

JICA-AMU
Symposium on



Environmental Health in Africa

29-30 January, 2025, Kenya

Final Report



Japan International Cooperation Agency Knowledge Co-Creation Program:
Health System Management for Regional and District Health Management Officers
(JICA-AMU)

Asahikawa Medical University
31 March 2025

Back cover

JICA-AMU Symposium on Environmental Health in Africa
29-30 January 2025, Kenya
Final Report

JICA-AMU:
Health System Management for Regional and District Health Management Officers
Asahikawa Medical University
31 March 2025

Contributors for writing a report:

Prof. Takahiko Yoshida (AMU)

Prof. Toshihiro Itoh (AMU)

Dr. Koji Kanda (AMU, Editor-in-chief)

Dr. Joseph Lenai (MOH Kenya, Co-chair)

All JICA-AMU community members

Correspondence:

Attn: Dr. Koji Kanda

Department of Social Medicine

Asahikawa Medical University

2-1-1-1, Midorigaoka Higashi, Asahikawa, Hokkaido, 078-8510, JAPAN

+81-166-68-2402

jica.asahikawa.med2023@gmail.com

<https://www.asahikawa-med.ac.jp/dept/mc/healthy/en/jica-amu-training-program-for-african-health-professionals/>

Table of Contents

Executive Summary	iii
1. Overview	1
2. Background	2
3. Objectives	3
4. Expected Outcomes	3
5. Schedule.....	4
6. List of participants	6
7. Day 0: 28 January 2025 (Courtesy Call to the Ministry of Health)	8
8. Day 1: 29 January 2025.....	9
Opening remarks	9
Keynote Speech	10
From your field.....	11
Field visits	14
9. Day 2: 30 January 2025.....	18
Field visits	18
Symposium: Environmental health challenge in Naivasha, Kenya	19
Wrap-up and JICA-AMU Alumni Strategic Framework 2025-2030	21
Closing remarks	25
10. Organizing Committee	27
11. Useful Links	27
Appendix.....	28
Appendix 1. Flyer.....	29
Appendix 2. Opening remarks	
(Ms. Mary Muriuki, Principal Secretary, MOH Kenya)	30
Appendix 3. Day 1: Speakers' abstract and PowerPoint slides	33
Appendix 4. Day 2: Speakers' PowerPoint slides.....	68
Appendix 5. JICA-AMU Alumni Strategic Framework 2025-2030 (with signature)	80
Appendix 6. Snapshots.....	83

Executive Summary

The first day of the meeting focused on environmental health issues in various African countries. Following the opening remarks from the principal secretary, Prof. Yoshida delivered a keynote speech that addressed environmental health challenges in Africa. Then, selected JICA-AMU alumni reported their field experiences, including mercury pollution from gold mining in Kenya, lead poisoning in Zambia, water pollution in Malawi, air pollution in Senegal, and spatial dynamics of environmental health in Ghana. Participants discussed the health impacts of these environmental challenges, potential solutions, and ongoing efforts to address them. The session ended with plans for a study tour to explore solid waste management and wastewater treatment practices, emphasizing the need for collaboration and collective action to tackle environmental health issues across Africa.

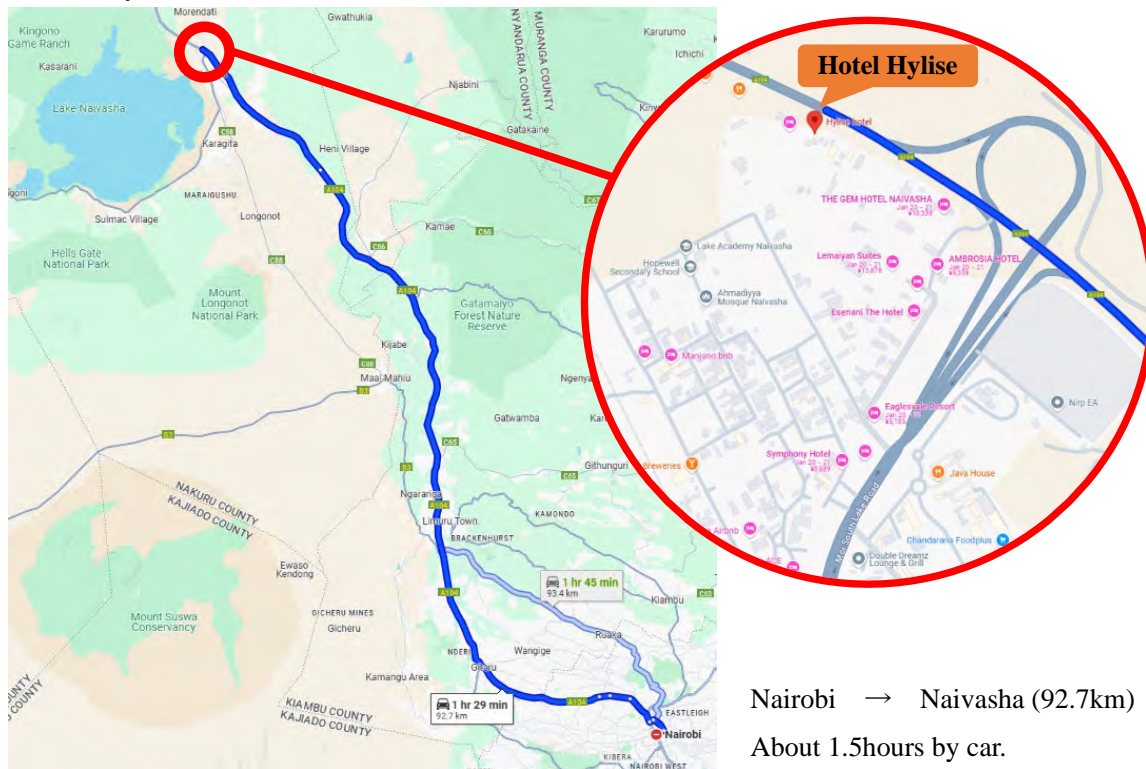
The Day 2 Symposium focused on environmental health challenges in Naivasha, Kenya, featuring presentations on wastewater management, regulatory frameworks, and public health initiatives. Based on the study tour visits, discussions covered waste management, water treatment, disease surveillance, and urban development, highlighting the need for improved infrastructure and collaborative approaches. The event concluded with reflections on the shared environmental issues affecting African cities and proposals for future alumni initiatives, emphasizing the importance of addressing these challenges to achieve better health outcomes.

1. Overview

- Date: 29-30 January, 2025
- Venue: (Hybrid) Hotel Hylise, Naivasha, Kenya, and online
<https://www.hylisehotel.com/>
- Target audience: JICA-AMU participants, government officials and policymakers, environmental health experts, NGO, community leaders, and advocates
- Capacity: approximately 30 persons on-site and 100 via online



▲Hotel Hylise



Nairobi → Naivasha (92.7km)

About 1.5hours by car.

▲Access

2. Background

Rapid economic growth and urbanization, as well as climate change, have led to the emergence of various environmental health challenges, including waste management issues due to increased waste and sewage discharge, air pollution, water pollution, and soil contamination. Today, over 99% of children globally are currently exposed to at least one of the climate and environmental hazards, shocks, and stresses such as water scarcity, various types of flooding, exposure to disease vectors, and air pollution¹⁾. Among these, air pollution is responsible for more than 6.5 million deaths worldwide each year, with 90% of related deaths occurring in low- and middle-income countries, many of which have failed to address the problem as a public health hazard²⁾. On the other hand, economic development in Sub-Saharan Africa is expected to continue, with a higher projected economic growth rate (Gross Domestic Product, GDP) of 3.5-4.0% for the period 2024-2026, compared to 2.6-2.7% globally³⁾. Urbanization is estimated to be responsible for 30% of GDP growth over the past 20 years⁴⁾, and forest cover has decreased by 12%, compared to a global decrease of 3%⁵⁾. These factors not only exacerbate the health status of African communities, but are also major obstacles to human prosperity. Therefore, we need to deepen the discussion on environmental health, find concrete solutions to the complex interaction between the environment and health, and effectively address the various health risks derived from environmental factors.

Asahikawa Medical University (AMU), Japan, has been implementing the JICA Knowledge-Co-Creation Program (JICA-KCCP), titled “Health System Management for Regional and District Health Management Officers” (JICA-AMU), since 2008. A total of 178 public health professionals from 29 African countries successfully participated in the program for their capacity building. During the program, AMU staff also visited various African countries, including Côte d'Ivoire, Ghana, Kenya, Liberia, Malawi, Rwanda, Senegal, Tanzania, and Zambia, to explore the current status of public health and environmental health measures in each country, and had a series of discussions with the JICA-AMU alumni and local health professionals. As a result, it was clear that, although most of them showed a high level of interest in environmental hazards and health risks, including air pollution, few countermeasures were being implemented. The JICA-AMU has offered for more than 15 years, but the FY2024 program was canceled. Instead, we decided to hold a symposium on environmental health, bringing together all those involved in JICA-AMU to review past activities, address future training needs, and facilitate discussions on environmental health in Africa.

References:

1. UNICEF. Climate Change. <https://data.unicef.org/topic/climate-change/overview/>
2. Fuller et al. Lancet Planet Health 2022;6:e535-47.
3. World Bank. Global Economic Prospect. 2024: p.4.
4. OECD/SWAC. Africa's Urbanization Dynamics 2022: The Economic Power of African Cities. 2022.
5. World Bank. World Development Indicators.

3. Objectives

The objectives of this symposium are as follows:

- Knowledge Sharing: To provide a forum for participants to share and deepen their understanding of the latest research findings and best practices in environmental health;
- Policy advocacy: To recognize the importance of policies related to environmental health; and
- Networking: To strengthen partnerships among environmental health professionals, government officials, NGOs, and community leaders to create a foundation for collaborative solution-seeking and/or future research agenda among the JICA-AMU community.

4. Expected Outcomes

- Share knowledge on environmental health
- Develop future research and project agenda for environmental health
- Building collaborative relationships

5. Schedule

Day 1: 29 January 2025

Time			Event
West Africa (zoom)	Japan (zoom)	East Africa (Kenya, on-site)	
-	-	10:00-11:00	Registration
8:00-8:10	17:00-17:10	11:00-11:10	Opening Remarks 1) Ms. Mary Muriuki (Principal Secretary for Public Health and Professional Standards, Ministry of Health, Kenya) 2) Ms. Junko Sasaki (Director, Training Division, JICA Hokkaido, Japan)
8:10-8:30	17:10-17:30	11:10-11:30	Keynote Speech: Prof. Takahiko Yoshida (AMU, Japan)
8:30-8:50	17:30-17:50	11:30-11:50	From your field: Mr. Samwel Ogwenko Oketch (Kenya)
8:50-9:10	17:50-18:10	11:50-12:10	From your field: Dr. Tina Chisenga (Zambia)
9:10-9:30	18:10-18:30	12:10-12:30	From your field: Dr. Pilirani Wezi Mumba (Malawi)
9:30-9:50	18:30-18:50	12:30-12:50	Break (refreshment)
9:50-10:10	18:50-19:10	12:50-13:10	From your field: Dr. Amadou Yeri Camara (Senegal)
10:10-10:30	19:10-19:30	13:10-13:30	From your field: Mr. Musah Ali (Ghana)
10:30-10:50	19:30-19:50	13:30-13:50	Q&A
10:50-11:10	19:50-20:10	13:50-14:10	Comments from Zoom participants
11:10-11:20	20:10-20:20	14:10-14:20	Day 1 Wrap-up
-	-	15:00-17:00	Field visit in Naivasha area 1) Naivasha Water & Sanitation Company (NAIVAWASCO) Treatment Plant 2) Final Disposal Site
-	-	18:00-20:00	Dinner

Day 2: 30 January 2025

Time			Event
West Africa (zoom)	Japan (zoom)	East Africa (Kenya, on-site)	
-	-	8:00-10:00	Field visit in Naivasha area 1) Kenya Marine and Fisheries Research Institute 2) Karagida Public Beach
		10:00-11:00	Registration
8:00-10:30	17:00-19:30	11:00-13:30	Symposium: Environmental health challenge in Naivasha, Kenya / Wrap-up and JICA-AMU Alumni Strategic Framework 2025-2030 Chairs: 1) Dr. Joseph Lenai (MOH, Kenya) 2) Dr. Koji Kanda (AMU, Japan) Panelists: 1) Mr. Felix Mwarema (Naivasha Water and Sanitation Company) 2) Ms. Mary Njoki (Naivasha Subcounty) 3) Ms. Margaret Kuibita (Department of Preventive Health Services, Nakuru County Government) 4) Mr. Daniel Mbogo Ndiritu (Naivasha Municipality)
10:30-10:40	19:30-19:40	13:30-13:40	Closing Remarks 1) Prof. Toshihiro Itoh (AMU, Japan)
-	-	14:00-15:30	Lunch

6. List of Participants

Onsite

No	Category	Country	Year	Name
1	JICA-AMU	Ghana	2015	Mr. Musah Ali
2	JICA-AMU	Kenya	2009	Mr. Daniel Kavoo
3	JICA-AMU	Kenya	2012	Dr. Ruth Mutua
4	JICA-AMU	Kenya	2014	Mr. Samwel Ogwenko Oketch
5	JICA-AMU	Kenya	2014	Dr. Caroline Kavilu
6	JICA-AMU	Kenya	2015	Dr. Joseph Lenai
7	JICA-AMU	Kenya	2019	Dr. Harry Mugun
8	JICA-AMU	Kenya	2022	Dr. Cheruiyot Japhet
9	JICA-AMU	Malawi	2022	Dr. Pilirani Wezi Mumba
10	JICA-AMU	Malawi	2022	Ms. Beatrice Thaulo Moyo
11	JICA-AMU	Senegal	2022	Dr. Amadou Camara Yéri
12	JICA-AMU	Sudan	2014	Mr. Eltayeb Osman Elmasalami
13	JICA-AMU	Zambia	2015	Dr. Tina Chisenga
14	non JICA-AMU	Kenya	-	Dr. Wando Stephen (on behalf of Dr. Donald Mogoi (JICA-AMU2023, Kenya))
15	non JICA-AMU	Kenya	-	Mr. Daniel Mbogo Ndiritu
16	non JICA-AMU	Kenya	-	Ms. Mary Njoki
17	non JICA-AMU	Kenya	-	Mr. Stephen Njuguna
18	non JICA-AMU	Kenya	-	Mr. Felix Mwarema
19	non JICA-AMU	Kenya	-	Ms. Margaret Kuibita
20	non JICA-AMU	Kenya	-	Ehiud Mukuora
21	AMU	Japan	-	Prof. Takahiko Yoshida
22	AMU	Japan	-	Prof. Toshihiro Itoh
23	AMU	Japan	-	Dr. Koji Kanda
24	JICA	Japan	-	Ms. Junko Sasaki
25	JICA	Kenya	-	Ms. Nae Kaneko

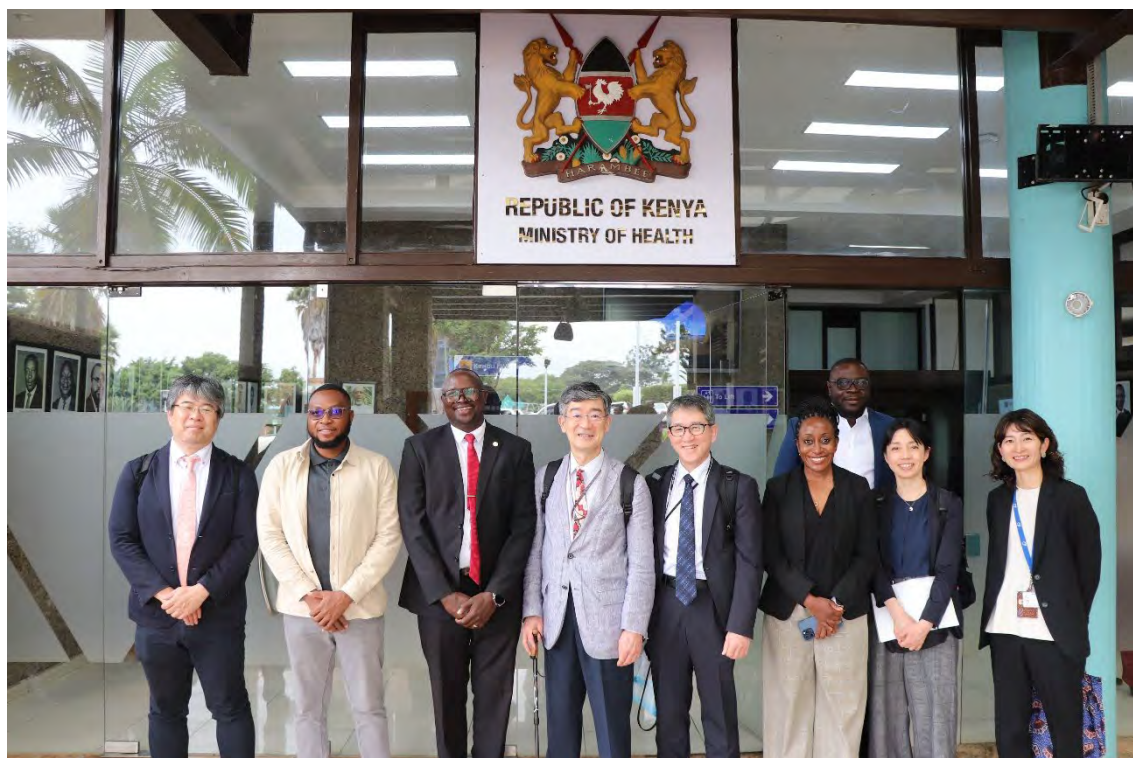
Online (JICA-AMU alumni and staff only)

No	Category	Country	Year	Name
1	JICA-AMU	Egypt	2018	Dr. Ali Ibrahim
2	JICA-AMU	Ethiopia	2015	ASSEFA Lulesged Nigussie
3	JICA-AMU	Ghana	2012	Douglas Aleungurah
4	JICA-AMU	Japan	-	Ms. MINAMI Kiwako
5	JICA-AMU	Kenya	2009	Ms. RABURU Jane Akinyi
6	JICA-AMU	Kenya	2013	Mr. OMWENGA Japheth Makono
7	JICA-AMU	Liberia	2020	Ms. ROBINSON Rebecca Sayearlo
8	JICA-AMU	Liberia	2022	Dr. Netty Nyonoh Joe
9	JICA-AMU	Malawi	2019	Dr. Juliana Kanyengambeta Mubanga
10	JICA-AMU	Malawi	2023	Ms. Modesta Mwagomba
11	JICA-AMU	Mozambique	2018	Dr. Gilda Florentina
12	JICA-AMU	Senegal	2023	Dr. Moussa Ndiaye
13	JICA-AMU	Sudan	2017	Hala Gasim Mohammed Alssied
14	JICA-AMU	Sudan	2018	Dr. Gamar Alanbiaa Mohammed Mahjoub
15	JICA-AMU	Sudan	2021	Dr. Arwa Yahya Hussin Gaddal
16	JICA-AMU	Tanzania	2012	Dr. BYALUGABA Beatrice Jane
17	JICA-AMU	Zambia	2016	Donald Mumba
18	JICA-AMU	Zimbabwe	2012	Dr. Justice Mudavanhu
19	AMU	Japan	-	Prof. Yuji Nishikawa (President)
20	AMU	Japan	-	Prof. Tomoko Fujii
21	AMU	Japan	-	Prof. Sachiko Shiokawa
22	AMU	Japan	-	Mr. Takuya Kami
23	AMU	Japan	-	Ms. Yoko Umeno
24	JICA	Japan	-	Ms. Nao OGASAWARA
25	JICA	Kenya	-	Mr. Elijah Kinyangi

Besides, 12 non-JICA-AMU participants from at least four countries and five AMU staff and students joined online.

7. Day 0: 28 January 2025 (Courtesy Call to the Ministry of Health)

Prior to the symposium, those who arrived in Kenya earlier paid a courtesy call to the Ministry of Health in Nairobi. Unfortunately, Ms. Mary Muriuki, the Principal Secretary for Public Health and Professional Standards, was unavailable. Still, the symposium co-chair, Dr. Joseph Lenai, Director for Preventive, Promotive Health Services and Disease Control, welcomed us, and we had a fruitful discussion about the upcoming two-day event.



8. Day 1: 29 January 2025

Opening remarks:

- The Day-1 Symposium began with a moderator and co-chair, Dr. Koji Kanda of AMU. After his brief introduction, he read an opening remark message from Ms. Mary Muriuki, Principal Secretary for Public Health and Professional Standards, Ministry of Health, Kenya, who was unable to attend due to other international meetings. She highlighted that 99% of children were exposed to environmental hazards globally, and 22,000 tons of waste generated daily in Kenya was only 10% effectively managed. She emphasized the need for a comprehensive national response campaign to tackle environmental challenges through an integrated approach that prioritizes people, community, and the environment. To address the root causes of environmental hazards in Kenya, 216 primary health centers were established across 46 counties, and 111,000 community health promoters were trained. She emphasized the importance of cooperation and collaboration in addressing environmental issues.
- Ms. Junko Sasaki of JICA Hokkaido also gave us a remark. She shared insights about Japan's involvement in environmental health programs, with a particular focus on the JICA-AMU Knowledge Co-Creation Program, which has been ongoing since 2008. The program aims to improve health systems for regional and district health officers across Africa, with 186 participants from 29 African countries to date. Ms. Sasaki emphasized that JICA's support and collaboration with local governments and universities have been vital to the success of this initiative. She acknowledged the challenges faced by African countries in strengthening their health systems and reiterated JICA's commitment to providing continuous support to address these challenges. In closing, Ms. Sasaki expressed gratitude for the participation of the delegates and the ongoing efforts to strengthen health systems through international cooperation and knowledge sharing.



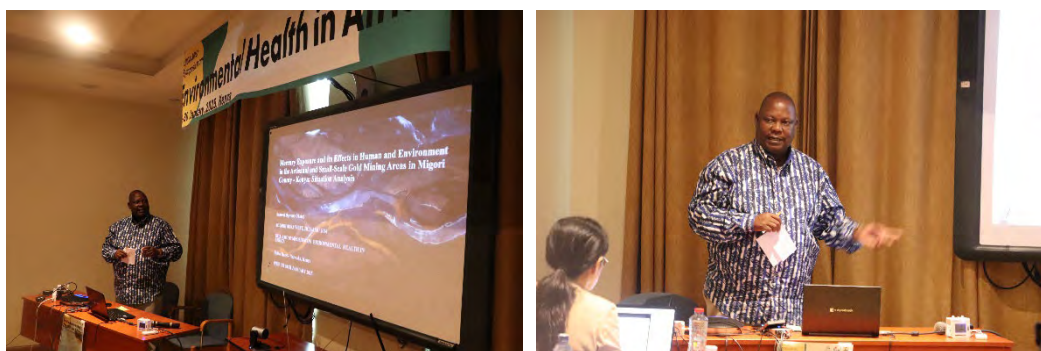
Keynote speech: Environmental Health Challenges in Africa

- Prof. Takahiko Yoshida, Professor Emeritus and former course leader of the IICA-AMU program, began by emphasizing the critical connection between environmental health and disease prevention, noting that a cleaner environment could prevent up to 25% of global diseases. He mentioned that this concept has been recognized since the time of Hippocrates, who identified the importance of a clean environment for maintaining health. He highlighted Japan's historical experience with environmental challenges, beginning with the industrialization period when environmental issues, such as air pollution, became significant. For instance, the Great Smog of London in 1952 was an example of severe air pollution leading to respiratory illnesses.
- Prof. Yoshida then discussed Japan's mercury poisoning cases, particularly Minamata disease, which is caused by mercury released from a chemical plant. This contamination accumulated in the food chain, poisoning many people, and remains a significant case study in environmental health. He used these examples to emphasize the importance of effective environmental management and regulation in preventing such disasters.
- He also explained the importance of maintaining hygienic conditions to avoid diseases caused by microorganisms and chemicals. While industrialization and economic growth are vital for development, they must be balanced with strong environmental protections to ensure public health. Prof. Yoshida emphasized that preventive measures, such as improved chemical management and stricter environmental regulations, could help prevent future health crises.
- He concluded by emphasizing that environmental health should be integrated into global health policies, particularly in Africa, where public health infrastructure remains a major challenge. His talk emphasized the importance of sustained international cooperation and knowledge exchange in enhancing global environmental health.



From your field:

- Mr. Samwel Oketch, a JICA-AMU2014 alumnus from Kenya, presented an analysis of mercury pollution from artisanal and small-scale gold mining in Migori County, Kenya. He highlighted the health risks associated with mercury exposure, including neurotoxicity and developmental disorders. Samwel explained that mercury was widely used in gold extraction, with significant amounts lost to the environment. He discussed policy challenges, including regulatory gaps and limited public awareness of mercury risks, and recommended strengthening regulatory frameworks, enhancing community education, and promoting sustainable practices to address the issue.



- Dr. Tina Chisenga, a JICA-AMU2015 alumna from Zambia, led a discussion on lead poisoning in Africa, focusing on Kawa in Zambia. She highlighted the significant health impacts, particularly on children, as well as the economic burden on society. Tina also discussed the historical background of lead mining in Kawa, which has led to extensive environmental contamination. She mentioned ongoing efforts to address the issue, including a World Bank project and the KAMPAI Project, which aimed to remediate lead poisoning and establish a sustainable socioeconomic model. Tina emphasized the need for coordinated efforts and increased investments in lead poisoning prevention and remediation programs. She concluded by asking how stakeholders could play a role in mitigating lead exposure in areas like Kawa and other polluted regions.



- Dr. Pilirani Wezi Mumba, a JICA-AMU2022 alumna from Malawi, discussed the issue of water pollution in Malawi, highlighting that it poses a significant threat to both public health and the environment. She noted that the problem is not only in Malawi but also across Africa, with inadequate waste management and sanitation infrastructure being major contributors. Wezi also mentioned the outbreak of cholera in 2022-2023, which affected over 58,000 people and resulted in 1,700 deaths. She suggested several solutions, including strengthening waste management and sanitation infrastructure, promoting sustainable agricultural practices, enhancing public awareness campaigns, and enforcing environmental regulations. Wezi emphasized the need for collaboration between the government and stakeholders to address the issue of water pollution.



- Dr. Amadou Camara Yéri, a JICA-AMU2022 alumnus from Senegal, discussed air pollution in Africa, focusing on the case study of Dakar, Senegal. He explained that pollution in Africa caused approximately 800,000 deaths annually, with indoor pollution being more dangerous than outdoor pollution. Dakar was highlighted as one of the most polluted cities globally, with high PM2.5 and PM10 particles. The main contributors to pollution in Dakar were industrial facilities, heavy traffic, aging vehicles, and natural factors like desert sand. Yeri outlined the health impacts of pollution, including respiratory and cardiovascular diseases, and described mitigation measures

such as air quality monitoring, import restrictions on older vehicles, and the promotion of renewable energy and mass transportation.



- Mr. Musah Ali, a JICA-AMU2015 alumnus from Ghana, discussed environmental health issues in Ghana, focusing on climate change and air and water pollution. He highlighted the importance of understanding where events are occurring, as well as the impact of climatic conditions on disease burden. Musah noted that Ghana is located in the Meningitis belt and that meningitis is seasonal, with higher incidence during the dry season. He also discussed the issue of air pollution, noting that Ghana has a high level of air pollution, particularly in urban areas, and that the government needs to improve air quality monitoring. Lastly, Musah addressed the issue of water pollution, particularly the problem of galamsey (illegal mining), which has led to a significant reduction in clean water production in Ghana. He concluded by emphasizing the need for collective action to address these environmental health issues.



- **Q&A:** In the meeting, the team discussed the challenges of charcoal burning and indoor air pollution in Kenya, with a focus on the use of charcoal as a cheaper alternative to LPG gas. The team also discussed the efforts of NGOs to promote cleaner alternatives and the use of special cooking pots to reduce pollution. The team also planned a study tour to visit sites related to solid waste management and wastewater treatment, with the

aim of learning best practices and potential collaborations. The conversation ended with a plan to leave for the study tour around 3 o'clock.



Field visits

Field visits to environmental health facilities were arranged by Dr. Angela Jamila, Director of Goldenlife Victors Hospital, Naivasha, for two days, today and tomorrow. The following facilities were visited in two separate vehicles (See the map on the next page).

- 29 January:
 - 1) Naivasha Water & Sanitation Company (NAIVAWASCO) Treatment Plant (Map No. 3)
 - 2) Final Disposal Site (Map No. 4)
- 30 January:
 - 1) Kenya Marine and Fisheries Research Institute (Map No. 5)
 - 2) Karagida Public Beach (Map No. 6)

Although we were unable to visit Hell's Gate and Olkaria Geothermal Drilling Station as initially planned, we still gained in-depth knowledge about the current situation and measures in the Naivasha area at the other facilities.

[illegible]

The first stop was the Naivasha Water & Sanitation Company (NAIVAWASCO) Treatment Plant (Map No. 3). This recycling facility, built in 1977, is located approximately 10 minutes by car south of the symposium site. After an overview of the facility by the person in charge, we toured the facility.



The next stop was the Final Disposal Site (Map No. 4). The site was in very harsh condition, as seen on Google Maps.



9. Day 2: 30 January 2025

Field visits

Today, after visiting the Kenya Marine and Fisheries Research Institute, Naivasha Station (Map No. 5), we headed to Karagida Public Beach (Map No. 6). This public facility is also an area where many people make a living by fishing. The problem here is that a large amount of garbage from the rivers leading to the lake washes ashore along the lakeshore. This time, we visited at the end of January, but we were told that the situation would become very serious around November every year.



Symposium: Environmental health challenges in Naivasha, Kenya

- Mr. Felix Mwarema, Technical Services Manager at Naivasha Water and Sanitation Company, presented the company's wastewater management strategy. He explained the company's structure and mandate to provide water and sanitation services. Felix discussed the wastewater management value chain, including containment, emptying, transportation, treatment, and disposal. He highlighted the challenges faced by the company, such as population growth outpacing infrastructure development, the hilly terrain making centralized treatment difficult, and outdated treatment methods. Felix proposed solutions, including expanding decentralized treatment facilities and increasing financing for existing facilities. He also presented four investment proposals totaling \$14.6 million USD, which would serve around 280,000 people in the Naivasha sub-county.



- Ms. Mary Njoki, the Environment Officer from Naivasha Sub County, presented the regulatory frameworks concerning the Environment Sector, focusing on the Nakuru County Waste Management Act of 2021. She discussed the department's role in waste management, including coordination, enforcement of laws, and collaboration with stakeholders. Mary also highlighted the challenges in waste management, including inadequate waste collection and recovery, as well as the need for policy and financial interventions. She proposed solutions, including strengthening municipal waste collection services, developing effective municipal waste management strategies, and establishing a Public-Private Partnership (PPP) model for waste recovery. Mary also emphasized the need for sensitization and awareness-raising on waste management, as well as the importance of maintaining collection vehicles properly. Lastly, she emphasized the need for infrastructure investments at the point of collection and recovery.



- Ms. Margaret Kuibita, a representative from the Department of Preventive Health Services, discussed the department's mission to provide integrated, high-quality health services to all. She highlighted the department's focus on preventive health services, including water sanitation and hygiene, food safety, and waste management. Margaret also mentioned the department's collaboration with other sectors and the use of operational research to improve their strategies. She touched on the department's policies and laws, including the Public Health Act and the Kenya Environmental Sanitation and Hygiene Policy. Margaret also discussed the department's water management, including community water supplies and household water treatment. She mentioned the department's efforts to promote sanitation and hygiene, including the development of a sanitation strategy and the declaration of all villages as open-defecation-free. Margaret also highlighted the department's work on healthcare waste management and emphasized the importance of consistent water quality monitoring.



- Mr. Daniel Mbogo Ndiritu, Naivasha Municipal Manager, discussed the establishment of Naivasha as a municipality in 2019, which covers an area of 941 square kilometers. He highlighted the municipality's key policy documents, including a 20-year integrated strategic urban development plan and a 5-year solid waste management plan. Daniel also mentioned ongoing infrastructure projects, such as the construction of a sewer

bypass and the development of a new sports market. He noted the municipality's resource gaps, including the need for more modern waste management vehicles and the lack of a stadium. Daniel also proposed future projects, including the creation of a waterfront promenade, affordable housing, and improvements to the housing of informal traders. He expressed hope for Naivasha to be recognized as a resource city and to work towards a more standardized urban institution.



Wrap-up and JICA-AMU Alumni Strategic Framework 2025-2030

- The co-chair, Dr. Joseph Lenai, a JICA-AMU2015 Alumnus, reflected on the presentations and site visits from the previous day and that morning, highlighting key points from various speakers and alumni presentations. He emphasized the urgent need for action on environmental issues, waste management, and pollution in Africa, noting their impact on human health and universal health coverage. The co-chair also summarized the site visits to a human waste recycling facility and a dumpsite, as well as the morning trip to Lake Naivasha. He drew parallels between the challenges faced in Naivasha and other African cities, suggesting that these issues are common across the continent.
- Dr. Lenai continued presenting a strategic framework for the group's future. He emphasized the need for institutional development and capacity building, proposing the formation of an Alumni Institute for Global Health Practice and Leadership. The co-chair also suggested renaming the training program to International Health Leadership and Management and developing a hybrid training approach. He proposed the creation of certification programs for priority African health issues and the development of alumni as subject matter experts and lecturers. The co-chair also suggested exploring the use of satellite-based pollution analysis and telemedicine technology, as well as developing joint research proposals for grants and funding. He proposed regular virtual meetings, regional alumni meetings, and thematic workshops and seminars. Lastly, he

suggested establishing a center of excellence and building a strong Japan-Africa health partnership.

- All the JICA-AMU participants signed the document, which was submitted to AMU professors (Figure, Appendix 5).



Figure. JICA-AMU Alumni Strategic Framework 2025-2030.

JICA-AMU ALUMNI STRATEGIC FRAMEWORK 2025-2030

A. INSTITUTIONAL DEVELOPMENT AND CAPACITY BUILDING

1. Formation of Alumni Institute

- Establish Africa Institute for Global Health Practice and Leadership
- Create regional and country representative structures
- Develop governance framework and operational guidelines
- Institute membership and volunteering mechanisms

2. Curriculum Enhancement

- Review and input into current JICA-AMU curriculum
- Rename program to "Health Leadership and Management"
- Develop hybrid training approach (Japan-Africa context)
- Integrate adaptive leadership and global health components

3. Academic Advancement

- Establish pathways for Masters and PhD programs
- Create certification programs for priority African health issues
- Support alumni research publication
- Develop alumni as subject matter experts/lecturers

B. KNOWLEDGE EXCHANGE AND COLLABORATION

1. Training and Development

- Implement satellite-based pollution analysis
- Develop short courses tailored to African context
- Utilize AI, technology, and telemedicine
- Create twinning programs between Japanese and African institutions

2. Research and Innovation

- Joint proposal writing for grants and funding
- Collaborative research projects
- Support for scientific publications
- Development of African solutions to African problems

3. Networking and Communication

- Create alumni database (186 participants)
- Establish WhatsApp groups and communication channels
- Conduct monthly virtual meetings
- Share best practices and experiences

C. STRATEGIC PARTNERSHIPS AND EVENTS

1. Continental Engagement

- Partner with local and regional health bodies
- Leverage other Japan-Africa support programs
- Create linkages between municipalities and prefectures
- Facilitate institutional twinning arrangements

2. Annual Events Calendar

- Africa Scientific Conference (rotating host countries)
- Regional alumni meetings
- Thematic workshops and seminars
- Environmental health and climate change symposiums

3. JICA Country Office Support

- Local alumni convergences
- Mobilization for umbrella body
- Project implementation support
- Resource mobilization

D. FOCUS AREAS AND PRIORITIES

1. Environmental Health

- Pollution monitoring and analysis
- Waste management
- Climate change adaptation
- One Health approach

2. Health Systems Strengthening

- Leadership development
- Management capacity building
- Policy advocacy
- Innovation and technology integration

E. IMPLEMENTATION FRAMEWORK

1. Immediate Actions

- Form WhatsApp group and database
- Establish interim steering committee
- Draft institute constitution
- Develop annual work plan

2. Medium-Term Goals

- Launch institute
- Begin short courses
- Initiate research projects
- Organize first scientific conference

3. Long-Term Vision

- Establish center of excellence
- Launch advanced degree programs
- Create sustainable funding mechanisms
- Build strong Japan-Africa health partnerships

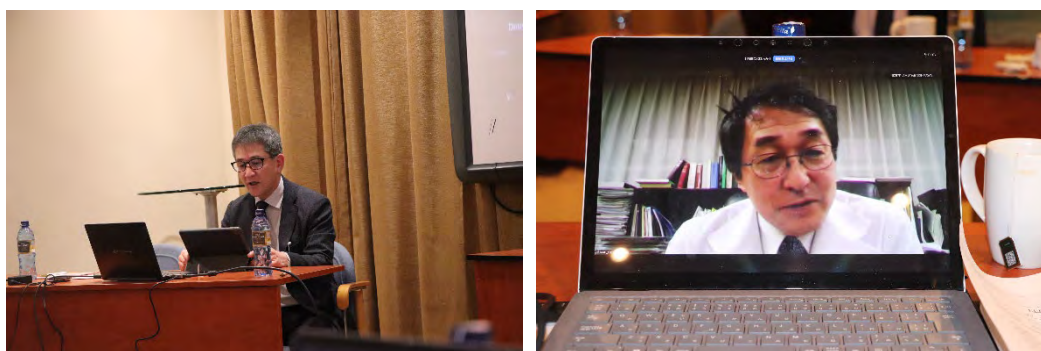
JICA-AMU ALUMNI

30TH January 2025

At HYLISE HOTEL NAIVASHA.

Closing remarks:

- Prof. Toshihiro Itoh, Professor and core member of the JICA-AMU program, thanked all participants, acknowledged the contributions of the Kenyan Ministry of Health and JICA, and reflected on the 16-year history of the JICA-AMU program. The importance of addressing environmental health challenges across African countries was emphasized. In addition to his remarks, online participants, including Prof. Yuji Nishikawa, AMU President, extended a warm message to us. Lastly, all the participants, both on-site and online attendees, took a group photo. The event ended with final farewells and expressions of appreciation among the participants.



10. Organizing Committee

Name	Affiliation
Prof. Takahiko Yoshida	Professor Emeritus, Asahikawa Medical University JICA-AMU Course Leader (2008-2022)
Dr. Joseph Kamario Lenai	Director, Preventive, Promotive Health Services and Disease Control, Ministry of Health, Kenya JICA-AMU2015
Prof. Toshihiro Itoh	Professor, AMU
Dr. Koji Kanda	Junior Associate Professor, AMU JICA-AMU Course Leader (2023-)
Dr. Angela Jamila (local logistics)	Director, Goldenlife Victors Hospital, Naivasha
Mr. Takuya Kami	Chief, AMU International and Regional Cooperation Office
Ms. Yoko Umeno	Officer, AMU International and Regional Cooperation Office
Ms. Junko Sasaki	Section Chief, JICA Hokkaido Office
Ms. Nao Ogasawara	Officer, JICA Hokkaido Office
Ms. Nae Kaneko	JICA Kenya Office
Mr. Elijah Kinyangi	JICA Kenya Office
Ms. Fridah Njiri	JICA Kenya Office

11. Useful Links

Name	URL
Symposium Day 1 (YouTube)	https://youtu.be/IPMp_ShoPOM
Symposium Day 2 (YouTube)	https://youtu.be/3l9O8fYK0so
JICA-AMU website (within the Department of Social Medicine, AMU)	https://www.asahikawa- med.ac.jp/dept/mc/healthy/en/jica-amu-training- program-for-african-health-professionals/
JICA-AMU Facebook	https://www.facebook.com/people/Amu- Jica/pfbid02uhSoph5zFCwuaYBP859d5KTpQdP3rvUW GDtkzyWDV4hLHm5A9uWoothW2UkximwQl/
JICA	https://www.jica.go.jp/english/index.html

Appendix

Appendix 1. Flyer

JICA-AMU
Symposium on

Environmental Health in Africa

29-30 January, 2025, Kenya





DAY 1

East Africa (Kenya, on-site)	Japan (zoom)	West Africa (zoom)
11:00-11:10	17:00-17:10	8:00-8:10
11:10-11:30	17:10-17:30	8:10-8:30
11:30-13:30	17:30-19:30	8:30-10:30
13:30-13:50	19:30-19:50	10:30-10:50
13:50-14:10	19:50-20:10	10:50-11:10
14:10-14:20	20:10-20:20	11:10-11:20

DAY 2

11:00-12:30	17:00-18:30	8:00-9:30
12:30-12:40	18:30-18:40	9:00-9:40

Opening Remarks
Ms. Mary Muriuki (Principal Secretary for Public Health and Professional Standards, Ministry of Health, Kenya)

Keynote Speech
Prof. Takahiko Yoshida (AMU)

From your field
Mr. Samwel Ogweni Okerch (JICA-AMU2014, Kenya)
Mr. Musah Ali (JICA-AMU2015, Ghana)
Dr. Tina Chisenga (JICA-AMU2015, Zambia)
Dr. Pilirani Wezi Mumba (JICA-AMU2022, Malawi)
Dr. Amadou Yeri Camara (JICA-AMU2022, Senegal)

Q&A

Comment from zoom participants

Day 1 Wrap-up

A symposium on future possibilities of JICA-AMU training agenda and collaborative research on environmental health
Chair: Dr. Joseph Kamario Lenai (JICA-AMU2015, Kenya)
Dr. Koji Kanda (AMU)

Closing Remarks

Outline of the Symposium

Format: Onsite and Online via ZOOM **Onsite Venue:** Hotel Hylise (Naivasha, Kenya / Tel: +254 (0) 758635914)

Capacity: 20 participants for onsite / 100 participants for online

Notes for on-site participants:

- Field trips are scheduled on the afternoon of Day 1 and the morning of Day 2.
- Meals and accommodation will be provided.
- Participants are responsible for their transportation to and from the venue.

Contact: jica.asahikawa.med2023@gmail.com

To apply, please use the QR code or visit the following URL: <https://x.gd/vHmBz>

Application deadline:(Onsite) 16 January, 2025 (Online) 27 January, 2025



Appendix 2. Opening remarks (Ms. Mary Muriuki, Principal Secretary, MOH Kenya)



**STATE DEPARTMENT FOR PUBLIC HEALTH AND PROFESSIONAL
STANDARDS**

**SPEECH FOR MARY MUTHONI MURIUKI, CBS, THE PRINCIPAL
SECRETARY FOR PUBLIC HEALTH AND PROFESSIONAL STANDARDS
ON THE JICA-ASAHIKAWA MEDICAL UNIVERSITY (JICA-AMU)
ENVIRONMENTAL HEALTH SYMPOSIUM TO BE HELD ON 29TH
JANUARY 2025 AT HYLISE HOTEL, NAIVASHA AT 0800HRS**

DATES: 29TH JANUARY 2025; TIME: 0800HRS

VENUE: HYLISE HOTEL, NAIVASHA

**Professor Takahiko Yoshida
Professors from Asahikawa Medical University
JICA JAPAN
JICA KENYA TEAM
JICA-AMU ALUMNI AND EXPERTS
Distinguished Guests,
Colleagues from the National Government and County Governments
Ladies and Gentlemen**

Good Morning

I am delighted to join you in this JICA-AMU symposium on Environmental Health in Africa. In our continent, we stand at a critical intersection of public health, environmental sustainability, and national development and hence as we gather here, we are reminded that the choices we make now will shape the future of our communities, our nations and our continent. Am glad that we have been joined by various experts from within and outside the country to discuss about environmental health issues, pollution and waste management.

Globally, 99% of children are exposed to environmental hazards and 6.5 million annual deaths occur from air pollution with vulnerable populations bearing the greatest burden. In addition, Urbanization, while contributing 30% to GDP growth, it places significant pressure on health and environmental systems for instance leading to forest cover decrease. These realities demand bold, transformative action.

In Africa and other developing countries, 90% of pollution-related deaths occur.

In Kenya, the reality is about 22,000 tonnes of waste are generated daily but only 10% of this is effectively managed. In this country, 4.7 million people are practicing open defecation with only 29% accessing proper sanitation facilities. These are not mere numbers; they represent real threats to our health, dignity, and economic future.

Ladies and Gentlemen

As a country, through partners like UNICEF, we launched the Kenya Sanitation Alliance targeting 15 counties with the highest rates of open defecation with the aim of eliminating open defecation in Kenya by end of this year, 2025. In addition to this strategy, we have our comprehensive National Response Campaign : "Epuka Uchafu, Linda Afya Nyumbani". This campaign reflects our commitment to tackle these environmental challenges through an integrated approach that prioritizes people, communities, and the environment whereby the Strategic Implementation Pillars are: personal hygiene focusing on School-based health education, Community hygiene practices and Menstrual and food hygiene management. The second pillar is The Environmental Hygiene which focuses on Monthly nationwide clean-up days, Strategic waste management and Climate-resilient interventions; and the third pillar is Water and Sanitation which looks at Expanding safe water access, Eradicating open defecation and Community-led total sanitation.

Kenya has been deliberate to move the Astana Declaration of 2018 on Primary Health Care to action by enacting four laws on 19th October 2023 to help the country accelerate achievement of universal health coverage guided by the government's agenda of bottom-up economic transformation agenda (BETA) where we aim to have a shift from curative to preventive and promotive health with much focus at the bottom of the pyramid-the household. To achieve this, the primary health care act of 2023 mandated us to form Primary Health Care Networks (PCNs). In Kenya we are aiming to establish 315 PCNs with a primary referral facility serving as a hub and health centres, dispensaries and community units serving as spokes in the referral web. In the last one year, with the support of our partners and government, we have established 216 PCNs across 46 counties with 111,000 Community Health Promoters trained, kitted and reporting through tablets on household health indicators. The Community health promoters are also helping to register households into the social health insurance in their community units.

Ladies and gentlemen

We gather here for two days to share Knowledge on environmental health, do Policy advocacy, Strengthen professional networks and develop collaborative research agendas. We are reimagining public health as a proactive, holistic approach to community well-being. By integrating

environmental health into our universal health coverage strategy, we address root causes, not just symptoms.

This symposium represents our commitment to creating resilient, healthy African communities through innovative, context-specific solutions that protect our most vulnerable populations.

Environmental health is fundamental to national prosperity, community well-being, and human dignity—it is not just a component of public health but its very foundation. Without addressing the root causes of environmental hazards, we cannot achieve sustainable development, safeguard the dignity of our people, or unlock the full potential of our economy.

Together, we will transform challenges into opportunities for sustainable development. I look forward to receiving a report on the deliberations and areas of synergy and collaboration including research to make Africa a disease-free continent with well managed environment and healthy populations.

I Thank You All.

Mary Muthoni Muriuki, CBS
Principal Secretary
State Department for Public Health and Professional Standards

Appendix 3. Day 1: Speakers' abstract and PowerPoint slides

Environmental Health in Africa



Takahiko Yoshida

Asahikawa Medical University, Japan

1. Environmental health

“Environmental health” is written as follow in WHO web site.

Healthier environments could prevent almost one quarter of the global burden of disease. All situations on the environment; clean air, stable climate, adequate water, sanitation and hygiene, safe use of chemicals, protection from radiation, healthy and safe workplaces, healthy agricultural practices, healthy cities and built environments, and a preserved nature etc. are all prerequisites for good health. And the COVID-19 pandemic is a further reminder of the delicate relationship between people and our planet.

Living organisms on Earth interact with their environment to form ecosystem. And human beings are one of the units consisting the Earth as ecosystem. This idea is the basis of planetary health.

2. Relation between Environment and Human Health

Humans are living organisms and are influenced by the environment. To survive, humans need to breathe air, absorb nutrients and water, and need appropriate temperature and humidity.

Therefore, the quality of the environment has a large influence.

On the other hand, humans place a burden on the environment to survive. Necessities for survival: breathing consumes oxygen and release carbon dioxide, consuming food and water as source of body construction and energy (biological and inorganic resources) and releasing waste and metabolic products. Furthermore, a highly civilized and cultural life leads to greater resource consumption and food waste. Therefore, minimizing the burden on the environment is a major challenge.

Environmental problems are a general term for problems caused by various human activities that change the environment to the extent that it impairs the beneficial use of the environment and the natural functions of the ecosystem.

Conception of hygiene in relating to environment

Meaning of word “Hygiene” is protecting life, maintaining health, and promoting health. Hygiene is a set of practices performed to preserve health. According to the WHO, “Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases.” (from Wikipedia)

Hygiene is achieved to be sanitary in the environment and the body. It had been known since the time of Hippocrates. He thought environmental disturbances such as seasons and air quality, as well as dietary disturbances can cause illness. And he appointed that resting and calming are the most and maintaining a clean environment and proper diet are important for human health.

Conversely speaking, “importance of maintaining a clean environment” means unsanitary conditions harm human health. And “unsanitary” is opposite word of “hygiene”. The main cause of health

problems at that time was infectious diseases. Over time, knowledge about human diseases has expanded beyond infectious diseases.

Proper hygiene: cleanness of environment and its opposite

Proper hygienic condition	Opposite condition
Biological: no pathogenic microorganism Avoiding infection and onset	Contamination with pathogens Mainly infected through the gastrointestinal tract or respiratory tract
Chemical: no harmful chemical materials Preventing entrance to the body	Contamination with pollutants Mainly absorbed via alimentary tract or respiratory tract
Physical: no harmful physical energy Protecting exposure to harmful physical energy	Existence of harmful physical energies Mainly exposed to external sources on whole body or local area
Sociological: no harmful behaviors and stress Avoiding unhealthy lifestyle and social factors	Having unhealthy lifestyle factors and facing social stresses

3. Types of major Environmental Problems

Environmental problems can be divided into two main categories: local issue and global issue.

Local issue of environmental problems

Problems near the source of contamination factors such as; Air pollution, Water pollution, Land pollution, Solid waste including electrical waste, Pathogen contamination and Physical Energy Pollution etc.

Global issue of environmental problems

Global effects caused by causative agents that move on a global scale such as; Climate changes including Global warming, Heat stress, Food shortage, and Ozon layer depletion, Acid precipitation, Volatile organic compound pollution and Plastic pollution etc.

4. Things to consider in environmental problems

Health risks tend to appear unproportionately within the vulnerable and disadvantaged population. So, it is more important to take measures in areas where environmental pollution is likely to occur and where many vulnerable people are living.

When implementing measures to address environmental issues, consideration must be given to the following items:

Who can be major victims.

Which areas are most likely to be affected.

What can be factors to make environmental pollution more likely to occur.

What can be factors to make it difficult to take measures to prevent or improve environmental pollution.

Victims of environmental problems

Health risks appear unproportionately within the vulnerable and disadvantaged population, including children, women, ethnic minorities, poor communities, migrants or displaced persons, elderly and patient with an underlying disease. In developing countries, people are particularly prone to multiple vulnerabilities.

Children are particularly vulnerable to certain environmental risks, including air pollution, unsafe water, sanitation and hygiene, hazardous chemicals and waste, radiation, climate change etc. Children and pregnant women are especially vulnerable to the hazardous pollutants, since exposure to toxicants

in the certain early development phase can lead to irreversible damage on infant and young children.

The reason are listed below;

Children are constantly growing. Children have a larger proportion of intake to their weight than adults at breath, eat food and drink. Children have different behaviors from adults; babies crawl on the ground, sucking fingers or putting things in mouth

History of common nuisance (environmental problems) in developed countries

In Japan, when modernization period began (1868-1912), the government promoted industrial development policies and environmental problems began. The same situation continued during the reconstruction period (1945-1955) after Japan's defeat in World War II and during high economic growth period (1955-1973).

The same situation has occurred in past (and in some cases still today) stages of development, even in the developed countries of the world.

Under such circumstances, vulnerable citizens become victims of health problems caused by air and water pollution and other environmental problems.

So this situation may be a negative example for developing countries. It seems easy to follow the same trend, but there is no need to imitate it.

Challenges for developing countries against environmental problems

Developing countries could be in the following situation:

- Rapid scientific development leads to delays in environmental conservation.
- Economic development tends to be prioritized.
- The burden of health problems due to NCDs is high and awareness of environmental issues is low.
- Delays in waste disposal and processing; lack infrastructure to properly disposal methods, and inadequate resources or regulation to limit improper waste treatment
- Large gap between urban and rural areas, and between the rich and the poor.

So, in developing countries, environmental problems are more likely to occur and worsen, so urgent measures are needed.

5. Environmental problems: specific issues and topics

1) Air pollution

Air pollution is contamination of the indoor or outdoor atmosphere by any chemical, physical or biological agent. Sources of air pollution are two origins of natural and human activities.

The main sources of air pollution chemicals are household combustion, transport engine, industrial facilities and forest fires.

Outdoor air pollutants of major public health concern are particulate materials (including PM_{2.5}), nitrogen dioxide, sulfur dioxide and photochemical oxidant (ozone). Load by domestic exhaust on the environment is relatively high.

Indoor air pollutants include carbon monoxide and particulate materials.

They are direct causes of respiratory and other diseases. And air quality of outdoor is closely linked to the earth's climate and ecosystems and impacts such as that carbon dioxide and methane mainly contribute global warming as greenhouse gases, and chlorofluorocarbons are known as ozone layer depleting substances, and acidity gases contribute water acidification and forest death via acid precipitation. These indirectly harm human health.

The sources of air pollution can be divided into natural origin and human activities. Later air pollution sources are the moving source; public transportation facility and the fixed source; public origin such as heating and cooking in houses and industrial origin such as thermal-electric power plant, waste incineration plant and industry plants. Although individual emission from household are small, the total environmental burden from public emission is relatively high.

Great Smog of London, 1952 is an example of world-famous classical air pollution and health

It was a severe air pollution disaster that affected London, UK, in December 1952. A period of cold weather and windless conditions condensed airborne pollutants mainly sulphury-dioxide mostly arising from coal burning, made thick smog layer over the city for 5 days. Within the following weeks, estimated between 10,000 and 12,000 died and more 100,000 got respiratory diseases as a direct result of the smog. Most of the deaths were caused by respiratory infections mainly bronchopneumonia or acute purulent bronchitis superimposed upon chronic obstructive pulmonary diseases.

Acid precipitation in Example: Death of Black Forest and dissolving of bronze statues

After the Industrial Revolution, countries such as Britain and Germany use large amounts of coal, which has a large impact on the forests of the Scandinavian Peninsula. In the 1950s, acidic precipitation (pH 4-5) caused by air pollutants from central Europe began to cause problems in southern Sweden and Norway, killing fish in lakes and rivers and dissolving old bronze statues.

Furthermore, by the 1980s, countries such as East Germany, Czechoslovakia, and Poland were also continuing to use high-sulfur coal, which led to the death of coniferous forests (called the Black Forest) across eastern Europe.

Despite health damage to residents, the governments at the time did not address this issue, making the damage even more severe.

2) Water contamination

Released substances into surface water (river or lake) or groundwater and oceans interfere with beneficial use of the water or with the natural functioning of ecosystems. Inadequate landfill of solid waste, and agricultural exceeded fertilizer and chemicals become water pollution via land pollution by rainfall.

Water bodies are polluted by a wide variety of substances including pathogenic microorganisms from feces, food residues and putrescible organic waste (can be nutrients to plankton), detergents, solid waste are mainly from urban runoff, toxic chemicals are from industrial plants or mine, and agriculture fertilizers, insecticides and herbicides are from rural area. Load by domestic discharge on the environment is relatively high.

Water pollution leads to many problems; degradation of aquatic ecosystems and water-borne diseases caused by both microbials or chemicals.

Two types of health impacts from waterborne diseases. One is infection by pathogens. Second is health disorders caused by harmful toxic substances such as oil, metals, plastics additives, pesticides, persistent organic pollutants and industrial waste products etc. Chemical contamination of water poses a health burden, whether natural in origin or anthropogenic.

Impacts on the water body are known to changing conditions such as pH, hypoxia or anoxia, eutrophication, increased temperatures, excessive turbidity, or changes of salinity.

Safe drinking water is crucial to prevent waterborne diseases and keep human health and well-being. Sufficient wash can also prevent numerous NTDs.

The sources of water pollution can be divided into natural origin and human activities. Later water pollution sources are public origin such as city sewage and industrial origine such as factory effluent, mine drainage and agricultural deposit and chemicals. Although the same as air pollution individual discharge amount from household are small, the total environmental burden from public discharge is relatively large.

Minamata diseases is an example of world-famous poisoning caused by methylmercury in discharged industrial wastewater in Japan

The released methylmercury accumulated in the food chain in marine organisms and eventually poisoned humans. It is a world-famous pollution-induced disease. During 1940s-1970s, there were more than 3000 designated victims.

Itai-Itai diseases is an example of world-famous poisoning caused by cadmium in discharged mine wastewater in Japan

Poisoning caused by eating rice that had accumulated cadmium in the water of the Jinzu River, which was contaminated by mine wastewater upstream. During 1910s-1970s, there were more than 200 surviving designated victims.

3) Electronic waste

Some specific waste materials are difficult to dispose of processing. Electric waste (e-waste) is one of them. Although it is true that e-waste contains precious metal resources, they may be imported into developing countries as resources and cause difficult environmental problems.

Informal recycling activities (dumping on land or in water bodies, open burning etc.) of e-waste release numerous chemical substances (lead, arsenic, mercury, cadmium, zinc, rare metals, dioxins etc.) into the environment and raise multiple adverse health effects. Health disorders such as burns, eye damage, respiratory diseases, developmental disorders in children etc. are observed in workers and residents living nearby.

Agbogbloshie located on the banks of Kore Lagoon on the Odau River, near Accra, Ghana.

It is the world's largest e-waste site and is home to around 80,000 people.

4) Plastic pollution in ocean environment

Ocean is the receiving body for much of the plastic waste generated on land via streams.

Discarded plastic waste harms wildlife and ecosystem and spoil the aesthetic scenery. Plastic waste can be broken down by waves and ultraviolet radiation into smaller pieces known as microplastics (less than 5 mm in length). Primary microplastics such as plastic fibers in synthetic textiles also enter the environment directly from household laundry.

Nanoplastics arise from plastic surfaces or from further decomposition of microplastics.

Plastics, with some exceptions, are not biodegradable regardless of their size.

Pollutants contained in plastic waste have a large impact on the environment during the recycling process. Plastic waste may be imported into developing countries as resources. Under the revised Basel Convention (2021), exports of contaminated plastic waste will require the consent of the recipient country.

Micro- and nano-plastics carry harmful substances onto their surface and into the human digestive and respiratory tract. The latter are wondering to be highly toxic because they enter the body, organs and cells.

5) Climate change

Climate change is impacting human lives and health in a variety of ways. Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year from malnutrition, malaria, diarrhea and heat stress alone.

Climate change impact human health in various forms as below. Increasing weather disasters such as heatwaves, storms and floods directly attack humans. Disruption of food systems by drought linking to declining agricultural yields and changes of ocean/lake condition linking to declining fish catches lead food shortage. Furthermore, increases in communicable diseases such as food-, water- and vector-borne diseases affect human health. Furthermore, climate change is undermining many of the social determinants for good health.

Climate change is a global issue and requires cooperation from all regions. On the other hand, Areas with weak health infrastructure; mostly in developing countries; will be the least able to cope without assistance to prepare and respond.

Examples of food- and drinking-borne diseases relating to climate changes

Microorganisms have a suitable temperature and humidity for growth. So global warming and increased precipitation contribute to their proliferation. Gastrointestinal infections with contamination of pathogenic organisms such as bacteria, virus, amoeba and protozoa. Food poisoning with toxins produced by bacteria or fungi. And food poisoning is caused by chemical substances (such as histamine) produced by food spoilage without involvement of bacteria.

Food poisoning due to toxins exist in natural plants or animals including marine life. Ex. Ciguatera toxin produced by dinoflagellate is accumulated in some fish and their habitat range is moving northward.

Poisoning from harmful chemicals in water or food. Those are caused by metals, organochlorine

compounds, organic fluorine compounds, dioxins, etc. Ex. Acid deposition leaches metals from the soil and waste materials and carry water body.

6. Measures for environmental problems

Since environmental pollution problems occur through multiple mechanisms, efforts in many fields are required for environmental conservation. Both environmental conservation efforts range from the national level to the individual level are required.

As national level: International Treaties like United Nations Framework Convention on Climate Change, Vienna Convention for the Protection of the Ozone Layer, Convention on Biological Diversity etc. and National Policy like Green Growth Strategy; aims to achieve carbon neutrality by 2050 (Japan), Eco-friendly agriculture practices, etc.

As individual level: Cultivating an awareness of personal responsibility for maintaining health and protecting the environment etc. and Practice actions that contribute to environmental conservation: Reduce waste, choose environmentally friendly products, save energy or choose renewable energy etc. in each individual daily lives, etc.

1) Basic strategies for environmental conservation

Fundamental principle is “Minimize the environmental impact of human activities”.

Basic strategy for Environmental Conservations is as below.

Basic tactics for treatment of contaminants: It is essential that pollutants should be treated before being released into the environment at the sources, whether pollution source is from point or distributed.

-Environmental impact assessment: Directly measure target substances in the environmental samples periodically. In this case, determine target substances to be measured in advance. It means that unknown substances are difficult to identify and measure the amount.

-Biological monitoring: Assessing the impact on living organisms in the environment. It should be done as screening and should not wait until biological effects are observed.

-Environmental Restoration: Recovery of pollutants scattered throughout the environment and restoration of ecosystems. Furthermore, once an environment is destroyed, it takes a huge amount of time, effort, and money to restore it.

2) A common strategies for individuals and industries to minimize the environmental impact of human activities.

Basic measures to reduce the burden on the environment are based on 3R or more R. Those R are Reduce, Reuse, Recycle, Repair, Refuse and Replace.

-Reduce consumption of resource and energy. Ex. avoid excessive use of vehicles, avoid excessive packaging or bags, etc.

-Reduce the amount of exhaust air and wastewater released into the environment.

-Replace the source of materials. Ex. plastic bags > paper bags, plastic bottles > glass bottles, etc.

-Replace the energy. Ex. coal > oil > natural energies, etc.

-Remove the contaminants. Ex. oil, residual food materials, source of increased salinity such as salt or sauce, detergents, etc.

-Remove contaminants in the exhaust air. Ex. removal equipment or filtration unit, etc.

-Refuse disposable supplies and Replace with personal permanent item, such as personal water bottle, tableware (fork, knife, spoon, or chopsticks) and shopping bags, etc.

-Reuse of items. Ex. refill to bottles, etc.

-Recycle. Usually, it means Remanufacturing using as raw material. Ex. Plastic items > plastic raw material, etc.

3) Type of pollution source and basic tactics to measures against pollutants

Pollutants come from emission source either point or dispersed sources

-Point source: pipe or channel from an industrial facility or a city sewage system, chimney of industrial facility or incinerator, incomplete waste disposal site.

-Dispersed source: variety of pollutants from unspecified area such as the runoff from agriculture field or storm drains, or unofficial trash dumping near houses, or burning of fields as slash-and-burn agriculture.

Basic strategy for treatment of contaminants is below

-It is essential that pollutants should be treated before being released into the environment at the sources, whether pollution source is from point or distributed.

-Point sources are easier to control than dispersed sources for safe treatment. Because they can be treated in clearly identified locations before they spread into the environment. Guidance by authorities and public processing are effective

-Measures for dispersed sources are difficult. It is necessary to raise environmental awareness among individuals, and alternatives strategies such as community-based facility development are also needed.

4) The role expected of the government in environmental issues (Examples of Japan)

The environment is not the property of any particular individual, so the role of government and other administrative bodies is essential. The main roles are as follows.

Strategy of appropriate chemical management

-The principle is to replace with safer substances and reduce the impact on people and environment.

-Scientific evaluation of chemical hazards and exposure risks on human and environment.

-Appropriate management of chemicals (manufacturing, use, reducing emissions into the environment, and disseminating information on hazards), etc.

Legal regulations from a pollution prevention perspective

-Regulation at the emission source such as industrial plants. Ex.; Basic Law on Pollution Control, Basic Environmental Law, Water Pollution Prevention Act, Sewerage Act, Air Pollution Control Act (to fixed sources by measurement of smoke volume, etc.), Soil Contamination Countermeasures Act (to specified facilities using hazardous substances), etc.

-Regulation in the environment: Evaluation based on the environmental Standards: Ex.; Environmental standards for water pollution, environmental standards for air pollution, soil environmental standards, etc.

Establishment and operation of an environmental pollution monitoring system

-Water Bodies; Constant monitoring as a rolling methods in public water bodies (fixed-point monitoring of water quality on Health items/living environment items), Continuous monitoring in groundwater,

-Air; Air pollutant wide area monitoring system,

-Soil; Soil pollution situation investigation, Measurement of groundwater quality (management of soil contamination)

5) The role of the public, ordinary people, in environmental preservation issues

Although the burden on the environment of each individual resident is small, the total burden is large because of the large number of residents. Therefore, the role of each resident is also important.

It is important to have a correct awareness of the resources and energy we consume in our lives as consumers, and to have an awareness of environmental conservation. The following awareness-raising activities and actions can help to achieve above.

-Education at a young age such as primary school.

-Awareness to the public: Personal responsibility in maintaining health and protecting the environment.

-Residents' comments to the government and businesses.

-Community activities for Environmental conservation / Living environment cleaning.

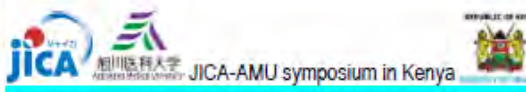





7. At the end





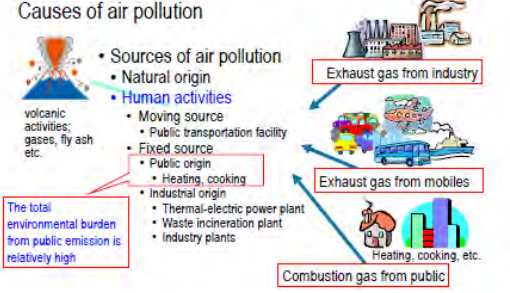

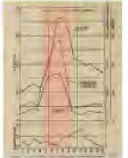
Dr. Hawking left the words before year he died in 2018. Towards the end of his life, Hawking made a disturbing prediction about the future of humanity. He commented that if humanity continues at its current pace, the Earth will be destroyed within 600 years. Hawking warned that if the Earth's population continues to grow rapidly, and energy consumption continues to rise along with it, the planet will soon become a "burning ball of fire." In a video appearance at the 2017 Tencent WE Summit, a convention held in Beijing in 2017, Dr Hawking revealed his belief that humanity is in danger of destroying itself "through its own greed and stupidity."

It is important for everyone to have a sense of cooperation and collaboration as a community, as consumers living in the same ecosystem. We should consider as own problems, not think as someone else's problem and correct ourselves, take the initiative, and influence others.

Government should prioritize protecting the health and well-being of its people. Economic growth sacrificing people's health may not last. "Watch out! Be on your guard against all kinds of greed; life is not determined by the amount of wealth you have." (Luke 12:15) Healthy people living in a healthy environment is the basis of a sustainable society.

Now is the time to take action before it's too late.

<p>  JICA-AMU symposium in Kenya </p> <p> Keynote speech: Environmental health in Africa </p> <p> Professor Emeritus Takahiko Yoshida, MD, PhD </p>	<p>Environmental health, WHO web site</p> <p>https://www.who.int/news-topics/environmental-health-topics</p> <ul style="list-style-type: none"> • Healthier environments could <u>prevent almost one quarter of the global burden of disease</u>. • The COVID-19 pandemic is a further reminder of the delicate relationship between people and our planet. • All situations on environment; clean air, stable climate, adequate water, sanitation and hygiene, safe use of chemicals, protection from radiation, healthy and safe workplaces, healthy agricultural practices, healthy cities and built environments, and a preserved nature etc. <u>are all essential qualification for good health</u>. <p>Environment situation has big impact on human health</p>
<p>Environment and Human Health</p> <p>  </p> <ul style="list-style-type: none"> • Living organisms on Earth interact with their environment to form ecosystem. • Human being is one of the units consisting the Earth as ecosystem. • This idea is the basis of planetary health. <p>Same as Ecosystem</p> <p>Ecosystem An ecosystem created inside a hollow glass ball. Water and air, algae and aquatic organisms live while receiving sunlight.</p> <p></p>	<p>Relation between Environment and Human Health</p> <p>  </p> <ul style="list-style-type: none"> • Humans are living organisms and are influenced by the environment. <ul style="list-style-type: none"> • To survive, humans need to breathe air, absorb nutrients and water, and need appropriate temperature and humidity. • Therefore, the quality of the environment has significant impact on human. • Humans place a burden on the environment to survive. <ul style="list-style-type: none"> • Necessities for survival: breathing consumes oxygen and release carbon dioxide, consuming food and water as source of body construction and energy (biological and inorganic resources) and releasing waste and metabolic products. • Furthermore, a highly civilized and cultural life leads to greater resource consumption and food waste. • Therefore, minimizing the burden on the environment is a major challenge.
<p>Definitions of Environmental relating words</p> <ul style="list-style-type: none"> • Environmental problems <ul style="list-style-type: none"> • are a general term for problems <u>caused by various human activities</u> that <u>change condition</u> to such an extent that <u>it impairs</u> • the <u>beneficial use of the environment</u> and • the <u>natural functions of the ecosystem</u>. • Term of "Good condition of environment" <ul style="list-style-type: none"> • are the environmental conditions that can be used to • maintain and improve human health are those in which • the ecosystem functions normally. • The word of "Hygiene" is a <u>suitable situation of environment</u> to maintain and improve human health. <p>Similar word</p>	<p>Conception of hygiene in relating to environment</p> <ul style="list-style-type: none"> • Meaning of word "Hygiene" is protecting life, maintaining health, and promoting health. • Hygiene is a set of practices performed to preserve health. <ul style="list-style-type: none"> • According to the WHO, "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." (from Wikipedia) • Hygiene is achieved to be <u>sanitary in the environment and the body</u>. • It has been known since the time of Hippocrates. <ul style="list-style-type: none"> • Keys as below. <ul style="list-style-type: none"> • Rest and calm are the most important. • Maintaining a clean environment. • Proper diet. <p>  If these conditions are met, you will be healthy. This idea is fit to modern health sciences. </p> <p>Conversely speaking, it means <u>unsanitary conditions harm human health</u>.</p> <ul style="list-style-type: none"> • The main cause of health problems at that time was infectious diseases. • Over time, knowledge about human diseases has expanded beyond infectious diseases.
<p>Hygiene: cleanness of environment and its opposite</p> <p>Not hygiene</p> <ul style="list-style-type: none"> • Biological: no pathogenic microorganism <ul style="list-style-type: none"> • Avoiding infection and onset • Chemical: no harmful chemical materials <ul style="list-style-type: none"> • Preventing entrance to the body <ul style="list-style-type: none"> • Avoiding poisoning • Physical: no harmful physical energy <ul style="list-style-type: none"> • Protecting exposure to harmful physical energy • Sociological: no harmful behaviors and stress <ul style="list-style-type: none"> • Avoiding unhealthy lifestyle and social factors • Protecting NCDs <p>  </p>	<p>Types of major Environmental Problems</p> <ul style="list-style-type: none"> • Local issue of environmental problems <ul style="list-style-type: none"> • Air pollution • Land pollution • Pathogen contamination • Water pollution • Solid waste including electrical waste • Physical Energy Pollution • Global issue of environmental problems: <ul style="list-style-type: none"> • Global effects caused by causative agents that move on a global scale <ul style="list-style-type: none"> • Climate changes <ul style="list-style-type: none"> • Global warming • Heat stress • Food shortage • Ozon layer depletion • Acid precipitation • Volatile organic compound pollution • Plastic pollution <p>  </p>

<p>Things to consider in environmental problems</p> <ul style="list-style-type: none"> Health risks tend to appear unproportionately within vulnerable and disadvantaged population. Therefore, it is especially important to take measures against environmental pollution in areas where many vulnerable people live. When implementing measures to address environmental issues, consideration must be given to the following items: <ul style="list-style-type: none"> What is happening. Who can be major victims Where (which areas) are most likely to be affected What can be factors to make environmental pollution more likely to occur What can be factors to make it difficult to take measures to prevent or improve environmental pollution <p><i>Epidemiological methods</i></p>	<p>Victims of environmental problems</p> <ul style="list-style-type: none"> Health risks appear unproportionately within the vulnerable and disadvantaged population, including children, women, ethnic minorities, poor communities, migrants or displaced persons, elderly and patient with an underlying disease. <ul style="list-style-type: none"> In developing countries, people are particularly prone to multiple vulnerabilities. Children are the most vulnerable in the group <ul style="list-style-type: none"> Children are particularly vulnerable to certain environmental risks, including air pollution, unsafe water, sanitation and hygiene, hazardous chemicals and waste, radiation, climate change etc. Children and pregnant women are especially vulnerable to the hazardous pollutants, since exposure to toxicants in the certain early development phase can lead to irreversible damage on infant and young children. <ul style="list-style-type: none"> Children are constantly growing. Children have larger proportion intake to their weight than adult at breath, eat food and drink. Children have different behaviors from adults; babies crawling on the ground, sucking or putting things in mouth
<p>History of common nuisance (environmental problems) in developed countries</p> <ul style="list-style-type: none"> In Japan, when modernization period began (1868-1912), the government promoted industrial development policies and environmental problems began. <i>Under influence of western countries</i> The same situation continued during the reconstruction period (1945-1955) after Japan's defeat in World War II and during high economic growth period (1955-1973). Environmental problem got more worse. The same situation has occurred in past (and in some cases still today) stages of development, even in the developed countries of the world. Under such circumstances, vulnerable citizens become victims of health problems caused by air and water pollution and other environmental problems. <p>↓</p> <ul style="list-style-type: none"> This situation may be a negative example for developing countries. It seems easy to follow the same trend, but there is no need to imitate it.  	<p>Challenges for developing countries against environmental problems</p> <p>Developing countries seem to be in the following situation:</p> <ul style="list-style-type: none"> Rapid scientific development leads to delays in environmental conservation measures. <ul style="list-style-type: none"> Environmental conservation measures cannot keep up with rapid scientific developments Economic development tends to be prioritized. The burden of health problems due to NCDs is high and awareness of environmental issues is low. Delays in waste disposal and processing. <ul style="list-style-type: none"> Lack of infrastructure to properly disposal methods Insufficient regulations to restrict improper waste disposal and treatment Large gap between urban and rural areas, and between the rich and the poor. Additionally, developing countries are developing faster than developed countries have developed. <ul style="list-style-type: none"> While developed countries had been able to adapt gradually, developing countries have no time to catch up. Adaptation in developed countries has been insufficient. <p>Developing countries, environmental problems are more likely to occur and worsen, so urgent measures are needed.</p>
<p>Environmental problem: specific issues and topics</p>	<p>Air pollution problems</p>  <ul style="list-style-type: none"> Air pollution is contamination of the indoor or outdoor atmosphere by any chemical, physical or biological agent. Sources of air pollution chemicals are household combustion, transport engine, industrial facilities and forest fires. Outdoor air pollutants of major public health concern are particulate materials (including PM2.5), nitrogen dioxide, sulfur dioxide and photochemical oxidant (ozone). Indoor air pollutants include carbon monoxide and particulate materials. They are direct causes of respiratory and other diseases. Air quality of outdoor is closely linked to the earth's climate and ecosystems and impacts such as that carbon dioxide and methane mainly contribute global warming as greenhouse gases, and chlorofluorocarbons are known as ozone layer depleting substances, and acidity gases contribute water acidification and forest death via acid precipitation. These indirectly harm human health. 
<p>Causes of air pollution</p>  <p>The total environmental burden from public emission is relatively high</p>	<p>Great Smog of London, 1952</p> <p>Example: World famous classical air pollution and health</p>   <ul style="list-style-type: none"> It was a severe air pollution disaster that affected London, UK, in December 1952. A period of cold weather and windless conditions, condensed airborne pollutants mainly sulphur-dioxide mostly arising from coal burning, made thick smog layer over the city for 5 days. Within the following weeks, estimated between 10,000 and 12,000 died and more 100,000 got respiratory diseases as a direct result of the smog. Most of deaths were caused by respiratory infections mainly bronchopneumonia or acute purulent bronchitis superimposed upon chronic obstructive pulmonary diseases.

Acid precipitation in Example: Death of Black Forest and dissolving of bronze statues

- After the Industrial Revolution, countries such as Britain and Germany use large amounts of coal, which has a large impact on the forests of the Scandinavian Peninsula.
- In the 1950s, **acidic precipitation (pH 4.5)** caused by **air pollutants** from central Europe began to cause problems in southern Sweden and Norway, **killing fish** in lakes and rivers and **dissolving old bronze statues**.
- Furthermore, by the 1980s, countries such as East Germany, Czechoslovakia, and Poland were also continuing to use high-sulfur coal, which led to the **death of coniferous forests** (called the Black Forest) across eastern Europe.
- Despite **health damage to residents**, the governments at the time did not address this issue, and making the damage even more severe.
In those era, citizens lived in developed countries were vulnerable peoples.



Water contamination problems

- Water contamination: Released substances into surface water (river or lake) or groundwater and oceans interfere with beneficial use of the water or with natural functioning of ecosystems.
 - Contribution of **soil pollution**: Inadequate landfill of solid waste, and agricultural exceeded fertilizer and chemicals become water pollution via land pollution by rainfall.
- Water bodies are polluted by a wide variety of substances including:
 - **Pathogenic microorganisms** from feces of human or animals.
 - **Food residues and putrescible organic waste** (can be nutrients to plankton), **detergents, solid waste** are mainly from **urban runoff**.
 - **Toxic chemicals** are from **industrial plants or mine**, and
 - **Agriculture fertilizers, insecticides and herbicides** are from **rural area**.
- Water pollution lead many problems; **degradation of aquatic ecosystems** and **water-borne diseases** caused by both **microbials** or **chemicals**.

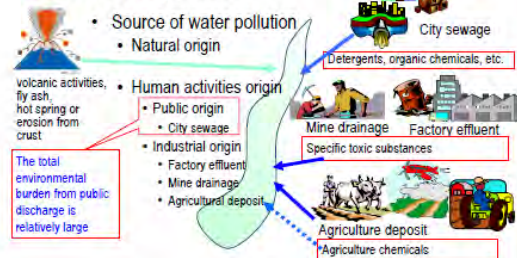


Water contamination problems continue

- Two types of **health impacts** from waterborne diseases
 - **Infectious diseases by pathogens**.
 - Sufficient wash can also prevent numerous NTDs.
 - **Health disorders by harmful toxic substances** such as oil, metals, plastics additives, pesticides, persistent organic pollutants and industrial waste products etc. Chemical contamination of water pose health burden, whether of natural or anthropogenic origin.
- **Impacts on water body**
 - **Damage of scenery and deterioration of living environment**.
 - via changing of conditions such as pH, hypoxia or anoxia, eutrophication, increased temperatures, excessive turbidity, or changes of salinity.
 - It will be an indirect impact on human.
- Safe drinking-water are crucial to prevent waterborne diseases and keep human health and well-being.

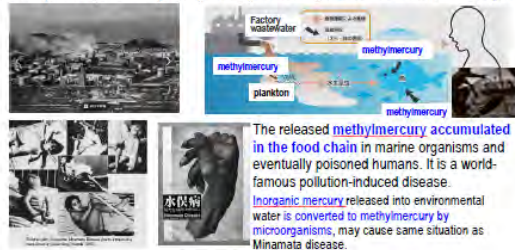


Cause of water pollution



Example: Minamata diseases

Famous poisoning caused by methylmercury in discharged industrial wastewater in Japan



Example: Itai-Itai diseases

Famous poisoning caused by cadmium in discharged mine wastewater in Japan



Electronic waste problems

- Some specific waste materials are difficult to dispose of processing. **Electric waste (e-waste)** is one of them. Although it is true that e-waste contains precious metal resources; they may be **imported into developing countries as resources and cause difficult environmental problems**.
- Informal activities (dumping on land or in water bodies, open burning etc.) of **e-waste release numerous chemical substances** (metals such as lead, arsenic, mercury, cadmium, zinc, rare metals, and dioxins etc.) into the environment and raise multiple adverse health effects.
- Health disorders such as burns, eye damage, **respiratory diseases, developmental disorders in children** etc. are observed.
 - Ex. Agbogbloshie, Accra, Ghana located on the banks of Kora Lagoon on the Odu River. It is the world's largest e-waste site and is home to around 80,000 people.



Problems of Plastic pollution in environment

- Ocean and lake are the **receiving body** for much of the plastic waste generated on land via streams.
 - Discarded plastic waste harms wildlife and ecosystem and spoil the aesthetic scenery.
- **Plastic waste** can be broken down by waves and ultraviolet radiation into smaller pieces known as **microplastics** (less than 5 mm in length).
- **Primary nanoplastics** such as plastic fibers in synthetic textiles also enter the environment directly from household laundry.
- **Nanoplastics** arise from plastic surfaces or from further decomposition of microplastics.
- Plastics, with some exceptions, are not biodegradable regardless of their size.
- Pollutants contained in plastic waste have a large impact on the environment during the recycling process.
 - Plastic waste may be imported into developing countries as resources.
 - Under the revised Basel Convention (2021), exports of contaminated plastic waste will require the consent of the recipient country.
- **Micro- and nano-plastics** carry harmful substances onto their surface and into the human digestive and respiratory tract. The latter are considered highly toxic because they enter the body and eventually in nucleus and mitochondria of cells.



<h3>Climate change problems</h3> <ul style="list-style-type: none"> Climate change is impacting human lives and health in a variety of ways. <ul style="list-style-type: none"> Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year from malnutrition, malaria, diarrhea and heat stress alone. Climate change impact human health in various forms. <ul style="list-style-type: none"> Increasing weather disasters such as heatwaves, storms and floods directly attack human. Disruption of food systems by drought and changes of ocean condition/lake lead food shortage. Increases in communicable diseases such as food-, water- and vector-borne diseases affect human health. Furthermore, climate change is undermining many of the social determinants for good health. Climate change is a global issue and requires cooperation from all regions. <ul style="list-style-type: none"> On the other hand, areas with weak health infrastructure, (mostly in developing countries) will be the hardest to cope without support for prepare and respond. 	<h3>Examples of food- and drinking-borne diseases relating to climate changes</h3> <ul style="list-style-type: none"> Microorganisms have a suitable temperature and humidity for growth. So global warming and increased precipitation contribute to their proliferation. <ul style="list-style-type: none"> Gastrointestinal infections caused by pathogenic organisms such as bacteria, virus, amoeba and protozoa occur through contaminated water or food. Food poisoning caused by toxins produced by bacteria or fungi in food / ingredients. Food poisoning caused by chemicals (such as histamine) produced by spoiling of food due to enzyme without the involvement of bacteria. Food poisoning due to toxins found in natural plants or animals including marine life. Ex. Ciguatera toxin produced by dinoflagellate is accumulated in some fish and their habitat range is moving northward with global warming. Poisoning from water or food contaminated with harmful chemicals <ul style="list-style-type: none"> Metals, organochlorine compounds, organic fluorine compounds, dioxins, etc. Ex. Acid precipitation leaches metals from soil and waste materials and carry them into water body.
<h3>Measures for environmental problems</h3>	<h3>Levels of environmental conservation efforts</h3> <ul style="list-style-type: none"> Environmental conservation efforts range from the national level to the individual level. National level <ul style="list-style-type: none"> International Treaties: United Nations Framework Convention on Climate Change, Vienna Convention for the Protection of the Ozone Layer, Convention on Biological Diversity National Policy: Green Growth Strategy; aims to achieve carbon neutrality by 2050 (Japan). Eco-friendly agriculture practices Individual level <ul style="list-style-type: none"> Cultivating an awareness of personal responsibility for maintaining health and protecting the environment. Practice actions that contribute to environmental conservation: Reduce waste, choose environmentally friendly products, save energy or choose renewable energy etc. in each individual daily lives.
<h3>Basic strategies for environmental conservation</h3> <ul style="list-style-type: none"> Fundamental principle: Minimize the environmental impact of human activities Basic Strategy for Environmental Conservation <ul style="list-style-type: none"> Basic tactics for treatment of contaminants <ul style="list-style-type: none"> It is essential that pollutants should be treated before being released into the environment at the sources, whether pollution source is from point or distributed. Environmental impact assessment <ul style="list-style-type: none"> Directly measure target substances in the environmental samples periodically. Determine target substances to be measured in advance Biological monitoring <ul style="list-style-type: none"> Assessing the impact on living organisms in the environment (including human beings). It should be done as screening and should not wait until biological effects are observed. Environmental Restoration <ul style="list-style-type: none"> Recovery of pollutants that have spread into the environment and restoration of ecosystems. Once an environment is destroyed, it takes a huge amount of time, effort, and money to restore it. 	<h3>A common strategies for individuals and industries to minimize the environmental impact of human activities.</h3> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> Fewer resources used and fewer polluting emissions </div> <ul style="list-style-type: none"> Measures to reduce the burden on the environment <ul style="list-style-type: none"> 3R or more R: Reduce, Reuse, Recycle, Repair, Refuse and Replace Reduce consumption of resource and energy Ex. avoid excessive use of vehicles, avoid excessive packaging or bags Reduce the amount of exhaust air and wastewater released into the environment Replace the source of materials Ex. plastic bags > paper bags, plastic bottles > glass bottles Replace the energy source Ex. coal > oil > natural energies Remove the contaminants Ex. oil, residual food materials, source of increased salinity such as salt or sauce, detergents Remove contaminants in the exhaust air Ex. using removal equipment or filtration unit Refuse disposable supplies and Replace with personal permanent item; such as personal water bottle, tableware (fork, knife, spoon, or chopsticks) and shopping bags, etc. Reuse of items Ex. refill to bottles, cases etc. Recycle: Remanufacturing using as raw material. Ex. Plastic items > plastic raw material
<h3>Type of pollution source and basic tactics to measures against pollutants</h3>   <ul style="list-style-type: none"> Pollutants come from emission source either point or dispersed sources. <ul style="list-style-type: none"> Point source: pipe or channel from an industrial facility or a city sewage system, chimney of industrial facility or incinerator, incomplete waste disposal site Dispersed source: variety of pollutants from unspecified area such as the runoff from agriculture field or storm drains, or unofficial trash dumping near houses, or burning of fields as slash-and-burn agriculture. Basic strategy for treatment of contaminants <ul style="list-style-type: none"> It is essential that pollutants should be treated before being released into the environment at the sources, whether pollution source is from point or distributed. Point sources are easier to control than dispersed sources for safe treatment. <ul style="list-style-type: none"> Because they can be treated in clearly identified locations before they spread into the environment. Guidance by authorities and public processing are effective Measures for dispersed sources are difficult. <ul style="list-style-type: none"> It is necessary to raise environmental awareness among individuals, and alternatives strategies such as community-based facility development are also needed. 	<h3>The role expected of the government in environmental issues (Examples of Japan)</h3> <div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: 10px auto;"> While chemical substances are beneficial to society, some are hazardous to human health and the environment. </div> <ul style="list-style-type: none"> Strategy of appropriate chemical management <ul style="list-style-type: none"> The principle is to replace with safer substances and reduce the impact on people and environment. Scientific evaluation of chemical hazards and exposure risks on human and environment. Appropriate management of chemicals (manufacturing, use, reducing emissions into the environment, and disseminating information on hazards) Legal regulations from a pollution prevention perspective <ul style="list-style-type: none"> Regulation at the emission source such as industrial plants: Ex.: Basic Law on Pollution Control, Basic Environmental Law, Water Pollution Prevention Act, Air Pollution Control Act (to fixed sources by measurement of smoke volume, etc.), Soil Contamination Countermeasures Act (to specified facilities using hazardous substances), etc. Regulation in the environment: Evaluation based on the environmental Standards: Ex.: Environmental standards for water pollution, environmental standards for air pollution, soil environmental standards, etc. Establishment and operation of an environmental pollution monitoring system <ul style="list-style-type: none"> Water Bodies: Constant monitoring as a rolling methods in public water bodies (fixed-point monitoring of water quality on health item/living environment items), Continuous monitoring in groundwater. Air: Air pollutant wide area monitoring system. Soil: Soil pollution situation investigation, Measurement of groundwater quality (management of soil contamination)

<p>Countermeasures to remove contaminants from emission gas</p> <ul style="list-style-type: none"> Remove equipment at spot sources <ul style="list-style-type: none"> Ex. desulfurization equipment for large plants Ex. Selective catalytic reduction denitrification (SCR) equipment for large incinerator / plants Remove equipment at dispersed sources <ul style="list-style-type: none"> Ex. SCR for each automobiles Ex. Particulate material filter for each automobiles  	<p>The role of the public, ordinary people, in environmental preservation issues</p> <ul style="list-style-type: none"> It is important to have a correct knowledge of the resources and energy we consume in our lives as consumers, and to have an awareness of environmental conservation. <ul style="list-style-type: none"> Education at a young age such as primary school. Awareness to the public: Personal responsibility to keep healthy and protect the environment. Residents' opinions to the government and businesses. Community activities for Environmental conservation / Living environment cleaning.   <p><small>Activity of living environment cleaning by resident volunteers</small></p>
<p>Words left behind by Hawking, who died in 2018 (thedailydigest.com)</p> <ul style="list-style-type: none"> Towards the end of his life, Hawking made a disturbing prediction about the future of humanity. He commented that if humanity continues at its current pace, the Earth will be destroyed within 600 years. Hawking warned that if the Earth's population continues to grow rapidly, and energy consumption continues to rise along with it, the planet will soon become a "burning ball of fire." In a video appearance at the 2017 Tencent WE Summit, a convention held in Beijing in 2017, Dr Hawking revealed his belief that humanity is in danger of destroying itself "through its own greed and stupidity." 	<p>Souvenir for JICA-AMU ex-participants on site: Place mats made from recycled Japanese kimono fabric</p>   <p> じわんろくじゅうにんげん、まじりていそくはつちをふやふやにやぶるゝ x-r utxxer 'esi kqjxm-tzwmtzlmxwgtzyamj qjs {nctsr jsys </p>
<p>At the end</p> <ul style="list-style-type: none"> It is important for everyone to have a sense of cooperation and collaboration as a community, as consumers living in the same ecosystem. <ul style="list-style-type: none"> Consider as own problems, not think as someone else's problem. Correct ourselves, take the initiative, and influence others. Government should prioritize protecting the health and well-being of its people. <ul style="list-style-type: none"> Economic growth at the expense of people's health cannot continue. Healthy people living in a healthy environment is the basis of a sustainable society. "Watch out! Be on your guard against all kinds of greed; life is not determined by the amount of wealth you have." (Luke 12:15) <p>Now is the time to act before it's too late.</p> 	

Mercury Exposure and Its Effects in Human and Environment in the Artisanal and Small Scale Gold Mining Asgm in Migori County- Situation Analysis



Samwel Ogweni Oketch

Sub-County Ministry of Health, Kenya

JICA-AMU2014

Introduction

Mercury contamination is a significant environmental health issue globally, with far-reaching implications for ecosystems and human health. Mercury exists in elemental, inorganic, and organic forms, with methylmercury (MeHg) being the most toxic. Globally, mercury pollution arises from natural sources such as volcanic activity and anthropogenic activities, including artisanal and small-scale gold mining (ASGM), industrial emissions, and fossil fuel combustion (UNEP, 2019). Mercury contamination in Kenya is particularly concerning in regions such as the Migori gold mining belt, where ASGM activities are prevalent.

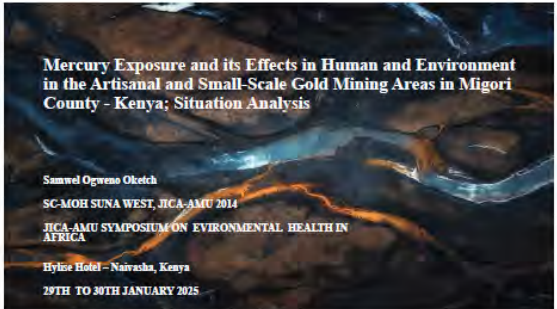




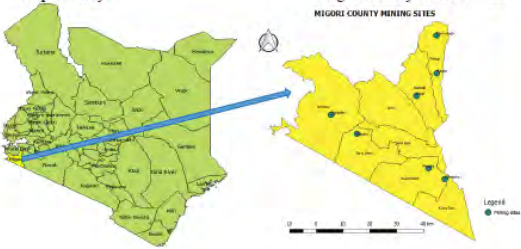


Mercury Impacts











Mercury once released, can travel long distances and persist in the environments where it circulates between air, water, sediments, soil and living organisms

Exposure to mercury, even in small amounts, causes severe health problems, contributes to the global loss of diversity and is exacerbated by climate change - part of the triple planetary crisis of climate change biodiversity loss and population

Conclusion

This Situation analysis highlights mercury's environmental and health impacts, identifies key challenges, and proposes actionable solutions tailored to the local context.

	<h2>Introduction</h2> <ul style="list-style-type: none"> Mercury is a naturally occurring element that is found in air, water and soil It is a heavy metal, an element, and therefore cannot be created or destroyed It can exist in different forms, element (metallic), inorganic (mercury chloride), and organic (methyl and ethyl mercury), all have different toxicity profiles with different implications It is a recognized toxic, mobile and persistent element with documented serious impacts on human health and environment Health Risks include neurotoxicity, developmental disorders, cardiovascular, reproductive and immune systems effects (WHO, 2016)
<h2>Introduction Cont...</h2> <ul style="list-style-type: none"> Major applications of mercury are in the health, chemical and mining processes and electronics and electronic switches Mercury dependent artisanal and small-scale gold mining ASGM is the largest source of mercury pollution on earth, releases 35 % of all mercury pollution to the environment (UNEP, 2013) In ASGM practice, the elementary mercury is used to extract gold from ore as an amalgam, which is typically isolated by hand and then heated to distill the mercury and isolate the gold During the panning process over 40% of mercury applied is lost, and 71% of the lost mercury is retained in the soil and water wastes (UNEP, 2013) 	<h2>Objective of the Situation Analysis</h2> <p>To demonstrate the magnitude of mercury pollution and its impact to human health and environment from the activities of artisanal and small gold mining in Migori County</p>
<h2>Current Situation of Mercury Pollution in Kenya</h2> <div> <div>  <p>Kenya does not produce Mercury. However, mercury finds applications in various industries such as healthcare, electronics, and mining among others</p> </div> <div>  <p>Efforts to phase out its use and promote safer alternatives are influenced by market dynamics (lack of cheaper alternatives, illegal imports, poor waste management)</p> </div> </div> <div> <div>  <p>On 22nd September 2023, Kenya became the 147th party to Minamata Convention on mercury</p> </div> <div>  <p>The government has established a task force to oversee the implementation of the convention</p> </div> </div>	<h2>Mercury Pollution in Migori County</h2> <p>Map of Kenya</p> <p>Migori County-Sub Counties</p> <p>MIGORI COUNTY MINING SITES</p> 
<h2>Mercury Pollution in Migori County</h2> <ul style="list-style-type: none"> ASGM is the primary source of mercury pollution in Migori County ASGM is prominent in Matsara (Suna West), Macalder (Nyamile), Masabio (Kuria West), Kisiere and Ekanwango (Rongo), Dedo (Awendu), and Kelaucha at the Kuria-Transmara border The proximity of the mining area to community boreholes and streams poses risks of water contaminations The Gold panning process is, in most cases, done by hand or makeshift tools, and a small pond is dug to train the wastewater Pan pond water accumulate a lot of mercury due to the repeat amalgamation process on them (Ogola et al., 2002) 	<h2>Mercury Pollution in Migori County Cont...</h2> <ul style="list-style-type: none"> Soil tailings are treated as waste soils after the recovery of amalgam The soil tailings are normally dumped in heaps at mine sites exposed to the environment At the end of the processing, mercury remains in pan pond water and soil tailing and during rainy seasons they are drained in the nearby rivers and streams Rivers in this region ultimately drain into the Lake Victoria 

 <h3>Practices at the Mining Sites in Migori County</h3> <ul style="list-style-type: none"> • In all the sites visited, mercury is used in ore amalgamation • There was no evidence of use of PPE • The mercury is stored in plastic bottles • Interview with the miners showed that on average 5 ml of mercury yields 10 grams of gold from 1 sack (long one) carrying an average of 25kg of ore • Once amalgamation has been done, the mercury is squeezed through a piece of clothing between their fingers and even between their teeth, to recover part of it for recycling purposes. • Gold is recovered through roasting of the gold mercury amalgam • Burning often take place both in open air and in enclosed huts to save the heat that might be blown by wind 	<h3>Previous Studies' Findings on Mercury Pollution in Migori County</h3> <ul style="list-style-type: none"> • The findings revealed effects on human health, groundwater and fish contaminations • Mercury concentrations in sediments collected from rivers in Migori County ranges between 30 and 2,380 µg/kg (Odumso et al., 2014) • Presence of mercury in human hair from people around Masara mine (CEJAD, 2017) • Blood mercury levels in 70% of the studied women around Mikeyi and Masara mines are over 0.58 ppm (IPEN, 2018) • Presence of mercury in tissues of Nile tilapia in the Migori gold mining belt are above the WHO recommended limits, 0.5 µg/g (Kola et al., 2019) 
<h3>Policy Challenges on Mercury Pollution in Migori</h3> <div>  <p>Regulatory Gaps: Weak enforcement of ASGM guidelines and alignment with the Minamata convention</p> </div> <div>  <p>Public Awareness: Limited understanding of mercury risks in mining communities</p> </div> <div>  <p>Monitoring Deficiencies: Lack of environmental surveillance and public health monitoring</p> </div>	<h3>Policy Recommendations</h3> <ul style="list-style-type: none"> • Strengthen Regulatory Frameworks: <ul style="list-style-type: none"> • Full implementation of the Minamata Convention • Develop national mercury management policies • Enhance Community Awareness: <ul style="list-style-type: none"> • Education campaigns on mercury risks and safer alternatives • Collaboration with NGOs and stakeholders 
<h3>Policy Recommendations (Cont...)</h3> <div>  <p>Enhance Monitoring and Research:</p> <ul style="list-style-type: none"> Regular environmental monitoring of mercury levels in soils, water, and biota. Explore cost-effective, mercury-free gold extraction methods </div> <div>  <p>Promote Sustainable Practices:</p> <ul style="list-style-type: none"> Support fish farming in non-contaminated areas. Provide subsidies for miners adopting mercury-free technologies </div>	<h3>Conclusion</h3> <div>  <p>Call to Action:</p> <ul style="list-style-type: none"> Implement policy reforms and educational campaigns. Leverage international partnerships and local knowledge </div> <div>  <p>Goal: Mitigate mercury's impacts on health and environment, advancing sustainable development</p> </div>
<h3>References</h3> <ul style="list-style-type: none"> • CEJAD, [2017]. Annual Report • Kola, S. et al. (2019). <i>Levels of mercury in Nile tilapia...</i> F1000Research. • Ogola, J. S. et al. (2002). <i>Impact of gold mining...</i> Environmental Geochemistry and Health. • UNEP, [2013]. The Emissions Gap Report • IPEN, [2018]. International Pollutants Emissions • UNEP, [2019]. <i>Global Mercury Assessment</i> • WHO, [2016]. Recommendation on Antenatal Care for Positive Pregnancy • WHO, [2018]. <i>Health and Climate Change</i> • WHO, [2021]. <i>Mercury and Health</i>. 	<h3>Acknowledgement</h3> <div> <div>MOH Kenya</div> <div>JICA-AMU</div> <div>County Government of Migori</div> <div>Colleagues (Dr. S. Kola, Christopher Omondi)</div> </div>

Arigato Gozaimasu!
Thank You!
Erokamano!



Lead Poisoning in Zambia



Tina Chisenga

East Central and Southern Africa Health Community,
Tanzania

JICA-AMU2015






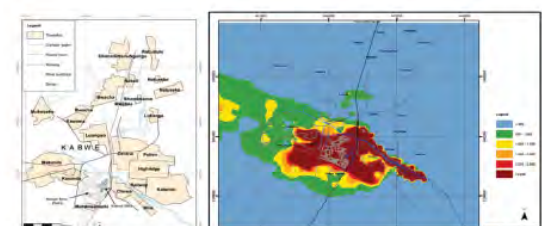
One striking illustration of the long-lasting effects of lead pollution on the environment and public health is Kabwe, Zambia. Due to the lack of decontamination procedures after the mine's closure, the town, which was built around a decommissioned lead-zinc mine and smelter that operated from 1902 to 1994, is plagued by widespread lead pollution. Residents are still exposed to hazardous levels of lead decades later, with youngsters playing in poisonous environs and destitute families searching for lead nuggets in contaminated soil (Blacksmith Institute, 2015). With soil lead concentrations as high as 51,188 mg/kg in some places, Kabwe has been listed as one of the top ten most polluted locations in the world (Blacksmith Institute, 2015).

The terrible effects of environmental pollution, especially on youngsters, are highlighted by health studies. According to a 2012 research, blood lead levels in Kabwe's children under seven years old were startlingly high, with medians of 39.3 µg/dL, 57.1 µg/dL, and 82.2 µg/dL in Chowa, Mukulu, and Kasanda, respectively. The crucial threshold of 65 µg/dL was exceeded by 57% of children in Kasanda. The highest amounts were seen in infants under two years old, which has grave consequences for behavior, cognitive development, and long-term societal results. To make matters worse, elevated amounts of lead have also been found in nearby livestock.

Lead exposure has negative health effects outside of Kabwe. Reduced intellect, learning impairments, sociobehavioral issues, and cardiovascular illness are all associated with exposure, even at low levels. Lead poisoning has a significant financial impact; it is predicted that Africa loses \$134.7 billion in productivity each year as a result of lower IQ. Poverty frequently intersects with the various sources of lead exposure in Africa, such as mining, battery recycling, lead-based paints, and traditional medicines, making the problem worse.

Interventions in Africa have not kept pace with those in developed countries, despite abundant evidence of the dangers. Although many African countries had phased out lead in gasoline by 2006, there are still regulatory gaps, especially regarding paint and occupational safety. There is an urgent need for comprehensive prevention methods that include blood lead screening, public education, strong legislation and enforcement mechanisms, national lead poisoning prevention initiatives, and involvement in international alliances.

The Kabwe tragedy emphasizes how urgently coordinated effort is needed to reduce lead exposure and the long-term effects it has on people and communities. It will need consistent funding, creative thinking, and a strong political will to address this issue and shield vulnerable groups—children in particular—from the harmful legacy of lead.

<h2>Lead Poisoning in Africa: A Focus on Kabwe Zambia</h2> <p>Challenges, Impact, and the Path to Mitigation Dr Tina Chisenga 29th January, 2025</p>	<h3>Outline of Presentation</h3> <ul style="list-style-type: none"> • Overview of Lead Poisoning • Lead Poisoning in Africa • Kabwe, Zambia: The "World's Most Polluted Town" • Health Impacts in Kabwe • Social and Economic Consequences • Efforts to Address Lead Poisoning in Kabwe • Challenges in Mitigation • The Way Forward • Conclusion 
<h3>Overview of Lead Poisoning</h3> <div> <div> What is Lead Poisoning? <ul style="list-style-type: none"> • Chronic exposure to lead, a toxic heavy metal, causing severe health impacts. • Common sources: mining, industrial emissions, contaminated water, soil, and food. </div> <div> Health Impacts: <ul style="list-style-type: none"> • Neurological damage, especially in children (reduced IQ, developmental delays). • Cardiovascular, renal, and reproductive system disorders. </div> <div> Economic Burden: <ul style="list-style-type: none"> • Increased healthcare costs and loss of productivity. </div> </div>	<h3>Lead Poisoning in Africa</h3> <div> <div> Context: <ul style="list-style-type: none"> • Africa faces a significant burden of lead poisoning due to artisanal mining, informal recycling, and industrial pollution. </div> <div> Key Statistics: <ul style="list-style-type: none"> • Estimated 800 million children globally have blood lead levels above 3.5–5 µg/dL; a substantial portion is in Africa. </div> <div> Vulnerable Groups: <ul style="list-style-type: none"> • Children under five, pregnant women, and occupational workers in mining and recycling. </div> </div>  <p>Figure 5: Lead exposure as a public health concern in countries of the WHO African Region: SELF ASSESSMENT (Source: WHO, 2014)</p>
<h3>Kabwe, Zambia: The "World's Most Polluted Town"</h3> <ul style="list-style-type: none"> • Kabwe – Central Province of Zambia • Formerly named Broken Hill until 1966, • lead and zinc deposits were discovered in 1902. • Kabwe also birthplace of Zambian politics • largest mine in the country for around 30 years • Silver and manganese were also mined • Kabwe one of the 10 most polluted places in the world • "tanks" have formed as abandoned mineshafts have filled with rainwater over decades. • In 1931 an early human fossil skull, called Broken Hill Man or Rhodesian Man, was found in the mine (classified as <i>Homo rhodesiensis</i> or <i>Homo heidelbergensis</i>). • In 2020, the skull was dated to 324 000 to 274 000 years ago, and has been noted for having a cranial capacity nearing that of modern humans.  	<h3>Kabwe, Zambia: The "World's Most Polluted Town"</h3> <ul style="list-style-type: none"> • Historical Context: <ul style="list-style-type: none"> • Lead mining and smelting operations active since 1904. • Closure of the mine in 1994 left behind extensive environmental contamination. • Extent of Pollution: <ul style="list-style-type: none"> • Soil lead levels in Kabwe exceed 10,000 parts per million (ppm) in certain areas (WHO guideline: <400 ppm for residential soil). • Contamination extends to homes, schools, and water sources. 
 <p>Lead soil levels Vs Townships/ Residential areas in Kabwe</p>	<h3>Health Impacts in Kabwe</h3> <div> <div> High Blood Lead Levels: <p>Studies show children in Kabwe have blood lead levels as high as 120 µg/dL. WHO considers levels above 5 µg/dL a concern.</p> </div> <div> Childhood Vulnerability: <p>Cognitive and behavioral issues. Higher risks of anemia, hearing loss, and slowed growth.</p> </div> <div> Community Impact: <p>Increased morbidity and reduced quality of life for residents.</p> </div> </div>

Social and Economic Consequences

Educational Challenges:

Reduced academic performance and school dropout rates.

Economic Impacts:

Decreased productivity and income loss.

Healthcare Burden:

Long-term healthcare needs for affected individuals and their families.

JICA Project on Lead Poisoning (KAMPAI Initiative)

- Kabwe Mine Pollution Abatement Initiative (KAMPAI)
- Prof. Luke Ivute Mumba (University of Zambia) and Prof. Mayumi Ishizuka (Hokkaido University)
- Completion Date: June 2022
- Address lead (Pb) contamination and its impacts in Kabwe, Zambia.
 - Focus: Develop environmental remediation protocols.
 - Establish a sustainable socio-ecosystem model.

Objectives

- Evaluate lead contamination pathways and impacts.
- Propose remediation methods.
- Strengthen monitoring and research capacity.
- Develop protocols for sustainable pollution control.

Efforts to Address Lead Poisoning in Kabwe

Government Initiatives:

Zambia Environmental Management Agency (ZEMA) remediation programs.

Community Interventions:

Awareness campaigns and educational programs.
Blood lead level testing and treatment centers.

International Support:

Donor-funded projects like the World Bank-supported Zambia Mining Environmental Remediation and Improvement Project (ZMERIP) - KAMPAI Project.

JICA Project on Lead Poisoning (KAMPAI Initiative)

Key Achievements

- Established monitoring labs at the University of Zambia (UNZA).
- Conducted health interventions, including lead testing and chelation therapy for over 10,000 children.
- Published 10+ research papers on contamination and remediation.
- Proposed cost-effective remediation methods using local materials.

Outputs and Results

- Environmental Analysis:** Identified high lead levels in soil, air, and food pathways.
- Health Impacts:** Documented neurodevelopmental and genetic effects in children.
- Economic Assessment:** Quantified socio-economic losses from lead exposure.
- Remediation:** Tested and recommended low-cost geo-remediation techniques.

Challenges in Mitigation

Limited Funding:

Insufficient resources for comprehensive remediation.

Lack of Awareness:

Many residents are unaware of lead poisoning risks.

Continued Exposure:

Informal mining and unsafe practices perpetuate contamination.

The Way Forward

Policy Recommendations:

Stricter regulations on mining and industrial waste management.
Enforcement of environmental protection laws.
Expand remediation protocols to other mining areas.

Community Engagement:

Empower local communities with knowledge and resources to mitigate exposure.

Sustainable Solutions:

Development of alternative livelihoods to reduce reliance on unsafe mining.
Investment in clean-up and infrastructure improvements.
Strengthen cross-ministry collaboration for sustainable policy integration.

Conclusion

Key Takeaways:

Lead poisoning remains a significant public health challenge in Africa, with Kabwe as a critical case study.
Addressing this issue requires coordinated efforts from governments, communities, and international stakeholders.

Call to Action:

Advocate for increased investment in lead poisoning prevention and remediation programs.
Prioritize health and safety in mining-affected communities.

Questions and Discussion

- How can we mobilize resources to address lead poisoning in Kabwe and similar areas?
- What role can each stakeholder play in mitigating lead exposure?
- Contact Information:**
 - Tina Chisenga
 - tchisenga@ecsa-hc.org
 - East Central and Southern Africa Health Community

Water Pollution in Malawi



Pilirani Wezi Mumba
Ministry of Health, Malawi
JICA-AMU2022

Water pollution is a pervasive global challenge, significantly impacting ecosystems, public health, and sustainable development. It arises from a myriad of sources, including industrial discharges, agricultural runoff, and inadequate sanitation systems, which compromise water quality and threaten the availability of clean water. In low-income countries like Malawi, water pollution is particularly critical, as limited resources and insufficient water management systems exacerbate the issue.

Malawi, a predominantly agriculture dependent country, has an extensive network of surface water bodies covering about 21 percent of the country's total area (approximately 24,400 km²). It has an estimated annual renewable freshwater resource of 3,000 m³ per capita. Malawi faces severe water pollution challenges, particularly from agricultural activities that contribute nutrient and pesticide runoff into water bodies, and from untreated industrial and domestic waste that contaminates rivers and lakes. Lake Malawi, the third-largest lake in Africa and a crucial resource for the country's economy, food security, and biodiversity, is increasingly at risk. The degradation of its waters disrupts livelihoods, threatens fish populations, and undermines the ecological balance of one of the world's most significant freshwater ecosystems.




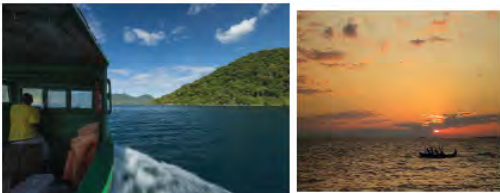
Furthermore, inadequate sanitation infrastructure in urban and peri-urban areas leads to untreated sewage entering water sources, exacerbating the spread of waterborne diseases such as cholera, dysentery, and schistosomiasis. Although assessments of domestic water points in Malawi indicate chemical and microbiological parameters within acceptable limits for drinking water, large segments of the population (>70% of Malawi's population lives in rural areas) of this population, some rely on untreated lake and river water, which remains vulnerable to contamination.

Addressing water pollution has become a national priority in Malawi. A key step in this effort was the establishment of the Ministry of Water and Sanitation in 2022, signalling a significant shift towards better oversight and coordinated management of the country's water resources. Policies related to water bodies are outlined in various documents, including the National Sanitation Policy. Through the Malawi Water Sector Investment Plan, the government has crafted a comprehensive strategy to improve sanitation and protect water bodies.

The government's approach focuses on addressing the root causes of water pollution, promoting multi-stakeholder collaboration, and strengthening water management systems. Key strategies include integrated watershed management, improved agricultural practices, enhanced wastewater treatment, and public education campaigns. These efforts are essential for safeguarding water quality, ensuring public health, and ensuring the sustainability of freshwater resources. By prioritizing these interventions, Malawi can mitigate the impacts of water pollution and foster sustainable development for its growing population.

<p style="text-align: center;">WATER POLLUTION IN MALAWI</p> <p style="text-align: center;">Dr Piliirani Wezi Mumba (Malawi)</p>	<p>Outline</p> <ul style="list-style-type: none"> • Introduction • Definition of water pollution • Overview of water pollution • Determinants • Sources of water pollution • Contributing factors • Impact of water pollution • Government role
<p>Introduction</p> <ul style="list-style-type: none"> • Malawi - landlocked country in southeastern Africa. • Has diverse geography and significant water resources. • Spans approximately 118,484 square kilometers. • Borders- Tanzania, Zambia, Mozambique • Lake Malawi: <ul style="list-style-type: none"> • One of the world's largest freshwater lakes, covering about 20% of Malawi's total area (29,600 square kilometers). • Vital resource for fishing, transportation, and tourism. • Home to a remarkable diversity of aquatic life, including fish. 	<p>Rivers</p> <ul style="list-style-type: none"> • Major rivers include the Shire River, (outlet for Lake Malawi which joins the Zambezi River) and the Ruo River. • Rivers are integral for irrigation, hydropower generation and agriculture.
<p>water pollution</p> <ul style="list-style-type: none"> • Contamination of water bodies (such as rivers, lakes, oceans, and groundwater) by harmful substances, which adversely affect aquatic ecosystems, human health, and the environment. • Occurs when pollutants, such as chemicals, industrial waste, sewage, agricultural runoff, or plastics, are discharged into water bodies without adequate treatment, disrupting the natural balance of the ecosystem. 	<p>Overview of water pollution</p> <ul style="list-style-type: none"> • Waste can be either solid, liquid, or gaseous. • Pollution is one of the biggest threats to biodiversity and the environment in the world. • Water pollution pose a threat to human health. • Local communities rely on these natural resources for water, food, recreation, and tourism(Mambra, 2019).
<p>Overview</p> <ul style="list-style-type: none"> • Waste dumping in Africa is becoming an increasingly insurmountable burden. • Kenya, Uganda and Tanzania, are suffering from the effects of waste (Treaster, 2011). • Most of its rivers and lakes are polluted. • Parts of Lake Victoria are also clogged with hyacinths and algae that have been thinning out the fish populations. • Efforts by the governments of Kenya, Uganda, and Tanzania to establish regulations. (Treaster, 2011). 	<p>water pollution in Malawi</p> <ul style="list-style-type: none"> • Water pollution in Malawi "a significant threat to public health and environment" • Waste collection and management & disposal still a big problem • Some of these wastes end up into water bodies. • This is harmful to the biodiversity of the ecosystem

<ul style="list-style-type: none"> • The lakeshore District Councils lack proper sewage disposal. • Majority of holiday resorts construct their own sewage and solid waste disposal systems. • Constructing these disposal systems is costly • Shire river has a lot of growths due to pollution • This affects Tourism development 	<ul style="list-style-type: none"> • Pollution directly impacts public health • Evidenced by frequent outbreaks of waterborne diseases such as cholera. • Only 67% have access to clean water in Malawi. • 33% use polluted water sources • Limited access to clean affects rural communities • There is need for intervention to address water pollution in Malawi
<p>Study on Mudi River, Blantyre, Malawi (Save et al. 2021)</p> <ul style="list-style-type: none"> • Objective: Analysis of biological, physical, and chemical pollutants. • Sampling Details: <ul style="list-style-type: none"> • Conducted at the river source, three points in the industrial site, and the outskirts of Blantyre. • Water collected using the grab sampling technique. • Key Findings: <ul style="list-style-type: none"> • Bacterial Count: Total bacterial count ranged between 1,433–1,800+ colonies per 100 mL. • Coliform Levels: <ul style="list-style-type: none"> • Source: 59,286 colonies per 100 mL. • Other points: Numerous to Count (NC) colonies per 100 mL. • Biological Oxygen Demand (BOD): 29.20–89.20 mg/L. • pH Range: 7.02–8.23. 	<p>Additional Findings on Mudi River (Save et al.)</p> <div> <div> <p>Key Measurements:</p> <ul style="list-style-type: none"> • Conductivity: 148.77–542.67 µS/cm. • Temperature: 21.13–23.67 °C. • Turbidity: 28.93–130.37 NTU. • Total Dissolved Solids (TDS): 69.17–271.67 ppm. </div> <div> <p>Metal and Nitrate Levels:</p> <ul style="list-style-type: none"> • Lead: 0.21–0.93 mg/L. • Cadmium: 0.00–0.02 mg/L. • Chromium: 0.10–0.46 mg/L. • Zinc: 0.05–0.18 mg/L. • Copper: 0.04–0.12 mg/L. • Nitrates: 2.56–15.64 mg/ </div> </div>
<p>Observations from the study</p> <ul style="list-style-type: none"> • Observations: <ul style="list-style-type: none"> • Most parameters exceeded European Commission Standards (1994) for aquatic life, irrigation, and domestic use. • Pollutant levels were generally lower at the source compared to other sampling points. 	<p>Sources of Water Pollution in Malawi</p> <ul style="list-style-type: none"> • Agricultural Sources: <ul style="list-style-type: none"> • Pesticides and fertilizers runoff. • Livestock waste contaminating water bodies. • Industrial Sources: <ul style="list-style-type: none"> • Discharge from industries and mining activities. • Heavy metal contamination. • Domestic Sources: <ul style="list-style-type: none"> • Poor waste disposal and lack of sanitation facilities. • Household waste entering water systems. • Natural Causes: <ul style="list-style-type: none"> • Erosion and siltation. • Organic matter from natural processes.
<p>Contributing Factors to water pollution</p> <ul style="list-style-type: none"> • Rapid population growth and urbanization. • Limited enforcement of environmental regulations. • Insufficient waste management infrastructure. • Deforestation and land degradation. 	<p>Mudi river polluted with waste</p> 

<p>Lilongwe river</p> 	<p>Rivers in Africa</p> 
<p>Lake Malawi</p> 	<p>Lake Malawi</p> 
<p>Impacts of Water Pollution in Malawi</p> <ul style="list-style-type: none"> • Health Impacts: <ul style="list-style-type: none"> • Waterborne diseases like cholera, typhoid, and dysentery. • Exposure to toxic chemicals causing long-term illnesses. • Economic Impacts: <ul style="list-style-type: none"> • Reduced productivity in agriculture and fisheries. • Increased healthcare costs. • Tourism • Environmental Impacts: <ul style="list-style-type: none"> • Loss of biodiversity in aquatic ecosystems. • Degradation of water quality affecting ecosystem services. 	<p>Cholera outbreak in Malawi</p> <ul style="list-style-type: none"> • Caused by the bacteria <i>Vibrio cholerae</i>. • Spread through contaminated water and poor sanitation. • Polluted water sources (rivers, wells, and lakes). • Improper disposal of human waste contaminates drinking water. • Agricultural runoff and industrial waste exacerbate contamination. <p>Key Statistics (Malawi)</p> <ul style="list-style-type: none"> • Recent outbreak in 2022–2023 • The outbreak affected all districts in the country <ul style="list-style-type: none"> • Over 58,000 cases reported. • More than 1,700 deaths (one of the deadliest outbreaks). • Most affected regions: Rural areas with limited access to clean water.
<p>Cholera</p> <p>Impacts of Cholera in Malawi</p> <ul style="list-style-type: none"> • High mortality rates in vulnerable populations. • Increased healthcare costs and loss of productivity. • Strain on public health systems and community disruption. <p>Solutions and Prevention</p> <ul style="list-style-type: none"> • Improving water sanitation, and hygiene (WASH) infrastructure. • Strengthening wastewater management systems. • Promoting public education on hygiene practices. • Collaboration with international organizations (e.g., WHO, UNICEF). 	<p>Drinking water quality assessments</p> <ul style="list-style-type: none"> • Data from Nkhosakota district • 4 water points were assessed <ul style="list-style-type: none"> ◦ Physicochemical parameters ◦ Turbidity-0.95-1.76 NTU (1 NTU) ◦ PH – 5.46 – 7.95 (5-8) ◦ Total hardness – 23 – 211 mg/dl (<500 mg/dl) • Microbiology – not contaminated • A study by WHO, 2023 showed some levels of contamination of some drinking water

<p>Drinking water quality audit (2020)</p> <ul style="list-style-type: none"> • Conducted by UNICEF and Ministry of forestry and natural resources • Different water sources were assessed • Parameters checked – PH, turbidity, microbiology, total hardness and treatment with chlorine <p>Most of the water sources were safe for consumption.</p>	<p>Mitigation Efforts for pollution</p> <ol style="list-style-type: none"> 1. Government policies and regulations. 2. Investments in clean water infrastructure 3. Public awareness campaigns (happening) <ul style="list-style-type: none"> • Establishment of regulatory frameworks • Government introduced a ministry responsible for water and sanitation in 2022, policies and regulations were also established
<p>Mitigation efforts...</p> <ol style="list-style-type: none"> 4. Community Advocacy for clean water policies 5. Health education initiatives 6. Partnerships for water quality initiatives 7. Monitoring, evaluation and continuous improvements. 	<p>Challenges in Addressing Water Pollution</p> <ul style="list-style-type: none"> • Limited financial and technical resources. • Weak institutional capacity. • Cultural and social barriers to behavior change.
<p>Recommendations and possible Solutions</p> <ul style="list-style-type: none"> • Strengthening waste management and sanitation infrastructure. • Maintaining the sewage pipes. • Promoting sustainable agricultural practices. • Public awareness campaigns and community involvement. • Enhanced monitoring and enforcement of regulations. • Collaboration between stakeholders, including local and international partners. • Avoid open defecation and disposal of waste in the rivers. • Need to continuously do water quality checks 	<p>References</p> <ol style="list-style-type: none"> 1. Kumwenda S, Tsakama M, Kalulu K, Kambala C. Determination of Biological, Physical and Chemical Pollutants in Mudi River, Blantyre, Malawi. 2012. 2. United Nations Environment Programme (UNEP), 2022. <i>Water Pollution: Causes and Consequences</i>. 3. United States Environmental Protection Agency (EPA), 2023. <i>Water Pollution Overview</i>. 4. Tsuro, L. (2021) The impacts of waste dumping in Lake Malawi, Development Southern Africa, 38:6, 985-1000, DOI: 10.1080/0376835X.2021.1919058 5. DRINKING-WATER-QUALITY-AUDIT-REPORT.pdf.
<p>• 6. WATER QUALITY TEST REPORT_KKBSP_DeChagos_095135.pdf.</p>	<p style="text-align: center;">END</p>

Air Pollution in Africa: Example of Dakar, Capital of Senegal



Amadou Yeri Camara
Ministry of Health, Senegal
JICA-AMU2022

According to the WHO, the combined effects of ambient air pollution and indoor air pollution are associated with approximately 834,000 premature deaths per year in the African Region. In 2019, the concentration of PM_{2.5} in the African Region was approximately 33 µg/m³. In Senegal, the indicative value for PM_{2.5} was 30 µg/m³ in 2023. With 4.5% of Senegal's population on 0.28% of the territory, Dakar hosts several polluting sectors such as cement plants, chemical industries, transport, and waste incineration, among others. This is why we will discuss the sources, consequences, measures, perspectives, and solutions to air pollution.


The high concentration of old vehicles contributes to the emissions of fine particles (PM_{2.5}, PM₁₀) and polluting gases (CO₂, NO_x). Industrial areas emit atmospheric pollutants due to the combustion of fossil fuels, chemical processes, and the lack of emission control systems. Open-air incineration of solid waste releases hazardous pollutants such as dioxins and furans. The use of wood and charcoal as a domestic energy source leads to emissions, particularly in rural areas. Saharan winds, especially the Harmattan, carry fine dust that degrades air quality.

Respiratory diseases (asthma, chronic bronchitis) and cardiovascular diseases increase due to exposure to pollutants. Vulnerable groups, such as children and the elderly, are often affected. In Senegal, 47% of deaths from stroke and heart ischemia are due to air pollution. This air pollution contributes to the degradation of ecosystems, notably through the acidification of soils and waters. The costs associated with healthcare and productivity loss due to pollution-related diseases are considerable.

Six pollution measurement stations have been installed in Dakar to assess the levels of particles and polluting gases and to send prevention messages. The state has established a Ministry of the Environment (1981), an Environmental Code (2001), a management and air quality control service, banned the import of vehicles over 8 years old, and promoted renewable energy with the implementation of electric buses. Senegal faces rapid urbanization, lack of resources, and climate change. Possible solutions include the renewal of the vehicle fleet, investment in modern and sustainable waste treatment solutions, energy transition, and stricter sanctions for polluting industries.

Additional efforts are needed to ensure a healthy environment for future generations. Cooperation between the government, citizens, and international partners will be essential to meet this challenge.

Keys-words : air pollution Health Senegal




Dakar



MUCS



JICA



REPUBLIC OF SENEGAL

AIR POLLUTION IN AFRICA

EXEMPLE DE DAKAR, CAPITAL DE SENEGAL

Dr Annette Ben CANARD
Public Health Specialist
WHO/AFRO/2022


Regional Director of Health/Senegal
Ministry of Health and Social Action, Senegal

Environmental Health in Africa, Kenya 29-30 January 2025

PLAN

- Generalities
 - Definitions
 - Mechanisms of Pollution
 - Epidemiology
- Case Study of Dakar, Senegal
 - Context
 - Causes
 - Consequences
 - Pollution Measurement
 - Mitigation Measures
- Conclusion





DEFINITIONS

Pollution ⇒ A set of natural or anthropogenic emissions, more or less toxic, which, even without being dangerous, can lead to the degradation of ecosystems and, consequently, the environment. These emissions may originate naturally or through human activities.

Particles ⇒ Particles are a complex mixture of organic and mineral substances suspended in the air, in solid and/or liquid form.

EPIDEMIOLOGY (1)

MORTALITY

The combined effects of ambient air pollution and indoor air pollution are associated with approximately 834,000 premature deaths per year in the African Region.

- 339 000 premature deaths due to ambient (outdoor) air pollution.

639,000 deaths in the region caused by indoor air pollution.

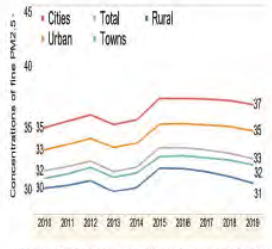


Deaths caused by indoor air pollution Deaths caused by ambient air pollution

EPIDEMIOLOGY(2)

Fine Particles (PM_{2.5})

- Average PM_{2.5} levels:
African region: 33 µg/m³;
World average: 32 µg/m³
- Highest PM_{2.5} levels: Cameroon (56.3 µg/m³), Nigeria (55.6 µg/m³), Niger (50.1 µg/m³)
- Lowest PM_{2.5} levels: Mauritius (10.4 µg/m³), Namibia (11.8 µg/m³), Kenya (12.5 µg/m³)



Level of fine particles by residence location in the African region (2010-2019):

MECANISMS (1)

Effects of air pollution on various ecosystems:



MECANISMS(2)

KEY POLLUTANTS

Ozone (O₃)
Nitrogen Oxides (NO_x): Mainly emitted by transportation, includes nitrogen monoxide (NO) and nitrogen dioxide (NO₂), expressed as NO₂ equivalent.
Sulfur Dioxide (SO₂): Indicator of industrial activities.
Carbon Monoxide (CO)
Particulate Matter (PM₁₀, PM_{2.5}, PM₁)
Volatile Organic Compounds (VOCs): Benzene, Toluene, Xylene
Heavy Metals: Arsenic, Cadmium, Chromium, Copper, Manganese, Nickel, Lead, Selenium, Zinc
Dioxins and Furans (PCDD/Fs)
Polycyclic Aromatic Hydrocarbons (PAHs)
Ammonia (NH₃): Presence of ammonium nitrate and sulfate, components of particulate matter



MECANISMS (3)

HEALTH IMPACTS OF POLLUTANTS

Polluant suivi	Origine	Impact sanitaire
Gaz d'azote (NO _x)	Transport et installations de combustion	crises d'asthme, sensibilité des bronches aux infections chez l'enfant
Ozone (O ₃)	Transformation NO _x et hydrocarbures par rayonnements solaires	larmes, irritations oculaires, etc.
Gazoline Volatile Xylene (BTEX)	Transport, industrie, nature	troubles du système nerveux, perte de conscience
Particules de poussières PM ₁₀ et PM _{2.5}	Transport, industrie et nature (poussières et vents de sable...)	pathologies respiratoires et cardiovasculaires
Monoxyde de carbone (CO)	Transport	intoxication chronique, maux de tête, vertiges, problèmes cardio-vasculaires
Dioxyde de soufre (SO ₂)	Combustion fuel et charbon	symptômes respiratoires aigus chez l'adulte et baisse capacité respiratoire chez l'enfant



<p>AIR POLLUTION MEASUREMENT(5) EXAMPLES OF ALERTS WEATHER AND AIR QUALITY REPORT Sent to : - Ministry of health and social action - Media</p> 	<p>MITIGATION MEASURES</p> <ul style="list-style-type: none"> • Establishment of the Ministry of the Environment (1981) • Environmental Code (2001) • Creation of the Air Quality Management and Control Service • Ban on importing vehicles older than 8 years • Promotion of renewable energy: <ul style="list-style-type: none"> ◦ Electric power plants ◦ Electric buses and trains • Promotion of mass transportation (TER, BRT) • Switching to natural gas for households to replace charcoal use 
<p>CONCLUSION</p> <ul style="list-style-type: none"> • Air pollution is a problem in Africa • Solutions include the renewal of the vehicle fleet. • Investment in modern and sustainable waste treatment solutions. • Energy transition, • and stricter sanctions for polluting industries. • Additional efforts are needed to ensure a healthy environment for future generations. • Cooperation between the government, citizens, and international partners will be essential to meet this challenge. 	 <p>THANK YOU SO MUCH ASANTEH JE VOUS REMERCIE</p>
<p>REFERENCES</p> <ol style="list-style-type: none"> 1. OMS Pollution atmosphérique : Le tueur invisible who.int 2. DIOUKHANE AM Le suivi de la qualité de l'air au niveau local: l'exemple du cgea au Sénégal 19 NOVEMBRE 2019 Centre de Gestion de la Qualité de l'Air Direction de l'Environnement et des Etablissements Classés MINISTRE DE L'ENVIRONNEMENT ET DU DEVELOPPEMENT DURABLE 3. ACHARD S. Pollution atmosphérique et Impacts sanitaires associés du 9 au 13 Mars 2020 Inseem U1153, Equipe HERA (Health Environmental and Risk Assessment) Université Paris Dauphine 4. SOW B. La qualité de l'air diminue à Dakar : que faire pour l'améliorer? Doctorant en physique, Université Alioune Diop de Bambey Published: July 26, 2023 4:59pm SAST 5. SECK M. Analyse des effets liés à la pollution atmosphérique au Sénégal, le cas de Dakar Thesis • November 2021 6. OMS Fiche d'évaluation santé et environnement Sénégal 7. WB, UNION EUROPEENNE Développer des systèmes de mesure de la qualité de l'air tout et comparaison de trois sources de données de la pollution à Dakar, Sénégal dime.transport 8. DHIS2 systeme.donnees.santeeurope.org/ / HISAS 	

Spatial Dynamics of Environmental Factors Influencing Health and Disease Burden in Ghana



Musah Ali

Ubora Institute, Ghana Health Service, Ghana
JICA-AMU2015

In the African region, the influence of diseases linked to environmental factors is considerable, resulting in profound socioeconomic repercussions. Environmental risks contribute to 23% of the overall disease burden in this area. A significant portion of deaths associated with environmental issues is due to infectious diseases, with approximately 28% of all premature deaths linked to these factors. Health conditions such as vector-borne diseases, diarrheal illnesses, cardiovascular diseases, and lower respiratory infections are significantly affected by environmental circumstances. Key contributors to these health challenges include persistent issues such as limited access to safe drinking water, inadequate sanitation, and a lack of clean cooking fuels. To foster healthier environments, it is vital to strengthen collaboration across various sectors, particularly in light of the constraints faced by healthcare systems. Improving environmental conditions has the potential to reduce nearly a quarter of the global disease burden.^{1,2,3,4}

Environmental factors such as climate variability, air pollution, and water contamination play critical roles in shaping the spatial distribution of health and disease burdens across Ghana. Climate change, manifested through rising temperatures and erratic rainfall patterns, has exacerbated diseases like malaria and meningitis. Regions in the northern savanna belt, including Upper East and Northern Regions, experience prolonged dry seasons followed by intense rains, creating ideal breeding grounds for mosquitoes. Malaria incidence in these regions is among the highest in the country, accounting for over 30% of outpatient visits nationally.^{5,6,7}

Air pollution, a significant urban health hazard, disproportionately affects cities like Accra, Kumasi, and Takoradi. Accra's average PM_{2.5} concentration of 36 µg/m³, driven by vehicular emissions, industrial processes, and open waste burning, far exceeds the WHO guideline of 5 µg/m³. These elevated pollution levels are linked to increased cases of respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD). Kumasi, a rapidly growing urban center, also faces similar air quality challenges due to increasing vehicular traffic.^{8,9}

Water pollution further compounds the health burden, particularly in rural and peri-urban areas. Illegal mining activities, known as "galamsey," and agricultural runoff contaminate water bodies such as the Pra and Birim Rivers, leading to high levels of heavy metals like mercury and arsenic. Communities reliant on these water sources face increased risks of waterborne diseases, including diarrhea, cholera, and typhoid. As of December 23, 2024, Ghana recorded 4,155 notified cases of cholera since October this year with 35 deaths, highlighting the critical need for improved water management.^{10,11}

Spatial analysis shows health disparities across regions, with rural areas more affected by water

pollution and climate-related diseases, while urban centers struggle with air pollution. Addressing these issues requires targeted interventions, such as reforestation for climate resilience, enforcing air quality standards in cities, and improving water sanitation in rural communities.

¹ WHO Africa, Regional Committee for Africa, Regional Strategy for the Management of Environmental Determinants of Human Health In the African Region 2017–2021, AFR/Rc67/6, June 2017: https://www.afro.who.int/sites/default/files/2017-07/AFR-RC67-6%20Regional%20strategy%20for%20environ%20health%20determ%20Human%20Health_1.pdf

² WHO, https://www.who.int/health-topics/environmental-health#tab=tab_1

³ World Health Organization, République Gabonaise & United Nations Environment Programme. New and Emerging Environmental Threats to Human Health. in First Interministerial Conference on Health and Environment in Africa: Health Security through Healthy Environments 6 (2008).

⁴ WHO, Preventing disease through healthy environments: assessment of the burden of disease from environmental risks, Geneva, World Health Organization, 2018

⁵ WHO 2023: [Climate change](#)

⁶ Ali, Musah, et al. "Spatial Epidemiology of Bacterial Meningitis in the Upper West Region of Ghana: Analysis of Disease Surveillance Data 2018-2020." *Clinical Infection in Practice* (2022): 100160. <https://doi.org/10.1016/j.ijid.2022.07.068>

⁷ Asori, Moses, Ali Musah, Julius Odei, Anthony Kwame Morgan, and Iddrisu Zurikanen. "Spatio-temporal assessment of hotspots and seasonally adjusted environmental risk factors of malaria prevalence." *Applied Geography* 160 (2023): 103104. <https://doi.org/10.1016/j.apgeog.2023.103104>

⁸ WHO 2021: <https://www.who.int/publications/i/item/9789240022294>

⁹ [Ghana - Clean Air Fund](#)

¹⁰ Asori, M., Mpobi, R. K. J., Morgan, A. K., Apoanaba, T. A., Katey, D., Ampofo, S. T., ... & Appiah, D. O. (2023). Is illegal mining socio-politically entrenched? An opinion piece of the interaction between formal politics and chief dominance in mineral governance, and its influence on fighting Galamsey in Ghana. *GeoJournal*, 88(2), 1953-1963.

¹¹ Ghana Health Service

SPATIAL DYNAMICS OF ENVIRONMENTAL FACTORS INFLUENCING HEALTH AND DISEASE BURDEN IN GHANA AND WEST AFRICA

Musah Ali

INTRODUCTION

- In the African region, the influence of diseases linked to environmental factors is considerable, resulting in profound socioeconomic repercussions. Environmental risks contribute to 23% of the overall disease burden in this area.
- A significant portion of deaths associated with environmental issues is due to infectious diseases, with approximately 28% of all premature deaths linked to these factors.
- Health conditions such as vector-borne diseases, diarrheal illnesses, cardiovascular diseases, and lower respiratory infections are significantly affected by environmental circumstances.
- Human health is intimately linked to one's geographical location. It may influence their wellbeing, either positively or negatively.

INTRODUCTION

HOW THE ENVIRONMENT IMPACTS OUR HEALTH

People are exposed to risk factors in their home, work place and community. These factors include:

- Air Pollution
- Water Sanitation
- Climate Change
- Occupational Risks
- Community Risks
- Radiation
- Agro-chemicals
- Waste Management
- Food Safety
- Vector Control
- Disaster Preparedness

01

CLIMATE AND DISEASES

CLIMATE ISSUE



- It is estimated that more than 1.2 million cases of bacterial meningitis are recorded annually (WHO, 2015; Zoon et al., 2016).
- Though bacterial meningitis is a worldwide disease, the epidemiology and pattern vary according to geographic region and season (Poon et al., 2020). 400 million people live in the stretched "African meningitis belt" of 26 countries.
- In Ghana, the northern zone (Northern, North East, Savannah, Upper East, Upper West Regions, and the Bono East Region) lie within the African meningitis belt (Pudugon et al., 2019).
- The Upper West Region has continued to experience isolated outbreaks during the dry season, which runs from October to April each year.

METHODS

Study Site



Study population

Bacterial meningitis cases (n = 1,176). The study considered all age groups and genders as part of the study population during the data extraction.

Data Collection (Secondary Data)

- Meningitis Data (Disease Surveillance Data)
- Household Data (CHPS Database)
- Spatial Data (Administrative level 2 and 3 DHMS-2)
- Climate Data: world-climate data portal

Data Analysis

Descriptive Statistics:

Freq, tables, Epi curve, Choropleth etc.

Spatial Statistics

- Global Moran's I: Analyzing meningitis autocorrelation
- Getis-Ord Gi* / Anselin Local Mi: Hotspots/Outliers Analysis
- GWR model: Assessing the impact of Socio-Bio-Climatic Dynamic Influence on Meningitis Prevalence

Tools/Statistical Packages

STATA version 14.0, MS Excel (2019), ArcGIS version 10.5 and GeoDa

RESULTS – Descriptive Statistics

Meningitis Weekly Incidence in Upper West Region, 2018 to 2020



Year	Cases	Deaths	CFR	CFR%
2018	423	38	31.9	7.5%
2019	312	24	40.7	13.0%
2020	422	34	48.1	11.4%

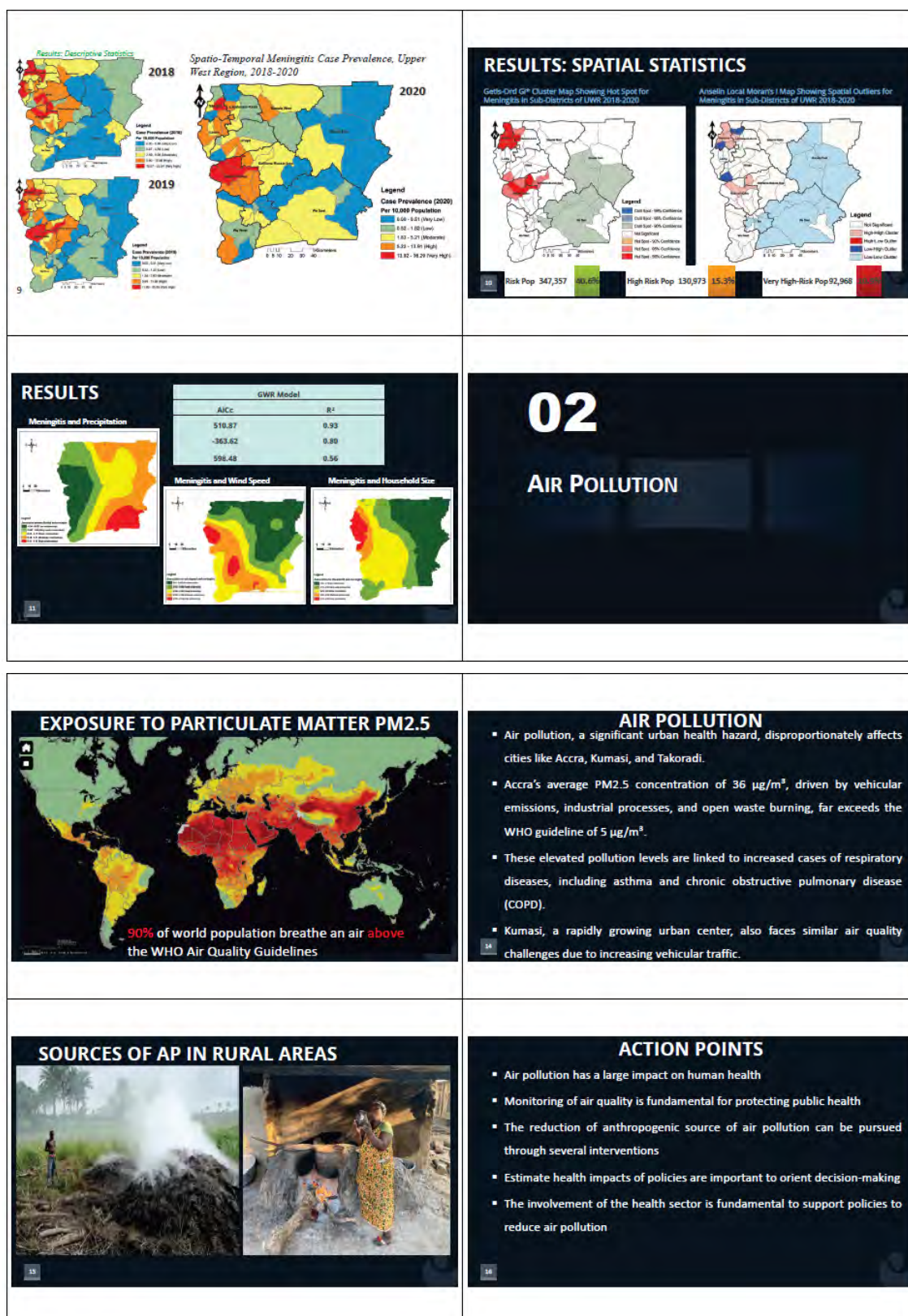
HYPOTHESIS

Weekly Incidence of Bacteria Meningitis 2018-2020



Study Hypothesis

- H_0 : There is no statistically significant clustering of meningitis cases in the UWR.
- H_0 : There is no statistically significant hotspots/Outliers of meningitis cases in the UWR.
- H_0 : There is no statistically significant relationship between meningitis cases and bio-climatic condition in UWR.
- H_0 : Household size is not a risk factors for the spread of meningitis in UWR.



<h2>02</h2> <h3>WATER POLLUTION</h3>	<h3>WATER POLLUTION</h3> <ul style="list-style-type: none"> Water pollution further compounds the health burden, particularly in rural and peri-urban areas. Illegal mining activities, known as "galamsey," and agricultural runoff contaminate water bodies such as the Pra and Birim Rivers, leading to high levels of heavy metals like mercury and arsenic. Communities reliant on these water sources face increased risks of waterborne diseases, including diarrhea, cholera, and typhoid. As of December 23, 2024, Ghana recorded 4,155 notified cases of cholera since October this year with 35 deaths, highlighting the critical need for improved water management.
<h3>WATER POLLUTION</h3> <p>minutes to access an improved source of drinking water. Another 11 per cent of the population, still drink from surface and other unsafe water sources.</p> <p><i>Seventy six per cent of households in Ghana are at risk of drinking water that is contaminated with faecal matter.</i></p>	<h3>WATER POLLUTION</h3> <p>Ghana's water supply - the lifeblood of our country - is in crisis because of this practice, which has been allowed to continue unchecked. The recent news of a 75% reduction in clean water supply to Cape Coast, Elmina and surrounding communities is a wake-up call, underscoring the alarming threat posed by illegal mining. This issue risks engulfing the entire country and reversing the progress we have made in providing clean water to everyone, everywhere."</p>
<h3>WATER POLLUTION</h3> <p>Before Now</p> <p>River Pra</p>	<h3>WATER POLLUTION</h3>
<h3>WATER POLLUTION</h3> <p>2004</p>	<h3>WATER POLLUTION</h3> <p>2015</p>



T H A N K Y O U!

Acknowledgment

- JICA
- AMU
- GHS
- Uboru Institute

Appendix 4. Day 2: Speakers' PowerPoint slides

Mr. Felix Mwarema (Naivasha Water and Sanitation Company)

<p>NAIVASHA WATER AND SANITATION COMPANY LTD (NAIVAWASCO) WASTEWATER MANAGEMENT</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>	<p>OVERVIEW</p> <ul style="list-style-type: none"> 01 Water Structure in Kenya 02 Waste Water Management 03 The STP Systems 04 Investment Opportunities 05 Outro <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>
<p>THE WATER ACT 2016</p> <p>National Level National Water Storage Authority (NWSA) Water Tribunal (formerly Water Appeal Board) (WTAB) Water Sector Trust Fund (formerly Water Services Trust Fund) (WSTF) Ministry of Water and Irrigation</p> <p>Regional Level Water Resources Authority (WRA) (formerly Water Resources Management Authority) (WRMA) Basin Water Resources Committee (BWRC) (formerly Catchment Area Advisory Committee) (CAAC) Water Services Regulatory Board (WASREB) Water Works Development Agencies (WWDA) (formerly Water Sanitation Boards) (WSB)</p> <p>Local Level Water Resources User Associations (WRUAs) Water Services Providers (WSPs) Consumers, Users</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>	<p>WATER STRUCTURE - COUNTY GVMT OF NAKURU</p> <ul style="list-style-type: none"> Develop and provision of water and sewerage services within the county as per the constitution Mobilise financial and other resources for water works development Put in place measures to secure the achievement of access to basic water and sanitation services within the county <p>NAIVAWASCO is an Agent of the CGN responsible for provision of water and sanitation services within Naivasha Sub-County</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>
<p>OVERVIEW OF NAIVAWASCO</p> <ul style="list-style-type: none"> Incorporated in 2005 Licensed and regulated by WASREB Mandated to supply water and sanitation services <p>Vision To realize a reliable, sufficient, high-quality water and sanitation services accessible within a reasonable distance</p> <p>Mission To continuously provide adequate high quality, affordable, accessible and sustainable water and sanitation services that exceed the needs and expectations of customers using contemporary technology.</p> <p>Slogan: WIFI you, better</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>	<p>LEGAL ENVIRONMENT</p> <ul style="list-style-type: none"> Incorporated under Company Act 2015 Cap 486 Operates within the existing legal structure Draws its Mandate under: <ul style="list-style-type: none"> Water Act 2016 Nakuru County Water Act 2021 PPMA 2012 BMCA 1999 PPMA 2019 County Government Act 2012 Other Acts governing public sector <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>
<p>SERVICE AREA-NAIVASHA SUBCOUNTY</p> <p>Map showing the service area of Naivasha Sub-County, including various wards and the location of Naivawasco's service area.</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>	<p>SANITATION VALUE CHAIN</p> <p>The diagram illustrates the sanitation value chain: CONTAINMENT (toilet) → EXFILLING (truck) → TRANSPORT (truck) → TREATMENT (plant) → RECYCLE/RE-USE (agricultural field).</p> <p>NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025</p>

NAIVAWASCO'S MANDATE

WATER SERVICE PROVISION
Abstraction, treatment, transmission and distribution of water.

WASTE WATER MANAGEMENT
Collection, transmission, treatment and disposal of sewage.

DEVELOPMENT
Development, maintenance and repair of county assets.

CUSTOMER RELATIONS
Establishing of customer connections & Enhancing customer relationships.

NAIVASHA WATER & SANITATION COMPANY LTD 9 Wednesday, March 5, 2025

THE TREATMENT PLANTS

History

- The STP**
 - Built in 1977
 - Designed to serve a population of 1700 persons
 - Treatment Design capacity – 1500 m³/day
 - Sources – industrial waste water, domestic waste water, municipal waste water, institutional waste water.
- The DTF**
 - Built in 2020
 - Treatment Design Capacity – 50 m³/day
 - Sources – Septic/pit faecal waste transported by Exhauster trucks.

NAIVASHA WATER & SANITATION COMPANY LTD 10 Wednesday, March 5, 2025

CHALLENGES

High Population growth rate in Naivasha – resulting in increased waste water available for treatment

A Centralized Treatment system resulting in low reach to other areas

Overstretched capacity of the STP resulting in low treatment efficiency and high operation costs

Outdated treatment methods resulting in low treatment efficiency and high operation costs

Financial constraint resulting in low infrastructural development of waste water services

NAIVASHA WATER & SANITATION COMPANY LTD 11 Wednesday, March 5, 2025

SOLUTIONS

Decentralize Treatment Systems

Increased financial investment in waste water management systems

Increased sewer reticulation systems in Naivasha

NAIVASHA WATER & SANITATION COMPANY LTD 12 Wednesday, March 5, 2025

INVESTMENT OPPORTUNITIES

SNO.	Block	Area Served	Reticulation network	Treatment Plant	Cost (Ksh.)	Cost (\$)
1	A	Upper Kayole, Kinamba, Karagita	123.42km	Proposed STP at KWS land	1,290,170,771.41	10,001,323.81
2	B	Hopewell, Buffalo mall, Naivasha town unserved areas	12.24km	Proposed STP at KWS land - Kibito	165,731,963.06	1,284,743.90
3	C	Mai-mahiu	38km	Proposed STP at KFS land - Mamahiu	387,709,391.85	3,005,499.16
4	D	Suberico, currently served areas	4.4km	Proposed STP at Naivasha town	46,705,149.93	362,055.43
Total					1,890,317,276.25	14,653,622.30

NAIVASHA WATER & SANITATION COMPANY LTD 13 Wednesday, March 5, 2025

BENEFICIARIES

SNO.	Block	Area Served	Beneficiaries
1	A	Upper Kayole, Kinamba, Karagita	235,000
2	B	Hopewell, Buffalo mall, Naivasha town unserved areas	4,500
3	C	Mai-mahiu	1,000
4	D	Suberico, currently served areas	40,000
Total			280,000 people

NAIVASHA WATER & SANITATION COMPANY LTD 14 Wednesday, March 5, 2025

NAIVAWASCO.... WITH YOU FOREVER!!
THANK YOU!

NAIVASHA WATER & SANITATION COMPANY LTD Wednesday, March 5, 2025

Ms. Mary Njoki (Naivasha Sub County)

<div data-bbox="316 383 662 450">  <p>County Government Of Nakuru</p> </div> <div data-bbox="311 459 699 526"> <p>SOLID WASTE MANAGEMENT- NAIVASHA</p> </div> <div data-bbox="311 568 558 649"> <p>MARY NJOKI ENVIRONMENT OFFICER- NAIVASHA SUBCOUNTY</p> </div>	<div data-bbox="833 378 995 409"> <p>OVERVIEW</p> </div> <div data-bbox="826 448 1315 495" data-label="Text"> <p>Nakuru County department of WEENRCC has 3 critical Acts and 1 bill to address environmental issues</p> </div> <div data-bbox="818 539 1329 649"> <div data-bbox="818 539 943 649">Nakuru County Waste Management Act 2021</div> <div data-bbox="943 539 1069 649">Nakuru County Climate Change Act 2021</div> <div data-bbox="1069 539 1203 649">Nakuru County Water and Sanitation Act 2021</div> <div data-bbox="1203 539 1329 649">Nakuru County Forest Management Bill</div> </div>
<div data-bbox="272 761 748 790"> <p>Nakuru County Waste Management Act 2021</p> </div> <div data-bbox="379 795 641 822"> <p>Role of the Department:</p> </div> <div data-bbox="266 857 783 1030"> <ul style="list-style-type: none"> Coordinate, promote and facilitate effective implementation of this act and policies, plans and strategies adopted on waste management; Coordinate and collaborate with national government's relevant lead agencies in waste management in the county; Enforce laws and guidelines related to waste management; Promote and facilitate compliance with this act and policies, plans and strategies adopted on waste management; In collaboration with relevant stakeholders carry out awareness creation, mobilization and capacity development on waste management; </div>	<div data-bbox="836 761 1311 790"> <p>Nakuru County Waste Management Act 2021</p> </div> <div data-bbox="944 799 1206 828"> <p>Role of the Department:</p> </div> <div data-bbox="810 833 1350 1030"> <ul style="list-style-type: none"> Mobilize and facilitate formation of local community or neighborhood initiatives or programs for waste management; Provide public services related to waste management; Supervise and coordinate private actors in waste management; Issue licenses required under this act; In collaboration with county treasury provide such incentives as may be necessary to promote community and private sector participation in sustainable waste management; Multi-sectoral approach on county solid waste management: this will involve departments, entities (public or private), or any other relevant agencies who have a role or stake in matters of solid waste management. </div>
<div data-bbox="376 1200 596 1227"> <p>NAIVASHA DUMPSITE</p> </div> <div data-bbox="236 1232 783 1456"> <p>Naivasha dumpsite is a county owned disposal facility which receives mixed municipal waste, the disposal site was started in 1998 and sits on a 4.382 ha piece of land. The site is managed through compaction and levelling of waste by use of county machinery. The county has:</p> <ul style="list-style-type: none"> deployed personnel to man the site, maintain tipping records and regulate entry and exit of vehicles secured the site with a gatehouse, boundary fence, toilet and a borehole conducted the required EIA report Conducted regular maintenance by levelling and compacting In partnership with a local firm, embraced the circular economy model to recover waste, create employment and curb environmental degradation. Developed the operation framework that guide on waste management </div>	<div data-bbox="853 1180 1297 1232"> <p>Private sector involvement in Solid waste management.</p> </div> <div data-bbox="802 1245 1339 1303"> <p>The County area of operation is: Management within the Central Business Districts (CBD) where it utilizes its own equipment and personnel to clean the areas, collect waste and dispose to the designated disposal sites.</p> </div> <div data-bbox="818 1310 1332 1426"> <ul style="list-style-type: none"> In the estates waste collection, transportation and disposal the services are offered through private service providers, contracted by Government to bridge in the gap. The groups involved in county solid waste management comprises: community based organizations (CBOs), youth groups, women groups and private entities. In this arrangement The County Government of Nakuru remains the supervisor, coordinator and regulator and ensures compliance of the contract by private solid waste service providers </div>
<div data-bbox="335 1585 692 1617"> <p>Advantages Of the PPP Model</p> </div> <div data-bbox="255 1637 774 1758"> <ul style="list-style-type: none"> Both the CGN and the Private Sector benefits from the partnership hence creating a win-win scenario Creates a robust system of employment Through the Integrated Solid Waste Management, pollution is minimized consequently leading to reduced GHG emissions and Global Warming The partnership helps in raising the awareness to the citizenry on matters solid waste and general environmental conservation </div>	<div data-bbox="836 1590 1165 1624"> <p>Alignment with the SDGs</p> </div> <div data-bbox="853 1646 1316 1870">  </div>

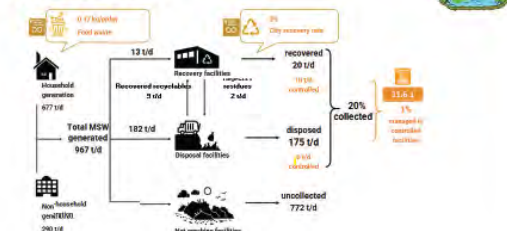
Waste SDG Indicators

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable	
Targets	Indicator
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	Proportion of municipal solid waste collected and managed in controlled facilities with regards to the total waste generated by the city
Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
Targets	Indicator
14.1 Index of coastal eutrophication and floating plastic debris density	Target 3: involving the development of internationally established methodology and standards

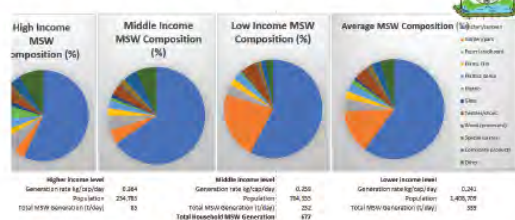
Goal 12: Ensure sustainable consumption and production patterns

Targets	Indicator
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.	Food loss Index Food Waste Index
12.4 By 2030, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment.	Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.	National recycling rate, tons of material recycled

Waste Flow



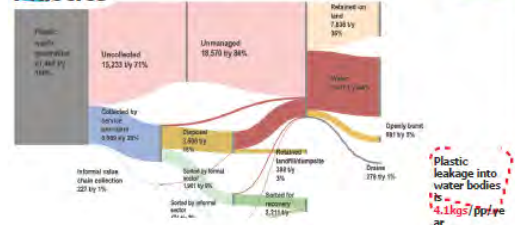
Household MSW Generation



Potential Recyclables

Types	Recyclable waste generation from households (t/d)
Food waste	407
Plastics dense	19
Plastic film	17
Paper and cardboard	28
Glass	6
Metal	9
Total	486

Waste Flow Diagram (WFD) for Plastics



Policy and financial gap Analysis

Why 80% of waste generated is NOT collected?

- Waste generators are adequately charged for collection services, but some are not willing to pay and opt for either discarding waste on land or in drains.
- Public disposition/behavior and awareness concerning the safe disposal of waste.
- Sporadic collection delays by the county trucks.
- Inadequate waste receptacles and transfer stations.
- The skips and trucks are sometimes not covered in transportation resulting in leakages.
- There is not sufficient equipment and PPE for workers such as street sweepers, drain cleaners, and manual loaders of collection vehicles.

Why is Waste Collection not adequately funded?

- The inability of the County Administration to exercise its full implementation of policy for revenue collection.
- Not all households pay for waste collection fees.
- Private collectors fees are largely determined by the operators themselves in an open competition framework and they may be hesitant to disclose the specifics of their collection fees.
- Businesses are only charged 60Ksh per single business permit (about 0.6 USD) annually, a fee intended to cover waste collection expenses.
- Environmental Management, SWM and Pollution Control shares an annual budget allocation for the financial year 2023-2024 of 176M and 105M for casual labourers
- For Nakuru to expand collection coverage from 20% to 100%, the financial resources entering the sector (either via fees or budgetary allocation) would need to be doubled or tripled (World Bank's What a Waste 2.0) suggests 45-115 USD/Tonne.



Why Waste Recovery is as low as 4%?

- Non-existence of Municipal MRFs/Transfer stations
- No source separation
- Almost 100% of recyclables supply is from the informal waste sector (done by waste pickers)
- A number/all informal waste collectors / intermediate traders are not licensed.
- There is not sufficient equipment and PPE for workers such as street sweepers, drain cleaners, and manual loaders of collection vehicles.



Waste Disposal – Open dumpin

Security	Is there boundary and access control allowing a single point of supervised access around the site	No	No
Water access	Is there any perimeter drainage maintained around the site	No	No
Slope stabilization	Are the slopes stabilized, mitigating the risk of landslide	No	No
Waste handling, containment value	Are waste trucks directed to a specific operational area of disposal	No	No
	Is there heavy mechanical equipment readily available	No	No
	Is waste layered and compacted within the specific operational area	No	No
	Is there some use of cover material	No	No
Fire control	Is there zero avoidance of burning waste on the surface of the landfill	No	No
Smelling	Are staff on-site during operational hours	Yes	Yes
Records	Is there a functional weighbridge in use	No	No
	Are there toilets and hand washing stations	No	No
EH&S	Are basic personal protective equipment in use	No	No



Areas of intervention:– Legislation, Finance, and Master plan.

- Strengthening the MSWM collection services through bylaws/ordinances for MSW collection in Nakuru:** The bylaw should mandate households and commercial entities to pay monthly waste collection fees to licensed operators. This should be based on a clear definition of waste collection services, determined fee structure, and associated penalties.
- Developing MSWM strategies and master plans** will be the first step for identifying areas of interventions in addition to regulatory frameworks. The plan can incorporate feasibility studies, benchmarking and/or business models for those interventions to be implemented.
- Strengthening waste collection by county government:** including purchase and proper maintenance of waste collection vehicles in Naivasha Municipality. PPE provision and tools for the workers, in addition to upgrading the design of waste collection vehicles with covers with tarpaulins or makeshift nets to prevent spillage of waste.



Areas of intervention: – Collection Coverage Improvement.

- Licensing waste collection groups and integrating the informal sector is a necessary process for formalizing the informal youth groups and CBOs who are engaged in waste collection and/or recovery activities. Register those CBOs and give licenses to charge for waste collection.
- Provision of a 'Community Resource Recovery Centre' to registered CBOs could go with licensing waste collection groups. Small-scale material recovery and transfer stations could be built and operated by licensed CBOs who sort and sell recyclables more efficiently. In town settings where households do not have gardens, those sites could be combined with small-scale bio-digester / containerized composting / black soldier flies and urban agriculture activities.
- Strengthening secondary waste collection by the County government, including the purchase of waste collection skips especially in Naivasha. PPE provision and tools for the workers, in addition to upgrading the design of waste collection vehicles with covers with tarpaulins or makeshift nets to prevent spillage of waste.



Community Resource Recovery Center



Home Composting Promotion

Promotion of home composting could be an effective measure to reduce MSW generation from households because more than 70% of household waste is organic. This could reduce the MSW generation to be collected by the county government drastically, saving the county government's budget for fuel and vehicle maintenance.



Sensitization and Source Separation

- Sensitization and awareness raising on the importance of MSWM,** especially on the no littering, segregation at source, home-composting, and importance of waste collection fee payment. School programs or painting of waste collection receptors with children, in addition to clean-up activities, could be organized and sensitization should also involve Mlangi Kumi and Jua Kali.
- Source separation.** The introduction of households to separate waste into wet and dry would support efficient resource recovery, allowing organic waste to be turned into compost and recyclable materials to be processed and reused. Communal collection points could introduce three collection containers – organic waste, recyclables, and residuals, for more efficient recovery of resources.




Disposal site improvement

• Turning Naivasha dumpsite into a "Basic" controlled disposal site, through the provision of the access road to Naivasha dumpsite, construction of cells, drainage, leachate collection and pond, etc.



Generation	Collection, Sorting and Transport	Recovery	Disposal
Policy Intervention <ul style="list-style-type: none">• Sensitization and awareness raising on the importance of MSWM• Source Separation• Hold regular stakeholders Dialogue Forums to strengthen the capacity of SWM actors.	Infrastructure Investment <ul style="list-style-type: none">• Strengthen MSWM Collection services through by-laws or ordinances• Licensing and capacity development for waste collection groups and integration of waste pickers.• Develop small-scale material recovery and transfer stations and licensed youth group to operate.• Develop network of medium to large MSWs and TSs for collection efficiency• Purchase and proper maintenance of collection vehicles	<ul style="list-style-type: none">• Develop MSWM strategies and master plans• tax exemption/subsidy scheme for private waste recovery companies to encourage registration• Establish a system to check on the control level of recovery facilities' operation regularly• Establish a Public-Private-Partnership scheme for the private sector's investment in waste recovery businesses• Establishment of collection points and small-scale recovery facilities• Develop decentralized community resource recovery facilities with small-scale material recovery and transfer stations and composting/anaerobic digestion in urban setting areas.• Develop small-scale material recovery and TSs in rural setting areas• Provide proper PPEs and access to social security schemes for workers (e.g. health care insurance, pension, etc.)	<ul style="list-style-type: none">• Improve operation control level at the dumpsite• Turning 'Mdeki' into "BASIC CONTROL".



County Government Of Nakuru

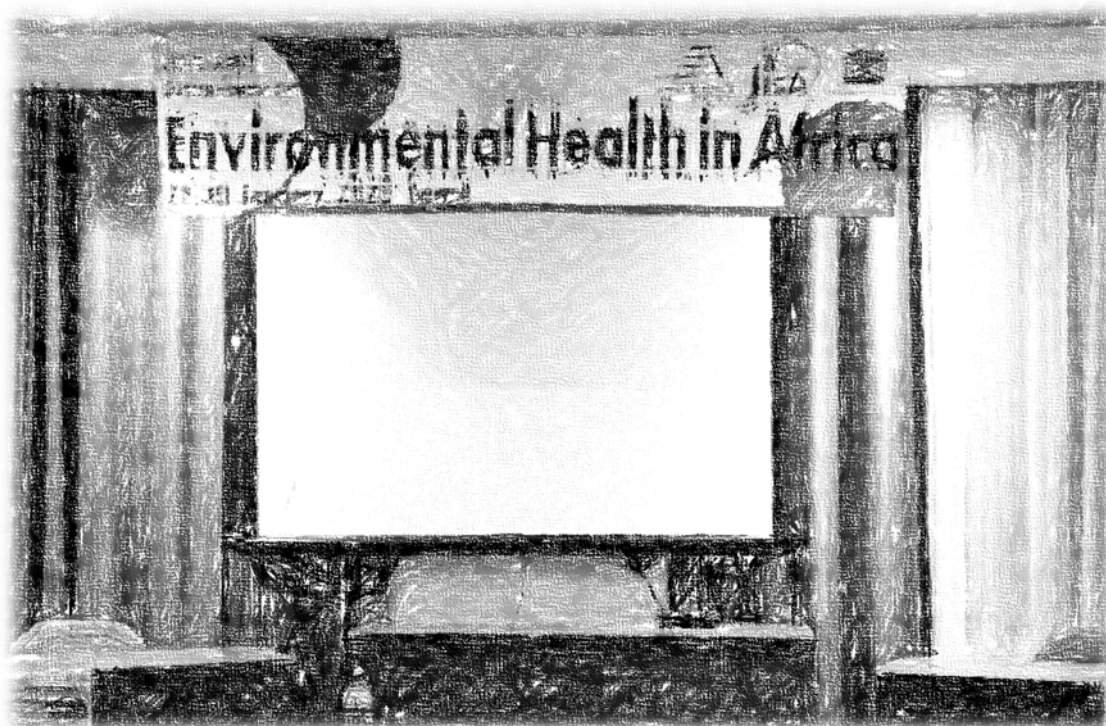
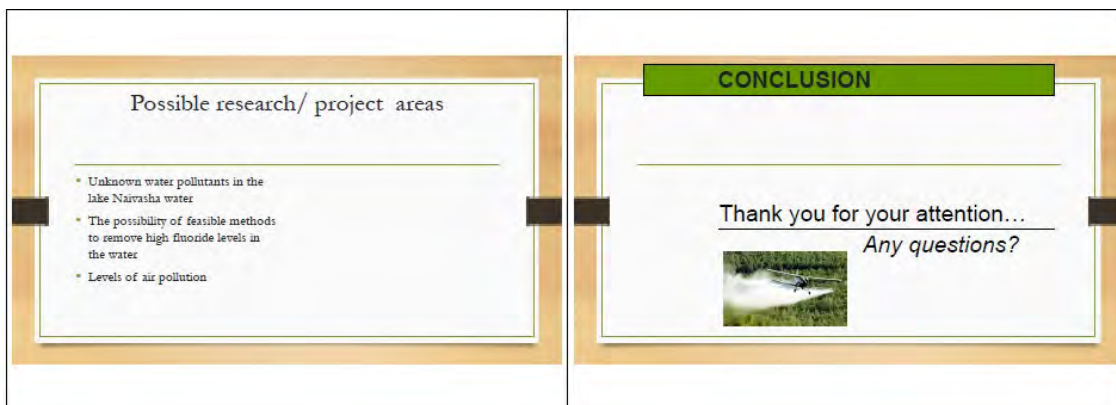
Thankyou!



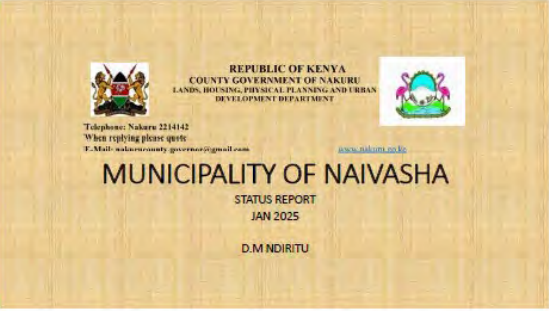

Ms. Margaret Kuibita (Department of Preventive Health Services, Nakuru County Government)







<h2 style="text-align: center;">ENVIRONMENTAL HEALTH NAIVASHA, KENYA</h2> <p style="text-align: center;">MARGARET KUIBITA SUBCOUNTY HEAD PUBLIC HEALTH SERVICES NAIVASHA</p>	<h3 style="text-align: center;">Overview of the Sub County</h3> <table border="1"> <thead> <tr> <th>Description</th> <th>Estimated Number</th> </tr> </thead> <tbody> <tr> <td>Population Total</td> <td>416,403</td> </tr> <tr> <td>Population Female</td> <td>209,034</td> </tr> <tr> <td>Population Male</td> <td>207,368</td> </tr> <tr> <td>Households</td> <td>12,409</td> </tr> <tr> <td>Population surviving infants (under 1 year)</td> <td>50,218</td> </tr> <tr> <td>Population under 5 years</td> <td>144,038</td> </tr> <tr> <td>Population under 15 years</td> <td>85,779</td> </tr> <tr> <td>Population 15-24 years</td> <td>115,761</td> </tr> <tr> <td>Women of childbearing age (15-49 years)</td> <td>169,059</td> </tr> <tr> <td>Population 25-59 years</td> <td>166,561</td> </tr> </tbody> </table> 	Description	Estimated Number	Population Total	416,403	Population Female	209,034	Population Male	207,368	Households	12,409	Population surviving infants (under 1 year)	50,218	Population under 5 years	144,038	Population under 15 years	85,779	Population 15-24 years	115,761	Women of childbearing age (15-49 years)	169,059	Population 25-59 years	166,561
Description	Estimated Number																						
Population Total	416,403																						
Population Female	209,034																						
Population Male	207,368																						
Households	12,409																						
Population surviving infants (under 1 year)	50,218																						
Population under 5 years	144,038																						
Population under 15 years	85,779																						
Population 15-24 years	115,761																						
Women of childbearing age (15-49 years)	169,059																						
Population 25-59 years	166,561																						
<h2 style="text-align: center;">BACKGROUND</h2> <p>HEALTH Sector The department comprises of three directorates i. Planning and Administration ii. Public health and sanitation iii. Medical Services Sector Vision and Mission Vision <i>A Healthy County</i> Mission <i>We provide integrated quality health services for all.</i></p>	<h2 style="text-align: center;">HEALTH SECTOR</h2> <p>FOCUS ON</p> <ul style="list-style-type: none"> • promotive health services • preventive services (environmental health) • curative services • rehabilitative services • human resource management. <p>WASH initiatives is prioritized under preventive health services.</p>																						
<h2 style="text-align: center;">Preventive health services (environmental health)</h2> <ul style="list-style-type: none"> • Lack of universal sanitation coverage • Food and water safety challenges • Medical Waste Disposal. <p>STRATEGIES</p> <ul style="list-style-type: none"> • Promote WASH initiatives and cross sectional collaboration. • Establishment of non-burning technology (biogas) and microwave machine at PGH • Environmental sanitation and pollution control • Enforcement and public awareness • Strengthen school health program • Collaboration and partnership • Operational research 	<h2 style="text-align: center;">Guiding policies and principles</h2> <ul style="list-style-type: none"> • International policies (SDGs, WHO), etc • Kenyan constitution (guarantee to safe • National government policies and statutes • County government policies and regulations • Nakuru county strategic plan <p>Examples</p> <ul style="list-style-type: none"> • Public health Act, Food Drugs and Chemical substances Act, The KESH policy 2013, The water Act, Nakuru county public health and sanitation Act 2017, sludge management regulations, etc 																						
<h2 style="text-align: center;">strategies</h2> <ul style="list-style-type: none"> • management of water and sanitation <p>Strategies to:</p> <ul style="list-style-type: none"> □ achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable □ Support and strengthen the participation of local communities in improving water and sanitation management 	<h2 style="text-align: center;">ACTIVITIES</h2> <table border="1"> <thead> <tr> <th>ACTIVITIES</th> <th>GAPs</th> </tr> </thead> <tbody> <tr> <td>• food and water quality control</td> <td>• A county food lab that can do extensive tests but can do more tests</td> </tr> <tr> <td>Inspection, sampling and analysis of all water sources and foods</td> <td>• Water quality issues</td> </tr> <tr> <td>• Environmental sustainability activities</td> <td>• Cost of water testing and logistic at the NPHL</td> </tr> <tr> <td>health care waste management and domestic waste management</td> <td>• Uncollected waste at the small towns</td> </tr> <tr> <td>Environmental sanitation</td> <td>•</td> </tr> <tr> <td>control of all environmental hazards</td> <td></td> </tr> <tr> <td>identification</td> <td></td> </tr> </tbody> </table>	ACTIVITIES	GAPs	• food and water quality control	• A county food lab that can do extensive tests but can do more tests	Inspection, sampling and analysis of all water sources and foods	• Water quality issues	• Environmental sustainability activities	• Cost of water testing and logistic at the NPHL	health care waste management and domestic waste management	• Uncollected waste at the small towns	Environmental sanitation	•	control of all environmental hazards		identification							
ACTIVITIES	GAPs																						
• food and water quality control	• A county food lab that can do extensive tests but can do more tests																						
Inspection, sampling and analysis of all water sources and foods	• Water quality issues																						
• Environmental sustainability activities	• Cost of water testing and logistic at the NPHL																						
health care waste management and domestic waste management	• Uncollected waste at the small towns																						
Environmental sanitation	•																						
control of all environmental hazards																							
identification																							

<div data-bbox="438 347 564 374" data-label="Section-Header"> <h3>milestones</h3> </div> <div data-bbox="287 400 718 546" data-label="List-Group"> <ul style="list-style-type: none"> • Development of policies to guide the various implementation of activities • Constitution of an coordination body (NACOSTEC) both at the county and subcounty level • Development of an inclusive CITYWIDE Inclusive sanitation strategy for Naivasha • Development of a SHIT FLOW DIAGRAM FOR Naivasha subcounty • A food and water quality control lab for the county </div>	<div data-bbox="933 371 1224 398" data-label="Section-Header"> <h3>GENERAL SANITATION</h3> </div> <div data-bbox="880 405 1319 582" data-label="List-Group"> <ol style="list-style-type: none"> 1. According to KIHBS 2015-16 most of the residents of Nakuru County dispose human waste through pit latrine which are covered which is at 76.9 percent. 2. Only 15.3 percent of the HH are connected to the main sewer (rest covered through outside sanitation facilities) 3. The number of HH with a place for hand washing near the toilet facility is at 18.6 percent. 4. Open defecation that was rampant in the rural areas is continuously being managed by the County and so far 326 villages (Naivasha has 188 villages and 183 have been declared open defecation free only 3 are remaining) across the county have been declared Open Defecation Free. 5. The increase of informal settlements, there are still cases of poor human waste disposal </div>
<div data-bbox="371 770 655 797" data-label="Section-Header"> <h3>WATER MANAGEMENT</h3> </div> <div data-bbox="301 804 708 974" data-label="List-Group"> <ul style="list-style-type: none"> * Water management by various institutions measures for sustainable use managed by The County water resource management and regulatory services are offered by Water Resource Management Authority (WRMA) and Rift Valley Water Services Board respectively. Further there are three County owned water service providers namely, Naivasha Water Sewerage and Sanitation Co. Ltd (NAIWASSCO), Nakuru Water Sewerage and Sanitation Co. Ltd (NARUWASSCO) and Nakuru Rural Water and Sanitation Co. Ltd (NARUWASSCO). Additionally other water supply schemes are managed by the community through their selected representatives and individuals </div>	<div data-bbox="841 705 1323 759" data-label="Section-Header"> <h3>Management of Health Care Waste in small and medium size health facilities</h3> </div> <div data-bbox="829 788 1074 952" data-label="List-Group"> <ul style="list-style-type: none"> Waste produced by small and medium rural health facilities is now collected and transported by a county health care waste collection vehicle Waste from private facilities is transported and taken to the hospital incinerator waste from flower farms is collected and taken to an incinerator by NEMA Licenced hazardous waste collectors </div> <div data-bbox="1085 759 1340 994" data-label="Diagram"> </div>
<div data-bbox="248 1149 539 1176" data-label="Section-Header"> <h3>Health care Waste Management</h3> </div> <div data-bbox="248 1198 553 1261" data-label="List-Group"> <ul style="list-style-type: none"> A medical waste treatment waste treatment microwave and shredder is used at the referral hospital A medical waste incinerator provided at the level 4, for medical waste treatment </div> <div data-bbox="248 1261 312 1279" data-label="Section-Header"> <h4>Challenges</h4> </div> <div data-bbox="248 1279 572 1299" data-label="Text"> <p>Diff transportation of waste from the rural facilities with difficult terrain</p> </div> <div data-bbox="240 1314 552 1435" data-label="Image"> </div> <div data-bbox="582 1126 782 1279" data-label="Image"> </div> <div data-bbox="582 1279 782 1435" data-label="Image"> </div>	<div data-bbox="914 1173 1235 1227" data-label="Section-Header"> <h3>Top ten diseases an indicator of environmental hazards</h3> </div>
<div data-bbox="343 1572 681 1628" data-label="Section-Header"> <h3>Sanitation marketing and stakeholder engagement</h3> </div> <div data-bbox="371 1608 732 1639" data-label="Text"> <p>Sanitation upgrading in rural and urban sanitation engagement urban</p> </div> <div data-bbox="303 1655 668 1794" data-label="Image"> </div>	<div data-bbox="874 1572 1278 1626" data-label="Section-Header"> <h3>Public engagement on environmental health issues</h3> </div> <div data-bbox="855 1628 1310 1805" data-label="Image"> </div>



Mr. Daniel Mbogo Ndiritu (Naivasha Municipality)

	<h3>Introduction</h3> <p>Municipality of Naivasha was established in April 2019 based on public participation and approval of the County Assembly of Nakuru, granting of the Municipal Charter, and establishment of the Municipal Board. The Municipality is established under article 48 of the Constitution, County Government Act section 148, Urban Areas and Cities Act 2011 (Amendment 2019) and other applicable laws.</p> <p>The Municipality covers seven(7) wards, six(6) in Naivasha Subcounty and one(1) in Gilgil Sub-county</p>
<h3>Municipality Boundaries</h3> 	<h3>Background Cont'd</h3> <p>In order to facilitate implementation of the Municipal functions outlined in the charter, the Board has developed and adopted the following key policy documents.</p> <ul style="list-style-type: none"> • 20yr Integrated Strategic Urban Development Plan (spatial plan) • 2) 5yr Integrated Development Plan (IDEP) • 3) 5yr Solid Waste Management Plan • 4) 21 no. draft reviewed by-laws • 5) Naivasha Regeneration Plan 2020 • 8) Performance contract
<h3>Functions</h3> <ol style="list-style-type: none"> 1. Promotion, regulation and provision of refuse collection and solid waste management services. 2. Promotion and provision of water and sanitation services and infrastructure (in areas within the Municipality not served by the Water and Sanitation provider) 3. Construction, Maintenance of Urban roads and associated infrastructure 4. Construction, Maintenance of storm drainage and flood controls 5. Construction, Maintenance of walkways and other non-motorized transport infrastructure 6. Construction, Maintenance of recreational parks and green spaces 7. Construction, Maintenance of street lighting 8. Construction, Maintenance and regulation of traffic controls and parking facilities 	<h3>Functions Cont'd</h3> <ol style="list-style-type: none"> 9. Construction, Maintenance of bus stands and taxi stands 10. Regulation of outdoor advertising 11. Construction, Maintenance and regulation of municipal markets and abattoirs. 12. Construction, Maintenance of fire stations, provision of firefighting services, emergency preparedness and disaster management. 13. Promotion and regulation of municipal sports and cultural activities 14. Regulation and provision of animal control and welfare 15. Enforcement of municipal plans and development controls 16. Municipal administration services (including maintenance of administrative offices) 17. Promoting infrastructural development and services within municipality. <p>• Any other functions as may be delegated by the County Government</p>
<h3>Infrastructure Projects</h3> <ol style="list-style-type: none"> i) Construction of 3.7Km Road in CCR, Site and Service and Kabati Estates Ksh 188m. ii) Construction of Naivasha Wholesale Market Phase I 149m iii) Construction of the Naivasha Wholesale Market Phase 2. 252m iv) Construction of Naivasha Municipality Park, improvement of Abutting Roads, Drainage, Paved Parking Bays and Non- Motorized transport. Ksh 69m. v) Construction to Bitumen standards of 2km roads in Lakeview estate Ksh 83.2m. vi) On-going Construction of sewer 600 meter sewer-bypass through Naivawasco 	<h3>On going Initiatives</h3> <ol style="list-style-type: none"> a) Phased delegation of functions to the Municipal Board in line with the Municipal Charter and UACA (Urban Areas and Cities Act) b) Harmonization of functions with County Departments and units c) Deployment of key technical staff in order to enhance technical capacity and service deliver through units of the Municipality Structure. d) Enhancement of Municipal budget support, capacity building and training of Municipal Board and Municipality staff e) Compliance with Minimum Conditions and Performance standards for the world bank funded KUSP 2 program.

<div>NAIVASHA MODERN MARKET</div> <div></div>	<div>NAIVASHA MUNICIPAL PARK PROJECT BRIEF</div> <div><ul style="list-style-type: none">• The project covered the following scope:• 1. Naivasha Municipal Park<ul style="list-style-type: none">❑ Construction of a perimeter wall❑ Construction of an ablution block❑ Construction of lawns and paved areas• 2. Abutting Roads<ul style="list-style-type: none">• a) Road 1 (70m)<ul style="list-style-type: none">❑ Construction of a walkway❑ Construction of a storm water drainage system• b) Road 2 (200m)<ul style="list-style-type: none">❑ Construction of a walkway & road❑ Construction of a storm water drainage system• c) Road 3 (200m)<ul style="list-style-type: none">❑ Construction of a walkway and parking bay❑ Construction of a storm water drainage system• d) Biashara Road<ul style="list-style-type: none">❑ Construction of a storm water drainage system❑ Construction of a parking bay</div>									
<div>Naivasha Municipal Park</div> <div></div>	<div>NMT, PARKING ,CABRO PAVING AND DRAINAGE</div> <div></div>									
<div>Lakeview Road</div> <div></div>	<div>CCR, Site and Service and Kabati Estate</div> <div>Construction of 3.7Km Road, drainages and NMT</div> <div></div>									
<div>Mama Ngina Street</div> <div>The project involved Construction of Drainage, Parking, Non -Motorised Transport and Beautification</div> <div></div>	<div>Proposed Projects</div> <table><tr><td>Proposed Naivasha Stadium</td><td>This is a flag ship project aimed at promotion of sport and cultural activities. Currently some partners have expressed interest in partnering with the County Government in the project.</td><td>Better Infrastructure/ Youth Development</td></tr><tr><td>Naivasha Waterfront Development.</td><td>This project is aimed at developing a Lake Naivasha Water front Leisure and Business Park at the former Livestock holding yard in Lakeview Ward.</td><td>Growing Trade and Business/Youth Development/Better Infrastructure/ Blue economy</td></tr><tr><td>Kenyatta gardens/ Kihoto grounds</td><td>The Municipal Board also intends to develop Kenyatta gardens/ Kihoto into a modern park with a football pitch, events ground, swimming pool, nature trails and other leisure and recreational facilities.</td><td>Youth Development/Better infrastructure</td></tr></table>	Proposed Naivasha Stadium	This is a flag ship project aimed at promotion of sport and cultural activities. Currently some partners have expressed interest in partnering with the County Government in the project.	Better Infrastructure/ Youth Development	Naivasha Waterfront Development.	This project is aimed at developing a Lake Naivasha Water front Leisure and Business Park at the former Livestock holding yard in Lakeview Ward.	Growing Trade and Business/Youth Development/Better Infrastructure/ Blue economy	Kenyatta gardens/ Kihoto grounds	The Municipal Board also intends to develop Kenyatta gardens/ Kihoto into a modern park with a football pitch, events ground, swimming pool, nature trails and other leisure and recreational facilities.	Youth Development/Better infrastructure
Proposed Naivasha Stadium	This is a flag ship project aimed at promotion of sport and cultural activities. Currently some partners have expressed interest in partnering with the County Government in the project.	Better Infrastructure/ Youth Development								
Naivasha Waterfront Development.	This project is aimed at developing a Lake Naivasha Water front Leisure and Business Park at the former Livestock holding yard in Lakeview Ward.	Growing Trade and Business/Youth Development/Better Infrastructure/ Blue economy								
Kenyatta gardens/ Kihoto grounds	The Municipal Board also intends to develop Kenyatta gardens/ Kihoto into a modern park with a football pitch, events ground, swimming pool, nature trails and other leisure and recreational facilities.	Youth Development/Better infrastructure								

Proposed Projects cont'd			Proposed Projects cont'd		
Kamere Water front development	Nairobi Municipality also prioritizes development of Kamere Beach into a dynamic smart modern park in conjunction with Kileleshwa and all other stakeholders.	Growing Trade and Business/ Youth Development/ Better Infrastructure/ Blue economy	Developing and commissioning of standard kiosks for small businesses	Municipal Board has designed standard kiosks for development along select streets targeting the lower end informal traders. They will create employment opportunities for the hustler nation as well as enhance the aesthetic beauty	Growing trade and businesses/ Clean Environment
11Km Mainaighu-Karuri St. Thoma-Cheruya to Maita Inn.	A ring road connecting 3 wards directly and 5 wards indirectly. It also connects Mainaighu, Karuri and Kileleshwa Market centers. Through the ring road most products from the new Nairobi suburbs will access larger market boxes. It also connects four major roads- Nairobi-Nairobi, Nairobi-Nairobi, Nairobi-Maitaighu and the Maita South Lake Road.	Better Infrastructure/ Growing trade and business	Beautification of the urban area (CBD)	Gardens, open spaces, trees, flowers, street lights and street furniture	Growing trade and businesses/ Clean Environment/ Health for all
Kileleshwa, Mainaighu, Karuri, Gilgil (Large Large) Road	This road will connect Nairobi and Gilgil Sub-Counties in the rural farming and livestock keeping areas. It will also open up small and big businesses including hotels. This road would be a game changer by connecting highly potential areas in Gilgil and Nairobi Sub-counties.	Better Infrastructure/ Growing trade and business/ food security and agro processing	Construction of new markets at Kinamba Karagita, Kamere and Kileleshwa	This will provide retail markets at ward and peri-urban areas.	Growing trade and business/ Youth Development
Affordable Housing	55 acres is available within the Municipality for the construction of houses under the affordable housing program. The Municipality will support the private sector to develop suitable housing infrastructure in support of the proposed industrial development at Othman, Othman, and the Nairobi Industrial Park.	Land and Physical Planning/ Better infrastructure/ Growing Business and Trade			
Proposed Projects cont'd			Proposed Projects cont'd		
Enhanced water supply and Sewerage expansion for Nairobi	Nairobi lacks adequate and safe drinking water as well as sewerage services. Out of estimated daily demand of 28000 Cubic Meters the Water Services Provider Nairobi Water only supplies 11,000 which is 39% of the demand. Only a third of the water consumers are connected with sewer. Nairobi water has 4000 times the WHO recommended fluoride levels in drinking water. This level of fluoride leads to weak bones among the youths thus denying specific job opportunities. There is potential for improved water supply from Proposed Malewa Dam and Kileleshwa and Kileleshwa Dams in Nyandarua County. The Municipality also targets sewer expansion.	Safe, Adequate Water and Clean Environment/ Growing Trade and Business/ Health for all/ Youth development and jobs for all.	Purchase of skip loaders and skip bins, Installation of waste/ litter bins	This is to enhance solid waste management.	Clean environment
			Road Construction, Foot Bridges, Drainage improvement, None Motorized Transports	Construction of 5km road, 10 Km Drainage, 10Km foot paths and 10KM NMT. Foot bridge at Maitani Primary and next to Municipal/ Sub-County offices	Better Infrastructure // Economic plan/ Growing trade and business/ Youth development/
			Construction of integrated public transport infrastructure	Partnership with Kenya Railways for a modern integrated public transport terminal. Development of modern Busparks, Matatu Terminus and Tuk Tuk and Motorbike shades	Land and physical planning/ Economic plan/ Growing trade and business/ Youth development/ Better infrastructure
Proposed Projects cont'd			THANK YOU		
Multipurpose hall for youth empowerment. Proposed Arena	Nairobi Municipal Board proposes a modern multi-purpose hall to foster talent development, public events	Youth development/ Growing trade and business			
ICT capacity and Digital mapping of the municipality,	Development of LDMs and GIS capacity for development control and mapping of essential services	Land and physical planning/ Economic plan/ Growing trade and business/ Youth development/ Better infrastructure.			
Construction of a modern fire station and emergency rescue centre	Disaster control and emergency response. Fire engine, fire station, ambulance and emergency response system.	Better infrastructure/ Youth Development/ Health for all			



Appendix 5. JICA-AMU Alumni Strategic Framework 2025-2030 (with signatures).

JICA-AMU ALUMNI STRATEGIC FRAMEWORK 2025-2030

A. INSTITUTIONAL DEVELOPMENT AND CAPACITY BUILDING

1. Formation of Alumni Institute

- Establish Africa Institute for Global Health Practice and Leadership
- Create regional and country representative structures
- Develop governance framework and operational guidelines
- Institute membership and volunteering mechanisms

2. Curriculum Enhancement

- Review and input into current JICA-AMU curriculum
- Rename program to "Health Leadership and Management"
- Develop hybrid training approach (Japan-Africa context)
- Integrate adaptive leadership and global health components

3. Academic Advancement

- Establish pathways for Masters and PhD programs
- Create certification programs for priority African health issues
- Support alumni research publication
- Develop alumni as subject matter experts/lecturers

B. KNOWLEDGE EXCHANGE AND COLLABORATION

1. Training and Development

- Implement satellite-based pollution analysis
- Develop short courses tailored to African context
- Utilize AI, technology, and telemedicine
- Create twinning programs between Japanese and African institutions

2. Research and Innovation

- Joint proposal writing for grants and funding
- Collaborative research projects
- Support for scientific publications
- Development of African solutions to African problems

3. Networking and Communication

- Create alumni database (186 participants)
- Establish WhatsApp groups and communication channels
- Conduct monthly virtual meetings
- Share best practices and experiences

C. STRATEGIC PARTNERSHIPS AND EVENTS

1. Continental Engagement

- Partner with local and regional health bodies
- Leverage other Japan-Africa support programs
- Create linkages between municipalities and prefectures
- Facilitate institutional twinning arrangements

2. Annual Events Calendar

- Africa Scientific Conference (rotating host countries)
- Regional alumni meetings
- Thematic workshops and seminars
- Environmental health and climate change symposiums

3. JICA Country Office Support
 - Local alumni convergences
 - Mobilization for umbrella body
 - Project implementation support
 - Resource mobilization

D. FOCUS AREAS AND PRIORITIES

1. Environmental Health
 - Pollution monitoring and analysis
 - Waste management
 - Climate change adaptation
 - One Health approach
2. Health Systems Strengthening
 - Leadership development
 - Management capacity building
 - Policy advocacy
 - Innovation and technology integration

E. IMPLEMENTATION FRAMEWORK

1. Immediate Actions
 - Form WhatsApp group and database
 - Establish interim steering committee
 - Draft institute constitution
 - Develop annual work plan
2. Medium-Term Goals
 - Launch institute
 - Begin short courses
 - Initiate research projects
 - Organize first scientific conference
3. Long-Term Vision
 - Establish center of excellence
 - Launch advanced degree programs
 - Create sustainable funding mechanisms
 - Build strong Japan-Africa health partnerships

JICA-AMU ALUMNI
30TH January 2025
At HYLISE HOTEL NAIVASHA.

DR. LEMAH-KENYA
SAMYER
DANIEL KAVOO SAN
JICA-AMU-KENYA
2009

Muradhi A.
Mummu

Dr. Harry Nigir
JICA-AMU 2019
+254738492774

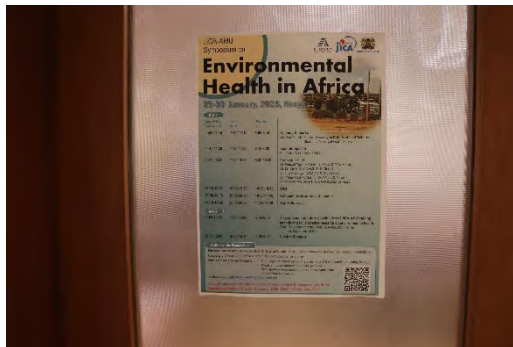
Beatrice Thaulo Mugo
JICA AMU 2022

Dr. Amabouyer CANARA
JICA - A 174 Senogard 2022

Dr. Piliro - Weri Mumbi
JICA - AMU 2022 (Maliaw)
+265996254545

Dr. Rueli Muriu
JICA-AMU-Kenya
2012
Elmasalami San - Sudan
JICA-AMU-2014
DR. CAROLINE KAVILU-KENYA 2014

Appendix 6. Snapshots



Final Report: IICA-AMU Symposium on Environmental Health in Africa, 29-30 January 2025, Kenya



Final Report: JICA-AMU Symposium on Environmental Health in Africa, 29-30 January 2025, Kenya





JICA-AMU:

Health System Management for Regional and District Health Management Officers

Asahikawa Medical University

31 March 2025
