Singapore Area Coordinator Drinking Water Annual Consumer Confidence Report

The U.S. Navy applies the regulations of the U.S. Safe Drinking Water Act (SDWA) to all U.S. Navy installations overseas. In accordance with the U.S. Department of the Navy regulations, Singapore Area Coordinator (SAC) issues an annual report describing the quality of our drinking water. This report reflects water quality monitoring data collected from January 1, 2022 through December 31, 2022.

SAC is pleased to report calendar year 2022's monitoring activities of our drinking water. Details of an exceedance that occurred in early 2022 are provided later in this report. We will continually monitor our drinking water to ensure we are meeting all U.S. and Singaporean standards for water quality.

Drinking Water Standards

To ensure water is safe to drink, the U.S. Navy complies with water quality standards set by the U. S. Environmental Protection Agency (EPA). Per Navy guidance, SAC is required to regularly test the installation's drinking water for contaminants and report the results on an annual basis.

Last year, SAC's drinking water met all EPA and Singapore National Environmental Agency (NEA) standards for drinking water quality. SAC's drinking water also met the standards established by the Department of Defense (DoD) Overseas Environmental Baseline Guidance Document (OEBGD) and CNICINST 5090.1 U.S. Drinking Water Standards for U.S. Navy Installations Overseas.

In the latest compliance monitoring period, SAC conducted tests for over 120 contaminants which have the potential to be present in drinking water. Table 1.0 identifies all contaminants detected in SAC water and their levels of concentration. All drinking water, to include bottled water, is reasonably expected to contain at least small amounts of some contaminants and the presence of contaminants in water does not necessarily indicate a health risk.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. Such individuals should seek advice from their health care providers about drinking water.

Water Sources

Singapore built a robust, diversified, and sustainable water supply from four water sources known as the Four National Taps – water from local catchment, imported water, reclaimed water (known as NEWater) and desalinated water. The Public Utilities Board (PUB) is the Singaporean agency responsible for the treatment and distribution of drinking water throughout the island. Water provided by the PUB arrives at SAC compliant with U.S. standards. No additional water treatment is provided by

SAC. The Public Works Department (PWD) routinely tests the water to ensure it meets water quality standards.

Additional information on the Four National Taps is avaialble on the PUB website: https://www.pub.gov.sg/

Water Treatment
Raw water from various sources within Singapore and Malaysia are conveyed by pipelines to local waterworks where it is chemically treated, filtered and disinfected. Treatment removes contaminants and improves water clarity and taste.

Most treatment plants use chemical coagulation to remove larger particles (i.e., dirt or debris) suspended in the raw water. Aluminum sulfate is the main coagulant, and hydrated lime and polyelectrolyte are used as coagulant aids. These chemicals cause the suspended matter to settle more readily, thus facilitating removal of large particles. Rapid gravity filtration is used to remove finer particles of suspended matter.

Chlorine, and sometimes ozone, is then added to the filtered water to disinfect and remove all harmful bacteria and viruses. Ammonia is added to combine with the free chlorine to form stable chlorine residual. Activated carbon is also used to remove any bad taste and odor from the water.

Sodium silicofluoride is added to the water as it progresses from the filters to the clear water tank. Fluoridation is required by the Singapore Ministry of Health, and has been a standard water treatment practice since 1957 to prevent tooth decay (cavities). The water is then pumped into the distribution system, ready for consumption.

Water Quality Monitoring
Singapore PUB and SAC routinely monitor for contaminants using certified laboratories and approved methods.

The following contaminants are monitored:

- Monthly – Total Coliform, pH, Total Chlorine, Bromate, Nitrate/Nitrite & Total Nitrate/Nitrite.
- Quarterly – Disinfection by-products [Total Trihalomethanes (TTHM) and Haloacetic Acids (HAA5), Volatile Organic Chemicals & Synthetic Organic Chemicals.
- Annually – Lead, Copper, Inorganic Chemicals, Pesticides, Herbicides & PCBs
- Once every three years – Radionuclides, Per- and Polyfluoroalkyl Substances (PFAS)
- Once every nine years – Asbestos

Table 1.0 lists contaminants detected during the last applicable sampling period. The samples were collected directly from water fixtures at selected locations throughout the water distribution system in the housing and industrial areas of SAC. Only contaminants detected during sampling are listed in the tables.

Substances Expected in Drinking Water
The source of drinking water comes from surface waters including rivers, lakes, streams, ponds and reservoirs. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants which may be present in SAC's water (listed alphabetically)

Arsenic occurs in inorganic and organic forms. Inorganic arsenic compounds (such as those found in water) are highly toxic while organic arsenic compounds (such as those found in seafood) are less harmful to health. Additional information on arsenic in drinking water is available from the EPA: http://water.epa.gov/lawsregs/rulesregs/sdwa/arsenic/index.cfm

Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.

Lead can come primarily from materials and components associated with service lines and home plumbing. Singapore ended the practice of using lead-containing materials in water systems over 20 years ago, though it is possible plumbing components over 20 years old may still contain lead. Elevated levels of lead in water can cause serious health problems, especially for pregnant women and young children.

When water in a pipe has been sitting for several hours, one can minimize the potential for lead exposure by running the tap for 30 seconds to two minutes before using water for drinking or cooking. Additional information on lead in drinking water is available from the EPA: https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Nitrate is an inorganic chemical that is naturally present in soil, water and food. Major sources of nitrate in drinking water include fertilizers, sewage and animal manure. Nitrates themselves are relatively nontoxic; however, when swallowed, they are converted to nitrites that can react with hemoglobin in the blood, creating methemoglobin. Infants convert approximately ten percent of ingested nitrates to nitrites,

double the conversion rate of older children and adults. High enough concentrations of nitrate in drinking water can result in a temporary blood disorder in infants called methemoglobinemia, commonly called "blue baby syndrome." In severe, untreated cases, brain damage and eventually death can result from suffocation due to lack of oxygen. Additional information on nitrate in drinking water is available from the EPA: http://water.epa.gov/drink/contaminants/basicinformation/nitrate.cfm

Organic chemical contaminants, including synthetic and volatile organic chemicals, are by-products of industrial processes and petroleum production, as well as gas stations, urban storm water runoff, and septic systems.

Radioactive contaminants which can be naturally-occurring or be the result of oil and gas production and mining activities.

What are per- and polyfluoroalkyl substances and where do they come from? Per- and polyfluoroalkyl substances (PFAS) are a group of thousands of man-made chemicals. PFAS have been used in a variety of industrial and consumer products around the globe, including in the United States for decades. Due to their widespread use and environmental persistence, most people in the United States have been exposed to certain PFAS. PFAS have been used to make coatings and products that are used as oil and water repellents for carpets, clothing, paper packaging for food, and cookware. They are also contained in some foams (aqueous film-forming foam or AFFF) used for fighting petroleum fires.

Is there a federal regulation for PFAS in drinking water?
There is currently no federal drinking water standard for any PFAS compounds. In May 2016, the U.S. Environmental Protection Agency (EPA) established a lifetime drinking water health advisory (HA) level at 70 parts per trillion (ppt) for individual or combined concentrations of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). Both chemicals are types of PFAS.

The Department of Defense (DoD) issued policies in 2020 to monitor drinking water for PFAS at all DoD owned or DoD operated water systems. DoD monitors for PFAS at a minimum of every three years. The DoD policy states that if water sampling results confirm that drinking water contains PFOA and PFOS at individual or combined concentrations greater than the 2016 EPA HA level of 70 ppt, water systems would 1) take immediate action to reduce exposure to PFOS or PFOA, to include providing alternative drinking water; and 2) undertake additional sampling to assess the level, scope, and localized source of contamination.

What about the EPA's 2022 interim Health Advisories or proposed regulations?
EPA issued interim Health Advisories for PFOS and PFOA in 2022. However these newer levels are below quantifiable limits (i.e., below detection levels). EPA is expected to issue a proposed regulation on PFAS drinking water standards for public comment in the next few months. DoD looks forward to the clarity that a nationwide regulatory standard for PFOS and PFOA in drinking water will provide.

In anticipation of this EPA drinking water regulation and to account for emerging science that shows potential health effects of PFOS and PFOA at levels lower than 70 ppt, DoD is evaluating its efforts to address PFAS in drinking water, and what actions we can take to be prepared to incorporate this standard, such as reviewing our current data and collecting additional sampling where necessary. DoD remains committed to communicating and engaging with our communities throughout this process.

Has SAC tested its water for PFAS?

Yes. In November 2022 samples were collected from Building 7-4 2nd floor SAC break room.

We are pleased to report that drinking water testing results were below the Method Reporting Limit (MRL) for all 18 PFAS compounds covered by the sampling method, including PFOA and PFOS. This means that PFAS were not detected in your water system. In accordance with DoD policy, the water system will be resampled every three years for your continued protection.

Water Quality Data Table
SAC conducts extensive monitoring to ensure your water meets all water quality standards. The results of the monitoring are reported in the tables on the following pages.

The presence of a contaminant does not necessarily indicate a health risk. Please note the PWD monitors many contaminants, in addition to the ones listed below, per the OEBGD and CNICINST 5090.1A. Only those contaminants detected during laboratory analysis are listed below. The water samples were collected from SAC facilities and analyzed by Marchwood Laboratory Services Pte. Ltd. an ISO / IEC 17025, 2019 Certified Laboratory.

Additional Information:
U.S. EPA Office of Water (www.epa.gov/safewater) and the Center for Disease Control and Prevention (www.cdc.gov) websites provide information on many issues relating to water resources, water conservation, and public health.

Singapore Area Coordinator Drinking Water Annual Consumer Confidence Report

Table Definitions and Abbreviations

AL (Action Level): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a water system must follow.

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no know or expected risk to health. MCLGs allow for a margin of safety.

MRDL (Maximum Residual Disinfectant Level): The highest level of drinking water disinfectant routinely allowed in drinking water. Addition of a disinfectant is necessary for the control of microbial contamination

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contamination.

N/A: Not applicable

ND: Not detected

mg/L (milligrams per liter): one part substance per million parts water (parts per million).

ng/L (nanograms per liter): one part substance per trillion parts water (parts per trillion)

µg/L (micrograms per liter): one part substance per billion parts water (parts per billion)

pCi/L (picocuries per liter): Measurement of the natural rate of disintegration of radioactive contaminants in water (also beta particles).

mrem/yr (millirem per year): one thousandth of a rem. Measurement of dose of absorbed energy adjusted to be equivalent for different kinds of radiation.

MFL (million fibres per liter): Measurement of the presence of asbestos fibres that are longer than 10 micrometers.

TT (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

90th percentile: Represents the highest value found out of 90 percent of the samples taken. If the 90th percentile value is greater than the AL, a treatment evaluation and/or mitigation actions must be conducted on the water system.

How to Read the Data Tables:
Starting with a "Substance", read across. "MCL" shows the highest level of substance (contaminant) allowed in drinking water. "MCLG" is the goal level for that substance (this may be lower than what is allowed). A "No" under "Violation" means the amount of the substance met government requirements. "Possible Source of Contamination" tells where the substance usually originates.

Unregulated substances are measured, but maximum allowed contaminant levels have not been established by the U.S.

Concerns/Additional Copies:
For questions, information, and /or additional copies, please contact Singapore Area Coordinator, Public Works Officer, LCDR Alex Rovinsky at (+65) 6750 2574 or email: alexander.j.rovinsky.mil@us.navy.mil

Singapore Area Coordinator Drinking Water Annual Consumer Confidence Report

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER

Public Notification

Singapore Area Coordinator (SAC) had Levels of Dichloromethane Above Drinking Water Standards

Our water system exceeded a drinking water standard. Even though this was not an emergency, as our customers, you have a right to know what happened and what we are doing to correct this situation.

An exceedance for Dichloromethane **(**CH_2Cl_2**)** in FY22 was discovered during SAC's September 2022 Sanitary Survey, while reviewing routine drinking water monitoring data for the presence of contaminants. On 14 March 2022, SAC received notice that a sample collected on 04 February 2022 effected the Locational Running Annual Average (LRAA) to exceed the Maximum Contaminant Level (MCL) for CH_2Cl_2. The sample collected results of 04 Feb 2022 indicated a concentration of 0.043 mg/L. The MCL for CH_2Cl_2 is 0.005 mg/L.

"LRAA" is the average of drinking water analytical results for samples taken at a particular monitoring location during the previous four calendar quarters. The LRAA is calculated using the following formula: LRAA = (Q1 + Q2 + Q3 + Q4) / 4.

What does this mean?

- This was not an emergency. If it had been, you would have been notified within 24 hours. However, some people who drink water containing dichloromethane in excess of the MCL over many years may develop liver damage and an increased risks of getting cancer.

What is being done?

- A SAC independent contracted laboratory issued a memo on 23 September 2022 notifying a transcription error for a Dichloromethane analysis sampling exceedance. However, SAC is unable validate the exceedance via quality control records. This public notification is out of an abundance of caution.

- Going forward, all sampling analysis are required to have quality control records accessible for validation investigation discrepancies.

- Prior to the exceedance of 4 February 2022, the LRAA was 0.0041 mg/L. Results from on-going quarterly sampling indicate there's no MCL CH_2Cl_2 exceedances

- Singapore Public Utility Board's (PUB) water quality data indicates no dichloromethane exceedances in water provided to SAC. (https://www.pub.gov.sg/watersupply/waterquality/drinkingwater)

What should I do?

- There is nothing you need to do. You do not need to boil your water or take other corrective actions. However, if you have specific health concerns, consult your doctor.

- If you have a severely compromised immune system, have an infant, are pregnant, or are elderly, you may be at increased risk and should seek advice from your health care providers about drinking this water. General guidelines on ways to lessen the risk of infection by microbes are available from EPA's Safe Drinking Water Hotline at 1-800-426-4791.

If you have questions or concerns regarding this notice, please contact the Singapore Area Coordinator Public Affairs Specialist at DSN 315 421 2994 or email: SAC_PAO@fe.navy.mil.

If you have any health questions or concerns, I encourage you to contact your primary health care provider.

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

TABLE 1.0: Drinking Water Constituents Detected						
Substance	**Unit of Measurement**	**Level Detected**		**Regulated Levels (OEBGD and CNICINST M-5090.1)**	**Violation**	**Possible Sources of Contamination**
		Low	**High**		**Yes / No**	
Inorganic Contaminants						
Antimony	**mg/L**	0.0034		MCL = 0.006 MCLG = 0.006	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Barium	**mg/L**	0.026		MCL = 2 .0 MCLG = 2.0	No	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Cadmium	**mg/L**	0.00028		MCL = 0.005 MCLG = 0.005	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Fluoride	**mg/L**	0.44		MCL = 4.0 MCLG = 4.0	No	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
Nitrate (as Nitrogen)	**mg/L**	0.68	0.87	MCL = 10 MCLG = 10	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Nitrite (as Nitrogen)	**mg/L**	0.026	0.084	MCL = 1.0 MCLG = 1.0	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Total Nitrite & Nitrate (as Nitrogen)	**mg/L**	0.76	0.92	MCL = 10 MCLG = 10	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Sodium*	**mg/L**	1.96		MCL = N/A MCLG = N/A	No	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
Disinfectant/Disinfection Byproducts						
Haloacetic Acids	**mg/L**	0.001	0.032	MCL = .06 MCLG = N/A	No	Byproduct of drinking water disinfection
Trihalomethanes (Total)	**mg/L**	0.041	0.052	MCL = .08 MCLG = N/A	No	Byproduct of drinking water disinfection
Total Chlorine	**mg/L**	0.23	1.89	MRDL = 4.0 MRDL = 4.0	No	Water additive used to control microbes
Microorganisms						
Total Coliform	**positive samples per month**	<1	<1	MCL = 0 MCLG = 0	No	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and E. coli only come from human and animal fecal waste
Radionuclide						
Gross Alpha	**pCi/L**	1.18		MCL = 15 MCLG = 0.0	No	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Combined Radium-226 and -228	**pCi/L**	ND		MCL = 5 MCLG = 0.0	No	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Beta particle and Photon Radioactivity (Gross Beta)	**pCi/L(screening testing)** Note: Additional testing and calculation for mrem/yr required if screening testing results >50pCi/L	5.1		MCL = 4 mrem/yr MCLG = 0.0 mrem/yr	No	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation

Volatile Organic Compounds (VOCs)						
Dichloromethane*	**mg/L**	<0.0005	0.0125	MCL = 0.005 MCLG = 0.005	Yes	Discharge from petroleum factories
Tetrachloromethane	**mg/L**	<0.0005	0.0015	MCL = 0.005 MCLG = 0.005	No	Discharge from petroleum factories

*The contracted laboratory sampling for Dichloromethane issued a memo on 23 Sep 2022 indicating the exceedance is the result of a transcription error. However, due to contractual limitations to access quality control data from the subcontractor, we are unable validate the exceedance did not occur.

Lead and Copper							
Substance	**Unit of Measurement**	**Level Detected**		**Regulated Levels (OEBGD and CNICINST 5090.1)**	**Violation**	**90th percentile**	**Possible Sources of Contamination**
		Low	**High**		**Yes / No**		
Copper	**mg/L**	0.0078	0.095	AL = 1.3 MCLG = 0	No	0.067	Corrosion of household plumbing systems: erosion of natural deposits
Lead	**mg/L**	<0.015		AL =0.015 MCLG = 0.0	No	<0.015	Corrosion of household plumbing systems: erosion of natural deposits

Per- and polyfluoroalkyl substances (PFAS)		
Constituent (ppt)	**Health Advisory Level (HA)**	**Locations sampled on 09 Nov 2022**
		Bldg. 7-4
1 Hexafluoropropylene oxide dimer acid (GenX)	NA	ND
2 N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	NA	ND
3 N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	NA	ND
4 Perfluoro-1-butane sulfonic acid (PFBS)	NA	ND
5 Perfluoro-n-decanoic acid (PFDA)	NA	ND
6 Perfluoro-n-dodecanoic acid (PFDoA)	NA	ND
7 Perfluoro-n-heptanoic acid (PFHpA)	NA	ND
8 Perfluorohexane sulfonic acid (PFHxS)	NA	ND
9 Perfluoro-n-hexanoic acid (PFHxA)	NA	ND
10 Perfluoro-n-nonanoic acid (PFNA)	NA	ND
11 Perfluorooctane sulfonic acid (PFOS)	70	ND
12 Perfluoro-n-octanoic acid (PFOA)	70	ND
13 Perfluoro-n-tetradecanoic acid (PFTeDA)	NA	ND
14 Perfluoro-n-tridecanoic acid (PFTrDA)	NA	ND
15 Perfluoro-n-undecanoic acid (PFUdA)	NA	ND
16 11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11CL-PF3OUdS)	NA	ND
17 9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	NA	ND
18 4,8-dioxa-3H-perfluorononanoic acid (ADONA)	NA	ND

Notes: *Sodium has no established MCL per OEGBD. Monitoring is required so concentration levels can be made available on request. This is one time sample with no high or low