proceedings

MDPI

Proceedings

Risk Assessment Analysis in a Municipal Wastewater Treatment Plant †

Magdalena Łój-Pilch *, Anita Zakrzewska and Ewa Zielewicz

Institute of Water and Wastewater Engineering, Silesian University of Technology, 44–100 Gliwice, Poland; anita.zakrzewska@polsl.pl (A.Z.); ewa.zielewicz@polsl.pl (E.Z.)

* Correspondence: magdalena.loj-pilch@polsl.pl

† Presented at Innovations-Sustainability-Modernity-Openness Conference (ISMO'19), Bialystok, Poland, 22–23 May 2019.

Published: 13 June 2019

Abstract: Risk management, an aspect of which is risk assessment, is a process supporting the proper function of municipal sewage treatment plants. Many factors affect the quality of treated wastewater. Risk assessment, its analysis, and hierarchization permit the elimination of events with the most destructive impacts on the purification process.

Keywords: risk management; risk assessment; municipal wastewater treatment plants

1. Introduction

Each operator of a system or technical facility is faced with risk. The more complex the functions of the system/object, from a technical point of view, the greater the threats to proper function. Municipal wastewater treatment plants are special facilities. Their exploiters have to deal with many problems, including variable loads of pollutants, extreme hydraulic loads, and adverse weather conditions [1,2]. The implementation of the risk management process is to enable better coping with the effects of adverse events and to prevent their occurrence. In general, the management process can be divided into two stages: risk assessment and risk control [3]. The components of the risk assessment are: identification, estimation, and determination of its acceptability [4]. The subject of the article is to present, using an example, the stages of risk assessment for estimating risk and determining its admissibility.

2. Material and Methods

The risk identified in an earlier stage of research was analyzed [5]. The occurring risk factors (inside, outside, internal, external, latent, explicit) were identified, and the types of risk events (qualitative, operational, ecological, financial) were identified. Based on the obtained results, the frequency of appearance events (F; see Table 1), and the losses (L; see Table 2) are determined and presented in the form of a risk matrix (Figure 1).

Table 1. Frequency of appearance (F).

Occurring Events:	Frequency of Appearance	
	(1/year)	(F)
rarely	≤2	1
often	2–4	2
very often	≥4	3

Table 2. Losses (L).

Type of Risk	Amount of Losses (L)
Qualitative	1
Qualitative, operational	2
Qualitative, operational, financial	3
Qualitative, operational, ecological, financial	4

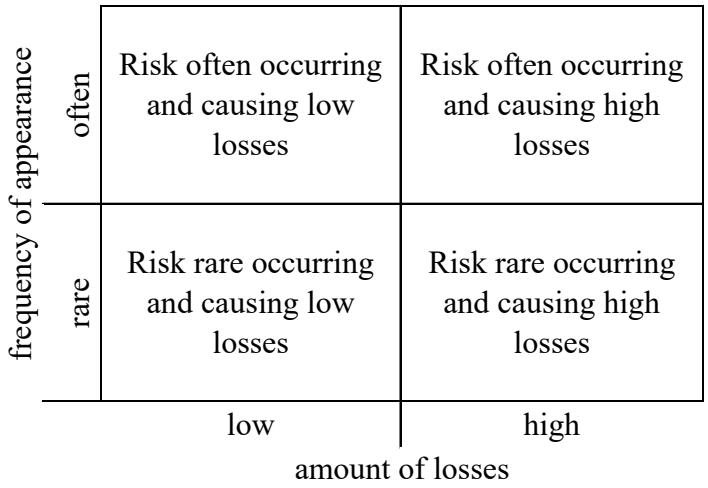

Figure 1. The simplest risk matrix—a risk map [6].

3. Results and Conclusions

The risk admissibility is determined on the basis of legal acts and adopted standards. Generally, risk levels are: acceptable (low), tolerable (medium), and unacceptable (high) risk. On the basis of the obtained risk map (Figure 2), individual areas defining risk admissibility can be determined.

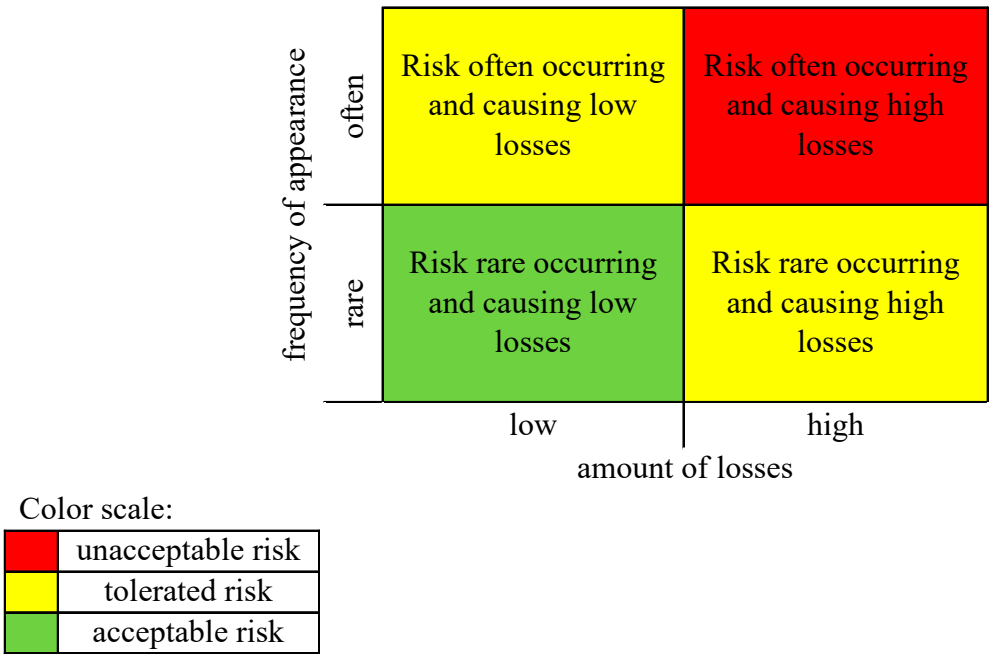

Figure 2. Risk hierarchy.

Analysis of the risk map along with its hierarchy provides the possibility for better management of the facility, and an awareness of the possibility of risk. The risk map of the analyzed wastewater treatment plant is presented in Figure 3.

Figure 3. The risk map of the analyzed object.

All events that occurred in the analyzed period are within the acceptable and tolerated range. These results indicate good functioning of the analyzed treatment plant.

Author Contributions: M.Ł. analyzed the data and contributed reagents/materials/analysis tools; M.Ł., A.Z., and E.Z. wrote the paper.

Acknowledgments: This work was supported by Research Funds For Young Researchers awarded to the Institute of Water and Wastewater Engineering of the Silesian University of Technology.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Andraka, D.; Dzienis, L. Required reliability level of wastewater treatment plants according to European and Polish regulations. *Zeszyty Naukowe Politechniki Białostockiej. Inżynieria Środowiska* **2003**, *16*, 24–28.
2. Żaba, T.; Krolikowski, A.; Królikowska, J. Failure frequency for a small water treatment plant. *Inżynieria Ekologiczna* **2011**, *24*, 215–225.
3. Kulińska, E. Metods for risk analisys in logistics processes. *Logistyka* **2011**, *2*, 385–409.
4. Iwanejko, R.; Rybicki, S. M. Risk management for sewage treatment plants. Part I: Does risk management for sewage treatment plants make sense? *Gaz Woda i Technika Sanitarna* **2008**, *2*, 10–13
5. Łój-Pilch, M.; Zakrzewska, A.; Zielewicz, E. Identification of threats that may pose a risk on municipal sewage treatment plant. *Instal* **2018**, *4*, 61–63
6. Zawarska, J. Identyfikacja i pomiar ryzyka w procesie zarządzania ryzykiem podmiotów gospodarczych. *Zarządzanie i Finanse* **2012**, *1*, 65–75

© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).