

ABSTRACT

The failure of the Wastewater Treatment Plant (WWTP) operation in the CV.XYZ tofu industry in 2023 shows the weakness of conventional approaches in facing operational, technological, financial, and environmental challenges. This research offers the novelty of integrating three risk analysis methods, namely HORShe, ISM, and ANP to design a comprehensive and structured wastewater mitigation strategy in small industries. HORShe was used to identify and prioritize risk agents. This study found a total of 28 risk events and 20 risk agents identified, with prioritization based on the highest ARP value of 9 risk agents such as A14, A10, A15, A6, A5, A3, A11, A20 and A2. ISM was used to reveal the hierarchical relationship between risk agents, and ANP to determine the most effective mitigation strategy based on the level of influence, interconnectedness, and difficulty of implementation. The results showed that the absence of SOP (A10) was the main root cause of other risk agents, while the ANP results showed that the most prioritized strategy recommended was the creation of SOP (PA1) that could minimize risk agents A2, A3, A6, A10, A11 and A20. This research not only produces technical recommendations, but also provides a risk-based policy framework that can be replicated in similar industries. Focusing on the context of the small-scale tofu industry in Indonesia, this study enriches the environmental risk management literature and provides an alternative model to support sustainable WWTP implementation.

Keywords: *Wastewater treatment, WWTP, Risk Management, HORShe, ISM, ANP.*