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Are your decisions based on obtained data?

Let's talk about how operators and engineers make decisions over utility water systems. Take this short quiz; give your plant one point for each "true" answer and zero for each "false" answer:

	T	F	
1.	__	__	The plant log sheets show specification limits.
2.	__	__	Operators or central lab are responsible for validating accuracy of non-conforming test results.
3.	__	__	All data are logged into an electronic database.
4.	__	__	The operator or central lab chemist enter data into the database *and* validate accuracy of data.
5.	__	__	*All electronic data* are stored on a server and accessible to *all* plant personnel.
6.	__	__	Critical data are automatically tabulated into trend graphs in the centralized database.
7.	__	__	The plant engineers have identified key performance indices (KPIs) and key operating indices (KOIs).
8.	__	__	The plant engineers tabulate compliance statistics for KOI and KPI data.
9.	__	__	The operations and tech-service personnel are trained to modify trend graphs and to conduct statistical analyses on the data.
10.	__	__	Operations and tech-service regularly review and use data to troubleshoot and to optimize operations.
	__	__	
	Total		

Measuring up. A perfect score (10) means that your plant personnel are tracking the health of your utility water systems and making data-based decisions about changes and corrective actions. Plants with less than a perfect score should ponder whether they are relying on experience, judgment or just plain "guessing" to determine the proper corrective action instead of analyzing data.

Date validation. Specification limits are analogous to speed limits. Without written limits on the log sheets, it's impossible for operators to have confidence that the process is in control. Most plants require an operator or central lab chemist to analyze a grab sample. However, most plants don't have a procedure to confirm *the accuracy* of the analysis. Analyzing the accuracy of data is important when testing results fail to conform to the specification limits, e.g., validate by exception. Many strategies can be used to validate analytical test results. Here is an example for this very complex subject.

First, it is reasonable to assume that the individual test results will follow a normal distribution. Second, the process engineer must specify the repeatability limit. Repeatability is a metric for test results when the same operator or chemist uses the same method on identical samples in the same laboratory using the same equipment in a short interval of time. The repeatability limit is the maximum difference between two test results. Process engineers establish a repeatability limit as "95%." For a single pair of test results, there is a 95% probability that the difference between the two results will be less than $1.96 \times 2 \times (\sigma^2)^{1/2}$ (see Eq. 1). In a normal distribution, 95% of all data is within 1.96 standard deviations (σ_r) of the mean.

$$\text{Repeatability limit} = 1.96\sqrt{2\sigma_r^2} \quad (1)$$

Data storage. In refineries and chemical plants, process units have electronic data storage in a location easily accessible to all plant personnel. But, surprisingly, many plants have not yet converted to the same system for data management of utility water systems. Collecting data from individual paper log sheets is so time consuming that most engineers choose not to invest the time and effort in creating the historical trend charts.

Engineers who master the software tools (data trending, statistical analyses) can take advantage of the carefully-gathered-and-validated data in the centralized database. Some plants create default trend graphs to simplify the user's review; however, training operations and tech service personnel to modify trend graphs and conduct statistical analyses on the data is the key to making data-based decisions for troubleshooting and optimizing operations. Training operations and tech-service personnel to modify trend graphs and conduct statistical analyses on the data is the key to making data-based decisions for troubleshooting and optimizing operations.

Indices and specifications. Constructing KOI and KPI trends is a simple way for organizations to manage process improvement. Plant personnel are responsible for identifying operating (KOI) and performance (KPI) parameters that are necessary to maintain reliable waterside operation. In cooling water systems, a KPI may be a maximum limit for admiralty corrosion rates as measured by corrosion coupons, while a KOI may be a minimum limit and/or a maximum limit for cooling water conductivity.

Plant personnel must establish specification limits for each KOI and KPI parameter based on industry standards, treatment program application guidelines and/or experience. Establishing a minimum acceptable compliance to the specification limits and tabulating compliance allows engineers and managers to focus on the "vital few" systems that require improvement. These benchmarks also provide clear targets for operator performance.

Summary. Data and sound analysis of that data provide the foundation for all improvement processes. Plant personnel must make a clear commitment to making decisions based on verifiable data, not assumptions and guesswork. HP

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