

DRAFT

Samoa National Drinking-Water Standards

As of 23 May 2008

Samoa Drinking -Water Standards Task Force

2008

Abbreviations and Acronyms

To do: Check each one if they exist in the document

µg/L	Micrograms per litre
ATO	Appearance, Taste and Odour in water may be affected in concentrations below the health-based limit
mg/L	Milligrams per litre
MAF	Ministry of Agriculture and Fisheries
MNRE	Ministry of Natural Resources and Environment
MOH	Ministry of Health
NTU	Nephelometric Turbidity Unit
SDWS	Samoa Drinking-water Standards
SPREP	Secretariat of the Pacific Regional Environment Programme
SWA	Samoa Water Authority
TCU	True Colour Unit
TDI	Tolerable Daily Intake
UNEP	United Nations Environment Programme
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

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Glossary of Terms

To do: Check each one if they exist in the document and update the definition.

Acute: Short term exposure to pollutants.

Aesthetic constituent: Anything in water that affects the taste, odour, colour, clarity or general appearance of the water.

Carcinogenic: A substance that causes cancer in a living organism.

Chronic: Long-term exposure to pollutants.

Coliform organisms: The bacteria used as indicators that organic, possibly faecal, contamination of water may have occurred. They are often referred to as total coliforms.

Contaminant: A substance or organism in water which can cause undesirable public health or aesthetic effects.

Disinfectant by-products: Contaminants produced in the drinking-water supply as a by-product of the disinfection process.

Disinfectant: A substance used in the disinfection process such as chlorine.

Disinfection: The process used to inactivate the microorganisms in the drinking-water supply.

Drinking-water: Water that meets the standards set out in the *Samoa Drinking-water Standards 2008* or later revisions.

***Escherichia coli* (*E. coli*):** Bacteria used as indicator that faecal contamination of the water has almost certainly occurred, and that, therefore, there is a possibility that pathogens are present.

Epidemiology / epidemiological: The study of the incidence, prevalence and transmission of infectious diseases.

Faecal coliforms / Thermotolerant coliforms: Bacteria used to indicate that faecal contamination has probably occurred and that the drinking-water needs to be treated as though there is a probability that pathogens are present.

Faecal matter: Human or other animal excrement.

Groundwater: Water that is contained beneath the surface of land in an aquifer. It is abstracted or taken out by using a borehole or a protected spring.

Guideline value: Acceptable concentrations of constituents, which indicate when the concentration of the constituent is high enough to have affected the aesthetic quality of the water.

Indicator: A constituent that is monitored because its presence indicates the presence of other organisms or constituents. The testing procedures are often too slow and costly for all the constituents, so an indicator is used.

Limit: The maximum amount of a substance which may adversely affect that health of consumers, that is legally permissible in drinking-water delivered to consumers without first notifying the public to take health precautions.

Microorganism: Viruses, bacteria, protozoa, algae and helminths that are all too small to see with the naked eye or without the magnification of a microscope.

NTU: Nephelometric turbidity unit. A measure of turbidity or cloudiness of water.

Pathogens: An organism capable of causing illness.

Pesticides: A substance or mixture of substances used to eradicate, destroy or control any pest.

pH: A measure of whether a substance is acidic or alkaline. pH of 7 is neutral and is desirable for drinking.

Potable water: Water suitable, on the basis of both health and aesthetic considerations, for drinking or culinary purposes. Water that meets the standards set out in the *Samoa Drinking-water Standards 2008* or later revisions.

Raw water: Surface or groundwater that is available as a source of drinking-water but has not received any physical or chemical treatment.

Surface water: Water that is taken for use from rivers, streams, lakes, reservoirs or unprotected springs.

Thermotolerant Coliforms / Faecal Coliforms: Bacteria used as indicators that faecal contamination has probably occurred. The drinking-water needs to be treated as though there is a probability that pathogens are present.

Turbidity: A measure of the loss of clarity in a sample caused by scattering of light by suspended particles in the sample. For these standards, turbidity is measured in nephelometric units.

Viruses: Sub-microscopic parasites of nuclei material enclosed in a protein coat which can replicate themselves inside living cells and may cause disease.

Water supplier: Any organisation that supplies water to consumers.

Introduction

“Good Quality Water” or “potable water” is water that is clear, colourless and free from objectionable odour and taste. It must not contain any substance, organism, chemical or radioactive material at a level and / or concentration which could endanger the consumers at all times.

These drinking water quality standards were prepared by the Samoa Drinking-water Standards Task Force which include members of various government departments and organisations such as:

- Ministry of Health
- Ministry of Agriculture and Fisheries
- Ministry of Natural Resources and Environment
- Ministry of Finance
- Water Sector Support Programme, European Union
- Samoa Water Authority
- World Health Organization

A national consultation was held to review the standards and elicit further comments from various stakeholders from government, academe, NGOs, international organizations, church groups, private entities, and other partners. The Task Force on Drinking-Water Standards worked to establish safe levels for all of the constituents found in water. These standards that follow have been based upon a review of the situation in Samoa along with baseline water and soil quality data and pesticide residues studies. These standards should be reviewed every 5-10 years.

Frequency of Sampling

Table 1 Frequency of Sampling for Microbiological Analysis

Population supplied with water	Minimum number of samples
1 – 1,000	1 per year
1,000 – 5,000	2 per year
5,000 – 100,000	1 per month for every 5,000 population
More than 100,000	10 per month + 1 for every 10,000 population

Table 2: Sampling and Monitoring Schedule for Microbiological Aspects

Sample Category	Minimum Monitoring frequency
Water from boreholes and springs entering the distribution system	Minimum of 4 samples per year
Untreated surface water entering the distribution system	Minimum of 4 samples per year
Final treated water entering the distribution system	Minimum of 1 per month
Final treated water at end points	Minimum of 1 per month for each 5000 people served

Table 3: Sampling and Monitoring Schedule for Chemicals

Contaminant	Minimum Monitoring frequency
Organic parameters and pesticides	Groundwater and surface water – once every 5 years
Inorganic parameters	Groundwater and surface water – once every 3 years

Microbiological Quality

Water used for drinking must be free from pathogenic organisms responsible for waterborne diseases. These pathogenic organisms include bacteria, viruses, protozoans and helminths.

Microbiological contamination of a water supply has the greatest potential for causing sickness and even death in a community. The transmission of diseases requires the presence of specific pathogenic organisms (such as *Vibrio cholera* and *Salmonella typhi*). However, the tests for individual types of such organisms are much too complex, costly, sensitive and slow to provide a practical means of monitoring and control. Therefore indicator organisms such as *Escherichia coli* (*E. coli*) and total coliform as indicator bacteria for pathogenic organisms are used. The Ministry of Health conducts testing for specific pathogens when their presence is suspected.

The entry of pathogenic organisms into a waterway is always accompanied by a much larger number of bacteria characteristic of faecal pollution. Therefore, the absence of such bacteria can reliably be taken to indicate the absence of pathogenic microorganisms. The use of *Escherichia coli* (*E. coli*) and total coliform organisms as indicator bacteria is firmly established as an effective monitoring procedure to assure the protection of the community from water-borne disease. These two indicators are not health threats; they only indicate whether other potentially harmful bacteria may be present. Coliforms are naturally present in the environment and in faeces while faecal coliforms and *E. coli* only come from human and animal faecal waste.

Table 4: Standard Values for Bacteriological Quality of Drinking-Water

Organisms	Standard values
Piped water supplies	
Treated water entering the distribution system	
<i>E. coli</i>	Must not be detected in any 100-ml sample.
Total coliforms	Must not be detected in any 100-ml sample.
Untreated water entering the distribution system	
<i>E. coli</i>	Must not be detected in any 100-ml sample.
Total coliforms	Must not be detected in any 100-ml sample. In the case of large supplies when sufficient samples are examined, they must not be present in 98 % of samples examined throughout the year.
Water in the distribution system	
<i>E. coli</i>	Must not be detected in any 100-ml sample.
Total coliforms	Must not be detected in any 100-ml sample. In the case of large supplies, where sufficient samples are examined, must not be present in 95 % of samples taken throughout any 12- month period.
Unpiped water supplies	
<i>E. coli</i>	Must not be detected in any 100-ml sample.
Total coliforms	Must not be detected in any 100-ml sample.
Emergency drinking-water supplies	
<i>E. coli</i>	Must not be detected in any 100-ml sample.
Total coliforms	Must not be detected in any 100-ml sample.

Chemical Aspects

Table 5: Limits for Inorganic Chemicals of Health Significance

Constituent	Limits ^a mg/litre	Potential Health Effects from Ingestion of Water
Antimony	0.005	Increase in blood cholesterol; decrease in blood glucose
Arsenic	0.01	Hyperkeratosis (skin damage), circulatory system problems; increased risk of cancer
Barium	0.7	Cardiovascular diseases, Increase in blood pressure
Boron	0.5	Gastro-intestinal irritation, testicular atrophy
Cadmium	0.004	Kidney damage
Chromium	0.05	Allergic dermatitis
Cyanide	0.08	Thyroid problems and damage to nervous system
Fluoride	1.5	Dental fluorosis (mottled teeth), Bone disease (pain and tenderness of the bones)
Lead	0.01	Delays in physical or mental development of infants and children; kidney problems and high blood pressure in adults
Mercury	0.001	Kidney and nervous system damage
Molybdenum	0.07	Essential element
Nickel	0.02	Certain persons are sensitive
Nitrate	50	"Blue baby syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.
Nitrite	3	"Blue baby syndrome" in infants under six months - life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.
Selenium	0.01	Hair or fingernail loss; numbness in fingers or toes; circulatory problems

^a Body weight used was 70 kg for Samoa as applicable; WHO used a global body weight of 60 kg for calculation of its guideline values.

Table 6: Limits for Organics Constituents in Drinking-water

Organic Chemicals	Limits mg/litre	Potential Health Effects from Ingestion of Water
Benzene	0.005	Anemia, decrease in blood platelets, increased risk of cancer
Carbon tetrachloride	0.005	Liver problems; increased risk of cancer
Polychlorinated biphenyls (PCBs)	0.0005	Skin changes, thymus gland problems, immune deficiencies, reproductive or nervous system difficulties, increased risk of cancer
Pesticides	Limits mg/litre	Potential Health Effects from Ingestion of Water
Chlorpyrifos	0.04	tbd
DDT	0.001	Reproductive difficulties
Glyphosate	0.7	Kidney problems; reproductive difficulties
Lindane	0.002	Liver or kidney problems
Malathion	1.0	Reproductive aberrations
Permethrin	0.02	tbd
2,4 D (2,4-Dichlorophenoxyacetic acid)	0.04	Kidney, liver, or adrenal gland problems

Table 7: Limits for Disinfectant and Disinfection By-products in Drinking-water

Disinfectant	Limit, mg/litre	Potential Health Effects from Ingestion of Water
Residual Chlorine	0.2 – 0.5	Stomach discomfort, objectionable taste and odour to consumers
Disinfection by-products	Limit, mg/litre	
Total Trihalomethanes	0.1	Liver, kidney or central nervous system problems; increased risk of cancer

Aesthetic Aspects

Table 8 Physical and chemical quality: aesthetic guidelines

Constituent	Maximum Value
Odor	Acceptable
Taste	Acceptable
Color	5 TCU
Turbidity	5 NTU
pH	6.5 – 8.5 (no unit)
Conductivity	1000 μ S/cm
Aluminium	0.2 mg/L
Ammonia	1.5 mg/L
Chloride	250 mg/L
Copper	1 mg/ L
Iron	0.3 mg/L
Manganese	0.1 mg/L
Sodium	200 mg/l
Sulfate	250 mg/L
Sulfide	0.05 mg/L
Total dissolved solids	1000 mg/L
Zinc	3 mg/L

Table 9 Priority parameters in small water supplies

Parameter ^a	Maximum Value
pH	6.5-8.5
Turbidity	5 NTU
<i>E. Coli</i>	0 per 100 mL
Total coliforms	0 per 100 mL
Residual Chlorine ^a	0.2-0.5 mg/L

^a Only if chlorine is applied to the water system

Water Safety Plans

Water safety plans use a comprehensive risk assessment and risk management approach that encompasses all steps in the water supply from catchment to consumer to consistently ensure the safety of water supplies (WHO Definition).

The basic principles applied are the following:

- Prevent contamination, do not wait for it to happen
- Use multiple barriers so that if one barrier fails the water stays safe
- Use management systems to make water safety management reliable
- Every improvement is worth it and helps improve public health

These concepts are based on the Hazard Analysis Critical Control Point (HACCP) used for food safety. (Add the three key components) Water Safety Plans for both urban and rural water supplies should be developed to complement and be part of the implementing guidelines for the national drinking water quality standards.

References

To do: Complete the citation of the following references.

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Inventory of Persistent Organic Pollutants and Persistent Toxic Substances, Samoa's POPs National Implementation Plan, Ministry of Natural Resources and Environment, 2004

Needs Assessment of Drinking Water Quality Surveillance and Control in Samoa, WHO/WEDC, 2001

WHO Guidelines for Drinking-water Quality - Incorporating First Addendum to Third Edition - Volume 1: Recommendations, 2006

Guidelines for Drinking-water Quality Management for New Zealand, 2005

Australian Drinking Water Guidelines, 2004

US Drinking Water Standards and Health Advisories, 2006

Philippine National Standards for Drinking-water, 2007

Draft Fiji National Drinking Water Quality Standards, 2006

Recommended Drinking Water Quality Standards for Papua New Guinea, 2000

Appendices

To do: Complete the list below (get list from MOH WQ unit)

- Members of the Drinking Water Standards Task Force
- List of participants to the national consultation workshop