



A Model for Risk Assessment of Wastewater Collection Networks

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Abstract

Wastewater collection networks are constantly faced with crises and risks, because of some problems during their operation. Assessment of risk in these networks is essential, because of its effects on human health and environment. In this paper a model is presented for increasing readiness of sewer networks to face the crisis. To calculate the network risks, at first possible threats are identified, then with the opinion of experts, the threats are ranked and those by higher hazard for the risk analysis are considered. Risk parameters, probability of threats, severity of their impact and vulnerabilities of network components have been measured by fuzzy multi criteria decision making methods, questionnaire and defined criteria. The relative weights of the criteria are obtained of paired comparisons by hierarchical fuzzy, Buckley method. Then Bunisson method is also used for comparison of the options' grade about any of the criteria. Thus the risk of any threat is achieved from the fuzzy multiplication of its independent factors including the threats occurrence probability, severity of its impact and network components vulnerability from the threats. Considering the magnitude of the calculated risks, threats are classified in several groups (low risk threats to high risk threat) and therefore approaches to dealing with each category are defined on the basis of those risks. These approaches are divided into three main categories, dealing with risk, risk transfer or risk acceptance. This method has been studied for a regional wastewater collection network in Tehran.

Keywords: Risk Assessment, Risk Management, Wastewater collection system, Multi Criteria Decision Making, Fuzzy Sets, Analytical Hierarchy process.

1. Introduction

According to high cost of renovation projects of wastewater collection systems, a model must be developed to evaluate the readiness and performance of networks especially in critical situations. Because many of the problems associated with these networks occur during the operation and in unusual conditions that is not considered during design time. The aim of this paper is to provide a model for evaluation of possible risks in a wastewater system. Thereby before occurrence of any event, possible consequences are identifying. In studies so far mostly network hydraulic performance is measured to understand the actual behavior and planning for principles operation and management of networks. The main objective of a wastewater collection network is the network's ability to service during its life cycle under various operating conditions. Tabesh and Madani (2009) calculated the performance and reliability indicators of network components. The calculation results were extrapolated to the entire network and so they found overall network performance indicators. Determination of the performance indices showed different states of vulnerability in the pipe network which can lead to efficient technical management of networks after design [1]. In general procedures and instructions have been prepared and developed for management and risk assessment of water and wastewater networks. One important way is Risk Analysis and Management for Critical Asset Protection