Why proper design and installation are so important—

To protect our water supply
Plumbing installation practices can impact drinking water quality. Copper is an acute contaminant that can cause gastrointestinal upset and other health problems. Installing copper pipe incorrectly can increase the copper concentration in drinking water above the national water quality standard. Metal shavings left in the pipe can also impact taste and odor.

To protect our environment
Like other heavy metals that accumulate in San Francisco Bay, excessive copper has a negative environmental impact. Of the copper discharged to the Bay from wastewater treatment plants, about 60% is believed to be from copper pipe corrosion. Copper is acutely toxic to plankton, and accumulates in shellfish, affecting their reproduction and growth. Impacts to these and other species can upset the natural balance of species.

The Bay Area Pollution Prevention Group (BAPPG) is a committee of the Bay Area Clean Water Agencies (BACWA) that develops Bay Area-wide pollution prevention programs. (BACWA is a joint public powers authority whose members include public utilities that collect and treat municipal wastewater from the nine Bay Area counties.) To this end, BAPPG initiated a public education program focused on promoting pollution prevention through individual actions.

Visit www.baywise.org to learn more about how you can reduce water pollution and protect local creeks, the San Francisco Bay, and the Pacific Ocean. This website has information on a wide range of pollutants, such as pharmaceuticals, copper, mercury, used cooking oil, and household and gardening products.

Graphics Sources:
Copper Tube Handbook, Copper Development Association (CDA), 2002.
Proper Design and Installation Steps

☐ **System design**
  ✓ Minimize direction and size changes.
  ✓ Avoid stagnant sections.
  ✓ Minimize velocity (< 8 ft/s in cold lines, and <4-5 ft/s in hot lines).

☐ **Storage Protection**
  ✓ Protect pipe from weather and damage.

☐ **Careful reaming and cleaning**
  ✓ Eliminate small burrs created from pipe cutting. This prevents metal shavings from causing taste/odor issues and reduces turbulence, thereby decreasing corrosion.
  ✓ Remove all oxides, debris, and surface soil from tube ends.

☐ **Select the correct flux, and avoid excess**
  ✓ Select only flux with the “ASTM B813” standard to limit flux corrosivity.
  ✓ Avoid petroleum-based flux as it cannot be effectively flushed out of the pipe.
  ✓ Avoid ammonia-based flux as it attracts bacteria, which may impact taste and odor.
  ✓ Avoid zinc-based flux due to water quality impact.
  ✓ Avoid using excess flux; residue can increase pipe corrosion.

☐ **Immediately flush the system**
  ✓ Remove aerator and strainer screens.
  ✓ Flush system at a velocity of 3.6 feet/second for at least 30 minutes.

☐ **Building commissioning and operation**
  ✓ Avoid “shock chlorination” unless required by code.
  ✓ Minimize hot water temperature; a system temperature of 125°F is recommended.
  ✓ For inactive buildings, flush the system once a month. Stagnant water corrodes pipe.

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Physical factors, such as flow velocity and water temperature, significantly affect pipe corrosion rate.

Skilled reaming, prior to soldering, removes burrs and rough edges. This removes spots where turbulence can occur, thereby reducing corrosion. It also removes metal shavings that could affect taste and odor.

Appropriate choice of flux and careful reaming and cleaning are key to avoiding pipe corrosion. Excess flux that has not been effectively flushed can create physical pitting in the pipe, increasing copper corrosion.

For line flushing, how much is 3.6 feet/second?

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Flow Rate (gal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ inch pipe</td>
<td>2.2 gal/min</td>
</tr>
<tr>
<td>¾ inch pipe</td>
<td>5 gal/min</td>
</tr>
<tr>
<td>1 inch pipe</td>
<td>8.8 gal/min</td>
</tr>
<tr>
<td>1½ inch pipe</td>
<td>20 gal/min</td>
</tr>
<tr>
<td>2 inch pipe</td>
<td>35 gal/min</td>
</tr>
</tbody>
</table>

The corroded pipe at right is from a 500-unit condominium complex. This corrosion was rapid, occurring prior to wallboard installation.

What happened?
The installer used a flux that was not ASTM B813 compliant, and did not flush excess flux after installation.

Excess flux remaining in a 6-year-old pipe

If flux is not flushed, a visible water quality impact occurs in water that is stagnant for three weeks.