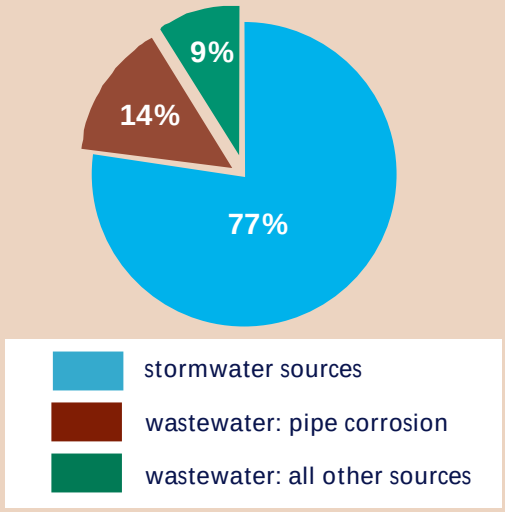
Preventing Corrosion Protects San Francisco Bay

A Fact Sheet for Designers

Copper Sources to the Bay

Like other heavy metals that accumulate in the Bay, excessive amounts of copper have a negative environmental impact. Copper enters the Bay via storm drains and discharge from wastewater treatment plants (see pie chart below). In South San Francisco Bay, about 77 percent of copper is from stormwater sources, while 23 percent is from wastewater treatment plants. Of that wastewater component, 60 percent is believed to be from copper pipe corrosion.(1)

Typical Breakdown of Bay Copper Sources



**Calculations based on data for South San Francisco Bay, south of the Dumbarton Bridge.*

Environmental Consequences

Copper is acutely toxic to plankton. Copper also accumulates in clam tissue, affecting reproduction, development, and growth. Because copper and other heavy metals affect these and other Bay species, they can upset the natural balance of species.

Wastewater Discharge Consequences

All Bay Area wastewater treatment plants receive permits to discharge to the Bay. These permits strictly limit copper in wastewater effluent. Many permits also require industrial and commercial pollution prevention programs to reduce copper discharges to the Bay.

Designers Are Part of the Solution!

Plumbing engineers and system designers can significantly reduce pipe corrosion by making simple design adjustments. The techniques listed below reduce pipe corrosion and help protect San Francisco Bay.(1)

1. Minimize velocity
2. Minimize hot water temperature
3. Specify low-corrosivity water-flushable fluxes
4. Avoid stagnant sections
5. Minimize direction and size changes

For further details regarding design methods to reduce corrosion, see the back of this fact sheet.

Pitting in 6-year-old cold water pipe caused by excess flux at solder joint. (2)

Less Corrosive Fluxes

The ASTM B813 flux standard limits flux corrosivity and requires that the flux be water flushable. While these are voluntary standards, the Copper Development Association encourages architects, engineers, contractors and building officials to specify and require the use of B813 fluxes.

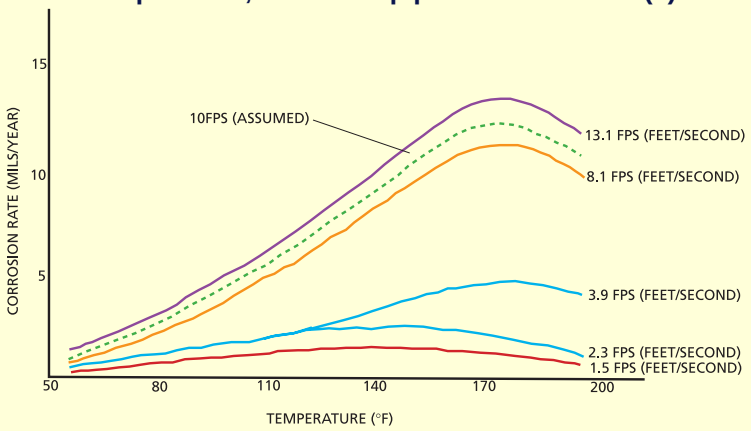
All flux manufacturers make a B813 flux. B813 fluxes commonly available in California include:

- Everflux
- Harris Bridget
- Sterling
- Fry's Fire Eater
- LaCo Ultimate B813 Flux

More Ways to Prevent Corrosion and Protect the Bay

- Use larger diameter piping to keep velocities low: cold line velocity < 8 ft/s; hot lines < 4-5 ft/s.
- Make sure return lines in a circulating hot water system have the same diameter as the supply lines.
- Avoid stagnant sections; minimize direction and size changes.
- Use compatible materials. When multiple materials do need to be joined, specify insulating unions. Specify copper or brass straps for supporting copper pipe.
- Prevent electrical currents by grounding directly to a copper rod driven into the earth. Do not attach a grounding wire to water pipes. Route wires away from water pipes and don't use galvanized nails that touch copper piping.
- Avoid induced stresses - provide enough pipe support and allow for thermal expansion.
- Consider non-copper pipe (e.g., PEX or stainless steel) where its use is permitted.
- Specify non- or low-lead faucets, valves and appurtenances. Use low flow fixtures and appliances and aeration faucet outlets.
- Specify fluxes that meet ASTM B813 standard. (3)
- Specify that copper tube and fittings be installed according to ASTM B828-92. (4)
- Emphasize careful reaming of cut ends in order to reduce turbulence. Plumbing inspectors and the Copper Development Association both report that unreamed tubing corrodes and fails much more quickly than tubing which is properly reamed.
- Emphasize correct use of ASTM B813 fluxes. Using excess flux or a corrosive flux cause early pipe failures.
- Use stainless steel piping and components for industrial process water supplies, heat exchangers, chillers, condensers when operating temperatures exceed 140°F.
- Incorporate coupons or easy-access inspection points into long stretches of pipe to simplify corrosion monitoring.
- Provide flanged fittings or unions for pumps and other devices that must be removed for maintenance. This reduces soldering to aged pipe.

Physical factors, such as flow velocity and water temperature, affect the pipe corrosion rate. (5)



References

1. Barron, Thomas, "Guidelines for Designers, Installers, and Owners of Copper Piping Systems" prepared for the City of Palo Alto, August 2001. Available at www.city.palo-alto.ca.us/cleanbay/pdf/cuguidelines.pdf
2. Lewis, Richard, "A White Paper Review: History of Use and Performance of Copper Tube for Potable Water Service," Washington Suburban Sanitary Commission, 1999.
3. ASTM B813-93, "Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube."
4. ASTM B828-92, "Standard Practices for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings."
5. Yeager, Thomas, "Copper Corrosion Reductions Associated with the Design and Construction Practices of Piping Systems, Heating Systems, Cooling Systems, and Hot Water Ciruclating Systems," Kennedy/Jenks Consultants, Final Report to City of Palo Alto and City of San Jose, June 1995, Page 4-19.

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BAPPG Bay Area Pollution Prevention Group

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