

# Best Practices for Liquid Analyzer Installation in Water and Wastewater Treatment

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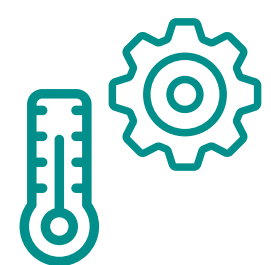
## INTRODUCTION

Liquid process analyzers are essential for real-time monitoring in water and wastewater treatment. Their ability to deliver reliable, high-quality data depends not just on the instrument itself, but on how it is installed, integrated, and maintained. Key factors, such as sample temperature, pressure, flow rate, utility quality, and environmental conditions, impact the performance. Design oversights, such as improper sampling, insufficient access, or unstable utilities, can lead to drift, downtime, or even failure.

These issues often stem from oversimplified planning that underestimates the analyzer's system-level requirements. When treated as a standalone component rather than part of a broader process, the analyzer is set up to underperform. Long-term success depends on deliberate engineering choices that account for installation environment, maintenance needs, and communication infrastructure from the outset.

## T.R.A.C.E. APPROACH FOR ANALYZER SUCCESS

The T.R.A.C.E. approach outlines five design priorities that drive analyzer reliability, sustainability, and data quality. Early planning using these principles helps avoid common installation challenges. Effective system design ensures the sample reflects the true chemical and physical properties of the process stream and reaches the analyzer without compromising measurement integrity [2].



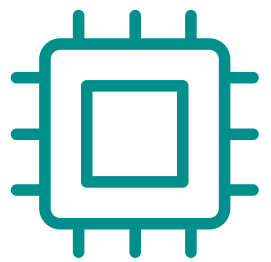
**T**emperature and Utilities: Establish and maintain stable temperature, pressure, flow, and clean power



**R**epresentative Sample: Deliver clean, filtered, and timely samples



**A**ccessibility: Ensure space for maintenance and remote visibility



**C**ontrol Integration: Connect to control systems for data and diagnostics



**E**nvironmental Compliance: Match location to safety, drainage, and enclosure needs.

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### REFERENCES

[1] Swagelok, "Sampling System Issues That Can Cost You," Swagelok Reference Point Blog, 2022. [Online]. Available: <https://www.swagelok.com/en/blog/sampling-system-issues-that-can-cost->

[2] ASTM International, "Standard Practice for Validation of Process Stream Analyzer Systems," ASTM D3764-01.

## REPRESENTATIVE SAMPLING

- Sampling errors account for nearly 80% of analyzer performance issues[1]. Most problems begin before the sample reaches the instrument.
- Fast-loop sampling maintains integrity, reduces lag, and ensures the analyzer sees fresh, process-relevant material.
- Dead-end sampling introduces purge delays and increases the risk of analyzing stale or unrepresentative data.
- Different grab and on-line sampling points create false discrepancies and undermine trust in the data.
- Proper sample conditioning, including filtration, flow control, and temperature stabilization, protects the analyzer and improves measurement accuracy.

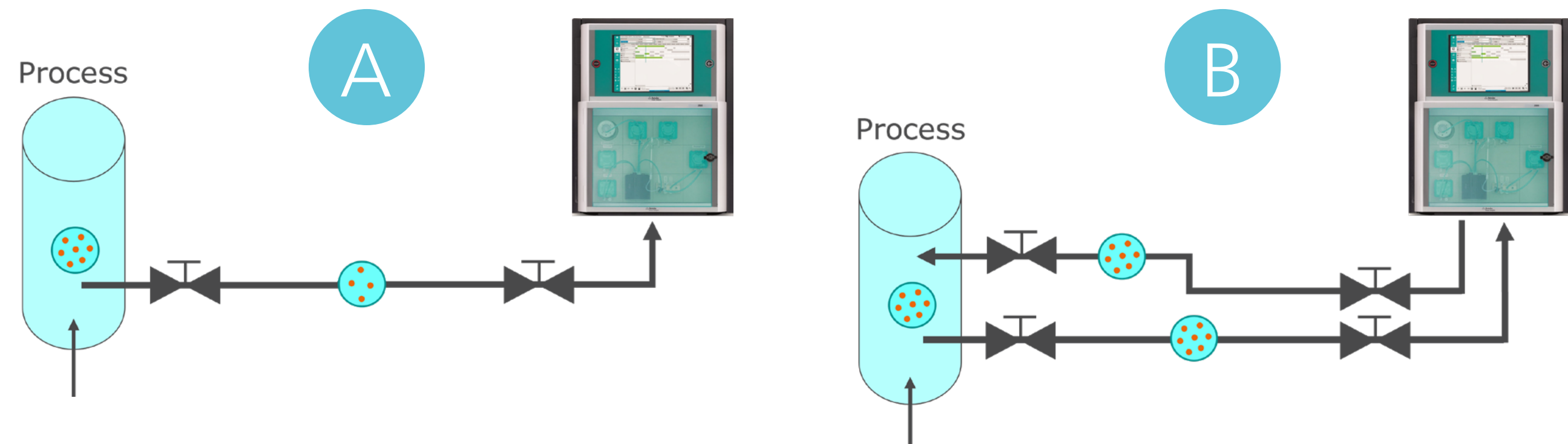


Fig. 1: Dead-End Sampling (A) vs. Fast-Loop Sampling (B).

## INTEGRATION & ENVIRONMENTAL DESIGN

Analyzer reliability depends not only on good sampling, but also on how well the system fits the plant environment. Factors like physical access, power quality, and connectivity all influence performance. Poor placement or limited visibility can delay maintenance. Electrical noise and lack of diagnostics can lead to erratic readings or downtime. Thoughtful design helps teams spot problems early, maintain the system efficiently, and keep the analyzer delivering dependable data.



Fig. 2: Analyzer installed in a harsh, low-visibility environment with poor access and high humidity. These conditions increase maintenance burden and risk of failure.

Designing for access, stability, and connectivity protects the analyzer and ensures long-term performance.

## CASE STUDY: IMPACT OF DEAD-END SAMPLING

A single analyzer was implemented to monitor multiple points through long, dead-end sample lines. Without continuous flow, each measurement pulled from stagnant sample trapped in the line. In the worst case, a 1/4" line required 15 analysis cycles to clear, and with one analysis every four hours, the result reflected conditions nearly four days out of date, misleading operators and delaying critical adjustments.

Tank	Line Length (ft)	Line Volume (mL)	Analysis Cycles to Purge	Result Delay (days)
1	26	238	6	1.6
4	39	357	10	2.4
7	62	567	15	3.9

Table 1: Dead-End Sample Lines Delay Real-Time Analysis

Switching to a fast-loop configuration reduced purge time to under one minute and ensured the analyzer always received fresh, process-representative samples. The change improved response time, restored trust in the data, and eliminated the need for excessive reagent use and manual validation. This case highlights why representative sampling is the most critical element of the T.R.A.C.E. method, and why proper planning matters more than just plugging in the analyzer.

## CONCLUSION

A successful analyzer installation requires more than just the right hardware. Using the T.R.A.C.E. approach helps teams design for performance, not just compliance. Thoughtful sampling, system integration, and access planning reduce maintenance burden, improve data reliability, and extend the analyzer lifespan.

