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 U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY 943-8881
 ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO
 ATTENTION OF

HSHB-MW-E

1 November 1993

SUBJECT: Water Quality Information Paper No. 38

RESPONSE GUIDANCE FOR
 MICROBIOLOGICAL CONTAMINATION
 OF POTABLE WATER SYSTEMS

I. PURPOSE. To provide guidance for local Preventive Medicine Activity (PVNTMED Actv) personnel when routine microbiological samples are positive, indicating possible water system contamination.

II. REFERENCES. A list of references is provided in Inclosure 1.

III. BACKGROUND AND OVERVIEW. The overall concept of this information paper is that local PVNTMED Actv personnel must take immediate corrective action when a water microbiological problem is indicated. Implementing timely corrective action can frequently rectify problems long before a full-scale incident develops. Maintaining open communication with the Facilities Engineering (FE) Utilities Staff is essential to return potability to the water distribution system. Local PVNTMED Actv personnel should assume the lead in coordinating with the FE Staff on operations planning during water emergencies. It must be emphasized that protection of the consumer is of the highest priority, and this must be kept in mind during implementation and performance of any water system purging operation.

IV. GENERAL GUIDANCE.

A. Actions to be Taken Before Positive Microbiological Results Occur - Day 0.

1. Review sample data for low chlorine residual results or other collection irregularities.

2. Notify the FE if chlorine residuals are not in compliance with TB MED 576 (maintaining a measurable residual in the distribution system).

3. Discuss remedial actions with the FE to immediately bring the chlorine residuals back in compliance with TB MED 576.

B. Actions to be Taken in the Event of Positive Microbiological Results - Day 1.

1. Review all microbiological quality control data.

9. Perform a preliminary onsite investigation at the water treatment plant to evaluate the disinfection process.

10. Monitor patient data from the hospital emergency room, the outpatient clinic, and the hospital admissions office (the Chief, PVNTMED Actv, may wish to coordinate with hospital personnel regarding culturing of patients).
NOTE: The Hospital Commander should be notified before implementing item 10.

D. Actions to be Taken When Positive Microbiological Results Continue to Occur - Day 3.

1. Check the quality control procedures and procedures involving sample collection, preservation, transportation, and microbiological analyses for any and all subsequent resampling.

2. Review FAC residual data and boost the chlorine residual to cysticidal and virucidal levels if epidemiological evidence remotely implicates the presence of nonbacterial organisms or pathogens (see TB MED 576).

3. Evaluate the collected microbiological data to include the specific identification of the organisms cultured in any resampling. NOTE: If the organisms are pathogenic and the technique is validated, the water system is probably contaminated, and human ingestion should be prohibited.

4. Coordinate with the PVNTMED Actv Chief, and notify the Installation Medical Authority, the Post Commander, and the Public Affairs Officer, concerning the extent of the contamination.

5. Contact the appropriate Regional Division Activity (RDA), USAEHA, for technical assistance. As the problem continues, the RDA will in turn contact the USAEHA Water Quality Engineering Division (WQED) for guidance.

6. Coordinate the notification of State and/or Federal authorities with the Post Commander as required. The Commander is responsible for official notification; however this authority is often delegated to the FE. Public notification requirements should be discussed with appropriate representatives designated by the Commander.

7. Assist with the implementation of an accurate public notification program that does not unduly alarm the consumers.

8. Establish an emergency water supply source, and institute distribution procedures as necessary. The following are offered only as possible alternatives. The Installation Medical Authority has the final approval authority for the methods and procedures selected.

a. Family housing/dining facilities. Boil water in accordance with local medical policy.

b. Administrative offices/troop units/barracks. Establish field water points utilizing organic engineering assets. The Installation Medical Authority will establish FAC residual criteria (in most cases, five (5) mg/L FAC residual should be adequate). PVNTMED Actv personnel should inspect all water trailers and verify the FAC residuals in the trailers at the point of consumption. Engineering assets should be tasked to ensure that water in trailers is chlorinated as necessary to maintain the established FAC residuals. Field PVNTMED units should be contacted if additional medical personnel or resources are needed during the emergency.

9. Monitor patient data from the hospital emergency room, the troop medical clinics, the outpatient clinics, and the hospital admissions office. Ensure that the treatment staffs are aware of the need to culture patients who have the appropriate symptoms, in an attempt to determine the cause of the illness. Correlate the patients' culture results with the microbiological analyses of the potable water system.

10. Initiate or expand a program for monitoring the raw water source for a minimum of TC, FC, and SPC. Analyze the raw water data and the microbiological data for possible trends. If the source appears to be microbiologically contaminated, conduct an investigation to identify and eliminate the source of the contamination.

11. Check or further investigate the operation of the water treatment plant if the raw water source is not microbiologically contaminated. Ensure that the chlorine dose is adequate to provide the desired FAC residual after the specified contact time. Ensure that the contact time provided is adequate.

12. Coordinate with the FE and establish a definite course of action which may include but not be limited to:

a. Conduct a joint building-by-building inspection in an effort to locate the source of the problem if the contamination is isolated to one area.

b. Reevaluate the pressure testing data.

(1) Identify any areas of low pressure.

(2) Check for negative pressures and for the potential for back siphonage.

(3) Check for water main and lateral leakage in low pressure areas if possible.

c. Check for areas of low water use which often results in low chlorine residuals.

(1) Identify any unused water lines that can be valved off to streamline the water flow in the used lines and therefore help to maintain an effective chlorine residual.

(2) Flush each dead end in turn until an acceptable FAC is attained. Establish this practice as a routine FE task to be accomplished in conjunction with the hydrant flushing program.

d. Expand the chlorine residual monitoring program using FE personnel to ensure that all distribution system loops are checked for low FAC residuals. Ensure that distribution system loops with low FAC residuals are flushed to bring the residuals up to the proper levels. Check these loops for potential cross connections.

e. Flush and superchlorinate the distribution system if the microbiological contamination persists (guidance on flushing and superchlorinating is provided in Inclosures 2 and 3, respectively).

13. Collect samples for microbiological analysis after the above corrective actions have been completed, to assess the effects of the corrective actions.

E. Actions to be Taken Based on the Results of Corrective Actions - Day 4.

1. If the microbiological contamination continues -

a. Intensify medical and facilities engineering efforts. Review and repeat the corrective actions previously performed. Identification of the microbiological contaminant source is essential to solve the problem.

b. Ensure that key personnel are accurately informed in a timely manner as to the status of the corrective actions being implemented.

2. If there has been an apparent correction of microbiological problem (two days of negative microbiological testing at the elevated FAC levels established by the medical authority):

a. Reduce the chlorine dose at the water treatment plant in steps with concurrent microbiological analyses so that a minimum of two consecutive days of negative results are observed at each level. Microbiological analysis should not commence at each step until the reduced chlorine level has equilibrated throughout the distribution system. The size of the decrement used to reduce the FAC residual to normal levels should be based on such factors as problem severity, difference between emergency and normal chlorine residuals, and other unique site-specific items. Contact WQED or the appropriate RDA of USAEHA if assistance is necessary in selecting an appropriate step size.

b. Collect samples from representative points in the distribution system after the chlorine residuals have returned to the normal levels until negative results are reported for at least two consecutive days.

3. Remove the water use restrictions only after microbiological verification that potability has been reestablished.

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4. If positive microbiological results are reported during the FAC residual step-down phase, immediately raise the residual back to the previous evergency levels. Reevaluate all microbiological data to formulate a plan of action. Once corrective actions have been completed, repeat the FAC residual step-down process.

F. Actions to be Taken After Returning the Distribution System to Normal.

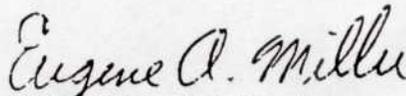
1. Continue the expanded microbiological monitoring for a suitable period of time (e.g., two or more weeks) after the water distribution system has been returned to normal.

2. Review and document the entire incident and discuss how the contamination might have been avoided and how the problem could have been handled smoother and more effectively after the problem did occur. It is important to learn as much as possible from these incidents to be able to avoid future problems or at least deal with them effectively when they do happen.



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4. If positive microbiological results are reported during the FAC residual at a low point, immediately raise the residual back to the previous average level. Reanalyze all microbiological data to determine a plan of action. Once corrective actions have been completed, repeat the FAC residual step-down process.

5. Actions to be taken after returning the distribution system to normal.

1. Continue the expanded microbiological monitoring for a suitable period of time (e.g., two or more weeks) after the water distribution system has been returned to normal.

2. Review and document the entire incident and discuss how the contact action might have been avoided and how the problem could have been handled. Another and more effectively after the problem had occurred. It is important to learn as much as possible from these incidents to be able to avoid future problems or at least deal with them effectively when they do happen.

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2. TB MED 576, Sanitary Control and Surveillance of Water Supplies at Fixed Installations, 15 March 1982.
3. TM 5-660, Operation of Water Supply and Treatment Facilities at Fixed Army Installations, 24 November 1952.
4. TM 5-661, Inspection and Preventive Maintenance Services for Water Supply Systems at Fixed Installations, 21 September 1945.
5. HSC PAM 40-3, Environmental Health Program, February 1981.
6. American Water Works Association, Standard C601, Standard for Disinfection Water Mains, 2 June 1968.
7. American Water Works Association, Standard D105, Standard for Disinfection of Water Storage Facilities, 15 June 1980.
8. American Water Works Association Standard A100, Standard for Deep Wells, 23 January 1966.

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1. EPA 40-2, Health and Environment, 22 September 1974.
2. Inorganic, Organic, and Nutrient Analysis of Water Samples at Fixed Installation, 15 March 1975.
3. EPA 40-2, Operation of Water Supply and Treatment Facilities at Fixed Installation, 24 November 1972.
4. EPA 40-2, Inspection and Preventive Maintenance Services for Water Supply Systems at Fixed Installation, 21 December 1972.
5. EPA 40-2, Environmental Health Program, February 1981.
6. American Water Works Association, Standard C601, Standard for Distribution Water Quality, 1 June 1988.
7. American Water Works Association, Standard D100, Standard for Distribution of Water Storage Facilities, 15 June 1988.
8. American Water Works Association Standard A100, Standard for Deep Wells, 23 January 1986.

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DISTRIBUTION SYSTEM FLUSHING INSTRUCTIONS

1. Clean all reservoirs/storage tanks prior to flushing. See Section 2 - Cleaning, AWWA Standard D105, for specific guidance.
2. Develop a detailed flushing plan using current water distribution system maps. As a general rule, the flushing should begin near the water treatment plant and then follow the general water flow pattern in the distribution system, working away from the plant to the outer areas. Ensure that the flushing crew is provided with a water distribution system map showing the flushing plan.
3. Ensure that a minimum flushing velocity of 2.5 feet per second is achieved as required by para 4-3, TM MED 576. Higher velocities may be necessary in severe cases.
4. Ensure that all hydrants are flushed.
5. Perform microbiological analyses to determine the presence of and to identify the types of organisms found in the water or residue flushed from the lines.

Incl 2

DISTRIBUTION SYSTEM FLUSHING INSTRUCTIONS

1. Close all reservoir/storage tanks prior to flushing. See Section 2.1 for specific guidance.
2. Develop a detailed flushing plan using current water distribution system maps. As a general rule, the flushing should begin near the water treatment plant and then follow the general water flow pattern in the distribution system, working away from the plant to the outer areas. Ensure that the flushing crew is provided with a water distribution system map showing the flushing plan.
3. Ensure that a minimum flushing velocity of 1.5 feet per second is achieved as required by para 4-2, IMHD 576. Higher velocities may be necessary in specific cases.
4. Ensure that all hydrants are flushed.
5. Perform microbiological analysis to determine the presence of and to identify the types of organisms found in the water or residue flushed from the lines.

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SUPERCHLORINATING INSTRUCTIONS

1. Determine the chlorine requirements for disinfecting all storage tanks/ reservoirs and distribution system piping using one of the three alternative methods listed in AWWA Standard D105 and AWWA Standard C601.
2. Disinfect all water storage reservoirs IAW AWWA Standard D105.
3. Disinfect the distribution system - one major loop at a time - using the method described in AWWA Standard C601.
 - a. Divide the water distribution system into major loops.
 - b. Pump the superchlorinated water into a selected major loop. Pull the chlorinated water into all mains and laterals. PVNTMED Actv personnel should verify that the correct residual is achieved in the main and lateral.
 - c. When the proper residual is achieved, the loop should be valved off and operating pressure should be provided with superchlorinated water from the storage reservoir. Normal water consumption will draw the superchlorinated water through the service connections and throughout the buildings.
 - d. Ensure a continuous supply of superchlorinated water is supplied to the isolated loop using dosage and time requirements found in AWWA Standard C601.
NOTE: This may involve batch chlorination of the storage reservoir. PVNTMED Actv personnel should verify the chlorine residual in the loop after the appropriate detention time.
 - e. Superchlorinate each major loop in this manner.
5. Return the FAC residual to the emergency levels previously recommended by medical authority.
6. Reinstitute microbiological monitoring.

Incl 3

SUPERCHLORINATING INSTRUMENTS

1. Determine the chlorine requirements for disinfection of storage tanks, reservoirs and distribution system piping using one of the alternative methods listed in AWWA Standard D103 and AWWA Standard D101.
2. Estimate the water storage reservoir IAW AWWA Standard D103.
3. Estimate the distribution system - one major loop at a time - using the method described in AWWA Standard D101.
4. Divide the water distribution system into major loops.
5. Pass the superchlorinated water into a selected major loop. Verify that the chlorinated water into all mains and laterals. Verify that the correct residual is achieved in the main and lateral.
6. When the proper residual is achieved, the loop should be valved off and operating one side should be provided with superchlorinated water from the storage reservoir. Normal water consumption will draw the superchlorinated water through the service connections and throughout the buildings.
7. Prepare a continuous supply of superchlorinated water as supplied to the selected loop using device and size requirements found in AWWA Standard D101. This may involve batch chlorination of the storage reservoir. VERIFY Actual residual should verify the chlorine residual in the loop after the appropriate retention time.
8. Superchlorinate each major loop in this manner.
9. Return the FAC residual to the emergency level previously recommended by local authority.
10. Repeat (use chronological) monitoring.

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