

Geography

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FACING SOIL AND GROUND WATER POLLUTION IN SOUTH TEHRAN

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In the article an environmental pollution of South Tehran (Rey Industrial area) was studied. The oil pollution of facing soil and ground water in Ray area was actualized since early 1970's. The aim of the study was to carry out a method to solve this problem.

It is shown the polluting material is the light oil and is measured the annual movement of polluting oil about 2.6 m per year.

In circumstances like these an urgent measures regarding to the related polluted region and pollution source, as well as detailed and preliminary investigations are recommended.

Keywords: South Tehran, Rey Industrial area, oil pollution, facing soil, ground water.

Introduction. Tehran Regional Water Board (TRWB) began a programmed effort aimed at assessing the likely magnitude and extent of biological and chemical contamination of Tehran and adjacent area ground water. The collected in 1987–1991 data in Tehran allow the TRWB to study the ground water planes and to define two regions that were called highly contaminated and low contaminated areas. The comparison of pollutant concentration for 1990–1992 has showed that the highly contaminated areas are spreading from central area to the other part of the aquifer. Another problem, beside pollution was determined, the essential quantities of water transmitted from Karaj, Lar and Latian dams, cause the rise of ground water plane [1, 2].

The oil pollution of soil and ground water of Rey Industrial area (RIA) was actualized since 1970, and in early 1980's already the local population can feel its influence. And although Iranian government has devised several countermeasures, however, considerable results were not seen, and the effect of pollution was increasing year by year. Then, due to the expansion of this pollution, a serious fear was raised as a result. Therefore, another investigation was started on the ground water pollution in the same area in 1997. However, this attempt was also halted afterwards [2–4].

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However, the spread of the pollution had been started earlier than the expectations, and despite of these activities there was no effective method due to the shortage of machinery or similar problems. Consequently, the ground water pollution in the RIA has been expanding every year, and the population of the area under suffering from a serious health hazard was compelled to live, particularly in recent years. On the other hand, Tehran Oil Refining Company (TORC), which is located in the core of RIA, had conducted some measures in this regard, as much as possible, such as collection of the ground water samples at the Qanat and water wells inside its site, monitoring of the fluctuation of ground water level, pumping out of the ground water etc.

Total plan of the works was divided to 2 phases.

Phase 1. Consists the pollution measurements in TORC, where general condition survey has been already implemented in that, and pollution general condition survey in wide Rey area.

Phase 2. Consists the pollution measurements in the wide Rey area.

Here the immediately practicable chosen pollution measures includes direct pump up of oil and oil containing water, which is accumulated in the ground.

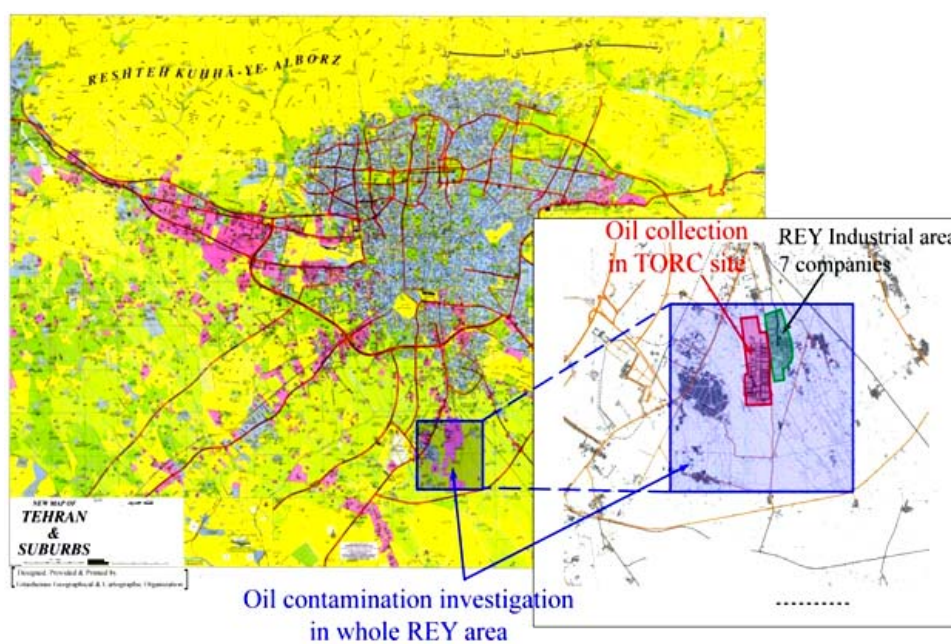


Fig. 1. Overall view of works' target area.

Materials and Methods. The works are separated into two Phases. Phase 1 will be implemented in this work and it is mainly separated into two items:

1. Pollution measures in TORC site.
2. Oil pollution survey in the whole Rey area (a $6 \times 6 \text{ km}^2$ area including RIA).

Besides, the consultant's scope of work for each item is as follows:

1. In TORC site: Basic plan and management of designing for pollution measures (collection and treatment of polluting oil and oil containing water).

2. In whole Rey area: oil pollution survey, ground survey, general condition survey, analysis of results and basic plan for pollution measures.

Overall view of related area of each work subject is shown in Fig. 1. Detailed map of the location is indicated in Fig. 2.

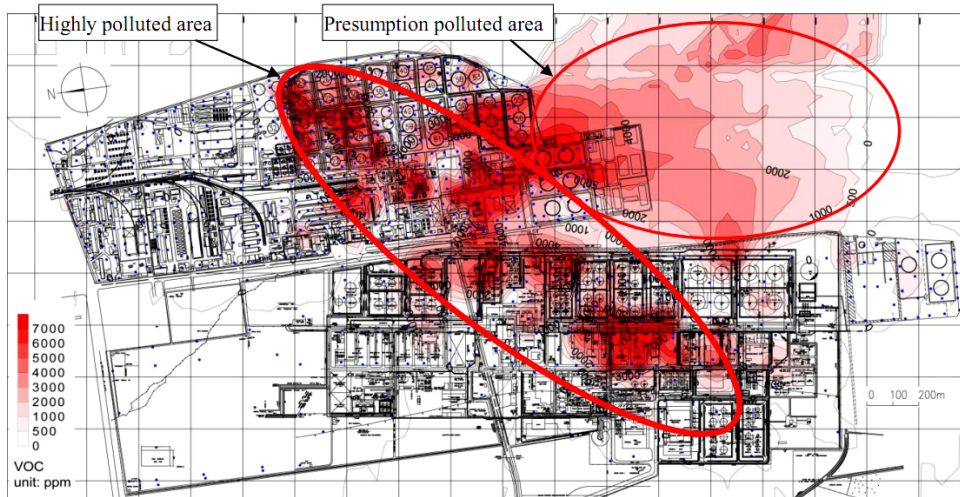


Fig. 2. Volatile Organic Compounds (VOC) gas density distribution in 4 m in TORC and the 7 companies in REY Industrial area.

In the target area of oil pollution investigation in the whole Rey area (a $6 \times 6 \text{ km}^2$ area including RIA).

Estimation of present condition of oil pollution. In the brief survey in TORC and the 7 companies in Rey area, measurement of VOC gas density, soil oil content analysis, oil layer thickness measurement in wells, component analysis of polluting oil etc. were conducted with the main aim to check polluting oil existence. In addition, methods for estimation of pollution source, pollution range, polluting material etc., in the implementation of the brief survey were used [2, 5].

Outline of present condition of pollution. Distribution of VOC gas density in the vicinity of Rey area was obtained based on VOC gas density measurement in



Fig. 3. Oil layer thickness in TORC and the 7 companies in RIA.

4 m in TORC, the 7 companies in Rey area and Pump station. This result is shown in Fig. 2. Measured points are shown with (●) sign in Fig. 2. In the southern part inside TORC and the 7 companies in Rey area a region with high VOC gas density that continues toward south west was confirmed. In addition,

presence of a region with high VOC gas density in South of the 7 companies of

Rey area was estimated. Since there are some villages in this region, an urgent work for estimation of pollution situation is required.

Fig. 3 indicates oil layer thickness in the holes of Monitoring Wells and Core Borings. Measured Monitoring Well and Core Boring is shown with (●) sign. Oil layer thickness was high in the southern side of TORC and the 7 companies in Rey area. Therefore, an overall condition survey is required in this region.

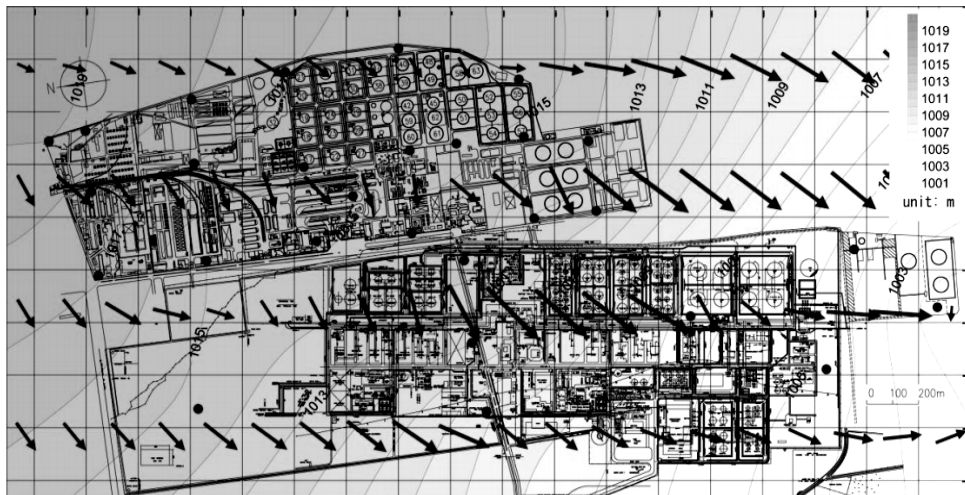


Fig. 4. Ground water flow direction in TORC and the 7 companies in Rey Industrial area.

In TORC and the 7 companies in Rey area, water level in the holes of Monitoring Wells and Core Borings was measured. These measurement results were used for estimation of distribution of ground water level and ground water flow direction in TORC and the 7 companies in Rey area, as shown in Fig. 4.

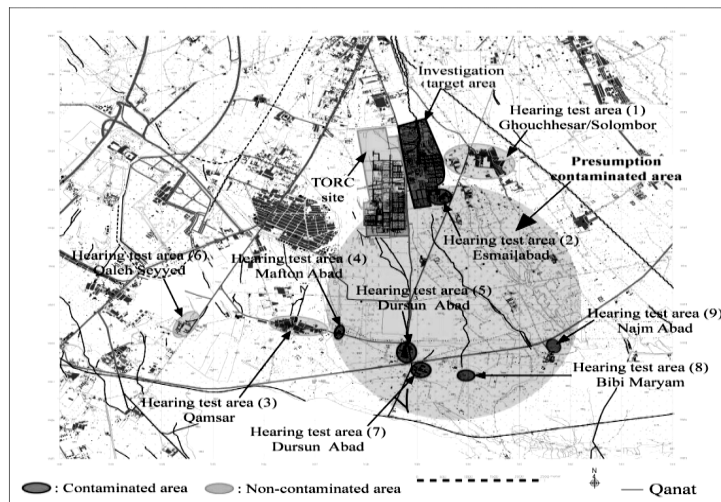


Fig. 5. Pollution range, estimated in the surroundings of RIA.

Monitoring Wells and Core Borings that water level was measured in them are shown with (●) sign (Fig. 4). Ground water flow direction was estimated to be towards southwest.

Based on the hearing survey carried out in the surroundings of Rey area, pollution expansion was estimated, as shown in Fig. 5.

From the results of in-site permeability test in TORC area and the 7 companies in Rey area it was estimated that with the small permeability coefficient that the ground has and according to the annual movement distance, polluting oil can not flow to the wide area.

However, as shown in Fig. 5, oil pollution has spread 5 km down stream of TORC. Therefore, presumably, spread of pollution to the wide region is caused by Qanat.

Results. Followings the results of the overall condition survey carried out till now are given:

A. Results of overall condition survey in TORC.

1. About geological and geotechnical property: there is a uniform ground of cohesive soil in TORC site.

2. About polluting material: with a high possibility the polluting oil is light oil.

3. About pollution range: pollution is spread in the southern part of TORC, especially in a region with a high VOC gas density over 7.500 ppm. There is a region inside TORC area with a high oil layer thickness.

4. About pollution source: with a high possibility, leakage from several points of pipelines and buried pipes is pollution source.

5. About movement of polluting material: there is a high possibility that ground water flow is toward southwest. The permeability coefficient is $k = 2.14 \cdot 10^{-4} \text{ cm/s}$. Annual movement of the polluting oil is about 0.85 m per year.

B. Results of overall condition survey in the 7 companies in Rey area and Pump station.

1. About geological and geotechnical property: there is a uniform ground of cohesive soil in Rey area.

2. About polluting material: with a high possibility the polluting oil is light oil. The quality of water in the 7 companies in Rey area and Pump station is obviously they bad for drinking and is not good regarding environmental protection point of view. Though with different degree of pollution existence of pollution by oil was confirmed.

3. About pollution range: in the south region of the 7 companies in Rey area and Pump station, a region with high concentration and wide extent of pollution was confirmed. The maximum depth of pollution in this region was about G.L. -30 m. Pollution has extended up to about 5 km in the downstream of Rey area.

4. About pollution source: drain pits in Distribution Product Oil Company are clearly pollution sources.

5. About movement of polluting material: ground water flow is toward southwest. The permeability coefficient is $k = 8.07 \cdot 10^{-4} \text{ cm/s}$. Annual movement of the polluting oil is about 2.6 m per year.

In circumstances like this, an urgent measures regarding to the related polluted region and pollution source as well as detailed investigation and preliminary investigation is recommended.

Discussion and Conclusion. Ground water is the main source of water in arid in arid and semi-arid regions. Therefore, pollution of ground water is a major issue, because aquifers and the contained ground water are inherently susceptible to contamination from land use and anthropogenic impact [6, 7]. In recognition of the need for effective and efficient methods for protecting ground water resources from future contamination, scientists and resource managers have sought to develop aquifer vulnerability assessment techniques for predicating, which areas are more likely than others to become contaminated as a result of activities at or near the land surface.

It is obvious that it was tried to control the pollution of wastewaters with pollutant. For this purpose, it is essential to recognize and study the polluted sources. However, if the trend of using wastewater and other interfere objects at the southern part of Tehran will continue, because of the health problems and reduce the risk of ground water pollution with pollutants, there is have to be more careful.

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ԱՄԻՐ ՀՈՍԵՅՆ ՖԱՀՐԱԳԻԱՆ

ՀԱՐԱՎԱՅԻՆ ԹԵՀՐԱՆԻ ՀՈՂԻ ՄԱԿԵՐԵՎՈՒԹԱՅԻՆ ԵՎ ՍՏՈՐԳԵՏՆՅԱ ՋՐԵՐԻ ԱՂՏՈՏՈՒՄԸ

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Աշխատանքում իրականացված է հարավային Թեհրանի արդյունաբերական գոտում հողի վերին շերտի և ստորերկրյա ջրերի աղտոտման ուսումնասիրությունը, և առաջին հերթին շրջակա միջավայրի վրա վերջինիս ունեցած ազդեցությունը: Հիմնախնդիրն առաջացել է անցյալ դարի 70-ականների սկզբից:

Վերլուծության միջոցով պարզվել է, որ աղտոտող նաֆթի շերտի տարեկան տեղաշարժը կազմում է շուրջ 2,6 մ: Այս պայմաններում խորհուրդ է տրվում անհապաղ միջոցներ ձեռնարկել և մանրամասն հետազոտություն իրականացնել աղտոտված շրջանի և աղտոտման աղբյուրի վերաբերյալ:

АМИР ХОССЕЙН ФАХРАДЯН

ПРОБЛЕМА ЗАГРЯЗНЕНИЯ ПОЧВ И ПОДЗЕМНЫХ ВОД
ЮЖНОЙ ЧАСТИ ТЕГЕРАНА

Резюме

В работе проведено исследование загрязнения нефтью почв и подземных вод южной части Тегерана с целью создания модели для разрешения этой проблемы и, прежде всего, снижения влияния на окружающую среду. Проблема стала актуальной с начала 70-х годов прошлого века.

По проанализированным данным, скорость распространения загрязняющей нефти составляет около 2,6 м в год. В подобных обстоятельствах рекомендованы детальные исследования и срочные меры в отношении источника загрязнения и загрязненного региона в целом.