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## Detecting Pipeline Leakage in Long-Distance Water Transmission: Case Study in Liaoning Province, China

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Pipeline leakage inevitably occurs in the long-distance water transmission process. If a leak cannot be identified and processed promptly, it can cause severe economic losses or environmental pollution. This paper proposes a method to evaluate pipeline leakages in long-distance water transmission. The pipeline located in Liaoning Province was selected; it is 63.97-km long and runs from west Shenyang to Liaoyang city. Flowrate time-series data were obtained from two flowrate stations; the data were measured using ultrasonic flowmeters. The variance and mean values of flowrate time-series data were determined and used to evaluate whether pipeline leakage occurs. A Chi-Square test was used to test if the variance of a flowrate time-series was equal to a specified value. The results indicate the following: (1) the method of variance test can be used to evaluate whether the pipeline operation is abnormal or not; (2) when the variance test on time series data of flowrate is abnormal for more than two days, the pipeline leakage situation can be evaluated; (3) the combination of the variance test and the mean value analysis can help locate the leak position, which provides a reference for site personnel. The method proposed in this paper can detect pipeline leakage in a timely manner, and further ensure normal water transmission operation in many cities downstream.