

Desalination Technology as a Health Hazard

By Larry Rose M.D., M.P.H.

Various causes of operational failures have been documented in many articles about the existing worldwide desalination plants in peer reviewed engineering articles. These articles are focused on the economic consequences of repair and maintenance. (Desalination: 153 (2002) pp. 199-205). Pipes, pumps, ejectors, valves, and most important the reverse osmosis membranes all have failed due to a variety of physical, and biological causes. These engineering analyses are only looking at the material reasons and costs of these failures. However when the source water is the San Francisco Bay highly polluted water, the potential contamination of the SWRO post treatment water that will be supplied to the Marin users is a real concern and has not been adequately studied.

San Francisco Bay Pollution

The history of the contamination of the S.F. Bay begins in a major way with the hydraulic gold mining runoff in the mid 19th century, followed by the location of industries and industrial agriculture located along the tributaries feeding into the delta, and on the shores of the Bay. Shipping, particularly oil spills, and nuclear powered ships are additional major factors. The illegal dumping of toxic chemicals, storm road runoff, dredging, inadequately designed sewerage plant discharges, runoff from solid, and toxic landfills, and discharges from power plants, oil refineries, chemical/plastic plants, high tech industries, construction, commercial paints, port facilities, shipyards, military facilities, households, commercial real estate, and hospitals are other important sources of Bay sediment/water pollution.

With improvements in chemical analytical technology the following are the major pollutants that have been well-documented in the Bay water/sediment and that have been found in the many life forms that have existed in San Francisco Bay, and have bio-accumulated, and bio-magnified and has resulted in a tragic diminution of all fish, Bay marine life (e.g., bivalves, crab, and other invertebrates), migratory birds, and a widespread, uneven contamination of all Bay waters/sediments: heavy metals (particularly mercury, lead, cadmium, chromium), dioxins, dibenzofurans, PCBs, polyaromatic hydrocarbons (PAHs), PBDEs (polybrominated diphenyl ethers), toxic pharmaceuticals (particularly hormone disruptors), personal care product chemicals, pesticides, fertilizer nitrates, and nitrites, solvents, detergents, plasticizers (e.g., bisphenyl A, and phthalates), plastic monomers, and many chemical breakdown molecules that often are more toxic than the original compound. Often the levels of these toxic compounds dramatically

and suddenly overwhelm all Bay life systems when catastrophic events occur -- e.g., the Costco Buscan oil spill -- and this highly toxic bunker oil is distributed along all of the Bay shores. Such spills have, and will continue to happen periodically.

There are six major sewerage disposal plants that are running processed sewer water into the southern Bay waters. These aging plants frequently malfunction as the stench of these events often wafts over the Marin County air as hydrogen sulfide (a toxic rotten eggs stench) causing downwinders to quickly roll up their windows. Raw sewerage Bay spills from six sewerage disposal plants frequently accompany these toxic gas emissions as hundreds of thousands of gallons of raw sewerage are dumped into the southern Bay waters annually. Inherent in this Bay contamination source is a unique public health hazard aside from the pharmaceuticals, endocrine disruptors, heavy metals, and toxic organics. Drug resistant highly virulent "superbug" microorganisms are produced in the mix that is coming from residents, hospitals, clinics, laboratories, and biotechnology. These are antibiotic resistant pathogens and DNA coded for antibiotic resistance that have been contributing to the spread and virulence of these "superbugs" to communities. Health care providers are well aware of the increasing incidence of MSRA and other new antibiotic resistant devastating infections. The genetic material is exchanged and antibiotic/chlorine resistance occurs in the mix of these sewer plants. Microorganism pathogenicity, antibiotic resistance, and virulence is potentiated. These DNA and viral-sized particles will pass through the reverse osmosis filters and will inevitably enter the Marin potable water supply with reverse osmosis desalination.

Chemicals as a Public Health Problem

There are at present over 85,000 chemicals in commercial use in the U.S. -- 10 to 15% of these are in "high volume" use. The vast majority of these chemicals have not been tested, but were grandfathered in when the Toxic Substances Control Act was implemented in the 1970's. The toxicologic testing that was done was only animal testing for acute effects. There was little or no testing for chronic or hormone disrupting multigenerational toxic effects. None of the toxicologic testing was done on the combinations of the multiplicity of chemicals that members of the public have adsorbed, and accumulated.

Testing for the major categories: carcinogens, mutagens, reproductive hazards (CMRs) are just now being adequately checked in Europe under the REACH program to screen out the worst chemicals,

Recent scientific discoveries led by Theo Colborn and other chemical hormone disruptor researchers have pushed the EPA into finally considering a chemical hormone disruptor screening program that will begin over the next 10 years. These hormone disrupting effects occur with water exposures in ultra dilute concentrations (below parts per trillion) particularly putting embryos, fetuses, newborns, infants, and young children at developmental

risk.

Recent surveys of the general U.S. population have shown an astounding presence of the most toxic of these same chemicals in the bodies of all adults. (The CDC Third National Report on Human Exposure to Environmental Exposure to Environmental Chemicals-2005). Other studies have shown the same chemicals in human cord blood (trans-placental fetal contamination), and maternal milk. The levels of these chemicals found in the bodies of the American public has been dismissed by many as being too dilute to link these findings to any of the major diseases that are the leading causes of mortality, morbidity in the U.S. However, in fact many of the increasing major diseases, or adverse health effects found in the general public, are only explained by environmental chemical exposures to these toxic chemicals.

These diseases that are increasing in incidence and are leading causes of disabilities and deaths are: a variety of cancers (breast, lung, leukemia, brain, lymphoma, prostate, pancreas, testicular, brain, melanoma, etc.), immune system dysfunction (decreased resistance to infectious diseases, autoimmune diseases), central nervous system dysfunction (Alzheimer's, Parkinson's, multiple sclerosis, learning dysfunction, memory loss), reproductive system dysfunction (infertility, birth defects, spontaneous abortions, premature births, defective sperm counts, developmental disabilities, dysfunctional sexual development, autism, low birth weight, birth defects), and epigenetic multigenerational effects.

Conclusion

The testing sampling "sampling and analysis program" implemented by the MMWD with the desalination "pilot plant", was done under ideal conditions, and not under sudden Bay water polluting events that frequently occur, e.g., a raw sewerage discharge, oil spills, an unexpected large chemical discharge, dredging the sediments, storms that kick up sediments, etc. It certainly did not take into account the frequent SWRO plant operational failures, and the resulting contaminated water that will be put into the general system. Therefore the potential health impact on Marin tap water users is not adequately addressed by the MMWD pilot desalination testing program.

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Background of the writer: Occupational/Environmental Medicine Specialist and a UCSF Occupational/Environmental Medicine assistant professor, and recently retired, after 28 years, as the senior medical director of the Cal/OSHA Medical Unit. Dr. Rose as a Public Health Medical Officer was the lead medical investigator in most of the industries that have been impacting the levels of pollution in San Francisco Bay.