How Clean is Clean?

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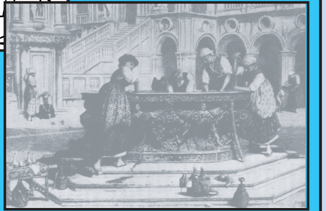
Water Quality

When most of us refer to “clean water” we are usually making a judgement relative to a standard. That standard can be based on concerns about human health, about aquatic life, or about perturbations from background or “natural” conditions. History has shown that the success of civilizations are dependent on issues related to the quality as well as quantity of accessible water (see pictures below). There are many methods that are used to determine the quality of water (physical, chemical and biological). Many of them are applied by the USGS here in the Vincent E. McKelvey Building to understand the processes that regulate the quality of our nation’s surface and ground waters. Some of the methods require highly controlled laboratory analysis and involve sophisticated instrumentation and sample handling. Others are much simpler to perform and can be readily executed in the field. Try this “hands on” demonstration to see one way we determine the quality of water.

Historical Water Purification

Egyptian method for water clarification by sedimentation. From the wall of the tomb of Amenophis II at Thebes, 1450 B.C.[a]



Venetian filter-cistern, circa 1560[a]

Conductivity & TDS (Total Dissolved Solids)

This hands-on presentation provides an example of a simple yet fundamentally important measure of water quality. The parameter is called conductivity and is a measure of how well water carries an electrical current. Although conductivity is dependent on water temperature, it is primarily affected by the presence of ions in solution. Therefore, elevated conductivity often represents elevated concentrations of total dissolved solids (salts) in solution. We welcome you to try to measure the conductivity for the wide range of water samples provided here. Note that specific conductivity is expressed in units of microseimens per centimeter (the reciprocal of an electrical resistence measurement). Because of osmotic balances within our bodies, potable water is typically below 900 microseimens per centimeter.

Do you know "how clean is clean"?

Try this “Hands On” Demonstration

What is in..........	Conductivity (microseimens per centimeter)	TDS (milligrams per liter)	pH	Ca & Mg (milligrams per liter)	Na (milligrams per liter)	Nitrate (milligrams per liter)	Cu (micrograms per liter)	Zn (micrograms per liter)	Comments
Pacific Ocean[b]	~60,000	35,000	7.8	1750	10800	0.6	0.2	0.5	Typical deep oceanic values
South S.F. Bay[c]	~50,000	30,000	7.8 - 8.2	1270	7700	~0.5	~2	~1	North of Dumbarton Bridge
U.S. EPA Standard[d]	900	500	6.5 - 8.5[j]	N/S	20	10.0	1000.0	5000.0	Health Standards from E.P.A.
Evian[e]	~550	309	7.2	102	5	4	0.7	4.0	Source: French Alps
Calistoga[f]	~120	110	6.1	6	8	0.6	0.1	2.3	Source: Napa Valley
Building Tap Water[g]	~90	260-267	7.0 - 8.8	65 - 67	25	<.05 - 2	<80	N/S	Source: Hetch-Hetchy Reservoir
Lab Water (M2021)[h]	~0.4	~0.06	7.4	0.00006	0.00001	<0.001	0.001	0.001	Highly filtered and processed

Sources of Information
a: Baker, M.N. 1981. The Quest for Pure Water. American Water Works Association, 2d edition, 527 p.
b: Millero, F.J. 1996. Chemical Oceanography, CRC Press, 1st edition, 469 p.
c: Chemical Oceanography; Regional Monitoring Program 1997 Annual Report, SFEI; and USGS Water Resources Data, CA, Water Year 1984
d: EPA Drinking Water Regulations and Health Advisories
e: Evian web site: http://www.evian.com
f: Calistoga web site: http://www.calistogawater.com
g: California Water Service Company, Bear Gulch District, 2002 Water Quality Report
h: Millipore Corporation, technical services
i: Parts of this paragraph were taken from Water Quality Association web site (http://www.wqa.org/WQIS/wqb-hardwater.html)
j: pH is an EPA Secondary Drinking Water Standard, an unenforceable federal guideline regarding taste, odor and color.

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