

# **ANNUAL DRINKING WATER QUALITY SURVEILLANCE REPORT 2020**

Royal Center for Disease Control  
MINISTRY OF HEALTH

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## 1. INTRODUCTION

According to United Nations "access to water and sanitation are recognized as human rights, reflecting the fundamental nature of these basics in every person's life. Lack of access to safe, sufficient and affordable water, sanitation and hygiene facilities has a devastating effect on the health, dignity and prosperity of billions of people, and has a significant consequences for the realization of other human rights". Bhutan as a member of United Nations and national water reference laboratory in Royal center for disease control is working hard to provide safe drinking water to every single household in the country. As Bhutan now has drinking water quality standard which describes the quality parameters set for the drinking water and maximum permissible limit for each of the set parameters. Such primary standards protect public health by limiting the levels of contaminations in the drinking water. In Bhutan, water supply systems are divided into two categories, the urban water supply system and rural water supply system. There are 34 urban health centers and 257 rural health centers identified as water quality surveillance centers. NWRL in RCDC in collaboration with National environmental commission, WHO and Ministry of work and human settlement works together for the continuous drinking water supply and most importantly safe drinking water by the activities such as conducting meetings among the collaborating partners, Trainings are also conducted for the trainers in Bhutan by the experts from other countries and NWRL also trains the laboratory staffs in urban centers and health assistant in rural centers to carry out the water quality testing. The water quality test results from the respective health centers are compared with the standard compliance values in Bhutan Drinking Water Quality Standard (BDWQS) 2016.

### 1.1 The general parameters that are currently monitored in Bhutan are:

#### 1.1a Parameters for Urban Health Centers

Sl.no	Parameters in BDWQS 2016(Urban)	Parameters tested
1	Color (TCU)	Thermo tolerant Coliform
2	Conductivity	Turbidity
3	Odor	pH
4	pH	Residual Chlorine
5	Taste	
6	Turbidity	
7	Calcium	
8	Free Residual Chlorine	
9	Iron	
10	Manganese	

<b>11</b>	Sulphate	
<b>12</b>	Fluoride(applicable to ground and spring Water only)	
<b>13</b>	Nitrate	
<b>14</b>	Arsenic(applicable to ground water only)	
<b>15</b>	E.COLI	

### 1.1b Monitoring Frequency

The monitoring is carried out once a month and reporting is made through Water Quality Monitoring Information System (WaQMIS) every month.

### 1.1c Parameters for Rural Health Centers

SL.NO	Parameters in BDWQS 2016(rural)	Existing Parameter
<b>1</b>	Conductivity	E.coli
<b>2</b>	Odour	
<b>3</b>	Appearance	
<b>4</b>	pH	
<b>5</b>	Taste	
<b>6</b>	Turbidity	
<b>7</b>	E.Coli	

Overall status RDWQM is carried out bi-annually (once in February-March and once in July-August) by 257 health centers from across the country. Unlike urban drinking water quality monitoring, currently only Escherichia Coli (E.Coli), appearance and odor are monitored for rural drinking water quality monitoring. E.Coli is tested using 3M Petri film E.Coli test kit.

For both urban and rural health center although there are several parameters as per BDWQS 2016, due to lack of equipment they are only able to perform few parameters.

### 1.2 ADHOC Testing:

Apart from the routine water samples NWRL also receives samples from private water service provider such as Mawongpa water solution, From Public to check their efficiency of new water filters at their homes, students for their research purposes and Projects such Gyalsung project that is ongoing.

## 2. Urban Drinking water quality surveillance:

### 2.1 Bacteriology (Thermo tolerant coliform):

Thermotolerant Coliforms are bacteria that can be introduced into drinking water supplies through human or animal feces. For water to be considered safe, Thermo tolerant Coliforms should not be detected in a 100mL sample of drinking water. If detected, it is an indication of the contamination of drinking water by feces and also suggests that other potentially-harmful microbes may be present. A total of 1289 samples were collected and tested for Thermo tolerant coliform from 34 urban health centers in the country for routine water quality surveillance. Out of which 46.6% of samples were found safe (0 CFU/100mL) and rest were found unsafe (>0 CFU/100mL Thermo tolerant Coliform).

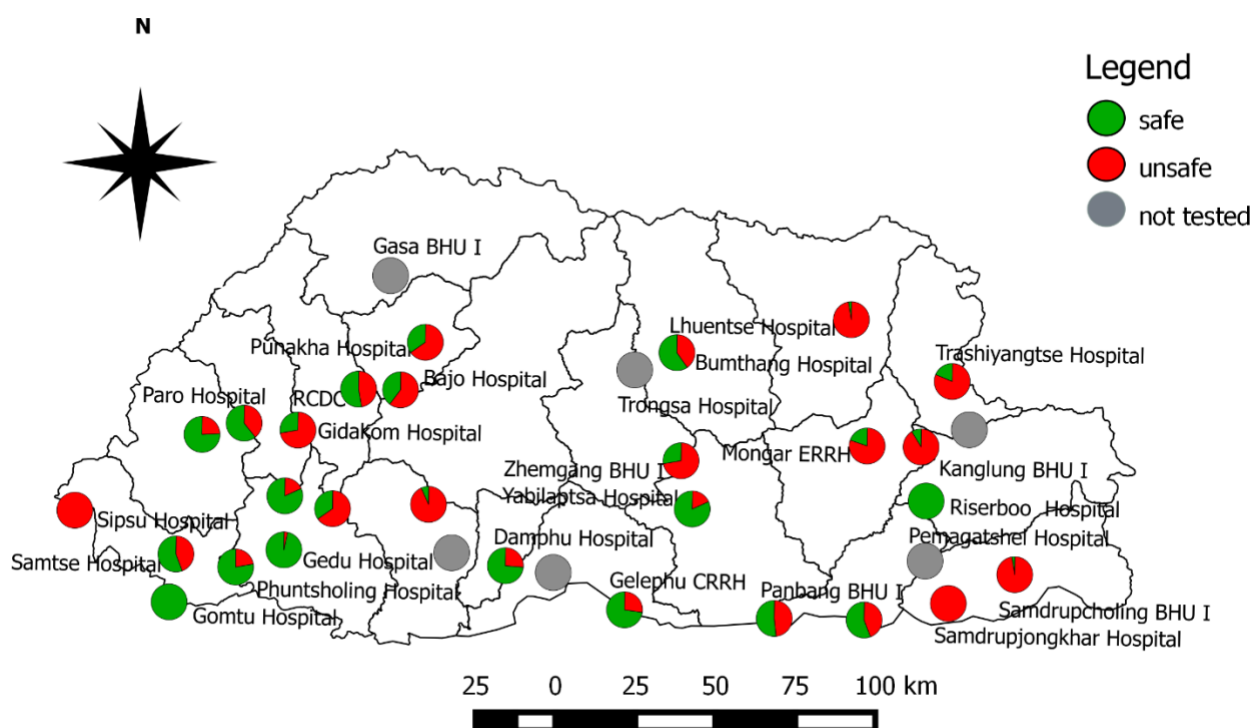


Figure1: Bacteriology test report of 34 hospitals/BHU-1 in urban area

The annual national surveillance data shows that out of 34 health urban health centers 28 healthcenters have tested and reported the result whereas 6 health centers has not reported. Out of 28 health centers that have reported, samples tested by Sibsoo BHU and Samdrupjongkhar hospital were found 100% unsafe. Similarly, reports from Lhuentse hospital, Dagana Hospital, Samdrupcholing BHUI and Kanglung BHUI reported more than 90% of the samples unsafe. (See figure1 and table1 for details)

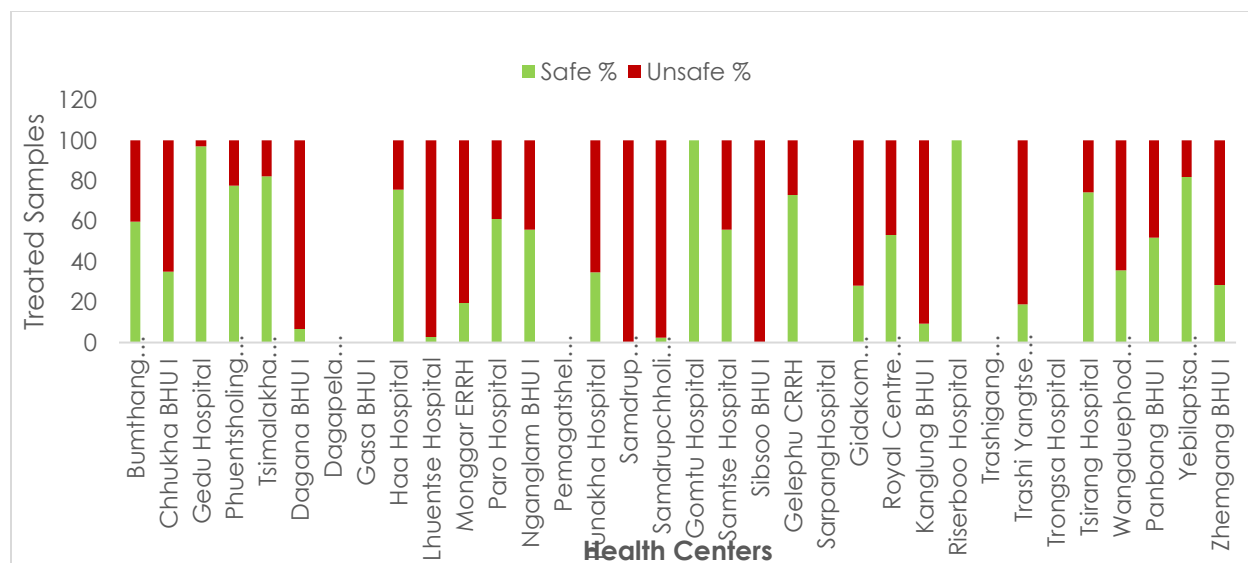


Figure2: quality of treated water from urban water supply

Table 1: Monthly water quality from various sampling points of urban health centers

Dzongkhag	Center	Total Sample s to be tested	Total Sample s Tested	Safe Water %	Unsafe water %	samples not tested	% Samples not Tested
Bumthang	Bumthang Hospital	84	55	60.0	40	29	35
Chhukha	Chhukha BHU I	48	20	35.0	65	28	58
Chhukha	Gedu Hospital	84	37	18.9	81.1	47	56
Chhukha	Phuentsholing Hospital	108	9	77.8	22.2	99	92
Chhukha	Tsimalakha Hospital	84	28	82.1	17.9	56	67
Dagana	Dagana BHU I	60	30	6.7	93.3	30	50
Dagana	Dagapela Hospital	60	0	0	0.0	60	100
Gasa	Gasa BHU I	48	0	0	0.0	48	100
Haa	Haa Hospital	60	45	75.6	24.4	15	25
Lhuentse	Lhuentse Hospital	72	72	2.8	97.2	0	0
Monggar	Monggar ERRH	84	76	19.7	80.3	8	10
Paro	Paro Hospital	96	54	61.1	38.9	42	44
Pemagatshel	Nganglam BHU I	60	25	56.0	44.0	35	58
Pemagatshel	Pemagatshel Hospital	72	0	0.0	0.0	72	100
Punakha	Punakha Hospital	72	72	34.7	65.3	0	0
Samdrup Jongkhar	Samdrup Jongkhar Hospital	120	10	0.0	100.0	110	92
Samtse	Samdrupchholing BHU I	60	40	2.5	97.5	20	33
Samtse	Gomtu Hospital	72	60	100.0	0.0	12	17

# Annual drinking water quality surveillance report 2020

Samtse	Samtse Hospital	108	95	55.8	44.2	13	12
Samtse	Sibsoo BHU I	72	36	0.0	100.0	36	50
Gelephu	Gelephu CRRH	204	85	72.9	27.1	119	58
Sarpang	SarpangHospital	72	0	0.0	0.0	72	100
Thimphu	Gidakom Hospital	48	32	28.1	71.9	16	33
Thimphu	Royal Centre for Disease Control	132	64	53.1	46.9	68	52
Tashigang	Kanglung BHU I	84	65	9.2	90.8	19	23
Tashigang	Riserboo Hospital	84	7	100.0	0.0	77	92
Tashigang	Trashigang Hospital	48	0	0.0	0.0	48	100
Trashi Yangtse	Trashi Yangtse Hospital	84	53	18.9	81.1	31	37
Trongsa	Trongsa Hospital	84	0	0.0	0.0	84	100
Tsirang	Tsirang Hospital	72	70	74.3	25.7	2	3
Wangduephodrang	Wangduephodrang Hospital	84	14	35.7	64.3	70	83
Zhemgang	Panbang BHU I	60	25	52.0	36.0	35	58
Zhemgang	Yebilaptsa Hospital	60	50	82.0	18.0	10	17
Zhemgang	Zhemgang BHU I	72	60	28.3	71.7	12	17

RED Highlights=100% unsafe

Yellow Highlights=>90% unsafe

Grey Highlights= Not Reported

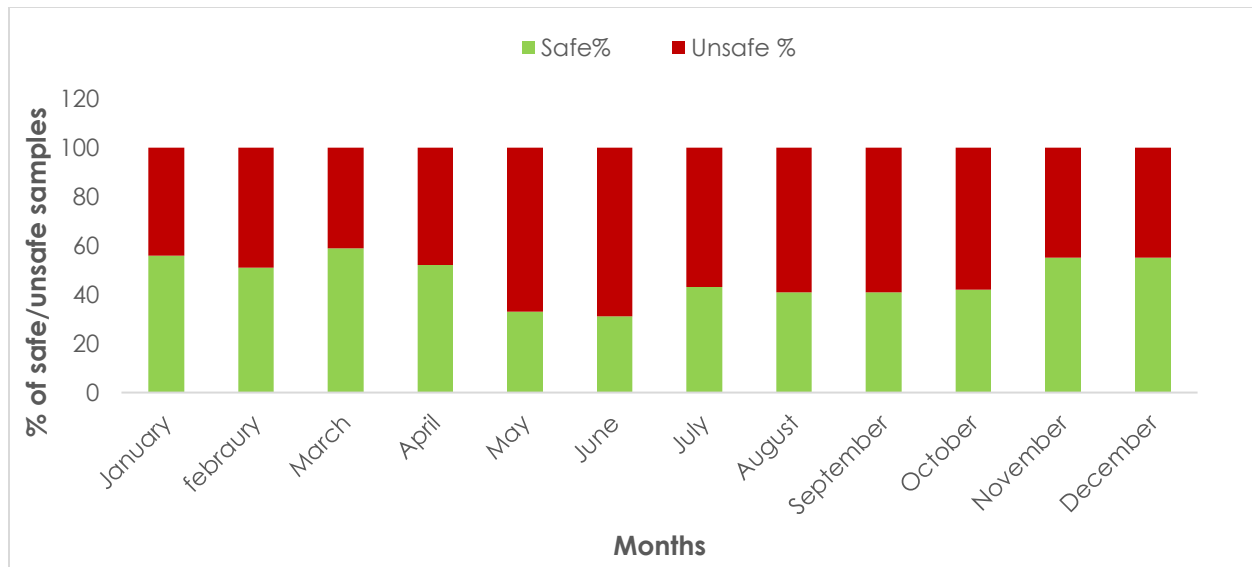


Figure 3: Seasonal variation of water quality (Based on Thermo tolerant coliform report)

The annual monthly graph for Thermo tolerant coliform indicates that the total number of unsafe water is comparatively higher during the months of May and June.



Table2: Consistency in reporting

Reporting Center	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	%
Bumthang Hospital	R	NR	R	R	R	R	R	NR	R	NR	R	NR	66.67
Chhukha BHU I	NR	R	NR	NR	R	NR	R	NR	NR	NR	R	R	41.67
Gedu Hospital	R	R	R	R	R	NR	R	NR	NR	NR	NR	NR	50
Phuentsholing Hospital	R	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	8.33
Tsimalakha Hospital	NR	NR	NR	R	R	R	R	NR	NR	NR	NR	NR	33.33
Dagana BHU I	R	R	R	R	R	R	NR	NR	NR	NR	NR	NR	50
Dagapela Hospital	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Gasa BHU I	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Haa Hospital	NR	R	R	R	R	R	R	R	R	NR	NR	R	75
Lhuentse Hospital	R	R	R	R	R	R	R	R	R	R	R	R	100
Monggar ERRH	R	R	R	R	R	R	R	R	R	R	R	NR	91.67
Paro Hospital	R	R	R	R	R	R	R	NR	NR	NR	NR	NR	58.33

Nganglam BHU I	NR	NR	NR	NR	R	NR	R	NR	R	R	R	NR	41.67
Pemagatshel Hospital	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Punakha Hospital	R	R	R	R	R	R	R	R	R	R	R	R	100
Samdrup Jongkhar Hospital	NR	R	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	8.33
Samdrupchholing BHU I	R	R	R	NR	NR	R	R	R	NR	R	R	NR	66.67
Gomtu Hospital	R	R	R	R	R	R	NR	R	R	R	R	NR	83.33
Samtse Hospital	R	R	R	R	R	R	R	R	R	R	R	NR	91.67
Sibsoo BHU I	R	NR	R	R	R	R	NR	NR	R	NR	NR	NR	50
Gelephu CRRH	R	R	R	R	NR	R	NR	NR	NR	NR	NR	NR	41.67
Sarpang Hospital	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Gidakom Hospital	R	R	R	R	R	R	R	NR	R	NR	NR	NR	66.67
Kanglung BHU I	R	R	R	R	R	R	R	R	R	R	R	R	100
Riserboo Hospital	R	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	8.33

Trashigang Hospital	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Trashi Yangtse Hospital	R	NR	R	R	R	R	R	NR	R	R	NR	NR	66.67
Trongsa Hospital	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0
Tsirang Hospital	R	R	R	R	R	R	R	R	R	R	R	R	100
Wangduephodrang Hospital	NR	R	R	NR	NR	NR	NR	NR	NR	NR	NR	NR	16.67
Panbang BHU I	R	NR	R	R	NR	NR	NR	R	R	NR	NR	NR	41.67
Yebilaptsa Hospital	R	R	R	R	NR	R	R	R	R	NR	R	R	83.33
Zhemgang BHU I	R	R	R	R	R	R	R	NR	R	R	R	NR	83.33
Royal Centre for Disease Control	R	R	R	NR	NR	NR	NR	NR	NR	R	R	R	50

Note:R=Reported

NR=Not reported

## 2.2 Physio-Chemical report

### 2.2a Turbidity

Turbidity is a measure of the cloudiness of the water caused by suspended particles or colloidal matter. It indicates the effectiveness of the treatment plants. Although turbidity may not have direct health effect it may have a negative impact on consumer acceptability.

A total of 1094 samples were monitored for turbidity from 34 urban health centers for routine water quality surveillance. Out of which 96.4% of the samples were found within acceptable limit (<5NTU).

The figure indicates maximum number of turbid samples were observed in May, June, July, September and October.

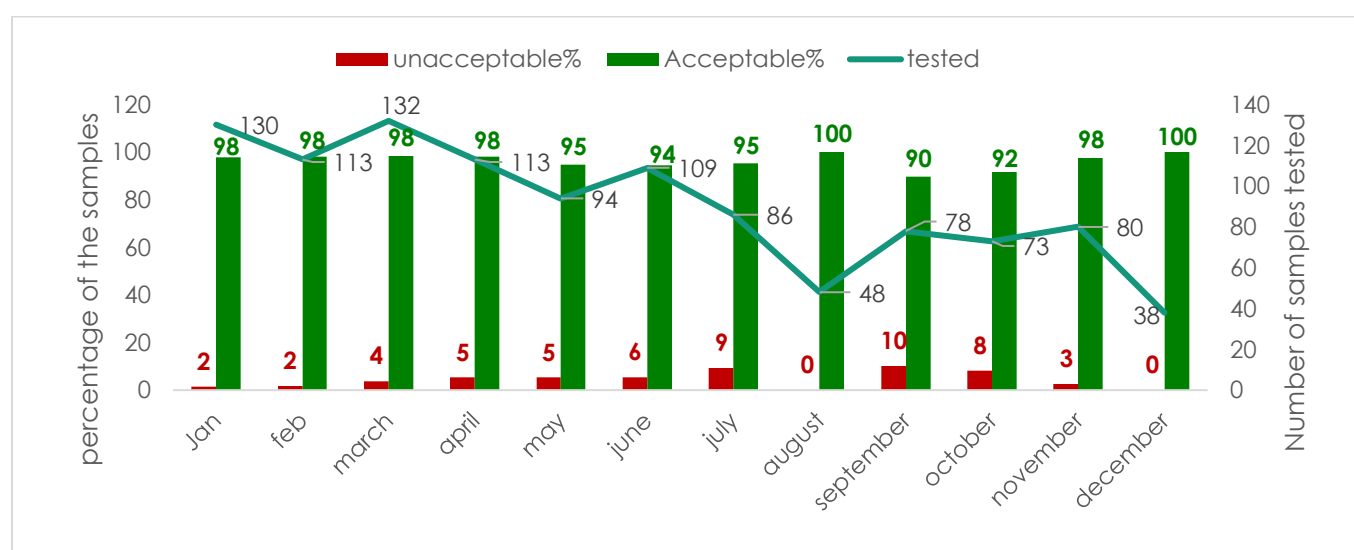


Figure4: Seasonal variation of turbidity from 34 health centers

Table3: Turbidity Compliance

Reporting Center	Compliant	Non compliant
Bumthang Hospital	51	3
Chhukha BHU I	18	2
Gedu Hospital	37	0
Phuentsholing Hospital	9	0
Tsimalakha Hospital	28	0
Dagana BHU I	0	0
Dagapela Hospital	0	0
Gasa BHU I	0	0
Haa Hospital	8	0
Lhuentse Hospital	0	0

Monggar ERRH	67	0
Paro Hospital	42	0
Nganglam BHU I	15	0
Pemagatshel Hospital	0	0
Punakha Hospital	68	0
Samdrup Jongkhar Hospital	10	0
Samdrupchholing BHU I	39	1
Gomtu Hospital	59	0
Samtse Hospital	95	0
Sibsoo BHU I	36	0
Gelephu CRRH	84	0
Sarpang Hospital	0	0
Gidakom Hospital	29	0
Royal Centre for Disease Control	62	2
Kanglung BHU I	64	1
Riserboo Hospital	0	0
Trashigang Hospital	0	0
Trashy Yangtse Hospital	42	0
Trongsa Hospital	0	0
Tsirang Hospital	71	0
Bajo Hospital	13	0
Panbang BHU I	25	0
Yebilaptsa Hospital	36	1
Zhemgang BHU I	53	7

### 2.3 pH

The allowable range for pH is 6.5 to 8.5 as per BDWQS. Out of 1803 samples tested only 2.5% of the samples were found non-compliant. The highest pH tested was found to be 9 and the lowest value was tested 5. (Name of the water supply)

### 2.4 Chlorine

Out of 34 urban reporting centres, only six health centers (Bajo, Bumthang, Gelephu, Phuntsholing, Thimphu and Samtse) monitor chlorine level in drinking water as there are no treatment facilities or non-functional treatment facilities. A total of 443 treated water samples were tested for Residual Chlorine and only 67.3% were inadequately (0.2-0.5ppm free residual chlorine) chlorinated. (Figure 5).

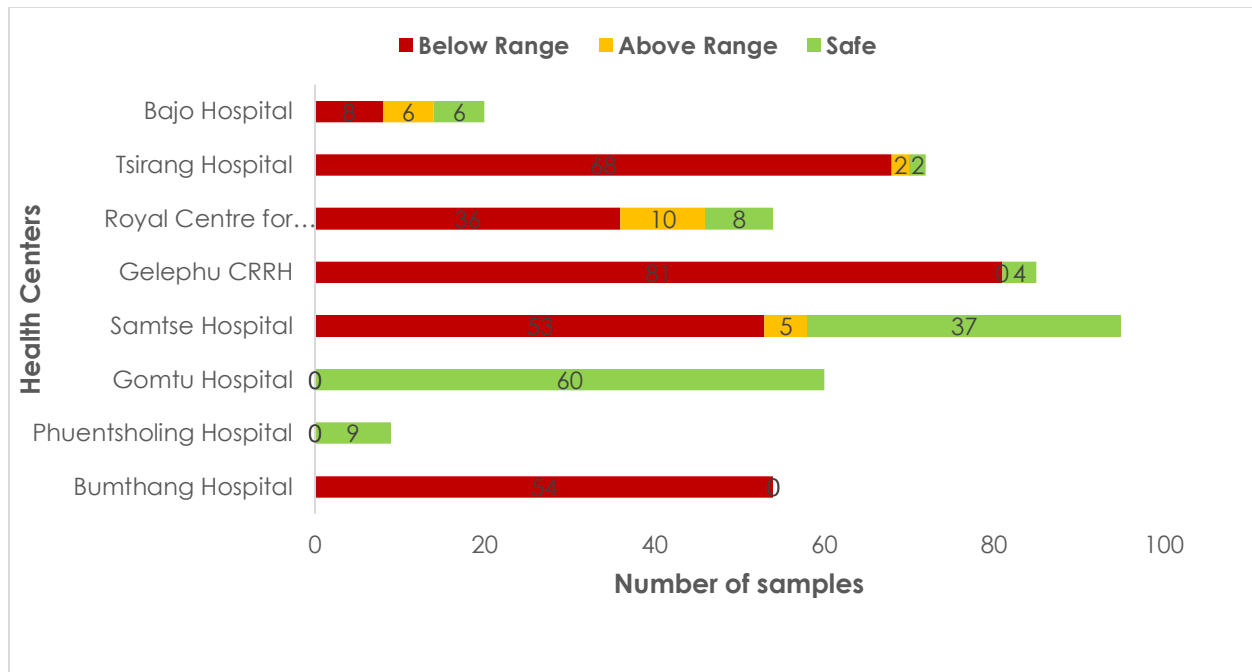


Figure 5: Residual Chlorine maintained at different urban drinking water treatment facilities

### 3.Rural Drinking Water Quality Monitoring (RDWQM)

#### 3.1 Report

A total of 1802 samples were collected and tested for E. coli and 24.98% were found to be unsafe for consumption. From the unsafe water samples 21.28% is of low health risk category, 2.9 % is intermediate to high health risk and 0.8% were grossly polluted (Detailed health risk category of the samples are shown in figure 6).

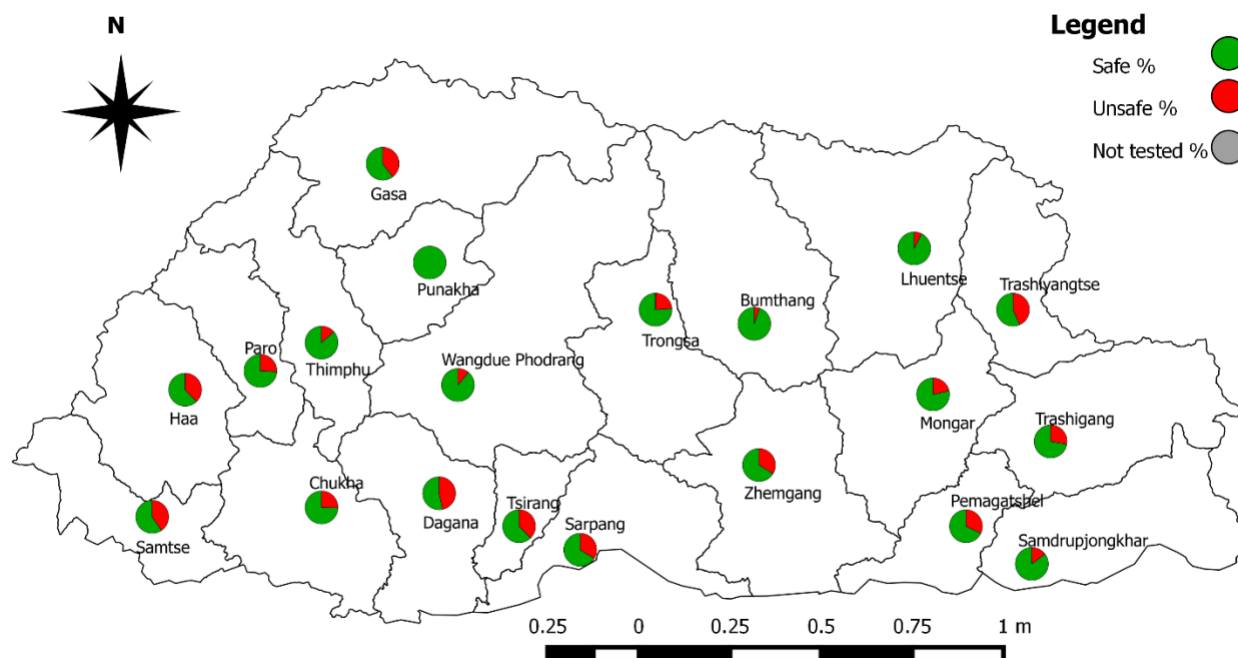


Figure6: Overall rural drinking water quality in terms of Thermotolerant coliform at dzongkhag level

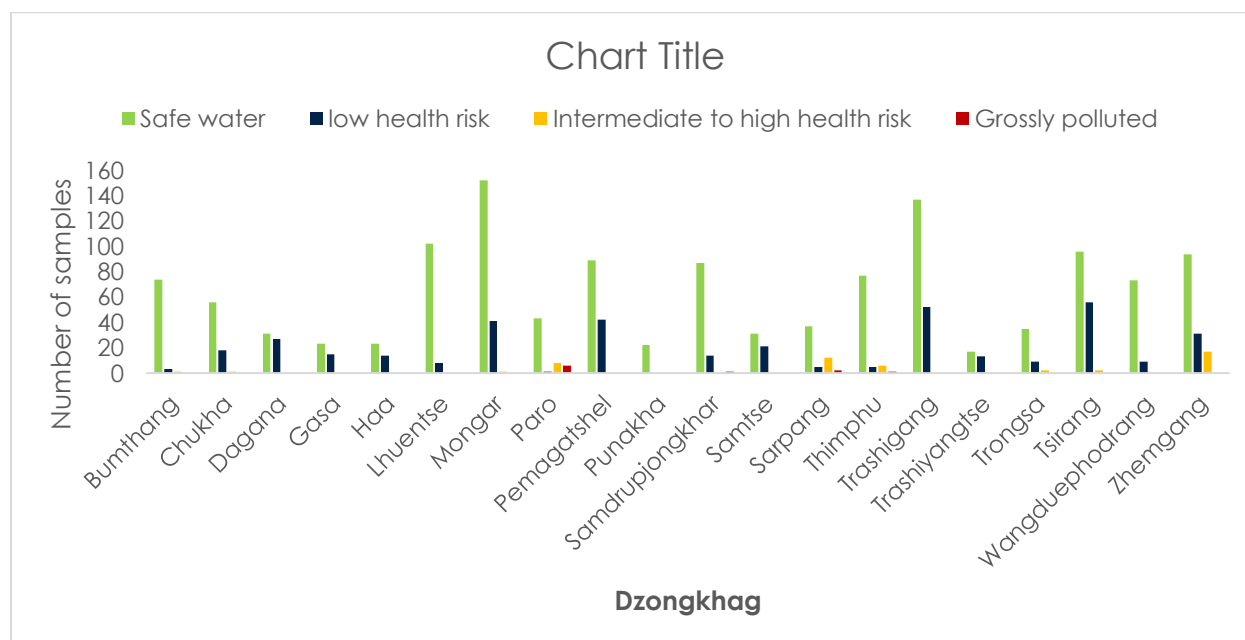


Figure7: Health risk category of the water quality results from different dzongkhags

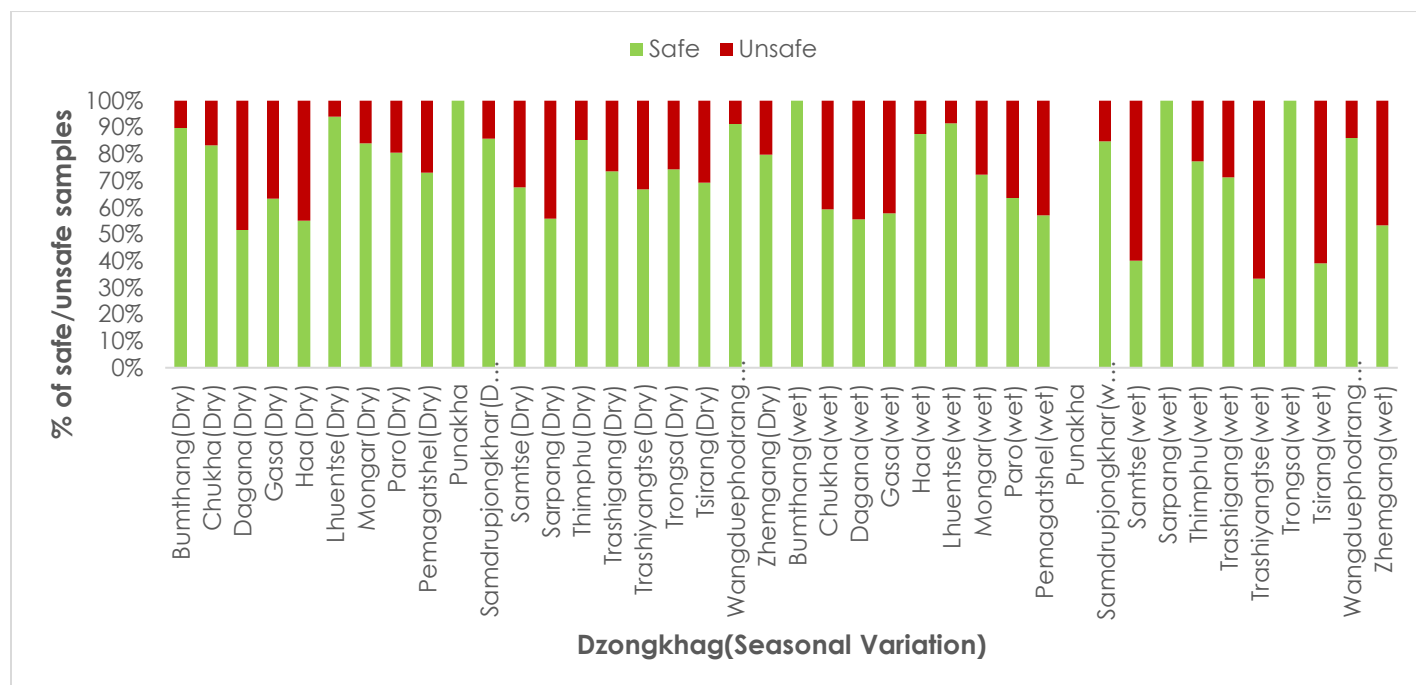


Figure8: Seasonal variation of rural drinking water quality

Table4: Seasonal variation of water quality in rural area

SL.NO	Dzongkhag	Safe(Dry)	UnSafe(Dry)	safe(Wet)	Unsafe(Wet)
1	Bumthang	35	4	39	0
2	Chukha	40	8	16	11
3	Dagana	16	15	15	12
4	Gasa	12	7	11	8
5	Haa	16	13	7	1
6	Lhuentse	48	3	54	5
7	Mongar	84	16	68	26
8	Paro	29	7	14	8
9	Pemagatshel	65	24	24	18
10	Punakha	22	0	0	0
11	Samdrupjongkhar	48	8	39	7
12	Samtse	25	12	6	9
13	Sarpang	24	19	13	0
14	Thimphu	75	13	82	24



<b>15</b>	<b>Trashigang</b>	75	27	62	25
<b>16</b>	<b>Trashiyangtse</b>	14	7	3	6
<b>17</b>	<b>Trongsa</b>	32	11	3	0
<b>18</b>	<b>Tsirang</b>	43	19	18	28
<b>19</b>	<b>Wangduephodrang</b>	42	4	31	5
<b>20</b>	<b>Zhemgang</b>	55	14	39	34

#### **4.Conclusion:**

A total of 3091 samples, 1289 from urban and 1802 from rural were tested for E.Coli in the year 2020. 46.6% of the 1289 samples from urban and 74.6% of 1802 samples from rural is found to be safe for consumption. The number of reported samples has decreased by 23% compared to the previous year (2019). Health centres like Dagapela, Gasa, Pemagatshel, Sarpang, Trashigang and Trongsa has not submitted a single test result. However, Lhuentse, Punakha, Kanglung and Tsirang has 100% test results.

443 treated water samples were tested for free residual chlorine by the six urban health centres and more than 50% (67.3%) were inadequately (0.2-0.5ppm free residual chlorine) chlorinated. Rest of the 34 urban health centres and rural health centres does not monitor free residual chlorine level in the drinking water. The reasons could be due to no treatment facilities or non-functional treatment facilities.

A total of 1094 samples were monitored for turbidity from 34 urban health centers for routine water quality surveillance. The least number of samples were tested for the month of August and December compared to the rest of the month and it is found that the all the tested samples were 100% within the acceptable limit. The highest number of samples were tested in January, February, March and April. The maximum number of turbid samples was observed in the rainy seasonal months such as May, June, July and September.

#### **5.Limitation of the report**

1. All the data are collected from Water Quality Monitoring Information System (WaQMIS)
2. Some health centers have not reported consistently
3. Some dzongkhags have more health centers and consequently more sampling stations compared to other districts.
4. Some of the water monitoring sites have private water sources (eg.in some schools). This report includes all the water samples monitored by surveillance sites both urban water supply and private water supplies.
- 5.Since many of staff got engaged in covid duty the test could not be performed for drinking water quality hence, decrease in the number of reported samples.

## 6.Recommendation

As per the report the following are some of the critical recommendations:

- A.** Report and data demands responsible DHO to update themselves on water quality report regularly of all the health centres and also do necessary follow up with the noncompliance.
- B.** Similarly officials from all the health centres should also make sure the reports are timely submitted.
- C.** The report also depict that there are only 6 health centres monitoring the free residual chlorine in drinking water currently and therefore it recommends the concern agency (national environmental commission) to put up chlorination facility in rest of the district health centres.
- D.** In case of any breakdown of the testing equipment or insufficiency of any testing reagents, the responsible person should inform RCDC.

## Reference:

<https://unsceb.org/sites/default/files/2020-12/UN-Water-2019-Annual-Report.pdf>

<http://www.rcdc.gov.bt/web/wp-content/uploads/2020/07/National-Guideline-for-Drinking-Water-Quality-Surveillance-V1.pdf>

[http://www.rcdc.gov.bt/web/wp-content/uploads/2021/03/Annual\\_Drinking\\_Water\\_Quality\\_Surveillance\\_Report\\_2019.pdf](http://www.rcdc.gov.bt/web/wp-content/uploads/2021/03/Annual_Drinking_Water_Quality_Surveillance_Report_2019.pdf)