Process Research Solutions, LLC

Process Research Solutions, LLC
PO Box 5593
Madison, WI 53705

www.processresearch.net

# Format for Monitoring Project Summaries

## Using the PRS Monitoring Stations or Related Monitoring Techniques

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## Using the PRS Monitoring Stations or Related Monitoring Techniques

## Background

This document describes a report format for presenting summarized water system monitoring data. The format is streamlined because the concepts behind the project approach are already described in the book, *Water Distribution System Monitoring: A Practical Approach for Evaluating Drinking Water Quality* (CRC Press, 2009). This book includes concepts of water chemistry and water quality, development of monitoring strategies, selection of key water quality parameters to track, and the use of a PRS Monitoring Station as a standardized apparatus at which to collect water samples representative of the water distribution system.

While the book advocates on-going routine monitoring for control of water quality, the monitoring efforts are many times divided into special projects with set goals. Even for routine monitoring efforts, it is useful to summarize the monitoring results during a budget period as a basis for planning the next budget period.

The intent is that each report can stand by itself to describe and present a monitoring project. Also, because of the same format being used for all reports, one monitoring project can easily be compared to another.

## Project Description

The Monitoring Project Summary report opens by briefly describing the background information of the project:

- Water Utility name
- Project title
- Project description
- Project goals
- Date range of project
- Sampling sites

The sampling sites can be:

- PRS Monitoring Stations (described in the *Water System Distribution Monitoring* book)

- Residences or other buildings in the distribution system
- Pipe film analyses from harvested pipes or from PRS Monitoring Station metal plates
- Lead and Copper Rule or other regulatory compliance sampling sites

## Water System Description

The reader can get a quick understanding of the type of water that is being tested by reading a description of:

- Water source
- Water treatment
- Water system configuration

## Summary of Results

Results are summarized by grouping water quality parameters into the following categories:

- Influent Water Quality – These parameters describe the water that flows into the sampling site and are analyzed from samples taken from flowing water. Examples of parameters are: total alkalinity, total hardness, background total and dissolved levels of iron, manganese, lead, and copper, etc.
- Operating Parameters – These parameters describe chemical conditions or treatments applied to the water. Examples of parameters are: pH, temperature, concentration of disinfection chemicals, concentration of corrosion control chemicals, etc. It is up to the author as to which parameters to define as influent water quality parameters and which to define as operating parameters.
- Reactions – These are parameters that describe the water after it has stagnated at the sampling site. After filling the site with influent water, the stagnation period allows time for chemical and microbiological reactions to occur. Examples of parameters are: total and dissolved lead and copper, heterotrophic plate count, nitrite, nitrate, etc.

## Conclusions

The first question to answer for any project is: Were project goals met? The first sub-section of the “Conclusions” is “Goals Addressed”.

The *Water System Distribution Monitoring* book emphasizes that most water quality issues are results from debris in pipelines and from biostability issues (i.e. inadequate disinfection). This report format addresses those issues directly in the “Conclusions” section with the sub-sections, “Debris” and “Biostability”.

The suppression of lead and copper concentrations and any other special issues can be addressed in this section as well.

## Recommendations

The "Recommendations" section describes what action should be taken next based on the results of the monitoring efforts in the described project.

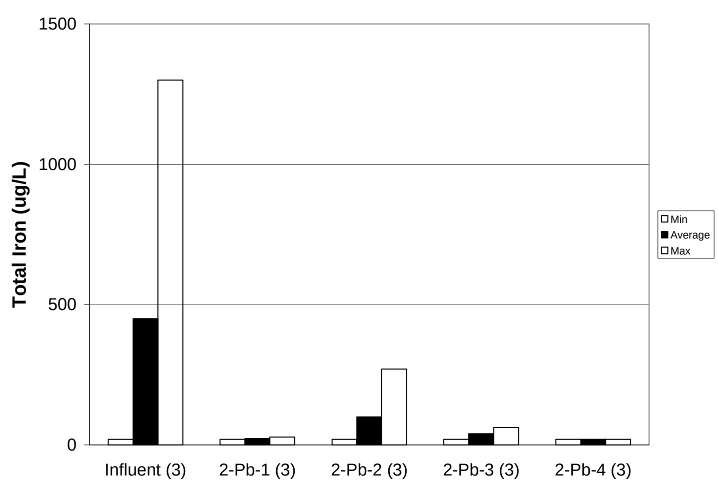
## Average and Range Graphs

Data for a project period are summarized in "average and range graphs" for quick comparison of results. The average of all data points for a parameter at each sampling site in the given project time period is shown on a bar graph for the purpose of quick comparisons.

Equally important is the variation of the data experienced during the project period. Variation is plotted on the bar graph as the minimum and maximum values observed for a parameter. The difference between the maximum and minimum values measured for a data set is called, "range".

Also important is the number of data points in a data set. The larger the data set, the more information on data trends has been captured. In cases where, for instance, dissolved lead is compared to total lead, a small data set can result in the dissolved concentration being larger than the whole (total concentration). One must take into account the size of the data set in their assessment of the data. The size of the data set is shown on the x-axis of the graphs by adding the number of data points in parentheses after the sampling site identification. For instance, for the influent sample tap to a monitoring station for a parameter that was measured 3 times in the project period, the label, "Influent (3)", will be placed on the x-axis. See Figure 1.

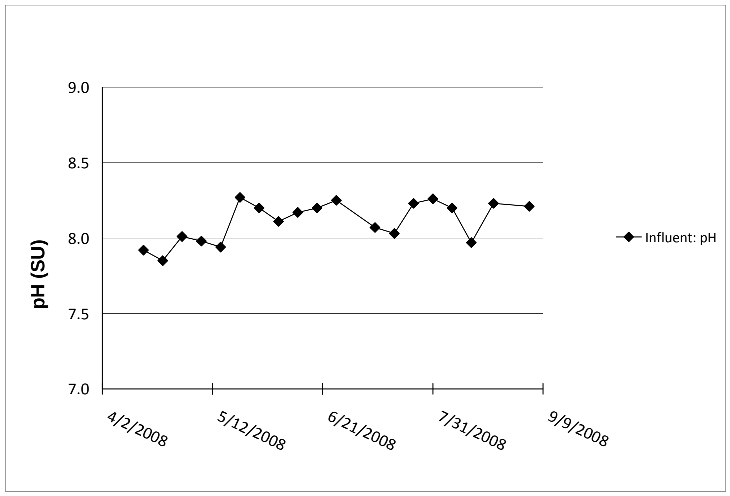
**Figure 1. Example of an Average and Range Graph**



## Time-series Graphs

Besides perusing the summary statistics (average and range) for each parameter, it is important to look at a graph of these parameters over time in order to get a better idea of what was occurring in the water system during the monitoring period. To this end, data are plotted in time-series graphs of each parameter at each sampling site. See Figure 2.

**Figure 2. Example of a Time-Series Graph**




For all graphs and calculations using the monitoring data, a value of "0" will typically not be used when a concentration of a parameter is not detected. Each analytical method has a limit of detection (LOD). Laboratories typically report concentrations below the LOD as "nd", "not detected", or <[LOD]. In those cases, the data management software, My Monitoring Data®, uses the limit of detection for the concentration.

## Raw Data

The raw data are listed in a final appendix of the report. This data can clarify any remaining questions about the trends experienced during the monitoring period. And, the data can be used in other projects for comparison of results, especially when the standardized monitoring stations are used.

## Project Comparisons

Summary reports can be compared to each other to look for other trends, such as:

- Comparison of residential sampling data to PRS Monitoring Station data
- Comparison of one water system against another
- Comparison of entry point monitoring data to that from an area of high water age.