ENGLISH SUMMARY

Summary

Since the construction of the Aswan High Dam, the quality of the Nile River water in Egypt has become primarily dependent on the water quality and ecosystem characteristics of the reservoir (Lake Nasser), and less dependent on the water quality of the upper reaches of the Nile. Water released from Lake Nasser generally exhibits the same seasonal variation and the same overall characteristics from one year to another.

Downstream changes in the Nile River water quality are primarily due to : (a) different hydrodynamic regimes regulated by the Nile barrages, (b) agricultural return flows and (c) domestic and industrial waste discharges, in addition to oil and wastes discharged from passengers and river boats. These changes are more pronounced as the river flows through the density populated urban and industrial centers of Cairo and the Delta region.

The main objective of this study was to assess the impact of organic wastewater discharge on the water quality of the Nile River .The investigation was limited to the Nile River basin from Aswan to El-Kanater, the length of which is 953 Km. The basin was divided into four reaches. The first reach extends from the outlet of the Aswan Dam (zero Km) to 167 Km, the second from 167 Km to 359 Km, the third from 359 Km to 544 Km and the fourth from 544 Km to 953 Km.

The results of the surveys, which have been carried out during the period from 1991 to 1999, indicated the presence of 32 industries and 73 drains. Physico-chemical characteristics of some parameters, which represent the impact of pollution with organic compounds on the water quality, were selected. These parameters were DO, BOD, COD surfactant, ammonia and oil & grease.The loads of pollution contributed by point sources were calculated.

The present study showed that hydrological conditions in the Nile River from Aswan to El-Kanater El-Khiria, have varied significantly during the past decade. Monthly Discharge during the eleven trips which have been carried out during the

period from 1991 to 1999 showed that the discharge varied from a minimum value of 68.4 MM^3/day during December-1996 to a maximum value of 250 MM^3/day during June 1998. Peak flow occurred during Jul-91, Aug-93 and Jun-98 period, as a result of summer runoff condition to the Nile River. Annual average discharges varied from a maximum value of 184 MM^3/day in 1999 to a minimum value of 147 MM^3/day in 1991, Annual mean discharge, showed a steady increase during the period from 1991 to 1999.These hydrological conditions affected the water quality of the Nile River water.

In 1998, available data indicated that DO concentrations and BOD values of the Nile water from Aswan to El-Kanater El-Khiria are within the permissible limits set by law 48/1982 (DO not less than 5 mg/l and BOD not more than 6 mg/l).

On the other hand, COD values started to increase at Km 472, a situation, which needs special attention. This could be attributed to the presence of organic compounds, which are not easily biodegradable.

In an attempt to quantify the pollution loads contributed by agricultural and industrial activities in each reach, a comparison between the wastewater discharged from both sources and their pollution loads, expressed in terms of COD and BOD was carried out. The results showed that 59% of the industrial wastewater discharged into the Nile from Aswan to El-Kanater El-Khiria is discharged into reach four. This is followed by reach one, which receives 26.4% of the total industrial discharge. This value represent 70.5% of the total wastewater discharged into reach one. However, it contributes 96.4% of the BOD load received by this reach. The rest (3.6%) is from agricultural drainage water. Corresponding value for COD load are 98.8% from industrial sources and 1.2% from agricultural drainage water. In reach two, the amount of wastewater received from both sources is almost equal (52.2% agricultural and 47.8% industrial). However, the BOD loads contributed by industrial wastewater (70.9%) is almost double that contributed from drainage water (29%). In reach three, the ratio of industrial : drainage water discharges was 2: 1, but the BOD load ratio was 6.75 industrial: 1 drainage water. The COD load followed the same pattern.

In 1999, available data indicated that DO concentrations ranged from 6.79 mg/l at Km 114.5 to 9.9 mg/l at Km 716.6.This is an indication of the high self purification capacity of the Nile along this distance.

The BOD values of the ambient Nile River water ranged from 0.8 to 4.5 mgO_2/l indicates the presence of a correlation between input of BOD load from point sources and the changes in ambient water quality. However, the BOD values are within the permissible limits set by law 48/1982.

The COD values ranged from 2 mgO_2/l at Km 299.2 and Km 361 to 25 mgO_2/l at K 646. Available data indicated that the fluctuation in COD values was relatively high. This is attributed to the high loads discharged from point sources. But at the same time the assimilation capacity is high, consequently the water quality improves very quickly.

Assessment of the available data shows a gradual increase in TSS concentration of the Nile River from Aswan towards the north at the Delta barrage. The highest value was found at Km 748 and Km 945.8.Physico-Chemical analysis of point sources showed that the highest suspended solids are discharged from Edfu paper and Sugar factories.

In general, surfactant concentrations were relatively low. The highest concentration was 0.044 mg/l at Km 716. This is due to the fact that surfactant concentrations in point sources are low.

Oil and grease concentrations of the ambient Nile River water from Aswan to the Delta barrage fluctuated up and down depending on the input from point sources and navigation.
In general, the concentrations of oil and grease of ambient water exceeded the limit set by law 48/1982(0.1mg/l).

In general, the NH_3 concentrations were found to be lower than the standard value given by law No. 48 for 1982 (0.5 mg/l).

With regard to point sources, the highest input was found in Khour El-Sail drain where the concentration of ammonia reached 96 mg/l. The next highest source was El-Hawamdia Sugar factory where the ammonia concentration was 2.5 mg/l.

To assess the present status of water quality in the river from Aswan to El-Kanater then forecast future trends,the results of eleven monitoring campaigns (from July 1991 to February 1999) for some organic parameters: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total Suspended Solid (TSS), Surfactant, Oil & grease and Ammonia (NH_3) were used. The data cover 30 sampling sites from Aswan to Delta barrage. From the available data, the following have been concluded:

Dissolved Oxygen (DO): concentrations below the limit of 5 mg/l in the first 100 Km close to Aswan Dam has been observed for some surveys. This may be due to the depth from which the water is released from Lake Nasser. In general, the oxygen situation of the Nile is not alarming. Specific "hot spots" could not be detected.

Biochemical Oxygen Demand (BOD) values: from the available data it can be concluded that the exception of some outliers during December 92 and October 95 surveys, BOD values are within the permissible limit of 6 mg/l. This is an indication of the high assimilation capacity of the Nile River within this reach. A situation that could be attributed to the high dilution factor.

Chemical Oxygen Demand (COD) values: show slight, but steady increase from South to North. This situation after 628 Km needs special attention.

Total Suspended Solids (TSS): from the available data it can be concluded that, the highest values of TSS may be attributed not only to the presence of point sources but also to the erosion and hydrodynamic regimes.

Surfactants: available data indicated no spatial correlation with sources of pollution. All values not exceeded the permissible limit of 0.5 mg/l. A situation could be attributed to the high dilution factor.

Oil and Grease: Available data indicated no spatial correlation with sources of pollution. All values exceeded the permissible limit of 0.1 mg/l.

Ammonia (NH_3): from the available data it can be concluded that, almost NH_3 concentration are within the permissible limit of 0.5 mg/l. This is an indication of the high assimilation capacity of the Nile River.

It is worth mentioning however, that it has been recently announced by the Minister of State for Environmental Affairs, that the problems for the Prevention of Industrial Pollution to the Nile has been successfully accomplished. The impact of the implementation of this program on the water quality of the river is not yet known.

The most important is that the Nile River maintained its self-purification capacity. To what extent the Nile sediment is contaminated with heavy metals and organic compounds is not known.