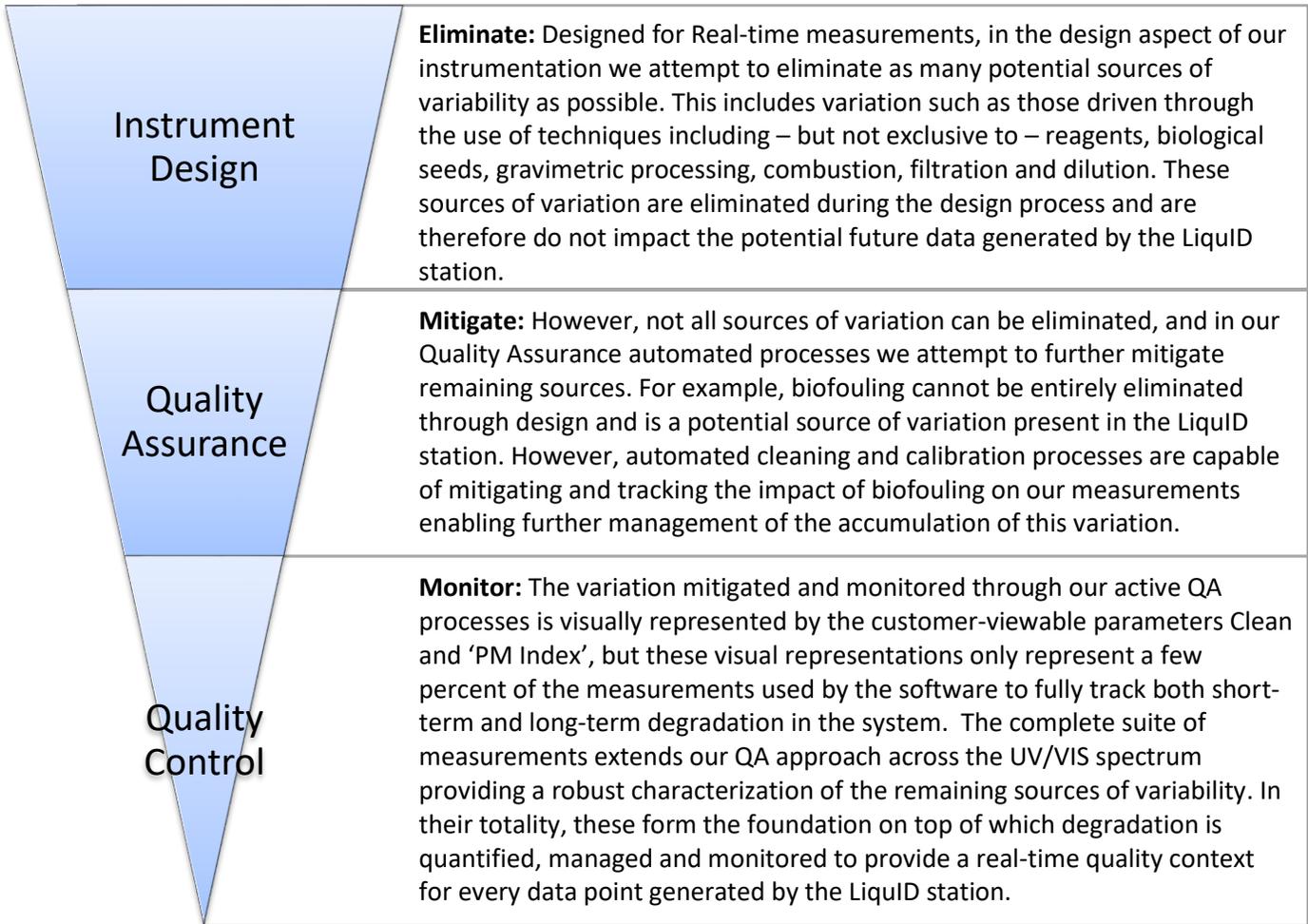# Continuous Quality Management

## Real-time data demands real-time QA/QC

ZAPS Technologies' quality management chain forms a quality assurance scaffolding that supports every LiquID station HMA reading. Our quality processes are ongoing, integrated readings which are used to evaluate station performance, identify external issues impacting data continuity or evaluate the quality of maintenance being performed.

### All Variability

This active management process for handling variability extends from our instrument design process through the minute-by-minute generation of real-time water quality data.

### Instrument Design

**Eliminate:** Designed for Real-time measurements, in the design aspect of our instrumentation we attempt to eliminate as many potential sources of variability as possible. This includes variation such as those driven through the use of techniques including – but not exclusive to – reagents, biological seeds, gravimetric processing, combustion, filtration and dilution. These sources of variation are eliminated during the design process and are therefore do not impact the potential future data generated by the LiquID station.

### Quality Assurance

**Mitigate:** However, not all sources of variation can be eliminated, and in our Quality Assurance automated processes we attempt to further mitigate remaining sources. For example, biofouling cannot be entirely eliminated through design and is a potential source of variation present in the LiquID station. However, automated cleaning and calibration processes are capable of mitigating and tracking the impact of biofouling on our measurements enabling further management of the accumulation of this variation.

### Quality Control

**Monitor:** The variation mitigated and monitored through our active QA processes is visually represented by the customer-viewable parameters Clean and 'PM Index', but these visual representations only represent a few percent of the measurements used by the software to fully track both short-term and long-term degradation in the system. The complete suite of measurements extends our QA approach across the UV/VIS spectrum providing a robust characterization of the remaining sources of variability. In their totality, these form the foundation on top of which degradation is quantified, managed and monitored to provide a real-time quality context for every data point generated by the LiquID station.

### Real-time Data

**Report:** Finally, at the end of the Quality Management Chain, both real-time data and the automated QA processes are reported in a manner that they can be easily interpreted and used to support managerial evaluations or regulatory audits. An aggressive real-time QA/QC approach ensures output from the LiquID station is reported with a high degree of certainty and provides a contextual means that facilitates its immediate use.

In a practical sense, our quality management chain results in real-time data that can be relied upon and used in real-time. In the following graph, a 2-year UVA record from the LiquID station has been supplemented by 441 grab sample results as entered into the LiquID station WUI grab sample tracking functionality by customer lab personnel. The LiquID station UVA data has been plotted as a daily average and consists of 472,527 real time UVT readings. The resulting graph, with $R^2$ of 0.91, is a testament to the strength of this type of automated QA process in favorable contrast to the traditional lab QA method which requires manual intervention during each lab reading.

## LONG-TERM DATA STABILITY



Figure 1: 2-year LiquID station WUI screenshot. Graph comparison of LiquID station daily average UVA data and Lab UVA data; statistical summary compares direct measurement times.
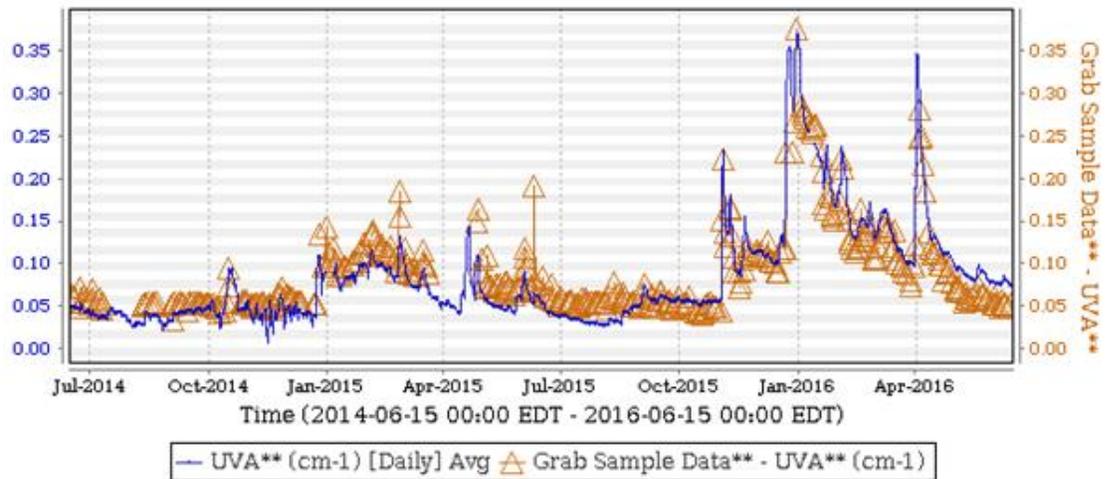
| | Traditional Lab | HMA (LiquID) |
|---|---|---|
| Readings (#) | 441 | 472,527 |
| Data Type | Daily Composite | Daily Average |
| Data availability | Grab Sample | Automated every 2 min. |
| Correlation | | $R^2 = 0.91$ |

As a manufacturer of real-time water quality monitoring instrumentation, the framework that we apply to ensure the quality of our data is of paramount importance. In mission-critical applications, ensuring that every data point is underwritten by a firm scaffolding of Quality Assurance controls ensures that the data delivered to the end user can be relied upon to deliver the accuracy, completeness, consistency and timeliness[4] demanded by information consumers. This framework also allows the data to be used – over extended periods of time – for applications such as networking, process control, visualization and data mining. In these and many other applications, the value of the data is proportional to the length of time between the data generation and when that data can be ultimately relied upon to be used. Real-time data demands real-time quality assurance.

Additional information on this topic can be found in the paper, 'Real-time QA/QC' available through this LINK  or via any of the following methods:

### Contact ZAPS for More Information

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