WATER QUALITY AND PUBLIC HEALTH

PRESENTED BY:

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CSIR – WATER RESEARCH INSTITUTE

23RD FEBRUARY, 2017
PRESENTATION OUTLINE

- INTRODUCTION
- WATER QUALITY MONITORING
- WATER SOURCES IN GHANA AND COVERAGE
- PUBLIC HEALTH
- MAJOR RIVER BASIN IN GHANA
- STATE OF WATER QUALITY
- CHALLENGES
- RECOMMENDATIONS
INTRODUCTION

• Sustainable Development Goals (SDGs) has a universal goal of ending poverty, protecting the planet and ensuring that all people enjoy peace and prosperity.

• SDG 6 addresses the issues of drinking water, sanitation, hygiene, and the quality and sustainability of water resources worldwide.

• About 6.6 billion people in 2015 (91%) of the global population, used an improved drinking water source, whereas 663 million used unimproved water sources.
INTRODUCTION CONT’D.

• About 1.8 billion people in 2012 were exposed to drinking water sources contaminated with faecal matter.

• Globally, about 4.9 billion people in 2015 used an improved sanitation facility. However, 946 million people lacked adequate sanitation facilities.

• In 2011, 41 countries were said to have experienced water stress, hindering the sustainability of natural resources, as well as economic and social development.

Source: UN, 2016
WATER QUALITY MONITORING (WQM)

• Water quality describes the state of the water including its physical, chemical and biological characteristics with regards to its suitability for a particular purpose.

• Basic selected parameters used in assessing drinking water quality:
  - Physical (pH, Temperature, TDS, TSS, Colour Turbidity, Conductivity, etc.)
  - Chemical ($\text{NO}_3^-\text{N}$, $\text{NH}_4^-\text{N}$, $\text{PO}_4^-\text{P}$, BOD, COD, DO, etc.)
  - Bacteriological (Total coliform, Faecal coliform, $E.\text{coli}$, Total Heterotrophic bacteria, etc.)

• Institutions involved in WQM: WRI, GWCL, CWSA, WRC, PURC, etc.
MAIN WATER SOURCES IN GHANA

RAW WATER
➢ SURFACE WATER: River, Streams, Lakes & Reservoirs, Ponds
➢ GROUND WATER: Well, Boreholes, Spring
➢ RAINWATER

POTABLE WATER
➢ URBAN - GWCL
➢ RURAL - CWSA
DRINKING WATER SUPPLY AND COVERAGE

GHANA WATER COMPANY LIMITED REGIONAL COVERAGE (2007 – 2015)
Rural Water Coverage Trends - 2000 to 2014

SOURCE: CWSA, 2015
MAIN SOURCES OF DRINKING WATER (BY REGIONS)

Source: Ansa-Asare, 2016 (Data from GSS, 2010)
MAIN SOURCES OF DRINKING WATER SUPPLY IN GHANA

- Other sources
  Spring, Sachet water, Tanker supply/Vendor

- Natural Sources
  River/ stream, rainwater, dugout/pond/lake/dam/canal

Source: GLSS 6, 2016
Sources of drinking water in different regions (WHO & UNICEF 2013)
SANITATION COVERAGE IN GHANA (1990-2012)

Sanitation coverage

- 1990: 22% Open defecation, 42% Other unimproved, 29% Shared, 7% Improved
- 2012: 19% Open defecation, 59% Other unimproved, 14% Shared, 14% Improved

Urban Sanitation

- 1990: 13% Open defecation, 46% Other unimproved, 1% Shared, 20% Improved
- 2012: 72% Open defecation, 7% Other unimproved, 7% Shared, 1% Improved

Rural Sanitation

- 1990: 4% Open defecation, 20% Other unimproved, 29% Shared, 33% Improved
- 2012: 15% Open defecation, 44% Other unimproved, 8% Shared, 4% Improved

WaterAid, 2014
### BACTERIOLOGICAL QUALITY (E.Coli) OF DRINKING WATER QUALITY

<table>
<thead>
<tr>
<th>REGIONS</th>
<th>POTABLE (%)</th>
<th>NON POTABLE (%)</th>
<th>NUMBER OF HOUSEHOLDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WESTERN</td>
<td>45.6</td>
<td>54.4</td>
<td>104,092</td>
</tr>
<tr>
<td>CENTRAL</td>
<td>55.2</td>
<td>44.8</td>
<td>78,140</td>
</tr>
<tr>
<td>GREATER ACCRA</td>
<td>58.3</td>
<td>41.7</td>
<td>195,775</td>
</tr>
<tr>
<td>VOLTA</td>
<td>19.9</td>
<td>80.1</td>
<td>52,131</td>
</tr>
<tr>
<td>EASTERN</td>
<td>31.3</td>
<td>68.7</td>
<td>96,202</td>
</tr>
<tr>
<td>ASHANTI</td>
<td>32.4</td>
<td>67.6</td>
<td>193,389</td>
</tr>
<tr>
<td>BRONG AHAFO</td>
<td>26.4</td>
<td>73.6</td>
<td>60,187</td>
</tr>
<tr>
<td>NORTHERN</td>
<td>13.3</td>
<td>86.7</td>
<td>63,491</td>
</tr>
<tr>
<td>UPPER EAST</td>
<td>16.1</td>
<td>83.9</td>
<td>30,544</td>
</tr>
<tr>
<td>UPPER WEST</td>
<td>27.6</td>
<td>72.4</td>
<td>13,106</td>
</tr>
</tbody>
</table>

*Source: GLSS 6, 2016*
BACTERIOLOGICAL QUALITY OF DRINKING WATER (GWCL) IN THREE REGIONS (2012 – 2014)

Western Region (May 2012)
Western Region (August 2012)
Eastern Region (December 2012)
Eastern Region (April 2013)
Accra-Tema (April 2014)

Bacteriological Quality of Drinking water (%)

Regions

Source: WRI
SOURCES OF CONTAMINATION OF WATER DISTRIBUTION SYSTEM

- Infiltration of contaminants into the pipe-network
- Intermittent piped water supply
- Chlorine decay (low residual chlorine)
### CHOLERA CASES IN GHANA

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CASES</th>
<th>DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970 - 1980</td>
<td>1,546</td>
<td></td>
</tr>
<tr>
<td>1981 - 1990</td>
<td>2,258</td>
<td></td>
</tr>
<tr>
<td>1991 - 1999</td>
<td>1,067</td>
<td></td>
</tr>
<tr>
<td>2000 - 2012</td>
<td>627</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>10,628</td>
<td>105</td>
</tr>
<tr>
<td>2012</td>
<td>9,542</td>
<td>100</td>
</tr>
<tr>
<td>2013</td>
<td>Few reported cases</td>
<td>Nil</td>
</tr>
<tr>
<td>2014</td>
<td>28,975</td>
<td>243</td>
</tr>
<tr>
<td>2015</td>
<td>680</td>
<td>10</td>
</tr>
<tr>
<td>2016</td>
<td>896</td>
<td>Nil</td>
</tr>
</tbody>
</table>

> Cholera is diarrhoea disease caused by bacteria *Vibrio cholerae* from contaminated drinking water.

Source: WHO, 2015 ; DSU. 2016
CHOLERA CASES IN GHANA-2014

Distribution of cholera cases in Ghana by region, 2014

Source: WHO, 2014
Cholera cases reported to WHO by year and by continent 1989–2015

Source: Weekly Epidemiological Record, 2016, 91(35)

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TYPHOID FEVER CASES IN GHANA (2014-2016)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CASES</th>
<th>DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>334,103</td>
<td>515</td>
</tr>
<tr>
<td>2015</td>
<td>337,120</td>
<td>91</td>
</tr>
<tr>
<td>2016</td>
<td>384,454</td>
<td>183</td>
</tr>
</tbody>
</table>

Source: Disease Surveillance unit of Ghana Health Service, 2016

- Typhoid fever is an acute illness associated with fever caused by the *Salmonella typhi* bacteria.
FAECAL- ORAL DISEASE TRANSMISSION

The F-Diagram

- Feces
- Fluids
- Fields
- Flies
- Fingers
- Food
- New Host

Source: Wagner and Lanois, 1958
ASSESSING SURFACE WATER QUALITY

• Water quality is assessed in relation to concentrations of the various water quality variables present in the water, whether they are within water quality guideline values.

• Assessment can be by water quality Index (WQI).

• The WQI is a simple means of assessing water quality, by integrating values of key water quality variables into a single number from 0 to 100.
## WQI CLASSIFICATION & INTERPRETATION

<table>
<thead>
<tr>
<th>Class</th>
<th>Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&gt; 80</td>
<td>Good / Unpolluted</td>
</tr>
<tr>
<td>II</td>
<td>50 - 80</td>
<td>Fairly good</td>
</tr>
<tr>
<td>III</td>
<td>25 - 50</td>
<td>Poor quality</td>
</tr>
<tr>
<td>IV</td>
<td>&lt;25</td>
<td>Grossly polluted</td>
</tr>
</tbody>
</table>
Ghana shares the Volta River Basin with Burkina Faso, Togo, Côte d’Ivoire and Mali.
MAJOR RIVERS & BASINS – COASTAL SYSTEMS

Coastal river systems drain 8% of total area of Ghana

<table>
<thead>
<tr>
<th>Basin</th>
<th>Area km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kakum</td>
<td>867</td>
</tr>
<tr>
<td>Amisa</td>
<td>15,576</td>
</tr>
<tr>
<td>Nakwa</td>
<td>1,409</td>
</tr>
<tr>
<td>Ayensu</td>
<td>1,709</td>
</tr>
<tr>
<td>Densu</td>
<td>2,564</td>
</tr>
<tr>
<td>Accra Plains</td>
<td>6,000</td>
</tr>
</tbody>
</table>
MAJOR RIVERS & BASINS – SOUTH WEST SYSTEMS

Ghana shares the Bia and Tano River Basins with Cote d’Ivoire.

<table>
<thead>
<tr>
<th>Basin</th>
<th>Area km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bia</td>
<td>6,965</td>
</tr>
<tr>
<td>Tano</td>
<td>16,060</td>
</tr>
<tr>
<td>Ankrobra</td>
<td>8,366</td>
</tr>
<tr>
<td>Pra</td>
<td>23,188</td>
</tr>
</tbody>
</table>
STATE OF SURFACE WATER QUALITY – SOUTH WEST SYSTEM

Source: Ansa-Asare et al., 2015
STATE OF WATER QUALITY – SOUTH WEST

Pra at Twifo-Praso

Ankobra at Dominase
STATE OF SURFACE WATER QUALITY – COASTAL SYSTEM

Source: Ansa-Asare et al., 2015
STATE OF WATER QUALITY - COASTAL

Kakum at Brimso (Cape Coast)  Weija Reservoir, Accra
STATE OF WATER QUALITY – VOLTA SYSTEM

Main Volta at Kpong
GROUNDWATER QUALITY (UPPER EAST)

FLUORIDE

IRON
STATE OF SURFACE WATER QUALITY

• The pollution is attributable to human activities e.g. removal of vegetative cover, illegal mining, fertiliser use etc.

• The decrease in WQ over the years is mainly caused by turbidity, TSS, high nutrients (NO$_3$-N and PO$_4$-P), high BOD (Organic matter)

• Highest areas of poor water quality are found in mining and illegal gold mining areas in the southwestern river system.

• Volta system had relatively good quality waters, and less turbid water then the southwestern and the coastal system.
WATER QUALITY MONITORING CHALLENGES

• Budget challenges compromise monitoring objectives
• Discontinuity of monitoring at end of sponsored project
• Gaps in data due to unavailability of funds
• Difficulty in establishing trends
• Difficulty in using data for future predictions
• Resources constraints
• Obsolete laboratory facilities (not state of the art)
SOME CHALLENGES OF DRINKING WATER SUPPLIERS (GWCL)

• High repair works due to pipe burst
• Limited distribution lines
• High level of physical water losses
• High cost of new service connection
• Low capacity utilization for some of the plants
• Low investment
SOME CHALLENGES OF DRINKING WATER SUPPLIERS (CWSA)

• Water quality: High iron (Fe), manganese (Mn), fluoride (F) and salt content in groundwater.

• Spare parts

• Low investment
SOME RECOMMENDATIONS

• Investment in Research and Strengthening of human resource capacity in water and sanitation

• Frequent independent monitoring of drinking water sources and distribution lines

• Education /Dissemination of information on safe water & sanitation

• Extension of distribution networks to all consumers

• Mobilization of new investment for water systems

• Enactment in the building code, requiring all building plans to include rain water harvesting facilities and enforcing it.

• Government should promote partnership between the public and private sectors in the provision of water supply and sanitation services.
THANKS FOR YOUR ATTENTION