WASTEWATER TREATMENT MANAGEMENT IN BELGIUM (WALOON REGION)

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Abstract. Belgium is amongst the small European countries. It is a federal state, divided into three Regions, corresponding to two different communities (Walloon region and Flanders) and a special Region status for the shared head city (Brussels). Water management belongs to the Regions. The Water Directive voted by the European Parliament has been transcribed into Belgian legislation and has to be applied by Regions. The legislation requires that any produced wastewater has to be treated adequately before discharge into environment. This paper will deal neither with industrial, nor agricultural applications of the law, but will focus on the domestic wastewater production, its problems and onsite implemented treatment solutions. 12% of the Walloon population (inhabitants of small villages in rural areas) will never be connected to any sewage network and thus to any treatment station, such as for cities. Before the end of 2015, these people must treat their own wastewater with officially recognized or not treatment systems. A method has been developed by the Agricultural University of Gembloux as a decision supporting tool for individual or collective systems. The software, named SAIWE (Système d'Assistance et d'Information Wallon pour l'Epuration autonome) is a step by step analysis methodology aimed at helping deciders to identify technical solutions (treatment plants) and to implement the best suited to local constraints. This paper summarizes official guidelines for those onsite solutions, and gives an overview of natural wastewater treatments applied in Belgium, especially with constructed wetlands use.

Key words: Belgian legislation, constructed wetland, decision tool, domestic wastewater treatment, natural systems

Introduction

In 2001, the European Parliament voted the Water Frame Directive, integrating management of surface and groundwater, and gathering former directives (Directive 91271/CEE). The member states have to translate it into their own legislation rules and have to treat adequately all produced wastewater before discharge into environment. Belgium being a federal state, water management is of regional competence. In the Walloon Region (southern and French speaking), the directive has been quickly applied for what concerns treatment and discharge of industrial wastewater. Treatment of agricultural wastewater is covered by the Nitrate Directive. Treatment of sewage wastewater has first been implemented in small villages and rural communities. When the large treatment plants under construction for the big cities will be completed, the Walloon Region will climb to the top tier of the European ranking based on the ratio of already-processed to still-to-be-processed PE. The modus operandi followed in The Walloon Region for treatment of urban wastewater is explained, together with some scientific research and progress.

Watewater Treatment in the Walloon Region (Belgium)

Legal framework: sanitation zones

Three zone types were defined according to a master plan based on the executive decree of September 19 1991, which defines the rules to edict and present the P.C.G.E. (Plans Communaux Généraux d'Egouttage – Municipal Master Plan for Sanitation). The *collective treatment zones:* a sewage network does exist; present and future houses are obliged to connect; the sewage wastewater is directly discharged into the network. The *individual treatment zones:* no network is present; the houses must be individually provided with a treatment system for their own wastewater. Finally, there are *transitory treatment zones;* they are supposed to gradually evolve into collective or individual treatment zones. By the decree of the 13th of September 2001, the Walloon government demarcated the four river basins and fourteen sub basins in the Walloon Region. By the decree of May 22 2003, the Walloon government adopted the General Regulations for treatment of urban wastewater. These regulations provide plans for sanitation per sub basin (P.A.S.H.) to replace the former municipal master plan for sanitation

(P.C.G.E.). Furthermore, for each sanitation zone, the method of disposal for the wastewater and the rainwater are specified.

The implementation

The S.P.G.E. (Société Publique de Gestion de l'Eau - Public Company for Water Management) entrust the P.A.S.H. completion to certified organizations. Through these new plans, sanitation does not follow the municipal borderlines anymore but the catchments limits. The communes have regrouped into public inter-municipal organizations which are in charge of the study, realization and maintenance of the collection and treatment of sewage wastewater in *the collective treatment* zones. In that way, sewage wastewater over the Walloon territory is administered by eight inter-municipal organizations. The municipalities may impose special measures to provide a collective treatment to a subset of houses coming under the rules of individual treatment, with the same deadline of the 31st of decembre 2015. The sanitation regime is then called *municipal individual treatment.* In the *individual treatment zones,* single households are themselves in charge of treating their wastewater before discharge into the environment. Every house or group of houses subject to the individual treatment regulations must be equipped with an individual sanitation system before the 31st of decembre 2015 at the latest. The individual treatment zones cover 13% of the Walloon territory, i.e. 132.000 houses.

Discharge of treated wastewater

Different receptor environments are considered depending on their capacity to absorb treated wastewater as well as rainwater. The enforced regulation classifies them into three categories: (i) existing channel (ditch or piping), (ii) surface water bodies and (iii) infiltration into the soil. Discharge into the first two categories is direct while infiltration requires the addition of a complementary infiltration system added to the treatment system. Infiltration must satisfy three objectives: draining off the discharged water, enabling the soil to play its purifier role and avoiding an excessive rise of the water table level if there is any. Infiltration techniques require that the soil offer a sufficient infiltration capacity, which is measured by the infiltration velocity. This velocity decides which infiltration system to choose. A sufficient available surface is required to install the system, which in practice, restrains the use of this technique to a few dozens of PE. The possible

systems are the trenches or the infiltration mound, the sand filter and the infiltration bed.

The water catchments are safeguarded by protection zones. In *close protection_zones,* the transfer time between the discharge and catchments points is estimated at 24 hours; infiltration systems and cesspools are prohibited. In *distant protection zones,* the transfer time is 50 days; cesspools are prohibited.

SAIWE Methodology

Within this present context, many municipal administrations, inter-municipal organizations and individuals ask themselves about the choice of a treatment system and the means to implement the P.A.S.H. This is the reason why a method of analysis has been designed intending to help stakeholders on the field to identify the treatment techniques best suited to the local constraints in the individual and transitory zones. This method of analysis is called "SAIWE" (Système d'Assistance et d'InformationWallon pour l'Epuration autonome, Walloon Assistance and Information System for individual Treatment) [Grela et *al, 2004*].

The SAIWE method of analysis considers 22 treatment paths combining:

(a) two collecting systems: wastewater and rainwater common or separated;
(b) four families of treatment systems: per parcel, per group, compact or non compact
(c) three families of discharge: free surface water bodies, infiltration into the soil or diversion of wastewater to another technical pool.

The method aims at identifying the best choice of technical solutions for treatment in urban zones subjected to the individual treatment regulations rather than comparing the performances of the different systems. It focuses on the coherence of the treatment process with the field constraints. At the end of the analysis, the deciders have at their disposal a map presenting the aptitude of the zone to the different treatment processes. This map is complemented by index cards presenting the best suited techniques to be implemented in each of the sub zones.

The SAIWE method proceeds in three steps: identification of the processes which can be implemented; among these, identification of the easiest to install; among these latter, identification of the easiest to operate.

In the first step, one searches for the processes which can be installed taking into account the local context. Five decision flowcharts have been designed, based on a dual logic. In order to answer the questions being asked by these flowcharts, some information must be gathered. To those emanating from the PASH must be added information concerning the localization of the houses, the geological characteristics of the soil, the estimated water table level, the existing agricultural drainage, the lowest points of the technical catchments, together with the identification of the concerned parcels owners, the characteristics of the surface water downstream of the discharge points. For a given parcel, it is estimated that the duration of the study cannot exceed one day, including the measurement of the infiltration velocity.

The decision flowchart n°1 defines the "general conduct of the analysis concerning the aptitude of the parcel to individual treatment and of the redefinition of the study zone". But, like Russian dolls imbedded into each other, the application of this decision flowchart n°1 requires the use of other flowcharts in order to enable answering some questions of the logical process. These other decision flowcharts, abbreviated hereafter as OD (Organigramme de Décision – DF Decision Flowchart), are:

- → DF nr°2: analysis of the suitability of processes to the given parcel;
- → DF nr°3: choice of the system for discharge of rainwater;
- → DF nr°4: separated water collectors and grouped treatment of wastewater;
- → DF nr°5: unitary water collecting and grouped treatment of wastewater.

The clarity of the flowcharts and the accuracy of the questions they ask offer the advantage of an easy use by non specialists.

In the second step, the SAIWE method of analysis identifies, among the feasible processes, those which are easiest to implement taking into account the local constraints. Actually, most often, the first step of the analysis demonstrates the feasibility of several methods. Their respective suitability must be compared taking into account the local constraints for what regards the discharge capacity, the nuisance, the operational responsibility and the human resources. To this end, several criterions are examined. Again, keeping in mind o simplify the operator task, an evaluation grid is design to incorporate these different criterions and enable a clear comparison of the pre-selected processes.

In the third and last step, the SAIWE method identifies, among the easiest processes, those which are easiest to operate taking again into account the local constraints. It is indeed quite useful to be aware of the operative requirements. To this end, a synthesis table summarizes the frequency of the operative intervention for the different individual treatment units [Grela et al, 2004].

As it can be seen, to choose a treatment system among the 22 which are proposed is not an easy task, due to the multiplicity of selection criterions. This justifies the purpose of developing the SAIWE method. It is especially concise since it uses five decisions flowcharts and two recap tables only. At the end of the study, it is therefore possible to identify the set of feasible solutions, parcel per parcel, and to pinpoint the advantages of some technologies with respect to the operative and monitoring requirements.

Treatment System

The two main treatment systems presently offered on the Walloon market are the so-called "extensive" and "intensive" systems. The extensive terminology gathers the treatment systems based upon a natural treatment by means of a planted filter, lagooning, stabilization pond, artificial humid zone, ... without further additional intervention be it mechanical, chemical energetic (without further mechanical or chemical intervention). Those systems are usually low cost technologies. The intensive systems gather the treatment systems with mechanical intervention and oxygenation. The available techniques are: those where the biomass is fixed on still or mobile supports, the activated sludge, the biodisks systems, the aerobic trickling filter. These conventional techniques are usually high cost technologies. All these techniques must enable to reach the treatment performances defined under the general and sectional conditions.

An allowance is granted for setting up an installation for the individual treatment of a house or group of houses built before the date of approval or modification for the P.A.S.H. which classified them. It is worth noticing that new constructions cannot be granted an allowance. The Walloon government decree of the 19th of July 2001 introducing an installation allowance for individual treatment of sewage wastewater defines the rules for granting such an allowance.

Presently, the extensive systems are very seldom used in the Walloon Region. Indeed, 98% of the total PE treated by stations located

in *collective treatment zones* and with a capacity above 2000 PE are processed by intensive systems treated while 2% only of the household wastewater is processed by extensive systems [Data from INASEP, 2005]. 61% of urban wastewater producer in agglomerations over 2000 PE are treated by existing stations while new stations must be built to treat the remaining 39% [SPGE, 2005]. The main intensive systems are based on activated sludge (90% of the treated PE). The main extensive system is the aerated stabilization pond: 82% of the extensive systems in use; constructed wetlands with free water flow, planted with macrophytes, treat 11% of the wastewater; the remaining 7% are treated by stabilization ponds with microphytes. Some of these stations date back to fifteen years. The main choice of intensive systems is explained by the amount of wastewater produced, their distribution over the territory and the available surfaces. The international lobbies in charge of building and operating the stations are commercially and politically well connected. The extensive treatments suffer from unfavourable bias on the basis of former unfortunate experiences; they are confined to rural zones where surfaces are available [Etat de l'Environnement Wallon, 2004].

The Epuval onsite constructed wetland system

Consumers of the new generation are better informed and more sensitive with respect to environmental problems; they care about energy savings and sustainable development. They are more open-minded and demand more natural and ecological systems. Stabilization ponds are replaced by constructed wetlands with surface or subsurface flow which require fewer surfaces per PE than lagooning; they require little maintenance cost and solve the olfactory problems generally associated with stabilization ponds. Within this context, two Walloon companies now propose certified treatment systems based on constructed wetlands with horizontal subsurface flow. The Epuval system is one of these systems.

The Epuval system results from experience gained over more than 20 years by the asbl Epuvaleau, depending on the Agricultural University of Gembloux (Belgium). It blends with the experience available in the United States, many European countries (more than 1.000 known installations in Europe) and the northern part of Belgium. Moreover, it fits with European standards in project. The Epuval 5EH system is designed for a single household, is available as a do-it-yourself installation and is certified by the Walloon Region, which can thus grant

an installation allowance (provided the usual criterions are met). Studies have been conducted for projects of communal individual treatment with a capacity of 40 to 650 PE.

The overflow of the sceptical tank pours into a distribution reservoir which flows into the constructed wetland. This filter is sized according to the amounts and characteristics of the wastewater. For instance, a single household (5 people) requires a 3 m^3 septic tank (the minimum imposed by the Walloon Region is 600 l/PE) and a wetland 13,5 m long, 2 m wide and 0,8 m deep. Its walls are concrete blocks. The sand bottom is levelled and protected by a wire mesh against rodents; it is then covered by a tarp made of EPDM or HDPE plastic. It is filled with non-limestone and gravels planted with *Phragmites* sp. The wastewater is cleaned all along its horizontal path in the filter, chiefly thanks to the micro organisms which develop on the roots and gravels. The water at the end of the filter is collected by a drain pipe and transit through an inspection reservoir before discharge into ditch, creek, filtering mound, wooded area, or other...). The so processed water satisfies the discharge norms imposed by the Walloon Region.

This gravel bed works by gravity flow, without additional energy (electric motor, pump, etc.). Its dimensions are modest (5 to 6 m^2 per PE). It is easy to maintain: emptying of the tank every 5 years and annual cut of the reeds advised (but not compulsory). It can be built by the owners, local bricklayers. It is a natural and ecological ecosystem, proven in other countries. It is a clean technology, respectful of the environment for what concerns construction, maintenance, performance and integration to the landscape.

Conclusion

The definition of the P.A.S.H enabled to classify the Walloon territory into zones depending on the type of wastewater treatment to be applied. Decision tools, such as the SAIWE method, are proposed to help the choice of the most appropriate treatment system. Finally, due to an increasing demand for ecological technologies with low energetic cost, extensive systems using constructed wetlands are being developed.

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MANAGEMENTUL TRATĂRII APELOR UZATE ÎN BELGIA (REGIUNEA WALONĂ)

-Rezumat-

Belgia se numără printre cele mai mici state europene. Este un stat federal, ce cuprinde trei regiuni (Reginea flamandă, walonă şi cea din Bruxelles cu statut special). Gestionarea resurselor de apă este de competenţă regională. Directiva apă, votată de Parlamentul European a fost transpusă în legislaţia belgiană şi implementată de regiuni. Legislaţia impune ca toate apele uzate să fie tratate într-o manieră corespunzătoare, înainte de a fi deversate.

Articolul de față se referă la la apele uzate menajere, problemele care se ivesc şi soluțiile găsite. 12% din populația walonă nu este conectată la rețeaua de canalizarea şi la o stație de epurare, așa cum este situația în orașe. Înainte de sfârșitul anului 2015, aceste persoane vor trebui, ele însele, să trateze apele uzate prin intermediul unui sistem de tratare oficial recunoscut sau nu. Facultatea de Ştiințe Agricole din Gembloux a dezvoltat o astfel de metodă utilă atât pentru sistemele individuale, cât şi pentru cele colective. SAIWE (Sistemul de Asistență şi Informare walonă pentru Epurarea autonomă) este o metodă de analiză pe etape ce urmăreşte să ajute decidenții în identificarea soluțiilor tehnice (stații de epurare) şi în alegerea celei mai bune soluții adaptate la condițiile locale. Articolul rezumă cele mai importante linii directoare oficiale găsite, punând accentul pe tratarea naturală a apelor uzate, în special prin utilizarea zonelor umende amenajate.

GESTION DU TRAITEMENT DES EAUX USÉES EN BELGIQUE (RÉGION WALLONNE)

- Résumé -

La Belgique compte parmi les plus petits pays européens. C'est un Etat fédéral, divisé en trois Régions (Région flamande, Région wallonne et Région bruxelloise à statut spécial). La gestion de l'eau est une compétence régionale. La Directive Eau, votée par le Parlement européen, a été transcrite dans la législation belge et doit être mise en oeuvre par les Régions. La législation exige que toute eau usée soit traitée de manière adéquate avant d'être rejetée dans l'environnement.

Cet article ne traite ni des applications industrielles ni agricoles de la loi, mais se concentre sur la production d'eaux usées domestiques, les problèmes encourus et les solutions mises en oeuvre. 12% de la population wallonne (habitants de petits villages en zones rurales) ne seront jamais connectés à un réseau d'égouts et donc à une station d'épuration, comme c'est le cas dans les villes. Avant la fin de l'année 2015, ces personnes doivent traiter elles-mêmes leurs eaux usées avec un système de traitement officiellement reconnu ou non. Une méthode a été développée par la Faculté universitaire des Sciences agronomiques de Gembloux en tant qu'outil de décision pour des systèmes individuels ou collectifs. Le logiciel appelé SAIWE (Système d'Assistance et d'Information Wallon pour l'Epuration autonome) est une méthode d'analyse par étape visant à aider les décideurs à identifier des solutions techniques (stations d'épuration) et à choisir celle qui convient le mieux

dans les conditions locales. Cet article résume les lignes directrices officielles pour ces solutions localisées, et donne un aperçu des traitements naturels des eaux usées utilisés en Belgique, spécialement avec emploi de zones humides aménagées.

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