PROJECT COMPLETION REPORT

A Water Quality Training Program for the
Louisiana Cooperative Extension Service

By
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and
Bill Branch

Louisiana Cooperative Extension Service
Louisiana State University
Baton Rouge, LA 70803

Prepared for
United States Department of the Interior

LOUISIANA WATER RESOURCES
RESEARCH INSTITUTE
Louisiana State University
Baton Rouge, LA 70803

September 1989
A WATER QUALITY TRAINING PROGRAM
FOR THE LOUISIANA COOPERATIVE
EXTENSION SERVICE
A WATER QUALITY TRAINING PROGRAM
FOR THE LOUISIANA COOPERATIVE EXTENSION SERVICE

By:

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Funded By:

U.S. Department of the Interior
Geological Survey
Section 104 Program

Through:

Louisiana Water Resources Research Institute
2401A CEBA Building
Louisiana State University
Baton Rouge, LA 70803

September 25, 1989
DISCLAIMER

The activities on which this report is based were financed in part by the Department of the Interior, U.S. Geological Survey, through the Louisiana Water Resources Research Institute.

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ABSTRACT

A Water Quality Training Program
For The Louisiana Cooperative Extension Service

Brenda G. Kelly and Bill Branch,
Project Coordinators

September 1989

The Information Transfer Program of the Louisiana Water Resources Research Institute, in conjunction with the Louisiana Cooperative Extension Service (LCES), developed a water quality training program for the state and parish staff of LCES. The purpose of the training program was to help LCES staff, through improving technical competence and availability of specialized information, more effectively and efficiently meet the citizens' requests for information and promote their understanding of water quality issues.

Seven one-day workshops were planned. To date, four workshops have been conducted at LCES district offices in Alexandria, Shreveport, Tallulah, and Baton Rouge (two districts combined meetings here). Other workshops are scheduled for fall, 1989. The workshops focused on drinking water issues, and included topics as natural ingredients to water quality, water quality standards, health effects of water quality, man's insults to water quality, the economics of water quality, home treatment devices, and area agency responsibilities over water quality. Presenters were experts from universities, and state and federal governmental offices in-state. Presently 220 LCES staff members have participated in the workshops.

Future plans include development of the workshop materials into a water quality reference manual, conductance of additional workshops, and developments and implementation of additional materials and programs on other water quality issues.
ACKNOWLEDGEMENT

The investigators wish to thank the Louisiana Cooperative Extension Service (LCES) state office for its cooperation in and financial assistance to this water quality training program. The LCES provided transportation to workshops, equipment for use in presentations, extensive graphics and duplication services for preparation of workshop handouts and visuals, and staff time to assist in many aspects of the program development and implementation.

To the staff of the LCES district and parish offices, thanks is extended for their eagerness to participate in the program and for their constructive feedback following each workshop.

A special thanks is extended to members of the LCES state staff and to representatives of state and federal agencies who contributed presentations during each of the training programs. Especially the presentations of Dr. Karem Behm (water conservation and economics), Dr. Claudette Reichel (home water treatment devices), and Saraleen Seals (health effects of water quality), are greatly appreciated.
TYPICAL WORKSHOP AGENDA
December 8, 1988

TO: All Cenla Area Extension Personnel

RE: Water Quality Meeting, December 15, 1988

Attached is an agenda and information relating to the Cenla Area Water Quality Meeting scheduled for December 15, 1988 in the Nursing School Auditorium at LSU-Alexandria. This has been prepared for you in advance by Mr. Bill Branch.

Plans are being made for lunch at the cafeteria in the Student Union building on the campus. The cost will be approximately five dollars ($5.00). Refreshments will be available in the lobby of the nursing building during the breaks.

Please try to be on time for the meeting since we will have a heavy schedule for the day. This meeting has been designed to assist you with water quality work in your parish when we start preparing the program and plan of work for FY 90.

Sincerely,

Leland Scoggins
Associate District Agent
Cenla Area

LS/gr

Enclosure

cc: Vice-Chancellor Loupe
    Dr. Karen Behm
    Mr. Bill Branch
    Dr. Lowell McCormick
    Dr. Jack Bagent
WATER QUALITY, CONSERVATION AND MANAGEMENT
TRAINING SESSION NO. 1
DRINKING WATER QUALITY AND AGENCY RESPONSIBILITY
NURSING SCHOOL AUDITORIUM
LSU ALEXANDRIA
9:15 am - 3:30 pm
DECEMBER 15, 1988

- Introduction and Administrative Details - Dr. Leland Scoggins
- Importance of Water Quality, Conservation and Management

  Economic Issues - Dr. Karen Behm
  Health Issues - Sara Seals

- Louisiana's Hydro-Geology - Brenda Kelly

  Geology
  Surface Water Basins
  Ground Water Aquifers
  Hydrologic Cycle
  Soils

- Water Quality - Bill Branch

  Standards
  Status
  Threats
  Testing

- Point-of-Use Water Treatment - Dr. Claudette Reichel

- Agency Responsibilities - Bill Branch, Moderator

  Michael Caze - DHH
  John Impson - DAF
  Bob Paul - DEQ
  Tom Ashby - DEQ
  Bo Bolourchi - DOTD
  J. B. LeRay - ASCS
  Harry Hawthorne - SCS
WATER QUALITY, CONSERVATION AND MANAGEMENT

TRAINING SESSION NO. 1

- Introduction & Administrative Details - Leland C. Scoggins, District Agent
  Cenla Area

  Reason for Training - Prepare LCES staff to conduct water quality
  educational programs

  Attendance -
  LCES    DHH    DAF
  SCS    DEQ    S&WCD
  ASCS    DOTD

  Lunch and Coffee Break

  Materials - Mimeographs available cover topics in more detail than
  presentations. Updated materials to follow. Waste management
  topics to be covered in later training sessions. Special
  topics by telelearning.

  Evaluation -

  - Importance of Water Quality, Conservation and Management - Karen S. Behm,
    Specialist, Family
    Resource Management

Health Issues

Carcinogens

Infant Mortality due to Nitrates

Intestinal Illness and Parasites

Sodium, Salts, Copper, Lead

Pesticides and Chemicals

Industry, Power and Transportation

Need large quantities of acceptable quality water in
uninterruptible supply.

Soil erosion causes sedimentation which increases cost of
maintaining water ways.

Louisiana has two of five largest ocean ports.
Irrigation

Largest user of groundwater.

Essential to survival and production of many alternative crops.

Insurance of productivity for traditional crops.

Much naturally occurring Louisiana groundwater of too poor quality for irrigation of sensitive crops (sodium and salts).

Aquaculture/Marine Fisheries

Good water quality essential to productivity.

Poor water quality prevents harvesting (bacteria) or increases cost of processing (purging).

High ammonia level in groundwater can kill fish.

Flooding

Louisiana leads nation in number of claims for flood damages, and in number of repetitive claims, even though it is 2nd in number of flood insurance policies and 3rd in dollar amount of insurance.

Recreation

Important source of revenue.

Agriculture is one of contributors to loss of recreational use of surface water.

- Louisiana's Hydro-Geology - Brenda Kelly, Assistant Director, Louisiana Water Resources Research Institute

Geology

55% of Louisiana is a natural flood plain.

Soils primarily laid down by rivers over thousands of years.

Relatively recent (geologically speaking) coverage by saltwater accounts for frequent occurrence of high salt levels in ground water and salt domes.
Surface Water Basins

State divided into twelve basins.

Groundwater Aquifers

State supplied by nine major aquifers.

Hydrologic Cycle

Total water supply is static.
Water cycles between phases and media.
Groundwater is source of 40% of surface water during low flow conditions.
Surface water supplies groundwater through aquifer recharge areas.

Soils

Frequent occurrence of heavy clays limit vertical movement of groundwater.
Horizontal layers of coarse sands encourage horizontal flow.
Leaching and surface runoff potential varies with soil type, cover and slope.

- Water Quality – Bill Branch, Specialist, Engineering Standards

Maximum Contaminant Levels (MCL)

Human toxicology data.
Animal toxicology data.
No observable effect level.
Water provides 20% exposure.
Average adult water consumption 2 liters/day.

Primary Pollutants

Pose health risk.

Secondary Pollutants

Esthetic concerns.
Bacteria

Indicator - fecal coliform, eschericia coli

Pathogens - Salmonella, Listeria, Typhoid, Hepatitis, Vibrio

Parasites - Giardia

Status

Surface Waters

Ground Water

Public Water Supply

Private Wells

Threats

Point Source Discharges

Non-Point Source

Agriculture, Forestry, Mining, Urban Septic Tanks, Irrigation

Sediment - 211 million tons/year (U.S.)

Bacteria

Nutrients - 1.4 million tons/year (U.S.)

Pesticides - 0.03 million tons/year (U.S.)

Water well construction and closure of abandoned wells

Seismic wells, back flow prevention, cross-connections

Testing

pH

Inorganics

Sodium, Chlorides

Copper, Lead

Organics

Acids

Chemicals

Pesticides
Bacteria

Fecal Coliform

Labs

Private

Public

- Point-of-Use Treatment - Claudette H. Reichel, Specialist, Housing

Water Softener

Calcium and magnesium replaced by sodium

Iron

De-Ionization

Filters

Mechanical

Carbon

Reverse Osmosis

Distillation

Bottled Water

Chemicals

Chlorine/chloramines

Iodine

Acid

Lime

Polymers

Ultra-Violet

Management

Maintenance

System Design
- Agency Representatives

LA Department of Health and Hospitals (DHH) - Michael Caze, Regional Engineer
  Public Water Supply
  Private Wells
  Septic Systems
  Publicly Owned Treatment Works
  Milk Sanitarians
  Food Processing
  Restaurants
  Public Health

USDA Soil Conservation Service (SCS) - Harry Hawthorne, State Engineer
  Watershed Program
  Resource Conservation and Development
  Waste Management Design
  Farm Plans

USDA Agricultural Stabilization & Conservation Service (ASCS) - J. B. LeRay
  Provisions of 1985 Farm Bill
    Swampbuster/Sod buster
    Cost Sharing
    Filter Strips

USDA Forest Service

USDA Environmental Protection Agency (USEPA)

LA Department of Environmental Quality (DEQ)
  Office of Water Resources
    Point Source
    Non-Point Source
    Groundwater
Office of Solid and Hazardous Waste
Solid Waste
Hazardous Waste
Underground Storage Tank
Office of Air and Nuclear
Radon
Odors, smoke, steam, dust
LA Department of Agriculture & Forestry (DAF)
Pesticides
Soil and Water Conservation Committee
Livestock Sanitary Board
Inspection Services
Slaughter Houses
Produce
LA Department of Transportation & Development (DOTD) - Zahir "Bo" Bolourchi
Office of Public Works
Water Well Registration
Water Well Driller Licensing
Abandoned Water Wells
LA Water Resources Information Center (LAWRIC)
LA Department of Natural Resources (DNR)
Office of Conservation
Oilfield Waste Regulation
Underground Injection Control
Soil and Water Conservation Districts
WATER QUALITY, CONSERVATION AND MANAGEMENT
TRAINING SESSION NO. 1
DRINKING WATER QUALITY AND AGENCY RESPONSIBILITY
LSU AGRICULTURAL CENTER BUILDING
ROOM 212
10:00 A.M. - 4:30 P.M.
FEBRUARY 27, 1989

- Introduction and Administrative Details - Dr. Stanley Lamendola

- Importance of Water Quality, Conservation and Management
  Economic Issues - Dr. Karen Behm
  Health Issues - Sara Seals

- Louisiana's Hydro-Geology - Brenda Kelly

- Water Quality - Bill Branch

- Point-of-Use Water Treatment - Dr. Claudette Reichel

- Agency Responsibilities - Bill Branch, Moderator
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   o Introduction and Economics
   o Health Effects of Water Quality
   o Geohydrology and Water Quality Monitoring
   o Water Quality Standards and Man's Impacts on Water Quality
   o Home Treatment Devices for Protecting Drinking Water
   o Agency Responsibilities for Water Quality

III. Workshop Evaluation Process

IV. Reference Manual

V. Other Handout Materials Developed for Future Workshops
HANDOUT MATERIALS
Session I

INTRODUCTION & ECONOMICS

Speaker: Dr. Kareem Behm
La. Cooperative Extension Service
REPORT OF THE LOUISIANA COOPERATIVE EXTENSION SERVICE
ON WATER QUALITY - A CRITICAL ISSUE

Water quality is an important issue to the state of Louisiana. Our petro-chemical industry and our agricultural, silvicultural, aquacultural and marine fisheries industries are our primary sources of employment and income. Each needs large quantities of high quality water, and has considerable water pollution potential.

Disposal of oilfield and hazardous wastes generated in Louisiana and other states through incineration and underground injection is a major industry. This leads to concerns about drinking water quality, especially when reports of high cancer rates and miscarriages are published.

Nearly half of the contiguous land mass of the United States drains through Louisiana. One third of our drinking water comes from surface sources, such as the Mississippi River, after extensive and expensive treatment. Spills from barge traffic and accidental releases from chemical plants lining the river frequently cause health concerns.

High quality groundwater is hard to find. Most of our surface water users do so because of high groundwater salinity. Irrigation wells have been abandoned for the same reason. The high solids and sodium contents of the water was killing the irrigated crops. Some of our public water supplies from groundwater sources have solids and sodium content in excess of 1,000 ppm and 200 ppm respectively. Over 200,000 households depend on private dug or drilled wells for drinking water. Few of these wells have ever been tested. Our frequent flooding provides opportunities for surface water contamination of those wells and their aquifers. There are numerous abandoned oilfield, seismic, industrial and domestic wells which have not been properly plugged and offer additional opportunities for groundwater contamination.

Over 600 improperly constructed dumps have ceased to operate during the last eight years because they did not meet current groundwater protection standards. There is concern that pollutants are leaking out of these sites into aquifers.

Our oyster beds are closed all too frequently to suit our fishermen. Inadequately treated sewage is the usual cause. One of our major scenic rivers, the Tangipahoa, was closed to contact sports in 1988 because of high coliform levels. Municipal sewage discharges, a slaughter house, and many domestic and agricultural sources discharge into the river and its tributaries.

LOUISIANA COOPERATIVE EXTENSION SERVICE (LCES) PROGRAMS

LCES's educational programs have stressed water quality, conservation and management for many years. We conduct agricultural chemical application training to improve applicator and equipment performance. We test soil samples and recommend fertilizer application rates. We test irrigation water samples and advise growers of potential problems.
You can help by preventing soil erosion. Maintaining a good vegetative cover on the soil helps reduce the amount of erosion. Avoiding applications of fertilizers and pesticides before a rain will help reduce the amount of chemicals washed into streams. Never throw organic matter such as leaves and grass clippings into the water. They require oxygen for their decomposition and may lower oxygen levels enough to kill fish in the stream.

**Why Should We Be Concerned About Water Conservation?**

Louisiana gets 50 - 60" of rainfall each year. The problem comes with distribution. Sometimes we have floods and sometimes we have droughts. In some areas we are using groundwater faster than it is being replenished. Some of our aquifers are declining and water must be pumped from greater depths. When this happens the water quality may also decrease.

Saltwater intrusion occurs when groundwater is removed faster than it is replenished in coastal areas. Saltwater, which is heavier than freshwater, moves in and is picked up by pumps and delivered to a water supply. Drought causes freshwater flows to be reduced and saltwater intrusion increases.

Finally, water conservation saves money. The less water we use, the less we have to pump, treat, test and distribute. The less we use, the less wastewater we have to treat and dispose of properly.

**What Can I Do About Water Conservation?**

At home, you can take a quick shower instead of filling the bathtub. There are also "low flow" shower heads and faucet restrictors which cut water consumption. New toilets are available which use much less water. Use a bucket and sponge to wash the car instead of letting the hose run all the time. A leaking faucet wastes many gallons of water every day. Repair kits are inexpensive and readily available.

Drip irrigation is an inexpensive and easy way to water shrubs, trees, flowers and gardens and uses much less water than watering with sprinklers or a hose. A well-designed sprinkler system can save water (and time) as compared with the use of a hose and portable sprinklers.

**What Have I Got To Do With Water Management?**

Management includes all of the things we do that affect our use of water. The amount of water we use, the things we use water for and the things we put into water, are under our control. There is no new water supply for this earth. The water we use today is the same water that's been on earth for thousands of years. "The Water Cycle" illustrates how water is transformed from one phase to another. We can manage our every-day lives to protect our water supplies. That makes each citizen responsible for managing water. That is a great responsibility. Exercise it wisely!
Our Agricultural Waste Management Committee includes representatives of regulatory agencies and advises producers and processors of best management practices for waste and wastewater management. We provide research data to regulatory agencies to assist them in their efforts to improve water quality.

We talk to individuals and groups about proper well construction and protection and septic system siting and operation. We advise local governments on public water supply and waste management.

Many of our 4-H Agents help youth pursue natural resource protection and water quality-related educational projects. LCES has been an active participant in developing Louisiana's litter prevention programs. Many of our 4-H Agents and youth participate in a well-publicized "Beach Clean Up" program and in "Trash Bash."

NEED FOR ADDITIONAL RESOURCES

Drinking Water Educational Program

An intensive educational program is being implemented to inform rural cities about the quality of drinking water being consumed by the 200,000 households using untested wells and to demonstrate proper treatment and protection techniques. Levels of health-related pollutants, such as sodium, chlorides, nitrate and bacteria need to be measured to develop a data base from which to plan corrective actions. Problem wells identified need to be inspected to determine if and how they can be properly sealed. Appropriate point of use treatment practices or alternative sources of water need to be recommended. Abandoned wells need to be located and properly plugged to protect our aquifers. Water quality education programs are being greatly expanded to increase the level of water technology understanding of youth, adults, and public officials. Once they understand the technology, they will be able to make better informed decisions concerning their individual and community actions related to water quality.

Agricultural, Aquacultural, Silvicultural, and Marine Fisheries Water Management

LCES is expanding its efforts to provide water management information to our producer and processor clients. Water supply and wastewater discharge problems can be reduced by reducing consumption. Simple input metering and output testing can provide data to demonstrate water conservation and wastewater minimization to dairymen, irrigators, slaughter house operators, and sweet potato canners, for example. This reduces demand on acceptable quality water, reduces costs of treating wastewater, and increases profitability for producers and processors.

Agricultural and Silvicultural Wastewater Recycling

LCES's efforts to assist municipalities and light industries as well as agricultural producers and processors in recycling non-hazardous wastewater and sludges through agricultural and silvicultural cropping systems is being expanded. In many cases we have helped reduce pollutant loading on streams and volume of wastes going into landfills as well as costs of operation for businesses and taxpayers, while providing a source of plant nutrients and irrigation water to the grower at little or no cost. These efforts have been endorsed by regulatory agencies who refer business and municipal leaders to us for assistance.
WATER QUALITY, CONSERVATION AND MANAGEMENT

Bill Branch

Why Is Water Important To Us?

Water is essential to life. We can get by without food for several days. We may be uncomfortable and feel weak, but we can survive. We cannot live more than a day or so without water. We only drink about 2 quarts a day, but use much more than that - 80 gallons per day including water for bathing and other uses! Louisiana’s total water usage averages 2,500 gallons per person per day.

Much of the food we eat is water and a lot of water is needed to produce our food. Irrigation is the largest use of water in the United States and most of it is used to produce food. Some irrigation produces fiber for clothing and some is used for lawns and flower production.

Water helps keep us cool. A summer shower can lower outside temperatures several degrees. We feel much cooler when we get rained on or when we jump into a swimming pool or lake. Clouds help shield us from the sun and make it cooler. Clouds are composed of water vapor. Perspiration is your body's way of cooling itself. The evaporation makes you feel cooler.

Water produces electricity. Hydro-electric power is generated by water which turns turbines which turn generators to produce electricity. The least expensive electricity is usually that generated from water power. The city of Vidalia, Louisiana is building a hydro-electric plant which will generate low cost electricity. Water is needed for cooling other types of electric generating plants using coal, oil, gas or nuclear energy for fuel. Hot water escaping from deep wells (geo-thermal) is used for generating power in some parts of the country.

Water provides the least expensive method of transportation for bulk commodities, such as coal, grain and minerals. Barge transportation on the Mississippi River is much less expensive than rail or truck transportation. New Orleans and Baton Rouge are among the five largest ocean-freight ports in the United States because of all the coal, grain and minerals that come down the Mississippi River.

Water provides jobs. Louisiana harvests more seafood than any other state. Menhaden, oysters, shrimp, crab and fin fish harvesting, processing and marketing are important industries employing many people. We grow a lot of catfish, bait fish, alligators, turtles, and crawfish in ponds and we harvest many tons of fish from our freshwater rivers, lakes and swamps. Louisiana is the number one fur producing state and most of the production is from the Atchafalaya Basin, our largest wetland area.
NITRATE AND DRINKING WATER

Trisha Bender
Pre-Med, LSU

Nitrogen is a vital part of our environment comprising 78% of the air we breathe. Plants use nitrogen to form amino acids and proteins which are necessary for plant growth and animal consumption. Nitrogen needs to be converted to ammonium (NH$_4^+$) or nitrate (NO$_3^-$) by physical, chemical and biological reactions in the soil and water in order for plants to use it.

Although nitrogen is an essential element, high concentrations of nitrate in the soil can lead to ground water contamination with subsequent adverse human and animal health problems. Because nitrate is water soluble, it can be leached into groundwater which is used for human and animal consumption. This occurs when the soil contains more nitrate than plants can use because of naturally occurring nitrate or waste disposal activities and excess nitrogen fertilization. Additional sources of nitrate leaching include septic tank leachfields and livestock and poultry operations. The Louisiana Department of Agriculture and Forestry has detected nitrate in water taken from a well used for a beef cattle operation. The level of nitrate was 54 ppm which is above the health standard of 45 ppm.

A human health problem caused by excess nitrate is known as the "blue-baby syndrome." In an infant's stomach, nitrate is converted to nitrite (NO$_2^-$) which is highly toxic. When the nitrite reaches the blood stream, it attacks the iron in hemoglobin and changes it into methemoglobin. Methemoglobin prohibits the red blood cells from carrying oxygen. Eventually, after more hemoglobin is converted to methemoglobin, symptoms of oxygen starvation occur. If more than half of the hemoglobin is changed, death is highly probable.

Nitrate is not the sole cause of methemoglobinemia. Factors such as the type of hemoglobin found only in the fetus, general infant health, inherited metabolic differences, and the extent of breast feeding as opposed to feeding with formula mixed with well water are involved in the potential for nitrate-induced methemoglobinemia. Children over the age of six months can handle the nitrate without this problem.

In 1986, two infants in South Dakota developed methemoglobinemia. The first died a month after symptoms developed because of lack of medical attention. The second recovered by changing source of drinking water after early diagnosis.
Not only are humans affected by nitrate poisoning, but so are animals such as cows or sheep. The effect of nitrite on the red blood cells in their blood system (cells becoming oxygen deficient) is the same as in humans. Nitrate poisoning is due to microorganisms in the first stomach which changes nitrate to nitrite. If the animal's diet is sufficient and it is in good health, the poisonous nitrite is quickly converted to ammonium and later used in protein-building. But, if cows or sheep consume extreme amounts of nitrate too quickly, the nitrite cannot be converted to ammonium and will build up to very poisonous levels which can eventually end in animal mortality. Every year, some livestock die from nitrate poisoning.

Fortunately, there are things that can be done to prevent such tragedies. For example, animals could be fed low-nitrate foods. Although they will eat plants that contain some nitrate, this would not increase the level of nitrite in the animal significantly. Different feeding methods also change nitrate concentrations in feed, such as hay or hay crop silage. These contain little nitrate because forage grasses and legumes (alfalfa, red clover, etc.) are naturally low in nitrate. In the home, nitrate can be diluted or removed by distillation. Unfortunately, those procedures are too expensive for the livestock water supplies. Local contamination from a livestock holding area or septic tank may be prevented by proper location of wells, by establishing good drainage away from the well and sufficiently sealing the well. A contaminated well may have to be abandoned and properly plugged.

Nitrogen is an important element of our environment. High concentrations of nitrogen (in the form of nitrate) in groundwaters can affect human and animal lives. If steps are taken to limit the amount of nitrogen getting into our drinking water these tragedies can be avoided.
Session II

HEALTH EFFECTS OF WATER QUALITY

Speaker: Saralene Seals
La. Cooperative Extension Service
Chemical contaminants occur in drinking water supplies throughout the United States, ranging from barely detectable amounts to levels that could possibly threaten human health. Determining the health effects of these contaminants is difficult, especially since researchers are still learning how chemicals react in the body to damage cells and cause illness.

**Possible Chronic Health Effects**

Toxic doses of chemicals cause either acute or chronic health effects. An acute effect usually follows a large dose of a chemical and occurs almost immediately. Examples of acute health effects are nausea, lung irritation, skin rash, vomiting, dizziness and even death.

The levels of chemicals in drinking water, however, are seldom high enough to cause acute health effects. They are more likely to cause chronic health effects—effects that occur long after exposure to small amounts of a chemical. Examples of chronic health effects include cancer, birth defects, organ damage, disorders of the nervous system, and damage to the immune system.

Evidence relating chronic health effects to specific drinking water contaminants is limited. In the absence of exact scientific information, scientists predict the likely adverse effects of chemicals in drinking water using laboratory animal studies and, when available, human data from clinical reports and epidemiological studies. The possible chronic health effects of the chemicals listed in this fact sheet are conservative estimates, rarely based on documented human health effects.

**Setting Standards**

In setting standards for drinking water contaminants, regulators estimate the concentration of a contaminant that a person can drink safely over a lifetime. These calculations are based on all available toxicological information and allow a generous safety margin. The following chart lists contaminants currently regulated by U.S.
Environmental Protection Agency (EPA) standards as well as those proposed for EPA regulation by 1989.

The EPA standard for drinking water, the Maximum Contaminant Level (MCL), is the highest amount of a contaminant allowed in drinking water supplied by municipal water systems. The MCL is set as close as possible to the Maximum Contaminant Level Goal (MCLG), which is a preliminary standard set but not enforced by the EPA. MCLG's are health goals based entirely on health effects, but MCL's also take into consideration the feasibility and cost of analysis and treatment of the regulated contaminant. Although often less stringent than the corresponding MCLG, the MCL is set to protect health.

Contaminants are regulated when they occur in drinking water supplies; they are expected to threaten public health; and they can be detected in drinking water by current laboratory methods. The EPA will continue to set standards for many other drinking water contaminants not listed in this fact sheet which meet these criteria.

### Regulated Contaminants

#### Inorganics

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>rocks and soil; may contaminate commercial phosphates in fertilizers and laundry detergents; pesticide residues; smelting, glass making, and coal mining.</td>
<td>skin and lung cancer; liver and kidney damage. MCL: 0.05 mg/L. MCLG: 0.05 mg/L</td>
</tr>
<tr>
<td>Asbestos</td>
<td>corrosion of asbestos-cement pipe in water distribution systems; manufacture of cement products, paper, floor tiles, paint, caulking, textiles and plastics.</td>
<td>lung cancer; gastrointestinal cancer when swallowed fibers exceed 10μm. MCL: —. MCLG: 7.1 million fibers (&gt;10μm long)/liter</td>
</tr>
<tr>
<td>Barium</td>
<td>rocks and soil; coal and gas mining; coal burning; diesel fuel combustion and jet fuel; paints, bricks and tiles.</td>
<td>hypertension and heart damage. MCL: 1.0 mg/L. MCLG: 1.5 mg/L</td>
</tr>
<tr>
<td>Cadmium</td>
<td>rocks, coal, and petroleum; byproduct of mining, smelting, refining and electroplating; discarded batteries, paints, and plastics; corrosion of galvanized pipe; landfills and industrial waste sites; fertilizers and sewage sludge.</td>
<td>kidney damage. MCL: 0.010 mg/L. MCLG: 0.005 mg/L</td>
</tr>
<tr>
<td>Chromium</td>
<td>rocks and soil; mining sites; chrome plating, cement production; waste incineration; contaminated laundry detergent and bleaches; septic systems.</td>
<td>liver, kidney and lung damage. MCL: 0.05 mg/L. MCLG: 0.12 mg/L</td>
</tr>
<tr>
<td>Copper</td>
<td>rocks and soil; coal burning; iron and steel production; industrial and sewage treatment plant wastes; corrosion of brass and copper pipes.</td>
<td>anemia; digestive disturbances; liver and kidney damage. MCL: 1.3 mg/L. MCLG: 1.3 mg/L</td>
</tr>
</tbody>
</table>

*The units of measurement are milligrams per liter (mg/L), micrometers (μm) and picoCuries (pCi).*
### Inorganics (continued)

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoride</td>
<td>rocks and soil; industrial wastes.</td>
<td>mottling of teeth; bone damage. MCL: 4.0 mg/L MCLG: 4.0 mg/L</td>
</tr>
<tr>
<td>Lead</td>
<td>rocks and soil; corrosion of lead pipes and lead-soldered pipe joints; combustion of leaded gasoline; smelter emissions and discarded storage batteries.</td>
<td>brain and nerve damage, especially in children; kidney damage; digestive disturbances; blood disorders; hypertension. MCL: .005 mg/L MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Mercury</td>
<td>soil and rocks; mining, smelting, coal burning; electrical equipment and fungicides.</td>
<td>brain and nerve damage; kidney damage; birth defects and skin rash. MCL: 0.002 mg/L MCLG: 0.003 mg/L</td>
</tr>
<tr>
<td>Nitrate</td>
<td>soils and mineral deposits; fertilizers, sewage and animal wastes.</td>
<td>Methemoglobinemia in infants. MCL: 10 mg/L nitrate-nitrogen 45 mg/L nitrate MCLG: 10 mg/L nitrate-nitrogen 45 mg/L nitrate</td>
</tr>
<tr>
<td>Selenium</td>
<td>soil and shales; coal burning, mining, smelting; manufacture of glass, paints, and drugs; fungicides and feed additives.</td>
<td>growth inhibition; skin discoloration; dental and digestive problems; liver damage and psychological disorders. MCL: 0.01 mg/L MCLG: 0.045 mg/L</td>
</tr>
<tr>
<td>Silver</td>
<td>soil, coal, and mineral deposits; ore mining and manufacture of alloys; photographic procedures and jewelry making;</td>
<td>agyria, a permanent blue-gray discoloration of skin, mucous membranes and eyes. MCL: 0.05 mg/L MCLG: —</td>
</tr>
</tbody>
</table>

### Organics

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylamide</td>
<td>drinking water treatment residue; well drilling; food production and processing; paper making and textile manufacturing.</td>
<td>cancer and nervous system effects. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Alachlor</td>
<td>agricultural herbicide.</td>
<td>cancer; damage to eyes and liver. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Aldicarb</td>
<td>agricultural insecticide.</td>
<td>cholinesterase inhibition. MCL: — MCLG: 0.009 mg/L</td>
</tr>
</tbody>
</table>
### Orgastics (continued)

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
</table>
| Benzene                         | leaking underground fuel storage tanks; industrial wastes; manufacture of pesticides, detergents and solvents. | leukemia and other cancers; nerve, lung, and kidney damage; blood disorders and reproductive effects.  
MCL: 0.005 mg/L  
MCLG: 0 mg/L                                               |
| Carbofuran                      | agricultural insecticide.                                               | Cholinesterase inhibition; reproductive and immune system effects.                                  
MCL: —  
MCLG: 0.036 mg/L                                      |
| Carbon Tetrachloride            | chemical disposal sites, contaminated soils, and landfills; aerosol sprays; cleaning agents and coolants; laundry and dry-cleaning operations. | cancer; central nervous system depression; liver and kidney damage.                                
MCL: 0.005 mg/L  
MCLG: 0 mg/L                                               |
| Chlordane                       | insecticide; hazardous waste sites.                                    | cancer; nerve and liver effects.                                                                 |
MCL: —  
MCLG: 0 mg/L                                               |
| 2,4-D                           | agricultural herbicide and aquatic weeds control.                       | liver and kidney damage; skin irritations and muscle effects.                                         
MCL: 0.01 mg/L  
MCLG: 0.07 mg/L                                           |
| Dibromochloropropane (DBCP)     | soil fumigant.                                                         | cancer; kidney and liver damage; infertility.                                                        
MCL: —  
MCLG: 0 mg/L                                               |
| p-Dichlorobenzene               | dye and pesticide manufacturing.                                       | liver and kidney damage; blood disorders.                                                            
MCL: 0.075 mg/L  
MCLG: 0.075 mg/L                                           |
| 1,2-Dichloroethane              | vinyl manufacturing; drycleaning solvent, metal degreasers, and adhesives; gasoline additive. | cancer; central nervous system depression; kidney and liver damage; lung and heart damage.                  
MCL: 0.005 mg/L  
MCLG: 0 mg/L                                               |
| 1,1-Dichloroethylene            | industrial solvent, cleaning and degreasing agent.                     | central nervous system depression; liver, kidney and heart damage.                                    
MCL: 0.007 mg/L  
MCLG: 0.007 mg/L                                           |
| cis and trans 1,2-Dichloroethylene | transformed from other chlorinated hydrocarbons in drinking water supplies; industrial cleaning and degreasing agents. | liver and kidney damage.                                                                            |
MCL: —  
MCLG: 0.07 mg/L                                           |
<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,2-Dichloropropane</td>
<td>industrial solvent and cleaning agents; dry cleaning fluid components, soil fumigants.</td>
<td>liver and kidney damage. MCL: — MCLG: 0.006 mg/L</td>
</tr>
<tr>
<td>Endrin</td>
<td>insecticide and rodenticide.</td>
<td>liver and nervous system effects: birth defects. MCL: 0.0002 mg/L MCLG: —</td>
</tr>
<tr>
<td>Epichlorohydrin</td>
<td>resin and rubber product manufacturing; contamination of materials used to process food and treat or store drinking water.</td>
<td>cancer; central nervous system, lung, liver and kidney effects; damage to male reproductive organ. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Ethyl benzene</td>
<td>hazardous waste sites and styrene production.</td>
<td>nerve, brain, liver and kidney effects. MCL: — MCLG: 0.68 mg/L</td>
</tr>
<tr>
<td>Ethylene dibromide</td>
<td>pesticide and soil fumigants; leaded gasoline additives.</td>
<td>cancer; liver, kidney, nervous system, gastrointestinal, and reproductive effects. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Heptachlor/Heptachlor Epoxide</td>
<td>insecticide and hazardous waste sites.</td>
<td>cancer; liver damage and central nervous system effects. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Lindane</td>
<td>pesticides.</td>
<td>liver and kidney damage. MCL: 0.004 mg/L MCLG: 0.0002 mg/L</td>
</tr>
<tr>
<td>Methoxychlor</td>
<td>insecticides.</td>
<td>nervous system, kidney, and liver effects. MCL: 0.10 mg/L MCLG: 0.34 mg/L</td>
</tr>
<tr>
<td>Pentachlorophenol (PCP)</td>
<td>herbicides and insecticides; water contact with PCP-treated wood; industrial waste sites.</td>
<td>liver and kidney damage; nervous system, immune system, and reproductive effects; blood disorders. MCL: — MCLG: 0.22 mg/L</td>
</tr>
<tr>
<td>Polychlorinated Biphenyls (PCBs)</td>
<td>hazardous waste sites; disposal and manufacture of electrical transformers, electromagnets, fluorescent lights and plastic.</td>
<td>cancer; liver damage. MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Styrene</td>
<td>manufacture of plastics, synthetic rubbers, resins, and insulators.</td>
<td>liver damage. MCL: — MCLG: 0.14 mg/L</td>
</tr>
<tr>
<td>Contaminant</td>
<td>Source</td>
<td>Possible chronic health effects</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>industrial metal, textile, and dry cleaning solvent.</td>
<td>cancer; liver and kidney damage; central nervous system depression.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: pending</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: pending</td>
</tr>
<tr>
<td>Toluene</td>
<td>paint, oil, resin manufacturing; leaking fuel storage tanks; jet fuel.</td>
<td>central nervous system depression; kidney damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: —</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 2.0 mg/L</td>
</tr>
<tr>
<td>Toxaphene</td>
<td>insecticides.</td>
<td>cancer, liver and kidney damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.005 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0 mg/L</td>
</tr>
<tr>
<td>2,4,5-TP (Silvex)</td>
<td>herbicides.</td>
<td>liver and kidney damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.010 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0.052 mg/L</td>
</tr>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>hazardous waste sites; industrial solvent and degreasers; drycleaning solvent.</td>
<td>central nervous system depression; liver and cardiovascular damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.20 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0.20 mg/L</td>
</tr>
<tr>
<td>Trichloroethylene (TCE)</td>
<td>hazardous waste sites; drycleaning solvent; manufacturing of chemicals and drugs.</td>
<td>cancer; nervous system depression and heart effects; liver and kidney damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.005 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Total Trihalomethanes</td>
<td>formed when residual chlorine in treated drinking water combines with naturally occurring organic matter.</td>
<td>cancer; heart, lung, kidney and liver damage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.100 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: —</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>manufacturing of plastics and synthetic rubber; corrosion of plastic pipes and soldering.</td>
<td>cancer; central nervous system depression; liver, reproductive, and digestive tract effects; birth defects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: 0.002 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Xylene</td>
<td>leaking underground fuel storage tanks; manufacturing of chemicals and drugs.</td>
<td>nervous system and reproductive effects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCL: —</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MCLG: 0.44 mg/L</td>
</tr>
</tbody>
</table>
### Microbial Pathogens

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coliform Bacteria (an indicator organism for fecal coliform, streptococcal, and other pathogenic bacteria).</td>
<td>sewage, animal wastes; backflow or improper pipe connections in water systems; improperly sealed or constructed wells.</td>
<td>gastroenteritis, salmonella infection, dysentery, typhoid fever and cholera. MCL: &lt;1/100 ml MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td>sewage and animal wastes.</td>
<td>giardiasis (a gastrointestinal infection causing diarrhea, abdominal cramps, and gas). MCL: — MCLG: 0 mg/L</td>
</tr>
<tr>
<td>Viruses</td>
<td>sewage</td>
<td>gastroenteric and other viral diseases; hepatitis. MCL: — MCLG: 0 mg/L</td>
</tr>
</tbody>
</table>

### Radioactive Elements

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Source</th>
<th>Possible chronic health effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha Particles</td>
<td>natural decay of uranium in rocks and soil</td>
<td>cancer; bone and kidney damage. MCL: 15 pCi/L MCLG: —</td>
</tr>
<tr>
<td>Radium-226, -228</td>
<td>natural decay of uranium in rocks and soil</td>
<td>bone cancer; bone and kidney damage; birth defects. MCL: 5 pCi/L MCLG: pending</td>
</tr>
<tr>
<td>Radon</td>
<td>decay of uranium in soils and rocks.</td>
<td>lung cancer, when released as a gas and inhaled. MCL: pending MCLG: pending</td>
</tr>
<tr>
<td>Uranium</td>
<td>soil and rocks</td>
<td>cancer and kidney damage. MCL: pending MCLG: pending</td>
</tr>
</tbody>
</table>
References


# SODIUM IN DRINKING WATER

## CONSEQUENCES OF VARIOUS CONCENTRATIONS OF SODIUM

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20 mg/l</td>
<td>Considered ideal level for drinking water. Allows individuals on Strict Sodium Restricted diet (500 mg/d or 1/2 gram/d) to drink water without problems.</td>
</tr>
<tr>
<td>20 - 100 mg/l</td>
<td>Individuals on Strict Sodium Restricted diet (500 mg/d or 1/2 g/d) should not use such drinking water. They represent about 0.9% of the population.</td>
</tr>
<tr>
<td>100 - 250 mg/l</td>
<td>Not for individuals on Strict Sodium Restricted diet (500 mg/d or 1/2 g/d). Individuals on Moderate Sodium Restricted Diet (1000 mg/d or 1 g/d) must keep food intake of salt to a strict minimum or use an alternate water source. Contributes up to 25% of the sodium intake in the mild or conservative diet for the general population, (2000 - 4500 mg/d). This would require individuals to watch sodium intake from food versus from water.</td>
</tr>
<tr>
<td>250 - 500 mg/l</td>
<td>Individuals on STRICT or MODERATE DIET should not use such drinking water. Individuals on MILD DIET (2000 mg/d or 2 g/d) can still use such water, but would have to watch carefully sodium intake from food. Contributes up to 50% of CONSERVATIVE DIET OF GENERAL POPULATION making such a difficult to be realistically applied to a large number of individuals.</td>
</tr>
</tbody>
</table>
300 - 500 mg/l  Taste Threshold, the water starts tasting salty
Not for Strict, Moderate or Mild restriction diet
Not for conservative diet as recommended for general population

3,000 - 5,000 mg/l  Some reported episodes of acute symptoms:
exacerbation of chronic congestive heart failure (consumption of water at levels of
4,200 mg/l and 3,500 mg/l)

Total Dissolved Solids  Levels of 2,000 - 4,000 mg/l of dissolved salts
are not palatable, may not quench thirst, and
may have laxative action on new users
Levels of 5,000 mg/l or more of total salts were
reported as bitter and acted as a bladder and
intestinal irritant
Waters containing greater than 4,000 mg/l of total
salts are generally considered unfit for human
consumption

NOTE:  Dissolved solids up to the following limits should not interfere
with the indicated uses.

<table>
<thead>
<tr>
<th>Domestic water supply</th>
<th>1,000 mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
<td>700 mg/l</td>
</tr>
<tr>
<td>Stock watering</td>
<td>2,500 mg/l</td>
</tr>
<tr>
<td>Fresh water fish and aquatic life</td>
<td>2,500 mg/l</td>
</tr>
</tbody>
</table>

10,000 mg/l of sodium contained in seawater

National Center for Health Statistics estimates that 2.8% of Americans are
currently on low-sodium diets prescribed for reasons of illness. This
includes the strict (500 mg/d), moderate (1,000 mg/d) and the mild (2,000
mg/d) diets.

Source:  State of Louisiana, Department of Health and Human Resources
Made Available by Saralene B. Seals, Extension Associate, Nutrition/Health
Session III

GEOHYDROLOGY AND
WATER QUALITY MONITORING

Speaker: Brenda Kelly
La. Water Resources
Research Institute
WATER QUALITY AND THE
NATURAL ENVIRONMENT

Handout

Water Quality, Conservation and Management
Training Program

Co-Sponsors:
Louisiana Cooperative Extension Service
Louisiana Water Resources Research Institute
WATER QUALITY PARAMETERS
Monitored Monthly by DEQ

Physical

- temperature
- turbidity
- conductivity
- true color
- total solids
- total suspended solids

Chemical

- arsenic
- cadmium
- chromium
- copper
- mercury
- lead
- nitrate and nitrite nitrogen
- total Kjeldahl Nitrogen
- total phosphorous
- chemical oxygen demand
- sulfates
- chlorides
- pH
- dissolved oxygen
- salinity
- alkalinity
- hardness
- total dissolved solids
- total organic carbon

Biological

- coliform bacteria
PROCESSES THROUGH WHICH WATER QUALITY CHANGES OCCUR

- Physical weathering and erosional processes
- Chemical interaction
  - hydration
  - hydrolysis
  - oxidation
  - carbonation
  - solution
- Biological processes
RESULTING SUBSURFACE PROFILE
GEOLOGIC FEATURES IMPACTING WATER FLOW, PARTICULARLY GROUND WATER
THE BEGINNING OF THE DELTA BUILDING PROCESS

IMPACT OF SEA LEVEL FLUCTUATIONS ON THE DELTA BUILDING PROCESS
THE UNITED STATES IN EARLIER GEOLOGICAL HISTORY
WHAT PRIVATE CITIZENS CAN DO TO HELP PROTECT GROUND WATER

Here are some steps you can take to help protect ground water in your own area.

* Become familiar with your local ground-water resources. Do you know which aquifer supplies your community's water system and private wells? How many people use it, and for what purpose?

* Become familiar with the common sources of ground-water contamination. Which of these activities take place in your community? How are they controlled?

* Find out how your community disposes of waste products. What waste products are used or produced by large industries in your area? How are toxic substances used, handled, or stored? Is there a special program for the disposal of household products such as solvents, empty paint cans or pesticide containers? Are septic tank ordinances adequate to protect ground water?

* Find out how extensively pesticides and fertilizers are used in your area. Follow label directions when you use pesticides and fertilizers yourself.

* Learn the procedures for reporting emergency spills or other kinds of contamination that may threaten water supplies. Do local agencies have contingency plans for responding to accidental spills or leaks of toxic substances?

* Find out who is responsible for managing local ground-water supplies. Participate in local water planning and conservation initiatives.

* Become familiar with State programs and activities to protect ground water. What chemicals are regulated by the State? Does the State have a ground-water classification system? Has the State developed programs to control sources of contamination? Attend and participate in public meetings and hearings on ground-water issues.

* Determine if existing ground-water protection authorities are adequate. Find out if there are local ordinances that provide ground-water protection. Is there an effective enforcement program to penalize polluters? Who should you call to report incidents of illegal waste disposal?

***Excerpt from "Protecting our Ground Water", a brochure published by the U.S. Environmental Protection Agency, Office of Public Affairs, September 1985.***
Session IV

WATER QUALITY STANDARDS & MAN'S IMPACTS ON WATER QUALITY

Speaker: Bill Branch
La. Cooperative Extension Service
OTHER HANDOUT MATERIALS
DEVELOPED FOR FUTURE WORKSHOPS
Activated Carbon Filter: A filter made of carbon particles containing numerous pores and channels which trap contaminants as water passes through; not effective for heavy metals, bacteria, nitrates, and dissolved minerals; most effective for organic compounds and general taste and smell problems.

Alkalinity: A measure of the ability of a water to neutralize acids. Alkalinity results from the chemical reactions of water with naturally occurring soil and atmospheric materials, and imparts to the water an ability to resist changes in quality (buffering capacity). Low alkalinitities indicate a limited ability to resist change, while high alkalinity imparts a bitter taste to the water and contributes to solids deposition that can clog pipes.

Alluvium: Sand, silt, or similar detrital material deposited in flowing water, or the permanent unconsolidated deposits thus formed.

Aquifer: A water-bearing geological formation composed of sand, gravel, permeable rock, or rock with cracks and fractures that occurs beneath the earth's surface. An aquifer may be bounded above or below by less permeable formations, and may or may not intersect (outcrop) the surface.

Arsenic: A toxic metal that is particularly harmful to man and higher animals because of its bioaccumulative characteristics in the food chain. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Artesian Aquifer: An aquifer confined between less permeable materials from which water will rise above the bottom of the overlying confining bed if afforded an opportunity to do so.

Barium: A toxic metal. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Biochemical Oxygen Demand (BOD): A measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by micro-organisms, such as bacteria.

Brackish Water: Water with more than 250 mg/l chloride.

Cadmium: A toxic metal that is particularly harmful to man and higher animals because of its bioaccumulative characteristics in the food chain. Though present in the natural environment in minute quantities, significant concentrations can come from
mining, industrial and agricultural sources.

Chemical Oxygen Demand (COD): A test used to measure the concentration of nonbiodegradable organics, as organic insecticides and herbicides, present in water. It is a widely used measure of the pollutional strength of domestic and industrial wastes. Other analyses must be applied to identify a specific organic.

Chloride: A compound in which chlorine is combined with another element. High concentrations cause a salty taste and may be a problem for persons with certain health conditions.

Chlorination: The process of treating water with chlorine to kill bacteria and ensure satisfactory disinfection.

Chlorine:

Chromium: A toxic metal. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Coliform bacteria: A group of bacteria from (or like those from) the colon or digestive tract of humans and other warm-blooded animals. The presence of coliform bacteria in well water may indicate contamination by surface water or faulty septic systems.

Conductivity (also Specific Conductance): Conductivity is a measure of a water's ability to carry an electrical current. It is temperature dependent and is used in water quality analyses to obtain a rapid estimate of dissolved solids content. A physical water quality parameter.

Confined Aquifer: A formation beneath the earth's surface that is saturated with water and enclosed by less permeable layers; the water is under pressure and may rise above the overlying confining bed if given an opportunity to do so.

Confining Bed: A geologic formation or stratum beneath, above, and surrounding an aquifer which, because of its position and its low permeability relative to the material in an aquifer, causes a hydrostatic head to be created or retained in the basin.

Copper: A non-toxic metal commonly found in natural waters. Man's activities also contribute to the quantities present in water.

Discharge: The movement of water from an aquifer to springs, seeps, marshes, streams, or flowing or pumping wells.

Dissolved Oxygen (DO): The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, or percent of saturation.

Distillation: A process to purify water in which water is heated
to steam and the steam is collected and condensed back to water. Some contaminants are left behind when the water turns to vapor, but others may condense with the steam.

Drainage Area: An area of land from which direct surface runoff from precipitation normally drains by gravity into the surface stream above a specific point.

Drinking Water Standards: Standards that define allowable concentrations of coliforms and certain chemicals, physical characteristics, and radioactivity in drinking water. They are prescribed by federal, state, or local authorities and also contain sampling, monitoring, and reporting requirements. Primary standards set limits designed to protect human health. Secondary standards are also set, and are established for the aesthetic (taste, color, etc.) maintenance of drinking water.

Effluent Limited (EL): Any segment of a stream where water quality is meeting and will continue to meet applicable water quality standards or where there is adequate demonstration that water quality will meet applicable standards after the application of effluent limitations required by the Clean Water Act as amended.

Fecal Coliform: A group of bacteria that are present in the colon or digestive tract of humans and other warm-blooded animals. Their concentrations are expressed as numbers of colonies per 100 ml of water sample. The presence of coliform bacteria in water may indicate contamination by surface water or faulty septic systems. They are used as a common indicator of biological pathogens, although not pathogenic themselves.

Fluoride: A metal present in limited quantities in surface water. Higher concentrations in ground water can be encountered in some regions. In large quantities, fluoride is toxic to humans and to other animals. Excessive intakes can result in discoloration of teeth (mottling) and bone fluorosis and other skeletal abnormalities. Small concentrations are beneficial to the formation of harder, stronger teeth that are more resistant to decay.

Groundwater: Water beneath the earth's surface in a layer of rock or soil called the saturated zone because all openings are filled with water; the water that supplies wells and springs.

Hardness: A physical-chemical characteristic of water, i.e. the concentration of metallic cations present in water. Hardness is the result of metal ions commonly present in the natural environment, primarily the salts of calcium and magnesium, such as bicarbonates, carbonates, sulfates, chlorides, and nitrates. Hardness causes curdling and increased consumption of soap, staining of clothes and fixtures, scaling in boilers, damage in some industrial processes, and sometimes objectionable taste. Hardness may also have a laxative effect and may be beneficial to the cardiovascular system.
Hazardous Waste:

Hydraulic Conductivity: The rate of flow of water in gallons per day through a cross section of one square foot at a standard temperature; a measure of permeability.

Hydrologic Cycle: The circuit of water movement from the atmosphere to the earth and return to the atmosphere through various stages or processes such as precipitation, runoff, infiltration, percolation, storage, evaporation, and transpiration. Also called WATER CYCLE.

Infiltration: Process of water moving into the ground, subsurface soil, and rocks from the surface.

Lead: A toxic metal. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Mercury: A toxic metal that is particularly harmful to man and higher animals because of its bioaccumulative characteristics in the food chain. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Metals: Naturally occurring and harmful to human health when present in excessive amounts. Metals that are harmful in small quantities are labeled toxic; all others are considered nontoxic. Sources include dissolution of natural deposits and discharges of domestic, industrial and agricultural wastes.

Natural Levee: A low, alluvial ridge adjoining the channel of a stream, composed of sediment deposited by floodwater that has overflowed the banks of the channel. It is common to streams that flow through alluvial valley land.

Nitrate and Nitrite Nitrogen: Measures the products of organic nitrogen decomposition present in water. Nitrite is an intermediate product that is highly toxic to aquatic organisms and is seldom present in concentrations exceedings 1 mg/l. Nitrate is a nontoxic end product.

Parts Per Million (ppm):

Permeability: The capacity of a rock or rock material to transmit a fluid. Also known as specific yield.

Pesticides: Chemical compounds used to control the growth of undesirable plants and animals. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

pH: A measure of alkalinity or acidity. The pH scale ranges from 0 to 14, with 7 representing neutrality, numbers higher than
indicating alkalinity, and numbers lower than 7 indicating acidity. The number is the negative logarithm of the concentration of hydrogen ions. Hydrogen ions are always present in natural waters, and their concentration, as measured by pH, affects the equilibrium between most chemical species, the effectiveness of water treatment processes, the potential of water to be corrosive, the suitability of water to support living organisms, and most other quality characteristics of water.

Porosity: The quality of being porous, or full of pores or openings; a measure of the amount of open space in a material or of the water storage capacity of a substance.

Recharge: The flow of water into the saturated zone; the return of water to an aquifer.

Recharge Area: The area where an aquifer outcrops or comes to the land surface which is the entry point for rain or surface water into the aquifer.

Reverse Osmosis: A filter process which forces water through membranes that allow water but not dissolved chemicals to pass through. The process is used to remove contaminants in water and can be used to desalinate salty groundwater.

Runoff: The part of the precipitation that runs off the surface of a drainage area and reaches a stream or other body of water, a drain or sewer.

Salinity: (1) The relative concentration of dissolved salts, usually sodium chloride, in a given water. It is often expressed as mg/l chlorine. (2) A measure of the concentration of dissolved mineral substances in water.

Silver: A toxic metal that is particularly harmful to man and higher animals because of its bioaccumulative characteristics in the food chain. Though present in the natural environment in minute quantities, significant concentrations can come from mining, industrial and agricultural sources.

Sulfates: Occurs in natural waters and wastewater. Can produce an offensive odor or taste. Consuming water with high concentrations may have laxative effects, but produces no significant danger to public health.

Temperature: Water temperature is a physical water quality parameter that affects other water quality parameters and the rate of chemical and biological reactions.

Total Dissolved Solids (TDS): A measure of matter dissolved in water. It consists mainly of inorganic salts, small amounts of organic matter, and dissolved gases. TDS impacts the aesthetics of a water, and may restrict the water's use for select intended uses. The solid materials present may be harmful to human health or may impair use particularly for agricultural and some
industrial uses.

Total Kjeldahl Nitrogen: A measure of organic nitrogen (unassimilated protein from plant and animal matter) present in water. Organic nitrogen is a nutrient for aquatic organisms.

Total Organic Carbon:

Total Phosphorus: A measure of organic and inorganic phosphorus present in water. Since phosphorus is a nutrient, its presence in water is indicative of the potential biological productivity of that water. Maintenance of phosphorus levels are important to natural waters as well as industrial and municipal wastewaters.

Total Solids: A physical water quality parameter that measures the combined total of the dissolved and suspended solids material in water. The test can be run to determine the amount of organic matter present and for the detection of radical changes in water density that would adversely impact wastewater treatment. Other water quality tests can more easily detect such changes.

Total Suspended Solids: A physical water quality parameter that measures the amount of sediment suspended in a stream. Its determination is extremely valuable in the analysis of polluted waters, and is also used to evaluate the strength of domestic wastewaters and the efficiency of treatment units.

Toxic Waste:

True Color: Color is a physical characteristic that is due to vegetable or organic extracts present in water as colloidal or suspended matter. Color is an important consideration for aesthetics, for certain industrial processes, and for an indicator of need for disinfection.

Turbidity: Turbidity is a measure of light transmitting propertities of water. It results from the presence of suspended or colloidal material in the water. Turbidity impacts aquatic life and is an important consideration in the aesthetics, filterability, and disinfection of drinking water. Turbidity is a physical water quality parameter.

Unconfined Aquifer: A water-bearing formation under the earth's surface not confined by an overlying impermeable layer. The height of the water in unconfined aquifers is referred to as the water table.

Water Pollution: The presence in water of impurities in such quantity and of such nature as to impair the use of the water for a stated purpose.

Water Quality: The chemical, physical, and biological characteristics of water with respect to its suitability for a particular purpose. The same water may be acceptable for
one purpose or use, and unacceptable for another, depending on its characteristics and the requirements for the particular use.

**Water Quality Standards:** Requirements established by governmental authority to prevent or abate water pollution. Standards levels vary for different uses with any use involving human consumption or human contact having more stringent standards.

**Water Table:** The level below which the soil or rock is saturated with water; the upper boundary of the saturated zone.

**Watershed:** The area from which all flowing water will drain to the same stream or river.
<table>
<thead>
<tr>
<th>ORIGIN</th>
<th>IMPURITY</th>
<th>IMPURITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ionic and Dissolved</td>
<td>Colloidal</td>
</tr>
<tr>
<td></td>
<td>Positive ions</td>
<td>Negative ions</td>
</tr>
<tr>
<td>Contact of water with minerals, soils, and rocks</td>
<td>Calcium (Ca⁺²)</td>
<td>Bicarbonate (HCO₃⁻)</td>
</tr>
<tr>
<td></td>
<td>Iron (Fe⁺²)</td>
<td>Carbonate (CO₃²⁻)</td>
</tr>
<tr>
<td></td>
<td>Magnesium (Mg⁺²)</td>
<td>Chloride (Cl⁻)</td>
</tr>
<tr>
<td></td>
<td>Manganese (Mn⁺²)</td>
<td>Fluoride (F⁻)</td>
</tr>
<tr>
<td></td>
<td>Potassium (K⁺)</td>
<td>Nitrate (NO₃⁻)</td>
</tr>
<tr>
<td></td>
<td>Sodium (Na⁺)</td>
<td>Phosphate (PO₄³⁻)</td>
</tr>
<tr>
<td>Zinc (Zn⁺²)</td>
<td>Hydroxide (OH⁻)</td>
<td>Borates (B₂O₅³⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silicates (Si₂O₅³⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulfate (SO₄²⁻)</td>
</tr>
<tr>
<td>The atmosphere, in rain</td>
<td>Hydrogen (H⁺)</td>
<td>Bicarbonate (HCO₃⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chloride (Cl⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulfate (SO₄²⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decomposition of organic matter in the environment</td>
<td>Ammonium (NH₄⁺)</td>
<td>Chloride (Cl⁻)</td>
</tr>
<tr>
<td></td>
<td>Hydrogen (H⁺)</td>
<td>Bicarbonate (HCO₃⁻)</td>
</tr>
<tr>
<td></td>
<td>Sodium (Na⁺)</td>
<td>Hydroxide (OH⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrite (NO₂⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nitrate (NO₃⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sulfide (HS⁻)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organic radicals</td>
</tr>
<tr>
<td>Living organisms in the environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipal, industrial, and agricultural sources and other human activity</td>
<td>Inorganic ions, including a variety of heavy metals</td>
<td>Inorganic ions, organic molecules, color</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted in part from Refs. [2.1] and [2.7].

**Table 2.1**

Summary of the Important Chemical and Biological Impurities Found in Water
# PRIMARY STANDARDS

## MAXIMUM CONTAMINANT LEVEL

### (MCL) (PPM)

<table>
<thead>
<tr>
<th>Inorganic Contaminant</th>
<th>MCL</th>
<th>Inorganic Contaminant</th>
<th>MCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>0.05</td>
<td>Lead</td>
<td>0.05</td>
</tr>
<tr>
<td>Barium</td>
<td>1.</td>
<td>Mercury</td>
<td>0.002</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.01</td>
<td>*Nitrate (N)</td>
<td>10. (10-45)</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.05</td>
<td>Selenium</td>
<td>0.01</td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.4, (Temp)</td>
<td>(0.7-1.8), (1.4-2.4)</td>
<td>Silver</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organic Contaminant</th>
<th>MCL</th>
<th>Organic Contaminant</th>
<th>MCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endrin</td>
<td>0.0002</td>
<td>2, 4-D</td>
<td>0.1</td>
</tr>
<tr>
<td>Lindane</td>
<td>0.004</td>
<td>2, 4,5-TD (Silver)</td>
<td>0.01</td>
</tr>
<tr>
<td>Methoxychlor</td>
<td>0.1</td>
<td>Total Trihalomethanes</td>
<td>0.1</td>
</tr>
<tr>
<td>Toxaphene</td>
<td>0.005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Total Coliform* 1 colony/100 ml water sample

**Volatile Organic Chemicals (8)** 0.002 - 0.075 ppm

**Radio Nuclides (3)** 5 - 50 pCi/L

**Turbidity** 1 - 5 **Turbidity Units (ntu)**

*"Immediate threat to health"

# SECONDARY STANDARDS

<table>
<thead>
<tr>
<th>Chlorides</th>
<th>250</th>
<th>Manganese</th>
<th>0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>1</td>
<td>Sulfate</td>
<td>250</td>
</tr>
<tr>
<td>Fluoride</td>
<td>2</td>
<td>Total Diss. Sol.</td>
<td>500</td>
</tr>
<tr>
<td>Iron</td>
<td>0.3</td>
<td>Zinc</td>
<td>5</td>
</tr>
</tbody>
</table>

**Color** 15 Color Units

**WATER HARDNESS**

<table>
<thead>
<tr>
<th>SOFT</th>
<th>1</th>
<th>17.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARD</td>
<td>7</td>
<td>119.7</td>
</tr>
</tbody>
</table>
Drinking Water

Maximum Contaminant Levels
(July 1988)

Coliform Bacteria
1 colony per 100 milliliters as monthly average

Turbidity
1.0 nephelometric turbidity unit as monthly average

Inorganic Chemicals
- Arsenic: 0.05
- Barium: 1.0
- Cadmium: 0.01
- Chromium: 0.05
- Lead: 0.05
- Mercury: 0.002
- Nitrate: 10.0
- Selenium: 0.01
- Silver: 0.05

Organic Chemicals
- Endrin: 0.0002
- Lindane: 0.004
- Methoxychlor: 0.1
- Toxaphene: 0.005
- 2,4-D: 0.1
- 2,4,5-TP Silvex: 0.01

Total Trihalomethanes
0.1 milligrams per liter as annual average

Secondary Contaminants
- Chloride: 250.0 mg/l
- Copper: 1.0 mb/1
- Color: 15 units
- Total Dissolved Solids: 500.00 mg/l
- Hydrogen Sulfide: 0.05 mg/l
- Iron: 0.3 mg/l
- Manganese: 0.05 mg/l
- Odor: 3 Threshold Number
- Phenols: 0.001 mg/l
- Sulfate: 250.0 mg/l
- Zinc: 5.0 mg/l
<table>
<thead>
<tr>
<th>Radionuclides</th>
<th>Picocuries Per Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Alpha Particles</td>
<td>15</td>
</tr>
<tr>
<td>Radium</td>
<td>5</td>
</tr>
<tr>
<td>Gross Beta Particles</td>
<td>50</td>
</tr>
<tr>
<td>Strontium 90</td>
<td>8</td>
</tr>
<tr>
<td>Tritium</td>
<td>20,000</td>
</tr>
<tr>
<td>Iodine 131</td>
<td>3</td>
</tr>
</tbody>
</table>

| Sodium | 20.0 milligrams per liter as an optimum level |

<table>
<thead>
<tr>
<th>Volatile Synthetic Organic Chemicals</th>
<th>Milligrams Per Liter as Annual Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>0.005</td>
</tr>
<tr>
<td>Carbon Tetrachloride</td>
<td>0.005</td>
</tr>
<tr>
<td>1,2-Dichloroethane</td>
<td>0.005</td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td>0.005</td>
</tr>
<tr>
<td>para-Dichlorobenzene</td>
<td>0.075</td>
</tr>
<tr>
<td>1,1-Dichloroethylene</td>
<td>0.007</td>
</tr>
<tr>
<td>1,1,1-Trichloroethane</td>
<td>0.2</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Source: Kentucky Cooperative Extension Service
Made Available by Saralene B. Seals
Extension Associate, Nutrition/Health
Session V

HOME TREATMENT DEVICES FOR
PROTECTING DRINKING WATER

Speaker: Dr. Claudette Reichel
La. Cooperative Extension Service
WATER TESTING

If a client is interested in testing a private well, for inorganics or organics, refer them to local or national labs. Companies which sell and service water treatment equipment will usually perform limited water testing. Yellow page listings may include:

Water Companies - Bottled, Bulk, Etc.
Water Filtration and Purification Equipment
Water Pollution Control
Water Softening and Conditioning Equipment, Service and Supplies
Water Treatment Equipment, Services and Supplies
Water Well Drilling Equipment and Supplies
Water Well Drilling and Service

Companies which do lab tests for the water and wastewater industry can perform the widest range of analyses. They are used to working with other companies rather than individuals. Your client needs to specify which elements are to be tested for since labs usually price a package of tests for a flat rate, many of which are of little value to most families. If a family member is on a sodium-restricted diet, the water should be tested for sodium. If an infant under six months of age is in the household, the water should be tested for nitrate. If the water well is near a landfill, dump, underground injection well or chemical storage site, specific chemicals or elements should be tested for. For other elements, check with the family doctor. Such labs may be listed in the Yellow Pages under:

Water Pollution Control
Engineers - Environmental
Engineers - Geotechnical
Engineers - Sanitary
Environmental Consultants
Environmental and Ecological Services

There are also national water testing labs which do a wide range of analyses. One such lab is Watercheck which tests for 50 or more elements and chemicals for about $70 (1-800-458-3330) and Water Test (1-800-426-8378) which has a similar program.

The Louisiana Department of Agriculture and Forestry and the U. S. Geological Survey conduct a limited water well testing program. USEPA will be testing wells in the Louisiana parishes for pesticides as part of a national survey. These programs are limited because of available funding.
TAP OR BOTTLED WATER?

Bill Branch

Americans are spending billions of dollars annually on bottled water. Some prefer bottled water for drinking and cooking because it looks, smells, and tastes "better" than water from their own well or water supply. Water is an excellent solvent, so it naturally acquires tastes, smells, and colors from the rocks, soils and organic matter with which it comes in contact. A particular water's "character" depends on its source, and any treatment it may have received before being consumed.

About one third of Louisiana's drinking water comes from surface sources, such as the Mississippi River. It is treated to remove sediment and chlorinated to kill bacteria before being delivered. The source and the treatment affect the taste, color and smell of the water.

The rest of our drinking water comes from wells. Most of our groundwater is relatively high in salts and minerals. Unless a person is on a salt or sodium restricted diet, these naturally occurring minerals are not usually harmful and have been associated with improved health in some research studies.

Some of the salts and minerals can be removed from water by "point of use" treatments such as filtration, distillation and reverse osmosis. Household units installed under a sink to remove solids from the water used for drinking and cooking (not bathing or washing dishes or clothes) may cost $200.00 to $700.00 initially and $20.00 to $100.00 annually for maintenance, depending on water volume and type of unit. Many restaurants use filtration units for water used to make coffee or soft drinks.

The cost of point-of-use treatment should be compared to the cost of bottled water if you are not satisfied with the tap water you are consuming.
Matching Water Quality Problems with Point-of-Use Treatments

Home water treatment devices are not all alike. Likewise, there is no device that solves all water quality problems. Careful match making is needed to choose the appropriate treatment system for the particular combination of pollutants.

Following is a guide to the types of water treatment techniques which can be effective in reducing the level of certain contaminants. It is important to realize however, that a device may decrease the level of a substance but not completely eliminate it. Also, each device needs consistent maintenance to be effective.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>Fiber Filter</th>
<th>Activated Carbon Filter*</th>
<th>Reverse Osmosis</th>
<th>Distillation</th>
<th>Ion Exchange* (Water Softener)</th>
<th>Ultra-violet Purifier</th>
<th>Other or combination of methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor taste</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>flat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotten egg odor</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Other odors</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbidity</td>
<td>X</td>
<td></td>
<td>(X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissolved iron (metallic taste)</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxidized iron (rust)</td>
<td>X</td>
<td></td>
<td>(X)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacterial iron (slime)</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard water (calcium, magnesium)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROBLEM</td>
<td>Fiber Filter</td>
<td>Activated Carbon Filter*</td>
<td>Reverse Osmosis</td>
<td>Distillation</td>
<td>Ion Exchange* (Water Softener)</td>
<td>Ultraviolet Purifier</td>
<td>Other or combination of methods</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------</td>
<td>--------------------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>--------------------------------</td>
<td>---------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Manganese</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total THMs (chloroform)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrates</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asbestos</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pesticides</td>
<td>X</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial/ household chemicals</td>
<td>X</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floride</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giardia cysts</td>
<td>(X)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viruses</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coliform bacteria</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Not all types of this device are equally effective on all indicated problems. Care must be taken to choose the correct type.

"X" = can significantly alleviate the problem.

"(X)" = can alleviate this problem, but not recommended.

"?" = removes some, but not all types of the substance.
Session VI

AGENCY RESPONSIBILITIES FOR WATER QUALITY

Speakers: Bill Branch
          Brenda Kelly
          Staff Members of Various Local,
          State & Federal Agencies
GROUND-WATER ISSUES

Ground water is available in most of Louisiana, and is suitable for most uses. In 1985, 1,450 million gallons per day of ground water was withdrawn in Louisiana—54 percent for irrigation and aquaculture, 21 percent for industry, 19 percent for public supply, 4 percent for rural domestic and livestock, and 2 percent for power generation.

Although the quantity and quality of ground-water resources generally are adequate, there are accompanying concerns. Principal issues related to ground water in Louisiana are:

- Ground-water availability;
- Ground-water quality;
- Saltwater encroachment;
- Movement and fate of contaminants from hazardous waste sites, landfills, and pits; and
- Contamination from agricultural practices.

U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate information on the Nation's water resources.

Water-resources activities of the USGS in Louisiana consist of collecting water-resources data, and conducting interpretive hydrologic investigations and research on current water issues. The USGS maintains offices in Baton Rouge and Ruston. In cooperation with Federal, State, and local agencies, the USGS has systematically collected ground-water data in Louisiana since 1938, and, in 1988, maintains a statewide network of 625 wells to monitor fluctuations in water levels, 40 wells to monitor organic chemicals, and 210 wells to monitor inorganic constituents.

Results of ground-water studies are used by Federal, State, and local agencies to assess ground-water resources, detect and define pollution and water-supply problems, estimate future conditions before development or land-use changes, and plan management strategies. Three examples of studies that relate to ground-water issues in Louisiana are discussed in the following sections.

Contamination of Ground Water at Willow Springs Hazardous-Waste Site

The USGS, in cooperation with the Louisiana Department of Transportation and Development (LTD), is studying contamination of ground water at the Willow Springs hazardous-waste site in Calcasieu Parish near Lake Charles. The study indicates the presence of waste plumes in the 70 to 90 feet of low-permeability sediments above the shallow sand of the Chicot aquifer. The Chicot aquifer is the principal source of ground water in southwestern Louisiana, provides about 42 percent of the total ground water withdrawn in the State, and has been proposed for designation as a "sole source aquifer" by the U.S. Environmental Protection Agency. The orientation of the plumes is consistent with the general direction of ground-water flow from unlined lagoons through the low-permeability sediments to the shallow sand. Although much of the contamination is confined to the low-permeability sediments overlying the shallow sand of the Chicot aquifer, chloride concentrations exceeding 100 milligrams per liter and some organic pollutants are present within the shallow sand. The information from this study will be useful to State and Federal agencies in understanding the movement of contaminants in ground water. This study also will be useful to management agencies for determining
THE PRIMARY RESPONSIBILITIES OF THE MAJOR STATE AND LOCAL AGENCIES REGARDING GROUND WATER PROTECTION

State

Environmental Quality: Ground water protection, regulation of hazardous and solid waste sites, remediation of abandoned hazardous waste sites, regulation of underground storage tanks, and remediation of contaminated ground water. The programs are carried out in compliance with the federal Resource Conservation and Recovery Act; the Comprehensive Environmental Response, Compensation, and Liability Act; the Water Pollution Control Act of 1972; the Clean Water Act of 1977; and the Louisiana Environmental Affairs Act of 1979, as amended.

Agriculture and Forestry: Controls use of pesticides and provides information on proper use. House Bill No. 1926 of the 1988 Legislature establishes a program to monitor levels of pesticides in the waters of the state. This bill requires that when the Commissioner of Agriculture and Forestry determines that pesticides in the waters of the state pose a threat to human health or the environment, the Commissioner shall: (1) issue a protective order limiting, restricting, or prohibiting the application of a pesticide; (2) communicate his findings, (3) participate in issuing remedial orders in accordance with cooperative agreements, and (4) participate in issuing public communications in accordance with appropriate governmental agencies.

Health and Hospitals: Maintain standards for and monitor quality of water from public supplies and general public health (e.g., bacterial contamination of rural domestic wells, commercial fisheries, recreational water); also regulates water bottling companies.

Natural Resources: The two largest agencies under Natural Resources are the Louisiana Geological Survey and the Office of Conservation. The Louisiana Geological Survey conducts geologic and hydrologic research. The Office of Conservation is a regulatory agency charged with regulating all aspects of the oil and gas industry. Under the Office of Conservation is the Injection and Mining Division, which regulates underground injection wells and surface and subsurface mining.

Transportation and Development: The primary water-related agency under DOTD is the Office of Public Works (OPW). The Water Resources Section (WRS) of OPW is charged with effective administration, conservation, and development of the ground water resources of the state; regulates the water well licensing, construction and registration programs; enforces water well regulations regarding abandoned water wells; is charged with procurement, storage, and dissemination of water-resources
<table>
<thead>
<tr>
<th>Category</th>
<th>Name</th>
<th>Phone</th>
</tr>
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<tbody>
<tr>
<td>STATE EXECUTIVE DIRECTOR</td>
<td>Willie F. Cooper</td>
<td>473-7721</td>
</tr>
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<td></td>
<td>Debra Manuel</td>
<td>473-7721</td>
</tr>
<tr>
<td>ADMINISTRATIVE</td>
<td>Wiley G. Heard</td>
<td>473-7732</td>
</tr>
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<td></td>
<td>Linda Young</td>
<td>473-7733</td>
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<td></td>
<td>Jeffrey Wade</td>
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<td>D. Wadsworth</td>
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<td>Brenda Hedgecock</td>
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<td>AGRICULTURAL CONSERVATION PROGRAMS</td>
<td>J. B. LeRay</td>
<td>473-7738</td>
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<td>Macaria Williams</td>
<td>473-7738</td>
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<tr>
<td>PRICE SUPPORT</td>
<td>John E. Stegen</td>
<td>473-7734</td>
</tr>
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<td></td>
<td>Gerard Labbe</td>
<td>473-7734</td>
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<td>Gloria Parrino</td>
<td>473-7734</td>
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<tr>
<td>PRODUCTION ADJUSTMENT AND COMPLIANCE</td>
<td>Elbert D. Wiggins</td>
<td>473-7743</td>
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<td>Ross Giamanco</td>
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<td>AUTOMATION</td>
<td>Lois B. Partney</td>
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<tr>
<td>COUNTY OFFICE REVIEWER</td>
<td>Johnnie LaFleur</td>
<td>473-7728</td>
</tr>
<tr>
<td>PARISH</td>
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</tr>
<tr>
<td>Avoyelles</td>
<td>P. O. Box 7099</td>
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</tr>
<tr>
<td>Caldwell</td>
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<tr>
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<tr>
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<tr>
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<tr>
<td>Winn</td>
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</tr>
</tbody>
</table>

*These numbers designated parishes of each District Director as shown below.*

1. Curtis L. Tubbs  ASCS Office - Ruston  North
2. Ernest L. Armstrong  ASCS Office - St. Joseph  Northeast
3. William J. Rush  ASCS Office - Natchitoches  Central
4. James H. Harvey  ASCS Office - St. Francisville  Southeast
5. Thomas H. Hespell  ASCS Office - Crowley  Southwest

Revised - 86/16/68
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF WATER RESOURCES
REGIONAL OFFICES

REvised 2/87

SOUTHEAST REGION:
St. Tammany
St. Bernard
Plaquemines
Jefferson
Orleans
St. Charles
St. John the Baptist
St. James
Washington

CAPITAL REGION:
Tangipahoa
St. Helena
Livingston
East Baton Rouge
West Baton Rouge
Ascension
E. Feliciana
Iberville
Pointe Coupee
W. Feliciana

NORTHWEST REGION:
Red River
DeSoto
Bienville
Claiborne
Caddo
Webster
Bossier

CENTRAL REGION:
Vernon (Upper Half)
Rapides
Avoyelles
Concordia
LaSalle
Grant
Natchitoches
Sabine
 Catahoula
Winn

LAFOURCHE REGION:
Terrebonne
Lafourche
Assumption
St. Martin (Lower Section)
St. Mary - East of Wax Lake Outlet
Lower Jefferson (Grand Isle)

NORTHEAST REGION:
Union
Morehouse
Richland
Madison
Lincoln
Jackson
Ouachita
Franklin
Tensas
Caldwell
E. Carroll
W. Carroll
Madison

ACADIANA REGION:
St. Martin (Upper Section)
Iberia
St. Mary - West of the Wax Lake Outlet
St. Landry
Evangeline
Vermilion
Acadia
Lafayette

SOUTHWEST REGION:
Jefferson Davis
Cameron
Calcasieu
Beauregard
Allen
Vernon (Lower Half)
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF WATER RESOURCES
REGIONAL OFFICES

CAPITAL REGIONAL OFFICE
11720 Airline Highway
Baton Rouge, La. 70817
Phone # (504) 295-8900
Linc. 8/426-8900

ACADIANA REGIONAL OFFICE
100 Eppler Road
Lafayette, La. 70505
Phone # (318) 265-5584
Linc. 8/328-5584

NORTHWEST REGIONAL OFFICE
1525 Fairfield Ave.
Shreveport, La. 71101-4388
Phone # (318) 226-7476
Linc. 8/521-7476

SOUTHWEST REGIONAL OFFICE
P. O. Box 3047 (70602)
1155 Ryan St.
Lake Charles, La. 70602
Phone # (318) 491-2082
Linc. 8/361-2082

NORTHEAST REGIONAL OFFICE
804 North 31st. St.
Monroe, La. 71211
Phone # (318) 362-5439
Linc. 8/266-5439

P. O. Box 8475
Monroe, La. 71211

SOUTHEAST REGIONAL OFFICE
3945 N. I-10 Service Rd/West
Metairie, La. 70002
Phone # (504) 838-5365
Linc. 8/637-5365

P. O. Box 8427
Metairie, La. 70011

GSRI LABORATORY
8618 GSRI Avenue
Baton Rouge, La. 70808
Phone # (504) 765-2405
Linc. 8/427-2405

LAFOURCHE REGIONAL OFFICE
302 Barataria St.
Lockport, La. 70374
Phone # (504) 568-8699
532-6206
Linc. 8/621-8699

CENTRAL REGIONAL OFFICE
P. O. Box 278
Tioga, La. 71477
Phone # (318) 487-5656
8/221-5656
WATER WELL DRILLING,
ABANDONMENT, AND
LICENSING INFORMATION

DISTRICTS
LOUISIANA
DEPARTMENT OF TRANSPORTATION
AND DEVELOPMENT

DOTD DISTRICT CONTACTS

2  Geneva Grille - New Orleans
   (504) 283-3418

3  Bill Fontenot - Lafayette
   (318) 233-7404

4  H. R. Pearson - Shreveport
   (318) 746-6100

5/58 Paul Coloquette - Monroe
   (318) 343-2811

7  B. J. (Joe) Landry - Lake Charles
   (318) 439-2406

8  Sidney Bertheaud - Alexandria
   (318) 443-2553

61 C. J. Gaudin - Baton Rouge
   (504) 231-4104

62 Bobby Womack - Hammond
   (504) 345-7390

BATON ROUGE HEADQUARTERS
WATER RESOURCES SECTION STAFF
   (504) 379-1434

Z. "Bo" Bolourchi, Chief
Clyde Carlson
Darrell Locker
Mike Dore
Trudy Dupuy

Address Correspondence to:
Department of Transportation and Development
Atttn: Chief, Water Resources Section
P. O. Box 94245
Baton Rouge, LA 70804-9245
ROSTER OF SANITARIANS

This roster includes: Parish Health Units, Sanitarian Regional Managers, Milk and Dairy Unit, Food and Drug Unit, Seafood Unit, Insect and Vector Unit (Fee Unit), and Regional Laboratories.

*Sanitarian Parish Manager's name is underlined.

ACADIA PARISH
530 West Mill St.
P. O. Drawer 1289
Crowley, LA 70527-1289
(318) 783-9025
LINC 328-5304

J. Russell Boudreaux
Albert Johnston
Rayford Robin

ALLEN PARISH
601 Fifth St.
P. O. Drawer 160
Oberlin, LA 70655
(318) 639-4390
LINC 361-2066

Ricky Mahaffey

ASCENSION PARISH
201 Opelousas St.
P. O. Box 389
Donaldsonville, LA 70346
(504) 473-8380
(504) 644-4582 (Gonzales)

Russell Gautreaux
Ronald Nettles

ASSUMPTION PARISH
Highway 1008
P. O. Drawer 9
Napoleonville, LA 70390
(504) 369-6031

Ellen Finger

AVOYELLES PARISH
109 Government St.
Marksville, LA 71351
(318) 253-4528

Jerry Smith
Sam Smith

BEAUREGARD PARISH
203 West Third St.
P. O. Box 327
DeRidder, LA 70634-0327
(318) 463-4486
LINC 361-2080

Bruce McFatter
Ron Yule
BIENVILLE PARISH
Corner Chestnut & Beech Sts.
P. O. Box 276
Arcadia, LA 71001
(318) 263-2125
LINC 521-7621

BOSSIER PARISH
700 Benton Rd.
P. O. Box 5608
Bossier City, LA 71111
(318) 741-7314
LINC 530-7317

CADDIO PARISH
1866 Kings Hwy.
P. O. Box 3008
Shreveport, LA 71133-3008
(318) 227-5222
LINC 521-5222

CALCASIEU PARISH
721 Prien Lake Rd.
Lake Charles, LA 70602
(318) 478-6020
LINC 367-1165

Caldwell Parish
HC 74, Box 28
Columbia, LA 71418
(318) 649-2393

CAMERON PARISH
Marshall & Louise Sts.
P. O. Box 930
Cameron, LA 70631
(318) 775-5368

CATAHOULA PARISH
309 Short St., 1st Floor
P. O. Box 240
Harrisonburg, LA 71340
(318) 744-5261
CLAIBORNE PARISH
624 West Main St.
Homer, LA 71040
(318) 927-6127
LINC 521-7431

James Comilla

CONCORDIA PARISH
905 Mississippi Ave.
P. O. Box 826
Ferriday, LA 71334
(318) 757-8632

Donnie McDonald

DESMOTO PARISH
120 McEnery St.
P. O. Box 312
Mansfield, LA 71052
(318) 872-0472
LINC 521-7467

Jimmy Brown

EAST BATON ROUGE PARISH
353 N. 12th St.
P. O. Box 3017
Baton Rouge, LA 70821
(504) 342-1734
LINC 421-1734

Grey Moy
T. H. Alford
Barrie Edgar
Mary Dixon
Gilda Fisher
Rayfield Jones
Robert Crain
David Bailey
Sheila Butler
Evelyn Owens
Grafton Cooper

EAST CARROLL PARISH
407 Second St.
Lake Providence, LA 71254
(318) 559-2012

Wayne Driver

EAST FELICIANA PARISH
Marston St.
P. O. Box 227
Clinton, LA 70722
(504) 683-8551

Peter Ricca

EVANGELINE PARISH
415 West Cotton St.
P. O. Box 369
Ville Platte, LA 70586
(318) 363-1135
LINC 328-5299

Steve Tate
Joe Soileau
FRANKLIN PARISH
704 Jackson St.
P. O. Box 547
Winnsboro, LA 71295
(318) 435-7516

GRANT PARISH
506 Main St.
P. O. Box 232
Colfax, LA 71417
(318) 627-3133

IBERIA PARISH
121 West Pershing St.
New Iberia, LA 70560
(318) 364-4514
LINC 328-5186

IBERVILLE PARISH
1100 Meriam St.
P. O. Box 444
Plaquemine, LA 70765-0444
(504) 687-9021

JACKSON PARISH
319 Sixth St.
P. O. Box 66
Jonesboro, LA 71251
(318) 259-6601

JEFFERSON PARISH
111 N. Causeway Blvd.
P. O. Box 652
Metairie, LA 70001
(504) 838-5140
LINC 637-5140
(504) 861-6521(Harvey)
LINC 632-6500

JEFFERSON DAVIS PARISH
314 Church St.
P. O. Box 317
Jennings, LA 70546
(318) 824-2193
LINC 361-2646

Truman McDaniel
Jerry Brevelle
Michael Stockstill
Robert Freeman
Mitchel Dutille
Marliese Samuel
Donald Lazarus
J. Betty DiMiceli
Frank Allo
Charles Johnson
Stanley Howat
Brenda Williams
William Senac
Ragus Legendre
Lubomir Boneff
Winifred Worley
George Borden
John Saladino
Lynell Ringo
Stacey Williams
Deborah Facen
Don Miller
LAFAYETTE PARISH
2100 Jefferson St.
Building B
Lafayette, LA 70501
(318) 265-5616
LINC 328-5616

LAFORUCHE PARISH
801 East Seventh St.
P. O. Box 876
Thibodaux, LA 70302
(504) 447-0921

LASALLE PARISH
305 N. First St.
P. O. Box 17
Jena, LA 71342
(318) 992-4842

LINCOLN PARISH
405 East Georgia Ave.
P. O. Box 869
Ruston, LA 71273-0869
(318) 255-3141
LINC 521-7695

LIVINGSTON PARISH
361 So. Magnolia St.
P. O. Box 365
Livingston, LA 70754
(504) 686-7829

MADISON PARISH
606 Depot St.
Tallulah, LA 71282-3884
(318) 574-3311

MOREHOUSE PARISH
1006 N. Washington
Bastrop, LA 71220
(318) 281-0751

NATCHEZ PARISH
625 Bienville St. Extension
P. O. Box 489
Natchez, LA 71457
(318) 357-3132
LINC 226-3136

Kenneth Duhon
Amy Broussard
Kenneth Arceneaux
Deborah LeBlanc
Verettia Navarre
Stanley Clause

Terry Bourgeois, Acting
Kenneth Jeffus

Donald McMillin

Clyde Aycock
Stephen Colvin

John Sziber
Sandra Sibley
Charles Methvien

Billy Griffis

Michael Deason
Rita Cobb
ORLEANS PARISH
4948 Chef Menteur Hwy., Suite 701
New Orleans, LA 70126
(504) 942-8283

JO ANNA MCLEAN
HABEEB M. HABEEB
RICHARD HEIDLOFF
CELLA TURNER
BURMA SMITH
JERRY GREEN
WALTER PICHON
JOY FREEMAN
GARY LOPINTO
ARDELL WALTERS
SONJA THOMAS
MARNITA DAY
MARLINE TULLIER
KENNETH LANIER
PATRICIA MONDY

OUACHITA PARISH
2913 DeSiard St.
P. O. Box 4460
Monroe, LA 71211-4460
(318) 362-3400
LINC 261-3400

ARTHUR FISHER
GEORGE INEICHEN
TOMMY FULLER
MARGARET STOKES

POINTE COUPEE PARISH
Hospital Road
P. O. Box 460
New Roads, LA 70760
(504) 638-7320

THOMAS E. (TED) DAVIS

RAPIDES PARISH
1200 Texas Ave.
P. O. Box 4087
Alexandria, LA 71301
(318) 487-5281
LINC 221-5282

T. J. SPEIR, ACTING
LEE TAYLOR
MICHAEL DOWTY
GARY LABORDE
D. GARY LINCECUM

RED RIVER PARISH
2015 Red Oak Rd.
P. O. Drawer 628
Coushatta, LA 71019
(318) 932-4087
LINC 521-7314

M. D. CANNON

RICHLAND PARISH
205 S. Eugene St.
P. O. Box 666
Rayville, LA 71269
(318) 728-4441

LOUIS LADART
SABINE PARISH
245 Highland Dr.
P. O. Box 398
Many, LA 71449
(318) 256-9203
LINC 221-5049

C. Quinton Corley
Dorothy Small

ST. BERNARD PARISH
2712 Palmisano Blvd., Bldg. C
Chalmette, LA 70043
(504) 278-7410
LINC 639-7415

William Hippler
Joseph Musso

ST. CHARLES PARISH
Corner of Post & Ellington Sts.
P. O. Box 1330
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(504) 785-2014

Richard Anzalone
Margaret Becnel
Kenneth Dolhonde

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P. O. Box 428
Greensburg, LA 70441
(504) 222-6178

Alan Lard

ST. JAMES PARISH
504 Louisiana Ave.
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(504) 869-4441

Jack Bates

ST. JOHN PARISH
343 Central Ave.
P. O. Drawer "P"
Reserve, LA 70084-0515
(504) 536-3535

Sidney Becnel

ST. LANDRY PARISH
308 W. Bloch St.
P. O. Box 552
Opelousas, LA 70571-0552
(318) 942-9736
LINC 328-5305

G. Wiley Sylvester
Donald Dupre
Jody Guidry
John S. Guillory

ST. MARTIN PARISH
415 St. Martin St.
St. Martinville, LA 70582
(318) 394-3097
LINC 328-5734

Alfred Potier
Carl Winingar
ST. MARY PARISH
1000 Perret St.
P. O. Box 582
Franklin, LA 70538
(318) 828-0410
(504) 385-1470 (Morgan City)

Joan Adams
Timothy Boyd

ST. TAMMANY PARISH
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P. O. Box 239
Covington, LA 70434
(504) 893-6208
LINC 652-6208
(504) 646-6448 (Slidell)
LINC 640-6448

William Hathaway
William DeBlanc
G. Lewis Brown
Raymond Mendel
Poppi Waskom

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P. O. Box 278
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(504) 748-8151
LINC 651-3858
(504) 549-5055 (Hammond)
LINC 651-5055

Robert Egnew
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Harold Hodges
Debra Lambert
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TENSAS PARISH
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P. O. Box 77
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P. O. Box 309
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Abbeville, LA 70510
(318) 893-1443
LINC 328-5722

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Sarite Stelly
Susan Trahan
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P. O. Box 1471
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LINC  361-2328

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Bogalusa, LA  70427
(504) 732-2510
LINC  621-2582
(504) 839-5646(Franklinton)
LINC  621-8968

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P. O. Box 814
Minden, LA  71058-0814
(318) 377-1294
LINC  521-5277
(318) 539-4314 or 9878(Springhill)

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P. O. Box 227
Port Allen, LA  70767
(504) 342-7528

WEST CARROLL PARISH
Koerner & Beale Sts.
P. O. Box 306
Oak Grove, LA  71263
(318) 428-9361

WEST FELICIANA PARISH
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P. O. Box 1928
St. Francisville, LA  70775
(504) 635-3644

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Winnfield, LA  71483
(318) 628-2148

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Karen Nash
John Self

Gaylon Alford
W. E. Knight
Drew Stevens
Dawn Mizell

David Jeane
David Gardner

McDonald Volentine

Nathan Hill

J. Kilren Vidrine

W. Tom McConnell
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P. O. Box 60630
New Orleans, LA 70160
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LINC 621-5181

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Marine Bldg., 5th Floor
New Orleans, LA 70119
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LINC 634-2415

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LINC 421-1625

TECHE - REGION III
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LINC 361-2037

Jefferson
Orleans
St. Bernard
St. Tammany

Ascension
East Feliciana
Livingston
St. Helena
Washington
West Feliciana
East Baton Rouge
Iberville
Pointe Coupee
Tangipahoa
West Baton Rouge

Assumption
St. Charles
St. John
Lafourche
St. James
Terrebonne

Acadia
Iberia
St. Landry
St. Mary
Evangeline
Lafayette
St. Martin
Vermilion

Allen
Calcasieu
Jeff. Davis
Beauregard
Cameron
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LINC 266-5224

Avoyelles
Concordia
LaSalle
Vernon
Catahoula
Grant
Rapides
Winn

Bienville
Caddo
DeSoto
Natchitoches
Sabine
Bossier
Claiborne
Lincoln
Red River
Webster

Caldwell
Franklin
Madison
Ouachita
Tensas
West Carroll
East Carroll
Jackson
Morehouse
Richland
Union
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LINC 621-5118

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LINC 221-5183

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Baton Rouge, LA 70821
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LINC 421-1541

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Dulance Reed
St. Landry Parish Health Unit
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LINC 651-3891

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Lezette Earhart
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(318) 362-5232
LINC 421-0991

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(318) 226-7478
LINC 521-7478

(318) 362-5232
LINC 266-5232
John W. Fontenot  
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Lafayette, LA 70501  
(318) 265-5311  
LINC 328-5311

Craighton Lacombe  
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LINC 361-2040

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Amite, LA 70422  
(504) 748-8193  
LINC 651-3891

John Mendow  
H. Rufus Williams  
Harry Goynes  
Rachel Harrington  
Delos Thompson  
Ed Kelley
# FOOD AND DRUG UNIT

William D. Swiler, Administrator  
325 Loyola Ave., Rm. 414  
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New Orleans, LA 70160  
(504) 568-5401  
LINC 621-5401

## CENTRAL OFFICE FOOD AND DRUG SANITARIANS

Steve Hayden, Chief Inspector  
Tony Vaccarella  
Claude Lewis  
Terrance Pattison  
Andrew Messina  
William MacMillan, Pharmacist

## REGIONAL FOOD AND DRUG SANITARIANS

<table>
<thead>
<tr>
<th>Region</th>
<th>Name</th>
<th>Address</th>
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</table>
| Baton Rouge | Cecil Ballard | 1220 Main St.  
P. O. Box 3633  
(504) 342-1610  
LINC 421-1610 | (504) 342-1610 | 421-1610 |
| Shreveport | James Newsom | 1525 Fairfield Ave., Rm. 566  
Shreveport, LA 71101-4388  
(318) 226-7432  
LINC 521-7432 | (318) 226-7432 | 521-7432 |
| Lafayette | William Harris | 302 Jefferson, Rm. 612  
Lafayette, LA 70501  
(318) 265-5311  
LINC 328-5311 | (318) 265-5311 | 328-5311 |
| Monroe | Wayne McCartney | 2913 Betin St.  
P. O. Box 6118  
Monroe, LA 71211-6118  
(318) 362-5248  
LINC 266-5248 | (318) 362-5248 | 266-5248 |
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LINC 621-8227 or 5406

CENTRAL OFFICE SEAFOOD SANITARIANS

Guy J. Brubacher, Jr.

REGIONAL SEAFOOD SANITARIANS

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LINC 328-5311

Claudette Skellham
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LINC 621-5139
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New Orleans, LA 70160  
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Linc 621-5100

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New Orleans, LA 70119  
(504) 568-2921  
Linc 634-2400

CAPITOL REGIONAL OFFICE-REGION 2  
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Baton Rouge, LA 70821  
(504) 342-1616  
Linc 421-1616

ACADIAN REGIONAL OFFICE-REGION 4  
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Lafayette, LA 70501  
(318) 265-5311  
Linc 328-5311

CENTRAL REGIONAL OFFICE-REGION 6  
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Alexandria, LA 71301  
(318) 487-5262  
Linc 221-5262

NORTHWEST REGIONAL OFFICE-REGION 7  
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Shreveport, LA 71101  
(318) 226-7470  
Linc 521-7470

NORTHEAST REGIONAL OFFICE-REGION 8  
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Monroe, LA 71211  
(318) 362-5222  
Linc 261-5222

William J. Hughes, Chief Engineer  
T. J. Ray, Administrator/SDWP  
George Robichaux, Sewage Administrator  
Leslie LeMon  
Larry Fox, Certification Officer

R. Douglas Vincent, District Engineer  
Fred Corliss, Regional Engineer  
Gus Gatzke, Regional Engineer  
Effie Michaels, Water Program Supervisor

James Antoon, Water Program Supervisor  
Lewis Carpenter, Plans Review

Don Guidry, Water Program Supervisor

Michael Cazes, Regional Engineer

Perry Watson, District Engineer  
Wayne Mulig, Regional Engineer  
Glynn Shelton, Water Program Supervisor

Robert Driggers, Regional Engineer  
Jay Hill, Water Program Specialist
LOUISIANA WATER DATA REFERRAL DIRECTORY

Bill Branch

Anyone searching for data concerning Louisiana's water resources may need a copy of the Louisiana Water Data Referral Directory, published by the Louisiana Water Resources Information Center (LAWRIC). The directory contains information on two of LAWRIC's computer files.

The Water Data File describes water resource by various agencies and explains how to obtain the data. Computer software needed to manipulate the data and hardware used are included in the file.

The Projects in Progress File describes water resource research projects in progress in 1985. Key words, study objectives and progress reports are included.

Directories are available for $10.00 and annual updates for $2.00. Persons interested in obtaining a Directory should contact LAWRIC at (504) 379-1478.

LAWRIC also has a Bibliographic File listing water related reports and documents published on Louisiana topics and a Geographic Referencing File listing locations of water data collecting stations used by various state and federal agencies in Louisiana.

The LAWRIC staff are aware of research and development involving water resources throughout Louisiana and are a good source of information referrals for anyone working in that area.
WATER QUALITY, CONSERVATION AND MANAGEMENT
TRAINING SESSION NO. 1
EVALUATION

This presentation was intended to introduce you to some of the technology involved with drinking water quality and to the agencies with water quality responsibility. Please tell us how well we did that and which subjects need more or less explanation. Any comments which will help us know what you need to support your water quality programming would be appreciated.

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Comments:
WATER QUALITY, CONSERVATION AND MANAGEMENT
TRAINING SESSION NO. 1
EVALUATION RESPONSES

Total Responses - 17.

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Comments: (7/15)

1. Agency responsibilities too lengthy. Reference sheets sufficient.
2. A little much - some I did not understand.
3. Good info.
4. Very good.
5. Too much material for one day.
6. Many of the words used were ones I wasn't familiar with. The information on pesticides, turbidity, etc., was difficult to understand. If an Extension agent can't understand some of the information, it would be difficult to inform clients. Too much info was presented.
7. Tried to cover too much in one day. Hard to comprehend so much information. Good handout materials.
8. Majority of training sessions excellent. One presentation included terms such as: "Way more bad things", "stuff", "critters", and "little jobs" which did very little to increase technical knowledge of drinking water quality.