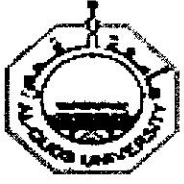


جامعة القدس



كلية الصحة العامة

School of Public Health

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Deanship of Graduate Studies  
Al- Quds University

**The Effect of Waste Water Treatment Plant  
Effluent (chemical quality) on Underground  
Water in Gaza City**

By  
**Sami H. Lubbad**

Master Thesis  
Al-Quds Palestine

May . 2005

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Effluent (chemical quality) on Underground  
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**By**  
**Sami Hussein Lubbad**  
**BSc. Of Agriculture- Alexandria- Egypt**

**A Thesis**

Submitted in partial fulfillment of the Requirement for  
the Degree of Master of Public Health- Public Health  
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**Supervisor**  
**Dr. Yousef Abu Safieh, PhD**  
**Chairman of Palestinian Environment Quality Authority**

May. 2005

MPH/ Public Health  
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# The Effect of Wastewater Treatment Plant Effluent (Chemical Quality) on Underground water in Gaza City

By

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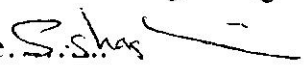
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Al- Quds University  
2005

## **Declaration**

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

**Signed by/  
Sami Hussein Lubbad**

**Date: May 2005**

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## ملخص الدراسة

يهدف هذا البحث لدراسة تأثير أحواض حقن مياه الصرف الصحي المعالجة علي تلوث الخزان الجوفي في المنطقة المحيطة حول محطة معالجة مياه الصرف الصحي الخاصة بمدينة غزة في حي الشيخ عجلين. من خلال رصد التغيرات في تراكيز بعض المركبات الكيميائية (النترات- النيتريت- المنظفات الصناعية) في مياه بعض الآبار الجوفية المحيطة بالمنطقة ولمدة ستة أشهر تقع في فصلي الربيع والصيف وملاحظة الفروقات هذه دراسة وصفية تحليلية اعتمدت التحليل الإحصائي الوصفي إضافة إلى ربط العلاقات ما بين المتغيرات المختلفة للدراسة

تم جمع البيانات من خلال تحليل كيميائي للمركبات في مختبر الصحة العامة التابع لوزارة الصحة سابقة الذكر وتم ربط العلاقة ما بين تراكيز المركبات الثلاثة في كل بئر وبعد كل بئر عن أحواض الحقن حيث أظهرت الدراسة علاقة عكسية قوية ما بين المسافة وكل عنصر من العناصر كما وأظهرت الدراسة علاقة عكسية قوية ما بين عمق البئر وتركيزات المركبات الثلاثة في جميع آبار الدراسة ما عدا بئرا واحدة وهو بئر المسلخ التابع لبلدية غزة ويعزى ذلك لوقوع البئر قريبا جدا من مذبج الحيوانات إضافة لقربه من أحواض الترشيح

أظهرت الدراسة فروقات واضحة في التفاوت في تركيزات المركبات الثلاثة والاختلافات الفصلية (الربيع والصيف) بشكل تصاعدي لعنصر المنظفات الصناعية حيث كانت في الشتاء أقل منها في الصيف. وتنازلية بالنسبة لمركبي النترات و النيتريت حيث كانت في فصل الشتاء أعلى من نظيرتها في الصيف

تم مقارنة نتائج الدراسة مع نتائج بعض السنوات (2000-2001) حيث اتضح وجود زيادة متنامية من عام لآخر في تراكيز العناصر الثلاثة وبصورة خاصة المنظفات الصناعية حيث بلغت الزيادة في بعض الآبار إلى أكثر من الضعف وهذا مؤشر واضح علي حدوث التلوث بمياه المجاري المعالجة حيث أثبتت التحاليل تضاعف تركيز المنظفات الصناعية في المياه المعالجة المحقونة للخزان إلى ضعفين ومما يؤكد حدوث التلوث هو أن المصدر الوحيد للمنظفات الصناعية في الخزان الجوفي هو مياه الصرف الصحي.

وعليه فإن عملية حقن الخزان الجوفي بمياه الصرف الصحي المعالجة هو مصدر تلوث مباشر للخزان الجوفي مؤكدا بينما تعتبر عملية الحقن أحد مصادر التلوث بالنترات و النيتريت .

لذا من الواجب اتخاذ التدابير اللازمة للحد من عملية التلوث والتنبه علي السكان القاطنين في المنطقة بعدم استخدام مياه الآبار في المنطقة المحيطة (بدائرة قطرها 800 مترا) في الشرب واستخدامها فقط في الزراعة والصناعة والاستخدامات المنزلية مع الأخذ بعين الاعتبار توفير مصدر بديل لمياه الشرب.

يتوجب أيضا خفض كمية المياه المعالجة المحقونة من خمسة عشر ألف مترا مكعبا يوميا الي خمسة آلاف مترا مكعبا يوميا وذلك للحد من التلوث المتصاعد سنويا.

## Abstract

An analytical, descriptive study was carried in Gaza Strip- Palestine in 2004, to determine the “effect of waste water treatment plant effluent on ground water (chemical quality) in Gaza City” through analyzing three chemical parameters( Nitrite, Nitrate and Detergent) used as indicators for pollution in the surrounding wells of the infiltration basins for a six month period .

A statistical analyses to check the correlation between different variables ( Nitrate, Nitrite and Detergents)of the study were obtained from the analysis of water samples to six wells for the three previous parameters .The analysis were done at the Public health laboratory-MOH.

The study findings indicate that: there was a strong inversely relationship between distance of wells from the infiltration basins and the concentration of the study chemical parameters.

There was a strong relation between the depth of wells from groundwater level and the chemical parameters except well No. R-270 El Maslakh well.

Seasonal variations noticed from the study results for the chemical parameters through wet season and dry season, where high concentrations of Nitrite and Nitrate noticed in the wet season and low concentrations noticed in the dray season, except detergents where high concentration noticed in the dry season than wet season.

From the comparison of the study results, with the previous data of the three parameters in the years 2000 and 2001, a trend of increasing the concentration of the chemical parameters in all wells was noticed. Effluent analysis indicates that the quality of effluent deteriorated from 2000 to 2004 rapidly, specially detergents which increased two folds, and in most of the groundwater wells detergents increased three folds at the same period. The study findings confirm that the infiltration basins are point source pollution in the surrounding area.

Faunally we recommend that:

Remedial actions must be taken to stop the deterioration of the groundwater quality in the area. Quality of rechargeable treated wastewater must be improved especially detergent removal. Potable water for drinking must be provided to the people in the area instead of the agricultural wells, and groundwater in the area must be used for agricultural, industrial and domestic uses, and not for human consumption.

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## **List of abbreviations**

<b>A.R</b>	Analytical Reagent
<b>EPA</b>	Environmental Protection Agency
<b>DW</b>	Distilled Water
<b>GWWTP</b>	Gaza Waste Water Treatment Plant
<b>ISO</b>	International Standards Organization
<b>LAS</b>	Linear Alkyl Benzene Sulfonate
<b>PEPA</b>	Palestinian Environmental Protection Authority
<b>PHG</b>	Palestinian Hydrological Group
<b>PHL</b>	Public Health Laboratory
<b>PPm</b>	Part Per Million
<b>PNA</b>	Palestinian National Authority
<b>PWA</b>	Palestinian Water Authority
<b>MB</b>	Methylein Blue
<b>MBAS</b>	Methylein Blue Active Substances
<b>MOH</b>	Ministry of Health
<b>MOA</b>	Ministry of Agriculture
<b>USGS</b>	United State Geological Survey
<b>WHO</b>	World Health Organization
<b>WPAP</b>	Water Resources Action Program
<b>WWTP</b>	Waste Water Treatment Plant
<b>PCBS</b>	Palestinian center/ Bureau of statistics

# Chapter 1

## Introduction

### 1.1 Background

The main source of water in Gaza strip is groundwater, so we must do our best to prevent contamination in the aquifer. High population density and over pumping from the wells will lead to decline in the water level and water quantity. So the groundwater vulnerable to contamination and deterioration in the water quality due to the human activities like agricultural activities, human wastes and disposal. Its difficult to stop water deterioration and for reclamation we must spend sums of money

### 1.2 Geography

Gaza Strip is a narrow coastal area of 365 Km<sup>2</sup> , it is 46 Kilometer long and 5-12 Km wide, the altitude is 0-40 meters above sea level, with a subtropical climate., It is flat and sandy with little fertile soil, the average rainfall 350 mm per year.( MOA, Report. 2002).

Gaza Strip is surrounded by the Palestinian lands occupied since 1948 from the north and east, the Mediterranean Sea from the west, with a coastline of 46 Km, and Egypt from the south. Gaza Strip is divided into five governorates, with several municipalities each.