Sustaining Utility Compliance When Using Contract Laboratories

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Most utilities must conduct a wide variety of tests on wastewater, stormwater, reuse water and drinking water to meet federal, state, and local compliance criteria. Because of the rising cost of maintaining National Environmental Laboratory Accreditation Conference (NELAC) certification for analytical testing, rising staff costs, and rising equipment costs, many utilities use contract laboratories for the more exotic or less frequently required tests. It is just not cost effective to maintain analytical capability to test analytical parameters a few times a year.

Over the past several years, I have noticed a continual drop in contract laboratory data quality. For example, results of 110,000 milligrams per liter (mg/L) of chloride for a raw water production well and total dissolved solids values of 9,000 mg/L for finished water are not isolated incidents. Unfortunately, other laboratory managers, as well as utility operators, are voicing the same concerns. This situation places the utility in a serious situation, since many quality problems can result in non-compliance status.

The assessment of our final product, whether reuse effluent or finished drinking water, is only as good as the analytical testing that produces the result. Invalidating contract laboratory data is sometimes difficult, and many times there is no chance to recollect the sample within the compliance period. The result is that the utility will be in non-compliance status.

The reality is that contract laboratories may receive several hundred samples daily, with some samples requiring analysis of over 100 analytes. Sample loads do not allow them to invest the care during processing, analysis, and reporting that the utility laboratory might invest. Because the utility's compliance depends on the result of the samples, a utility laboratory has a vested interest in ensuring high-quality analysis through extra care during the analytical process and comparison of results with compliance limits and historical data.

There are two important components in sustaining compliance when using contract laboratories. The first is to educate contract laboratories on the importance of the samples. Not only could the utility face hefty fines for inaccurately analyzed samples, but the health and safety of thousands of people could be at risk.

Compliance monitoring periods are specific and stringent. If the contract laboratory does not report the data in time to allow reanalysis or recollection, the utility may find itself in non-compliance. Some monitoring, such as that for the lead and copper rule, may not be recollected. Careful analysis the first time is critical.

In Broward County, drinking water reports are due the by the 10th of the month for the previous month, which requires turnaround times of less than seven days to allow for report generation and review. Utilities rely on contract laboratories to provide accurate data with short turnaround times.

The second component in sustaining utility compliance when using contract laboratories is to select the right laboratory and to work with the laboratory to ensure accurate, timely results. A carefully crafted scope of work that outlines the sample load, the expected analyses, and sample matrices, along with the following requirements or specifications, increases the likelihood of meeting the utility's analytical needs:

- Specify turnaround times.
- Specify the desired report format.
- Specify the sample pickup procedure and shipping responsibility.
- Specify the bottle provider and source.
- Specify the preservative provider (in sample bottles or separately).
- Provide a copy of the laboratory quality manual.
- Provide a copy of the latest proficiency sample results (after study closes).
- Provide proof of certification for each analyte.
- Require all analytical work to meet NELAC requirements.
- Specify that only NELAC certified tests may be used.
- Specify that all samples are analyzed within holding times.
- Specify that no payments will be made for samples analyzed out of holding time or qualified because of laboratory error.
- Specify that all samples are analyzed by the agreed upon method.
- Specify that all non-conforming samples be qualified or flagged.
- Require the laboratory to maintain certification for all required analytes.
- Require all subcontractors to be NELAC certified for the subcontracted test.
- Require all subcontractors to be approved in writing before use.
- Require the laboratory to notify the utility of any failed proficiency test samples.
- Require the laboratory to maintain thermal preservation during hurricanes/power outages.
- Require the laboratory to submit the results of external agency audits.
- Specify QA level reports with data reports.
- Require re-analysis of samples upon request.
- Require raw data upon request.
- Require the ability to visit/audit the laboratory as needed.

After reviewing the quality manual, proficiency study results, certification status for all analytes of interest, and recent audit results, the best laboratory may not be the lowest bidder. A contract laboratory with a strong quality system, certification for every

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analyte of interest, and passing proficiency studies will be less expensive over time. An onsite visit should be conducted before making the final selection.

Once the laboratory has been selected, the utility must work with the laboratory staff—especially the project and contract manager—to provide as much information as possible about each project and sample. The utility should provide the following information for each project before submitting any samples for analysis:

- Number of samples
- Site descriptions
- Matrices
- Analytical tests
- Specific methods
- Compliance limits
- Historical data ranges

Almost all contract laboratories use an automated software system, Laboratory Information Management System (LIMS), to track and manage samples and data. The laboratory may be able to program the compliance limits, as well as historical data ranges, for each sample or project so that the analyst or data reviewer receives notice of any data excursions.

Before the beginning of each sampling period (monthly works nicely), the utility should send the contract laboratory a schedule with the planned project dates, number of samples, matrices, analytes, and notes regarding short holding times. This information should be sent to the laboratory with enough time to ensure delivery of sample bottles and preservatives. Pick-up times should be coordinated to ensure analysis within holding times for short holding-time samples.

Prompt review of reports is critical to allow for re-analysis and resampling. The validation process for each project can be quickly and easily conducted using a predetermined set of checks for each project. The following elements, as well as any other checks critical for a particular project, may be included in a checklist:

- Correct field information (date, time, sampler, field identification numbers)
- Correct field test data entry
- Specified and certified analytical methods used
- Sample holding times met
- Data within historical ranges
- Data within compliance limits
- Data qualifiers acceptable
- Laboratory quality control within acceptable limits

If the data does not pass these checks, the utility should contact the contract laboratory for corrections, recalculations, or re-analysis. There may still be time to save the data. Since even a trained eye can overlook a check when reviewing data, it is helpful to always use the checklist. Also, the checklist form provides documentation of the data validation process.

After careful laboratory selection and performance of the data validation process, the utility is rewarded by discovering data issues. Data problems will arise. If data validation never detects excursions or problems, the data validation process is ineffective and must be re-tooled.

Corrective actions should be initiated when a problem is discovered. The contract laboratory should investigate the cause, propose corrective actions, and report back to the utility. All findings should be documented.

Over time, trends in the data may become visible, such as low-level contamination for zinc or frequent errors in a particular laboratory section, such as the metals. At this point, an audit of the contract laboratory may help to identify the cause of the problem.

When conducting the audit, an experienced auditor with an analytical background or a chemist with some auditing experience is helpful. A quality assurance contractor may be used if the utility does not have the in-house staff for this type of work.

If data quality problems or other difficulties such as the inability to meet turn-around times persist, it may be time to move on to the next laboratory. The steps outlined here will not ensure that a contract laboratory will provide good data, nor will these steps ensure compliance with regulatory limits. These steps will increase the likelihood of obtaining timely, good-quality data. A utility may have to change laboratories several times before finding a contract laboratory to meet its needs.

The question remains, "Why is it so difficult to find an excellent contract laboratory when NELAC regulations are tighter than ever?" The answer may be that while documentation, traceability, and other requirements are stringent, these requirements are time-consuming.

Laboratories may be so focused on meeting the documentation requirements that simple error prevention (such as making sure that the correct sample bottle is analyzed or that the correct dilution factor is applied to the result calculation) is not reinforced. Errors such as 110,000 mg/L for chloride, most likely due to sample mix-up or incorrect dilution factor, could be eliminated or reduced with more attention to the basics of laboratory analysis.

In order to obtain good data in a timely manner, the utility must work with the contract laboratory and the contract laboratory must understand the importance of accurate, timely analysis and reporting. These two elements will help ensure that data meet regulatory requirements and will allow utilities to sustain compliance. Otherwise, utilities may be forced to conduct the work themselves through cooperative arrangements or appeal to laboratory accrediting agencies for more effective approaches for error prevention and faster turn-around times.