



## Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004

Anar Koli Mahbub<sup>1</sup>, Dr. Mohammad Rezaul Karim<sup>2</sup>

<sup>1</sup>Joint Secretary, Cabinet Division, Bangladesh Secretariat, Dhaka

<sup>2</sup>Deputy Director, Department of Governmental System, Bangladesh Public Administration Training Centre, Savar, Dhaka, Bangladesh

---

### Published Online:

31 October 2024

**ABSTRACT:** This policy evaluation analyzes the consistencies within the National Policy for Arsenic Mitigation (2004) in Bangladesh, which aims to tackle the extensive groundwater contamination by arsenic. The study evaluates the internal coherence of the policy's goals, tactics, and implementation measures through a comprehensive examination. Significant focus areas include policy objectives alignment different policy components along with related national and international laws, plans, guidelines and strategies. The paper also attempts to explore effectiveness, identify gaps or inconsistencies, and recommend measures to enhance the implementation and impact of the policy. The analysis highlights several notable benefits of the strategy, including its thorough approach to identifying sources of contamination, advocating for safe alternatives for drinking water and enhancing public knowledge of the risks associated with arsenic. Additionally, the policy emphasizes the inclusion of several sectors, such as health, water resources, and environment, thereby establishing a comprehensive mitigation approach. However, the analysis also highlights areas that could potentially improve coherence. There needs to be more coordination between implementing agencies, discrepancies in the distribution of resources, and difficulties in ensuring the long-term sustainability of mitigation measures. In addition, the policy delineates specific mitigation strategies; moreover, their implementation typically needs to be more consistent, resulting in disparate results across different areas. Suggestions entail improving cooperation between agencies, guaranteeing a fair and uniform allocation of resources, and implementing a comprehensive monitoring and evaluation system to evaluate advancements and adjust programs accordingly. The study emphasizes the importance of reevaluating the policy to address these issues, strengthening its internal consistency and efficacy in reducing arsenic contamination in Bangladesh.

### License:

This is an open access article under the CC BY 4.0 license:

<https://creativecommons.org/licenses/by/4.0/>

**KEY WORDS:** Arsenic Mitigation, Groundwater Contamination, Public Health, Policy Coherence, Policy Gaps, Implementation Effectiveness.

---

### 1.1 BACKGROUND:

Arsenic contamination in groundwater has emerged as a critical public health and environmental concern in Bangladesh, posing significant challenges to sustainable development efforts. It is considered one of the major issues related to public health in Bangladesh (Rahman et al, 2018). The maximum amount of arsenic that can be found in water is 0.01 mg/liter. The WHO states that the range for Bangladesh is 0.05 milligrams/liter; nevertheless, a survey found that 27% of tube wells in the country had higher levels of arsenic contamination, exceeding 0.05. There is currently evidence of severe arsenic occurrence in over 85% of the country's area and 61 Bangladeshi districts (Rahman et al, 2022). The Department of Public Health and Engineering reports that the average rate of pollution is 29%, with a range of 1.0 to 90%. According to a study, 80 percent of the shallow tube wells polluted with arsenic in 15 percent of Bangladeshi communities were utilized for domestic purposes, such as drinking and cooking (Ahmad,

## **Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004**

Khan and Haque, 2018). Skin lesions, cancer, respiratory issues, cardiovascular disorders, poor pregnancy outcomes, and delayed cognitive development in children are just a few of the health effects caused by arsenic (UNICEF & WHO 2018) .

In response to this pressing issue, the Government of Bangladesh introduced the National Policy for Arsenic Mitigation in 2004 (GOB 2004), aiming to comprehensively address the adverse impacts of arsenic contamination on human health, water resources, and socio-economic development. The policy addresses the following areas: (1) identification of the nature and extent of the problem; (2) arsenic mitigation activities; (3) institutional arrangement; (4) research and development; (5) information, applied research, and reference laboratory; (6) collaboration and cooperation; and (7) policy implementation issues.

This paper adopts a multidimensional approach to evaluate the coherence of the National Policy for Arsenic Mitigation 2004 in Bangladesh. It begins by analyzing the alignment of the policy with internal governance structures, including its integration with national health, water, and environmental policies as well as it aims to align the policy with the objectives of the 8th Five-Year Plan (2020-2025) (GOB, 2020) and Perspective Plan of Bangladesh (2021-2041) (GOB, 2020) to improve public health and ensure access to safe water for all citizens. Furthermore, the paper examines the policy's coherence with international frameworks such as Sustainable Development Goals (SDGs) (UNDESA). The achievement of Goal 6 (Access to safe water) and Goal 3 (Good Health) of SDG are closely related to arsenic contamination mitigation.

The paper also attempts to explore effectiveness, identify gaps or inconsistencies, and recommend measures to enhance the implementation and impact of the policy. This paper seeks to contribute to ongoing efforts to safeguard public health, protect water resources, and promote sustainable development in Bangladesh and beyond.

### **1.2 Statement of the Problem:**

The National Policy for Arsenic Mitigation introduced by the Government of Bangladesh in 2004 represents a significant effort to combat the pervasive issue of arsenic contamination in groundwater. However, the effectiveness of this policy hinges on its coherence across various dimensions, including alignment with internal governance structures and integration with policy frameworks within Bangladesh, including health, water, and environmental policies. Smith et al. (2000) in their study state that only 1% of the rural population in Bangladesh was aware of arsenic contamination in drinking water. Lack of awareness hindered preventive measures and community participation in mitigation efforts. The Bangladesh Bureau of Statistics reported in 2009 that around 20 million people in Bangladesh were exposed to arsenic concentrations above the WHO guideline of 10 µg/L. The scarcity of safe drinking water for the affected population, particularly in remote rural areas, was a vital problem in implementing the policy. A study by Khan and Khan (2009) reported that only about 5-10% of the affected population had access to arsenic-safe water supply systems. Implementing the National Policy for Arsenic Mitigation faced challenges due to technical complexity and high costs. As per the research of the World Health Organization (WHO) arsenic poisoning affects millions of people worldwide, causing various health issues like skin wounds, cancer, and cardiac diseases. Inadequate medical support to affected individuals posed significant challenges for the policy to come into effect. The Department of Public Health Engineering (DPHE) reported in 2008 that only a fraction of the tube wells in Bangladesh were tested for arsenic contamination, highlighting the lack of effective monitoring mechanisms which hinders implementation of the policy. Ahmad, S, Khan, M. and Haque, M. (2018) point out that arsenic mitigation policy suffers from sustainability as it proves to be difficult to maintain, operate, and regularly monitor these systems as well as to conduct research and innovation, especially in environments with limited resources.

Studies have shown that arsenic contamination disproportionately affects marginalized communities, including the poor and those living in rural areas (Ahmed et al., 2006). Inequalities in socio-economic structure and lack of ensuring justifiable access to safe drinking water posed significant challenges in arsenic mitigation efforts (Ali, 2006).

The study on the coherence of Bangladesh's National Arsenic Policy of 2004 is significant for understanding its impact on arsenic contamination mitigation efforts and public health outcomes. It can be beneficial to both the researchers and the policymakers in various ways. It can identify challenges and barriers hindering the coherent implementation of the policy. It can evaluate the policy's coherence in addressing the needs and concerns of affected communities. This research can assess whether resources allocated to arsenic mitigation efforts have been effectively utilized and whether there is a need for reallocation or additional funding. It can also examine the coherence of the National Arsenic Policy with other relevant policies and strategies to ensure alignment and synergy in achieving common objectives. This research will be helpful in contributing to the achievement of SDGs closely related to arsenic contamination in Bangladesh. Evaluating the coherence of the policy promotes accountability and transparency in governance by assessing the government's commitment to addressing arsenic contamination.

### **1.3 Objectives of the Research:**

The objective of the study is to investigate how this policy is coherent with the different national policies including 8<sup>th</sup> Five Year Plan and aligned with the international policy, Sustainable Development Goals in particular.

Specifically, it aims analyzing the alignment of the policy with internal governance structures, including its integration with national health, water, and environmental policies as well as 8th Five-Year Plan (2020-2025) in improving public health and ensuring access to safe water for all citizens; and examining the policy's coherence SDG-6 (Access to safe water) & SDG-3 (Good health).

## **Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004**

The research also makes an effort to investigate efficacy, pointing out bottlenecks and contradictions and suggesting actions to improve the policy's impact and execution.

### **2.0 LITERATURE REVIEW**

Arsenic contamination has been considered as a significant public health and environmental challenge in Bangladesh, affecting millions of individuals and undermining sustainable development efforts. In response to this crisis, the Government of Bangladesh introduced the National Policy for Arsenic Mitigation in 2004. In this section detailed discussion will be conducted regarding relevant literature addressing arsenic contamination, policy coherence, and arsenic mitigation strategies in Bangladesh.

#### **2.1. Adversity of arsenic contamination:**

Arsenic contamination in groundwater has been extensively documented in Bangladesh, with studies highlighting its widespread presence and adverse health effects (Smith et al., 2000) UNICEF & WHO (2018). Khan et al. (2012) and Ahmad, S, Khan, M. and Haque, M.. (2018) provide a comprehensive review of the causes, effects, and possible remedies for arsenic contamination in Bangladesh, emphasizing the urgent need for mitigation measures.

#### **2.2 Importance of policy coherence**

The Organisation for Economic Co-operation and Development (OECD) emphasizes the importance of policy coherence in addressing complex challenges such as water quality management (OECD, 2011). Further, Meinen-Dick et al. (2002) discuss methods for studying collective action in rural development, highlighting the importance of integrating policies across sectors for effective resource management.

#### **2.3 Coherence of Arsenic mitigation policy with others**

Ahmed, F, Kamal A. & Idrish, M. (2023) and Ahmad, S, Khan, M. and Haque, M. (2018) discuss various aspects of the Arsenic mitigation policy of Bangladesh with other policies related to the water, air and environment and point out their coherences and the points that require more interventions from the policymakers.

#### **2.4 Arsenic Mitigation Strategies**

Ahmed et al. (2006) assess the effectiveness of arsenic mitigation strategies in Bangladesh, emphasizing the importance of ensuring safe drinking water for vulnerable populations. Besides, National Policy for Arsenic Mitigation, 2004, Implementation Plan for Arsenic Mitigation for Water Supply 2018 (Ministry of Local Government, Rural Development and Cooperative, Government of Bangladesh) and National Arsenic Mitigation Policy Implementation Plan (2009-2013) (DPHE 2008) also state a number of guidelines to mitigate arsenic.

#### **2.5 Implementation challenges and recommendations:**

Hoque et al. (2016) and Ahmad, S, Khan, M. and Haque, M. (2018) provide a progress report on arsenic mitigation strategies in Bangladesh, identifying implementation challenges and areas for improvement that implementation face numerous challenges relating to stakeholders, structural limitations and non-cooperation of beneficiaries because of their illiteracy.

#### **2.6 Role of community participation**

George et al. (2006) evaluate an arsenic education program in Bangladesh, highlighting the role of community participation in raising awareness and promoting mitigation efforts. Paul et al. (2018) examine factors influencing community participation in arsenic mitigation activities, emphasizing the importance of stakeholder engagement in policy implementation.

#### **2.7 Need for global collaboration**

Berg et al. (2001) investigate arsenic contamination of groundwater in Vietnam, highlighting similarities with the situation in Bangladesh and the need for international collaboration. Naujokas et al. (2013) provide an overview of the health effects of chronic arsenic exposure worldwide, emphasizing the need for global action to address this public health problem.

### **3.0 METHODOLOGY**

The research has used a secondary data-based qualitative approach to explore the coherence of Bangladesh's National Policy for Arsenic Mitigation 2004 within its specific context. Case studies, relevant laws, regulations, and government reports. Document analysis has been utilized to understand the policy's objectives, strategies, and implementation mechanisms, as well as to identify any gaps or inconsistencies in its coherence with internal and external policy frameworks. Data have been collected from document analysis and analyzed thematically using qualitative data analysis techniques. Themes related to policy coherence, implementation challenges, stakeholder perspectives, and comparative insights are identified, coded, and interpreted to generate critical findings and recommendations. Data credibility has been maintained by using authentic sources such as government publications, international reports and research articles from scholarly journals.

#### **4.0 DATA ANALYSIS AND FINDINGS**

Bangladesh's water policy and plans address groundwater arsenic hazards affecting drinking water and water supply. The National Policy for Safe Water Supply and Sanitation (1998) is the central policy that aims to ensure that all citizens have access to a basic level of water supply and sanitation services. In 2004, the "National Policy for Arsenic Mitigation (NPAM 2004)" was formulated. A few policies and initiatives complement the national strategy, emphasizing water supply, sanitation promotion, and arsenic-safe water. The following are the essential documents related to water management in Bangladesh: (a) the National Water Policy 1999, (b) the National Water Management Plan 2001, (c) the Implementation Plan for Arsenic Mitigation in Bangladesh (IPAM) 2004, (d) the Sector Development Plan (2011–2025), (e) the Bangladesh Water Act, 2013, (f) the National Strategy for Water Supply and Sanitation 2014, (g) the Implementation Plan of Arsenic Mitigation for Water Supply (IPAM-WS) (Revised), 2018, and (h) the National Strategy for Water Supply and Sanitation (Revised), 2021. The subsequent chapters aim to identify the coherences, synergies and similarities between the NPAM 2004 and other related policies, strategies, recommendations, and plans of both national and international arenas.

##### **4.1.1 National Water Policy, 1999 and Bangladesh Water Act 2013**

The National Water Policy (NWP) 1999 is a contemporary and informative document that prioritizes the advancement and use of secure groundwater and surface water resources to fulfill the nation's water needs and guarantee water stability across various socioeconomic strata. The NPAM 2004 aligns with Section 4.6 of the NWP 1999, which mentions surface water pollution, arsenic contamination in groundwater, water table lowering, pesticide leakage into shallow aquifers, and coastal salt intrusion. The policy aims to protect water resources from pollution and ensure access to safe and reasonably priced drinking water through rainwater harvesting and conservation. It also emphasizes raising awareness to address water supply and sanitation challenges (GOB, 1999). The Bangladesh Water Act 2013 establishes the country's essential legislative framework for water management and conservation. It serves as the primary tool for promoting effective water administration. The Act includes critical measures for the nation's comprehensive development, administration, extraction, allocation, utilization, safeguarding, and preservation of water resources. The Act also prioritizes potable and household water in shortage-stricken areas aligning with NPAM 2004. (GOB, 2013). In connection with the water act, in 2018, the Arsenic Reduction for Water Supply, 2004 Implementation Plan underwent amendments to address issues and harness the potential for sustainable arsenic reduction. The Arsenic Mitigation Implementation Plan comprises four inspectoral plans prioritizing screening, testing, monitoring, reporting, and accountability. It also emphasizes awareness building and public participation, establishing and managing a data repository, institutional and technological aspects, integrated monitoring and surveillance, and research and development to combat arsenic in Bangladesh (GOB 2018).

##### **4.1.2 The National Water Management Plan 2001 and strategic development plan**

The primary goal of the 2001 National Water Management Plan was to address widespread groundwater contamination due to the harmful effects of inorganic arsenic. It assessed existing and prospective contamination, the food safety risks of irrigating with arsenic-contaminated water, and domestic water treatment technologies. The strategy incorporates methods to alleviate arsenic-related problems in the Water Supply and Sanitation (WSS), agriculture, and health domains. The plan prioritized NPAM 2004 to find sustainable and economical solutions for arsenic in all sectors. (GOB,2001). It also links to the National Implementation Plan for Arsenic Mitigation 2004 aiming to provide arsenic-affected communities with clean drinking water. To mitigate the future health implications of groundwater arsenic poisoning and achieve the NPAM 2004 goals, the government launched several programs in these locations.

The Sector Development Plan (2011–2025) for Water and Sanitation in Bangladesh acknowledges the objectives of NPAM 2004 in several areas: (a) investigating, assessing, monitoring, and managing arsenic; (b) safeguarding the quality of groundwater; (c) regulating the extraction of groundwater; (d) regulating the drilling of tube wells; (e) evaluating the sustainability of existing and planned practices; and (f) establishing the required legislative framework. (GOB, 2011).

The National Strategy for Water Supply and Sanitation 2014 focuses on reducing arsenic contamination. Subsequently, the strategy underwent an update and revision in 2021. The National Strategy for Water Supply and Sanitation focuses on several key areas, including (a) screening and monitoring for arsenic; (b) disposal and research of arsenic-laden sludge; (c) testing all new groundwater supply sources; (d) implementing arsenic mitigation technology; (e) conducting public awareness campaigns; (f) reducing the standard for arsenic in drinking water to 10 µg/L; (g) promoting piped water supply in areas affected by arsenic; (h) ensuring that every household has access to an arsenic-safe water source within a 30-minute walk; (i) coordinating arsenic-related activities among various ministries, divisions, government agencies, NGOs, and the private sector at different levels, from national to union; and (j) promoting the use of harmonized approaches such as the Arsenic Safe Union (GOB, 2014)(GOB, 2021).

##### **4.1.3 National Environment Policy 2018**

The National Environment Policy 2018 is an all-encompassing document that covers several environmental concerns, such as air and water pollution, waste management, biodiversity conservation, and climate change adaptation. It integrates environmental considerations into national planning and sectoral policy and promotes green technologies to support sustainable development. Chapter 3.2 of the strategy outlines specific guidelines to ensure integrated water resource management implementation. Directives

## **Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004**

such as recharging groundwater, ensuring availability of safe water, testing water quality, and finding and keeping underground safe water reservoirs free of arsenic, lead, and other harmful substances resemble NPAM 2004. (GOB 2018)

### **4.1.4 Broader visions of the government: 8th Five-Year, Perspective and Delta plan**

The 8th Five-Year Plan (2020-2025) offer a valuable understanding of the country's endeavors to address arsenic contamination in a broader development framework. The 8th Five-Year Plan proposes substantial funding for water supply infrastructure to guarantee access to safe drinking water for 98% of the population by 2025, with a specific focus on rural areas where arsenic poisoning is most pronounced. Improved healthcare services and arsenic mitigation technology are part of the 8th Five-Year Plan to reduce arsenic-related health issues. Some major objectives of NPAM 2004 like coordination among government institutions, NGOs, and international partners as well as community engagement and public awareness do have coherences with the plan. (GOB 2020)

NPAM 2004 significantly aligns with the objectives stated in the Bangladesh Perspective Plan (2021–2041). The Perspective Plan 2021, a component of Vision 2041, seeks to elevate Bangladesh to a middle-income nation by making substantial advancements in healthcare, water quality, and sustainable development. NPAM 2024 aligns with the Perspective Plan (2021-2041), incorporating several primary objectives. To reduce arsenic exposure aligns with the Perspective Plan's objective of enhancing health and nutrition outcomes. In addition, the other goals of the Plan, such as ensuring access to uncontaminated drinking water and promoting environmental sustainability, align with the objectives of the National Arsenic Mitigation Policy of 2004. (GOB 2021)

Bangladesh's National Arsenic Mitigation Policy can substantially contribute to the goals of the Bangladesh Delta Plan 2100, which include sustainable water management, climate resilience, and socioeconomic growth. The Delta Plan 2100 addresses the difficulties raised by climate change, water security, and environmental sustainability, which closely correspond to the goals of NPAM 2004 (GOB 2018).

### **4.1.5 United Nations Human Rights and SDG**

Bangladesh has repeatedly acknowledged the human right to access safe drinking water and sanitation globally. The nation ratified the UN General Assembly resolution 64/292 (The human right to water and sanitation) on July 28, 2010. This resolution acknowledges the misuse of access to safe and clean drinking water as well as sanitation as fundamental human rights that are necessary for the complete enjoyment of life and all other human rights. Bangladesh, has endorsed multiple resolutions asserting that the right to safe drinking water and sanitation stems from the right to a satisfactory quality of life (UNHRC, 2012). NPAM 2004 explicitly states all these rights.

The Sustainable Development Goals (SDGs) of the United Nations serve as the blueprint for worldwide development after the successful ending of the Millennium Development Goals (MDGs). The leaders of all 193 nations worldwide unanimously adopted the Sustainable Development Goals (SDGs) between 2016 and 2030. The 17 objectives and 169 targets of the SDGs aim to address poverty, inequality, and climate change and create a sustainable future for all (UNDESA). The Sustainable Development Goals prioritize Goal 6 (clean water and sanitation), emphasizing the importance of "achieving universal and equitable access to safe and affordable drinking water for all by 2030." The "NPAM 2004" tests and treats arsenic-contaminated water sources, matching SDG 6's goal of universal water and sanitation. NPAM 2004 aligns with Goal 2 (Food Security) and Goal 3 (Good Health and Well-Being) by aiming to decrease arsenic exposure in drinking water. NPAM 2004 specifically targets to reduce disparities in access to safe drinking water aligning with SDG 10 (Reduced Inequalities). While the main focus is on mitigating arsenic, it also indirectly supports SDG 13 (Climate Action) by promoting sustainable water management practices that improve resilience to climate change impacts. (UNICEF & WHO, 2018)

### **4.1.6 Guidelines by Development Partners**

WHO (World Health Organization) and UNICEF (United Nations International Children Emergency Fund) jointly published a report named "Arsenic Primer: Guidance on the Investigation & Mitigation of Arsenic Contamination" in 2018. It provides practical assistance for UN agency staff, government colleagues, and development professionals dealing with arsenic pollution of drinking water. There are a number of guidelines here to recommend national health-based targets, water suppliers' water safety plans to identify and mitigate all drinking-water safety risks, and independent surveillance to ensure standards are met, taking into account local priorities, environmental conditions, economic status, and institutional capacities. It provides the conceptual framework for arsenic risk management in the water sector and beyond (UNICEF & WHO, 2018).Appendix-A shows Coherences of different national and international Policy/plan/act/strategy /guideline with National Policy for Arsenic Mitigation 2004 at a glance.

## **4.2 Findings of the study**

Since the formulation of the NPAM 2004, a number of strategies and implementation plans have been initiated to supplement and implement it. Still, the desired success has not been achieved. Going through the various related national and international policies, laws, plans, guidelines along with scholarly articles and reports, the policy gaps and the challenges lingering the policy's proper implementation are stated in the following findings:

### **4.2.1 Lack of updating the policy and coordination**

The NPAM 2004 has not been updated since its inception although contemporary policies have been updated and revised; for example the National Environment policy of 1992 was revised in 2018. It requires to incorporate coherences and references of

## **Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004**

related national and international policies, acts, plans and directives like the perspective plan, 8<sup>th</sup> five-year plan, Delta plan, SDGs etc. in NPAM 2004 which can add more values and weights (Faisal, Gupta and Basnayake. 2021).

The NPAM 2004 outlines the impacts of arsenic-contaminated groundwater on agriculture, the food chain, and public health. Hassan (2018) points out that the National Food Policy 2006, National Agriculture Policy 2018, and National Health Policy 2011 lack arsenic mitigation provisions despite groundwater arsenic contamination influencing policies in these three distinct sectors. There needs to be coordination between the policy frameworks implemented by the relevant ministries.

### **4.2.2 Ambitious Goals**

Compared to the executing institutions' existing resource capability and implementation state, many of the policy instruments' criteria seem disproportionate. In 2005, the government declared its aim to guarantee universal access to clean drinking water by 2011 and sanitation for all by 2013, yet these objectives still needed to be fulfilled. These plans appear to be quite ambitious. The absence of practical strategies in the policy framework raises concerns regarding the authenticity and trustworthiness of the entire policy (Hassan 2018).

### **4.2.3 Lack of sufficient resources and logistic and technical support**

A lack of adequate financial resources and poor budget allocation impede the complete implementation of programs to mitigate arsenic. As per report of the World Bank (2005), despite substantial efforts, the amount of funds needed to resolve the arsenic crisis completely is much more significant than the resources now available. In his report, Adams (2013) states that the government initiated a project which employed a two-pronged approach to mitigation with the aid of development partners, costing US\$30 million but during the project's first year, donors lost interest due to its lack of success, and development stopped.

The policy's implementation is hindered by technical challenges in discovering and executing suitable arsenic removal methods in various geographical locations. Analysis of approximately 125,000 government water points installed from 2006 to 2012 revealed that DPHE water points did not prioritize areas with a high risk of arsenic contamination (DPHE/JICA, 2010; DPHE/UNICEF, 2013; HRW, 2016). Furthermore, it was determined that around 5% of these water points were contaminated, exceeding the permissible limit of 50 µg/L set by the Bangladesh Standard (HRW, 2016).

### **4.2.4 Socio-economic factors of stakeholders**

Many rural people are unaware of the hazards associated with arsenic contamination and the existence of solutions to alleviate them. Water Quality Thematic Report (DPHE, BBS & UNICEF 2021) reveals that less than 50% of rural people in Bangladesh were unaware of arsenic contamination in drinking water. Many rural poor people place a low priority on health concerns caused by arsenic poisoning, deeming health and illness issues "non-threatening" (Gibbon, 2000). Despite being aware of the toxic nature of arsenic in their drinking water, individuals in some areas of Bangladesh persistently use arsenic-contaminated water (Hassan, 2018). Arsenic pollution has resulted in some unanticipated social and societal problems that require proper acknowledgment. Recent studies confirm that society's most economically disadvantaged segment faces the most severe arsenic issues. In rural areas, individuals displaying symptoms of arsenicosis experience various forms of social discrimination, including ostracism, neglect, challenges in finding a spouse, divorce, family conflicts, workplace discrimination, and difficulties in socializing (M.A. Rahman et al., 2018; Ahmad et al., 2007; Mahmood and Halder, 2011). Arsenicosis diagnoses can lead to societal stigma, as people mistakenly associate the disease with past or current misdeeds (Rahaman, Mise and Ichihara 2022).

### **4.2.5 Lack of innovation implementation**

The NPAM 2004 has guided the development of several implementation plans. The 2004 Implementation Plan for Arsenic Mitigation for Water Supply was amended in 2018 to address arsenic issues and capitalize on opportunities. The National Strategy for Water Supply and Sanitation 2014 primarily focuses on arsenic mitigation. Subsequently, the strategy underwent an update and revision in 2021. However, upon reviewing all of those plans and methods, they appear to be opposite sides of the same coin. They have replicated most of the plans or tactics from 2004 or 2014. No unique ideas are included there. (Faisal, Gupta and Basnayake. 2021).

Faisal, Gupta and Basnayake (2021) states that there needs to be more sophisticated and technology-driven monitoring and evaluation mechanisms now in operation to assist in implementing arsenic mitigation strategies. Many implementation projects still use manual M&E processes, resulting in poor governance compared to expectations. A well-designed policy instrument using IT-enabled platforms, GIS technologies, remote sensing, simulation, and analytics tools must include sector-specific arsenic mitigation.

### **4.2.6 Insufficient collaboration among the different parties involved**

An outstanding feature of the institutional framework for arsenic-related interventions is the involvement of numerous governmental and non-governmental agencies. However, there needs to be more effective coordination at the national level to address the sector's challenges. Hassan (2018) points out that LGD (Local Government Division), LGED (Local Government Engineering Department), DPHE (Department of Public Health Engineering), WASA (Water Supply and Sewerage Authority), Paurashavas (municipalities), city corporations, Upazila Parishad, and Union Parishad are crucial actors at the national and rural levels in driving the progress of the Water Supply and Sanitation (WSS) sector. Numerous NGOs and other relevant stakeholders complement their efforts. The

## **Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004**

participation of numerous government agencies, institutions, and other stakeholders has resulted in a disorganized situation, leading to a fragmented coordinating process (Khan and Young, 2014). Appendix-B shows Activities and roles of different stakeholders in arsenic mitigation in Bangladesh.

It is critical to prioritize thorough research to determine water supply possibilities relevant to each region and effectively plan arsenic mitigation strategies as region-specific water supply options may work better due to geo-hydrology, soil types, and water chemistry differences. Understanding water chemistry is crucial for advancing arsenic removal methods (Milton et al., 2006). Unfortunately, Bangladesh's entire arsenic mitigation effort lacks the scientific approach despite the initial phase's intended completion (HRW, 2016).

### **4.2.7 Limitations of the healthcare system and access to potable water**

Sarker (2010) recognized resource scarcity and inadequate medical infrastructure as significant barriers to mitigating the health risks associated with arsenic. Hassan (2015) demonstrates that many individuals suffering from arsenicosis in rural regions can seek alternative medical care, such as homeopaths, village doctors, ayurvedic doctors, and local pharmacists. The healthcare system's inability to accurately detect and effectively treat health issues caused by arsenic significantly hinders the execution of the arsenic mitigation program in Bangladesh (Hassan 2018).

Lack of sufficient access to potable water has been a primary factor contributing to non-adherence. Moreover, factors such as turbidity, unpleasant odors and tastes of drinking water, the inconvenience of fetching water from a distant source due to distance and time limits, and social disputes influence compliance. Collecting water from tube wells was highly convenient for rural residents. Despite the long-standing reliance on tube wells for underground water, many individuals face challenges transitioning to alternative water sources that are less convenient than tube wells (Milton et al., 2007).

### **4.2.8 Lack of proper monitoring, evaluation and effective data management**

The policy lacks a rigorous monitoring and evaluation framework to assess progress and measure mitigation measures. There are indications of data duplication and a deficiency in implementing suitable data management and sharing standards among the parties involved. Consequently, promptly obtaining the appropriate data from the correct authorities can take time and effort. Numerous agencies utilize IT-enabled platforms to store and manage their data, but these solutions are not conducive to immediate and effortless access. Daily implementation programs generate substantial amounts of data, yet they fail to adequately save and archive this data to support data analytics and decision-making.

### **4.2.9 Lack of Sustainability in Mitigation Efforts:**

Arsenic mitigation initiatives must be sustainable, including safe water source maintenance and monitoring. Ahmed et al. (2006) found that inadequate maintenance led to the functional failure of a significant number of deployed arsenic removal units within a few years. The SONO filter is one of several filters utilized as an alternative for mitigating arsenic exposure. An assessment of the technical and social aspects of the situation indicated that consumers are hesitant to fix the malfunctioning filter personally. Other issues with the filter included maintenance problems, inadequate guidance on sludge disposal, a sluggish flow rate, and a lack of accountability. Other filters exhibited the same shortcomings as the SONO ones. (Milton et al., 2007).

### **4.2.10 Regional political influence**

Local politics have a significant influence on the allocation of deep tube wells and the selection of new water sources in rural areas, particularly in Upazila and Unions. Human Rights Watch published a report in 2016 that revealed local politicians in positions of power obstruct the distribution of new government water points by diverting these vital public resources to their political followers and allies, even before their construction (HRW 2016).

## **5. CONCLUSION AND RECOMMENDATIONS**

Bangladesh's National Policy for Arsenic Mitigation (2004) was a vital response to the severe arsenic pollution that threatened the nation's groundwater supplies. This program sought to protect everyone's health and guarantee clean drinking water. A thorough policy analysis has identified several coherences and policy gaps, which are crucial for guiding future policy improvements. Addressing these gaps will protect public health and ensure that everyone can access clean drinking water. The recommendations based on the policy gaps include more vigorous implementation, robust monitoring, better research, and better stakeholder collaboration, updating the policy etc. The knowledge gained from this policy study can direct upcoming changes and create more potent mitigation plans for arsenic. The study recommend following suggestions:

(a) The NPAM 2004 should be updated with incorporation of references of recent national and international policies, plans, acts and guidelines. New technologies in the field of water, health, environment and other arsenic related sectors should be included to add values in it.

(b) An extensive and independent project focused on mitigating arsenic is necessary to reduce the exposure to arsenic in drinking water across all unions in areas affected by arsenic contamination. It is essential to end any improper conduct in distributing and installing water technologies, ranging from local political coercion to bribery. The allocation shall be determined according to the genuine needs of individuals and communities.

## Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004

(c) It is enhancing the development and execution of enhanced monitoring and medical care facilities. The DGHS should be responsible for these treatment facilities. A simple treatment for skin lesions at community healthcare centers in villages is necessary to ensure that individuals in rural regions who are economically disadvantaged have access to healthcare services.

(d) The recommended threshold for arsenic consumption in drinking water should be reduced from 50 µg/L to 10 µg/L, in accordance with the standards set by the World Health Organization (WHO) and the United States Environmental Protection Agency (USEPA), to decrease the significant health risks faced by individuals exposed to this contaminant.

(e) Launching a nationwide awareness campaign on the health issues stemming from arsenic is crucial. Disseminating pertinent information via various media platforms, mobile devices, and novel communication methods like village theater and music is essential for reducing the health risks associated with arsenic poisoning. Furthermore, implementing health camps at the village level can improve the knowledge and understanding of individuals living in arsenic-contaminated areas and those suffering from arsenic-related illnesses. Conducting concise training programs for various professional groups (such as schoolteachers, religious leaders, health workers, village doctors, village development committee members, etc.) in rural regions of Bangladesh will provide positive outcomes.

(g) Laboratory techniques should regularly monitor the water quality at all water sites. Furthermore, community healthcare centers at various administrative levels must have access to the DPHE zonal laboratories to test the extent of groundwater arsenic pollution. This would allow for prompt decision-making regarding the treatment of patients with arsenicosis.

(h) The accumulation of arsenic sludge poses a significant environmental hazard. Improper disposal of extremely poisonous arsenic sludge can pollute adjacent water bodies and seep into the groundwater. Hence, it is imperative to establish a sludge management program prior to treating water contaminated with arsenic from aquifers.

(i) Water quality and arsenic-related issues should be incorporated into the academic curriculum at the school level to ensure students have easy access to information on these topics.

(j) To ensure openness in the implementation of any project, "bulletin boards" in public areas are necessary. These bulletin boards inform local populations about the concentration of arsenic in water and identify the locations for installing and distributing arsenic-safe water points and technologies.

(k) A committee with representatives from many government ministries should be established to supervise the national efforts to reduce arsenic levels. This committee should be independent of the Department of Public Health Engineering (DPHE) and the Directorate General of Health Services (DGHS). Its primary role would be to monitor and assess the data related to the progress of arsenic mitigation and the management of patients affected by arsenic contamination. This regulatory authority would have the autonomy to conduct comprehensive testing of all public and private water sources, assess the health status of individuals affected by arsenicosis, and submit detailed reports to the parliament, including updates on the implementation of the national plan.

(l) Coordination is necessary for arsenic mitigation efforts among several ministries and divisions (such as LGD, MoH&FW, MoA, and MoWR) and between government agencies, NGOs, and the business sector at various levels, ranging from national to union. Research is essential for mitigating arsenic poisoning. An ongoing research effort focused on arsenic poisoning would be highly helpful in enhancing surveillance and improving treatment for patients with arsenicosis.

## REFERENCES

1. Ahmad, S. A., Khan, M. H. and Haque, M. (2018) 'Arsenic contamination in groundwater in Bangladesh: implications and challenges for healthcare policy', *Risk Management and Healthcare Policy*, 11, (pp. 251–261).
2. Ahmed, M. F, Ahuja, S., Alauddin, M., Hug, S. J., Lloyd, J. R., Pfaff, A. & van Geen, A. (2006). Ensuring safe drinking water in Bangladesh. *Science*, 314(5806), (pp. 1687-1688).
3. Ahmed, F, Kamal A.K.I & Idrish, M.H.B. (2023) A review of current water governance in Bangladesh: A Case study on administrative and performance of water policy, *Scientific Research Journal (SCIRJ)*, Volume XI, Issue XII, ISSN 2201-2796
4. Ahmad, S.A., Sayed, M.H.S., Khan, M.H., Karim, M.N., Haque, M.A., Bhuiyan, M.S.A., Rahman, M.S., Faruquee, M.H., (2007) Sociocultural aspects of arsenicosis in Bangladesh: community perspective. *J. Environ. Sci. Heal. Part A*. 42, 1945–1958. doi: 10.1080/10934520701567247
5. Ali, M, A. (2006) Arsenic Contamination of Groundwater in Bangladesh. *International Review for Environmental Strategies*, Vol. 6, No. 2, pp. 329 – 360
6. BBS (2009). *Bangladesh Multiple Indicator Cluster Survey 2009: Monitoring the situation of children and women*. Dhaka, Bangladesh: Bangladesh Bureau of Statistics.
7. Berg, M., Tran, H. C., Nguyen, T. C., Pham, H. V., Schertenleib, R., Giger, W., & Stüben, D. (2001). Arsenic contamination of groundwater and drinking water in Vietnam: a human health threat. *Environmental science & technology*, 35(13), (pp. 2621-2626).



## Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004

8. DPHE (2008). National Arsenic Mitigation Policy Implementation Plan (2009-2013). Dhaka, Bangladesh: Department of Public Health Engineering.
9. DPHE (n.d.). Arsenic. Available at: <https://thefinancialexpress.com.bd/views/views/prolonged-heat-waves-challenge-sustainable-development> (Accessed: 07 May 2024)
10. DPHE, BBS & UNICEF (2021) Bangladesh MICS 2019: Water Quality Thematic Report, UNICEF Bangladesh Available at <https://psb.gov.bd/policies/wqtr2019.pdf>
11. DPHE/JICA. (2010) Situation Analysis of Arsenic Mitigation 2009. Dhaka: Department of Public Health Engineering and Japan International Cooperation Agency.
12. DPHE/UNICEF. (2013) SHEWA-B and Nationwide Water Point Mapping Programme (NWMP) Survey Results, 2012–2013. Dhaka: Department of Public Health Engineering and UNICEF.
13. Faisal, A, Gupta, N and Basnayake, S. (2021) Water Sector Policy Frameworks in Bangladesh: Review Report. Bangkok: ADPC
14. George, C. M., Factor-Litvak, P., Khan, K., Islam, T., Singha, A., Moon-Howard, J, & Graziano, J. H. (2006). Approaches to increase arsenic awareness in Bangladesh: an evaluation of an arsenic education program. *Health education & behavior*, 33(3), (pp. 267-282).
15. Gibbon, M. (2000). The Health Analysis and Action Cycle an Empowering Approach to Women's Health. *Sociological Research Online* 4(4). [<http://www.socresonline.org.uk/4/4/gibbon.html>]
16. GOB. (1999). National Water Policy 1999. Ministry of Water Resources, Dhaka: Government of Bangladesh. Available at <https://faolex.fao.org/docs/pdf/bgd146075.pdf>
17. GOB. (2001). National Water Management Plan 2001. Ministry of Water Resources, Dhaka: Government of Bangladesh. Available at [https://warpo.portal.gov.bd/sites/default/files/files/warpo.portal.gov.bd/page/d921b920\\_da0c\\_4775\\_a5c2\\_5c33e6938232/nwmp\\_vol4.pdf](https://warpo.portal.gov.bd/sites/default/files/files/warpo.portal.gov.bd/page/d921b920_da0c_4775_a5c2_5c33e6938232/nwmp_vol4.pdf)
18. GOB (2004). National Policy for Arsenic Mitigation, 2004. Ministry of Local Government, Rural Development and Cooperative, Government of Bangladesh Available at: <https://dphe.gov.bd/site/page/df5879cb-6445-4cb4-a748-f83c1b3c0854/National-Policy-for-Arsenic-Mitigation-2004> Accessed: 06 May 2024
19. GOB. (2004). Implementation Plan for Arsenic Mitigation in Bangladesh. Local Government Division; Ministry of Local Government, Rural Development & Cooperatives. Dhaka: Government of Bangladesh.
20. GOB. (2011). Sector Development Plan (SDP) for Water Supply and Sanitation Sector in Bangladesh (FY 2011–25). Local Government Division; Ministry of Local Government, Rural Development & Cooperatives. Dhaka: Government of Bangladesh.
21. GOB. (2013). Bangladesh Water Act 2013. (Act No 14 of 2013). Article 3, Bangladesh Gazette, pp. 14277–14300, December 29, 2013, Dhaka: Government of Bangladesh.
22. GOB. (2014) National Strategy for Water Supply and Sanitation. Policy Support Unit, Local Government Division; Ministry of Local Government, Rural Development & Cooperatives. Dhaka: Government of Bangladesh.
23. GOB (2018) Bangladesh Delta Plan 2100, General Economic Division (GED), Ministry of Planning, Government of Bangladesh. Available at <https://bdp2100kp.gov.bd/Document/ReportPdfView>
24. GOB (2018). Implementation Plan for Arsenic Mitigation for Water Supply (IPAM-WS), Ministry of Local Government, Rural Development and Cooperative, Government of Bangladesh Available at: <https://psb.gov.bd/policies/ipame.pdf> (Accessed: 07 May 2024)
25. GOB (2018) National Environment Policy 2018, Ministry of Environment, Forest and Climate Change, Available at: <https://moef.gov.bd/site/page/1c05e31e-1bb0-46ce-95a3-6ee3c82b439f/Environment--Laws-&-Acts>
26. GOB (2020). Eighth Five Year Plan (2020-2025). General Economic Division (GED), Ministry of Planning, Government of Bangladesh. Available at 2021-02-03-17-04-ec95e78e452a813808a483b3b22e14a1.pdf (plancomm.gov.bd) (Accessed: 08 May 2024)
27. GOB (2020). Perspective Plan of Bangladesh (2021-2041). General Economic Division (GED), Ministry of Planning, Government of Bangladesh. Available at [https://plandiv.gov.bd/sites/default/files/files/plandiv.portal.gov.bd/files/79060938\\_fbce\\_4286\\_b787\\_e8f41edfc615/PER\\_SPECTIVE%20PLAN%20of%20BD%202021-2041.pdf](https://plandiv.gov.bd/sites/default/files/files/plandiv.portal.gov.bd/files/79060938_fbce_4286_b787_e8f41edfc615/PER_SPECTIVE%20PLAN%20of%20BD%202021-2041.pdf) (Accessed: 08 May 2024)
28. Hassan, M. M. (2018) Arsenic in Groundwater: Poisoning and Risk Assessment, CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW,
29. Hossain, M. (2006). Arsenic contamination in Bangladesh—An overview. *Agriculture, Ecosystems & Environment*, 113(1–4), 1–6. <https://doi.org/10.1016/j.agee.2005.08.034>
30. Hoque, B. A., Hoque, M. M., Ahmed, T., Islam, S., & Azad, A. K. (2016). Arsenic mitigation strategies in Bangladesh: A progress report. *Journal of Health, Population, and Nutrition*, 35(1), (pp. 22-24).

## Anar Koli Mahbub et al, Policy Coherence of Arsenic Mitigation in Bangladesh: An Analysis of National Policy for Arsenic Mitigation 2004

31. HRW (Human Rights Watch). (2016) Nepotism and Neglect: The Failing Response to Arsenic in the Drinking Water of Bangladesh's Rural Poor. New York: Human Rights Watch. Available at <https://www.hrw.org/report/2016/04/06/nepotism-and-neglect/failing-response-arsenic-drinking-water-bangladeshs-rural>
32. Khan, N. I. and H. Yang. (2014). Arsenic mitigation in Bangladesh: An analysis of institutional Stakeholders' opinions. *Science of the Total Environment* (pp 488–489:493–504.)
33. Khan, M. M. H., and Khan, A. H. (2009). Waterborne arsenic poisoning in Bangladesh: challenges and prospects. *International Journal of Environmental Health Research*, 19(4), (pp. 313-324).
34. Khan, A. W., Sikder, A. M., Hussam, A., & von Brömssen, M. (2012). Review of the arsenic contamination in groundwater: Causes, effects and possible remedies. In *Management of natural resources, sustainable development and ecological hazards* (pp. 139-153). Springer, Berlin, Heidelberg.
35. Mahmood, S.A.I and Halder, A.K. (2011) The Socioeconomic impact of Arsenic poisoning in Bangladesh, *Journal of Toxicology and Environmental Health Sciences* Vol. 3(3), pp. 65-73, March 2011, Available at <http://www.academicjournals.org/JTEHS>
36. Meinzen-Dick, R. S., Di Gregorio, M., & McCarthy, N. (2002). Methods for studying collective action in rural development. *Agricultural Systems*, 72(1), (pp. 37-56).
37. Patrick Adams (2013) In Bangladesh, Funds dry up for Arsenic mitigation research, *The Lancet*, Published: November 2013, DOI:[https://doi.org/10.1016/S0140-6736\(13\)62391-0](https://doi.org/10.1016/S0140-6736(13)62391-0)
38. Rahman, M.A., Rahman, A., Khan, M.Z.K., Renzaho, A.M.N., 2018a. Human health risks and socio-economic perspectives of arsenic exposure in Bangladesh: a scoping review. *Ecotoxicol. Environ. Saf.* 150, 335–343. doi: 10.1016/j.ecoenv.2017.12.032
39. Rahman, M.S, Mise, N and Ichihara, S. (2022) Arsenic contamination in food chain in Bangladesh: A review on health hazards, socioeconomic impacts and implications, Elsevier, [www.elsevier.com/locate/heha](http://www.elsevier.com/locate/heha)
40. Milton AH, Smith WT, Dear K, Caldwell B, Sim M, Ng J. (2006) Arsenic mitigation: Drinking water options in Bangladesh. In: Naidu R, Smith E, Owen G, Bhattacharya P, Nandenbaum P, editors. *Managing arsenic in the environment: From soil to human health*. Collingwood, Victoria: CSIRO Publishing; pp. 355–62.
41. Milton, A. H., Hore, S. K., Hossain, M. Z., & Rahman, M. (2012). Bangladesh arsenic mitigation programs: Lessons from the past. *Emerging Health Threats Journal*, 5. <https://doi.org/10.3402/ehth.v5i0.7269>
42. Milton AH, Milton AH, Smith W, Dear K, Ng J, Sim M, Ranmuthugala G, (2007) A randomised intervention trial to assess two arsenic mitigation options in Bangladesh. *J Environ Sci Health A Tox Hazard Subst Environ Eng.* 2007;42:1897–908
43. Naujokas, M. F., Anderson, B., Ahsan, H., Aposhian, H. V., Graziano, J. H., Thompson, C and Suk, W. A. (2013). The broad scope of health effects from chronic arsenic exposure: update on a worldwide public health problem. *Environmental Health Perspectives*, 121(3), (pp. 295-302).
44. Organisation for Economic Co-operation and Development (OECD). (2011). *Making water reform happen in Mexico*. OECD Studies on Water, OECD Publishing.
45. Paul, K. C., Ali, M., & Hassan, M. Q. (2018). Factors influencing the participation of community people in arsenic mitigation activities in Bangladesh. *Environmental Science and Pollution Research*, 25(21), (pp. 20953-20966).
46. Rahman, A. Rahman, M. Khan, Z. K. & Renzaho, A.M.N. (2018). Human health risks and socio-economic perspectives of arsenic exposure in Bangladesh: A scoping review, *Ecotoxicology and Environmental Safety*, Volume 150, (pp. 335-343), ISSN 0147-6513,
47. Rahaman, M.S. Mise, N. & Ichihara, S (2022). Arsenic contamination in food chain in Bangladesh: A review on health hazards, socioeconomic impacts and implications, *Hygiene and Environmental Health Advances*, Volume 2, ISSN 2773-0492, Available at: <https://doi.org/10.1016/j.heha.2022.100004> Accessed: 08 May, 2024
48. Smith, A. H., Lingas, E. O., & Rahman, M. (2000). Contamination of drinking-water by arsenic in Bangladesh: a public health emergency. *Bulletin of the World Health Organization*, 78(9), (pp. 1093-1103).
49. UNICEF & WHO (2018). *Arsenic Primer: Guidance on the Investigation & Mitigation of Arsenic Contamination*. Available at: <https://www.unicef.org/documents/arsenic-primer-guidance-investigation-mitigation-arsenic-contamination> Accessed: 09 May, 2024
50. United Nations Department of Economic and Social Affairs (UNDESA). (n.d.) *Sustainable Development Goals*. Available at: <https://sdgs.un.org/goals> Accessed: 09 May, 2024
51. World Bank. (2018). *Bangladesh - Water Supply Program Project* (English). Available at: <http://documents.worldbank.org/curated/en/773171468743407429/Bangladesh-Water-Supply-Program-Project>. Accessed: 10 May, 2024
52. World Bank. (2005). *Towards a more effective operational response - arsenic contamination of groundwater in South and East Asian Countries* (Vol. 2): Technical Report (English). Washington, D.C.:WorldBankGroup. <http://documents.worldbank.org/curated/en/421381468781203094/Technical-Report>