DISSERTATION TRAINING

AT

International Institute of Health Management Research

A REPORT ON

‘Assessment of Drinking Water Quality in Public Drinking Points in Hauz Khas Subdivision, South Delhi District of National Capital Region’

BY

Dr. NANCY CHAKMA

ENROLLMENT NO: PG/22/056

Under the guidance of

Dr. PUNIT YADAV

PGDM (HOSPITAL AND HEALTH MANAGEMENT

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International Institute of Health Management Research
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She comes across as a committed, sincere, and diligent person who has a strong drive and zeal for learning.

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This is to certify that Dr Nancy Chakma, a graduate student of the PGDM (Hospital & Health Management) has worked under our guidance and supervision. She is submitting this dissertation titled **Assessment of Drinking Water Quality in Public Drinking Points in Hauz Khas Subdivision, South Delhi District of National Capital Region** at IIHMR, Delhi in partial fulfilment of the requirements for the award of the PGDM (Hospital & Health Management). This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report, or book.

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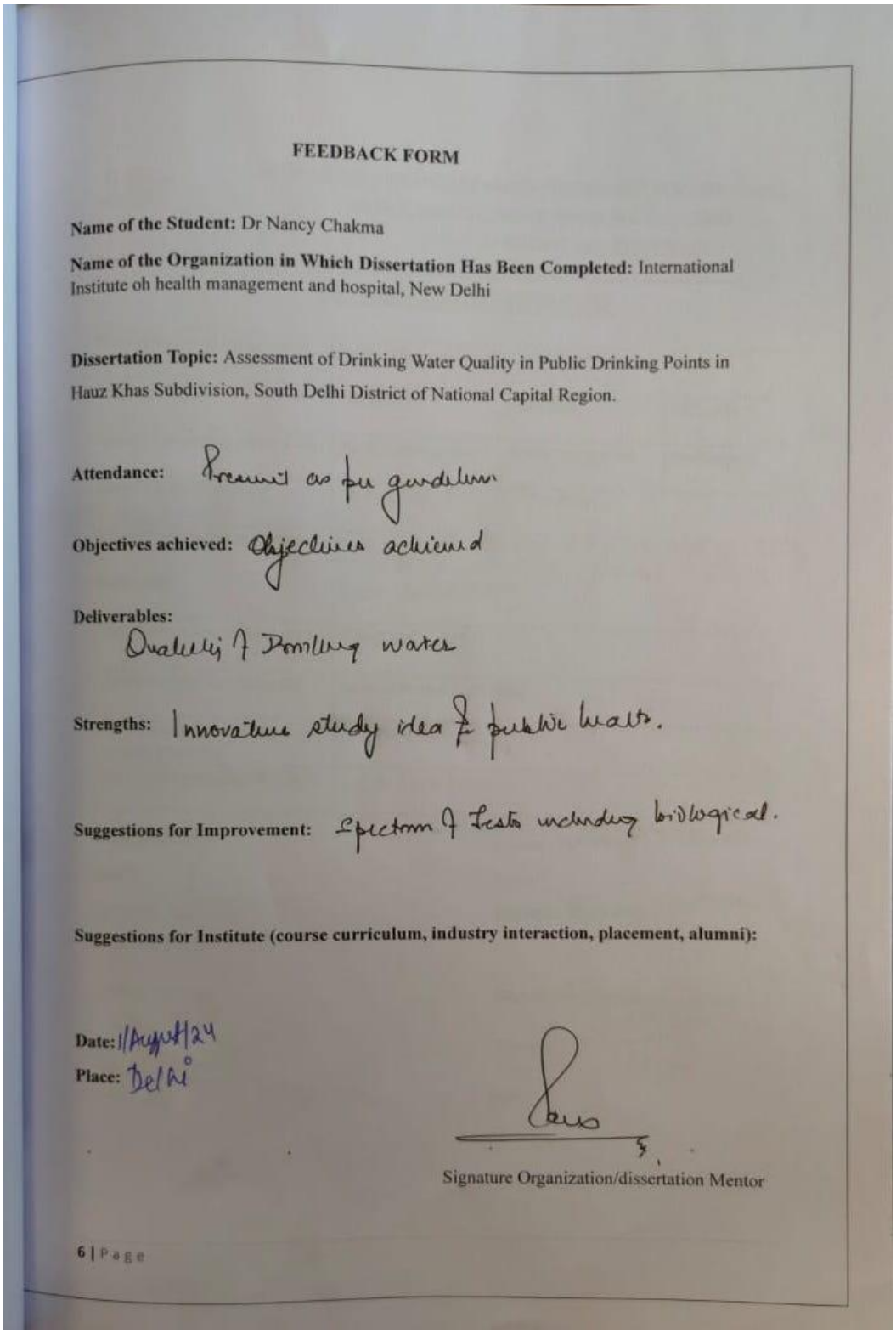

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Suggestions for Improvement: Spectrum of tests including biological.

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

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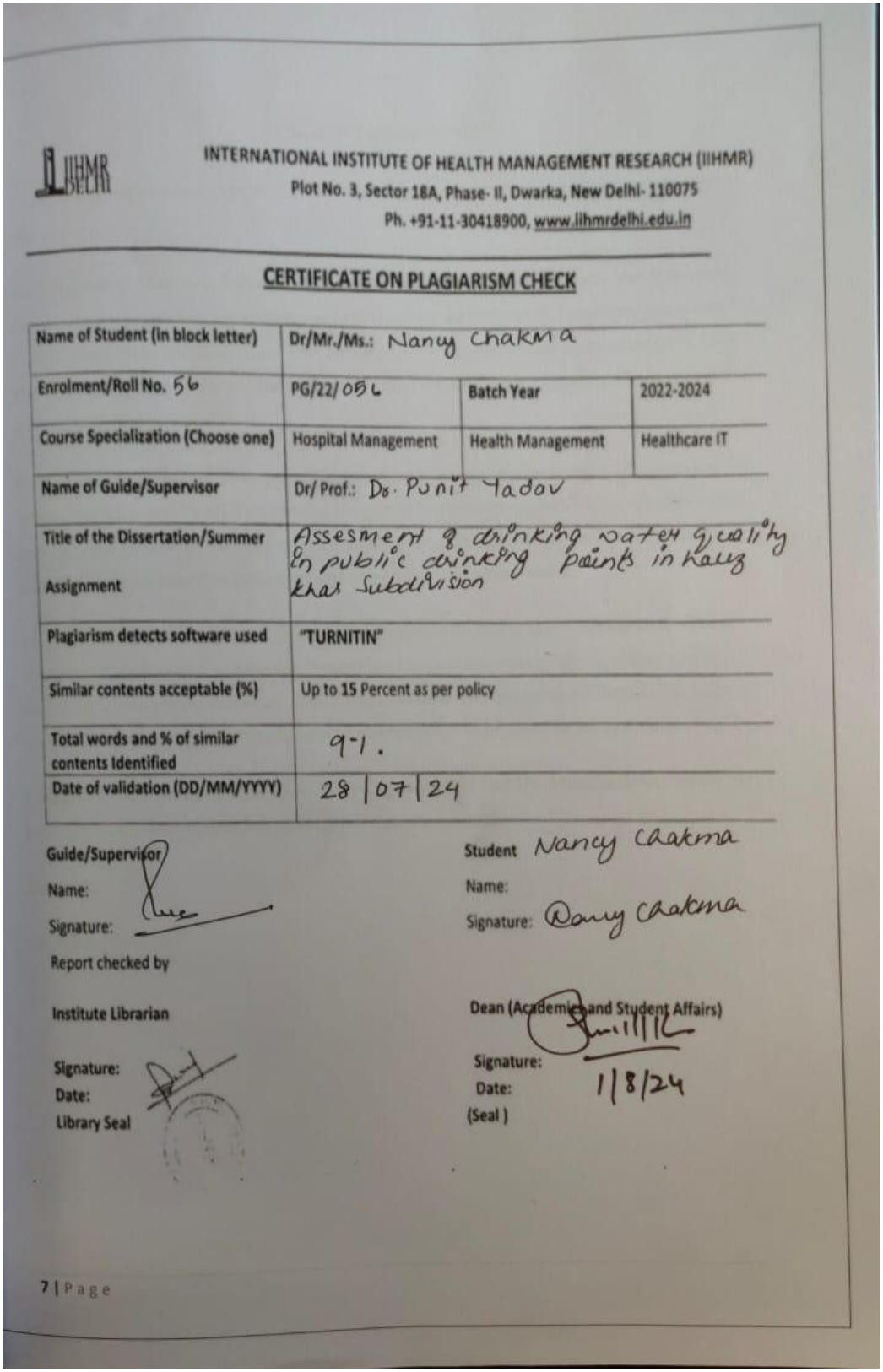

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It is an esteemed pleasure to present this dissertation report by thanking everyone who helped me.

The opportunity I had with **International Institute of Health Management and Research , Delhi ,**was a great chance for learning and professional development. Therefore, I consider myself a very lucky individual, as I was provided with the opportunity to be a part of it. I am also grateful for having the chance to meet so many wonderful people and professionals who led me through this period.

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Sincerely,

Dr. Nancy Chakma

Contents

Abbreviations

WHO	World Health Organization
BIS	Bureau of Indian Standards
DJB	Delhi Jal Board
MCD	Municipal Corporation of Delhi
NABL	National Accreditation Board for Testing

Organization Profile

The International Institute of Health Management Research (IIHMR), New Delhi is allied to the 'Society for Indian Institute of Health Management Research' which was established in October 1984 under the Societies Registration Act-1958.

IIHMR-Delhi was setup in 2008 in response to the growing needs of sustainable management and administration solutions critical to the optimal function of healthcare sector both in India and in the Asia-Pacific region.

IIHMR, Delhi is a Leading institute of higher learning that promotes and conducts research in health and hospital management; lends technical expertise to policy analysis and formulation; develops effective strategies and facilitates efficient implementation; enhances human and institutional capacity to build a competent and responsive healthcare sector. Its multi-dimensional approach to capacity building is not limited to academic programs but offers management development programs, knowledge and skills-based training courses, seminars/webinars, workshops, and research studies.

Four Core Activities are;-

- Academic courses at masters and doctoral level in health and hospital management to meet the growing need of skilled healthcare professionals.
- Research that has high relevance to health policies and programs at national and global level.

- Continued education through management development programs and executive programs for working professionals to help them upgrade their knowledge and skills in response to the emerging needs of the industry.
- Technical consultation to the national and state-level flagship programs to address the gaps in planning as well as implementation.

Mission

IIHMR Delhi is an institution dedicated to the improvement in standards of health through better management of health care and related programs. It seeks to accomplish this through management research, training, consultation and institutional networking in a national and global perspective.

Vision

IIHMR is a premier institute in health management education, training, research, program management and consulting in the health care sector globally. The Institute is known as a learning organization with its core values as quality, accountability, trust, transparency, sharing knowledge and information. The Institute aims to contribute to social equity and development through its commitment to support programs aimed at poor and the deprived population.

Abstract

Introduction- Safe drinking water is a fundamental right of every human being. Safe and easily accessible water is essential not just for drinking but also for domestic use and food production, emphasising its role in avoiding waterborne infections and boosting overall health. Contaminants such as bacteria, viruses, heavy metals, and chemical pollutants can enter water supplies through various pathways, including agricultural runoff, industrial discharges, and aging infrastructure. The burden of these diseases not only impacts individual health but also places significant strain on local healthcare systems and public resources, hence Assessing the quality of drinking water in public drinking points is a critical endeavour that directly impacts public health and safety.

Objective- The study was conducted to assess the water quality at various public drinking sources in Hauz Khas Subdivision of South Delhi District and determine the compliance to water quality standards as laid down by BIS.

Methodology-This is a primary study, Water samples were collected from various MCD public water points, Water points in institutional areas like hospitals, government offices, police stations and these samples were analysed by using the Jal TARA Standard Water Testing Kit-14, which is commercially available. This kit is designed to evaluate various chemical parameters of water samples effectively.

Results- The water quality analysis indicates that the water is generally safe for consumption, with fluoride, ammonia, and residual chlorine levels within the BIS standards. However, the pH levels and the iron concentration in some samples are areas of concern.

Conclusion- The results indicate that while most parameters are within the permissible limits set by the Bureau of Indian Standards (BIS), there are areas of concern that warrant further attention. By addressing sources of supply, regularly checking the plumbing system for sign of corrosion, water treatment and inspection , the water supply can be maintained at a high quality, ensuring the health and safety of the consumers.

Keywords: Safe drinking water, Water Quality, Bureau of Indian Standards

Topic: **Assessment of Drinking Water Quality in Public Drinking Points in Hauz Khas Subdivision, South Delhi District of National Capital Region**

Introduction

Safe drinking water is a fundamental right of every human being (1). The World Health Organization (WHO) estimates that approximately 2 billion people globally lack access to safely managed drinking water (2). Safe and easily accessible water is essential not just for drinking but also for domestic use and food production, emphasising its role in avoiding waterborne infections and boosting overall health. The World Health Organization has issued guidelines regarding drinking water quality which are required to be adhered to ensure population health (3). The guidelines have been used by the central pollution Control Board in India for establishing standards in the country and as a basis for environmental determinant of health (4). The guidelines also ensure that waterborne diseases are prevented in human populations. The quality of water for drinking varies greatly depending on a variety of elements, such as the source of the water, treatment processes, and integrity of distribution systems. Contaminants such as bacteria, viruses, heavy metals, and chemical pollutants can enter water supplies through various pathways, including agricultural runoff, industrial discharges, and aging infrastructure. These contaminants offer considerable health concerns especially to vulnerable groups such as babies, the elderly, and those with weak immune systems (5), (6). Over the years, there has been a greater focus on aesthetic features of drinking water, such as turbidity, and taste, which can influence public perception and consumption patterns (7). In India, the situation is particularly alarming. The country faces significant challenges in providing safe drinking water to its vast population (8). The Bureau of Indian Standards (BIS) has established the IS 10500:2012 standard, which outlines permissible limits for various contaminants in drinking water. However, compliance with these standards remains

inconsistent across urban and rural areas, with studies indicating that many water sources in major cities, including Delhi, fail to meet safety criteria. Most of the India's drinking water comes from surface water sources such rivers, streams, ponds, and lakes as well as groundwater that is drawn using handpumps from borewells, tubewells, and dug wells and its quality can vary significantly depending on the region and the level of contamination (9). al Jeevan Mission, is envisioned to provide safe and adequate drinking water through individual household tap connections by 2024 to all households in rural India. The programme will also implement source sustainability measures as mandatory elements, such as recharge and reuse through grey water management, water conservation, rain water harvesting. The Jal Jeevan Mission will be based on a community approach to water and will include extensive Information, Education and communication as a key component of the mission. The Jal Jeevan Mission will be based on a community approach to water and will include extensive Information, Education and communication as a key component of the mission. JJM looks to create a jan andolan for water, thereby making it everyone's priority..

Rationale

Delhi, the capital of India, has a population of approximately 33,807,403 in 2024 (10). The average water consumption per capita in Delhi is the highest in India and faces a significant challenge in providing safe and clean drinking water to its residents (11). The Delhi Jal Board (DJB), which is in-charge for the production and supply of water in the National Capital, faces significant challenges in maintaining water quality (12).

Hauz Khas in South Delhi, a historically significant area, is home to a diverse population that includes both affluent residents and economically disadvantaged communities. This diversity often results in disparities in access to safe drinking water, In Hauz Khas, the sources of drinking water include municipal supplies from Delhi Jal Board, as well as water from institutions such as hospitals, government offices, and police stations. However the water quality from these sources can vary widely due to factors such as aging infrastructure, inadequate sanitation practices, and Environmental pollutions previous studies have highlighted alarming statistics regarding water quality in South Delhi, revealing that a

substantial proportion of water samples collected from various sources, including public drinking points, have been found unfit for consumption Contaminated water sources can lead to a range of waterborne diseases, including cholera, dysentery, and typhoid fever, which disproportionately affect vulnerable populations(13),(14). The burden of these diseases not only impacts individual health but also places significant strain on local healthcare systems and public resources. Safe drinking water is a fundamental right of every human being (15), contaminants that might cause health problems, such as germs and hazardous chemicals, should not be present in safe drinking water, hence Assessing the quality of drinking water in public drinking points is a critical endeavour that directly impacts public health and safety.

Objective

- To assess the water quality at various public drinking sources in Hauz Khas Subdivision of South Delhi District and determine the compliance to water quality standards as laid down by BIS.

Methodology

Study design- Primary Study

Study Area-Hauz Khas Sub – Division of South Delhi District, National Capital Region.

- **Inclusion criteria:** MCD public water points, Water points in institutional areas like hospitals, government officDes, police stations.

- **Exclusion Criteria:** Household water sources, drinking water points by communities or charitable agencies, water fountains, ponds, and open stagnant water sources which are unfit for drinking will be excluded from this study.

Study Duration- The duration of the study was one month.

Sampling Technique-

Purposive sampling technique was adopted to collect water samples from the subdivision areas of District.

Data Collection : The sample was taken out of 50 ml vials that had been autoclave-sterilized beforehand. The locations of public government hospitals, clinics, and offices were located using Google Maps and a list of these locations was obtained from the official South Delhi government websites. A 50 ml vial was used to collect the water sample, and the coordinates and location were recorded using the 'geo tag' app. Later that day, the 50 ml water sample was divided into two sterile vials for each parameter. The same day, the data was analyzed. The analysis was conducted "in-vitro," with the room's temperature maintained at its ideal level in a dimly lit space. The Bureau of Indian Standards (BIS) guidelines were used. These standards provide a comprehensive framework for evaluating various water quality parameters, ensuring that the water meets the necessary health and safety criteria.In the analysis process, the results obtained from the water samples were compared against the BIS standards. This comparison allowed for a clear determination of whether the water was safe for consumption or if it contained levels of contaminants that could pose health risks.By relying on the BIS guidelines, the categorization of the water samples was conducted systematically. This approach ensures that the assessment is thorough and aligns with established safety protocols, ultimately helping to safeguard public health and providing accessibility to quality drinking water.

Data Analysis-

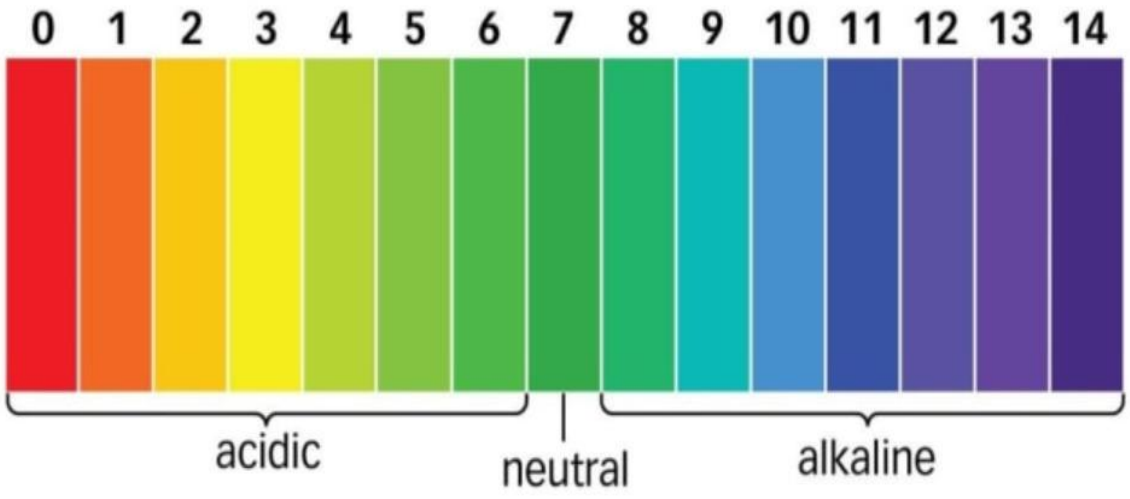
The analysis of the water samples for this study was conducted using the Jal TARA Standard Water Testing Kit-14, which is commercially available. This kit is designed to evaluate various chemical parameters of water samples effectively. It has been validated by laboratories accredited by the National Accreditation Board for Testing and Calibration

Laboratories (NABL), ensuring its quality and reliability in accordance with established testing guidelines. Its primary role is to assess laboratories across India to ensure consistency and quality in testing results. The validation of the Jal TARA kit by NABL-accredited labs further reinforces its credibility and effectiveness for water quality testing. By utilizing the Jal TARA Standard Water Testing Kit-14, the study ensures that the analysis of the water samples adheres to recognized standards. This strategy not only increases the accuracy of the outcomes but also helps in overall goal of assessing the safety of water for consumption, aligning with national quality assurance protocols.

***Based on the following Chemical characteristics water samples were assessed**

Sample	Fluoride	Ammonia	Residual chlorine	pH	Nitrate	Iron

***Ph scale used for reference**



***Following Basic Water Quality Parameters given by BIS were used as reference for this study.**

Basic water quality parameters

Characteristic	Unit	Requirement (Acceptable limit)	Permissible limit in the absence of alternate source
pH	-	6.5- 8.5	No Relaxation
Fluoride (as F) *	Milligram/ litre	1.0	1.5
Nitrate (as NO3)	Milligram/ litre	45	No Relaxation
Iron (as Fe) *	Milligram/ litre	1.0	No Relaxation
Free residual Chlorine	Milligram/ litre	0.2	1

Results

The table presents the chemical analysis of 23 water samples, with measurements for the following parameters:

- Fluoride
- Ammonia
- Residual chlorine
- pH
- Nitrate
- Iron

Report on Water Quality Analysis: Iron, pH, Fluoride, Ammonia, and Residual Chlorine

Nitrate is a common contaminant found in drinking water, primarily originating from agricultural runoff, wastewater discharge, and other anthropogenic activities. The presence of elevated nitrate levels in drinking water can pose significant health risks, especially to vulnerable populations such as infants. This report evaluates the nitrate concentrations in the collected samples, also assesses its compliance with BIS for drinking water quality.

According to standards Concentrations above the mentioned limit can lead to health issues, based on the nitrate concentrations observed in the samples:

- Samples 1, 3, 4, 5, 6, 8, and 11 (45 mg/L): These samples are at the upper permissible limit set by BIS. While they are technically acceptable for consumption, continuous exposure at this level is not advisable, especially for sensitive populations.

- Samples 2, 7, 9, and 12 (10 mg/L): These samples are well below the permissible limit and are considered safe for drinking.

- Sample 10 (8 mg/L): This sample also falls below the permissible limit and is safe for consumption.

- Samples at 45 mg/L are permissible but should be monitored closely to avoid potential health risks associated with prolonged consumption.

- Samples at 10 mg/L and 8 mg/L are safe for drinking.

The quality of drinking water is critical for public health, and various parameters must be monitored to ensure safety and compliance with established standards. This report evaluates the concentrations of iron, pH levels, fluoride, ammonia, and residual chlorine in twelve water samples, comparing the results against the Bureau of Indian Standards (BIS) specifications for drinking water (BIS 10500:2012)

1. Iron Concentration

- Samples with Iron Concentration:

- 0.1 mg/L: Samples 1, 3, 4, 5, 6, 7, 8, 9, 10, 12

- 0.3 mg/L: Sample 2

BIS Standard for Iron: The permissible limit for iron in drinking water is 0.3 mg/L .

Analysis:

- All samples except Sample 2 (0.3 mg/L) comply with the BIS standard. Sample 2 is at the permissible limit, so it is acceptable for consumption.

2. pH Levels

- pH Levels in Samples:

- pH 5: Samples 1, 4, 5

- pH 6: Samples 3, 6, 7, 8

- pH 7: Samples 2, 9, 11

- pH 8: Sample 10

- pH 9: Sample 12

BIS Standard for pH: 6.5 to 8.5 .

Analysis:

- Samples 1, 4, and 5 (pH 5) fall below the acceptable range and may be considered acidic, which can lead to corrosion of plumbing and leaching of metals.

- Samples 3, 6, 7, 8, 9, 11, and 10 (pH 6 to 8) are within the acceptable range.

- Sample 12 (pH 9) is slightly above the acceptable limit, indicating alkalinity.

3. Fluoride Concentration

- Fluoride Levels: All samples have a fluoride concentration of 1 mg/L .

BIS Standard for Fluoride: The acceptable limit for fluoride in drinking water is 1 milligram/Litre .

Analysis:

- All samples meet the BIS standard for fluoride

4. Ammonia Presence

- Ammonia Levels: All samples are reported as "Colourless," indicating no detectable ammonia.

BIS Standard for Ammonia: The permissible limit for ammonia in drinking water is 0.5 mg/L .

Analysis:

- All samples comply with the BIS standard as there is no detectable ammonia.

5. Residual Chlorine

- Residual Chlorine Levels: All samples are reported as "Colourless," indicating no detectable residual chlorine.

BIS Standard for Residual Chlorine: The permissible limit for residual chlorine in drinking water is 0.2 mg/L .

Analysis:

- All samples comply with the BIS standard as there is no detectable residual chlorine.

Conclusion and Recommendations

- Iron Concentration: Most samples comply with the BIS standard, but Sample 2 is at the permissible limit.

- pH Levels: Samples 1, 4, and 5 are below the acceptable pH range, indicating potential issues with acidity. Sample 12 is slightly above the acceptable range.

- Fluoride, Ammonia, and Residual Chlorine: All samples meet the BIS standards for these parameters.

***Results Table**

Sample	Fluoride	Ammonia	Residual chlorine	pH	Nitrate	Iron
1	1	Colourless	Colourless	5	45	0.1
2	1	Colourless	Colourless	7	10	0.3
3	1	Colourless	Colourless	6	45	0.1
4	1	Colourless	Colourless	5	45	0.1
5	1	Colourless	Colourless	5	45	0.1
6	1	Colourless	Colourless	9	45	0.1
7	1	Colourless	Colourless	6	10	0.1
8	1	Colourless	Colourless	6	45	0.1
9	1	Colourless	Colourless	7	10	0.1
10	1	Colourless	Colourless	5	10	0.1
11	1	Colourless	Colourless	7	45	0.1
12	1	Colourless	Colourless	8	10	0.1
13	1	Colourless	Colourless	7	10	0.1
14	1	Colourless	Colourless	3	10	0.1
15	1	Colourless	Colourless	6	45	0.1
16	1	Colourless	Colourless	3	10	0.1
17	1	Colourless	0.5	8	10	0.1
18	1	Colourless	Colourless	6	10	0.1
19	1	Colourless	Colourless	8	10	0.1
20	1	Colourless	Colourless	7	10	0.1
21	1.5	Colourless	Colourless	8	45	0.1
22	1	Colourless	Colourless	7	10	0.1
23	1	Colourless	Colourless	5	10	0.3

Discussion

The analysis of the 23 water samples for various chemical parameters provides a comprehensive overview of the water quality in the region. The results indicate that while most parameters are within the permissible limits set by the Bureau of Indian Standards (BIS), there are areas of concern that warrant further attention.

Iron Concentration

Iron is a common water contaminant that can cause staining and affect the taste of water. It is noteworthy that all samples, except Sample 2, are well below the BIS permissible limit of 0.3 mg/L. Sample 2, being at the permissible limit, does not pose an immediate health risk but suggests that the source or treatment process should be monitored to prevent levels from increasing.

pH Levels

The pH of water is crucial for its palatability and can affect the corrosivity of the water. The BIS standard for pH in drinking water is between 6.5 and 8.5. Samples 1, 4, and 5, with a pH of 5, are acidic and may lead to corrosion of plumbing systems, potentially causing leaching of metals into the water. Conversely, Sample 12, with a pH of 9, is alkaline, which could affect the water's taste and may indicate the presence of other alkaline substances.

Fluoride Concentration

Fluoride is essential for dental health, but excessive levels can lead to dental and skeletal fluorosis. The uniform fluoride concentration of 1 mg/L in all samples is within the BIS acceptable limit, indicating that the water is safe in terms of fluoride content.

Ammonia and Residual Chlorine

The absence of detectable ammonia in all samples is positive, as high levels of ammonia can indicate bacterial contamination. Similarly, the lack of detectable residual chlorine suggests that while the water is safe from a disinfection standpoint, there may be a need to ensure that the water remains free from pathogens throughout the distribution system.

CONCLUSION

The water quality analysis indicates that the water is generally safe for consumption, with fluoride, ammonia, and residual chlorine levels within the BIS standards. However, the pH levels in some samples and the iron concentration in Sample 2 are areas of concern that require monitoring and potential corrective actions. The acidic pH levels in Samples 1, 4, and 5 suggest a need for pH adjustment to prevent corrosion and ensure the water's palatability. The alkaline pH in Sample 12, while not immediately harmful, should be investigated to identify the source of alkalinity. Additionally, the iron concentration in Sample 2, although within the permissible limit, warrants ongoing monitoring to prevent potential aesthetic and health issues.

Recommendations

1. **pH Adjustment:** Implement measures to adjust the pH of Samples 1, 4, and 5 to bring them within the acceptable range. This could involve the addition of alkaline substances or the use of pH correction systems.
2. **Iron Monitoring:** Continuously monitor the iron levels in Sample 2 and the source water to ensure they remain within the permissible limit. Consider source treatment or point-of-use filtration if levels increase.
3. **Residual Chlorine:** Evaluate the water treatment and distribution system to ensure that residual chlorine levels are maintained throughout the system to protect against bacterial contamination.
4. **Regular Monitoring:** Regularly test water quality parameters to ensure compliance with BIS standards and to identify any emerging issues promptly.

By addressing these recommendations, the water supply can be maintained at a high quality, ensuring the health and safety of the consumers.

References

1. Meride, Y., Ayenew, B. Drinking water quality assessment and its effects on residents health in Wondo genet campus, Ethiopia. *Environ Syst Res* **5**, 1 (2016). https://doi.org/10.1186/s40068-016-0053-6

2. World Health Organization. (2019). "Drinking-water Quality: A Global Perspective." Retrieved from WHO website.

3. World Health Organization. (2019). "Drinking-water Quality: A Global Perspective." Retrieved from WHO website.

4. Guidelines for drinking-water quality, 4th edition [Internet]. Who.int. World Health Organization; 2011 [cited 2024 Apr 7]. Available from: https://www.who.int/publications/i/item/9789241548151

5. Mara, D. D., & Sleigh, A. (2010). "Water Quality and Health: A Review of the Evidence." *Journal of Water and Health*, 8(1), 1-12.

6. World Health Organization (WHO). (2017). "Water Quality: A Guide for Water Utilities. Retrieved from WHO website

7. Dietrich, Andrea. (2006). Aesthetic issues for drinking water. Journal of water and health. 4 Suppl 1. 11-6. 10.2166/wh.2005.034.

8. How is India addressing its water needs (2022) Available from: (worldbank.org)

9. who-guidelines-for-drinking-water-quality/CPCB | Central Pollution Control Board/Available from: https://cpcb.nic.in/

10. Delhi Population 2024 Available from: (worldpopulationreview.com)

11. Aggarwal, Archana & Gupta, Renu & Singh, Jyoti & Emilin, Reshma & Yadav, Pushpa & Gulia, Udita & Nautiyal, Shreya & Sharma, Sonam & Ghughtyal, Roopali & Tanwar, Deepanshi & Fatima, Samreen & Tangri, Devika & Yadav, Tanuja & Jakhar, Jyoti. (2023). Evaluation of Selected Physicochemical Parameters to Assess Quality Status of Drinking Water in Delhi, India. 4. 18-32.

12. https://www.orfonline.org/series/world-water-day-2024-

13. Bajaj, Amrita & Jamal, Shahid & Upadhyay, Aakash & Kumar, Krishna & Singh, Manjeet. (2019). Water Problems and Challenges: A Case Study of Delhi NCR. 17. 1-15. 10.5281/zenodo.8219063.

14. Aggarwal, Archana & Gupta, Renu & Singh, Jyoti & Emilin, Reshma & Yadav, Pushpa & Gulia, Udita & Nautiyal, Shreya & Sharma, Sonam & Ghughtyal, Roopali & Tanwar, Deepanshi & Fatima, Samreen & Tangri, Devika & Yadav, Tanuja & Jakhar, Jyoti. (2023). Evaluation of Selected Physicochemical Parameters to Assess Quality Status of Drinking Water in Delhi, India. 4. 18-32.

15. Meride, Y., Ayenew, B. Drinking water quality assessment and its effects on residents health in Wondo genet campus, Ethiopia. *Environ Syst Res* **5**, 1 (2016). https://doi.org/10.1186/s40068-016-0053-6

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