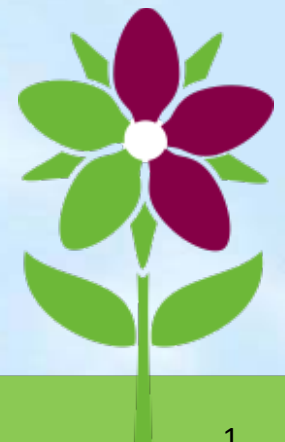


Kahramaa-overview on Water Quality Management & Desalinated Drinking Water Standards and Guidelines

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Water quality & health: **Importance**

- The Quality of Water is of Universal Health concern. Water is essential for life but it can also transmit diseases in countries in all continents from the poorest and wealthiest.
- Pollutants can enter the water supply from source till consumer tap: from human and industrial activities that can reach raw water supply, chemicals used in treatment & their by-products, infiltration of polluted water during distribution in water networks and from un-proper handling & storage of water at customers premises & filling stations.



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How can we ensure quality of water?

• End water testing & standards

- The traditional approach to ensure water quality and safety has **relied on the testing of Drinking Water** either as it leaves the treatment works or at selected points, either within the distribution system or at consumer taps. The Quality Standards are used & imposed on water utilities to comply with through **testing water at the consumer point to ensure its compliance with standards and by source water** minimum treatment requirements.
- This verification process involving testing, produce results that could be checked against the final Drinking Water Quality standards and accordingly water can be judged **that it is safe & acceptable.**

The problem with this approach is that the results are **too little and too late for preventive action.**

Too little:

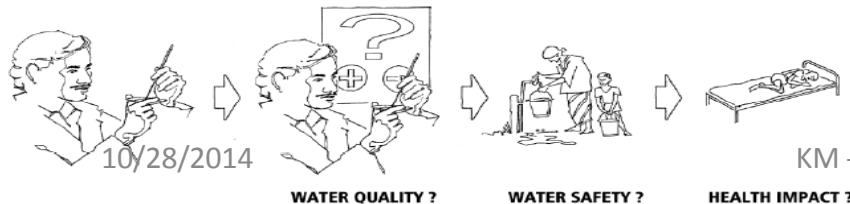
1- because so few samples are taken compared to the amount of water produced. Therefore, conclusions drawn about the safety of the water from the results of such sampling are inevitably compromised, particularly for microbial quality and in systems with high throughput of water.

2- pathogens (Protozoa, Cryptosporidium) may be present when the commonly used indicator bacteria (Coliforms) are not present and diseases can still be transmitted by water that meets standards for indicator bacteria.

Too late

because usually by the time the results are available, the water has been supplied and may have been consumed and therefore preventive action is no longer possible.

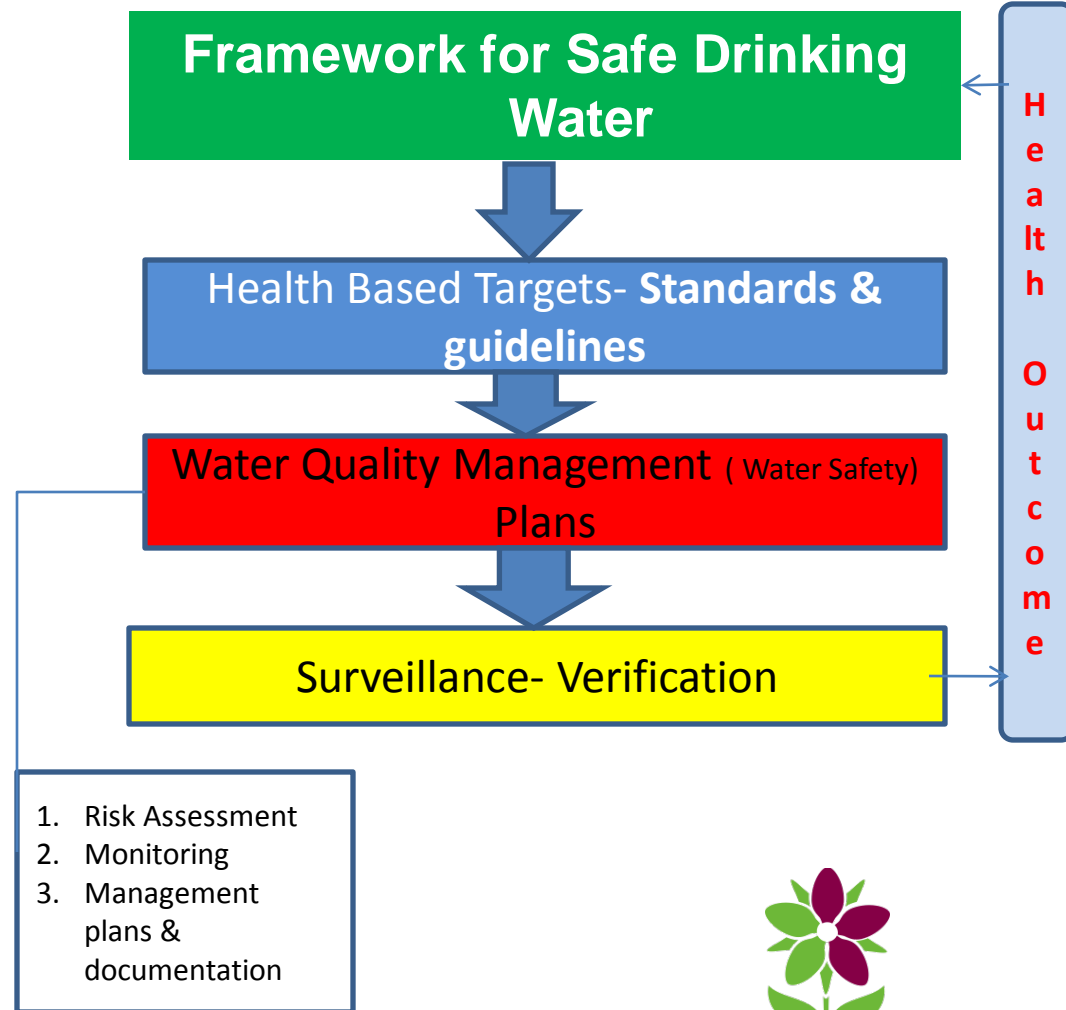
This is a particular problem in relation to microbial quality, where most tests provide quantitative results only after several hours of incubation.



Water Quality Management Plans

Acknowledging the limitation of end product or water testing, WHO adopted new approach 2004-2008 towards ensuring water safety by using a holistic risk assessment and management approach that extends throughout the drinking water supply from catchment to the consumer point to identify risks & how these risks can be managed through ensuring effective & managed control measures.

WHO identified in its water quality framework five key components that are required to deliver safe drinking water.



- **The new approach** have the advantage over end-product testing through ensuring that the processes involved in delivering safe drinking water are **operated properly and under full control at all times** to reduce, eliminate or prevent contamination of the water supply.
- Using such approaches, enables **in-depth understanding and evaluation** of water systems, hazards and assessment of risks beside water quality management.
- Monitoring allow **rapid identification of when control is compromised, and so enable action to be taken immediately** to bring the system back into control, before any contaminated water is distributed and consumed.
- Introduce a **systematic approach** throughout the water sector, which establishes & increase credibility
- Provide the opportunity for various agencies and stakeholders to identify their areas of responsibility and become involved and offers the outcome of a **cooperative and coordinated approach** with improved understanding of the responsibilities of all parties.
- Address continuous development & research needs

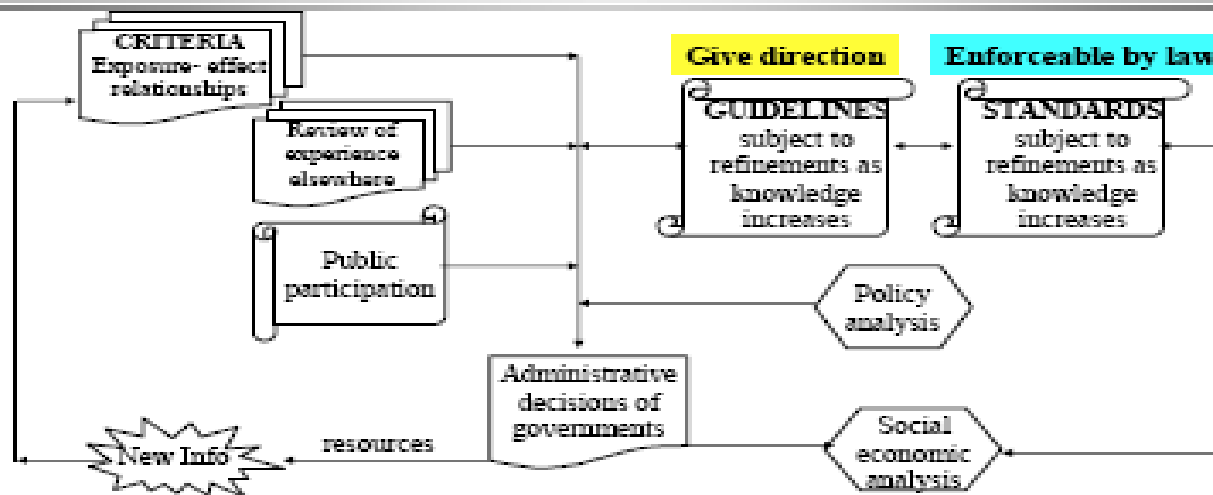


Guidelines For Drinking Water Quality By World Health Organization (WHO)

- WHO has published in 1983, 1993 and 2004, 2008 **Guidelines** for Drinking Water Quality. Guidelines are updated through a process of rolling revisions. Previously WHO published in 1958, 1963 and 1971 International standards that focused only on numerical values for allowable concentrations of potential contaminants. **The objective of the guidelines is the protection of public health by** ensuring safety of Water
- Safe drinking Water as defined by the Guidelines, **is the water that does not represent any significant risk to health over lifetime of consumption and exposure**
- The guidelines include **Health Based Guideline Values**: which are a measure of the water quality characteristics that based on present knowledge, does not result in any significant risk to health of the consumer over a lifetime of consumption.
- **Aesthetic Based Guideline Values** (Refer to as Secondary Guideline Values by EPA): which are the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, such as appearance color taste and salinity. **No aesthetic guideline values has been set by WHO, only those of health significance?**
- The Guidelines in general provide a scientific point of departure for national authorities to **develop drinking water standards appropriate for national situation.**



Relationship between Criteria, Guidelines and Standards



National Standards usually emanate from WHO Guidelines

Standards are mandatory while guidelines are for guidance purposes

WATER QUALITY STANDARDS: WHAT ARE THEY GOOD FOR?

- A basis for assessing water quality data
- A "trigger" for initiating action
- An "end point" for terminating action
- A regulatory tool
- **Water Quality Standards either set in one standard or as primary Health related & enforced standard & secondary standard that recommends level for non-health related contaminants parameters such as:**
 - ▶ flavor, odor, color
 - ▶ iron
 - ▶ manganese
 - ▶ sulfate
 - ▶ hydrogen sulfide
 - ▶ chloride



WHO Drinking Water Guidelines?? Does it cover all significant characteristic of desalinated water?

- Existing WHO Guidelines **does not fully cover** the unique factors that can be encountered during intake, production and distribution of desalinated water as desalination is applied to non-typical source waters, and often uses non-typical technologies.
- Apart from the quality and safety of the finished drinking water, numerous other health and environmental protection issues are also evident when considering the impacts of desalination processes.



What are the needed answers related to WHO Guidelines or GCC Standards

- What is the appropriate guidance for aesthetic and stability factors, e.g., TDS, pH, taste/odour, turbidity, corrosion indices, etc.?
- What should be the quality management guidance for blending waters that are added post desalination for adjustment and stabilization?
- Should guidance reflect potentially nutritionally desirable components of reconstituted finished water, e.g., calcium, magnesium, fluoride?
- What are appropriate considerations for assuring the healthfulness of drinking water produced by desalination of seawater and brackish waters?
 - Should these reflect climate?
 - Should any other high end uses be considered?



More guidance required

- How should the quality specifications and safety of chemicals and materials used in production and in contact with the water e.g., coagulants, disinfectants, pipe and surfaces in desalination plants, distribution systems, etc be addressed?
- How should guidance include recommendations for monitoring of plant performance and water during distribution, e.g., key chemicals and microbiological parameters and frequencies?
- How should the guidance include considerations of environmental protection factors relating to siting, marine ecology, ground water protection, energy production, and air quality.



Notes on GSO Water Quality Standards, 2009:

Many important parameters for desalinated water are not included in the standard or even as secondary standard such as: **Turbidity, Hardness, EC & Chloride**

- Magnesium & Calcium: potentially nutritionally desirable components: Several authors have suggested that reduced cardiovascular mortality and other health benefits would be associated with minimum levels of approximately 20 to 30 mg/l calcium and 10 mg/l magnesium in drinking water
- **pH:** (rounding figures required).
- **Sulfate, sodium , aluminum (linked to zehmer in some studies) and zinc,** not included, these may affect taste, integrity of distribution system and used as indicator for performance? Notably at GCC??? Any guidance values?
- **Fluoride :** Also after 30 minutes contact time How much required chlorine at end of distribution system?
- **Consider average daily temperature in calculations??**
- Also the **coliform** group was only enforced in distribution while not at delivery point, this is not applicable.



- **Chlorine dioxide** very important in GCC countries although it is controlled by its residues yet by itself can create odor, require and thus require guidance on limits?
- **THM** 1 ug/l should be the ratio or higher limits considering constituents. Also halo acetic acid causing bladder cancer to be considered.
- The standard list many parameters such as nucleotides and pesticides and etc., not applicable for desalinated water, using WHO reference would be satisfactory.
- The standard recommended to use uniform units either micrograms or ppb?
- Levels at delivery point are crucial to manage quality, which is different than usual water: a **TDS** >250 indicate a failure of treatment.
- What are actions in cases of pollution how pollution is determined confirmed? Example coliforms, confirmed or presumptive samples, when water is confirmed free.



Other points to be considered

- **NO** enforceable standards for water sources used for drinking purposes has been referred to .
- **NO** specific minimum monitoring requirements for drinking water or sources has been referred to.
- **NO** minimum standards for the design, construction, maintenance or closure of groundwater wells used for drinking has been referred to
- **No** guidance document on how countries **implement the standard**, no of samples, type of samples, results handling, interpretation of results, waivers and else.,
- Guidance to include also recommendations for monitoring of plant performance and water during distribution, e.g., key chemicals and microbiological parameters and frequencies.
- **IN summary National Standard** should consider recent advances in the field of water quality management, Countries standards to be emanated from WHO guidelines with some additions & modification for national critical parameters along requirement for Water Safety plan implementations.



General notes on GCC Standards, regulations

- **No** time indicated for review of standards. Suggested to be reviewed every three years maximum.
- Standards for water should be approved by water utilities beside public health institutions to be applicable for enforcement before issuing, if not approved to be discussed with them.
- Standards should be circulated officially to concerned parties for enforcement
- If standards include new conditions to be enforced, this should be discussed and a time limit to be given for companies to adhere to this condition and waiver from complying with this condition to be granted in the mean time



KM-Water Quality Targets & Management Approach

- **Developing the current standards**; Kahramaa has completed a study for setting Qatari desalinated drinking water standards. The proposed standards include two water quality levels one to be effective at the delivery point of the desalination plants and one at entry point to consumer network.
- As Kahramaa is not only targeting to achieve full compliance with these water quality standards but also to prevent any water quality failure by **establishing a comprehensive quality management system and framework** based on risk assessment approach that identify hazards and control measures from source until consumer connection point. The system objective is ensuring that the processes involved in delivering safe drinking water are operated properly and under full control at all times **and it involves periodic inspection and auditing activities beside reporting data management procedures & requirements.**



Conclusion

- Kahramaa has completed setting its water quality management framework including developed standards to be adopted at delivery point and in distribution network beside water quality or safety management plans to be imposed on water supply system from source to tap. The management plan includes minimum monitoring requirement for water at delivery point and in distribution system beside quality management plan requirements.
- Kahramaa invite all GCC countries to adopt the same in order to develop Quality Management Aspects in accordance to best international advances & practices in this field.
- Having a uniform approach will facilitate implementation nationally leading to uniform and higher level of water quality and better health for all.
- Having a uniform requirement for operation key performance indicators for desalinated water such as turbidity, TDS and others., will facilitate bench marking within the GCC countries for continuous improvement.







Thank You

