Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

Items to be Considered and Addressed

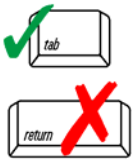
For PWS Use Only – *not to be returned to MassDEP.*

PWSs may find this self-evaluation form a useful tool.

- Sampling and Results
- System Specifics, Supply Specifics, Storage Specifics
- Backflow Prevention Devices
- Potential For Biofilm
- Public Notification Public Relations
- Remedial Options Considered
  - A. Chlorination of Supply
  - B. Chlorination of Storage
  - C. Chlorination of Distribution System
- Summary and Conclusions, Comments

A. Sampling & Results

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



Date of Sampling _____ Total Number of Samples _____

Number of total Coliform positive _____ Number of fecal or E. coli positive _____

Total Number of *Repeat Samples* _____ Number of *Repeat Positive* Samples _____

1. Are these positive samples located in one general area of the distribution system? ☐ Y ☐ N
2. Is the discovery of coliform bacteria a recurring situation? ☐ Y ☐ N

2a. Explain: _____

3. Was the previous cause for coliform bacteria in the system determined? ☐ Y ☐ N

3a. Explain: _____

4. What is the *background bacterial count* at positive sites? _____
5. Have the *background bacteria* counts been increasing in the system? ☐ Y ☐ N

5a. Explain: _____

6. Has the background bacteria been increasing in the area of concern? ☐ Y ☐ N

6a. Explain: _____

7. The immediate matter of concern is *total coliform* ☐ Y ☐ N
8. The immediate matter of concern is *fecal coliform* ☐ Y ☐ N
9. The immediate matter of concern is *E.coli* ☐ Y ☐ N
10. The immediate matter of concern is *background bacteria* ☐ Y ☐ N
11. The immediate matter of concern is *other* ☐ Y ☐ N

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

A. Sampling & Results (cont.)

12. Contact with laboratory indicates a potential *sampling* or *analysis problem* ☐ Y ☐ N

12a. Describe: _____

13. Contact with *surrounding communities* indicate *similar* problems ☐ Y ☐ N

13a. Describe: _____

14. Were *standard sampling procedures* utilized to the best of your knowledge? ☐ Y ☐ N

14a. If not, explain: _____

15. Are *Personnel* collecting samples the same? ☐ Y ☐ N

16. Is there a change in *sampling locations?* ☐ Y ☐ N

17. Was there any change at the *sample tap*? ☐ Y ☐ N

18. Was there a *change in pH?* ☐ Y ☐ N

19. Was there a *change in water temperature?* ☐ Y ☐ N

B. System Specifics

20. List the *main supply* to the area of concern (well/ wells, surface supply, etc.):

_____

21. Was all *source water* free of positive results? ☐ Y ☐ N

21a. If not, explain: _____

22. List the *storage facilities feeding* the area of concern:

_____

23. Was all *storage water* free of positive results? ☐ Y ☐ N

23a. If not, explain: _____

24. Have any *repairs* recently been made in the distribution system? ☐ Y ☐ N

24a. Describe: _____

25. Have any system improvements recently been made in the distribution system? ☐ Y ☐ N

25a. Describe: _____

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B. System Specifics (cont.)

26. Were these improvements *new mains?* ☐ Y ☐ N

27. Were these mains *chlorinated?* ☐ Y ☐ N

28. Has a *temporary connection* to a hydrant for service or pool filling been made? ☐ Y ☐ N

29. Has a new *development* water system been recently connected? ☐ Y ☐ N

30. Was the system *disinfected?* ☐ Y ☐ N

31. Was a *report* received? ☐ Y ☐ N

32. Has there been a *recent fire?* ☐ Y ☐ N

33. Is a *flushing program* ongoing? ☐ Y ☐ N

34. Have *street sweeping* operations utilizing hydrants been ongoing? ☐ Y ☐ N

35. Have any new *wells feeding irrigation systems* recently been put on line? ☐ Y ☐ N

36. Were there any recent changes in *system hydraulics, reverse flow, etc?* ☐ Y ☐ N

36a. Describe: _____

37. Is the area of concern on *town sewer*? ☐ Y ☐ N

38. *Percent* on *septic systems:* _____ %

39. Are there reports of *major failure* of septic systems in area of concern? ☐ Y ☐ N

39a. Describe: _____

40. Has *input* from the *Board of Health* been received? ☐ Y ☐ N

40a. Explain: _____

C. Supply Specifics

41. Have any *repairs or modifications* been made at the *supplies?* ☐ Y ☐ N

42. List the *supply modifications,* including repairs, changes in chemical feed, etc.

_____

43. Is the system *normally chlorinated?* ☐ Y ☐ N

44. *Compound* added: _____

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

C. Supply Specifics (cont.)

45. Desired *residual* at *supply:* _____

46. *Residual at last test:* _____

47. Desired *residual in system:* _____

48. *Residual at last test* in area of concern: _____

49. Is the chlorination *system operating satisfactorily*? ☐ Y ☐ N

50. Is a *corrosion control program* in effect? ☐ Y ☐ N

50a. Describe: _____

51. Have any *changes* been made in the *corrosion control compound* utilized? ☐ Y ☐ N

51a. Explain: _____

52. Has the *feed rate changed?* ☐ Y ☐ N

53. Is *pH adjustment* utilized? ☐ Y ☐ N

54. Is *chlorine* added to *day tank?* ☐ Y ☐ N

54a. Describe: _____

55. Which supplies are located in close *proximity to surface waters, wetlands, etc?*

_____

56. Are any of the *supplies surface water*? ☐ Y ☐ N

57. Are any *groundwater supplies* designated as being *influenced by surface water?* ☐ Y ☐ N

58. Has there been an *above average* amount of *precipitation* during the past month? ☐ Y ☐ N

59. Was *flooding* evident in the area of the supplies? ☐ Y ☐ N

60. Has there been an *increase in pumping* at these supplies? ☐ Y ☐ N

60a. Describe: _____

61. Has there been a noticeable *decrease in water level* in the area of the supplies? ☐ Y ☐ N

62. Has there been any *unusual activity* ongoing within the Zone I of the supplies? ☐ Y ☐ N

62a. Describe: _____

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

C. Supply Specifics (cont.)

63. Has there been any *unusual activity* ongoing within the Zone II of the supplies? ☐ Y ☐ N

63a. Describe: _____

D. Storage Specifics

64. Have any *repairs or modifications* been made to the *storage facilities?* ☐ Y ☐ N

65. Has an *inspection* of the storage facilities recently been performed? ☐ Y ☐ N

65a. If yes, when? _____ Date

66. Were any *deficiencies* in the *roof* noted? ☐ Y ☐ N

67. Were there any *deficiencies* noted on the *roof hatch?* ☐ Y ☐ N

68. Was it *locked?* ☐ Y ☐ N

69. Is *cathodic protection* provided? ☐ Y ☐ N

70. Are the *cover plates water tight?* ☐ Y ☐ N

71. Is there an *exterior weir box?* ☐ Y ☐ N

72. Was the *overflow screen* checked? ☐ Y ☐ N

73. Has the *interior floor* of the storage facility been recently inspected for residue? ☐ Y ☐ N

74. Is there evidence or a history of *roosting birds* on this facility? ☐ Y ☐ N

E. Backflow Prevention Devices

75. List the backflow devices in the general area of concern:

_____

76. Do any of these have a *history of failure?* ☐ Y ☐ N

76a. Describe: _____

77. List those *recently tested*: _____

78. Did any *fail?* ☐ Y ☐ N

78a. Explain: _____

79. List those *to be tested*: _____

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E. Backflow Prevention Devices (cont.)

80. Is an *active cross-connection program* in effect? ☐ Y ☐ N

F. Potential for Biofilm

81. Was the *drinking water temperature* at its highest at the time of positive results? ☐ Y ☐ N

82. Has the system experienced or suspected a *biofilm* problem in the past? ☐ Y ☐ N

83. Was it *confirmed*? ☐ Y ☐ N

83a. Explain: _____

84. Has a *microbiological species identification* been completed? ☐ Y ☐ N

85. The predominant species are:

a. *Escherichia Coll (E-coli)* ☐ Y ☐ N

b. *Klebsiella* ☐ Y ☐ N

c. *Enterobacter* ☐ Y ☐ N

d. Citrobacter ☐ Y ☐ N

e. *Serratia* ☐ Y ☐ N

f. *Campylobacter* ☐ Y ☐ N

g. *Vibro cholerae* ☐ Y ☐ N

h. *Aeromonas* ☐ Y ☐ N

i. *Salmonella* ☐ Y ☐ N

j. *Pseudomonas* ☐ Y ☐ N

k. *Legionella* ☐ Y ☐ N

l. *Pneumophila* ☐ Y ☐ N

m. *Bactillus* ☐ Y ☐ N

n. *Micrococcus* ☐ Y ☐ N

o. Other _____ (specify) ☐ Y ☐ N

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

F. Potential for Biofilm (cont.)

86. Has fire flow testing indicated *tuberculation buildup* in piping (decrease flow)? ☐ Y ☐ N

87. Has a *new corrosion control facility* been recently activated? ☐ Y ☐ N

88. Is *pH adjustment* utilized in this facility? ☐ Y ☐ N

89. What is the *pH change* at the supply? _____

90. What is the *desired pH* in the system? _____

91. What is the *actual pH* in the area of concern? _____

92. Have *phosphates* recently been added as a *corrosion control* measure? ☐ Y ☐ N

93. What is the *compound utilized:*

a. *Orthophosphate* ☐ Y ☐ N

b. *Polyphosphate* ☐ Y ☐ N

c. *Blended Phosphate* ☐ Y ☐ N

d. *Silicates* ☐ Y ☐ N

e. *Other* _____ ☐ Y ☐ N

94. Have there been any unusual *occurrences* that could cause *increases of biofilm nutrients* such as increases in *organic carbon, nitrogen, or phosphorus* at the supplies (heavy rainfall, excessive surface water runoff, flooding, etc.)? ☐ Y ☐ N

94a. Explain: _____

G. Public Notification

95. Do you suspect the problem to be biofilm oriented? ☐ Y ☐ N

95a. Explain: _____

96. Has *MassDEP* been notified? ☐ Y ☐ N

96a. Date notified: _____

97. *Recommendations* received from *MassDEP*

_____

98. Is *public notification necessary?* ☐ Y ☐ N

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G. Public Notification (cont.)

99. Has *public notification* been completed? ☐ Y ☐ N

100. Where was public notice published/ posted? _____

100a. Date published/ posted: _____

101. Has *MassDEP indicated a mailing* will be necessary? ☐ Y ☐ N

102. *How* is the *mailing* to be accomplished? _____

102a. Date of mailing _____

103. Was the *public notification waived?* ☐ Y ☐ N

103a. By whom? _____

103b. Date: _____

H. Public Relations

104. What measures are to be taken for *public relations?*

_____

105. Has your *staff answering the phones* been instructed regarding *potential questions* and the *proper responses?* ☐ Y ☐ N

105a. Explain: _____

106. Have the various *town boards/officials* been made aware of the problem and action being taken? ☐ Y ☐ N

107. Have local *medical care facilities and doctors* been made aware of the problem and action being taken? ☐ Y ☐ N

108. Are *newspaper announcements* necessary to inform the public of the *progress being made* to eliminate the problem? ☐ Y ☐ N

109. What would you *do differently* in public relations if this situation *occurs again?*

_____

110. From the testing to date, does the discovery of coliform bacteria appear to be a *health threat?* ☐ Y ☐ N

110a. Explain: _____

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

I. Remedial Options Considered

111. Is temporary chlorination of the supplies a viable option? ☐ Y ☐ N

A. Chlorination of Supply

112. How will it be instituted? _____

113. Desired free chlorine residual: _____ mg/L

114. Compound to be utilized:

a. Ca(ClO)2, calcium hypochlorite (HTH @ 65% chlorine) _____

b. NaClO, sodium hypochlorite (12.5% chlorine) _____

c. Other _____

115. Supply discharge rate: _____ gpm (gpm x 1440 = gpd)

Calculations for HTH feed for a 24 hour period

$$\#HTH = \frac{\text{chlorine (ppm)} \times \text{rate (gpd)} \times 8.34\ \#/gal}{1{,}000{,}000 \times .65}$$

Sample Problem (HTH) Chlorination of Supply

Want to feed a concentration of 1.2 ppm (mg/l) free chlorine to a supply with a discharge rate of 500 gallons per minute.

500 gpm x 1440 min/day = 720,000 gpd

$$\#HTH = \frac{1.2\ ppm \times 720{,}000\ gpd \times 8.34\ \#/gal}{1{,}000{,}000 \times .65} = 11.08 \text{ pounds HTH per day}$$

Calculation for chlorination at Well # _____ utilizing HTH

$$\#HTH = \frac{\_\_\_\_\_\ (ppm) \times \_\_\_\_\_\ gpd \times 8.34\ \#/gal}{1{,}000{,}000 \times .65} = \text{ pounds HTH per day}$$

Calculations for sodium hypochlorite (NaOCl) for a 24 hour period

In general, a solution of NaOCl at 12.5% solution yields 1 pound of chlorine per gallon

$$\text{gallons of 12.5\% NaOCl (or \#s of chlorine)} = \frac{\text{chlorine (ppm) X rate (qpd) X 8.34 \#/qal}}{1{,}000{,}000}$$

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

I. Remedial Options Considered (cont.)

Sample Problem (12.5% NaOCI) chlorination of supply

Want to feed a concentration of 1.2 ppm (mg/0 free chlorine to a supply with a discharge rate of 500 gallons per minute.

500 gpm X 1440 min/day = 720000 gpd

gallons 12.5% NaOCI = $\frac{\text{1.2 ppm X 720,000 gpd X 8.34 \#/gal}}{\text{1,000,000}}$ = 7.2 gallons NaOCI per day or 7.2 # chlorine

If chlorine solution concentration different, use same calculation with ratio of concentration used as a multiplier. If solution is 5.5%, calculate as follows:

12.5%/5.5% = 2.272 multiply calculation solution by 2.272

(for sample problem) 2.272 x 7,2 gallons NaOCI = 16.4 gallons NaOCI per day

Calculation for chlorination at supply utilizing NaOCI

gallons 12.5% NaOCI = $\frac{\text{ppm x qpd x 8.34 \#/gal}}{\text{1,000,000}}$ = gallons NaOCI per day

B. Chlorination of Storage Facility

116. Is chlorination of the storage facilities a viable option? ☐ Y ☐ N

117. How will it be instituted? _____

118. Desired free chlorine residual: _____ mg/L

119. Compound to be utilized:

a. Ca(ClO)2, calcium hypochlorite (HTH @ 65% chlorine) _____

b. NaClO, sodium hypochlorite (12.5% chlorine) _____

c. Other: _____

d. Storage capacity _____ gallons

Calculations for HTH feed for a water storage facility

$$\#\text{HTH} = \frac{\text{chlorine (ppm) x capacity (gallons) x 8.34 \#/gal}}{\text{1,000,000 x .65}}$$

Sample Problem (HTH) chlorination of storage

Want to attain a concentration of 1.2 ppm (mg/}) free chlorine within a 2,000,000 million gallon storage facility.

$$\#\text{HTH} = \frac{\text{1.2 ppm x 2.000,000 gallons x 8.34 \#/gal}}{\text{1,000,000 X .65}} = 30.8 \text{ pounds HTH}$$

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

I. Remedial Options Considered (cont.)

Calculation for chlorination of storage utilizing HTH

$$\#\ HTH = \frac{\text{ppm} \times \text{gallons} \times 8.34\ \#/\text{gal}}{1{,}000{,}000 \times .65} \quad \text{pounds HTH}$$

Calculations for sodium hypochlorite (NaOCI) feed for a water storage facility

Remember a solution of NaOCI at 12.5% solution has 1 pound of chlorine per gallon

$$\text{gallons of 12.5\% NaOCI (or \#'s of chlorine)} = \frac{\text{chlorine (ppm)} \times \text{volume (gallons)} \times 8.34\ \#/\text{gal}}{1{,}000{,}000}$$

Sample Problem (12.5% NaOCI) chlorination of supply

Want to feed a concentration of 1.2 ppm (mg/l) free chlorine, to a supply with a discharge rate of 500 gallons per minute.

500 gpm x 1440 min/day = 720,000 gpd

$$\text{gallons NaOCI (or \#'s of chlorine)} = \frac{1.2\ \text{ppm} \times 2{,}000{,}000\ \text{gallons} \times 8.34\ \#/\text{gal}}{1{,}000{,}000} = 7.2\ \text{gallons NaOCI per day}$$

Calculation for chlorination at storage utilizing NaOC1

$$\text{gallons NaOCI} = \frac{\text{ppm} \times \text{gpd} \times 8.34\ \text{al/gal}}{1{,}000{,}000} = \text{gallons NaOCI per day}$$

C. Distribution System Chlorination

120. Is *site specific chlorination* in the distribution system warranted? ☐ Y ☐ N

121. How will it be instituted? _____

122. Is the *flow* basically in *one direction*? ☐ Y ☐ N

123. Can a flow rate be determined? ☐ Y ☐ N

124. Can a bleeder be installed to maintain a relatively constant flow? ☐ Y ☐ N

125. What is the desired residual in the system? _____ mg/L

126. What is the chlorine feed rate at the site of injection? _____ mg/L

127. Has flushing in the area of concern been instituted? ☐ Y ☐ N

127a. Explain: _____

128. Can the area be isolated to insure against reverse flow carrying contamination to other sections of the system?

128a. Explain: _____

Calculations the same for feeding in the distribution system as at the supply, once an average flow rate is determined

Items to be Considered and Addressed upon Discovery of Coliform Bacteria

J. Summary and Conclusions

129. Was the problem determined? ☐ Y ☐ N

129a. Explain:

129b. If not, what is suspected?

130. Reason for this suspicion:

131. Recommendations for eliminating this problem in the future:

132. Recommendations for investigating future similar problems:

General Comments

134.

135. If this situation occurs again, would you do anything differently?