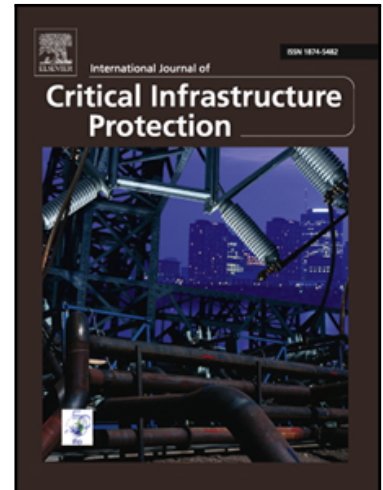


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Vulnerability Analysis of Critical Infrastructures in the Case of a Semi-Centralised Water Reuse System in Qingdao, China

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Abstract: Urban centres in newly industrialised countries are experiencing rapid population growth, which poses challenges for infrastructure planning. Semi-centralised water infrastructures have a modular architecture that enables water reuse, and thus they are able to meet these challenges. Since such socio-technical systems represent critical infrastructures, it is appropriate to analyse their vulnerability to internal and external hazards (*e.g.* technical failure, drought) as well as their dependencies on other infrastructures (*e.g.* energy supply). The vulnerability analysis in this paper focuses on the pilot plant of a semi-centralised water infrastructure in Qingdao, China, and uses a newly developed methodology combining expert discussions, questionnaires, a vulnerability assessment heuristic, and cross-impact matrices. The results identified the technical components that were more vulnerable to hazards or the failure of other components. This applied mainly to technical components in the resource recovery centre (RRC). Hazards and system components that have the greatest impact on the vulnerability of other components were also identified. This applied mainly to human failure and the RRC control system. It can be concluded that vulnerability management measures need to focus on the identified hazards and system components. Furthermore, measures to minimise health risks for users should be specifically analysed.

Keywords: blackwater, greywater, socio-technical system, source separation, water infrastructure

INTRODUCTION

Water infrastructures supply drinking and service water and safely dispose of domestic wastewater. A centralised infrastructure design has proven to be appropriate for urban agglomerations in the West for the last 150 years, however urban centres in newly industrialised countries, *e.g.* China, India and Brazil, are experiencing rapid population growth. Moreover, cities in semi-arid regions have to deal with the challenge of water scarcity, which is being exacerbated by climate change. Dealing with these challenges, particularly when they occur simultaneously, requires water infrastructures that are adaptable and flexible [1–3].

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