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An Analysis of the Potability of Water in Logan County

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The Edwin P. McCabe Honors Program

Senior Thesis

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Langston University
Langston, Oklahoma

AN ANALYSIS OF THE POTABILITY OF WATER IN LOGAN COUNTY

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AN ANALYSIS OF THE POTABILITY OF WATER IN LOGAN COUNTY

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CHAPTER I

BACKGROUND AND SIGNIFICANCE OF THE STUDY

INTRODUCTION

Water is the most abundant substance on earth. It is also the most abundant substance people consume. Biologists suggest that a woman's body is 55 to 65 percent water, and a man's body contains 65 to 75 percent water (Pringle 1982). Because water is a "universal solvent," it is difficult to keep it free from pathogenic microbes and chemical substances that may be hazardous to human health. Water which is free of such contaminants and is pleasing to the sight, taste, and smell is termed "potable water."

"The next great domestic crisis we may face as a nation is the water crisis and...its solution may be more expensive and more elusive than the energy crisis" (1984, cited in Rothman). These remarks were made by Oklahoma congressional representative Mike Synar at the second National Water Conference in Philadelphia, Pennsylvania. They represent society's sincere interest in maintaining safe drinking water.

Most people take safe, inexpensive drinking water for granted. They are confident that the drinking water in the United States is the best in the world. Therefore, they rarely give it a second thought. They also spend considerably less for it than for other utilities such as electri-

city, natural gas or telephone service.

> According to the Environmental Protection agency (1990) Newspaper and television report new environmental hazards almost daily. Should we pay more attention to drinking water quality?...Are drinking water sources both below and above ground becoming so contaminated that the water we drink posess health risks? What is the government doing to protect our drinking water supplies?

Drinking water must be pleasing to the sight, taste, or smell and harmful substances must be eliminated. These harmful substances are commonly referred to as contaminants. Federal and state agencies have set standards for the maximum contaminant levels in drinking water. However, research indicates that it is almost impossible to isolate organisms responsible for important waterborne diseases. Therefore, sanitarians and public health workers have concluded that the only safe way to prevent waterborne diseases is to eliminate important bacteriological and chemical contaminants.

Statement of the Problem

Recent questions have been raised concerning the drinking water supplying the citizens of Logan County. This study seeks to determine how well Logan County's potable water supply conforms with state and national drinking water standards. Emphasis is placed on the maximum contaminant

levels of water supplying the Langston community and surrounding areas.

Questions posed to residents who are receiving their primary drinking water supply from the Langston Public Water System include

1. To what extent do you utilize Langston's water supply for drinking, bathing, cooking and washing (clothes, dishes etc)?
2. Based on an daily average, how would you describe the appearance of the water?
3. Based on an daily average, how would you describe the water's odor?
4. Based on an daily average, how would you describe the water's taste?
5. What are some of the health effects associated with high contaminant levels in drinking water which you have experienced?

Purpose of the Study

This study seeks to determine the following:

1. How high is the chemical contaminant level in the drinking water supplying the residents of Logan County?
2. How high is the biological contaminant level?
3. Are related illnesses in the area characteristic of the contaminant level observed?
4. Are residents of the Langston community satisfied

with their drinking water supply?

Limitations

This study is limited primarily to data collected by the State Environmental Laboratory Service at the Oklahoma Department of Health. However, results of water quality analyses conducted on the campus of Langston University are also included. The data consist of laboratory results of chemical and bacteriological analyses of water supplying Langston University and surrounding areas, Coyle, and Guthrie. The most recent available chemical analysis report (from the State Environmental Laboratory) for drinking water supplying Langston and Coyle was completed February 12, 1990. Guthrie's most recent available chemical analysis report was completed November 20, 1991. Reports of microbiological contamination reflect the period of January 1, 1993, to January 1, 1994. This report is the most significant. Its results may explain the possible occurence of recent illnesses in the previously mentioned areas. The water quality survey was limited to persons who utilize the Langston Public Water System as their primary drinking water source. Persons residing on the campus of Langston University were excluded from the survey.

Organization of the Study

The background and significance of the study, which includes an introduction, statement of the problem, research

questions, purpose, and limitations of the study are presented in Chapter I. The pertinent literature on water quality standards, chemical and biological contaminants, and health effects of drinking water contaminants is reviewed in Chapter II. The methodology and procedures are presented in Chapter III. Chapter IV includes a data analysis and results and discussion. The last chapter consists of the summary and conclusions.

CHAPTER II

REVIEW OF RELATED LITERATURE

The examination of drinking water for contaminants has been thoroughly researched. Many articles and books have been published concerning the biological and chemical contamination of drinking water and its effects on populations. The literature reveals that there is a worldwide concern for the availability and destribution of safe drinking water.

Jonathin King, author of "Troubled Water" (1984), states:

> Chemical contamination of drinking water burst into the national conscousness in 1974, when the EPA announced that its test identified 66 different organic chemicals in the drinking water of New orleans....Shortly following the EPA's report, the Private Environmental Defense Fund released a study linking New Orleans elevated cancer death rates with the presence of organic cancer causing chemicals in the city's drinking water (p.27).

According to "Maintaining Safe Drinking Water," a publication by The United States Environmental Protection Agency (1990),

> The EPA and the states work together to ensure that every citizen drinks water that is safe. Historically, states set their drinking water standards and ran their drinking water programs. This changed in 1974, when

> congress passed the Safe Drinking Water Act to establish nationally consistent drinking water standards. State public and environmental agencies still have the primary responsibility for carrying out and enforcing the drinking water regulations written to implement the act. (Anon. 1990)

In Oklahoma, these primary agencies are the Oklahoma Water Resources Board (OWRB) and the State Department of Environmental Quality. "...the Oklahoma Water Resources Board is required to set water quality standards which are practical and in the best interest and to classify the waters according to their best present and future uses" (OWA 1990). The OWRB, in conformity with state and federal guidelines, established the first standards for the state's surface waters in 1968 and for its ground water basins in 1982 (OWA 1984). Due to growth in population and in the industrial and agricultural sectors, the standards are examined every three years.

According to the EPA (1985), The National Interim Primary Drinking Water Regulations define a Maximum Contaminant Level (MCL) as "the maximum permissible level of a contaminant in water which is delivered to the free-flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system." With this definition, the Federal regulations

clearly recognize that the quality of drinking water can be affected by its distribution lines and that it is the responsibility of the water surveyor to consider these problems in providing water to its customers. (Anon. 1985)

According to the Oklahoma Water Atlas (1990), the state's ground waters are held in 23 major basins and contain "an estimated 320 million acre-feet of water storage." Also, groundwater accounts for approximately 40% of total water used in the state..." (OWA 1984). A basin is defined as a rock formation, or group of formations, that contains sufficient saturated material to yield significant quantities of water to wells and springs.

Logan County's ground water basin consists of the Gerber-Wellington formation. The entire basin has a total thickness of 80 to 1000 feet. Well yields range from 50 to 450 gallons per minute. However, "in Logan County it is shaly and well yields are 10 gallons per minute or less near Guthrie" (OWA 1990). Water in this basin is high in sulfate, chloride, or other mineral constituents and has a total dissolved solid range of 75 to 900 mg/L (OWA 1990).

According to Jonathin King (1985),

> Contamination of the nation's ground water ranges from the EPA's one percent to as high as four percent. But the extent of the problem is not known. The EPA requires public water systems to sample for only a few of the individual chemicals commonly found in ground

water, and no testing is required for the millions of private wells. (King, 1985)

Surface waters consist of ponds, lakes, rivers, and streams. Stewart (1990), points out, "Despite the goal of the 1972 Clean Water Act to eliminate pollution by 1985, and after spending over $300 billion dollars, surface water pollution remains severe and widespread" (Stewart 1990).

The town of Langston, Oklahoma, draws its potable water supply from Langston Lake. The lake, constructed in 1966, is owned by the city of Langston and has a shoreline length of eight miles. According to the Oklahoma Water Atlas (1990), the lake's major function is for water supply, flood control, and recreation. City officials suggest that 42,000 gallons per day of high quality water is distributed.

The Environmental Protection Agency suggests (1990),

> ...small water systems which serve 25 to 3,300 people ...have great trouble consistently complying with drinking water regulations. Often they cannot afford the operations and maintenance expense required to do so. Small communities do not enjoy "economies of scale" as do large communities, where costs are less per customer. A large community can spread costs of water among many users allowing each customer to pay a smaller amount than a person in a small community with the same cost of producing and delivering water. Small systems will have an even harder time complying with

the new regulation that EPA is developing to implement.... (Anon. 1990)

Biologically safe water is one of the most important facts in determining its potability. The EPA also states that "Water systems must ensure that the drinking water they supply does not have contaminant levels higher than the law allows. Contaminants are pollutants that could make it unhealthy to use the water for human consumption" (Anon. 1990).

According to John C. Stewart, author of "Drinking water Hazards" (1990), "water pollutants can be classified as: biological contaminants, inorganic chemicals, radioactive elements, fertilizers, and synthetic organic chemicals" (Stewart 1990).

King (1985) states, "Despite the publicity surrounding chemical poisons in our drinking water, bacterial contamination contains the most common water quality problem in individual or small systems." He suggests that "...28% of rural households drink water that contains more than the federal limit of one coliform bacterium per 100 milliliters" (King, p. 52).

Coliforms are indicator organisms used in determining the presence of pathogenic bacteria in water. They are found in the feces of man and warm-blooded animals and accompany infectious pathogenic organisms. If they are found in water, it is very likely that pathogenic bacteria

will also be present.

There are many health effects of common drinking water contaminants. King (1984) makes the following statements:

> ...it is extremely difficult to predict the harm of long term exposures to low levels of toxic chemicals in drinking water.... some individuals are more susceptible than others. Children, for example are often more vulnerable because of their lower body weight, immature and growing body organs, more highly permeable skin, and faster respiratory rate. Genetic factors, general health, and life-style (including smoking and diet) can also affect susceptibility to chemicals. (p. 134)

A drinking water distribution system is among the most important source of contamination. Stewart (1990) suggests,

> Community water system outbreaks generally occur in small water systems and result in a limited number of illnesses. In these systems, untreated or inadequately treated water is responsible for the majority of waterborne disease outbreaks. Too many people in one area will sooner or later be confronted with disease resulting from too much waste. With adequate treatment of waste and drinking water, this can be overcome. Any breakdown in the treatment system puts us back at the mercy of natural laws.... Water initially exiting the drinking water plant may be disinfected, but growth that can lead to outbreaks is still possible in the

system due to: contamination of the storage unit for the distribution; stagnant water in dead-end pipes where microorganisms can grow; lack of adequate residual chlorine sustained throughout the system or abundance of nutriens for the growth of microorganisms; seasonal temperature changes; sediment deposits which allow for stagnation; and stagnant or standing water (Stewart 1990).

HEALTH EFFECTS OF COMMON DRINKING WATER CONTAMINANTS

Chemical and biological pathogens are responsible for the contamination of drinking water. The health effects associated with these contaminants are numerous.

Common Chemical Contaminants

Copper: Vomiting and abdominal pain.

Cadmium: High blood pressure; effects on lungs, cardiovascular system; pulmonary (liver) disorders an kidney damage.

Mercury: Effects on the Central Nervous System.

Arsenic: Gastrointestinal tract problems; liver cancer, cardiovascular disease, diseases of the CNS.

Lead: Headaches, anemia, nerve problems, mental retardation and learning disabilities in children, birth defects, and possible cancer.

Chromium: Suspected cancer from some forms.

Nitrates: Interference with oxygen metabolism, cancer

Dioxin: Skin disorders, cancer and mutations.

Common Biological Contaminants

Viruses and Bacteria: A wide range of ailments ranging from diarrhea, cramps, and nausea to more serious illnesses such as hepatitis and meningitis. Biological organisms are by far the most common cause of acute waterborne illness in this country. (Stewart 1990 and Rothman 1984)

On June 22, 1992, the Oklahoma State Board of Health established the most recent public water supply regulations. The purpose of these regulations is to assure the safety of pubic water supplies with respect to bacteriological and chemical contaminants. The following pages include the maximum allowable levels for inorganic chemicals, turbidity and microbiological contaminants as outlined in the Oklahoma State Board of Health Public Water Supply Regulations.

A. Maximum allowable levels for inorganic chemicals (Primary Standards).

1. The following shall be the maximum allowable levels for inorganic chemicals in all community and non-transient non-community public water systems:

CONSTITUENT	LEVEL (mg/l)
Asbestos	7 mill fiber/l
Barium	1.0
Cadmium	0.005
Chromium	0.1

Mercury	0.002
Selenium	0.05
Arsenic	0.05
Fluoride	4.0

2. The maximum allowable level for nitrates and nitrites for community, non-community and non-transient non community public water supply systems shall be as follows:

CONSTITUENT	LEVEL (mg/l)
Nitrate (as nitrogen)	10
Nitrite (as nitrogen)	1
Total Nitrate and Nitrite	10

3. The State Board of Health recommends that public water supply systems comply with the following maximum levels for certain constituents:

CONSTITUENT	LEVEL
Aluminum	0.05-0.2 mg/l
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	Non-corrosive
Fluoride	2.0 mg/l
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold

Silver	0.1 mg/l
Sulfate	0.1 mg/l
Total Dissolved Solids	500 mg/l
Zinc	5 mg/l

4. The maximum allowable level for lead in community public water supply systems shall be 0.005 mg/l until December 7, 1992.

(OSDH, p.1-2)

B. Maximum allowable levels for turbidity.

1. The maximum allowable levels for turbidity shall apply to all public water supply systems which use surface water.... The maximum allowable levels for turbidity in drinking water, measured at a representative entry point(s) to the distribution system are:

2. One (1) nephelometric turbdity unity (NTU), as determined by a monthly average except that five (5) or fewer nephelometric turbidity units may be allowed if the supplier of water can demonstrate to the Department that the higher turbidity does not do any of the following:

   a. Interfere with disinfection;

   b. Prevent maintenance of an effective disinfectant agent throughout the distribution system; or

   c. Interfere with microbiological determi-

nations.

3. Five (5) nephelometric turbidity units based on an average for two (2) consecutive days.

4. For systems using conventional filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95 percent of the measurements taken each month. If OSDH determines that the system is capable of achieving at least 99.9 percent of the measurements taken each month removal and/or inactivation of Giardia lamlia cysts, the Department may allow more than one (1) NTU in no more than five (5) percent of the samples taken each month. Turbidity levels of representative samples of the system's filtered water shall at no time exceed (5) NTU. This standard shall be effective June 29, 1993.

C. Maximum allowable levels for microbiological contaminants.

1. The following shall be the maximum allowable level for microbiological contaminants.
For systems which collect fewer than forty (40) samples per month, if no more than five (5) percent of the samples collected during the month are total coliform positive, the system is considered to be in compliance with the maximum

allowable level for total coliforms.

2. Any fecal coliform positive repeat sample or E. coli positive repeat sample or any total coliform-positive following a fecal coliform or E. coli-positive routine sample constitutes a violation of the maximum allowable level for total coliforms. For purposes of the public notification requirements, this is a violation which may pose an acute risk to health.

(OSDH, p. 3-4)

CHAPTER III

Methodology and Procedures

Introduction

This study was conducted to analyze the potability of water supplying residents in Logan County. The bacteriological analysis results are based primarily on data collected from the Oklahoma State Department of Health Environmental Laboratory. Telephone calls were made to the Oklahoma Department of Environmental Quality to secure the most recent available laboratory results of chemical and bacteriological contaminants in drinking water supplying residents in Guthrie, Langston, and Coyle. Results were received through the mail by way of Mr. Narayan Gautam at the State Environmental Laboratory. Chemical testing of Langston's water supply was conducted on the campus of Langston University. A qualitative water pollution kit designed by LAB-AIDS, Incorporated, in Bohemia, New York, was used to test the presence of several chemicals. Water samples were collected from the following sites at Langston University:

Hamilton Hall (2nd floor)	Page Hall (1st floor)
Brown Hall (1st floor)	Jones Hall (2nd floor)
Moore Hall (2nd floor)	Hale Student Center
Young Hall (1st floor)	I.W. Young Auditorium

John Montgomery Multi-purpose Building

The water samples were tested for the presence of the

following chemicals: Ammonia nitrogen, Chlorine, Chromium, Copper, Cyanide, Iron, Nitrogen, Phosphorous, Silica, and Sulfide.

The procedure for testing each respective chemical is outlined in steps I-X:

I. Ammonia nitrogen

Procedure:

A. Measure a 10ml sample into the calibrated tube.

B. Add 1 drop of Ammonia Test sol. #1 to the water sample. Mix.

C. Add 8 drops of Ammonia Test Sol. #2 to the water sample. Mix.

D. If ammonia nitrogen is present in sample, a yellow color will develop. Allow 8-10 minutes for full color development.

(Note: The sample can be poured into the large well of the Chemplate to await the time.)

II. Chlorine

Procedure:

A. Fill a Chemplate cavity approximately 2/3 full with the water to be tested.

B. Add 2 drops of Chlorine Test Solution and mix with the plastic spatula.

C. If chlorine is present, a yellow color will develop. Allow 5 minutes for full color development.

III. Chromium (chromate)

Procedure:

A. Measure 10ml water sample in a calibrated tube.

B. Add a level spatuala of the Chromate Indicator Powder. Replace the cap and mix the sample until the powder is dissolved.

C. A reddish-purple color forms in the presence of chromate and the amount of color is directly proportional to the amount of chromium (chromate) present in the sample.

IV. Copper

Procedure:

A. Fill a Chemplate cavity approximately 2/3 full with a sample of water.

B. Add 1 drop of Copper Test Sol #1. Mix and allow to stand for 1 minute.

C. Add 2-3 drops of Copper Test Sol. #2. Mix and allow to stand at least 2 minutes but not more than 10 minutes.

D. An orange-colored solution indicates the presence of copper.

V. Cyanide

Procedure:

A. Measure a 10ml water sample into the calibrated tube.

B. Add 2 drops of Cyanide Test Sol. #1 and mix.

C. Add 2 drops of Cyanide Test Sol. #2 and mix.

D. If cyanide is present, a pink color will develop which turns violet in a few minutes. Allow approximately 10 minutes for the color to develop.

VI. Iron

Procedure:

A. Measure a 5 ml water sample in the calibrated tube.

B. Add 5 drops of Iron Test Sol. #1.

C. Add 1 level spatula of Iron Indicator Powder to the sample. Replace the cap and mix to dissolve.

D. If iron is present, a wine red color will develop. Allow 2 minutes for full color development.

VII. Nitrate Nitrogen

Procedure:

A. Place approximately 3ml of a water sample in the calibrated tube.

B. Add enough Nitrate Test Sol #1 (2ml) to bring the sample up to 5 ml. Mix.

C. With a plastic spatula, add 2 level measures of Nitrate Indicator #2 Powder.

D. Replace the cover and shake until the powder is completely dissolved.

E. If nitrate nitrogen is present, a very light pink color will develop (trace amounts). A reddish purple color will develop with high concentrations of nitrate nitrogen. Allow 5 minutes for full color development.

VIII. Phosphorous

Procedure:

A. Measure a 5ml water sample in the graduated tube.

B. Add 15 drops of Phosphate Test Sol #1 and mix. Allow to stand 3-5 minutes. A light yellow color may appear.

C. Add 2-3 drops of Phosphate Test Sol. #2. Replace the cover and mix.

D. If phosphate is present, a blue color will form immediately.

IX. Silica

Procedure:

A. Measure a 5ml water sample in the calibrated tube.

B. Add 3 drops of Silica Test Sol. #1 and Mix.

C. Add 6 drops of Silica Test Sol. #2 and Mix.

D. Add 4 drops of Silica Test Sol. #3 and Mix.

E. Add 1 drop of Silica Test Sol. #4 and mix.

F. If silica is present, a blue color will form immediately.

X. Sulfide

Procedure:

A. Measure a 5 ml water sample in the graduated tube.

B. Add 15 drops of Sulfide Test Sol. #1 and mix. (Note: this solution has a high sulfuric acid content and care should be taken.)

C. Add 3 drops of Sulfide Test Sol. #2. Mix and allow to stand for 1 minute.

D. Add 20 drops of Sulfide Test Sol. #3 and mix.

E. If sulfide is present, a blue color will appear.

Questionaire Design

The questionnaire was distributed to thirty individuals who utilize the Langston Public Water System as their primary drinking water source. The questionnaire was designed to elicit special information pertaining to the potability of water as viewed by residents in the city of Langston.

The first question is designed to provide information pertaining to the water's use. Because potable water should be pleasing to the senses, questions two, three, and four ask about the water's appearance, odor, and taste based on a daily average. Question five asks for an explanation of why the user may consider the water's appearance, odor, or taste unsatisfactory. Question six is somewhat an open-ended question. It contains a list of a few common health effects

associated with high contaminant levels in drinking water. The question asks the surveyee to indicate what health effects apply to him/her (see Appendix A for the Questionnaire).

CHAPTER IV

RESULTS AND DISCUSSION

This study analyzes the potability of water supplying residents in Logan County in Oklahoma. The literature reveals that contaminant levels in drinking water should not exceed certain limits. The literature also indicates that high levels of certain biological and chemical contaminants may affect health. This chapter presents the findings of chemical and biological contaminants in water supplying residents of Guthrie, Langston, and Coyle. Also included are the results of Langston's water quality survey.

Chemical Contaminants in Logan County Drinking Water

All chemical contaminants in drinking water supplying residents of Guthrie, Langston and Coyle conform with the suggested maximum allowable levels established by the State Department of Health. However, Langston's turbidity level was found to be 4.5 Nephelometric Turbidity Units (NTU) at the time of testing. The state's maximum allowable level for turbidity is 5 NTU, indicating a difference of only 0.5 NTU. Of the three testing sites, Langston's turbidity level was the highest. The hydrogen ion concentration (pH) of Langston's water was also the highest among the three testing sites. Langston's pH was 8.0 while the maximum allowable level is 8.5. This indicates that the water's pH was only 0.5 units from the maximum allowable level.

The drinking water supplying residents in Coyle contained the highest contaminant levels among the three testing sites in respect to Lead (9ug/l), Barium (167ug/l), and Copper (229 ug/l). Coyle's total alkalinity (396 mg/l) and specific conductance (1564 umHos/cm) was also highest. As a result of the chemical testing conducted on the campus of Langston University, the presence of Ammonia nitrogen, Chlorine, Chromium, Copper, Cyanide, Iron, Nitrate nitrogen, Phosphorous, Silica and Sulfide was not detected.

Biological Contaminants in Logan County Drinking Water

According to the Oklahoma State Department of Health (1992), Langston's public water system serves a population of approximately 3,300 to 4,100. Therefore, a minimum of four samples per month must be collected for microbiological contamination. During the period of January 1993 to January 1994, all samples collected were reported as being a "safe bacteriological sample" or "total coliform negative sample. Therefore, zero (0) coliform bacteria were found in 100ml samples.

Coyle serves a population of approximately less than or equal to 1,000. Therefore, the minimum number of samples it must collect is one (anon. 1992). No (0) coliform were found in the drinking water supplying Coyle during January 4, 1993, and April 5, 1993.

Guthrie serves a population of less than or equal to 8,501 to 12,900. Therefore, it must collect a minimum of

ten samples per month according to the State Department of Health. Samples collected during the period of January 1993 to January 1994 were reported to be "safe bacteriological sample" or "total coliform negative" samples.

Logan County drinking water contained no (0) coliform bacteria and is therefore considered safe.

Langston Water Quality Survey Results

Thirty residents of the Langston community responded to the questionnaire. In regard to water usage, residents indicated that they use Langston's public water supply primarily for bathing or brushing teeth. This usage was followed by washing (clothes, dishes etc...), cooking, and drinking, respectively. Eighty-eight percent of the residents surveyed reported being unsatisfied with the water's taste. Ninety-three percent reported being unsatisfied with the water's appearance and six percent were unsatisfied with the water's odor. Over sixty percent of the residents said they purchase bottled water or obtain it from other sources.

The following health effects of common drinking water contaminants were reported: skin disorders, hair loss, diarrhea, and kidney problems. Eighty percent reported experiencing skin irritations, twenty-five percent reported hair loss, and fewer than five percent reported experiencing diarrhea and kidney problems.

Data Collection

The following pages present all data collected during this study. Pages 29-31 contain the State Environmental Laboratory results of all chemical contaminants found in drinking water supplying residents in Langston, Coyle, and Guthrie, respectively. Pages 32-37 contain the State Environmental Laboratory summary of bacteriological analyses of water supplying the town of Langston (and surrounding areas), Coyle, and Guthrie respectively. Page 38 includes a summary of all chemical contaminants found as a result of water quality research performed on the campus of Langston University.

DATE COLLECTED 01/24/90 TIME 09:00
DATE RECEIVED 01/29/90
DATE COMPLETED 02/12/90
STATION PWF 1020911 DEPTH CODE
COLLECTED BY BW

STATE ENVIRONMENTAL LABORATORY SERVICE
REPORT OF ANALYSIS

LANGSTON UNIV

ROCKE AMONETTE
STATE ENVIRONMENTAL LAB
FIELD SECTION
OKLAHOMA CITY OK 73152

CITY LOGAN COUNTY HEALTH DEPT

SAMPLE TYPE- D
PUBLIC WATER SUPPLY SAMPLE

CONCENTRATION IN SAMPLE

PARAMETER	REMARK	VALUE	UNITS	PARAMETER	REMARK	VALUE	UNITS
CHLORIDE		16	MG/L	FLUORIDE TOTAL		0.20	MG/L
NITRITE-NITRATE AS N		0.5	MG/L	PH		8.0	STD UNI
SPECIFIC CONDUCTANCE		363	UMHOS/CM	ALKALINITY, TOTAL		150.0	MG/L
TURBIDITY		4.5	NTU	ARSENIC-TOTAL	<	15	UG/L
BARIUM TOTAL		97	UG/L	CADMIUM-TOTAL	<	2	UG/L
CHROMIUM-TOTAL	<	10	UG/L	COPPER-TOTAL	<	10	UG/L
LEAD-TOTAL	<	5	UG/L	MERCURY-TOTAL	<	0.5	UG/L
SELENIUM-TOTAL	<	5	UG/L	SILVER-TOTAL	<	3	UG/L
SODIUM-TOTAL		13	MG/L				

REMARK CODE EXPLANATIONS

< LESS THAN DETECTION LIMIT

SOURCE LANGSTON
PROGRAM PWS INORGANICS ANALYASIS
COUNTY LOGAN

CITY LANGSTON

SAMPLE NUMBER 178593 00000
DATE COLLECTED 01/24/90 TIME 09:00
DATE RECEIVED 01/29/90
DATE COMPLETED 02/12/90
STATION PWF 2004203 DEPTH CODE
COLLECTED BY BH

OKLAHOMA STATE DEPARTMENT OF HEALTH
STATE ENVIRONMENTAL LABORATORY SERVICE
REPORT OF ANALYSIS

COYLE

LOGAN COUNTY HEALTH DEPT

COPY ROCKE ARONETTE

SAMPLE TYPE- D
PUBLIC WATER SUPPLY SAMPLE

CONCENTRATION IN SAMPLE

PARAMETER		VALUE	UNITS	PARAMETER		VALUE	UNITS
CHLORIDE		192	MG/L	FLUORIDE TOTAL		0.34	MG/L
NITRITE-NITRATE AS N		6.9	MG/L	PH		7.2	STD UNIT
SPECIFIC CONDUCTANCE		1564	UMHOS/CM	ALKALINITY, TOTAL		296.0	MG/L
TURBIDITY		0.9	FTU	HARDNESS, TOTAL		15	MG/L
ARSENIC TOTAL		167	UG/L	CADMIUM-TOTAL	<	2	UG/L
CHROMIUM-TOTAL	<	10	UG/L	COPPER-TOTAL		229	UG/L
LEAD-TOTAL		9	UG/L	MERCURY-TOTAL	<	0.5	UG/L
SELENIUM-TOTAL	<	5	UG/L	SILVER-TOTAL	<	3	UG/L
SODIUM-TOTAL		91	MG/L				

REMARK CODE EXPLANATIONS

< LESS THAN DETECTION LIMIT

SOURCE COYLE
PROGRAM PWS INORGANICS ANALYSIS
COUNTY LOGAN

CITY COYLE

LEGAL

/4 /4 /4 SEC 06 T 17N R 01E IM

SAMPLER'S COMMENTS

ANALYST'S COMMENTS INITIAL VALUE 16.0, REPORTED NITRATE-NITRITE VALUE IS THE MEANS OF RESAMPLES, 189867=1.7; 191460=9.4; 191461=9.5

David B. Poole
ENVIRONMENTAL LABORATORY SERVICE

ANALYST

OSDH FORM NO 814A (6 88)

SAMPLE NUMBER 209260 00000
DATE COLLECTED 10/17/91 TIME 10:00
DATE RECEIVED 10/24/91
DATE COMPLETED 11/20/91
STATION PWF 1020903 DEPTH CODE
COLLECTED BY MS

OKLAHOMA STATE DEPARTMENT OF HEALTH
STATE ENVIRONMENTAL LABORATORY SERVICE
REPORT OF ANALYSIS
GUTHRIE

LOGAN COUNTY HEALTH DEPT

COPY POCKE AMONETTE/WQS-10TH FLOOR

SAMPLE TYPE- D
PUBLIC WATER SUPPLY SAMPLE

CONCENTRATION IN SAMPLE

PARAMETER		VALUE	UNITS	PARAMETER		VALUE	UNITS
CHLORIDE	<	10	MG/L	FLUORIDE TOTAL		0.13	MG/L
NITRITE-NITRATE AS N	<	0.5	MG/L	PH (LAB)		7.35	STD UNI
SPECIFIC CONDUCTANCE		440	UMHOS/CM	SULFATE	<	20	MG/L
SOLIDS,TOTAL DISS		265	MG/L	ALKALINITY,TOTAL		232.0	MG/L
HARDNESS,TOTAL		160	MG/L	TURBIDITY		0.8	NTU
ARSENIC-TOTAL	<	15	UG/L	BARIUM TOTAL	<	10	UG/L
CADMIUM-TOTAL	<	2	UG/L	CHROMIUM-TOTAL	<	10	UG/L
COPPER-TOTAL	<	10	UG/L	IRON-TOTAL		26	UG/L
LEAD-TOTAL	<	5	UG/L	MANGANESE-TOTAL	<	10	UG/L
MERCURY-TOTAL	<	0.5	UG/L	SELENIUM-TOTAL	<	5	UG/L
SILVER-TOTAL	<	3	UG/L	SODIUM-TOTAL		31	MG/L
ZINC-TOTAL	<	5	UG/L				

REMARK CODE EXPLANATIONS

< LESS THAN DETECTION LIMIT

SOURCE GARBER WELLINGTON
PROGRAM WATER FACILITIES ENG (PWS)
COUNTY LOGAN

CITY GUTHRIE

LEGAL
¼ SW ¼ SEC 32 T 17N R 02W IM

SAMPLERS COMMENTS

ANALYSTS COMMENTS

David W. Poole
David W. Poole
ENVIRONMENTAL LABORATORY SERVICE

SUMMARY OF PWS SAMPLES FOR BACTERIOLOGICAL ANALYSIS

PROJECT	LAB	SAMPLE LOCATION	LOC-CODE	COLLECTED	COLLECTOR	TEST1	REJ-CODE	VALUE	TEST2	VALUE	COUNTY	RETAKE-FOR
1020911		LANGSTON PWA										
	30001	272865 LANGSTON HEAD HOUSE	H07	01/13/93 13:05	HJ	MF/PA		0			LOGAN	
	30001	272866 LANGSTON STUDENT UNI	C04	01/13/93 18:30	HJ	MF/PA		0			LOGAN	
	30001	272867 LANGSTON ELEM SCHOOL	S04	01/13/93 13:15	HJ	MF/PA		0			LOGAN	
	30001	275939 UNIVERSITY POLICE	P02	02/19/93 00:00	J	MF/PA		0			LOGAN	
	30001	275940 ELEMENTARY	S04	02/19/93 13:00	J	MF/PA		0			LOGAN	
	30001	275941 YOUNG HALL	B06	02/19/93 13:15	J	MF/PA		0			LOGAN	
	30001	279217 BREAUX HALL		03/31/93 10:00	HJ	MF/PA		0			LOGAN	
	30001	279220 LANGSTON ELEM	S04	03/31/93 10:20	HJ	MF/PA		0			LOGAN	
	30001	279221 STUDENT UNION LU	C04	03/31/93 10:15	HJ	MF/PA		0			LOGAN	
	30001	284791 POLICE DEPT	S02	05/28/93 11:00	HF	MF/PA		0			LOGAN	
	30001	284794 YOUNG HALL	Y03	05/28/93 11:15	HJ	MF/PA		0			LOGAN	
	30001	284795 FOOD MART	L03	05/28/93 11:30	HJ	MF/PA		0			LOGAN	
	30001	288206 COLEMAN	H02	06/30/93 13:00	HJ	MF/PA		0			LOGAN	
	30001	288209 YOUNG HALL	Y03	06/30/93 12:30	HJ	MF/PA		0			LOGAN	
	30001	288214 STUDENT UNION	C04	06/30/93 12:45	HJ	MF/PA		0			LOGAN	
	30001	291388 T.G. O PARK	P0L	07/30/93 10:00	HJ	PA/PA		0			LOGAN	
	30001	291389 LINDSEY	L05	07/30/93 11:00	HJ	PA/PA		0			LOGAN	
	30001	291392 LANSTON UNIV POLICE	S02	07/30/93 08:20	HJ	PA/PA		0			LOGAN	
	30001	291393 LANGTON U S UNION		07/30/93 08:35	HJ	PA/PA		0			LOGAN	
	30001	301347 STUDENT UNION	C04	10/29/93 11:15	HJ	PA/PA		0			LOGAN	
	30001	301348 BREAUX HALL	B06	10/29/93 11:00	HJ	PA/PA		0			LOGAN	
	30001	301349 JOHN COLEMAN	H02	10/29/93 12:30	HJ	PA/PA		0			LOGAN	
	30001	301350 WATER PUMPHOUSE	P14	10/29/93 12:00	HJ	PA/PA		0			LOGAN	
	30001	294908 STUDENT UNION	C04	09/01/93 10:00	HJ	PA/PA		0			LOGAN	
	30001	294910 LANGSTON PARK	P01	09/01/93 10:30	HJ	PA/PA		0			LOGAN	
	30001	294914 BREUUIT HALL	B06	09/01/93 10:10	HJ	PA/PA		0			LOGAN	
	30001	304124 BREUUD	B06	11/30/93 11:00	J	PA/PA		0			LOGAN	
	30001	304125 YOUNG HALL	Y03	11/30/93 11:15	J	PA/PA		0			LOGAN	
	30001	304126 T G GREEN PARK	P01	11/30/93 11:30	J	PA/PA		0			LOGAN	
	30001	306629 PHYSICAL PLANT	P05	12/30/93 11:45	HJ	PA/PA		0			LOGAN	
	30001	306630 LANGSTON CITY HALL	L07	12/30/93 11:15		PA/PA		0			LOGAN	
	30001	306631 BREAUX HALL	B06	12/30/93 11:30	HJ	PA/PA		0			LOGAN	
	30001	309261 YOUNG HALL	403	01/31/94 08:80	H JONES	PA/PA		0			LOGAN	
	30001	309263 LANGSTON UNIV POLICE	S02	01/31/94 08:15	H JONES	PA/PA		0			LOGAN	
	30001	309264 T.G. GREEN PARK	P01	01/31/94 08:30	H JONES	PA/PA		0			LOGAN	

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SUMMARY OF PWS SAMPLES FOR BACTERIOLOGICAL ANALYSIS

PROJECT	LAB	SAMPLE LOCATION	LOC-CODE	COLLECTED	COLLECTOR	TEST1	REJ-CODE	VALUE	TEST2	VALUE	COUNTY	RETAKE-FOR
2004203		COYLE										
	30001	271725 115 E CRAWFORD	CHS	01/04/93 10:30	JG	MF/PA		0			LOGAN	
	30001	274918 211 W LEE	960	02/08/93 10:30	JG	MF/PA		0			LOGAN	
	30001	277112 116 W MAIN	185	03/03/93 11:00	JG	MF/PA		0			LOGAN	
	30001	280503 111 S PULLIAM	S5C	04/12/93 10:30	JG	MF/PA		0			LOGAN	
	30001	282765 814 S COTTINGHAM	23M	05/05/93 10:30	JG	MF/PA		0			LOGAN	
	30001	285798 516 E BOND	002	06/07/93 11:30	JG	MF/PA		0			LOGAN	
	30001	289023 516 E BOND	002	07/06/93 11:30	JG	MF/PA		0			LOGAN	
	30001	292021 115 E CRAWFORD	CHS	08/03/93 13:00	JG	PA/PA		0			LOGAN	
	30001	298788 515 E MAIN	64A	10/05/93 10:30	JG	PA/PA		0			LOGAN	
	30001	298788 515 E MAIN	64A	10/05/93 10:30	JG	PA/PA		0			LOGAN	
	30001	295901 101 N COTTINGHAM	181	09/08/93 10:00	JG	PA/PA		0			LOGAN	
	30001	301854 211 W LEE	96G	11/02/93 14:00	JG	MF/PA		0			LOGAN	
	30001	304692 116 W MAIN	185	12/06/93 11:00	JG	PA/PA		0			LOGAN	
	30001	307097 111 N PULLIAM	S5C	01/04/94 11:00	JG	PA/PA		0			LOGAN	
	30001	279779 111 S PULLIAM	S5C	04/05/93 10:00	JG	MPN/PA	LK				LOGAN	

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PROJECT	LAB	SAMPLE LOCATION	LOC-CODE	COLLECTED	COLLECTOR	TEST1	REJ-CODE	VALUE	TEST2	VALUE	COUNTY	RETAKE-FOR
1020903		GUTHRIE										
	30001	271477 1423 E NOBLE	OSG	01/04/93 08:45	EDDIE	MF/PA		0			LOGAN	
	30001	271481 901 N WENTZ	DQS	01/04/93 08:33	EDDIE	MF/PA		0			LOGAN	
	30001	271482 1402 S DIVISION	MMS	01/04/93 07:55	EDDIE	MF/PA		0			LOGAN	
	30001	271485 2700 W OKLAHOMA	RBQ	01/04/93 08:09	EDDIE	MF/PA		0			LOGAN	
	30001	272405 2015 E OKLAHOMA	TMG	01/11/93 08:34	EDDIE	MF/PA		0			LOGAN	
	30001	272406 2800 W OKLAHOMA	LCH	01/11/93 08:20	EDDIE	MF/PA		0			LOGAN	
	30001	272407 502 S DIVISION	HDI	01/11/93 08:04	EDDIE	MF/PA		0			LOGAN	
	30001	273079 1423 E OKLAHOMA	OSQ	01/19/93 09:12	EDDIE	MF/PA		0			LOGAN	
	30001	273080 915 S DIVISION	GWP	01/19/93 08:50	EDDIE	MF/PA		0			LOGAN	
	30001	273081 2700 W OKLAHOMA	RBG	01/19/93 09:01	EDDIE	MF/PA		0			LOGAN	
	30001	273958 1402 S DIVISION	MMS	02/01/93 07:58	EDDIE	MF/PA		0			LOGAN	
	30001	273963 2700 W OKLAHOMA	BBQ	02/01/93 08:12	EDDIE	MF/PA		0			LOGAN	
	30001	273966 1423 E NOBLE	OSG	02/01/93 08:55	EDDIE	MF/PA		0			LOGAN	
	30001	273967 901 N WENTZ	DQS	02/01/93 08:38	EDDIE	MF/PA		0			LOGAN	
	30001	274817 502 S DIVISION	HDI	02/08/93 07:50	EDDIE	MF/PA		0			LOGAN	
	30001	274818 2800 W OKLAHOMA	LCH	02/08/93 08:09	EDDIE	MF/PA		0			LOGAN	
	30001	274822 2015 E OKLAHOMA	TMG	02/08/93 08:27	EDDIE	MF/PA		0			LOGAN	
	30001	275836 1423 EAST NOBLE	OSG	02/18/93 08:09	EDDIE	MF/PA		0			LOGAN	
	30001	275837 2700 W OKLAHOMA	RBG	02/18/93 07:55	EDDIE	MF/PA		0			LOGAN	
	30001	275839 915 S DIVISION	GWP	02/18/93 07:40	EDDIE	MF/PA		0			LOGAN	
	30001	276471 1402 S DIVISION	MMS	03/01/93 08:03	EDDIE	MF/PA		0			LOGAN	
	30001	276474 901 NORTH WENTZ	DQS	03/01/93 08:32	EDDIE	MF/PA		0			LOGAN	
	30001	276475 1423 E NOBLE	OSG	03/01/93 08:45	EDDIE	MF/PA		0			LOGAN	
	30001	276476 2700 W OKLAHOMA	RBQ	03/01/93 08:18	EDDIE	MF/PA		0			LOGAN	
	30001	277316 2800 W OKLAHOMA	LCH	03/08/93 08:08	EDDIE	MF/PA		0			LOGAN	
	30001	277317 502 S DIVISION	HDI	03/08/93 07:50	EDDIE	MF/PA		0			LOGAN	
	30001	277318 2015 E OKLAHOMA	TMG	03/08/93 08:32	EDDIE	MF/PA		0			LOGAN	
	30001	278153 1423 E NOBLE	OSG	03/15/93 08:27	EDDIE	MF/PA		0			LOGAN	
	30001	278154 2700 W OKLAHOMA	RBG	03/15/93 08:14	EDDIE	MF/PA		0			LOGAN	
	30001	278155 915 S DIVISION	GWP	03/15/93 08:00	EDDIE	MF/PA		0			LOGAN	
	30001	279406 1402 S DIVISION	MMS	04/05/93 08:04	EDDIE	MF/PA		0			LOGAN	
	30001	279413 901 N WENTZ	DQS	04/05/93 08:33	EDDIE	MF/PA		0			LOGAN	
	30001	279424 2700 W OKLAHOMA	RBQ	04/05/93 08:20	EDDIE	MF/PA		0			LOGAN	
	30001	279429 1423 E NOBLE	OSG	04/05/93 08:50	EDDIE	MF/PA		0			LOGAN	
	30001	280341 2015 E OKLAHOMA	TMG	04/12/93 08:22	EDDIE	MF/PA		0			LOGAN	
	30001	280343 2800 W OKLAHOMA	LCH	04/12/93 08:03	EDDIE	MF/PA		0			LOGAN	
	30001	280344 502 S DIVISION	HDI	04/12/93 07:45	EDDIE	MF/PA		0			LOGAN	
	30001	281041 2700 W OKLAHOMA	RBQ	04/19/93 08:50	EDDIE	MF/PA		0			LOGAN	
	30001	281044 915 S DIVISION	GWP	04/19/93 09:14	EDDIE	MF/PA		0			LOGAN	
	30001	281045 1423 E NOBLE	OSG	04/19/93 09:05	EDDIE	MF/PA		0			LOGAN	

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30001		281940	1402 S DIVISION	MHS	05/03/93 08:03	EDDIE	MF/PA		0			LOGAN	
30001		281944	2700 W OKLAHOMA	RBG	05/03/93 08:22	EDDIE	MF/PA		0			LOGAN	
30001		281945	1423 E NOBLE	OSG	05/03/93 08:50	EDDIE	MF/PA		0			LOGAN	
30001		281947	901 N WENTZ	DQS	05/03/93 08:35	EDDIE	MF/PA		0			LOGAN	
30001		283445	502 S DIVISION	HDI	05/13/93 12:50	EDDIE	MF/PA		0			LOGAN	
30001		283446	2800 W OKLAHOMA	LCH	05/13/93 13:10	EDDIE	MF/PA		0			LOGAN	
30001		283447	2015 E OKLAHOMA	TMG	05/13/93 13:25	EDDIE	MF/PA		0			LOGAN	
30001		283564	915 S DIVISION	GWP	05/17/93 09:30	EDDIE	MF/PA		0			LOGAN	
30001		283567	1423 E NOBLE	OSG	05/17/93 10:20	EDDIE	MF/PA		0			LOGAN	
30001		283570	901 NORTH WENTZ	DQS	05/17/93 10:02	EDDIE	MF/PA		0			LOGAN	
30001		285633	901 N WENTZ	DQS	06/07/93 08:27	EDDIE	MF/PA		0			LOGAN	
30001		285634	1423 E NOBLE	OSG	06/07/93 08:50	EDDIE	MF/PA		0			LOGAN	
30001		285635	2700 W OKLAHOMA	RBG	06/07/93 08:20	EDDIE	MF/PA		0			LOGAN	
30001		285636	1402 S DIVISION	MHS	06/07/93 08:06	EDDIE	MF/PA		0			LOGAN	
30001		286525	502 S DIVISION	HDI	06/14/93 08:15	EDDIE	MF/PA		0			LOGAN	
30001		286528	2800 W OKLAHOMA	LCH	06/14/93 08:31	EDDIE	MF/PA		0			LOGAN	
30001		286532	2015 E OKLAHOMA	TMG	06/14/93 08:50	EDDIE	MF/PA		0			LOGAN	
30001		287284	1423 E NOBLE	OSG	06/21/93 08:15	EDDIE	MF/PA		0			LOGAN	
30001		287286	2700 W OKLAHOMA	RB	06/21/93 08:06	EDDIE	MF/PA		0			LOGAN	
30001		287287	915 S DIVISION	GWP	06/21/93 07:45	EDDIE	MF/PA		0			LOGAN	
30001		288486	2700 W OKLAHOMA	RBG	07/06/93 08:28	EDDIE	PA/PA		0			LOGAN	
30001		288488	1402 S DIVISION	MHS	07/06/93 08:10	EDDIE	PA/PA		0			LOGAN	
30001		288489	1423 E NOBLE	OSG	07/06/93 09:00	EDDIE	PA/PA		0			LOGAN	
30001		288497	901 N WENTZ	DQS	07/06/93 08:45	EDDIE	PA/PA		0			LOGAN	
30001		289333	2800 W OKLAHOMA	LCH	07/12/93 08:20	E	PA/PA		0			LOGAN	
30001		289334	502 S DIVISION	HDI	07/12/93 08:05	E	PA/PA		0			LOGAN	
30001		289335	2015 E OKLAHOMA	TMG	07/12/93 08:34	E	PA/PA		0			LOGAN	
30001		290270	901 N WENTZ	DQS	07/19/93 08:22	EDDIE	PA/PA		0			LOGAN	
30001		290271	1423 E NOBLE	OSG	07/19/93 08:35	EDDIE	PA/PA		0			LOGAN	
30001		290272	915 S DIVISION	GWP	07/19/93 07:50	EDDIE	PA/PA		0			LOGAN	
30001		291440	1402 S DIVISION	MHS	08/02/93 08:00	EDDIE	PA/PA		0			LOGAN	
30001		291441	2700 W OKLA	RBG	08/02/93 08:21	EDDIE	PA/PA		0			LOGAN	
30001		291442	1423 E NOBLE	OSG	08/02/93 08:45	EDDIE	PA/PA		0			LOGAN	
30001		291446	901 N WENTZ	DQS	08/02/93 08:30	EDDIE	PA/PA		0			LOGAN	
30001		292544	502 S DIVISION	HDI	08/09/93 08:00	EDDIE	PA/PA		0			LOGAN	
30001		292546	2800 W OKLAHOMA	LCH	08/09/93 08:22	EDDIE	PA/PA		0			LOGAN	
30001		292548	2015 E OKLAHOMA	TMG	08/09/93 08:41	EDDIE	PA/PA		0			LOGAN	
30001		293458	2700 W OKLAHOMA	RBG	08/16/93 08:06	EDDIE	PA/PA		0			LOGAN	
30001		293459	915 S DIVISION	GWP	08/16/93 07:45	EDDIE	PA/PA		0			LOGAN	
30001		293460	1423 E NOBLE	OSG	08/16/93 08:32	EDDIE	PA/PA		0			LOGAN	
30001		298212	1402 S DIVISION	MHS	10/04/93 08:29	EDDIE	PA/PA		0			LOGAN	
30001		298213	2700 W OKLAHOMA	RBG	10/04/93 08:44	EDDIE	PA/PA		0			LOGAN	

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30001	298215	901 N WENTZ	DWS	10/04/93 09:00	EDDIE	PA/PA		0			LOGAN	
30001	298224	1423 E NOBLE	OSG	10/04/93 09:13	EDDIE	PA/PA		0			LOGAN	
30001	299429	2015 E OKLAHOMA	TMG	10/11/93 09:16	EDDIE	PA/PA		0			LOGAN	
30001	299430	2800 W OKLAHOMA	LCH	10/11/93 08:55	EDDIE	PA/PA		0			LOGAN	
30001	299431	502 S DIVISION	HDI	10/11/93 08:36	EDDIE	PA/PA		0			LOGAN	
30001	300193	1423 E NOBLE	OSG	10/18/93 08:46	EDDIE	MF/PA		0			LOGAN	
30001	300194	915 S DIVISION	GWP	10/18/93 07:30	EDDIE	MF/PA		0			LOGAN	
30001	300195	2700 W OKLAHOMA	RBG	10/18/93 08:25	EDDIE	MF/PA		0			LOGAN	
30001	298212	1402 S DIVISION	MMS	10/04/93 08:29	EDDIE	PA/PA		0			LOGAN	
30001	298213	2700 W OKLAHOMA	RBG	10/04/93 08:44	EDDIE	PA/PA		0			LOGAN	
30001	298215	901 N WENTZ	DWS	10/04/93 09:00	EDDIE	PA/PA		0			LOGAN	
30001	298224	1423 E NOBLE	OSG	10/04/93 09:13	EDDIE	PA/PA		0			LOGAN	
30001	299429	2015 E OKLAHOMA	TMG	10/11/93 09:16	EDDIE	PA/PA		0			LOGAN	
30001	299430	2800 W OKLAHOMA	LCH	10/11/93 08:55	EDDIE	PA/PA		0			LOGAN	
30001	299431	502 S DIVISION	HDI	10/11/93 08:36	EDDIE	PA/PA		0			LOGAN	
30001	300193	1423 E NOBLE	OSG	10/18/93 08:46	EDDIE	MF/PA		0			LOGAN	
30001	300194	915 S DIVISION	GWP	10/18/93 07:30	EDDIE	MF/PA		0			LOGAN	
30001	300195	2700 W OKLAHOMA	RBG	10/18/93 08:25	EDDIE	MF/PA		0			LOGAN	
30001	295217	1423 E NOBLE	OSG	09/07/93 09:20	EDDIE	PA/PA		0			LOGAN	
30001	295218	122 E CLEVELAND	V66	09/07/93 09:06	EDDIE	PA/PA		0			LOGAN	
30001	295219	1402 S DIVISION	MMS	09/07/93 08:05	EDDIE	PA/PA		0			LOGAN	
30001	295220	901 N WENTZ	DQS	09/07/93 08:50	EDDIE	PA/PA		0			LOGAN	
30001	296148	2700 WEST OKLAHOMA	RBG	09/13/93 08:08	EDDIE	PA/PA		0			LOGAN	
30001	296149	502 SOUTH DIVISION	HDI	09/13/93 07:50	EDDIE	PA/PA		0			LOGAN	
30001	296163	2015 E OKLAHOMA	TMG	09/13/93 08:40	EDDIE	PA/PA		0			LOGAN	
30001	296969	1116 S DIVISION	GWP	09/20/93 07:35	EDDIE	PA/PA		0			LOGAN	
30001	296971	2800 W OKLAHOMA	LCH	09/20/93 08:20	EDDIE	PA/PA		0			LOGAN	
30001	296972	1423 E NOBLE	OSG	09/20/93 08:33	EDDIE	PA/PA		0			LOGAN	
30001	301372	2700 W OKLAHOMA	RBG	11/01/93 08:37	EDDIE	PA/PA		0			LOGAN	
30001	301373	1402 S DIVISION	MMS	11/01/93 08:20	EDDIE	PA/PA		0			LOGAN	
30001	301374	901 N WENTZ	DQS	11/01/93 08:55	EDDIE	PA/PA		0			LOGAN	
30001	301376	1423 E NOBLE	OSG	11/01/93 09:07	EDDIE	PA/PA		0			LOGAN	
30001	302298	2015 EAST OKLAHOMA	TMG	11/08/93 08:45	EDDIE	PA/PA		0			LOGAN	
30001	302299	2800 W OKLAHOMA	LCH	11/08/93 08:23	EDDIE	PA/PA		0			LOGAN	
30001	302300	502 S DIVISION	HDI	11/08/93 08:06	EDDIE	PA/PA		0			LOGAN	
30001	303059	915 S DIVISION	GWP	11/15/93 07:45	EDDIE	PA/PA		0			LOGAN	
30001	303058	2700 W OKLAHOMA	RBG	11/15/93 08:22	EDDIE	PA/PA		0			LOGAN	
30001	303061	1423 E NOBLE	OSG	11/15/93 08:40	EDDIE	PA/PA		0			LOGAN	
30001	304496	1423 EAST NOBLE	OSG	12/06/93 08:40	EDDIE	PA/PA		0			LOGAN	
30001	304497	901 NORTH WENTZ	DQS	12/06/93 08:22	EDDIE	PA/PA		0			LOGAN	
30001	304498	2700 WEST OKLAHOMA	RBG	12/06/93 07:55	EDDIE	PA/PA		0			LOGAN	
30001	304499	1402 SOUTH DIVISION	MMS	12/06/93 07:34	EDDIE	PA/PA		0			LOGAN	

* For additional information please call the STATE ENVIRONMENTAL LABORATORY at (405) 271-5240.

SUMMARY OF PWS SAMPLES FOR BACTERIOLOGICAL ANALYSIS

PROJECT	LAB SAMPLE	LOCATION	LOC-CODE	COLLECTED	COLLECTOR	TEST1	REJ-CODE	VALUE	TEST2	VALUE	COUNTY	RETAKE-FOR
30001	305471	2015 E OKLAHOMA	TMQ	12/13/93 08:55	EDDIE	PA/PA		0			LOGAN	
30001	305472	2800 W OKLAHOMA	LCH	12/13/93 08:36	EDDIE	PA/PA		0			LOGAN	
30001	305473	502 S DIVISION	HDI	12/13/93 08:18	EDDIE	PA/PA		0			LOGAN	
30001	306124	2700 W OKLAHOMA	RBG	12/20/93 08:12	EDDIE	PA/PA		0			LOGAN	
30001	306125	1423 E NOBLE	OSG	12/20/93 08:27	EDDIE	PA/PA		0			LOGAN	
30001	306127	915 S DIVISION	GWP	12/20/93 07:45	EDDIE	PA/PA		0			LOGAN	
30001	306646	901 NORTH WENTZ	DQS	01/03/94 08:55	EDDIE	PA/PA		0			LOGAN	
30001	306647	1402 SOUTH DIVISION	MNS	01/03/94 08:14	EDDIE	PA/PA		0			LOGAN	
30001	306652	1423 EAST NOBLE	OSG	01/03/94 09:11	EDDIE	PA/PA		0			LOGAN	
30001	306654	2700 WEST OKLAHOMA	RBG	01/03/94 08:33	EDDIE	PA/PA		0			LOGAN	
30001	307528	2015 EAST OKLAHOMA	TMQ	01/10/94 08:42	EDDIE	PA/PA		0			LOGAN	
30001	307529	2800 WEST OKLAHOMA	LCH	01/10/94 08:25	EDDIE	PA/PA		0			LOGAN	5
30001	307531	502 SOUTH DIVISION	HDI	01/10/94 08:08	EDDIE	PA/PA		0			LOGAN	

* For additional information please call the STATE ENVIRONMENTAL LABORATORY at (405) 271-5240.

An Analysis of Chemical Contaminants in Langston's Water Supply Conducted on the Campus of Langston University

Chemical Name	Absent (A)/Present (P)
Ammonia nitrogen	A
Chlorine	A
Chromium	A
Copper	A
Cyanide	A
Iron	A
Nitrate nitrogen	A
Phosphorous	A
Silica	A
Sulfide	A

CHAPTER V

SUMMARY CONCLUSIONS AND IMPLICATIONS

Chapter One presents the background necessary to understand the extent of this study. It also includes the research questions. Chapter Two presents the pertinent literature on water quality standards, chemical and bacteriological contamination, and health effects of drinking water contaminants. Chapter Three provides a description of the research methodology and the questionnaire used in the survey. Chapter Four is a description of the laboratory results obtained from a chemical and bacteriological analysis conducted by the Oklahoma State Environmental Laboratory and on the campus of Langston University. This chapter also includes the results obtained from the Langston Water Quality Survey.

How high is the chemical contaminant level in the drinking water supplying the residents of Logan County? All chemical contaminants were found to be significantly lower than the maximum allowable levels established by the State Environmental Laboratory. Although these values were acceptable, Langston's turbidity level (4.5 NTU) was only 0.5 NTU's less than the maximum allowable level of 5.0 NTU. This rather high turbidity level suggests why ninety-three percent of the residents surveyed are unsatisfied with the water's appearance. Water experts suggest that turbidity

levels may be affected by the leaching of particles from distribution lines. The chemical testing conducted on the campus of Langston University suggests that ammonia nitrogen, chlorine, chromium, copper, cyanide, iron, nitrate nitrogen, phosphorous, silica and sulfide are present in very small amounts, if at all. These results conform with the chemical analysis results reported by the State Environmental Laboratory.

How high is the biological contaminant level? Bacteriological analyses of waster supplying residents of Langston, Coyle, and Guthrie determined that zero coliform bacteria were present in any of the water samples. Therefore, no biological contaminant level was observed. The Oklahoma State Department of Health suggests that samples in which no coliform bacteria are present are considered as "safe bacteriological samples."

Are related illnesses in the area characteristic of the contaminant level observed? The following health effects of common drinking water contaminants were reported by residents who utilize the Langston Public Water System as their primary drinking water source: skin disorders, hair loss, diarrhea, and kidney problems. Of thirty people surveyed, more than eighty percent reported experiencing skin irritations, twenty-five percent experienced hair loss, and fewer than five percent reported experiencing diarrhea and kidney problems. Because the chemical contaminants

associated with the observed health effects were significantly lower than the maximum allowable levels, there is little indication that related illnesses in the area are characteristic of the contaminant level observed. However, because a significantly large percentage of those surveyed reported experiencing skin irritations, further testing should be conducted to determine the level of dioxin and other chemical contaminants responsible for skin irritations.

Are residents of the Langston community satisfied with their drinking water? Six percent of the residents surveyed reported being unsatisfied with the water's taste, eighty-nine percent reported being unsatisfied with the water's odor. Over sixty percent of the residents stated that they purchase bottled water or obtain it from other sources. Collectively, this data suggests that residents of the Langston community are unsatisfied with their water.

Potable water is free of harmful contaminants and pleasing to the senses. An analysis of the potability of water in Logan County has determined that the water is of high quality. No biological or chemical contaminants exist in the waters supplying Guthrie, Langston, and Coyle at levels that should cause alarm. However, the majority of Langston's residents are unsatisfied with their drinking water. A new water treatment plant is currently under construction for the Langston community. This plant will al-

leviate high turbidity levels and ensure residents that their water is even safer to drink. Water quality specialists suggest that contaminant levels in drinking water may fluctuate periodically. Therefore, a followup study should be conducted to determine if the proposed outcome is realized.

APPENDIX A

Questionanaire

Langston Water Quality Survey

1. Please indicate by number (1 being most to 5 least) the extent to which you utilize Langston's water supply for the following:
   _____Drinking
   _____Bathing/brushing teeth
   _____Cooking
   _____Washing (clothes, dishes etc...)
   _____Other

2. Based on an daily average, how would you describe the appearance of the water?

   A. Satisfactory
   B. Unsatisfactory

3. Based on an daily average, how would you describe the water's odor?

   A. Satisfactory
   B. Unsatisfactory

4. Based on an daily average, how would you describe the water's taste?

   A. Satisfactory
   B. Unsatisfactctory

5. If you have marked unsatisfactory for any of the above questions, please explain. In your explanation, indicate where you acquired the water.

_____
_____
_____
_____

6. The following is a few common health effects associated with high contaminant levels in drinking water. Please check those which you honestly believe apply to you.

_____ Headaches _____ Skin disorders _____ Hair loss
_____ Nausea _____ Gastrointestinal problems (diarhea)
_____ Anemia _____ Liver damage _____ Cancer
_____ Kidney Problems (gallstones) _____ Central Nervous System
_____ Other_____
_____ None apply

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