

The Environmental Impact of Building a Wastewater Treatment Plant

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Abstract

The purpose of a wastewater treatment plant is to ensure the environmental comfort in that locality. In certain cases, building a sewerage network and a treatment plant can have an impact on the environment. That is why, upon building a wastewater treatment plant, an environmental impact assessment of this work is necessary. A wastewater treatment plant is directly aimed to the environmental protection and, especially, by performing the sewerage networks and the wastewater treatment plants, the people's life and comfort are improved. This paper aims at assessing the environmental impact of building a wastewater treatment plant.

Keywords: environmal impct, waste treatment plant.

1. Introduction

The effects of building a wastewater treatment plant are direct, but they can also have a series of indirect effects with major implications on the environment. The functional impact on the environment results following the designed functions of these building categories or as an implicit and inevitable result of performing the designed functions.

The designed functions of the waterworks are very different and they mainly refer to buildings for treating and discharging wastewater from the limits of populated centres, industrial platforms, respectively for any type of activity. These buildings can also ensure, under certain conditions, the production of electricity by burning the resulted biogas.

For a correct and rigorous impact assessment, the legislative requirements, which will be briefly presented as follows, should be observed. The procedure on the environmental impact

assessment is a requirement of the Directive 85/337/EEC (EIA Directive) regarding the assessment of the effects of certain public and private projects on the environment, amended by Directive 97/11/EEC with further amendments. EIA Directive is transposed in the national legislation by Government Decision 445/2009 on the assessment of the impact of certain public and private projects on the environment, being implemented by regulatory acts which will no longer be mentioned in this paper.

The environmental impact assessment has the purpose of identifying, describing and assessing, in an appropriate manner for every case, in compliance with the legal provisions, the direct and indirect effects of building a wastewater treatment plant on the following factors: human beings, fauna and flora; soil, water, air, climate and landscape. The interaction between these factors is also assessed [1].

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2. Materials and methods

The stages of performing the impact assessment

The environmental impact assessment is made in stages and it is regulated by the O.M. 135/2010 on the approval of the Implementing regulations of assessing the environmental impact for public and private projects. This contains some stages that must be rigorously observed, i.e.:

- Initial project assessment which is performed by the competent authorities in order to be able to perform the environmental protection. In this stage, the project localisation is presented in relation with the natural protected areas
- The stage in which the projects fall within the procedure by means of which the environmental impact is assessed;
- The stage in which the domain is defined, by means of which the environmental impact report of this building is assessed and performed.
- The stage in which the quality analysis of the environmental impact report due to the waterworks is performed.

In order to perform the environmental assessment, several stages are required, as follows:

- presentation of general data
- description of the activity, respectively of the importance of building this wastewater treatment plant in that community
- environment plan specifying the need of the site plan
- sources of pollutants and protection of environmental factors
- the impact on the environment
- impact assessment and conclusions
- environmental assessment report

3. Results and discussion

The stages of performing the impact assessment

During the first stage of performing the impact assessment, the presentation of the importance and of the need of building a wastewater treatment plant in that area is required.

By building a public utility wastewater treatment plant and by implementing the provided works, improvements are brought to the wastewater system as compared to the current situation.

These works contribute to the increase of the state of well-being and health of the population and also to the environmental protection. If the building of the wastewater treatment plant is performed without significant negative effects on the environment, then the role of this construction has a positive impact on the wastewater discharged in the emissary. It is known that discharged water into the emissary should be at the quality parameters provided by the national and European Union legislation.

General data on the project, the designation of the investment objectives, the project holder, the execution duration, the operation time and duration should also be specified. As regards the wastewater treatment plant, the operation regime of this investment object will have an operation time of 24 h/day, and the duration of 365 days/year.

In the second stage, the purpose and the need of this work to build the wastewater treatment plant, the public utility and last, but not least, a brief description of the type of desired wastewater treatment plant and which can be built in that area are presented, taking into account the specificity of the area and the number of related inhabitants. It should also be taken into account the fact that the number of inhabitants could increase in the following years. In the third stage, the environment plan of the work is started. The geographical delimitation of that site, the geologic elements presenting the geological structure of the subsoil and of the mineral resources, the seismic potential of the area (in compliance with the provisions of the Regulation P100-1/2006), the prevailing soils in the area should be mentioned here.

Mentioning the prevailing soils in the area have a special importance because, in certain situations, deeper diggings are required, these being made only in certain types of soil [2].

In this part as well, it is necessary to present the water resources, i.e. surface water, groundwater and standing water.

In the presentation of the climate and of the natural phenomena specific to the area, it is necessary to present the altitude, the landforms, the vegetation and water that cause differentiations in the development of climatic elements, the imposed changes relating mainly to the land. The values of the multiannual average quantities of rainfalls and the values of the

minimum recorded annual quantities should also be mentioned. The climatic temperature factors are also specified, i.e.: the annual average air temperature; the minimum absolute air temperature; the maximum absolute air temperature; annual average rainfalls; frost line [3]. Another specification is the wind regime, the annual frequency of the winds on certain directions that present changes conditioned by the character of the general circulation and the land.

The presentation of the flora, fauna and of the vegetation specific to the area, as well as of the aquatic and terrestrial ecology follows and last, but not least, a significant importance in establishing the quantity of water necessary for treatment falls on the urban and public interest settlements.

In the fourth stage of the environmental assessment, the description of the activities in which the installations and of the works from the sewerage outline and the execution of the treatment plant are presented follows. Here, the type of sewerage system, separate or combined, and the localities from the surface of which wastewater is collected. The sizing of any treatment plant is made in compliance with the legislation in force and mentioning the materials from which the sewerage and the treatment plant are executed, briefly, the design parameters should be mentioned in detail.

After all these stages, the stage in which the environmental impact is assessed starts. During the environmental impact assessment stage, the pollution sources and the protection of environmental factors during the execution period, the water pollutant emissions and the water quality protection are presented. The concentrations and the weight rates of pollutants from domestic wastewater at the entry into the treatment plant are resumed in a table and the emissions of air pollutants and the protection method of the air quality should be mentioned. The air pollution sources during the execution period are, in general: dust, VOC, fine particles and exhaust emissions from construction machinery. Reducing these dust quantities generated during the execution of the designed works can be made by permanently spraying the work areas. During the execution of the construction works, it will be attempted not to affect the population and biodiversity in the area

by the noises specific to these types of activities, by maintaining the machines at a normal operation regime, without having technical difficulties that could cause, by accident, certain noises, respectively unwanted vibrations, due to certain malfunctions [3].

In order to prevent the noise pollution caused by vehicles, a periodical technical inspection of these vehicles is required and the technical conditions limiting the noise, the technical conditions provided upon their approval for circulation should be observed. The work schedule and circulation of vehicles in the area is established so that the rest periods of the inhabitants from the area are observed. It would also be recommended to have as few machines in the area as possible, of small and medium capacity. Thus, the effects that generate the impact are generally low, thus, no other protection measures are required.

Another stage of this part is the specification of pollution sources and how to protect soil quality. Potential sources of soil pollution could be the leaks of lubricants or other petroleum products in the built-up area and within the construction site management. In order to prevent soil pollution during the execution of the works, all protection measures will be taken, according to the technical safety regulations in force to avoid accidental leaks of fuels or lubricants into the soil.

It is imperative in this phase to specify that after the completion of the works, the surface of the land affected by the construction sites will be restored to its original state, ecological reconstruction measures for the areas affected by the construction of the treatment plant will be taken, by restoring the topsoil by grassing, as well as by landscaping.

The waste management has a particular importance at this stage of the project. Landfilling must be made in such a way that the health of the population is not endangered. The use of processes or methods that may harm the environment must also be avoided. Landfilling must be made without polluting the water, soil, plants or animals, and without causing problems through noise or odours and adverse effects on nearby regions or places of public interest [4].

The next stage is to highlight the sources of pollution and the protection of environmental factors during the exploitation period. The steps

to be followed are similar to those presented in the above mentioned paragraphs, mentioning that the sources of pollutants for groundwater and surface water are:

- seepage of domestic wastewater through the leaks of the joints from the sewerage pipes or from their connection with the manholes;
- accidental discharges of partially treated or untreated domestic wastewater as a result of accidental damages or accidental flooding of the treatment plant [5].

Another very important chapter in drafting an environmental assessment is the impact on the environment during the execution and exploitation period. This chapter studies the impact on water, air, soil, the impact of noise and vibration, the impact on fauna and vegetation, the impact on human settlements and other objectives in the area. These studies are made both during the execution period and during the exploitation period [6].

A final stage is the assessment of the impact which is a process with the role of identifying, describing and establishing, on a case-by-case basis and in accordance with the law in force, the direct and indirect, main and secondary effects of a project on the health of humans and of the environment, as well as with the role of establishing a series of measures to reduce them. One of the most used methods for impact assessment is the Rojanschi method [4].

- This method is one of the most used applied methods in order to assess the environmental impact in Romania. It is based on the estimation of the environmental quality indices depending on a reliability scale. These quality indices are:
Pollution index: P_i

$$I_p = \frac{C_{\max}}{C_{\text{admis}}}$$

C_{\max} – maximum concentration of the pollutant

C_{admitted} – admitted concentration of pollutants

$P_i = 0 \dots 1$ – the environment is affected within the admitted limits, and the effects are positive or negative without being harmful.

- The quality index QI

$$I_c = \frac{1}{\pm E}$$

Where:

$E > 0$ – positive influence on the environment

$E < 0$ – negative influence on the environment

$E = 0$ – no influence on the environment

$QI = 0 \dots +1$ - influences are positive, and the environment is affected within the admitted limits;

$QI = -1 \dots 0$ - influences are negative, and the environment is affected over the admitted limits;

$QI = 0$ - the environment is not affected by the project

- The global pollution index P_{gi} is established based on an analytical quantitative method, the report between the ideal and the real state being made.

$$P_{gi} = S_i / S_r$$

If:

$P_{gi} = 1$ - there is no pollution

$P_{gi} > 1$ - there are environmental quality changes

Same environmental impact assessment is also made during the execution period. The impact assessment is calculated based on the pollution indices P_i for air environmental factors, urban settlements.

The impact assessment based on the quality indices QI is made for the water and soil environmental factors. The assessment of the global impact during the execution is also required by granting certain reliability grades [4]. Following these assessments, a pollution index chart is made during the execution and exploitation period. An example of such a chart from the execution period is given in figure 1.

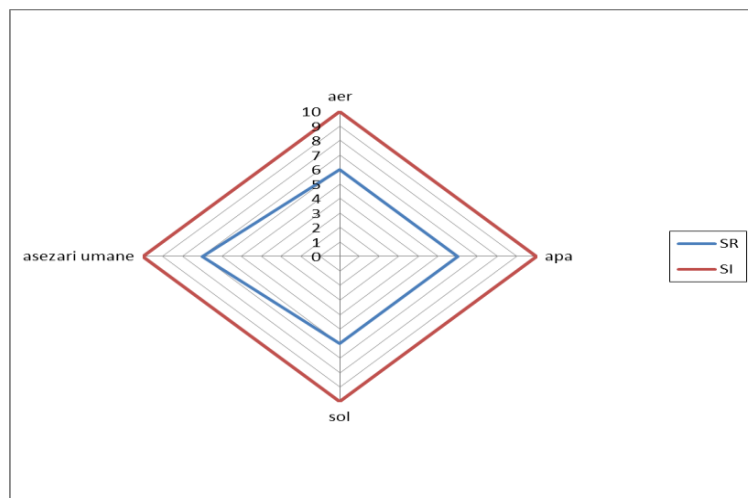


Figure 1. Calculation of the pollution index during the execution period

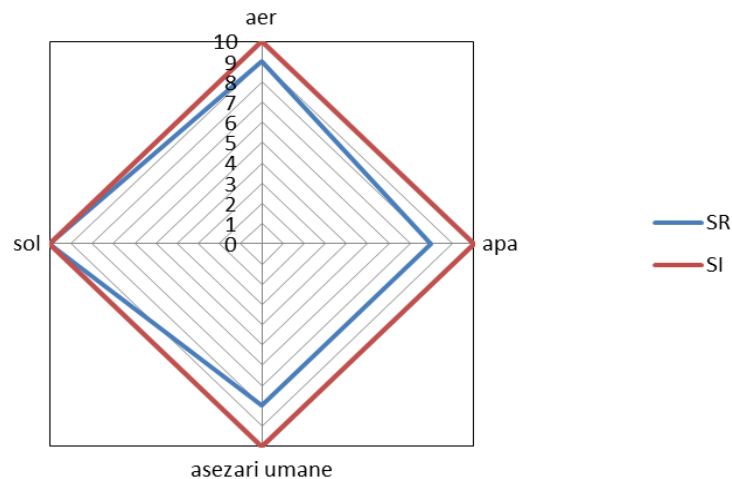


Figure 2. Calculation of the pollution index during the exploitation period

There is also a chart in which the calculation of the pollution index during the execution period is presented, figure 2

4. Conclusions

After performing the impact assessment, it is necessary to present certain conclusions on the recommendation of the fundamental assessment for the execution of the project under maximum safety and environmental protection conditions. These conclusions are made on the degree of impact of environmental factors during the execution and exploitation period. It is mentioned for every studied environmental factor (air, water, soil, human settlements) if it is affected during the execution and exploitation period. In such case, the methods to remove

possible pollutions from every environmental factor should be mentioned.

Finally, a report will be drafted, which is nothing else than an abstract of those presented above. This report should observe the framework content approved by Government Decision 860/2003 and should be followed step by step when the impact assessment is drafted for a certain activity.

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