WATER QUALITY EVALUATION IN A MECHANIZED FARM IN NIGER STATE (CASE STUDY OF NASKO FARMS NIGERIA LIMITED)

BY

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CERTIFICATION

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DEDICATION

This project is dedicated to my Late Mother MRS FATIMA YAYI UMAR.

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I wish to express my sincere gratitude to Almighty Allah for making it possible for me to go gh this programme successfully. I also thank the almighty Allah for sparing my life up to this day ranting me the strength to make this work a reality.

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ABSTRACT

his research work is based on the results obtained from tests carried out on the physical, and bacteriological analysis of the two sources of water supply (Dam and Borehole) for the on in Nasko Village in Niger State.

he sample bottles were labeled and appropriate symbol given to each bottles for easy ation. The water sample colleted in labeled bottles for each source was analysed for a r period. Using word health organization (WHO) guide-lines on quality recommended. After ion of the analyses for both seasons, the results of the tests were then compared with W.H.O ble limits to show whether the parameters analysed falls within permissible limits.

From the results obtained of physical tests for both season, it has been observed that taste, and appearance of the water sample are acceptable, since all falls within W.H.O. Standards. The Turbidity values obtained from both season also falls within WHO limits indicating that it n limit recommended by the W.H.O. The temperature was uniform throughout the season.

From the chemical examination conducted, P.H. of water samples analysed is satisfactory, ll the values got falls within the range recommended by W.H.O. But regular check of this eter is very important to prevent the possible problems of acidity or alkalinity especially in ion water. From the results obtained as shown in table 5 all the parameter were within the limits ts iron which has been observed from the results obtained for both season to be above the W.H.O st desirable level of 0.1 and less than maximum permissible level of 1. It is recommended that e (Fe^{2+}) is observed to be relatively serve, it should be careful monitored and if possible be given priate chemical treatment that will prevent the increase of iron buiid up.

From the bacteriological examination carried out, it is observed that the total colonies forming is more in rainy season then dry season. This may be attributed to the facts that during the rainy on, more refuses or wastes are washed into the river as a result of erosional conditions which

ntaminate the river more. While during the dry season, bacteria forms spores or cysts which stop em from multiplying due to unfavorable conditioned of the weather as well soil that is always hot.

From these bacteriological examination conducted, it was observed that in dam samples, som ganisms were present which indicate the presence of E. Coli and thus, not portable. This indicate at dam water should not be used for drinking because of its contamination but be used for irrigation irposes. Dam water must be treated before recommended for human used.

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CHAPTER ONE

INTRODUCTION

Water according to the Greek Philosopher pindar of the fifth century B.C., is the best of all things. It could perhaps be an overstatement, but the facts, remain that it is one of the basic compounds without which life in any form is not possible in this world. Man, animal and plants need water for survival. Water is essential for satisfaction of all basic human needs. Water is a basic ingredients for Food Production and further increase in the world's food production cannot be made without instituting better water quality.

Water quality deals with the supply of quality water for public and Agricultural uses. It is the supply of water in its purest form for public to stop the spread of diseases to both human and livestock and also the supply of water to agricultural land in the form that it will not affect the growing plants.

Man requires safe and reliable water for his domestic, agricultural, or industrial activities in quality and quantity. The origin of this source of water supply could either be Natural rainfall, well or Bore-hole.

The Natural Rainfall as it falls, flows on the surface of the land dissolves some chemical element and bacteriological substances that will affect its quality to both the public and agricultural land.

In determining water available for agriculture uses, information is required on both quantity and quality. The quality need has often been neglected. Quality should infer how well a water supply fulfils the needs of the intended user and must be evaluated on the basis of its suitability for the intender user. If two different water supplier are available, one will usually produce better result or cause few problems than the other and is, therefore, consider more acceptable or of better quality. In the case of drinking water, people have always expressed preference of one water supply over another.

The better tasting one becomes the preferred water supply. This is a personal preference, but taste is a simple evaluation based on the relative acceptability for the intended use.

Different uses will have different quality needs for example most river waters are good quality for irrigation but may be unacceptable for municipal use without treatment. After chlorination, low salinity water is of excellent quality for municipal use but may be too corrosive for industrial use without further treatment. Such low salinity water may also cause soil permeability problems in irrigated agriculture.

By virtue of the nature of its source, water be it surface or ground water is exposed to distinct characteristics on its quality and supply.

Water can thus be considered as the most important raw material of civilization, source without it, man and plant cannot survive. The idea of water as a natural resource is essential, with increasing in population with corresponding food demand, increasing supplies of quality water.

The impact of seasonal variation on farming allow non-continous food production under natural conditions throughout the year. This is often supplemented using irrigation process in dry season. The extent of food produced and available for the growing population will still be very low if production is left at the subsistence level.

Various farm's owned by government or agro-allied companies and individual were established with necessary inputs, implements and machinery storage facilities and large expanse of land for full mechanized farming operation.

With the huge investment in such mechanized farms, there is need to ensure a year round productivity to justify the investment. Water (Natural or artificial) is an important limiting factor in food production for both man, animals and crops. There is a need therefore to investigate the quality and quantity of water available in these farms.

Man requires water for his numerous activities, be it domestic agricultural, or industrial; for water to be safe and reliable for these activities, it must satisfy the standard qualitative requirement recommended by the world health organization.

These requirements are broadly classified into three areas; which are physical and bacteriological parameters. Due to the importance of water, man has employed ways of storage both for domestic, agricultural and industrial use by means of storage reservour in forms of Dams, Surface reservour and elevated reservour to enhance its availability.

1.1 AIMS AND OBJECTIVE

This project work is aimed at studying the quality and distribution of water in mechanized farm in Niger State, using Nasko farm as a case study.

The study should be able to provide or determine:-

(1) The chemical quality of water for agricultural purposes and public use.

(2) To compare or correlate the chemical analysis data with W.H.O acceptable limits.

(3) To proffer corrective measures and management practice for irrigation and portability where such acceptable limits are exceeded.

1.2 STATEMENT OF PROBLEMS

The increasing population world wide calls for exploration of water for domestic and commercial purpose, this is so because the importance of water to man, plant and animals is too much to mention, hence ways and methods exploring, conserving and recycling water has to be identified so as to experience its scarcity which will have consequence effect to man and its environment.

Water plays very important parts in the Life of a farmer. Hence for both the low and subsistence farmer, water has to be sourced especially for irrigation. In growing this water, its quality and quantity has to be considered to determined whether the water meet W.H.O standard.

1.3 JUSTIFICATION

Since water is a universal material and common in origin, man has to employ ways of its utilization not only for drinking, but also for public and agricultural uses.

To achieve this, its quality has to be examined for various uses such as:-

(1) To protect the health of the consumers by eliminating water borne infection.

(2) To protect the plants against dissolved chemicals that will affect their growth.

(3) Also for authentic reason, the removal of qualities which are not harmful, but are authentically unpleasant. For example the removal of taste, colour, ordour and turbidity.

(4) For economic reason e.g, in softening water and removing iron to reduce laundry costs and save the laundred materials.

(5) For industrial purposes, for example, in the preparation of water suitable for use in boilers. Also example of removal of salts of calcium amd magnesium which would form scales in boilers and increase heating cost and time.

(6) Also to ascertain whether the existing irrigation waters would have any detrimental effects on the soil or crop or not.

1.4 SCOPE OF STUDY

The scope of this project is to:-

(1) Identify the sources, types and quantity of water available.

(2) Analysis of the water to ascertain its quality for man, animals and irrigation purposes.

(3) Make recommendation for quality and distribution.

CHAPTER TWO

LITERATURE REVIEW

According to Nikoladze, D, (1989) the quality of Natural Water depends upon its content of impurities.pure water is a tasteless, colourless, and odorless liquid made up of hydrogen and oxygen with a chemical formular of H_2O. Because water is almost universal solvent, most natural as well as man – made substances are soluble in it to some extent. Consequently, water in nature contain, dissolved substances. In addition, as a result of hydrologic cycle, it contain various other substances as well as gases. These substance are often identified as the impurities found in water.

The quality of water is an important aspect in ground water utilization. Water in nature is not pure, it contain dissolved and suspended matter that may affect the quality of the water to the extent that it is unsuitable for use as a water supply, in industry, and or in agriculture.

The quality of water in nature is affected by the other natural environment, such as the amount of rock and soil minerals dissolved in the ground, the effect of human intervention such as the injection of waste water from industrial complex into an aquifer. As a result of past and present activities of human beings, the quality of water in nature cannot be easily attributed to only one of these factor (Newmen, 1988).

The earliest attempst at classification of water quality were based on biological indicators and were devised in the middle of the last century (Kolenati 1842 and Cohn 1853, both quotted in libermann 1962). These workers observed that organisms present in polluted water are different from those that occur in clean water and thus were able to construct a classification scheme of water quality.

Abdel – Aziz I. 1986, Report that pure water (H_2O) does not generally occur in nature. Even rain water is not pure, as was thought in the past. Natural water from surface or ground sources, contains dissolved solids and gases as well suspended matter. The quantity and quality of these constituents depends on geologic and environmental factors, and are continuously changing as a result of the reaction of water with contact media and human activities.

What is known as natural water may have already been polluted, and the term may be misleading. Natural water corresponds to the state of water at the time it was used or sampled for investigations and analysis.

In order to determined the acceptable water quality for recharge purposes or for use in agriculture and industry or for human use, the water has to undergo certain tests. Generally, these are chemical, physical and biological tests. The results of these tests are then compared with the acceptable standard for any particular use. These standards vary from one discipline to another for example, acceptable water quality for agriculture may be unacceptable for drinking. Even within a certain discipline such as industry, an acceptable water quality standard for a certain operation may not be acceptable for another operation.

The interaction between groundwater and its natural environment tends to create a chemical equilibrium that leads to a stationery groundwater quality. However, such factors as chemical reactions, circulation of water of different quantities from various sources, and withdrawal of water and recharge of aquifers by polluted and clean water lead to changes in the chemical and other qualities of water (Abdel-Aziz I. 1986).

Most of the substances that occur in natural waters are shown in table 1. All these substance do not occur in single water, and their concentration varies widely for different waters. Some substances of sanitary significance occurring in water because of artificial contamination, such as phenols and cyanides, are not specifically included in the table. Other substance such as the secretions of certain micro-organisms which cause ordours but which in such minutes amounts that they cannot be detected by chemical analysis, are not shown.

The presence and concentration is indicated by ordour measurement. Several other substances of some sanitary significance such as lead, copper, zinc and chloride which enter water because of treatment or from the pipes of the distribution system, are not shown since they do not usually occur in natural waters.

According to Nekoladze, D, (1989) the chemical composition of natural waters, which is understood as a complex of mineral and organic substances present in various forms of Ionic – molecular or colloidal state, may be thought to consist of five principal groups:

(1) Main irons which are present in appreciable concentration (Sodium Na+ potassium K^+, calcium Ca^{2+}, magnesium mg^{2+}, sulphates SO_4; carbonates CO_3^{2-}, chlorides CL^-, hydracarbonates (HCO_3^-);

(2) Dissolved gases (Nitrogen N_2, Oxygen O_2, Carbondioxide CO_2, hydrogen sulphide H_2S, etc).

(3) Biogenic elements (Compounds of phosphorous, nitrogen and silicon);

(4) Microelements (Compounds of all other chemical elements; and

(5) Organic substances Suspended matter in water may contain particles of different size, from colloidal to coarse – disperse.

Form the results of Bashir Mohammed (2000) obtained for the examination carried out of physiochemical and Bacteriological properties of surface water in Niger State, the result shown that must of the chemical composition determined in Nasco dam is satisfactory in quality for Irrigation purposes. The total dissolved solid of all sample and the PH valves indicate that the water can be used without restriction on most soil, the electrical conductivity in all samples are also of the class one rating, indicating that the waters can be used on most soils without soil salinity developing. The Nitrate and phosphate concentration are generally very low, addition of NPK compound fertilizer is recommended for optimum yield.

Also Mallam Mohammed Babako (1998) conducted a similar work on water quality, using Nasco farm as a case study. From the tests conducted on physical chemical and Bacteriological properties, it was found from the results of is analysis the dam water is fit for human consumption what only for irrigation purposes while that of borehole is fit for domestic and agricultural purposes. The PH of water determined by Babako Mohammed was satisfactory since all values got fall within the range recommended by the WHO.

ALKALINITY AND HARDNESS

The alkalinity of water is a measure of its capacity to neutralize acids. In natural waters the alkalinity is related to the bicarbonate, carbonate, and hydroxide concentration.

In alkaline waters, normal carbonate, Co_2 Ion on the addition of acid. Borate, silicates, and phosphates also cause alkalinity, but they are usually not present in natural water in appreciable quantities.

TABLE 1: SUBSTANCES OCCURING IN NATURAL WATERS

SUBSTANCE	SUSPENDED	COLLOIDAL	DISSOLVED		
			NOT IONIZED	POSITIVE	NEGATIVE IONS
Of Mineral Origin	Clay, Sand, other inorganic soils.	Clay, Silical, SiO_2 Iron, oxide, Fe_2O_3 Alumina Al_2O_3 Mangame Oxide MnO_2		Calcium Ca^{++}40 Magnesium Mg (24.3) Sodium Na^+ (23) potassium K^+(39.1) Iron Fe (55.8) Manganese Mn (54.9) Hydrogen (H (1)	Bicarbonate HCO_3 (61) Sulphate SO_4 (96) chloride Cl^- L35.5 Nitrate NO_3—(62) Carbonate (Co_3 (60) Hydroxyl OH^- (17) Silicate HS_1O4(77.1) H_2BO_3 (60.8) Phosphate HP04 –(97) Iodide I^-126.9) Fluoride F^-(19)
Of organic origin	Organic soil (Top soil) Decomposing Organic Waste	Vegetable colouring Matter organic wastes	Vegetable Colouring matter organic wave Ammonia NH_4OH Carbonic acid H_2CO_3 other organic acids	Ammonium NH_4^+ Hydrogen H^+	Nitrogen NO_3^- Nitrite NO_2^- Hydroxyl, OH Bicarbonate HCO_3 other organic acids
GASES			Free Carbon dioxide, CO_2 Oxygen O_2 Nitrogen N_2 Hydrogen H_2 Sulphide, H_2 Methane, CH_4 Sullphurdioxide SO_2, Ammonia		
Living Organism	Fish Life Algae diatoms Minute animals	Bacteria Viruses, Algae diatoms, minute animals.			

HARDNESS

When acidic rain water infiltrates down to limestone formation, it dissolves the calcium and magnesium carbonates, producing water that is hard.

The hardness of water represent its content of metals which form precipitates under the normal condition of use water. These include all metals of table 1 except Na^+ and K^+ where salts are soluble. Most of the hardness of water is due to the presence of Ca^{++} and mg^{++}, hardness, like alkalinity, is expressed in ppm as $CaCo_3$. It is objectionable principally because of soap waste and boiler scale. Boiler scale is obtained by the precipitation of the metal as salts (principally carbonates, sulphates, chlorides and nitrates) owning to their increased concentration upon the evaporation of the water. If the hardness is less than 100 ppm, awater is generally considered soft, but for efficient boiler use and for a certain industrial processing purposes waters of zero hardness are desirable.

In summary, hardwater is water that has a high soap consuming power (i.e water which will not produce lather unless a large amount of soap is used).

Hardness in water is due primarily to the presence of Ca^{2+} and mg ion in water. The presence of the following may cause slight increases in hardness. Fe, Mu, Cu, Ba and Zn

Hardness of water (Hr) in general is numerically evaluated in terms of the concentration of the calcium (Ca^{2+}) and magnesium (mg^{2+}) ions. Hardness (Hr) is expressed in milligrams per litre as $CaCo_3$ (Calcium carbonate) and is calculated from the equation Hr = 2.5Ca + 4.1 mg (Toad 1980).

Water is classified as soft when Hr is less than 75mg/l as $CaCo_3$, moderately hard when the ranges from 75 to 150 mg/l as $CaCo_3$, hard when Hr ranges from 150 – 300 mg/l as $CaCo_3$, and very hard when Hr exceeds 300 mg/l as $CaCo_3$ (Sawyer and Mc Carty, 1967). Only soft water can be used domestically; otherwise water softening processes are required. The effect of soft and hard water on health have been rather controversial (Crowford 1972, Nerietal, 1975).

WATER SOFTENING PROCESS

Water softening process are:-

(a) **PRECIPITATION METHODS:-** Water softening by precipitation is based on binding calcium cations, Ca^{2+} and magnesium Cations, Mg^{2+}, with ions, Co_3^{2-} and O.H$^-$. The chemical reactions results in the formation of difficulty soluble compounds, $CaCo_3$ and mg $(O.H)_2$, that precipitate out and are removed from the water. The Co_3^{2-} and OH^- ions are added to the water being treated with various reagents precitators such as caustic lime, Cao or slake lime, $Ca(OH)_2$, sodium hydrate (Caustic soda), NaoH and sodium carbonate (soda ash), Na_2Co_3.

(b) **LIME TREATMENT**:- Liming is practiced where it is necessary to decrease the alkalinity of initial water. The processes that develop during lime treatment of water can be represented by the formular in ionic form.

$Hco_3 + OH \quad = \quad CO_3^2 + H_2^O$

$Ca + CO_3^{2-} \quad = \quad CaCo_3$

$Mg^{2+} + 2OH^- = \quad Mg\ (OH)_2$

$CO_2 + 2OH^- = \quad CO_3^2 + H^2O$

© **WATER TREATMENT WITH SODA AND LIME:-** This method permits water softening to 300 – 400 milligram equivalent per kilogram (mg – equi/kg), when heated to high temperature, some water can be softened to a residual hardness of abut 200mg equv/kg. Lime decreased Hc, Hmg and removes, Co_2 from the water. Non carbonate hardness that shows up after liming due mainly to calcium compound is got rid by soda ash.

$Ca_2^+ \ + \ Co_3^{2-} \qquad CaCo_3.$

SANITARY SIGNIFICANCE OF IMPURITIES

The impurities that is of greatest sanitary significance in water to be used for drinking purposes are pathogenic bacteria and other pathogenic micro – organisms. The most serious water borne diseases are cholera in the all world and typoid fever in American, but other important human diseases, such as dysentery and diarrhea, are known to be water borne, and still others may be.

The isolation of the causative organisms of these diseases because these diseases are of intenstinal origin and the source of the germ in water in human excreta, the presence of the colon bacillus (B Coli or e. Coli) whose manual habitat is the alimentary canal of man and other mammas is the best evidence of sevage pollution.

The 1946 U.S public Health Service Drinking water standards of water used for drinking purposes on interstate carrier, which standards have been adopted by many public health authority and are widely used, required a most probably number (M.P.N) of Coliform bacteria not exceeding II per 100ml of water for all samples collected in one month.

STANDARDS CHEMICAL ASPECTS

PHYSICAL CHARACTERISTICS:-

(1) Turbidity shall not exceed 10 ppm (Silica Scale)

(2) Colour shall not exceed 20 ppm (Standard Cobalt Scale)

(3) There should be no objectionable taste or ordour.

CHEMICAL CHARACTERISTICS

(1) Lead, Pb, shall not exceed 0 – 1 ppm

(2) Fluoride, F, shall not exceed 1.5 ppm

(3) Arsenic, As, shall not exceed 0.05 ppm

(4) Selenium, SSC, shall not exceed 0.05 ppm.

(5) Salts of Barium, Ba, hexavalent dramin Cr^{6+}, heavy metal glucosides, or other substances with deleterians physiological effects shall not be added for water treatment purposes.

(6) Copper, Cu, should not exceed 3.0 ppm

(7) Iron, Fe, and Magnese, Mu, together should not exceed 0.3 ppm.

(8) Magnesium, Mg, should not exceed 125 ppm

(9) Zinc, Zu, should not exceed 15 ppm

(10) Chloride, CL should not exceed 250 ppm

(11) Sulphate, SO_4, should not exceed 250 ppm

(12) Total Solids, Ts, should not exceed 500 ppm, but may be permitted up to 1.00 ppm.

(13) For chemically treated waters, the PH should not be greater than about 10.6, the normal carbonate (Co_3) alkalinity should not exceed 120 ppm as $CaCo_3$, and the total alkalinity shold not exceed the hardness by more than 35 ppm as $CaCo_3$.

Many of the requirements of the US.P.H standards have no health significance although they are of aesthetic importance. The presence of too much lead may result in lead poisoning. Lead is not present in natural waters but may enter the water by solution from lead services and plumbing system, if the water is corrasive to lead, Aesenic, selemin, and hexavalent chromium are all toxic and their concentration must be limited.

The toxicity of copper to man has been the subject of much discussion, but it now appears that Cu is not injurious up to concentration of about 20 ppm. The taste of water becomes disagree-able when the Cu content reaches about 5 ppm. Zinc appears to be safe in drinking water up to concentration of about 40 ppm, but without that concentration it will impart a milky appearance and as astringent taste to the water. Too much mg So_4 (Espon salt) and Na_2So, (Glanber's salt) in water produce Laxative effects. NaCL and $NaNo_3$ tend to produce thirst, and carbonates and hydroxide tend to neutralize the acid of the stomach.

Iron is non – official to the health, it is objectionable because of red – water and strains. Manganese is more objectionable than Iron because of strains and because of its interference with the orthotolidine test for residual chlorine. It's concentration should be limited to less than 0.1 ppm.

The presence of fluoride in concentration exceeding 0.5 ppm may result in wild endemic dental fluororis (mottled enanel) in children, although, about 1.5 or more ppm of iron is required for severe cases. It has recently been found that fluoride in drinking water is accompanied by new health officials are now advocating the addition of fluorides to drinking water up to about 1.0 ppm in regions where caries is prevalent.

BACTERIOLOGICAL STANDARDS

Coliform organisms should ideally be absent from any water enteringa system whether treated and untreated. Both the WHO and EPA recognize that the presence of Coliforms become significant over a period of time. The most up to date standard at the writing of this project, is the EPA standard, which recognizes the use of membrane, filters. The WHO standard are quoted only for completeness as one expects them to be updated in the future.

OTHER W.H.O AND EPA STANDARDS

The sampling regularity required for chemical determination by the WHO and EPA vary from 3 months to 2 years. But it would be more frequent when waste discharges into the water are expected. Some of the chemicals for which analysis is done are toxic beyond a certain level others may affect the aesthetic and other aspects of the water without necessarily affecting health. The chemical for which analysis is required or recommended are given in Table below which indicates the level beyond which they become toxic or give rise to various difficulties, which are themselves are listed.

ABLE 2: CHEMICALS FOR WHICH ANALYSIS IS REQUIRED OR RECOMMENDED IN WATER.

ubstance	Consequences of Excess Amount in-organic Chemicals	Limits allowable water (mg/litre)		
rsenic	Tonic	0.05	0.2	0.05
arium	-	-	-	1.0
admimum	Tonic	0.01		0.01
hromium	Tonic	0.05	0.5	0.05
ynanide	Tonic	0.05	0-01	-
louride	Fluorosis	0.7-1.7	1.0-1.5	1.4-2.4
ead	Tonic	-		0.05
Aercury	Tonic	-	0.01	0.002
elenin	Tonic	0.01	-	0.01
itter	Tonic		0.05	0.05
Nitrate	Danger of Infentile Methane-Oglobinaemic	50-100	- 50-100	10.00
Phenolics	Tastes especially in chlorimated water	0.001		
Copper	Astingent taste Discoloration and corrosion of pipes	0.5-3.0		
Iron	Taste, discohoration, deposits and growth of Iron bacteria. Turbidity.	0.1 0.05		
Marganese				
Zinc	-do-	5.0		
Magnesium Sulydrate Hydrogen Sulphate	Antingent taste; Opalescence and sand-like deposites Hardness, taste Gustro-intestinal irritation Taste and Odour	30-250 350 0.05		

Source: (WHO 1971 EPAYT 176)

ORGANIC CHEMICAL (PESTICIAES)

SUBSTANCE	TOLERANCE LIMIT
(A) CHLORINATED HYDROCARBONS	
ENDRIN TOXIC - - - - -	0.0002
LINDANE - do - - - - - -	0.004
METHOXYCHLOR TOXIC - -	0.1
TOXAPHENE TOXIC - -	0.005

(B) **CHLOROPHENOXYS**

2, 4 D	- do - - - - -	0.1
2, 4, 5 Tp	- do - - - - -	0.01

TURBIDITY

The EPA regulations requires that drinking water be sampled for turbidity at least once a day by the Nephelometric method set out in standard methods. The method consists of comparing the turbidity along with that determined in a series of tubes containing suspended particles of formation polymer. The maximum level of turbidity unit (Tu).

Not more than five may be allowed if it can be shown that this level of turbidity does not interfere with disaffection or with the counting of micro – organisms.

TABLE 3: W.H.O GUIDELINES FOR INORGANIC AND ASTHETIC QUALITY OF WATER FOR HEALTHY SIGNIFICANCE CONCENTRATION IN MG/LITRE.

CHEMICAL CONSISTITUENT	PERMISIBLE LIMITS	EXCESSIVE LIMITS	MAXIMUM ALLOWANCE LIMITS
ABSENIC	0.05	-	0.2
ABBESTORS	NO GUIDELINES VALUE SET	-	-
BARIUM	NO GUIDELINES VALUE SET	-	-
BERYLIUM	NO GUIDELINES VALUE SET	-	-
CADMIUM	0.005	-	-
CHLORIDE	200	400	-
CHROMIUM	0.05	-	0.05
CYANIDE	0.1	-	-
FLOURIDE	1.5	-	-
	(IT INCLUDES BOTH NATURAL FLUORIDE AND DELIBRATELY ADDED FLUORIDE LOCAL OR		
LEAD	CLIMATIC)		
MERCURY	0.05	-	0.1
POTASSIUM	0.001	-	-
SODIUM	20.0	100.0	-
CALCIUM	200.0	-	-
MAGDNESIUM	75.0	200.0	-
NITRATE	50.0	150.0	-
NICKEL	10.0	45.0	-
SELENIUM	-	-	-
ALUMINIUM	0.01	1.5	-
COPPER	0.2	1.0	-
IRON	1.0	1.50	-
MANGANESE	0.3	1.0	-
DETERGENT	0.1	0.5	-
	NO GUIDELINE. THERE SHOULD BE NO FOAMING,		-
SOLIDS, TOTAL SOLIDS	TASTE OR ODOUR PROBLEMS		
	1,000	-	-

Source: American Public Health Services (A.P.H.A)

TABLE 4: W.H.O STANDARD FOR PHYSICAL AND BACTERIOLOGICAL PARAMETER, FOR DRINKING WATER

PARAMETER	HIGHEST DISPERAISALEL LEVEL (MG/L)	MAXIMUM PER MISSIBLE LEVEL (MG/L)
APPEARANCE	CLEAR AND ATTRACTIVE	
TASTE AND ODOUR	UNOBJECTIVE	UNOBJECTIVE
COLOUR (^{O}H)	5	50
TURBIDITY	≤5	25

BACTERIOLOGICAL STANDARDS

The standard for the bacteriological characteristics is stated below:

(1) Throughout any year 95% of sample should not contain any coliform organisms in 100 ml

(2) No sample should contain e. Coli in 100 ml of sample analyzed.

(3) No sample should contain more than 10 Coliform organisms per 50 ml.

(4) Coliform organism should not be detectable in 100ml of any consecutive sample.

Source - W.H.O guidelines for Drinking water.

PURIFICATION OF WATER

WATER TREATMENT:- The treatment of water in order to make it suitable for drinking, domesti or industrial, agricultural uses includes a complex of physical, chemical and biological methods which change the initial composition of water. Water treatment involves not only purification and removal c various unwanted and harmful impurities, but also improvement of the natural properties of water by adding certain deficient ingredient.

Thus, because drinking water and that of livestock at Nasko farm is obtained from deep wells with no bacterial no treatment, as you can see from the results of the biological test, on the other hanc the Nasko earth dam having source of river or stream water, extensive purification including chlorination is applied for its treatment if is used for drinking.

TREATMENT (OR PURIFICATION) OF DRINKING OF WATER

All methods of water treatment can be divided into the following main groups.

(a) Those aimed at improving the organoleptic properties of water such as clarification, decoloration, deodorization.

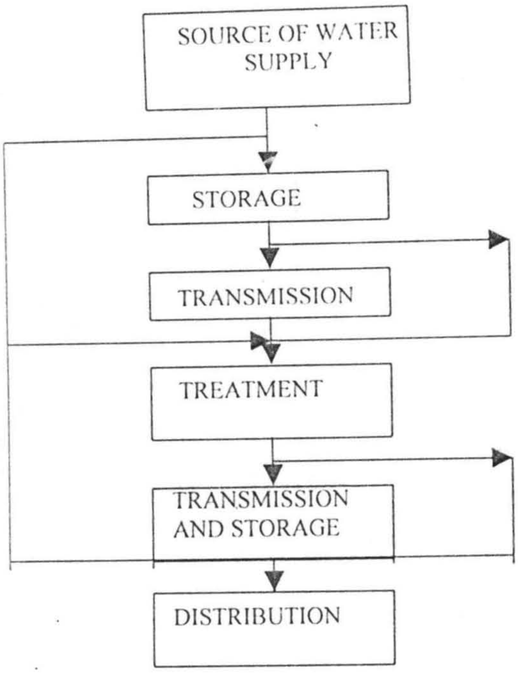
(b) Those which ensure epidemiological safety such as chlorination, Ozonization, ultraviolet irradiation and

© Those by which the mineral composition of water is conditioned such as fluorination, softening and desalination.

A particular method of water treatment is chosen upon preliminary examination of the composition and properties of water of the water source to be used and ocmparism of these data with the consumers requirement.

WATER SUPPLY SYSTEMS

A water supply system capable of supply a sufficient quantity of portable water is a necessity for a modern city.



Fg. 3

INTERRELATIONSHIP OF THE FUNCTIONAL ELEMENTS OF MUNICIPAL WATER SUPPLY SYSTEM.

THE FUNCTIONAL ELEMENTS OF PUBLIC WATER SUPPLY SYSTEMS.

FUNCTIONAL ELEMENT	PRINCIPAL CONCERNS IN FACILITIES DESIGN PRIM/SEC.	DESCRIPTION
Sources of Supply.	Quantity/Quality	Surface water source of supply such as river, lakes, and reservoir, or groundwater source.
Storage	Quantity/Quality	Facilities used for the storage of surface water, usually located at or near the source of supply.
Transmission	Quantity/Quality	Facilities used to transport water from storage to treatment facilities.
Treatment	Quantity/Quality	Facilities used to improve or alter the quality of water.
Transmission and Storage	Quantity/Quality	Facilities used to transport treated water to intermediate storage facilities and to one or more plants for distribution.
Distribution	Quantity/Quality	Facilities used to distribute water to the individual users connected to the system.

Source: National commission on water Quality on Assessment of Technologies

Water supply are classified as surface and groundwater supplies. Surface supplies may be divided into two groups:

(a) Those from large rivers or lakes which must be pumped into the distribution systems.

(b) Those from smaller upland streams which required storage reservoir and pipe lines for delivery usually by gravity, to the distribution systems.

Ground - water supplies are obtained from wells, springs, precipitation and the infiltration of surfaces water from run-offs and streams.

EFFECTS OF SOURCE OF SUPPLY UPON WATER QUALITY

The quality of water is determined by its contents of living organisms and by its content of mineral and organic matter. Living organisms may be present in suspension and in colloidal dispersion. Mineral and organic matter may be in solution in colloidal dispersion, and in suspension. Practically, all the foreign matter in water is collected as the water over the surface of the ground or through the soil and rocks. Rain water is saturated with the gases of the atmosphere, but it contains few other impurities except in areas where the atmosphere is charged with smoke or dust.

IRRIGATION

Irrigation generally is defined as the application of water to soil for the purpose of supplying the moisture essential for plant growth. However, a more inclusive defination is that irrigation is the application of water to the soil for any number of the following purposes:

(1) To add water to soil to supply essential nutrient for plant growth.

(2) To provide crop insurance against short duration droughts.

(3) To cool the soil and atmosphere, thereby making more favourable environment for plant growth.

(4) To reduce the hazard of frost.

(5) To wash out or dilute salts in the soil.

(6) To reduce the hazard of soil piping.

(7) To soften tillage pens and clods.

(8) To delay bad formation by evaporative cooling.

Irrigation may be accomplished in the following ways:

(1) By flooding the surface,

(2) By means of furrous

(3) By applying water undernealth the land surface through sub-irrigation thus causing the water table to rise.

(4) By sprinkling

(5) By trickle systems.

QUALITY OF IRRIGATION WATER

In determining water availability for irrigation, information is required both its quantity and quality; however, the quality need has often been neglected. Quality should infer how well a water supply fulfills the needs of the intended user and must be evaluated on the basis of its suitability for the intended use.

Water used for irrigation always contains some dissolved substances which, as a general collective term, are called salts. These include relatively small but important amounts of dissolved solids originating from dissolution or weathering of rocks, soil, lime, gypsum and other salt sources a water passes over or percolates through them. The suitability of water for irrigation will be determine by the amount and kind of salts present. Various soil and cropping problems can develop with poor water quality. Special management practices may than be required to maintain full crop productivity With good quality water there should be infrequent or no problem affecting productivity. With good quality water there should be infrequent or no problem s affecting productivity. The problem that result from using a poor quality water will vary in kind and degree. The most common ones are discussed below.

(i) **SALINITY**

A salinity problem related to water quality occurs if the total quantity of salts in the irrigation water is high enough that salts accumulate in the crop root zone to the extent that yields are affected. If excessive quantities of soluble salts accumulate in the crop root zone, the crop has extra difficult in extracting enough water from the salty soil solution.

(ii) **PERMEABILITY**

A permeability problem related to water quality occurs when the rate of water infiltration is reduced by the effect of specific salts or lack of salts in the water to the extent that the crop is not adequately supplied with water and yield is reduced.

(iii) **TOXICITY**

A toxicity problem occurs when certain constituents in the water are taken up by the crop and have accumulated in amount that results in reduced yield. This is usually related to one or more specific ions in the water such as boron, chloride and sodium.

(iv) **MISCELLANEOUS**

The quality of irrigation water creates several other problems including excessive vegetative growth, lodging and delayed crop maturity resulting from excessive nitrogen in the water, white deposits on fruits or leaves due to sprinkler irrigation with high bicarbonate water and abnormalities caused by an unusual PH of the water.

WATER CONVEYANCE STRUCTURE

Structure used for water conveyance are varied to meet condition of terrain and floor requirements. To convey water to the point of use for irrigation in most efficient manner is a challei as far as NASCO farm is concerned. There was no data available and the only way to meet this requirement is to provide the necessary data such as the topography, soil type, climate etc. This will help in the provision of conveyance structure.

The most recent conveyance structures are:-

(i) **Flumes:-** For crossing natural depression or narrow valley and for conveying irrigated water along very steep side hills, the structures are constructed either of wood or metals.

(ii) **Tunnels:-** To shorten the length of a diversion canal, to avoid difficulty and expensive construction on step.

SURFACE RESERVOIRS

Surface reservoirs are limit to store irrigation water for rise when the natural flow of a stream is not sufficient to meet irrigation demands.

All storage dams must be built with spillways large enough to convey the maximum anticipated flood flows.

The capacity of each reservoirs is fixed largely by the natural conditions of the valley in which water is to be stored, together with the height of a dam must be to store the quantity of water needed and economically available. Capacities vary from a few hundred hectare – meters for reservoirs on small streams to millions of hectare – meters. Dams constructed for storage of irrigation water vary from a few meters in height, built at a low cost, to massive masonry structures over 200 meters high.

CHAPTER THREE

METHODS AND MATERIALS

This section of work deals with methods adopted in the course of the project. The procedures, precautions and problem encountered and solution during the course of the work.

The General water use considered in this project includes public and agricultural.

Water is selected for various uses according to certain quality standards as earlier discussed, it must meet in order to be deemed suitable for the purpose intended. These standards are very important, and should be established only after careful consideration. The standards are measured according to criteria depending on the ultimate water use.

EXAMINATION

Samples of water for examination were collected in two clean sterile bottles for the two seasons [redacted]h. The two sample bottles were labeled "A and B". The one labeled "A" was for Bore hole while the other labeled "B" was for Earth dam were collected and analyzed for physio-chemical and bacteriological test.

The samples collected from the Earth dam was collected several point far away from the bank, this is because samples collected around the bank will be toxic because of the dissolved faces of the bacteria present.

Since it was not possible to start treating the samples there, I then quickly returned to Minna with the samples to laboratory immediately for the samples to be analysed.

SAMPLING POINTS

This refers to the points where the water samples is collected i.e. Earth dam and bore hole used for public and agricultural purpose in Nasko village.

The Dam is located at the North West of the villages, which expected to supply the farm through open channel. Whereas, the borehole is situated in the farm yard. The water is usually pumped from the Bore-hole to the reservoirs. The reservoirs in the Nasko farm yard are of two types.

(1) The surface reservoir which have little or no elevation above the ground which is constructed on earth.

(2) The elevated reservoir built entirely above the ground with elevated tanks which are made of steel.

It was at this source of supplies that the sample of water were drawn for analyzes for this study.

It was observed that the inhabitant and the livestock in the farmyard solely depend on the borehole usually stored in the reservoir because of the non-availability of tap or other source of water in the village.

PROBLEMS ENCOUNTERED

In the cause of carrying out the analysis on the samples collected, some test could not be immediately conducted because there was no equipment until we got back to Minna.

Scarcity and cost of reagents used for analysis was a big problem, which constitute another major hindrance in the course of the research.

PHYSICAL EXAMINATION

The principal physical characteristic of water are colour, turbidity, tastes and odour, temperature, and other physical factors. Capable of defacing the water such as total solid contents of water. Physical properties cannot be completely over looked in relation to chemical composition of water.

APPEARANCE

The appearance of water refers to the way the water looks, appearance of water can be affected by the level of impurities which the water contained e.g vegetable, humus, iron, manganese and industrial waste such as dye.

All the listed contaminants are capable of impacting colour to the water which will in turn makes it not authentic to consumers. For the purpose of this project work, the sample collected conforms with the general and accepted standard required to an appreciable extent.

TASTE AND ODOUR

This are caused by the presence of decomposed organic material and volatile chemical by diluting the sample until the taste and odour are no longer detectable by human test. Drinking water should be practically free of colour, tastes, and odour.

Water may have a salty taste, bitter, sweet or acid taste.

A salty taste water is usually due to the presence of sodium chloride, a bitter taste is formed by magnesium sulphate; an acid taste in most cases is explained by an excess of dissolved carbon dioxide.

Odour and taste are recognized as quality factors which affect water in several ways either acceptability of drinking water or and recreational water etc. Determination of taste and odour is still based on subjective judgement given by a panel of tasters.

P.H. MEASUREMENT

This is the measured of acidity or alkalinity of a sample. It also refers to the effective concentration (activity) of hydrogen ions in the water.

The P.H. of water determines properly whether the water is fit for drinking or domestic use even in irrigating of crops. The PH can be measure on PH scale, which ranges from PH 1 to 14.

Therefore, when PH is equal to 7, It is neutral waters, when PH is less than 7, it is acidic water, and when more than 7, it is alkaline waters. Natural waters can be classified by the PH index in the following manner. Acidic (PH 1-3), weakly acid (PH = 4-6), Neutral (PH = 7), Weakly alkaline (PH = 8-10), and alkaline (PH = 11-14). The reactivity of natural water usual ranges between 6.5 and 8.5 which corresponds to the limits established for portable water (Hem, 1970). The PH of neutral water is usually governed by some salts dissolved init e.g carbondioxide, Hydrogen carbonate and carbonate in equilibrium.

TURBIDITY

Turbidity is a measure of suspend and colloidal matter in water. Such as organic matter, micro-scopic organisms, and particles of clay and salt. Turbidity decreases the clarity of water and this results from the finely divided impurities, regardless of source, that may present in water. The degree of turbidity depends on the fineness of the particles and their concentration. In the past, the standard of comparison was the Jackson turbidimeter in which turbidity was taken as a measure for the depth of water required to cause image of a candle flame to disappear. Today, turbidity is measure with turbidimeter by measuring the interference to the passage of light through a water sample. Water turbidity can also be measured by photoelectric colorimeters. The turbidity of portable water should not exceed 1.5ml.

CHEMICAL EXAMINATION

The chemical characteristics of water are quantified in terms of the inorganic and organic constituents that may be present. Chemical characteristics tend to be more specific in nature than some of the physical parameters and are thus more useful in assessing the quality of water, physical parameters are easy to be determined and some may be readily observable by a layman e.g Temperature, taste and odour, colour, turbidity, solids and possible the electrical conductivity.

These physical parameters are not enough for the quality of water to be properly analyzed. This is why the chemical analysis of water needs to be carried out and this is usually done in the laboratory. The chemical characteristics of water helps to know more about the water quality especially the kind of dissolved element it contains. This will help to know whether the water is toxic or non – toxic; This aspect of water analysis helps in knowing the level of pollution and contamination in the area.

LABORATORY ANALYSIS OF WATER SAMPLES

As a result of advances in technology, automated technique for water characterization was adopted. A C100 series multi parameter bench spectrophotometer was used for the determination of the concentration in water was careful noted.

DETERMINATION OF PHOSPHATE

The programme number corresponding to phosphate on the secondary LCD was selected by programme t. The curvet was filled to 1.5cm below the rim with 10ml of unrelated sample. The curvet was then placed into the holder by pressing ZERO and "sip" will blink on the display. Wait for a few second and ready for measurement.

The curvet was removed and 0.5ml of HI 93717A molybdate reagent added followed by 0.5ml of HI 93717B Amino Acid reagend and then replaced to take the reading by pressing READ TIMED and REA DIRECT after 5 minutes. In both cases "Sip" will blink during measurement. The instrument shows the concentration in mg/l (ppm) of phosphate.

DETERMINATION OF IRON

The programme number corresponding to iron on the secondary LCD was selected by programme t. The curvet was filled to 1.5cm below rim with 10ml of reacted sample. The curvet was then place into the holder by pressing ZERO and "SIP" will blink on the display. Wait for a few seconds and will show "0-0". Now the meter is zeroed and ready for measurement.

The curvet was removed and 1 packet of HI 93721A Reagent added followed by one packet of HI 93721B Reagent 2 and then replaced to take the reading by pressing READ TIMED and READ DIRECT after 5 minutes. In both cases "SIP" will blink during measurement.

DETERMINATION OF SULPHATE CONTENT

The Lovibond container was rinsed and fill with sample to 50ml mark one sulphate Nos. 1 tablet was added and the container was shaken until the tablet disintegrates completely. The container was allowed to stand for 15 minutes.

Next the same number of sulphate Nos 2 tablet was added as were required in the above hardness test and the container was shaken until the tablets are completely disintegrated. The adding of sulphate Nos 2 tablet was further done, and the container shaken as before and at this stage, counting of tablet was started (calling this tablet the first) The sulphate Nos 2 tablets was added continuously in this manner one at time until the colour changes from purple through grey to green. The number of sulphate Nos 2 tablet required from the start of counting was noted and this was called N.

DETERMINATION OF NITRATE

PROCEDURE:- The programme number corresponding to Nitrate on the secondary LCD was selected by pressing programme t. The curvet was filled to 1.5ml below the rim with 10ml of unreacted sample. The curvet was than placed into the holder and positioned securely into the groove by pressing ZERO and "Sip" will blink on the display after which the display shows -"0-0-".

The curvet was removed and the content of one packet HI 93728 reagent than added and shaked for one minute and replaced. READ TIMED was pressed with display showing count down prior to the measurement and READ DIRECT pressed after 41/2 minutes to get the concentration in mg/l of nitrate.

DETERMINATION OF P.H

PROCEDURE:- The programme number corresponding to P.H. on the secondary LCD was selected by pressing programme t. The curvet was filled up to 1.5cm below the rim with 10ml of unreacted sample. The curvet was then placed into the holder by pressing ZERO and "Sip" will blink on the display after which the display show "0.0-".

The curvet was removed and 0.2ml of HI 93710 phenol red indicator added to the sample and swirled to mix.

The curvet replaced and reading taken by pressing READ DIRECT. The instrument directly displays, the PH measured value.

DETERMINATION OF CALCIUM HARDNESS

PROCEDURE:- The programme number corresponding to Hardness Ca on the secondary LCD was selected by pressing programme t. The graduated beaker was filled to 50ml mark with the sample. And 0.5ml of HI 93720A Calcium indicator solution was added and swirl to mix after which 0.5ml of Alkali solution for HI 93720B calcium and magnesium added and swirled to mix.

Two curvets were filled up to 1.5cm below the rim with 10ml of sample each. One drop of HI 93720C of EGTA solution was added to one curvet to serve as blank. The blank was placed into the holder by pressing ZERO of instrument. "Sip" will blink on the display after which the display show – "0.0-".

The buffered blank was removed and the sample inserted into the instrument. READ DIRECT was pressed to display the concentration in mg/l (ppm) of calcium as $CaCo_3$.

DETERMINATION OF DISSOLVED OXYGEN

PROCEDURE:- The programme number corresponding to Dissolve oxygen on the secondary LCD was selected by pressing programme t.

60ml BOD bottle was filled with unreacted sample 5 drops of HI 93732A and 5 drops of HI 93732B was added to the sample and swirled and the sample changes to orange and floceulent agent appear. After about 2 minutes, the upper half of the bottle become limpid and 10 drops of HI 93732C added.

The curvet was filled to 1.5cm below the rim with 10ml of unreacted sample and placed into the holder, this is the blank. By pressing ZERO of the instrument, "Sip" blinked on the display, after which the display showed –0,0- The curvet was removed and disposed of the blank then filled back with 1.5cm below the rim with 10ml of the reacted sample and replaced back to take the reading by pressing READ DIRECT. The result is display in mg/l of oxygen.

DETERMINATION OF CHLORIDE

PROCEDURE:- The programme number corresponding to total, chloride on the secondary LCD was selected by pressing programme t. The curvet was filled to ¼ below the rim with 10ml of unreacted sample, repeated for each surface water. The curvet was than placed into the holder and positioned securely into the groove by pressing ZERO of the instrument. "Sip" will blink on the display after which the display shows –0,0-.

The curvet was removed and 1 packet of HI 93711-0 was added and shaked gently and then replaced. Read time was pressed with display showing count down prior to the measurement and READ DIRECT was pressed after about 2 ½ minutes to take the final reading display. Concentration in mg/l of chloride.

DETERMINATION OF ELECTRICAL CONDUCTIVITY MEASUREMENT

Instrumental method was employed in carrying out the test using TDS/Conductivity meter procedure. The sample was collected in a beaker. The instrument was switch on. The TDS/Conductivity meter was brought to conductivity measurement by pressing mode. The electrode probe was inserted into the sample. The meter was made to give result by pressing read. The result was effected on the dial and after recorded in Ns/cm.

DETERMINATION OF TOTAL DISSOLVED SOLID MEASUREMENT

Instrument method was employed in carrying out the test using TDS/conductivity meter.

PROCEDURE

The sample was collected in a beaker. The instrument was switch on. TDS/Conductivity meter was brought to total dissolve solid measurement by pressing the mode. The electrode probe was inserted into the sample. The meter was made to give result by pressing read. The result was thereafter recorded in mg/l.

BACTERIOLOGICAL EXAMINATION (COLIFORM COUNT)

While a chemical analysis is necessary for the purpose of detecting poisonous or corrosive substance in water, for determine hardness and for giving indications for the degree of organic pollution or pollution, chemical test cannot show the presence or absence of pathogenic bacteria in water. Chemical and physical analysis should therefore be accomplished by bacteriological examination. This test is usually done to look for organism, called coliform, and must sensitive is Eschericha Coli, which is found in water. Their presence indicates contamination by faces.

METHOD

The most probable number (MPN) was adopted for the test for the presence of E. Coli in the water sample collected. This method is divided into three different stages, which are the presumptive test, the confirmed test and the completed test.

The tests were performed sequential on each sample under analysis (both rain season and dry season samples collected). They detect the presence of Coliform bacteria (indicates of Faecal contamination).

The search for organisms indicative of faecal pollution of water supplies – ideally, the finding of those indicator, bacteria should denote the potential presence of intestinal pathogens. Indicator bacteria should be abundant in faeces and sewages.

(A) PRESUMPTIVE TEST AND DETERMINATION OF MOST PROBABLE NUMBER

This process determines the presence of Coliform bacteria in a water sample, and gives some index as to the possible number of organism present in the sample under analysis.

Three separate series consisting of three groups, making a total of nine tuber per series, in test tube rack. The tubes are labeled as to the sample source and volume of sample inoculate as illustrated, and identify with initials. The sample were shake thoroughly, and using a 10ml pipette, 10ml aliquots was inoculated into three tubes labeled LB2X – 10ml. Using a 1ml pipette 1 in water was inoculated into three tubes labeled LB1X – 1ml. With subsequent flaming of containers, using a 0.1ml pipette 0.1m of water was transferred to three tubes labeled LB1X – 0.1ml.

The procedure was repeated for the 2 samples analysed. The tubes were incubated for 48hrs at 37°C.

(B) CONFIRMED TEST

This process confirms the presence of Coliform bacteria in water sample showing a positive presumptive tests, confirmation of these results is necessary, since positve presumptive tests may be the result of organisms of non Coliform origin that are not recognized as indicators of faecal pollution.

The confirmed test requires the selective and differential media such as Eosin methylene blue (EMB) or Maccon key Agar be streaked from a positive lactose broth tube obtained from the presumptive test. The nature of these differential and selective media may be reviewed briefly. E.M.B forms a complex that precipitate out on to the Coliform Colines, producing dark colour and metallic green. This reaction is characteristics of indicator micro-organisms.

PROCEDURE

The EMB plate and Maccon key agar plates were labellel using a positive 24hrs lactose broth culture from presumptive test. One EMB plates, one Macconkey agar plate were streaked to obtain discrete colonies. The above mentioned procedure was repeated for the remaining samples. All plates were incubated at an inverted position for 24 hours at 37°C.

COMPLETED TEST

The completed test confirms the presence of Coliform bacteria in a water sample, or if necessary to confirm a suspicious but doubtful result of the previous test. The completed test is the final analysis of the water sample. It examines the Coliform Colonies that appeared on EMB or Maccon key agar plates used in the confirmed.

PROCEDURE

The tubes are labellel as before. One lactose broth and one nutrient agar slant from the isolated colony obtained from an EMB or Maccon key agar plate from the confirmed test. All tubes were incubated for 24hrs at 37°C.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION.

This section of study work deal with the analysis of the results obtained from the laboratory of the four (4) samples of water obtained from the NASKO.

The objective of this chapter is to analyse the laboratory results of the sample and compared with the world health organization standard recommended for public and agriculture use.

The laboratory results of samples contained in table on this ND means Not Determined. NIL means the same thing as 0.00 value or vice-versa, which both implied not available or not detected in the analyzed water sample.

Boron is absent is absent in both sample during the rain period but slightly presently at bore hole during the dry season.

The total hardness is equal to the sum of calcium hardness (Ca^{2+}) and magnesium hardness (Mg^{2+}).

RESULTS OF PHYSICAL ANALYSIS OF WATER SAMPLES

This deals with the determination of colour, turbidity, taste and odor and other physical factors capable of defacing water such as total solid contents of water. The result from the visual means method used show that all the samples observed were clear and not objectionable and does satisfy the recommended level by World Health Organizations The taste and odor of all samples were not objectionable.

The samples obtained are observed for appearance and were all clear and attractive and thereby confirmed with the recommended standard of W.H.O.

RESULTS OF CHEMICAL ANALYSIS OF WATER SAMPLES

Chemical characteristics tend to be more specific in nature than some of the physical parameters which depends on climate, they are thus more useful in assessing the properties of a sample. Chemical composition of surface water depend on the characteristics of the geology of the area where the samples were taken. Surface water acquires the characteristics of the rock through which it flows.

Chemical materials that may be discharged into a receiving water may be classified as organic and inorganic pollutent, while organic materials may be defined as compounds containing a carbon atoms undesirable results from the discharge of inorganic

material includes changes in the PH of water caused by salts and toxicity caused by heavy metals (Furman 1962). Fews of the elements were analysed using multiparameter Bench spectrophotometers.

The elements analysed are chlorine, Nitrate, phosphate, potassium, calcium, sodium, sulphate, iron, dissolved oxygen, total dissolved and PH.

The PH value of the water are shown in table 5. PH is the degree of acidity or alkalinity contained in the sample. The PH value in the four samples ranges from 6.2 – 7.4 and 6.3 – 7.4 showing there is no change in the PH of earth dam in both season when compared to the value of

Table 5. LABORATORY RESULTS OF CHEMICALS/ PHYSICAL/TDS/EC TESTS.

A PHYSICAL TEST	DAM	BORE-HOLE	DAM	BOREHOLE	W. H. O	BABAKO 1998	
	RAINING SEASON		DRY SEASON			DAM	BORE-HOLE
Date of Water Sampling	18/11/2000	18/11/2000	15/3/2001	15/3/2001		13/11/98	13/11/98
Date of Analysis	19/11/2000	19/11/2000	16/3/2001	16/3/2001			
Temperature	25°C	25°C	25°C	25°C	25°C		
Appearance	Clear	Clear	Clear	Clear	Clear		
Colour	8 PCU	3 PCU	1 PCU	1 PCU	5		
Taste	None	None	None	None	Acceptance		
Odour	None	None	None	None	Acceptance		
Turbidity	4NTU	1NTU	2NTU	1NTU	5		
Electrical Conductivity (E.C) Microhoms /Cm	0.05	0.07 Ms/Cm	0.089 Ms/Cm	0.012 Ms/Cm		0.088 Ms/Cm	0.046 Ms/Cm
B CHEMICAL TEST							
P.H at 25°C	7.4	6.2	7.4	6.3	6.5-8.5	6.86	7.19
Nitrate (NO_3) mg/L	1.3	6.4	2.6	2.5	45 Mg/L	10.80	6.10
Phosphate (PO_4) mg/L	15.3	18.5	10	13	-	0.02	0.03
Potassium (K^+) mg/L	1.2	3.2	6.2	1.3	100 Mg/L	4.23	7.41
Sodium (Na^+) mg/L	1.3	1.2	1.3	2.6	200 Mg/L	1.38	0.97
Calcium mg/L	5.0	7.85	11.6	16	200 Mg/L	10.60	18.99
Magnesium mg/L	N.D	N.D	N.D	N.D	100 Mg/L	7.22	19.23
Chloride mg/L	9.8	1.9	43	0.7	200 Mg/L	33.90	16.89
Sulphate mg/L	6.67	10.5	2.3	3.1	200 Mg/L	22.0	29.11
Carbonate mg/L	N.D	N.D	N.D	N.D		Nil	Nil
Bicarbonate mg/L	4.2	90	35	28		87.60	17.56
Iron mg/L	0.20	0.28	0.17	0.3	0.1	1.02	1.38
Maganess mg/L	N.D	N.D	N.D	N.D		0.02	0.30
Zinc mg/L	N.D	N.D	N.D	N.D		3.67	4.48
Copper mg/L	N.D	N.D	N.D	N.D		0.42	0.86
Dissolved Oxygen (Do) mg/L	3.3	3.0	2.7	5.4	-	N.D	N.D
Total Dissolved Solid (TDS) mg/L	85	46	75	40	100 Mg/L	132.40	98.68
Boron (Bo) mg/L	0.00	0.00	0.00	0.2	-	N.D	N.D

Babako (1998), there is a decreased in value of PH of dam. The value of the bore-hole obtained for rainy and dry season period are below the W.H.O recommended value for water quality. But Babako (1998) falls within the maximum allowable limit of PH 9.2. In general, the values got conform within the range recommended by the world health organization standard, which infers that they are in safe range for drinking water.

CHLORIDE CONCENTRATION

Chloride is considered to be an important element in water because its concentration determines the susceptibility of water to pathogens that causes water born diseases.

From the results showed in table 5, it was observed that the chloride concentration in the Borehole was lower than that of the dam. This is likely as a result introduction of the chloride into the dam by surface run-off from the waste water from the town. Waste surface usually contain high chloride than under ground water.

During the raining season, Dam was 9.8mg/l and that of Borehole was 1.9mg/l. While during the dry season, it was 43mg/l for dam and 0.7mg/l for bore hole.

The variations between the two season may due to the fact that during the raining season, there is more water in the dam which lead to more dilution than during the dry season. For the borehole, the chloride concentration in the raining season was surprinsingly higher than that of the dry season. Although, it was expected that this could have been as a result of the fact that the waste water that infiltrate into water table in the borehole during the raining season contained much more chloride which was not retained by infiltration.

These results obtained for the borehole and the surface dam compared favourably with those of Babako (1998). The chloride levels determined for the two water bodies in both season do not pose any appreciable threat since the values obtained were within the W.H.O. standard.

WORLD HEALTH ORGARNISATION (WHO) DRINKING WATER STANDARDS.

WRDR/007

Fig. 4

CHARACTERISTIC	HIGHEST DESIRABLE LEVEL	MAXIMUM PERMISSIBLE LEVEL
Total Solids (mg/l)	500	1,500
Colour (H)	5	50
Taste	Unobjectionable	-
Odour	Unobjectionable	-
Turbidity (NTU)	5	25
Chroride (mg/l)	200	600
Iron "	0.1	1
Manganese "	0.05	0.5
Copper "	0.05	1.5
Zinc "	5	15
Calcium "	75	200
Magenesium "	30	150
Sulphate "	200	400
Total hardness (as $CaCO_3$) mg/l	100	500
Nitrate (as NO_3) mg/l	45	-
Phenol (mg/l)	0.001	0.002
Anionic detergent	0.02	1.0
Fluoride (mg/l)	09-1.7 (mean temp 12°) 06-08 (mean temp 32°)	
pH (units)	7-8	Min 6.5 Max 9.2
Arsenic (mg/l)	-	0.05
Cadmium (mg/l)		0.01
Chromium (6+)	-	0.05
Cyanide mg/l	-	0.05
Mercury "	-	0.001
Lead "	-	0.10
Selenium "	-	0.10
Polynuclear Aromatic hydrocarbons (mg/l)	-	0.0002
Gross alpha radioactivity (pc/ls)		3
Gross beta radioactivity (pc/ls)	-	30

erio;ogocal standards for water in distribution system.

In 95% of samples examined throughout a year, coliform bacteria should be absent in 100ml
No sample should contain E.coli in 100ml
No sample should contain coliform organisms for 100ml.
Coliform organisms should not be detectable in 100ml of any two consective samples.

Source:

Federal Minis
of Water Reso

NITRATE CONCENTRATION

The Nitrate concentration of the sample were lower than W.H.O standard of 45mg/l. The results of the raining season indicate that the borehole has a higher concentration of nitrate value of 6.4 mg/l and that of dam was 1.3mg/l. This higher value obtained from the borehole might due to the presence of cattle pens near the yard where the bore hole is located. During the rain, the **cow dung** contains nitrate which may leached into the sub-surface strata and down to the aquifers. It may also be possible that the aquifer is taking its recharge from contaminated source. From the results of dry season obtained, it shows that the concentration of nitrate is higher than that of borehole. This may be as a result of the fertilizer applied to the farm land which was washed to the dam. During the dry season, the nitrate level is expected to be different from the one obtained during the raining season due to the local concentration and in contrast with borehole, there is no infiltration during the dry season. This may therefore account for the difference in the nitrate levels for the borehole for the two season.

POTASSIUM CONCENTRATION

From table 5, potassium concentration for both season was below the W.H.O standard of 20 – 100 mg/l permissible limits. The values obtained for raining season were 1.2mg/l and 6.2mg/l for the dam. And that of Borehole was 3.2mg/l and 1.3mg/l potassium in the raining was higher than the dry season, this might have been due to the fact that much potassium containing fertilizer was washed into the dam during the raining season and there was much more water than in the dry season. Hence, higher potassium concentration in the raining season. Also, the local farmers around this dam practice dry season farming with used of chemical fertilizers (e.g NPK & UREA). This goes along way in adding more potassium to the water body (Dam).

For Borehole, potassium concentration during the raining season was higher than that of dry season, this might have been as a result of higher infiltration rate observed during the raining season than during the dry season.

The results obtained for both season of dam and Borehole compared favourbly with those of Babako (1998)

SULPHATE CONCENTRATION

The sulphate concentration could results from geological formation and weathering effect of rock and owing to their high solubility sulphates (mostly of Na, Ca & Mg) are present in all kinds of natural water. The result obtained from the analysis showed that the sulphate content of the dam during the dry season is lower than that of the raining season while that of the bore-hole for raining season was higher for dry season. The higher sulphate content of the dam during the raining season than the dry season might have been due to the more weathering effects of rocks experience in the raining season than in the dry season.

Babako (1998) results showed Borehole recorded the highest value fo 29.11mg/l and that of Dam was 22mg/l. The W.H.O standard for sulphate is 200mg/l permissible limit from the results of the analysis, all values obtained are far below the W.H.O Standard.

Water with concentration of sulphates ions more than 250mg/l may be destructive to concrete structures owing to the formation of gypsum (by the reaction between sulphates and lime of cement); which result inan increases of the volume of concrete and in cracking.

BORON CONCENTRATION

The results obtained for both season showed that boron was not present in the samples examined except in borehole during the dry season where little quantity of boron was dictated.

Boron, though essential to normal growth of plants, is toxic under same condition in concentration as low as 1/3 part per million. Since all the tested samples does not contain Boron (except in Borehole during the dry season) the water source requires addition of Boron in irrigation water for fruitful productivity. There was no W.H.O standard permissible limits for these paramete

SODIUM CONCENTRATION

The results obtained for both season showed Dam recorded 1.3mg/l for both season. While that of Borehole was 1.2mg/l for raining season and 2.6 mg/l for dry season. Babako (1998) results showed Dan was 1.28mg/l while Borehole was 0.97mg/l. The W.H.O standard for sodium is 100-200mg/l. From the results of both season stated above, all the results obtained falls within the permissible limits which means it will not affect the supply of water for both public and Agricultural uses.

The higher concentration of sodium in irrigation water may have detrimental effect. Amount in excess of 700 mg/l are harmful to some plants, and more than 200 mg/l of dissolved salt is injurous to almost crops (.Keller , 1965).

PHOSPHATE CONCENTRATION

This substance may arise in sample as a result of washing of the farmland and dissolve of salts in water as it flows as surface water.

The concentration of phosphate in the two water bodies was high during the raining season than in the dry season. For the two season, the dam had low phosphates values than the bore-hole. This might have been as a result of the fact that there is more water volume in the dam which means more dilutions than in the bore hole. (This variation has been showed in Fig. 1&2.

BICARBONATE CONCENTRATION

The highest value of bicarbonate was recorded in raining season with Borehole recording the highest value of 90mg/l while that of dam was 42mg/l While during the dry season dam recorded 35mg/l and Borehole was 28mg/l.

High concentration of bicarbonate ions may result in precipitation of calcium and magnesium bicarbonates form the soil solution increasing the relative proportion of sodium and thus the sodium hazard. Thus highest value recorded in the raining season was due to a lot of Biological activities.

DISSOLVED OXYGEN

Oxygen may appear in water mainly upon contact with atmospheric air. Oxygen is practically absent in artesian water but is usually present in surface water in high concentration (.Nikoladze, G. 1982). A sharp drop of oxygen concentration may be indicative of contamination of water.

From the results of the two seasons analyzed, dams was 3.3mg/l for raining season and 2.7mg/l for dry season while that of Borehole for raining season was 3.0mg/l and that of dry season was 5.4mg/l.

The W.H.O standard of Dissolved oxygen is not stated. The different between the two seasons might be due to a lot of biological activities during the raining season whose by product are oxygen.

CALCIUM CONCENTRATION

Salts of calcium, magnesium, sodium and potassium may prove injurious in irrigation. In excessive quantities these salts reduce the osmotic activity of plants, preventing the absorption of nutrients from the soil (Wilcox, . 1960).

From the table 5, the results obtained shows the highest concentration of calcium was recorded in the borehole for both season.

Babako (1998) results showed there is a significant increased. The W.H.O standard permissible limits of calcium is 75 – 200mg from the table 5 …., the calcium results obtained falls within the limit from (fig 1 and 2), the variation between the two season might be due to the leaching, or the bed rock of the area or the soil of the area.

IRON CONCENTRATION

Iron can be present in natural waters in different forms, depending on the PH index and oxygen content. For instance, iron may be present in the form of bi and trivalent ions, organic and inorganic colloids, complex compounds (.Nikoladze G, 1989).

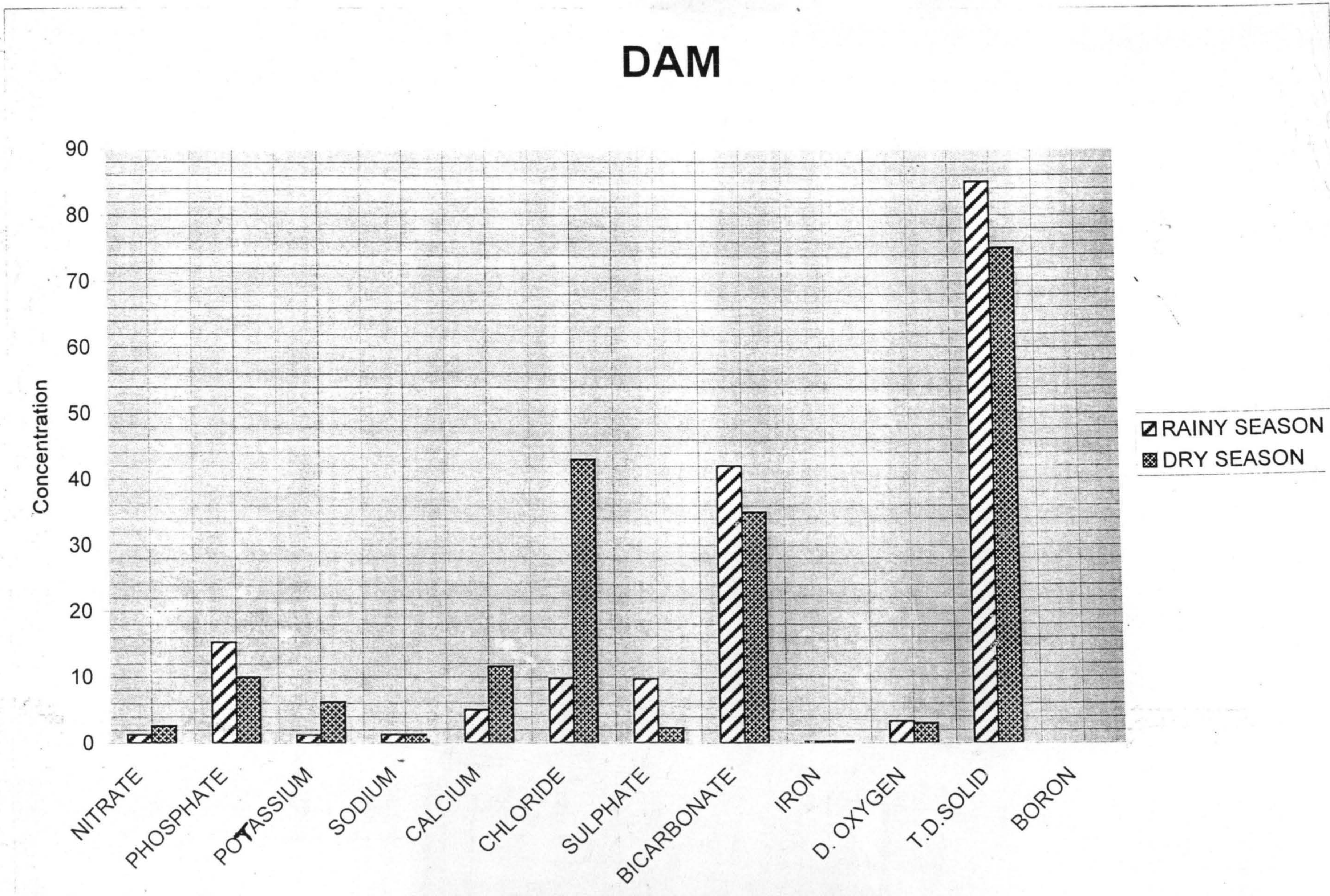
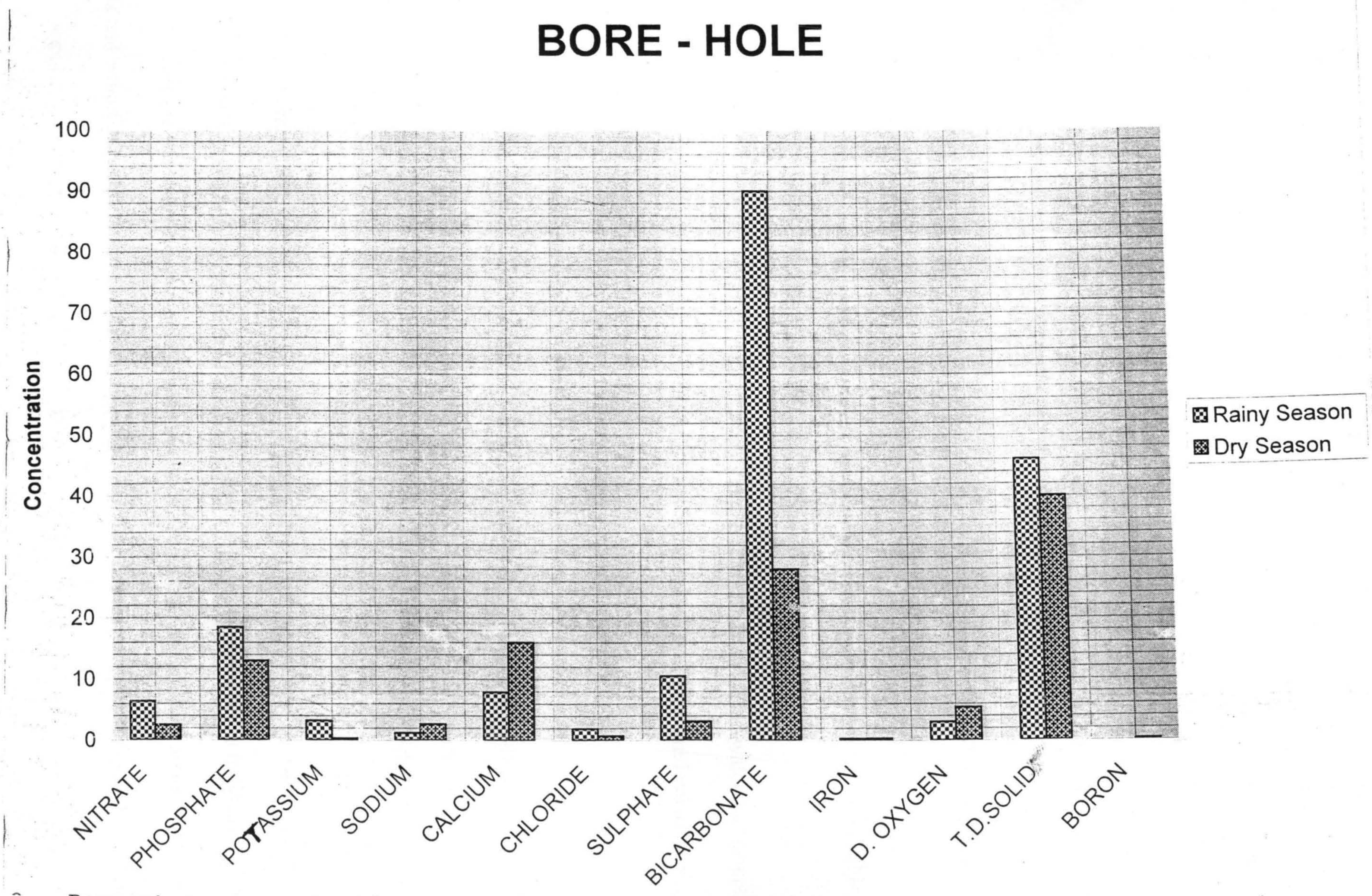


Fig. 1

...age concentation of various chemical parameters in the Dam samples during the dr



Percentage concentration of various chemical parameters in the Borehole samples during
season.

OBSERVATION AND RESULTS

PART A. PRESUMPTIVE TEST

All the tubes were examined after 24hrs and 48hrs of incubation and results recorded in the charts as:

(a) POSITIVE: 10% more of gas appear in a tube in 24hrs.

(b) DOUBTFUL: Gas develops in a tube after 48hrs.

© NEGATIVE: There is no gas in the tube in the series in 48hrs.

Table 6 . PRESUMPTIVE TEST TABLE

WATER SAMPLE	ACID AND GAS LB2X 10ML				LB1X-1			LB1X-0.1			READ-ING	MPN		RANGE 95 % PROBA-BILITY
TUBE	1	2	3		4	5	6	7	8	9				
BORE-HOLE	-	-	-		-	-	-	-	-	-	0-0-0	-	-	
DAM SAMPLE	+ve	+ ve	+ ve		+ve	+ve	+ve	-ve	-ve	-ve	3-3-0			

INTERPRETATION

Since gas appeared in the two tubes labeled LB2X – 10, LB1X – 1 and absent in LB1X – 0.1, the series was read 3-3-0. From MPN tube, such reading indicate that there is approximately 1000 micro-organisms per 100ml of water, with 95% probability that there are between 150 and 4,000 organisms present.

The Borehole showing 0-0-0 readings indicate there are no micro – organisms present.

The most probable number (MPN) of Coliform present in 100ml of water tested can be estimated by the number of positive tubes that shown up after incubation.

PART B. CONFIRMED TEST:- All the plates were examined as to the presence or absenced of E. Coli Colonies.

Table 7 CONFIRMED TEST TABLE RESULTS

WATER SAMPLE	COLIFORMS		PORTABLE
	EMB PLATE	MACCONKEY AGAR PL.	NOT CONCLUSIVE
BORE HOLE		NO GROWTH	
DAM	PINKISH COLONIES Seen	BLUISH METALLIC Seen	

PART C. COMPLETED TEST

All lactose fermentation broth culture were examined as to the presence or absence of acid and gas.

Gram staining was performed using nutrient agar slant cultures of the organism that showed a positive result in the lactose fermentation broth.

The sticks were examined microscopically for the presence of gram – negative, short bacilli which are indicative of E.Coli and thus non portable water. Gram staining reaction and morphology of the cells where recorded.

Table 8 COMPLETED TEST TABLE

WATER SOURCE	LACTOSE BROTH A/G (+) or (-)	GRAM STAIN REACTION MORPHOLOGY	PORTABILITY	
			PORTABLE	NON-PORTABLE
BORE HOLE	-	-		
DAM	POSITIVE A/G	Gram tve rod in shape bacilli		

TOTAL VIABLE COUNTS:- A determination of the total number of viable bacteria in a water sample is a useful supplementary test although of limited value by itself. It gives an indication of the amount and type of organic matter present in the supply. In any case, the test does not give detail information as if the bacteria is pathogenic. 1ml of each of the samples in pipetted with aster: i.e pipette into sterite petridishes. A sterile molten medium was poured into the petridish and mixed properly. Incubation was done at 37°C for 18 hours. Colines that developed were enumerated.

RESULTS OF TOTAL VIABLE COUNT IN RAINING SEASON

SAMPLE SOURCE	COUNT CFU	TOTAL CFU
BORE HOLE	50	50
DAM	250	250

During dry season, the same procedure was taken as the raining season.

DRY SEASON TOTAL VIABLE COUNTS RESULT TABLE

SAMPLE SOURCE	COUNT CFU	TOTAL CFU
BORE HOLE	20	20
DAM	120	120

From the results of the two seasons, total viable counts, it was observed that the results of the counts in raining season is more in both Borehole and Dam as a result of the following:

(1) During dry season, some bacteria forms spores or cyst which stops them from multiplying due to unfavourable condition of the weather as well soil that is always hot.

(2) During raining season, more wastes and refuses are washed to the river as a result of erosional condition which contaminate the river.

(3) Also, during raining season, the bacteria cysts or spore are broken and the multiplication continuous in million in number.

ACTERIOLOGICAL ANALYSIS RESULTS

While a chemical examination is necessary for the purpose of detecting poisonous or corrosive ubstances in water for determining the effects it will have both on public and agricultural use because f its hardness and elements that affect plants. Chemical test cannot show the presence or should be ccompany by bacteriological examination.

As mentioned before, bacteriological analysis is important for detecting biological pollution of vater. Most pathogenic bacteria found in water are indigenous to the intestinal tract of animals and umans, but isolating them from natural water is difficult in the laboratory. Because bacterial of Coliform group are relatively easy to isolate and identify, standard tests to determine their presence or bsence in a water sample are drinking purposes. Coliform test results are reported as the most probable number (MPN) of Coliform group organism in a given volume of water.

These text is usually done to look for organism call Coliforms, found in water. Their presenc ndicates that the water is contaminated. From Bacteriological results, the Dam samples is nicroscopically, the organism is gram – positive, rod in shape, short bacilli which are indicative of E. Coli and thus not portable. From the finding, it shows that Dam water should not be used for irrigatio purposes. It should not be used by public to avoid spread of diseases such as cholera, typhoid fever, dysentery and diarrhea.

Bore hole sample shows 0-0-0 readily which indicate there are no micro-organisms present hence it is portable. Hence water from Bore hole sample should be the water to supply to the farm instead for human and livestock consumption

From the results of the total viable counts, the total CFU is more during the raining season than in the dry season. The standard of CFU is between 30 and 300 colonies. If the number did not fall within this range, the sample has to be diluted further using sterile distilled water.

From the results of Colony forming units (CFU), it shows that the CFU is higher in raining season than in the dry season.

From the results, Bore hole records 50CFU while Dam records 250CFU during the Raining season.

During dry season, the CFU is less in both bore hole and dam. Bore hole record 20CFU while Dam recorded 120CFU.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Since all the parameters were within the World Health Organization Standard, the water from the bore hole is fit for domestic and agricultural purposes. While that of dam is fit for Agricultural purposes.

5.2 RECOMMENDATION

From all the results obtained of the water samples analysed, it has been observed that most of our surface water supplies are of satisfactory quality for irrigation purposes.

It is recommended that where iron (Fe^{2+}) is observed to be relatively severe, it should be carefully monitored and if possible be given appropriate chemical treatment that would prevent the increase of iron build – up.

It is advisable that the water with higher iron-build up should be treated by Aeration process. This process is achieved by exposing the water to air or by introducing air into water. The principal types of Aeration devices are:- (1) Cascade Aerator (2) Spray or fountain Aerators, in which the water is sprayed into the air. (3) Injection diffusers, in which air in the form of small bubbles is injected into the liquid and (4) Mechanical Aerators, which promote the mixing of the liquid and exposed the water to the atmosphere in the form of fine droplets.

The P.H of water samples analyzed is satisfactory since all the values got fall within the range recommended by the world health organization standard, which infer they are in safe range. But regular check of this parameters is very important to prevent the possible problem of acidity or alkalinity especially in irrigation water.

From Bacteriological examination conducted, it was observed that in dam samples, some organisms were present which indicate the presence of E. Coli and thus not portable. Thus indicate that dam water should not be used for drinking because of its contamination but be used for irrigation purposes. In this case, it must be treated before recommended for human consumption.

I will therefore, used this medium through the management of Nasko farm to recommend to the authorities of Magama Local Government to look into possible ways of providing portable water supply through construction of Borehole since it was observed that water got from this source is of good quality.

Finally, since Dam water have been analysed and found to be good for irrigation, I recommend the management of Nasko farm to embark on dry season farming.

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