يتم حفظ و تخزين و استخدام المواد و الكيماويات في المصنع بشكل جيد و يتناسب مع كل مادة و منع تسريب المواد خارج الخزان					
30	يتم التعامل مع المواد الكيميائيةالمتسربة بشكل جيد و يتناسب مع كل مادة على حده					
31	يتم حفظ المواد الكيميا ئية في مناطق مغلقة					

	لمنع تعرضها للعوامل الجوية المختلفة					
32	**تتوفر إضاءة جيدة بالقرب من خزانات الأسمنت و المواد الأخرى**					
33	**يتم عمل مراقبة و صيانة دورية لخزانات الأسمنت و المواد الأخرى**					
	ثامناً : نظام إدارة البيئة في المصنع					
34	**تعتبر حماية البيئةمن أولويات إدارة مصانع الخرسانة**					
35	**يوجد سياسات واضحة خاصة بإدارة المخاطر البيئية الناتجة عن المصنع**					
36	**يوجد خطة متكاملة لإدارة المخاطر البيئية في المصنع**					
37	**يتم الإستفادة من التغذية الراجعة في إدارة المخاطرالبيئية**					
38	**يحصل المصنع على جميع التراخيص اللازمة و المتعلقة بحماية البيئة من التلوث**					
39	**تهتم إدارة المصنع بإصدار شهادات خاصة بحماية البيئةكشهادة الأيزو 14001**					
40	**تتوفر في قطاع غزة جهات مختصة تمنح شهادات خاصة بحمايةالبيئة من التلوث مثل شهادة الأيزو 14001**					
41	**تقدم المصنع بطلب للحصول على إعتماد من جودة البيئة**					
42	**المصنع لديه إعتماد من وزارة الإسكان و سلطة جودة البيئة**					

شكرا جزيلا ،،

Appendix (C): Ministry of Local Government publication for the regulatory requirements of concrete and blocks factories in Gaza Strip

Palestinian National Authority
Ministry
Of Local Government

السلطة الوطنية الفلسطينية
وزارة
الحكم المحلي

قرار رقم 2011-22 بتاريخ 2011/11/2

بشأن/ الشروط التنظيمية لمصانع الباطون والبلوك – غزة

القرار

☒ بعد الاطلاع على قرار اللجنة المركزية بجلستها رقم ٢٠١١/١٣ بتاريخ ٢٠١١/٧/٧ بشأن ترخيص مصانع الباطون والبلوك ضمن محافظات قطاع غزة.

☒ وبعد الاطلاع على تقرير اللجنة الفرعية المؤرخ في ٢٠١١/٨/٨ وبعد الاطلاع على مستندات الملف والمناقشة بين أعضاء اللجنة المركزية وممثلي الوزارات قررت اللجنة المركزية اعتماد النظام المعد من قبل اللجنة المركزية حسب الشروط التنظيمية التالية:-

أولاً: يمنع إقامة مصانع باطون أو مصانع بلوك في المناطق السكنية والتجارية والمجاور التجارية.

ثانياً: بالنسبة لمصانع البلوك (في المناطق الزراعية والزراعية المساعدة):-

١. المساحة يجب أن لا تقل عن ١٠٠٠م٢ باستثناء المصانع الواقعة على الطريق رقم ٤ فيجب أن لا تقل المساحة عن ٥٠٠م٢.
٢. الشارع الواقع عليه المشروع يجب أن لا يقل عن ١٢م ويجب أن يكون مفتوح على الطبيعة بنفس العرض.
٣. ارتفاع السور يجب أن لا يقل عن (٤م بلوك + ٣م صفيح) من جميع الجهات.
٤. لا يقل البعد بين حد المشروع والمباني السكنية وحدود المناطق ذات الاستعمال المغاير عن ٥٠م كحد أدنى من جميع الجهات.
٥. زراعة أشجار عالية داخل السور (كينا أو سرو) في حال قرب المصنع من المباني السكنية.
٦. تحديد ساعات العمل بحيث يكون العمل خلال ساعات النهار فقط في حال قرب المصنع من المباني السكنية.
٧. موافقة جميع الجهات المعنية قبل منح الرخصة.
٨. وضع رشاشات مياه أعلى أماكن تشوين المواد الخام.
٩. الالتزام بممارسة جميع الأعمال داخل حدود المشروع في كافة مراحل العمل.
١٠. في حالة وجود كسارة يجب الالتزام بالاشتراطات الواردة في نظام الكسارات المعتمد والمنشور في الوقائع الفلسطينية.
١١. يشترط وجود غرفة إدارة وغرفة للعمال + حمام به دش للاستحمام داخل موقع المشروع.
١٢. أن يحضر المستدعي تعهد عدلي بالانتقال للمنطقة الصناعية حين الطلب منه ذلك من قبل اللجنة المركزية.

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Gaza(Abu Khadra complex) –Tel:2820273-Fax2866844 *** غزة/مجمع الدوائر الحكومية(أبو خضرة)–ت:٢٨٢٠٢٧٣/فاكس: ٢٨٦٦٨٤٤

Palestinian National Authority
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السلطة الوطنية الفلسطينية
وزارة
الحكم المحلي

ثالثاً: بالنسبة لمصانع الباطون (في المناطق الزراعية والزراعية المساعدة) :-

١. المساحة يجب أن لا تقل عن ٣٠٠٠م٢ وواجهة المشروع عن ٣٠م.
٢. الشارع الواقع عليه المشروع يجب أن لا يقل عن ٢٠م ويجب أن يكون مفتوح على الطبيعة بنفس العرض.
٣. إذا كان المشروع يقع على الطريق رقم ٤ فيمتنع وجود إنشاءات بعمق ٢٠م عن الشارع ما عدا المباني الإدارية.
٤. ارتفاع السور يجب أن لا يقل عن ٩م (٤م بلوك + ٥م صفيح).
٥. لا يقل البعد بين حد المشروع والمباني السكنية وحدود المناطق ذات الاستعمال المغاير عن ٥٠م كحد أدنى من جميع الجهات.
٦. زراعة أشجار عالية داخل حدود المشروع + وضع رشاشات مياه + أغطية أماكن تخزين المواد الخام.
٧. موافقة جميع الجهات المعنية قبل منحه الرخصة.
٨. الالتزام بممارسة جميع الأعمال داخل حدود المشروع في كافة مراحل العمل.
٩. في حالة وجود كسارة يجب الالتزام بالاشتراطات الواردة في نظام الكسارات المعتمد والمنشور في الوقائع الفلسطينية.
١٠. أن يحضر المستدعي تعهد عدلي بالانتقال للمنطقة الصناعية حين الطلب منه ذلك من قبل اللجنة المركزية.

م. سفيان أبو سمرة
رئيس اللجنة المركزية للأبنية وتنظيم المدن
بمحافظات غزة

❖ صورة / للملف بالإدارة العامة للجنة المركزية.

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