1 General
1.1 This section describes the procedure to ensure the delivery of potable water as approved by Indiana Department of Environmental Management.
1.2 All repaired or newly constructed potable water lines must be properly disinfected by one of the methods described below and be approved by the owner’s representative before resuming service. The appropriate method shall be applied to all pipe on either side of any new piping or fittings and continuing to the nearest mechanical valves that can stop water flow so as to isolate the piping.
1.3 For the purpose of the procedure outlined below, "Authorized University Employees" are a Water Works Operator appropriately trained and employed by Purdue University.
1.4 For this section of the guidelines underground pipe includes all piping prior to, that is on the system side of, the building backflow prevention system or, if no backflow prevention equipment exists, the main shut-off valve on the interior of the building.
1.5 Each disinfection process will be recorded on a Potable Water Line Disinfection Monitoring form. Copies of this form will be forwarded to the Utilities Department and the original will be filed in the Water Works Office.
1.6 Operation of the potable water distribution system (the opening and closing of valves) shall be by a University Water Works Employee.

2 Air Testing
2.1 Under no conditions will air pressure be allowed as a testing medium for any water piping system.

3 Applicable Codes
- IDEM 327 IAC 8-3.2-18 Rule
- ANSI / AWWA B300 Hypochlorites
- ANSI / AWWA C651 Disinfecting Water Mains
- ANSI / AWWA C600 Installation Of Ductile Water Mains And Their Appurtenances
- ANSI / AWWA C605 Underground Installation Of PVC Pressure Pipe And Fittings For Water
- Indiana State Plumbing Code (latest edition adopted by the State)

4 Disinfectant Monitoring Methods
4.1 The disinfectant level will be monitored by at least one of the following methods:
- Dipstick Method
- Colormetric Method

5 Potable Water for Flushing
5.1 Water for testing shall be arranged for by the Contractor with the Owner’s Representative.
5.2 Potable water for flushing, chlorinating, pressure testing, etc. must be supplied through a horizontally mounted reduced pressure type backflow preventer, so as to protect the potable water system from the cross connection.
5.3 The Contractor shall furnish all necessary equipment, piping, pumps, fittings gauges, etc. and personnel to properly conduct the testing.

6 Chlorination
6.1 Hypochlorites shall be certified by NSF/ANSI 60 per AWWA B300 Section 4.4.2
6.2 Sodium Hypochlorite: The disinfectant used for sanitizing plumbing parts and materials that directly contact potable water will be NSF/ANSI 60 approved bleach which has a chlorine concentration of 5.25%.
6.3 Calcium Hypochlorite: Chlorination granules that are specifically for municipal water treatment containing approximately 65% chlorine by weight and are readily soluble in water.

Note: Do NOT use chlorine tablets or granules intended for swimming pool disinfection, as this material is extremely difficult to eliminate from the pipe after the desired contact time.
6.4 The Contractor shall supply all valves, backflow preventers, chlorine, sodium sulfite, gauges, and all other equipment required to complete this procedure.

7 Draining Of Working Area
7.1 The Contractor shall provide and operate pumps or other equipment necessary to drain and keep excavations, pits, trenches, etc., free of water.
7.2 The Contractor shall be responsible for the proper treatment and discharge of all testing, drainage and other water from the construction and repair site or as the result of construction and repairs. This treatment and discharge shall be in accordance with federal, state, and local regulations and ordinances.

8 Procedure for new sections of underground pipe

8.1 Disinfect The New Piping And Fittings.

8.1.1 Chlorine dosing, water addition and testing must be witnessed and approved by an Authorized University Employee.

8.1.2 The slug method is typically the preferred method at Purdue University. Refer to AWWA Standard C651, Section 4.4: Methods of Chlorination.

8.1.3 Calcium hypochlorite granules are placed in the piping as it is installed, the piping is completely filled with water to eliminate air pockets and the piping is flushed to remove particulates.

8.1.4 Chlorinating the Piping: Refer to the “Purdue University Water Works Table of Chlorinating Dosages” in this Guideline. The target level is 200 ppm free residual chlorine when the water temperature is above 48°F but at no time may the free residual chlorine level exceed 400 ppm. The main must be disinfected at zero pressure (0 psi) by gauge for three hours.

8.2 Flush the Non-Potable Water from the Pipe and Fittings.

8.2.1 This procedure must be witnessed and approved by an Authorized University Employee or Designated Representative.

8.2.2 Flushing must be through an unrestricted outlet so that minimum pressure is applied to any portions of the water system not under repair.

8.2.3 Flowing water velocities, from the flushing, must be greater than one foot per second (1 FPS) and less than two and a half feet per second (2.5 FPS).

8.2.4 Flush six (6) minutes for every 100 feet of pipe from the farthest block valve to the repair point.

8.2.5 This step must be done in conjunction with Section 8.4 below.

8.3 Neutralize the Chlorine Remaining in the Disinfecting Water.

8.3.1 This procedure must be witnessed and approved by an Authorized University Employee. Refer to AWWA Standard C651 Section 4.5.2 Disposing of Heavily Chlorinated Water. As the disinfecting solution is flushed from the main it must react with granular technical grade sodium sulfite (Na2SO3).

8.4 Test for the Absence of Disease Indicator Bacteria; Total Coliforms:

8.4.1 This procedure shall be performed by an Authorized University Employee.

8.4.2 Refer to AWWA Standard Methods for the Examination of Water and Wastewater.

8.4.3 During the testing period, the work area shall be safe and protected from unauthorized access.

8.4.4 Free residual chlorine concentration shall be measured and reported for all samples. Two samples shall be taken; one of the potable water used for flushing just prior to the backflow preventer, and the second of the water from the repaired main and fittings. Another set of two samples at the same locations shall be taken 24 hours later.

8.4.5 No further work on the new pipe and fittings will be permitted until two sequential indicator bacteria tests (Total Coliform, Fecal Coliform) results are reported as “ABSENT”. Indicator bacteria testing shall be expected to take seven (7) days.

8.4.6 Written record, signed by the appropriate Purdue employee, of the indicator bacteria testing results shall be supplied to the Water Works Manager.

8.4.7 In the event two sequential indicator bacteria tests are not reported as “ABSENT”, repeat previous sections of this guideline until such results are obtained.

8.5 Flush The New Piping And Fittings To Remove All Loose Materials.

8.5.1 This procedure must be witnessed and approved by an Authorized University Employee or Designated Representative.

8.5.2 See AWWA Standard C651 Figures 1 & 2 and Table 3.

8.5.3 Flushing must be through an unrestricted outlet so that minimum pressure is applied to any portions of the water system not
under repair. Flowing water velocities, from the flushing, must be greater than two and a half feet per second (2.5 FPS) and less than ten feet per second (10 FPS).

8.5.4 Flush two (2) minutes for every 100 feet of pipe from the farthest block valve to the repair point.

8.5.5 At no time shall pressure be above 20 psi.

8.5.6 Flushing shall be to the nearest Authorized University Employee approved storm water drain.

9 Procedure for repaired sections of underground pipe

9.1 General

9.1.1 Disinfections will take place by using a chlorine concentration of 200 ppm with a contact time of three hours.

9.1.2 Refer to the Purdue pipe diameter to length chlorination dosage chart for the correct combination of bleach measured in ounces or Gal.lons. The chart also includes a reference for mixing 200 ppm chlorine solutions for submerging and surface disinfecting.

9.2 Reinstating Drained Systems, Major Repair or Renovation, and Cross Connection Repair:

9.2.1 Flood the affected water system with the 200 ppm chlorine solution.

9.2.2 Calculate the chlorine concentration by using the attached chart and protect the existing distribution system from potential back flow. Make sure the disinfectant is distributed throughout the system by checking for bleach odor at the outlets.

9.2.3 Valve off and allow to stand at zero pressure for three hours.

9.2.4 Submerge smaller plumbing materials which come in contact with potable water into a container with 200 ppm chlorine solution with a contact time of three hours. Any accumulation of dirt or contamination should be removed prior to submerging. These containers should be used for no other purpose.

9.2.5 The existing plumbing fixtures to which the sanitized hardware is to be attached should be thoroughly sprayed, swabbed, or soaked with a 200 ppm chlorine solution prior to connection.

9.2.6 Contact the Authorized University Employee so that the disinfectant level can be monitored.

9.2.7 Flush the system.

9.2.8 A bacterial water sample will be taken at the discretion of the Authorized University Employee.

9.3 Taps

9.3.1 Before the process of cutting and making a tap into the potable water system is initiated all surface dirt and contamination should be removed. A liberal application of a 200 ppm chlorine solution must then be applied to the tap site and to the cutting equipment.

9.4 Repair Clamps

9.4.1 If the water line remains live, and the pressure in the line remains above 20 psig at all times during the repair, then disinfection with chlorine will not be required. If the pressure drops below 20 psig at any time then the disinfection process will be followed.

9.5 Temporary Feeds or Bypass Lines

9.5.1 The type of plumbing materials being used for the construction of a bypass will determine the disinfection process. Smaller plumbing materials can be submerged while hoses should be flooded. Use the 200 ppm chlorine solution with a contact time of 3 hours for both procedures. Apply liberal amounts of a 200 ppm chlorine solution to the existing plumbing connection points. Temporary lines must be equipped with a back flow device so that the main water distribution system is protected.

10 Disinfection and flushing tables

10.1 Measuring Reference

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half Teaspoon</td>
<td>0.08</td>
</tr>
<tr>
<td>Teaspoon</td>
<td>0.16</td>
</tr>
<tr>
<td>Tablespoon</td>
<td>0.5</td>
</tr>
<tr>
<td>Cup</td>
<td>8.0</td>
</tr>
<tr>
<td>Pint</td>
<td>16</td>
</tr>
<tr>
<td>Quart</td>
<td>32</td>
</tr>
<tr>
<td>Gallon</td>
<td>128</td>
</tr>
</tbody>
</table>
### 10.2 200 ppm Concentration Reference

<table>
<thead>
<tr>
<th>Bleach</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 Oz.</td>
<td>1 Gallon</td>
</tr>
<tr>
<td>5.0 Oz.</td>
<td>10 Gallons</td>
</tr>
</tbody>
</table>

### 10.3 Sodium Sulfate required neutralizing 200 ppm chlorine per 100 lin. ft. of pipe

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>6”</td>
<td>0.47</td>
</tr>
<tr>
<td>8”</td>
<td>0.83</td>
</tr>
<tr>
<td>10”</td>
<td>1.30</td>
</tr>
<tr>
<td>12”</td>
<td>1.88</td>
</tr>
<tr>
<td>14”</td>
<td>2.55</td>
</tr>
</tbody>
</table>
**10.4 Chlorinating with 5.0% bleach dosages**

<table>
<thead>
<tr>
<th>Pipe Dia. (in)</th>
<th>Lin. Feet</th>
<th>10’</th>
<th>25’</th>
<th>50’</th>
<th>75’</th>
<th>100’</th>
<th>300’</th>
<th>1000’</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>0.064 Oz.</td>
<td>0.144 Oz.</td>
<td>0.288 Oz.</td>
<td>0.432 Oz.</td>
<td>0.58 Oz.</td>
<td>1.7 Oz.</td>
<td>5.744 Oz.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.224 Oz.</td>
<td>0.576 Oz.</td>
<td>1.152 Oz.</td>
<td>1.728 Oz.</td>
<td>2.304 Oz.</td>
<td>6.896 Oz.</td>
<td>1.436 Pint</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>0.512 Oz.</td>
<td>1.296 Oz.</td>
<td>2.592 Oz.</td>
<td>3.872 Oz.</td>
<td>5.168 Oz.</td>
<td>15.52 Oz.</td>
<td>1.616 Qt.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.912 Oz.</td>
<td>2.304 Oz.</td>
<td>4.592 Oz.</td>
<td>6.896 Oz.</td>
<td>9.2 Oz.</td>
<td>1.724 Pint</td>
<td>2.873 Qt.</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>1.44 Oz.</td>
<td>3.584 Oz.</td>
<td>7.184 Oz.</td>
<td>10.77 Oz.</td>
<td>14.37 Oz.</td>
<td>1.347 Qt.</td>
<td>1.122 Gal.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2.064 Oz.</td>
<td>5.168 Oz.</td>
<td>10.34 Oz.</td>
<td>15.52 Oz.</td>
<td>1.293 Pint</td>
<td>1.939 Qt.</td>
<td>1.616 Gal.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3.68 Oz.</td>
<td>9.12 Oz.</td>
<td>1.149 Pint</td>
<td>1.724 Pint</td>
<td>1.149 Qt.</td>
<td>3.447 Qt.</td>
<td>2.873 Gal.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>8.272 Oz.</td>
<td>1.293 Pint</td>
<td>1.293 Qt.</td>
<td>1.939 Qt.</td>
<td>2.586 Qt.</td>
<td>1.939 Gal.</td>
<td>6.464 Gal.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>14.7 Oz.</td>
<td>1.149 Qtr.</td>
<td>2.298 Qtr.</td>
<td>3.447 Qtr.</td>
<td>1.149 Gal.</td>
<td>3.447 Gal.</td>
<td>11.49 Gal.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.436 Pint</td>
<td>1.796 Qtr.</td>
<td>3.591 Qtr.</td>
<td>1.347 Gal.</td>
<td>1.796 Gal.</td>
<td>5.387 Gal.</td>
<td>17.95 Gal.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1.034 Qtr.</td>
<td>2.586 Qtr.</td>
<td>1.293 Gal.</td>
<td>1.939 Gal.</td>
<td>2.586 Gal.</td>
<td>7.757 Gal.</td>
<td>25.85 Gal.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1.408 Qtr.</td>
<td>3.519 Qtr.</td>
<td>1.76 Gal.</td>
<td>2.639 Gal.</td>
<td>3.519 Gal.</td>
<td>10.558 Gal.</td>
<td>35.19 Gal.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>1.839 Qtr.</td>
<td>1.149 Gal.</td>
<td>2.298 Gal.</td>
<td>3.447 Gal.</td>
<td>4.596 Gal.</td>
<td>13.789 Gal.</td>
<td>45.96 Gal.</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>2.873 Qtr.</td>
<td>1.796 Gal.</td>
<td>3.591 Gal.</td>
<td>5.387 Gal.</td>
<td>7.182 Gal.</td>
<td>21.546 Gal.</td>
<td>71.82 Gal.</td>
<td></td>
</tr>
</tbody>
</table>

Chlorine dosage of 200 ppm may be used for dosage times of 3 hours when water temperature > 48 F