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The Impact of the Urban Wastewater Treatment Directive on Wastewater Management Strategy and Current Legislation in Turkey's Special Environmental Protection Areas

Wastewater Management in SEPA's

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***Abstract*— The purpose of the Urban Wastewater Treatment Directive (UWWTD) 91/271/EEC is to protect the environment from the adverse effects of wastewater discharges and to ensure that all significant discharges are treated before being released to receiving waters. It lays down uniform emission standards, or percentage reductions in pollutant concentrations, for discharges from urban wastewater treatment work serving a population equivalent of 2 000 or more. As regards treatment of urban wastewaters, secondary treatment is the general rule, with additional nutrient removal (tertiary treatment) required for sensitive areas. The UWWTD also sets out deadlines for treatment requirements based on the size and location of the agglomerations and the characteristics of the receiving waters.**

This paper outlines the wastewater management strategy implemented in the Turkey's Special Environmental Protection Areas (SEPAs) and gives key requirements of the UWWTD. On the other hand, it outlines the adaptation of the Turkish Water Pollution Control Regulation (TWPCR) to UWWTD and gives comments on the improvement of the TWPCR.

The basic aim of this study was to examine the national wastewater management strategy implemented in SEPAs and to compare the requirements of the UWWTD with current TWPCR. This study showed that although the TWPCR shares the objectives of the UWWTD and includes corresponding requirements of treatment of wastewater, it is less detailed; plenty of issues mentioned in the UWWTD are missing in the TWPCR.

Keywords— Urban Wastewater Directive; Turkish Water Pollution Control Regulation; SEPAs; Wastewater Management.

I. INTRODUCTION

The gradual but irreversible deterioration of coastal waters around the world calls upon us to take up the challenge of managing water pollution. It is no longer enough to simply evacuate wastewater from our cities; effective wastewater management has become essential. It is complex and expensive task, but, if we do not begin to manage our sewage environmentally sustainable manner, we stand to lose our habitat and livable environment in the future.

For a long time, low population densities and the prevailing rural economy kept pollution localized, preventing it from spilling over into the wider environment. With modest consumption levels and no drains to concentrate sewage and take it away, rivers and coastal zones remained comparatively free of human-caused pollution. In addition, the absorption capacity of the natural environment was adequate to deal with these modest pollution loads. The pollution load discharged into the environment has increased concurrently, and in many places, nature can no longer deal with these pressures; the very basis of a number of economic activities is threatened.

Turkey has gone through great evolution over the last twenty years in creating mechanisms to tackle its environmental problems. An environmental act was accepted in 1983, the Ministry of Environment was established in 1991 and public awareness and demand for a clean environment is now growing. The environmental act represents the polluter pays principle and describes activities to avoid and solve environmental problems involving identification of zones to be declared as Special Environmental Protection Areas (SEPAs).

SEPAs have been established in line with national legislation, international nature conservation conventions and have an international ecological importance because of their historical, natural and cultural values. These areas have been declared pursuant to article 9 of the Turkish Law of Environment and the addendum protocol to the Barcelona Convention (protocol concerning protected areas in the Mediterranean) to ensure sustainable

conservation and use for future generations. Seventeen SEPAs were declared by decree of the Turkish Cabinet of Ministers. SEPAs are also protected by a large number of other existing nature conservation designations like the RAMSAR Convention, the Washington Convention CITES, the Bern Convention and the Barcelona Convention.

The Environmental Protection Agency for Special Areas (EPASA) is a part of the Ministry of Environment & Urbanization and is responsible for the management, planning and protection of these seventeen SEPAs. The basic rational for the existence of the EPASA is the Ministerial Decree No: 383 accepted in 1989. With this decree the Authority was first joined to the Prime Ministry; but later in 1991 it was attached to the Ministry of Environment than to The Ministry of Forest in 2003; Finally EPASA was attached to the Ministry of Environment & Urbanization in 2011.

The Agency is in charge of obtaining an establishment of long-term balance between ecological values and development. From this point, determination of wastewater management strategies in the SEPAs and implementation of the necessary infrastructure are the main tasks of the EPASA.

The 2004 Turkish Water Pollution Control Directive (TWPCR) sets out principles for classifying ground and surface water quality in three and four classes, respectively. This regulation aims at both conserving the quality of water resources in ecosystems and protecting and improving water quality to meet national requirements. It prescribes protection zones and land use strategies in regard to reservoirs and lakes used for drinking water. Principles for discharging effluent to ground and surface waters, and for treating wastewater, are also considered in the TWPCR.

The UWWTD sets specific emission limit values to be reached by the treatment plants and this involves the correct and adequate management of those plants. This directive will clearly help the implementation of these management systems in order to get to the correct management and exploitation of these plants. The directive thus will prompt organizational innovation, besides the building and use of urban wastewater treatment works. According to the requirements set in the legislation and in order to reach them, the Turkish plants should have had primary and secondary treatments, and any kind of nutrient removal process. One of the clearest consequences of the implementation of the UWWTD in Turkey will be the significant increase in the number of urban wastewater treatment plants. This increase will improve both the quality of the continental waters and the quality of the coastal waters, since the implementation of the UWWTD will help to attain the objectives set by the bathing water directive.

Presently Turkey is so far behind the EU standards of wastewater management, general environmental protection policy and economic prosperity. The directive will help the formation and/or proper implementation of wastewater management strategy in Turkey. A key first step will be the production of a strategic plan to identify an affordable way forward. The EU standards will certainly require high investment in wastewater treatment plants and collection systems. Improving the standard of management and operation of some existing facilities at much lower cost may however offer considerable improvements in environmental performance. In the short term the best policy could be to use the resources available to upgrade the existing plants, to improve, renovate the existing collecting systems, outfalls and to adopt the existing treatment and collecting systems to the new volumes of water and pollution loads detected. In the long term, incorporation of secondary treatment into existing plants which only work with primary treatments in accordance with the requirements of the directive, incorporation of the complementary treatment systems required to reduce the amount of nutrients to urban wastewater plants situated in sensitive areas and incorporation of new systems to avoid or reduce the environmental impacts of these plants (visual impact, smell, noise etc.) could be planned due to the poor state of Turkey's economy.

This paper particularly focuses on SEPAs since developments in management strategy of the EPASA will be a perfect example for Turkey to begin to form its national wastewater management strategy. It outlines the wastewater management strategy implemented in the SEPAs and gives the key requirements of the UWWTD. Moreover, it compares the requirements of the UWWTD with current TWPCR and finds a number of deficiencies in the TWPCR that should be addressed.

II. Current Wastewater Management Practices and Concerns in the SEPAs and Wastewater Management Strategies of the EPASA

The aim of the wastewater management is meeting and continuing the desired wastewater quality targets that can be provided by effluent limit values. In Turkey, water quality and quantity protection is under the responsibility of several ministries and authorities such as Ministry of Environment and Urbanization, Ministry of Forestry and Water Affairs, Ministry of Tourism and Culture, Ministry of Food, Agriculture, and Livestock, Ministry of Health, İlbank, and Municipalities. This situation causes complex institutional arrangement for wastewater management by overlapping and competing responsibilities between different ministries and authorities. Different kind of institutions having same responsibilities for wastewater management and control collect lots of data but a coordinating institution that collects and shares this information with other related institutions does not exist.

Marine, coastal and wetland ecosystems have been particularly affected by industrial and agricultural pollution, domestic waste and agricultural desiccation in Turkey. However, these problems are mostly solved in SEPAs since planning for investment of sewerage and wastewater treatment is principal responsibility of the EPASA and industrial activities are forbidden in

SEPAs. The Authority has dealt with solution of wastewater collection, wastewater treatment and disposal problems in seventeen SEPAs since 1993 and nineteen wastewater treatment plants are under operation. The reason of this success is funding for environmental conservation activities ranging from planning and programming to implementation carries high priority in the budget of the EPASA.

Article 10 of the UWWTD states that, urban wastewater treatment plants should be designed, constructed, operated and maintained ensuring sufficient performance under all normal local climatic conditions. It is partly corresponded since EPASA is responsible for design and construction of sewerage and wastewater treatment plants in SEPAs. However, after the completion of the treatment plants Municipalities operate them. Unfortunately, wastewater treatment plants cannot be adequately operated and maintained due to lack of funding and technical staff of Municipalities. For these reasons, EPASA tried to strengthen the Municipalities by supplying necessary funds and realizing training courses for personnel operating the wastewater treatment plants within the borders of SEPAs.

The management seeks to improve the quality of the SEPA's environment and public health in the SEPA by providing modern, reliable, and cost-effective wastewater collection and treatment facilities. Complementary programs are being implemented to improve environmental monitoring and enforcement.

The main wastewater management strategies of EPASA are,

- construction of wastewater collection systems (passing of collection systems from sand dunes, areas rich in biodiversity, flora and fauna etc. is prohibited),
- construction of wastewater treatment plants (wastewater treatment plants in SEPAs should meet the emission limits of the UWWTD),
- monitoring the wastewater treatment plants effluents (monthly analysis of plant effluents is performed),
- realization of capacity building programs for staff operating treatment plants (training of treatment plant's personnel is carried out in every year),
- extension, improvement and renovation of the existing collecting systems,
- modification and improvement of obsolete installations,
- adaptation of the existing treatment and collecting systems to the new volumes of water and pollution loads detected,
- incorporation of secondary treatments into existing plants which only work with primary treatments in accordance with the requirements of the UWWTD,
- incorporation of the complementary treatment systems required to reduce the amount of nutrients to urban wastewater plants situated in SEPAs, and
- incorporation of new systems to avoid or reduce the environmental impacts of these plants (visual impact, smell, noise, etc.).

These strategies are also intended to meet the requirements of the Directive on Urban Wastewater Treatment. The Authority is aware of research on wastewater technologies and therefore on the innovation process should focus on three main lines;

- research on the biological processes and biological cycles of nutrients in order to improve the knowledge of those biological cycles and its potential application to the removal processes,
- development of technology able to reach the proposed goals, and
- implementation of the new technology developed on an real scale.

III. Meeting the Council Directive on Urban Wastewater Treatment Targets

A. The Council Directive on Urban Wastewater Treatment (UWWTD)

The EU Urban Wastewater Treatment Directive (91/271/EEC) focuses primarily on the removal of oxygen-depleting substances, phosphorus and nitrogen, which negatively impact surface water quality. In 2005, wastewater treatment plants must remove at least 75% of the concentrations of nitrogen and phosphorus from wastewater. Its aim is to decrease the pollution load originating from municipal sewage and biodegradable wastewater from certain industrial sectors into surface water bodies and the reduction of nitrogen and phosphorus load. The directive sets out a time-schedule for wastewater collection, treatment systems and required treatment level. All agglomerations greater than 2 000 p.e. (population equivalent) must have collection systems for urban wastewater by specified deadlines. Secondary treatment (biological) is compulsory for both sensitive and less sensitive areas however; tertiary treatment (nutrient removal) is required only for sensitive areas.

The objective of the Directive is to;

- protect the environment from the adverse effects of discharges of urban wastewater and of wastewater from industrial sectors of agro-food industry,
- provide prior regulation or specific authorization for all discharges of urban wastewater and industrial wastewater from the particular sectors mentioned in the Directive, as well as for all discharges of industrial wastewater into urban wastewater systems,
- provide urban wastewater collecting systems and treatment plants for all agglomerations above 2 000 population equivalents,
- ensure that by 31/12/2000 the industrial wastewater from the mentioned sectors shall before discharge respect the established conditions for all discharges from plants representing 4 000 population equivalent or more,
- provide before 31/12/1998 general rules or registration or authorization for the sustainable disposal of sludge arising from wastewater treatment and, by the same date, to phase out any dumping or discharge of sewage sludge into surface waters,

• ensure that the urban wastewater discharges and their effects are monitored, and
• publish situation reports every two years and establish implementation programs.

Under the directive, secondary treatment is normally required for all significant discharges that is for all those serving more than 10 000 p.e. into coastal waters and all those serving more than 2 000 p.e. into estuaries or inland waters. For discharges serving population equivalents below these thresholds, the requirement is for appropriate treatment, which will allow the receiving waters to meet the relevant quality standards. Sewage discharged from areas with p.e. above 10 000 into areas designated as sensitive will require more stringent treatment to limit the concentration of nutrients.

The sensitive areas must be designated according to one or more of the following criteria:

• water bodies which are found to be eutrophic or which in the near future may become eutrophic if protecting action is not taken,
• surface freshwaters intended for the abstraction of drinking waters and which could contain more than 50 mg/l of nitrates if action is not taken, and
• areas where further treatment is necessary to fulfill other Council Directives.

B. Deficiencies in Turkish Water Pollution Control Regulation (TWPCR)

The Turkish legislation prior to Directive 91/271/EEC did not focus especially on urban wastewater treatment but on industrial wastewater. The TWPCR does not consider or commend any kind of special technology; it even does not specify this at a primary, secondary or tertiary level, and there is no record of the existing technologies in the plants prior to the implementation of the directive. Since the UWWTD 91/271/EEC makes this specification, plants must install the correct technology. The effluent quality required can give an idea of the existing technology prior to the implementation of the directive. As can be seen from Table 1, the maximum permissible BOD concentration level is twice as high in the TWPCR and there are no limit values for total nitrogen and phosphorous concentrations in urban wastewater discharges.

The TWPCR is close to the UWWTD 91/271/EEC, but that there is no clear obligation to collect wastewater from all municipalities with over 2 000 population. Turkish legislation is broader and more precise when it addresses industrial wastewater, for which standards have been set up on a sectoral basis (industries have been classified in 16 categories).

The objectives of the TWPCR are similar to those of EU legislation such as “Surface Water Quality Directive” and the “Directives on Dangerous Substances Discharge in Surface Waters and in Ground Waters”. However, water quality standards and emission limit values are less stringent in Turkey and there are fewer parameters with which to determine quality classes. Turkish legislation lists hazardous substances which are most toxic and persistent. In regard to the permitting procedure, a permit is required for major sources of polluted wastewater, although without referring explicitly to the substances concerned.

Based on the results of the comparison of the UWWTD (Council Directive, 1991) with the TWPCR (Official Journal, 2004) listed in Table 2, it can be concluded that the TWPCR should be updated to comply with the UWWTD. Plenty of issues mentioned in the UWWTD are missing in the TWPCR like Article 8, 9, 10, 14, 15, 16, Annex I.B, Annex I.D, Annex II and Annex III. Some of the articles such as Article 2, 3, 4, 5, 6, 7, 11, 12, 13 are less detailed and insufficient compared to the UWWTP. This comparison will be very beneficial for determining the priority actions needed to achieve the incremental improvements for complying with the UWWTD.

IV. SUGGESTED IMPROVEMENTS IN THE TURKISH WATER POLLUTION CONTROL REGULATION

Following issues should also be considered in the TWPCR in addition to improvements suggested for it as showed in Table 3. Because, many of these are a pre-requisite to the implementation of the UWWTD as they establish the necessary regulatory framework within which wastewaters are managed.

• The TWPCR should include technological aspects shown in Table 4 to be used for the execution of the Directive 91/271/EEC.
• Although TWPCR describes appropriate treatment, it should distinguish primary and secondary treatment.
• Sensitive and less sensitive area definition must be given in the TWPCR according to the criteria given in Annex II of the UWWTD.

The new Water Law that clearly defines the duties and the responsibilities of the Ministry of Environment and Urbanization and the roles of the other institutions should be brought in to force. Having a comprehensive Water Law will minimize the overlapping in responsibilities between different institutions and make it easier to transpose the current EU water directives. It is strongly recommended that all provisions of the UWWTD be transposed as revised Water Pollution Control Regulation under the new Water Law.

It is also strongly recommended that attention should be paid to following issues in the Turkish national program.

• making water supply and sanitation integral parts of poverty alleviation programs,
• incorporating water supply and sanitation as integral parts of human settlement programs,
• improving service delivery, operation, maintenance, service reliability, and water quality,
• making massive infusions of financial resources coupled with effective cost recovery policies,

- decentralizing and devolving responsibilities to the lowest appropriate level of management,
- integrating water supply and sanitation with hygiene education,
- focusing on the gender dimension of water supply and environmental sanitation,
- improving information management, and
- integrating water supply and sanitation within a holistic approach to the development, management, and use of water resources.

V. DISCUSSION AND CONCLUSION

Turkey has to carry out a significant effort to improve its technological capability in the area of urban wastewater treatment. The main obstacles for improving the innovation process in Turkey are;

- lack of adequate financial resources, cost of innovations, risks associated with the innovations,

lack of specialized staff, and

- lack of technological information and external technical services supporting the innovation process.

The main problems associated with urban wastewater treatment in Turkey are;

- urban collecting systems with insufficient capacity or in very bad condition,
- obsolete treatment plants,
- insufficient human and materials means to carry out adequate exploitation and maintenance of the treatment plants,
- deficient control and tracking of the treatment plants by competent authorities,
- non-existence or insufficient execution of municipal bylaws which regulate the discharges to the collecting systems,
- poor concern about treatment and elimination of sludges produced during urban wastewater treatment, and
- insufficient consideration and management of storm waters.

The main problems associated with the implementation of UWWTD;

- too tight deadlines to reach the objectives of the directive,
- too much financial effort is needed,
- lack of correct control of the urban wastewater treatment plant discharges due to the administrative complexity,
- incorrect maintenance and exploitation of these urban wastewater treatment plants, although the development of management systems by the consortiums is improving the situation, and
- lack of a correct identification of sensitive areas.

The principal conclusions from this study are as follows;

- The UWWTD is an excellent guide in developing legislation and may be modified to suit the SEPAs needs and conditions.
- According to the requirements set in the legislation and in order to reach them, the Turkish plants should have had primary and secondary treatments, and any kind of nutrient removal process.
- One of the clearest consequences of the implementation of the UWWTD in Turkey will be the significant increase in the number of urban wastewater treatment plants. This increase will improve both the quality of the continental waters and the quality of the coastal waters, since the implementation of UWWTD will help to attain the objectives set by the bathing water directive.
- Presently Turkey is so far behind the EU standards of wastewater management, general environmental protection policy and economic prosperity. The directive will help the formation and/or proper implementation of wastewater management strategy in Turkey. A key first step will be the production of a strategic plan to identify an affordable way forward.
- Turkey as a candidate to the EU should set its national wastewater strategies to meet the targets set in the UWWTD.
- A major problem was recognized to be the poor state of the economy, which limits the amount of money available from within the country for all investments including wastewater management improvements.
- It should be recognized that implementation of the UWWTD must remain a long-term goal, to be achieved through a succession of incremental steps, in line with economic and institutional development.
- The improvement in wastewater management standards can therefore only progress by small incremental steps made in pace with economic development. A quick step change towards the EU standards cannot be achieved. Incremental improvements may be won at relatively low cost by improving the management and operation of the better existing facilities.
- In the short term the best policy could be to use the resources available to upgrade the existing plants, to improve, renovate the existing collecting systems, outfalls and to adopt the existing treatment and collecting systems to the new volumes of water and pollution loads detected.
- In the long term, incorporation of secondary treatment into existing plants which only work with primary treatments in accordance with the requirements of the directive, incorporation of the complementary treatment systems required to reduce the amount of nutrients to urban wastewater plants situated in sensitive areas and incorporation of new systems to avoid or reduce the environmental impacts of these plants (visual impact, smell, noise etc.) could be planned due to the poor state of Turkey's economy.
- Although the TWPCR shares the objectives of the UWWTD, it is less detailed; plenty of the issues regulated by the UWWTD are not covered in the TWPCR,

- Studies on improvement of the TWPCR should be started and finalized as soon as possible.
- The definitions in the TWPCR are needed to be updated,
- Emission limits for wastewater treatment for the industrial sectors listed in the Annex III of the UWWTD should be included in the TWPCR.

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