# ENVIRONMENTAL EFFECTS OF DRILLING ONSHORE OIL AND GAS WELLS AND STUDYING THE SITE RESTORATION

**By**
**Khaled Gamal Mohamed Abdel Razek**
**B.SC. Science (Chemistry), Ain Shams University, 1994**
**Master in Environmental Sci., Ain Shams University, 2003**

**A Thesis Submitted in Partial Fulfillment**
**of**
**The Requirement for the Doctor of Philosophy**
**In**
**Environmental Science**

**Department of Basic Environmental Science**
**Institute of Environmental Studies & Research**
**Ain Shams University**

***2013***

**APPROVAL SHEET**

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# ABSTRACT

The environmental effects of wastes (drilling muds & cuttings) generated from the drilling of onshore oil wells in southern western desert, were studied through analyses of different salts, total hydrocarbons and heavy metals. The aim was to determine their possible impacts on their environments due to disposal of these wastes.

These drilled wastes generated from the drilling of onshore wells indicated the presence of considerable amounts of salts and relatively low concentrations of leached petroleum hydrocarbons and heavy metals. The highest concentration of chlorides and sulphates were recorded in the cutting samples which reached 31.5 and 4.2 mg/g respectively..

Total and leachable hydrocarbon concentrations (after 5 and 10 days) , were determined indicating that the highest value were 21.9 µg/g and (5.88 and 31.19µg/l), respectively. Contrarily, the lowest values were 8.6 µg/g and (0.91 and 1.30µg/l), respectively.

Seven heavy metal compounds: Ni, Ba, Cd, Cr, Pb, Ag and Zn were detected in five samples of drilling cutting wastes were collected from five active exploratory wells. Barium, Chromium, Zinc and Nickel were the abundant metals, while Cadmium was the least metal in the investigated cutting sediments of the different sites. Barium was detected in all leachable heavy metals with base water after 5 and 10 days with a concentration range from 2.6 to 7.8µg/g. Silver (Ag) values were below the detectable levels except at only one station. Values of the other metals varied significantly from one station to another.

The solid wastes (drilling muds & cuttings) if properly managed can serve as raw materials for cement producing plants, bricks and expanded clay producing plants and can also be used in land restoration projects. Disposal of cuttings and drilling wastes into the onshore environment should be totally discouraged and litigated.

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|---|---|
| APHA | American Public Health Association |
| API | American Petroleum Institute |
| ASTM | American Society for Testing and Materials |
| E&P | Exploration and Production |
| EC | Electrical Conductivity |
| EGPC | Egyptian General Petroleum Corporation |
| EIA | Energy Information Adminstration |
| EPI | Environmental Performance Indicators |
| EPA | Environmental Protection Agency |
| EPI | Environmental Performance Indicators |
| GOS | Gulf of Suez |
| IWMP | Integrated Waste Management Plan |
| OBM | Oil Base Mud |
| Offshore | Marine Activities |
| OGP | Oil & Gas Producers |
| Onshore | Activities on Land |
| PAHs | Polycyclic Aromatic Hydrocarbons |
| PCA | Principal Correspondence Analysis |
| RCRA | Resource Conservation and Recovery Act |

| | |
|---|---|
| S/S | Solidification/Stabilization |
| SAR | Sodium Adsorption Ratio |
| SPIGEC | Saskatchewan Petroleum Industry Government Environment Committee |
| TDU | Thermal Desorption Units |
| TFM | Total Fluid Management |
| TPH | Total Petroleum Hydrocarbon |
| USEPA | United States Environmental Protection Agency |
| USCOTA | U.S. Congress Office of Technology Assessment |
| W.D. | Western Desert |
| WBM | Water Base Mud |
| CPCB | Central Pollution Control Board |