Wonderful Water: How Standards Can Achieve Clean Water and Sanitation for the World

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Abstract

Water is an important component to every living person in the world, and without it, we couldn't survive. The world's lack of access to clean water is a major issue that needs to be solved. The United Nations created 17 Sustainable Development Goals to encourage people to better protect the environment. The Sustainable Development Goal 6 focuses on achieving clean water and sanitation. There are many challenges that comes with trying to achieve clean water and sanitation, such as hazardous wastes and chemicals getting into the water. However, standards can help overcome these challenges and help achieve the Sustainable Development Goal. The International Organization for Standardization (ISO) and ASTM International both have technical committees that were created to discuss the issues around unclean water. This paper discusses the standards created by these two standards developing organizations (SDOs) and how they can play a role in achieving clean water and sanitation for the world.

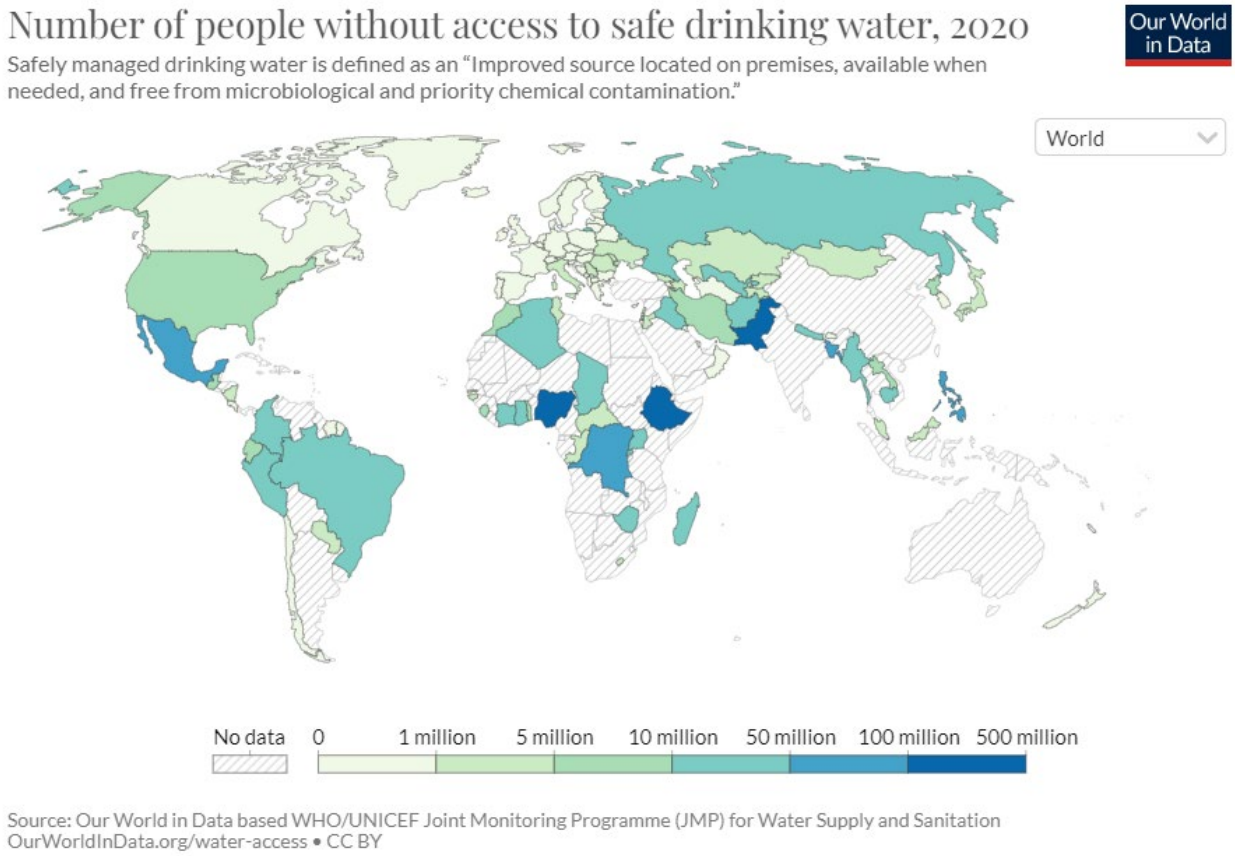
Introduction

One of the world's largest health and environmental problems is having unclean water. Not having access to clean water can lead to infectious diseases and provoke malnutrition. One out of every four people do not have access to clean drinking water.[1] Years of pollution and misuse of water has created water stress. Many countries are facing problems related to water scarcity that is caused by climate change, and lack of investment in water and sanitation.[17] Clean water and sanitation is one of the seventeen United Nations Sustainable Development Goals (SDGs), which serves as a call to action for the world to come up with ways to better protect the environment. This is where standards can come into play. Standards can help achieve clean water and sanitation for everyone.

Sustainable Development Goal 6

The United Nations adopted the SDGs in 2015 to encourage nations to join together to support the general welfare of all people by the year 2030. One of the SDGs adopted was SDG 6, which focuses on maintaining a clean and stable water supply, as well as effective water sanitation for everyone.[6] Achieving this goal could save around 829,000 people each year, who die from illnesses related to drinking unclean water, having lack of sanitation, and poor hygiene practices.[1] Clean water is one of the world's most important items, however, not everyone has access to it. Having viable control of water resources and access to safe water and sanitation will help with economic growth and productivity, as well as provide great support for existing investments in health and education.[5] See Figure 1 for a map of the number of people without access to safe drinking water.

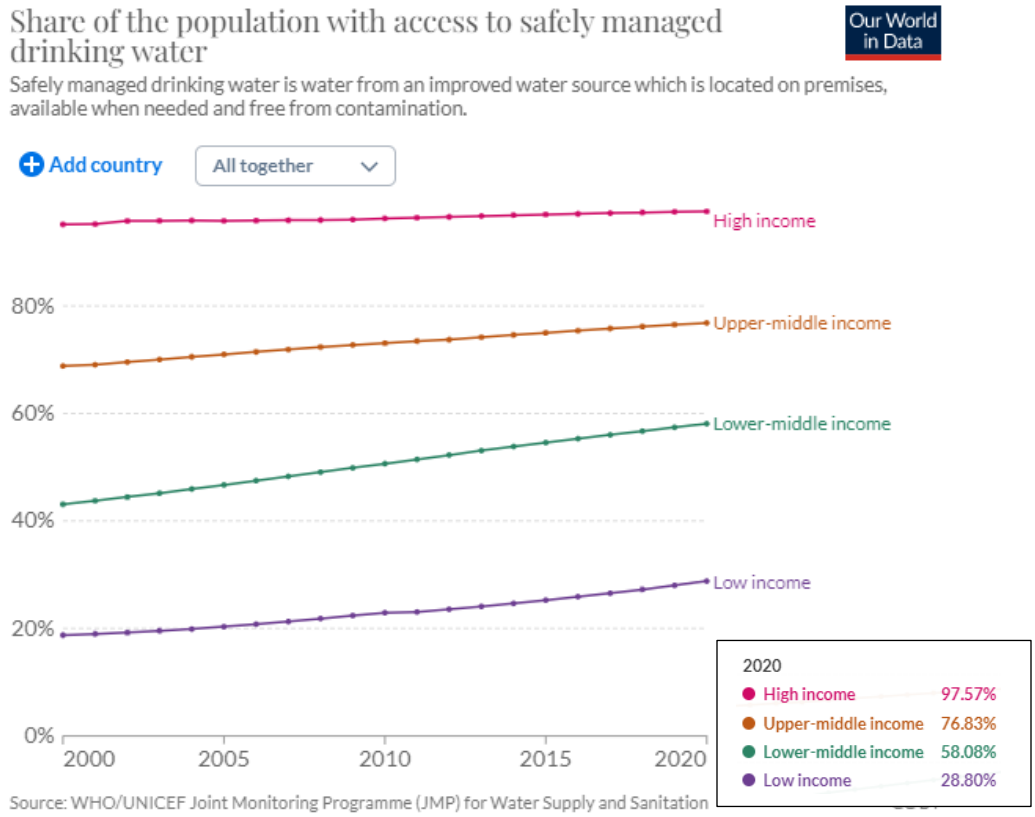
Figure 1. Number of People Without Access to Drinking Water



Source: https://ourworldindata.org/water-access#access-to-safe-drinking-water

The WHO/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation published updated data in 2020 on the share of the population with access to safely managed drinking water. Based on Figure 2, the people with access to safe drinking water were 97.5% of high income people, 76.83% upper-middle income, 58.08% lower-middle income, and 28.80% low income.[1] While some of these numbers are low, the United Nations created the SDG 6 to encourage people to work to ensure availability of clean water and sanitation for everyone. Developments in drinking water, sanitation, and hygiene are important for advancement in other areas of development as well, such as health, education, and nutrition. UNICEF's contribution for achieving this goal revolves around bringing clean drinking water and sanitation to homes, schools, and health centers.[18]

Figure 2: Share of Population with Access to Safely Managed Drinking Water



Source: https://ourworldindata.org/water-access#access-to-safe-drinking-water

Challenges of Achieving Clean Water and Sanitation

There are many challenges when it comes to achieving clean water and sanitation for everyone. Providing clean water and sanitation gets more difficult to reach as environmental degradation takes place. This is because lakes, rivers, forests, and all water-related ecosystems affect the conditions and amount of available water. Water conditions are also affected by fertilizers, salt water intrusion, and natural waste. According to Paul (n.d.), "Developing countries discharge almost 90% of sewage untreated into water bodies, and 1.8 billion people use a source of drinking water with fecal contamination (para. 14)."[12] Also, hazardous wastes, such as pharmaceuticals, pesticides, industrial chemicals, and personal care products create a water quality challenge. Each day, around 2 million tons of waste drains into the world's water supply.[13]

Many people think of the extreme when it comes to lack of access to clean water, when in reality, even some of the wealthiest places have challenges with achieving clean water. One common challenge for people is lack of access to basic indoor plumbing. Around 1.6 million people in the United States alone do not have access to either a toilet, a shower, or running water.[14] See Figure 3 for other diverse access challenges that families may be affected by.

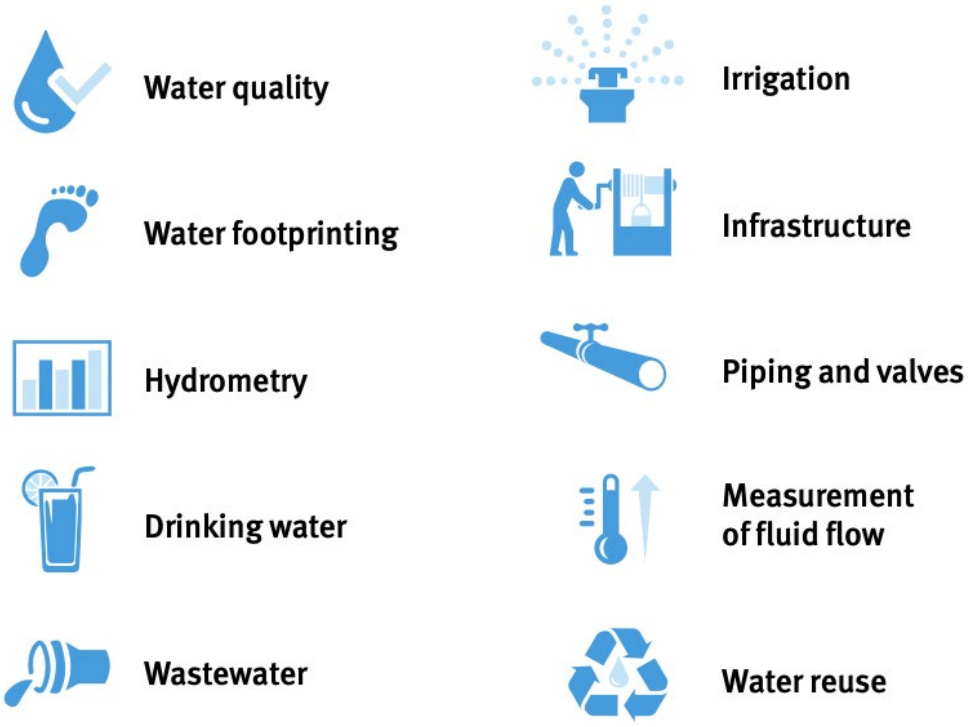
Figure 3: Challenges of Having Access to Water

Source: https://efc.web.unc.edu/2018/02/13/clean-water-access-challenges-in-the-united-states/

International Organization for Standardization

The International Organization for Standardization (ISO) has developed over 1,200 standards related to water, with many more standards in development.[7] ISO standards cover almost every water issue from reusing water, wastewater and sewage networks, monitoring water footprints, efficient irrigation, and activities relating to the supply of drinking water.[8] See Figure 4 for a list of other water-related categories that ISO covers.

Figure 4: ISO Covered Water-Related Categories

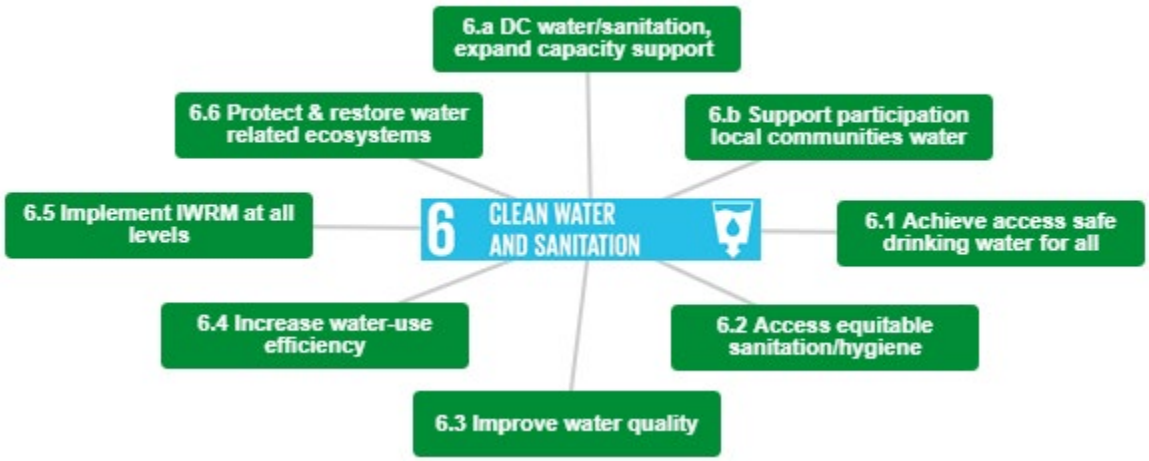


Source: https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100293.pdf

ISO has a technical committee (TC) that focuses specifically on drinking water supply and wastewater systems. This committee is ISO/TC 224, which focuses on three standards, which are ISO 24510, *Activities Relating To Drinking Water And Wastewater Services - Guidelines For The Assessment And For The Improvement Of The Service To Users*; ISO 24511, *Activities Relating To Drinking Water And Wastewater Services - Guidelines For The Management Of Wastewater Utilities And For The Assessment Of Wastewater Services*; and ISO 24512, *Activities Relating To Drinking Water And Wastewater Services - Guidelines For The Management Of Drinking Water Utilities And For The Assessment Of Drinking Water Services*.[7] ISO 24510 lays out instructions on how to determine users' needs and how to determine whether or not they are being met.[9] ISO 24511 addresses instructions on how to manage wastewater systems and is relevant to systems at any level of development. This includes treatment facilities, pit latrines, networks, and on-site systems.[10] ISO 24512 defines the components of drinking water, as well as wastewater

services.[11] These three standards from the ISO/TC 224 committee specifically support the United Nations' SDG 6, Target 6.1, which relates to achieving universal access to safe and affordable drinking water for all, and Target 6.3, which relates to improving water quality by decreasing pollution, removing dumping and reducing the release of dangerous chemicals, and increasing recycling and safe reuse globally. See Figure 5 for all targets of the United Nations' SDG 6.

Figure 5: SDG 5 Targets



Source: https://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-6

When it comes to water quality, ISO has a technical committee that concentrates on everything from natural mineral waters to plant treatment agents. This committee is ISO/TC 147, which has over 300 standards for water quality.[7] This committee provides common terminology, radioactivity measurements, sampling, biological methods, microbiological methods, and physical, chemical, and biochemical methods.

One important standard developed by this committee is ISO 7888, *Water Quality - Determination Of Electrical Conductivity*, which deals with the determination of electrical conductivity in all types of water. The measurement can be used to monitor the quality of surface waters, waste waters, and process waters in supply and treatment plants.[16] If the conductivity value becomes too high, it means that unwanted amounts of toxic wastes exists in the water. Having higher conductivity in the water causes damage to water heaters and plumbing through chemical build up and disintegration.[15] It can also be toxic to humans if too much is consumed over time. However, this

can be avoided if proper monitoring of electrical connectivity is made, and the standard ISO 7888 can help with this.

When it comes to agriculture and irrigation, ISO has a technical committee that works to ensure efficiency by laying out performance measurement and test methods. This committee is known as ISO/TC 23/Subcommittee (SC) 18. SC 18 focuses specifically on irrigation and draining equipment and systems. Agriculture is key to the world's food production and takes in a huge amount of the world's freshwater use. ISO/TC 23/SC 18 currently has 42 standards relating to irrigation and drainage equipment and systems.[7]

ISO also has a committee that creates standards for water reuse. This committee is ISO/TC 282, which takes into consideration the potential for unintentional exposure or ingestion. [19] Water reuse can help take on supply problems by creating new sources.[7] ISO 24416, *Water Reuse In Urban Areas - Guidelines For Water Reuse Safety Evaluation - Stability Evaluation Of Reclaimed Water*, is one standard developed by SC 2 under ISO/TC 282. ISO 24416 presents methods and guidelines for stability evaluation of reclaimed water. This standard can be utilized in many stages of water reclamation work, including transportation, application, storage, and post assessment.[19] ISO 24416 directly supports the United Nations' SDG 6, Target 6.3, which is to improve water quality, wastewater treatment, and safe reuse.[20]

ASTM International

ASTM International has a water committee known as D19 that was created to discuss the issues around unclean water. The D19 committee is ASTM's largest committee and has been working since 1932 to generate standards and guidelines to help create a clean water supply for everyone. This committee has over 290 standards that focus on water cleaning and filtration product development, water sampling and analysis, and more.[2]

Because cyanide is so toxic, ASTM's D19 committee worked to create ASTM D2036, *Standard Test Methods for Cyanides in Water*. Cyanide is such a highly toxic substance that much of the effort around having clean water and sanitation has concentrated on removing it from the world's water supply.[2] If it is found in amounts greater than the health standard that is set by the Environmental Protection Agency (EPA), it can cause major health problems. Short-term effects people can have after being exposed to high levels of cyanide are tremors, rapid breathing, and

other neurological effects. Long-term effects can include nerve damage, weight loss, and thyroid effects. The majority of cyanide releases to water are from iron and steel mills, organic chemical industries, and metal finishing industries.[3]

ASTM D2036 contains regulations that require the cyanide in domestic and industrial wastes and surface waters to be monitored. ASTM D2036 uses the following test methods: Total Cyanides after Distillation, Cyanides Amenable to Chlorination by Difference, Weak Acid Dissociable Cyanides, Cyanides Amenable to Chlorination without Distillation. This standard requires a spot test procedure that gives a rapid screening of the sample collected to determine if there is more than 0.05 mg/L (ppm) of cyanides responsive to chlorination, cyanogen, chloride, or thiocyanate are present in water, waste water, and saline water. With time, the test can be used to evaluate the approximate concentration range of these compounds based on the color development and comparing it to other treated samples of known concentration.[4] ASTM D2036 can help contribute to the United Nations' SDG 6, Target 6.1, which is to achieve safe and affordable drinking water.[20]

Conclusion

The demand for clean water is rising significantly and has became one of the world's largest health and environmental problems. There are many SDOs like ISO and ASTM that work to develop standards to help solve the problems around unclean water. Standards can play a role in fixing these problems and achieving clean water and sanitation for everyone. Standards can help achieve the United Nations' SDG 6 and all of its targets. Although we don't always see the value that standards provide, they play a significant role in our lives and can help create clean water and sanitation for the world.

References

1. Ritchie, H., & Roser, M. (2021, July 1). Clean water. Our World in Data. https://ourworldindata.org/water-access
2. Sprinkle, T. (n.d.). 6 Standards for Cleaner Water. Standardization news. https://sn.astm.org/features/6-standards-cleaner-water-.html
3. APEC Water Systems - #1 US manufacturer of reverse osmosis drinking water filter systems. APEC Water Systems - #1 US Manufacturer of Reverse Osmosis Drinking Water Filter Systems. (n.d.). http://www.freedrinkingwater.com/water-contamination/cyanide
4. ASTM International. (2009). ASTM D2036: Standard Test Methods for Cyanides in Water. ASTM International.
5. Environment, U. (n.d.). Goal 6: Clean water and sanitation. UNEP. https://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-6
6. Sustainable development goal 6: Clean water and sanitation. Education. (n.d.). https://education.nationalgeographic.org/resource/sustainable-development-goal-6-clean-water-and-sanitation/
7. ISO And Water. (n.d.). https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100293.pdf
8. Clean Water and Sanitation. ISO. (2023, May 19). https://www.iso.org/sdg/SDG06.html
9. ISO 24510:2007. ISO. (2020, July 16). https://www.iso.org/standard/37246.html
10. ISO 24511:2007. ISO. (2021, January 29). https://www.iso.org/standard/37247.html
11. ISO 24510:2007. ISO. (2020a, July 16). https://www.iso.org/standard/37246.html
12. Paul, D. (n.d.). The water and Sanitation Challenge. International Institute for Sustainable Development. https://www.iisd.org/articles/deep-dive/water-and-sanitation-challenge
13. The Global Water Quality Challenge & SDGs. UNESCO. (2018, April 10). https://en.unesco.org/waterquality-iiwq/wq-challenge
14. Riggs, E. (2018, March 2). Clean Water Access Challenges in the United States.

Environmental Finance Blog. https://efc.web.unc.edu/2018/02/13/clean-water-access-challenges-in-the-united-states/

15. Why measuring conductivity in water is important for all applications. Atlas Scientific. (2022, November 3). https://atlas-scientific.com/blog/why-is-conductivity-important-in-water/#:~:text=Excess%20ions%20contributing%20to%20higher,occurs%20over%20extended%20time%20periods.

16. ISO 7888:1985. ISO. (2023b, April 3). https://www.iso.org/standard/14838.html?browse=tc

17. United Nations. (n.d.). Water and Sanitation - United Nations Sustainable Development. United Nations. https://www.un.org/sustainabledevelopment/water-and-sanitation/

18. SDG Goal 6: Clean Water and Sanitation. UNICEF DATA. (2021, February 17). https://data.unicef.org/sdgs/goal-6-clean-water-sanitation/

19. ISO/TC 282 - Water Reuse. ISO. (2023d, May 19). https://www.iso.org/committee/4856734.html

20. Goal 6: Clean Water and Sanitation. The Global Goals. (2023, April 18). https://www.globalgoals.org/goals/6-clean-water-and-sanitation/