On-site wastewater treatment systems and legal regulations in the European Union and Hungary

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Abstract: The on-site wastewater treatment systems (WWTS) provide an alternative to regional wastewater treatment plants. Their application can be limited by the options for the disposal of treated water.

The Hungarian settlement structure underpins the importance of on-site WWTSs. It would be essential to apply wastewater treatment methods that are economical and environmentally reliable contributing to meet the requirements raised by the EU.

The aim of the research was to examine the regulations and practice of different European countries and to develop recommendations for further use of treated water originating from on-site WWTSs considering the Hungarian circumstances illustrated with an example.

Key-words: decentralised systems, legislation, water reuse, sewage disposal

1. Introduction

An alternative to the centralized way of wastewater treatment has begun to evolve nowadays: the application of on-site WWTSs as a decentralized way of sewage treatment.

These small-scale units have high priority in low population density areas, where the discharge of sewage to a central WWTP through a drainage system is not profitable. Constructing too long drainage conduits is not rational for two reasons: high costs and stagnant wastewater. The latter can cause rotting and/or
cooling down of the sewage in cold weather depending on the hydraulic residence time [1]. These make wastewater treatment much more difficult.

The Council Directive 91/271/EEC concerning urban wastewater treatment states that where wastewater collection systems are not justified either by economic or environmental aspects individual systems should be used. In case of Hungary this task is rendered more difficult by the numerous sensitive areas where further inspections on realisation have to be done. The reuse of treated water is not regulated either.

2. The European context

Of the total number of settlements in member countries of Central and Eastern Europe Global Water Partnership program\(^1\) 91.4 % have less than 2000 inhabitants [2]. This concerns around 20% of the CEE population which is around 4% of Europe’s population. The perspective until 2015 is that 75-90% of the total CEE population will become connected to the centralized systems of sewerage and wastewater treatment. This leaves a gap of 10-15%, corresponding to about 20 million rural inhabitants [2]. Since there is no obligation for the wastewater treatment for those settlements there is a risk of neglecting the problem.

\[\text{Figure 1: Reuse types and corresponding European Directives [4]}\]

\(^1\) Bulgaria, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Ukraine, from now: CEE countries. Moldavia was not included at the time of the survey.
The European Council Directive 91/271/EEC concerning urban wastewater treatment states that “Treated wastewater shall be reused whenever appropriate” [3]. The problem is that the term 'appropriateness' remains legally undefined. One possibility to decide whether a reuse application is appropriate is to consider the costs and benefits.

Though there is no uniform regulation on water reuse in the EU, some of the concerns relevant to water reuse applications have already been addressed by separate directives. Figure 1 gives an overview of the different reuse purposes and relevant directives. It has to be mentioned that there are certain domestic applications that do not need potable water quality (i.e. toilet flushing). There is still a gap even in the European legislation concerning the quality criteria of greywater for non-potable use.

The Swedish framework for regulation of on-site treatment systems was updated in 2006 and 2008 [5]. One specification is that on-site systems need to reduce BOD\textsubscript{7} and phosphorus by 90% and nitrogen by 50% in sensitive areas, whereas systems in other areas must reduce BOD\textsubscript{7} and phosphorus by 90% and 70% respectively [5, 6]. Despite the strict limits, many conventional on-site wastewater treatment systems in Sweden do not meet these requirements [5]. Hence, many private households will need to improve their treatment systems.

In Finland, approximately one million residents (around 19% [7]) and over one million vacationers are located outwith the municipal sewer network [8]. It has been estimated that in rural areas the discharge of phosphorus to water is 50% higher than in urban areas [9]. For this reason, rural wastewater treatment is tightly connected to eutrophication and needs to be considered in planning water management and restoration processes. One interesting point of the Finnish regulation is that the corresponding decree encourages the use of dry toilets [8].

A study was carried out by the University of Brighton investigating the extent of rural sewage treatment in the UK [9]. Approximately 98% of UK households are connected to the sewerage network [10], therefore the majority of municipal wastewater from both urban and rural areas is treated in wastewater treatment plants. In the United Kingdom water supply and wastewater industries are privately owned since 1989 therefore profit is an important aspect in the UK.

The distribution of the unconnected 2% of households is currently unknown [9], but it is probable that many of these properties are situated in rural areas. Of the non-mains systems 77% treats wastewater in septic tanks, 14% has package plants and 9% is unknown, which is not very promising. Still, in the UK the greatest problem in wastewater treatment seems to be the state of private sewers, i.e. those structures that are not owned by the one of the nine major sewerage companies. 45% of private sewers are in a condition susceptible to
deterioration and 17% are at significant risk of failure [9]. The problem will be solved only in 2011 when the ownership will be transferred to the sewerage companies [11].

3. Hungarian specialities

96% of Hungary’s surface water comes from the neighbouring countries. Due to this fact, the quality and quantity of the Hungarian water bodies depend greatly on the interventions of these countries. However, Hungarian industrial and agricultural pollution contributes to the contamination of those as well and un- or not well-treated sewage plays a great role in the pollution load of the water supply. Since more than 90% of drinking water comes from groundwater, its protection is a strategic task in Hungary [12].

![Figure 2: Settlement structure of Hungary (according to data of 2006.12.31.)][12]

About the settlement structure of Hungary it can be stated that the proportion of settlements with less than 2000 inhabitants is high (75.3%) but only 16.9% of the population lives in there (Figure 2) [12]. Therefore the proportion of the amount of Hungary’s whole wastewater flow coming from
these settlements is only 4.7%. Despite of this fact, these are the places where the installation of small WWTUs should be taken into consideration regarding that their uniting into a wastewater treatment agglomeration group\(^2\) is not feasible in many cases (mostly when these small settlements are far from each other in addition)[9].

The proportion of households in areas with no available sewerage system is 24.7 % (according to data of 2006.12.31.) [12].This data underpins the need for packaged WWTUs in Hungary.

**Figure 3:** The status of wastewater treatment in Veszprém County, Hungary

Veszprém County is taken as an example for the Hungarian situation. In 2007 79.4% of households were connected to sewage systems which is higher than the nationwide average (69.8%) [13]. This is mainly because Veszprém County has great territories of highly sensitive areas concerning groundwater [219/2004] therefore to solve the question of wastewater treatment was of high priority. Nonetheless at present there are 85 settlements (39.2%) that are unconnected whereof at 41+1 settlements (19.3 %) centralised wastewater treatment will be applied in the near future (Figure 3) [14, 15, 16, 17]. The addition of plus one refers to a settlement that was not included in the list of agglomerations [14] but decided to invest in a local wastewater treatment plant in order to allow new investments at the village [18]. That concerns about 5.9%

\(^2\) e.g. the agglomeration group in the area of Veszprém with a central WWTP in Veszprém
of the population and 6.4% of the households of the county. At almost all of the remaining settlements on-site wastewater treatment systems are applicable [15]. There are only 9 settlements that are on highly sensitive areas but at 7 of these decentralised means of wastewater treatment are allowed since their residential areas do not concur with vulnerable territories therefore discharge is possible. The other two must join a wastewater treatment agglomeration. Fortunately in both cases this can be carried out: both villages are in the neighbourhood of a regional wastewater treatment plant.

It has to be stated that according to the corresponding legislation [15] only the disposal of treated wastewater originating from on-site WWTUs established in vulnerable areas is prohibited, treatment is not. Taking the costs of this solution into consideration if treated wastewater has to be delivered to a municipal WWTP the implementation of a package plant becomes uneconomical. The only alternative in this case would be the total recycling and reuse.

One of the biggest problems connected to the introduction of small WWTUs in Hungary is that regulation concerning their establishment, maintenance and the disposal of treated water is scattered in parts of more than ten laws, and the disposal of treated water is not regulated properly. Regarding the problem, in case of less than 500 m³/year water output the town-clerk has the competence of licencing. The Hungarian National Public Health and Medical Officer Service (ÁNTSZ) contributes as specialised authority. In special cases when the construction of the facility requires a building permit the Regional Inspectorate for Environment, Nature and Water is of competence [18]. Unfortunately the only way of disposal that can be permitted following the required examinations is the discharge of water into land drains according to Government Decree 50/2001. (3. IV.) [19], in spite of the fact that these WWTUs can produce high standard effluents assuming proper maintenance. This way the treated water could be laid back to the house for non-potable reuse purposes.

In advance, it is important to create an organization dealing with the authorization and regular control of decentralized WWTUs, and even to put an emphasis on the producers’ and users’ responsibility. Figure 4 shows the suggested decision-making model concerning the disposal of the effluent of small WWTUs. While making the model reasons that preclude on-site WWTUs were not taken into consideration. The coloured cell contains the solution for which there is no legislation in Hungary yet. This paper wanted to put an emphasis on this imperfection which greatly puts the spreading of decentralized WWTUs back in Hungary.
4. Conclusions

Wastewater treatment in rural areas is the next problem that has to be faced in Europe. There are countries that have taken steps in order to preserve their ‘good state’ of their water bodies from that point of view and others have to deal with the question in order to provide their citizens with proper sanitation systems. In the case of Hungary the problem concerns one quarter of the population but the numerous regulations concerning on-site WWTSs and the legislation gap of water reuse hinder the spreading of environmentally feasible solutions. The latter applies to most of the European countries as well.

References


[17] Register of The Middle Transdanubian Inspectorate for Environment, Nature and Water on wastewater treatment plants
