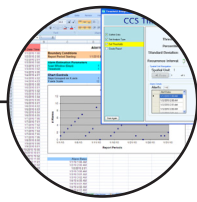
United States
Environmental Protection
Agency

Customer Complaint Surveillance Primer

For Water Quality Surveillance and Response Systems



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Introduction

A Water Quality Surveillance and Response System (SRS) provides a systematic framework for enhancing distribution system monitoring activities to detect emerging water quality issues and respond before they become problems. An SRS consists of six components grouped into two operational phases, surveillance and response. The surveillance components are designed to provide timely detection of water quality incidents in drinking water distribution systems and include: Online Water Quality Monitoring, Enhanced Security Monitoring, Customer Complaint Surveillance and Public Health Surveillance. The response components include Consequence Management and Sampling & Analysis, which support timely response actions that minimize the consequences of a contamination incident. The *Water Quality Surveillance and Response System Primer* provides a brief overview of the entire system (USEPA, 2015).

This document provides an overview of the Customer Complaint Surveillance (CCS) component of an SRS. It presents basic information about the goals and objectives of CCS in the context of an SRS. This primer covers the following four topics:

- **Topic 1**: What is CCS?
- **Topic 2**: What are the major design elements of CCS?
- **Topic 3**: What are common design goals and performance objectives for CCS?
- **Topic 4**: What are cost-effective approaches for CCS?

Topic 1: What is CCS?

CCS consists of information management systems, processes and procedures that collectively compile, track and analyze water quality-related customer complaints indicative of a water quality incident.

Figure 1 illustrates the *Funnel/Filter/Focus* surveillance approach of CCS. First, all complaints are *funneled* into one location, such as a call management system, to ensure that complaints are not missed. Next, water quality complaints are *filtered* out from non-water quality complaints by Customer Service Representatives (CSR) or other water utility staff. Finally, water quality specialists *focus* on the remaining complaints to assess whether the complaints are related to a water quality incident or to system operations, such as main breaks or maintenance. CCS can track the time, number and location of complaints that are entered into call or work management systems, and alert utility personnel of unusually high call volumes or spatially-clustered complaints.

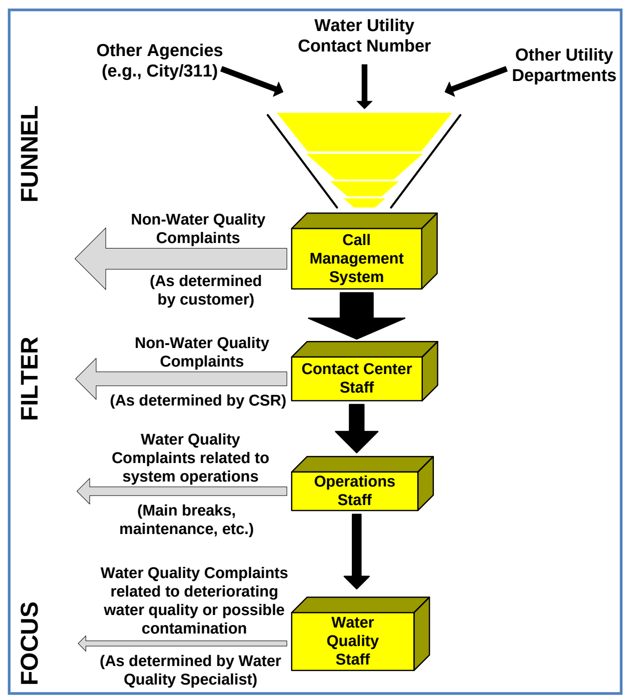

Figure 1. Recommended Funnel/Filter/Focus Approach for Utility-managed Customer Calls

Topic 2: What are the major design elements of CCS?

The major design elements for CCS are shown in **Figure 2** and described under the remainder of this topic.

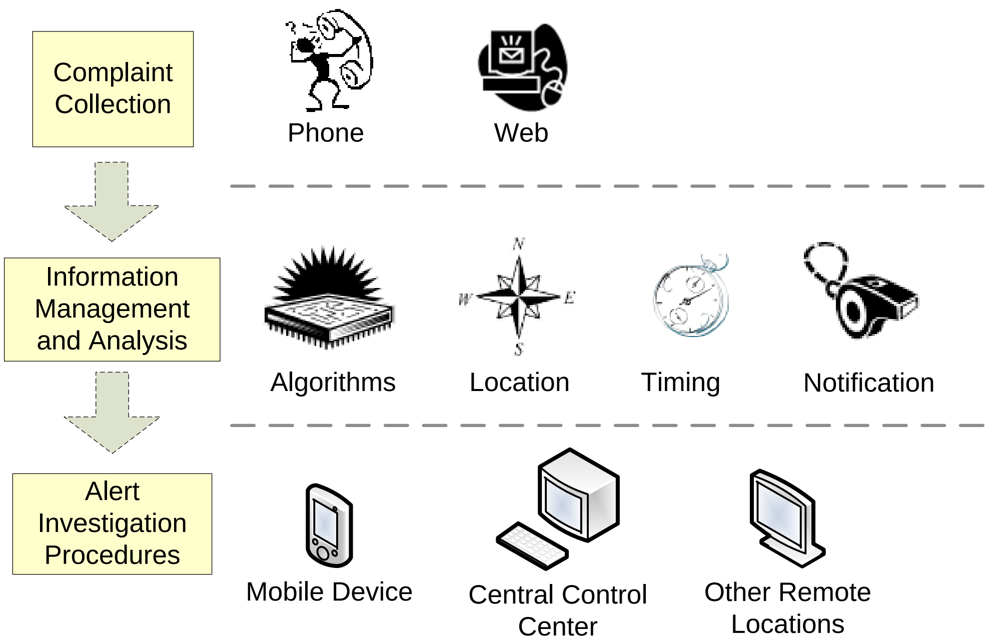

Figure 2. CCS Design Elements

Complaint Collection

A variety of methods are available to funnel all customer calls to one point of contact. For example, a unified call center with a widely publicized telephone number helps to ensure that the majority of complaints are captured.

Additionally, procedures should be put in place for water quality-related complaints that are initially received by external agencies, such as a city-wide call center or a 311 system. These procedures funnel calls to the CCS centralized complaint management system, ensuring robust surveillance by accounting for all calls.

DID YOU KNOW?

Many utilities with CCS utilize a 311 system for complaint collection. This allows them to build on an existing system, with only minor procedural changes needed to implement the design element.

Complaint collection has two design sub-elements:

- **Communicating Water Quality Concerns**: Activities implemented to ensure that customers are aware of how to report their water quality concerns to the utility.
- **Consolidating Water Quality Complaints**: Systems or procedures that filter water quality complaints to a central location, facilitating timely and efficient data analysis.

Information Management and Analysis

A key requirement of CCS is the ability to systematically track water quality complaints from receipt to closure. Existing customer complaint processes used by a utility can typically be leveraged to develop a CCS information management and analysis system. One of the most important decisions when implementing CCS is determining which datastreams should be incorporated. Most of the CCS tracking mechanisms work behind the scenes, limiting interference with day-to-day operations. Complaints are continuously analyzed for information indicative of a water quality incident in the distribution system, such as an unusually high numbers of calls or clustering of complaint locations. CCS information management and analysis has six design sub-elements:

- **Complaint Descriptive Data and Categories**: Capture and categorize complaint descriptions for the purpose of data analysis and alert investigations.
- **Detecting Abnormally High Complaint Volumes**: Develop processes to identify complaint volumes attributable to a significant change in water quality.
- **Timeliness of Detection**: Ensure data is reviewed with sufficient regularity to identify potential water quality incidents as they develop.
- **Establishing Thresholds**: Develop alerting thresholds that are insensitive to normal variation in call volume, yet low enough to detect potential water quality incidents.
- **Spatial Clustering Analysis**: Use spatial analysis to determine whether an unusually high volume of calls is clustered, and to determine the area of the distribution system impacted by a possible water quality incident.
- **Alert Notifications**: Develop reliable processes for informing utility personnel when alerting thresholds are exceeded.

CCS can take advantage of existing information management systems used in a typical call management process by filtering water quality-related complaints. Utilities without formal call management systems or software may still reap the benefits of CCS by: 1) streamlining the manner in which water quality-related complaints are managed, and by 2) instituting frequent checks of the number of water quality-related calls received over time.

DID YOU KNOW?

Many utilities with CCS modified their existing data management systems by establishing water quality-related complaint categories and then tracking the resolution of these complaints through their customer service process.

Water quality-related customer complaint data that is collected should be analyzed in a timely manner for conditions indicative of a water quality incident in the distribution system. This involves identifying when the total number of water quality-related complaints is unusual compared to an established baseline. The anomaly detection process can be automated using simple counting algorithms, which automatically track the number of calls over a defined period of time. When the number of calls exceeds a pre-determined threshold value, an alert is generated and utility personnel notified.

If spatial data is available, the frequency of complaints within hydraulically related areas, such as pressure zones or service areas, can also be evaluated. In addition, mapping the location of complaints can highlight clustering, which focuses investigation and response actions.

An example of a detection timeline is illustrated in Figure 3. The delay times for detection shown in the middle row provide a sense of how quickly CCS data is available. For this example, data is extracted from existing call and work management data systems and analyzed in near real time (every 15 minutes or less) using a simple counting algorithm. Upon generation of an alert, notifications are sent to investigators using an existing email server.

DID YOU KNOW?

USEPA's SRS Program has published a *Threshold Analysis Tool* that performs statistical analysis of complaint data to guide the development of threshold values.

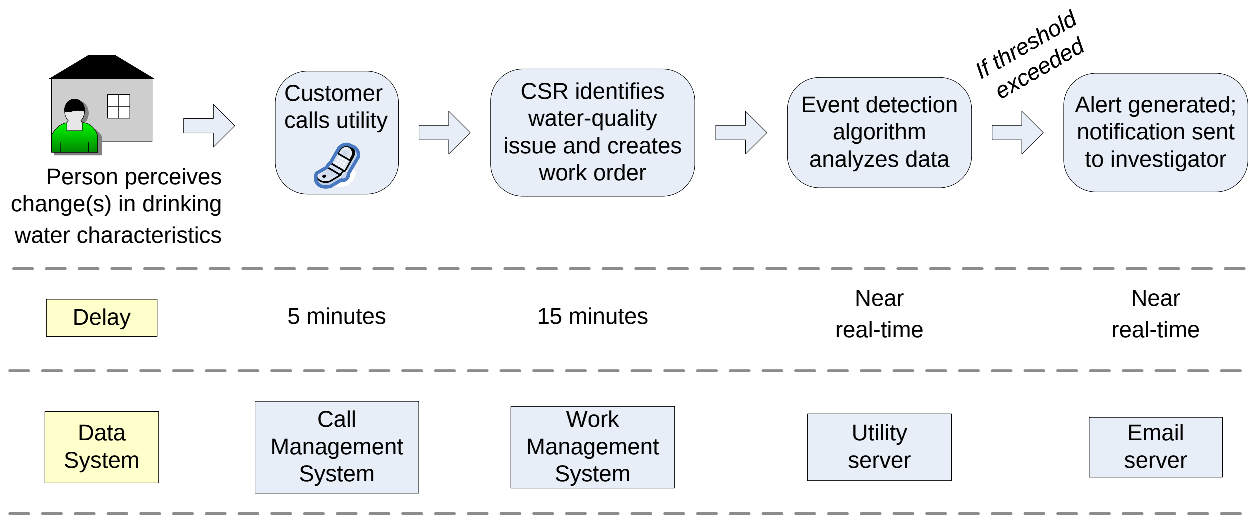

Figure 3. Example of a CCS Detection Timeline

Alert Investigation Procedures

CCS alerts need to be promptly investigated by utility personnel to determine whether the alerts can be explained by known factors, such as distribution system work near the area of the complaint locations. Example steps performed during CCS alert investigations are described below.

1. A CCS investigation begins following receipt of an alert, signifying an anomaly in one or more CCS datastreams.
2. Utility personnel use a CCS alert investigation checklist to guide them through a predetermined procedure to determine if the complaints are related to a water quality incident in the distribution system.
3. If it is determined the alert is not related to a water quality incident in the distribution system, the investigation is closed and logged.
4. If a water quality incident cannot be ruled out, the investigation continues according to procedures in the drinking water utility's Consequence Management Plan.

Topic 3: What are common design goals and performance objectives for CCS?

The design goals and performance objectives established for CCS by the utility provide the basis for the design of an effective component.

CCS Design Goals

Design goals are the specific benefits that utilities expect to achieve by implementing CCS. A fundamental design goal of an SRS is the ability to detect and respond to water quality anomalies in the distribution system. In addition to this fundamental SRS design goal, other CCS-specific design goals such as improving the level of customer service can be realized. Examples of common CCS design goals are listed in **Table 1**.

Table 1. Examples of Common CCS Design Goals

Design Goal	Description
Detect water contamination	CCS provides an early indicator of water contamination which may impact the health of customers or utility infrastructure.
Monitor the impact of system operations on customers	Some utility operations, such as changing sources and chlorine feed levels, can impact the aesthetics of the drinking water. CCS can alert the utility if these changes are noticed by customers.
Increase the level of customer service	CCS can alert the utility to distribution issues, such as main breaks, through customer complaints. This can reduce utility response time while providing the latest information to CSRs receiving customer complaints.
Improve the response to water quality complaints	Developing CCS procedures can streamline and standardize a utility's decision-making process when investigating customer water quality complaints.

CCS Performance Objectives

Performance objectives are measurable indicators of how well the SRS meets the design goals established by the utility. Throughout design, implementation and operation of the SRS or its components, the utility can use performance objectives to evaluate the added value of each capability, procedure or partnership. While specific performance objectives should be developed by each utility in the context of its unique design goals, general performance objectives for an SRS were defined in the *Water Quality Surveillance and Response System Primer* (USEPA, 2015) and are further described in the context of CCS as follows.

- **Incident coverage**: Detect and respond to a broad spectrum of water quality incidents. CCS is limited to detection of contaminants which alter the taste, odor or appearance of drinking water. Within this subset of contaminants, CCS can detect incidents regardless of the source.
- **Spatial coverage**: Achieve spatial coverage of the entire distribution system. Theoretically, CCS has the ability to cover every customer in the distribution system. Spatial coverage is improved by educating customers about how to contact the utility.
- **Timeliness of detection**: Detect water quality incidents in sufficient time for effective response. This performance objective is dependent upon how quickly data is available for analysis and how often the analysis is performed.
- **Operational reliability**: Minimize downtime for equipment, personnel and other support functions necessary for the component to meet the other performance objectives. Operational reliability for CCS is achieved by ensuring that information management and analysis systems continue to operate.
- **Alert occurrence**: Minimize the number of invalid alerts, which are not caused by abnormal water quality, while maintaining the ability of the system to detect true water quality anomalies. The balance between reducing the rate of invalid alerts while maintaining detection capabilities is primarily a function of the quality of the data monitored by the system and the data analysis method(s) used.
- **Sustainability**: Provide value to day-to-day utility operations and distribution system management that exceeds the cost to deploy and operate the component. Because CCS involves little to no physical equipment, it is relatively easy to sustain.

Topic 4: What are cost-effective approaches for CCS?

Utilities can take the following simple steps to develop the foundation for CCS:

- Review historical customer complaint data, and estimate a threshold for the number of calls or work orders that could be indicative of a water quality incident.
- Evaluate the daily volume of water quality complaints relative to the threshold, and manually plot the locations of calls on a map with 'push-pins' to identify clusters.
- Establish procedures for investigating water quality complaint clusters and train staff on their execution.

Next Steps

Visit the Water Quality Surveillance and Response Website at http://water.epa.gov/infrastructure/watersecurity/lawsregs/initiative.cfm for more information about SRS practices. The Website contains guidance and tools that will help a utility to enhance surveillance and response capabilities, as well as case studies that share utility experiences with SRS implementation and operation.

References

USEPA. (2015). *Water Quality Surveillance and Response System Primer*, 817-B-15-002.