



40 minutes total

## Lesson Plan 18

# Evaluating a Laboratory Report

### Overview of Activities

1. Introduction
2. Laboratory Report Basics
3. Evaluating a Lab Report
4. Review

### Learning Outcomes

At the end of this session participants will be able to:

1. Explain the essentials of a laboratory report
2. Evaluate a basic drinking water quality lab report

### Materials & Preparation

- Activity: Introduction
- Handout: Introduction Activity: Sample Lab Report, see end of lesson, (one page per group). Note: report is unreadable.
- Activity: Laboratory Report Basics (Graffiti Wall)
- Flip chart paper with the following headings: Units Of Measure, Microbiological Indicators, Chemical Parameters (including symbols), Acceptability Parameters, Acronyms, Comparative Standards, Time Limits For Tests
- Flip chart markers (to prevent bleedthrough onto the wall)
- Activity: Evaluating a Lab Report
- Handout: Sample Water Quality Lab Report. See end of lesson (one page per participant) Note: If possible substitute a lab report from a local source.

### Recommended Reading

- None

5 minutes



## Introduction

1. Tell participants to imagine they work for a non-governmental organization (NGO) that has drilled several boreholes. They have sent samples to a laboratory to test the water quality and have just received the laboratory report. They must now interpret the report.
2. Ask participants to find a partner.
3. Pass around copies of the Introduction Activity Sample Lab Report and ask for their assessment of the report.
  - *The laboratory report is unreadable*
  - *Can't understand the report*
4. Present the learning outcomes or an overview of the lesson.

20 minutes



## Laboratory Report Basics

1. Explain that laboratory reports have their own language, and in order to understand the reports they will have to use what they have learned in the workshop.
2. Tape flip chart paper with topic headings around the room for the Graffiti Wall activity. (Units Of Measure, Microbiological Indicators, Chemical Parameters (including symbols), Acceptability Parameters, Acronyms, Comparative Standards, Time Limits For Tests)
3. Divide participants into groups of 3-4 people.
4. Ask each group to start at a different piece of flip chart paper and write down (with markers) everything they know or remember about that topic.
5. After 1-2 minutes, tell the groups to move clockwise to the next piece of paper. They should read what the previous groups wrote, and add only new ideas that have not yet been written.
6. Continue until each group has written on each topic.
7. Ask groups to circulate around the room and read all the pages.
8. Debrief with the whole group and discuss any ideas that were incorrect or missing.
9. Review new acronyms and terms sometimes used in laboratory reporting:
  - MCL – Maximum Contaminant Level, the highest level of a substance allowed in drinking water (set by National Standards)
  - SMCL – Secondary Maximum Contaminant Level, non-enforceable limits that include acceptability parameters such as taste and odour
  - ND or nd — not detected
  - FTU — Formazin Turbidity Unit a measure of turbidity equal to NTU (uses different test methods)

- AL – Acceptable limits (according to local standards or guidelines)
- BDL – Below detection limit

10. Discuss common microbiological data found in lab reports and the significance.

- Total coliforms (TC) – not specific to fecal contamination therefore not very useful except in a broad sense. Total coliforms are also found in soil and vegetation.
- Thermotolerant coliforms (TTC) and fecal coliforms (FC) – mean the same thing, and names are often used interchangeably, a better indicator of fecal contamination.
- E. coli – best indicator of fecal contamination, internationally recognized standard for indicator organisms.

10 minutes

## Evaluating a Lab Report



1. Hand out the Sample Water Quality Lab Report to each participant.
2. Use the sample report as a guide to discuss elements commonly included in lab reports.
  - Test parameter
  - Units of measurement (ppm, ppb, mg/L etc.)
  - Test results
  - Comparative standards (National Standards or Guidelines, WHO guidelines)
  - Date of sampling and testing (remember that microbiological samples must be tested within six hours and anything over 24 hours is not acceptable)
  - Sometimes the method or instrument used for testing
  - Sometimes the method detection limit (refers to the sensitivity of the instrument used for testing)
  - Sometimes the symbols for the chemical elements being tested: e.g., Fe = Iron; Nitrate =  $\text{NO}_3^-$ ; Mn = Manganese
  - Indicators of above or below recommended limit or range
  - Comments or notes
  - Recommendations for results that do not meet the standards
  - Signature and date of report
3. Ask: “What elements of the report stand out to you?” Allow two minutes to evaluate the report.
  - **Iron levels are significantly above acceptability limits (this is the most significant result of this report)**
  - Consumers are not likely to use this well for either clothes washing or drinking due to high iron levels
  - Turbidity levels are likely due to suspended iron

- Lab report made no recommendations for the high iron levels
  - Single asterisk is above recommended limit
  - Double asterisk is below recommended limit
  - No recommendations for parameters that are outside the limits except regular monitoring of water quality
  - Although turbidity is above the standard, it is still within operating parameters for the biosand filter
  - Free chlorine is not expected from a hand pump (borehole)
4. Explain that lab reports must be read carefully to extract all the relevant information. It is the responsibility of the client to understand what test results mean and what, if any, appropriate actions must be taken in response.

### Key Points

- Lab reports may have different formats but should provide relevant information
- Some information is critical, e.g., units
- Comparison data is important, e.g., national standards

5 minutes

## Review



1. In pairs discuss what improvements could be made to the sample lab report. Allow two minutes for discussion.
2. Ask participants to share ideas.
  - Time of testing for microbiological samples
  - Notes section could refer to the high level of iron
  - Recommendation for high iron level
  - Recommendation for high turbidity
  - Statement of method and/or equipment used for testing
  - Detection limit for method used for testing


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# Introduction Activity

Handout

## Sample Lab Report



SEEDS OF HOPE  
INTERNATIONAL PARTNERSHIPS

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 Follow us on Facebook at 2oHIP Water Lab

P.O. Box 250107, Ndola, Zambia  
 Plot 384 Makoli Avenue, Town Centre  
 Ndola, Zambia

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2oHIP WATER LAB ANALYSIS REPORT

Date Tested: 29\01\2019-30\01\2019  
 Date Sampled: 29\01\2019

Client: Lynx Zambia Ltd.  
 Location: Ndola town centre.  
 Sample Description: Before UV

Parameter	Unit	Result	Zambian Standard (S 190: 2010)
E.coli (faecal Coliforms)	CFU/100ml	Not detected	0
Total Coliforms	CFU/100ml	Not detected	20
Turbidity	NTU	1.20	2
pH	-	8.00*	6.5-8.0
Ammonia	mg/L	0.016	-
Calcium Hardness	mg/L	40	200
Chlorine (free)	mg/L	0.03**	0.3-0.2
Fluoride	mg/L	Not detected	1.2
Iron	mg/L	0.02	0.3
Phosphate	mg/L	2.8	-
Nitrate	mg/L	2.0	10

\*\*\* = Below the recommended range

Notes:

- The water tested negative for both E.coli and other coliforms.
- All other parameters tested fell within the Zambian Standard except for pH and free chlorine.

Recommendations:

- Regular monitoring of the water quality.

Date: 30\01\2019

Elijah Mutasya  
 Laboratory Manager  
 Cc Program Manager SHIP-WETC

## Evaluating a Lab Report Activity

Handout

## Sample Water Quality Lab Report



Sample Description: Borehole w Hand Pump

Date Sampled: 16/01/2019

Location: Kawama Ndola

Date Tested: 16/01/2019- 17/01/2019

Parameter	Units	Results	Zambian Standard
<i>E.coli</i> (Faecal Coliforms)	CFU/100mL	Not detected	0
Total coliforms	CFU/100mL	Not detected	20
Conductivity(EC)	μS/cm	238	1500
Total dissolved solids	mg/L	159.46	1000
Turbidity	NTU	41*	5
pH	-	6.54	6.5- 8.0
Calcium Hardness (CaCO <sub>3</sub> )	mg/L	65	500
Chloride	mg/L	Not detected	250
Chlorine(free)	mg/L	0.006**	0.2-0.5
Magnesium	mg/L	Not detected	150
Copper	mg/L	Not detected	1.0
Fluoride	mg/L	0.41	1.5
Iron	mg/L	1.95*	0.3
Manganese	mg/L	0.009	0.1
Nitrate	mg/L	0.011	10
Nitrite	mg/L	Not detected	1.0
Sulphate	mg/L	Not Detected	400
Zinc	mg/L	Not Detected	3

‘\*’= Above the recommended limit. ‘\*\*’= Below the recommended range

**Notes:** The water quality tested negative for both *E.coli* and Total Coliforms.

All other parameters tested fell within the Zambian Standard except for Turbidity, Free Chlorine and Iron.

**Recommendations;** Regular monitoring of the water quality.

Elijah Mutafya  
Deputy Manager  
Cc Program Manager AFMAC

Date: 17/01/2019