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Fort Collins Utilities' Water Production Division Mission:

To produce an ample quantity of safe, affordable and aesthetically pleasing drinking water for Utilities' customers.

Combined Filter Effluent (CFE) Turbidity Spike After-Action Review
Water Treatment Facility
4316 Laporte Ave.
1 p.m., Wednesday, Jan. 10, 2018

Attendees: Staff from Utilities' Water Treatment Facility Operations, Customer Connections, Environmental Regulatory Affairs and Water Resources and Treatment

What Happened?

a. On the morning of Thursday, Dec. 14, 2017, the lime feed at the Water Treatment Facility failed, and alkalinity levels in the finished water started to drift out of internal treatment parameters.
b. To increase alkalinity, plant flow was decreased to 6 million gallons per day (MGD). The alkalinity then rose back up into parameters, and the Combined Filter Effluent (CFE) turbidity quickly jumped to 2.50. The regulatory maximum allowable CFE turbidity is 1.0 ntu. NTU is a measure of turbidity or cloudiness in the water.
c. Staff started increasing flow again after the turbidity spike. The CFE turbidity alarm had a low warning level alarm of 0.10 ntu and had no additional alarms or notifications for higher turbidities. The turbidity dropped below 1.0 ntu after 18 minutes. According to the Colorado Department of Health and Environment (CDPHE), turbidity over 1.0 ntu is a Tier 2 violation requiring a Public Notice within 30 days.
d. The lime system was repaired, and the alkalinity was restored to be within the appropriate treatment parameters.
e. CDPHE was not notified within 24 hours of the turbidity spike over 1.0 ntu, as was required; however, CDPHE did receive notification via Utilities' monthly turbidity report, which was sent in the beginning of January 2018. The failure to notify within 24 hours was due to several factors; 1) staff believed that because the spike was caused by lime, the violation was not a public health issue and there was no need to contact CDPHE, 2) each individual filter was well below 0.10 ntu, therefore the water was safe for the public to drink. 3) Staff were so focused on fixing the alkalinity problem and meeting water quality and safety standards that they did not see the bigger picture associated with the CFE exceedance, 4) Reliance on past actions of the CDPHE, e.g., historically forgiving turbidity exceedances that were not due to filter exceedances clouded staff's perception of the seriousness of the violation.
f. It is now obvious that all staff need extensive training on all CDPHE regulatory limits, and the appropriate follow-up procedures.

g. Finally, the location of the lime feed was found to be directly over the CFE turbidity sampling location. In certain flow situations, this can lead to the lime reading as high turbidity, which is what caused the turbidity spike. The CDPHE has subsequently recommended that CFE turbidity should occur upstream of all chemical addition.

Public Notification

The Utilities' PIO (Public Information Officer) said collaboration was outstanding. One overall issue that could be improved was developing the final wording of the Public Notice with CDPHE. The PIO worked with staff and spoke with CDPHE to get the Public Notice language issue reconciled. Within two hours, the City IT Department was able to send emails to all customer accounts.

Other observations:

- On-call tree and internal notification process worked well to begin the public notification process. Several observations were made that text is the best form of communication. Not everyone checks their email on weekends.
- Customer Connections group has a variety of templates for use in tier violation instances. The PIO immediately began completing templates for staff to review, then send the info to the CDPHE for final review.
- Other Public Notices: CSU sent an email. Fort Collins-Loveland Water District decided not to notify, nor were they required to by the CDPHE. Fort Collins Loveland Water District was not required to send a public notice due to low risk.
- Public Notices were distributed to the NextDoor neighborhood website.
- Council received copy of Public Notice in their "read-before" packet on January 9, 2018.
- Feedback from customers included confusion around the Public Notice language; it was too technical. They were confused by whether lime was safe or not and what turbidity meant.

Opportunities/Corrective Action Reports (CARs)

Each CAR will identify actions, opportunities for improvement, responsible parties and schedules for completion. All proposed CARs are listed below.

1. SCADA Alarms
    a. Add new SCADA alarms for the CFE Turbidity. Current alarm is set to 0.10 ntu. Add alarms for 0.50 ntu and 1.0 ntu. The 0.50 alarm will also have an automatic Operations on-call page and a directive to start plant shutdown procedures. 1.0 ntu will have the same alarms, as well as direction to call CDPHE at 1-877-518-5608.
    b. Add new alarm to show whether the lime mixers are turning.
    c. Update Daily Report to show CFE turbidities and highlight any exceedance of 1.0 ntu.
    d. Add an orderly plant shutdown process to SCADA.
    e. Notify Soldier Canyon of any impending CDPHE related issue(s).
2. Minimum Plant and Filter flows – Investigate whether a minimum plant flow should be locked in to SCADA. Also, install SCADA alarm to ensure that at least on filter from Filters 9 through 23 is on while Filters 1 through 8 are online. This will also allow for adequate up flow and mixing to

occur at the lime feed location. Investigate a maximum lime feed flow, as well as a maximum flow change over a period, e.g., no more than a 10 mgd change over one hour.

3. Training
    a. Train all staff around all CDPHE notification limits (including chlorine residual).
    b. Train staff on when to notify on-call Operations group regarding CDPHE notifications and treatment limits.
    c. Train all staff on the CFE location, and make sure they understand the location of all chemical feeds in relation to the CFE sampling location.
4. Monthly Operating Report – Formalize the Monthly Operating Report (MOR) sign-off process with a checklist attachment. Also have an Environmental Regulatory Affairs (ERA) member review the report before submission. Ensure all staff know and understand the data in the MOR and how the MOR form is created.
5. Process Improvement Team – Convene a team of staff (Plant, Water Quality Lab and ERA) to review Reg 11 for all regulatory limits and the required follow-up procedures. Cross reference list of limits with SCADA alarms to ensure all limits are alarmed with appropriate notification procedures. Install alarms in SCADA and in XLIMS to notify staff of required follow-up procedures in case of an exceedance. Involve Lean (Problem Solving) error-proofing tools and procedures. Note – SCADA and XLIMs are computers systems and a database to track and control all plant data.
6. Water Quality Response Team – Develop a contact list for the Water Quality Response Team (WQRT), and reconvene the team to train/prepare for all water quality-related issues or emergencies.
7. Lime feed system - Develop analyses, construction plans and CDPHE permissions to move the lime addition point downstream of the CFE turbidity sampling point. The current lime feed location is directly on top of the CFE turbidity sample location. Contract with CH2M to perform this work as soon as possible. Perform trial runs of feeding lime downstream of the CFE to track alkalinity and PH at Sample Station 1.
8. CFE Turbidimeter procedures – Develop and train on a new Standard Operating Procedure (SOP), where a grab sample is taken after any turbidity exceedance, physical bump by a person, or an Out of Service (OOS) event. Also add CDPHE notification procedures to SOP. Correct sampling times sign at turbidimeter.
9. A second turbidimeter in the CFE – Contract with CH2M to investigate the possibility of installing a second, non-regulatory turbidimeter in the CFE downstream of the current sampling location. The data from this turbidimeter would help in cases where spikes are caused by bumps or non-turbidity related issues.
10. Data validation – Review data validation process. Verify who reviews and discards data, and verify discard procedures. Coordinate data validation with the preparation of the MOR Form. Centralize report preparation with one team/person for consistency of training and notification procedures.
11. Prioritize plant processes for staff – Develop and train staff on a list of priorities to prioritize issues when they arise – e.g., low chlorine residual requires a larger response than low alkalinity.

12. Maximo maintenance schedules – Maintenance schedules for the lime tanks will be increased in Maximo to prevent future failures of the lime mixing system. Maximo is the computerized maintenance management system.
13. Lime switch over valves – Add new isolation valves to allow for the quick transfer of lime to the auxiliary lime tank.
14. Incorporate LEAN Problem Solving processes – Utilize City LEAN process improvement staff to review all proposed processes and alarms. Have LEAN staff review existing response procedures and processes to try and "error proof" the regulatory tracking and response procedures.
15. 3rd party review of the incident – Contract with CH2M to perform and independent third-party review of the turbidity incident and have them develop a list of improvements.

For More Information

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- *Esta información puede ser traducida, sin costo para usted, 970-212-2900.*