

Health Consultation

ASSESSMENT OF CANCER INCIDENCE FROM THE
LOUISIANA TUMOR REGISTRY FROM 1988 - 2004

CALCASIEU PARISH, LOUISIANA

SEPTEMBER 27, 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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HEALTH CONSULTATION

ASSESSMENT OF CANCER INCIDENCE FROM THE LOUISIANA TUMOR REGISTRY
FROM 1988 – 2004

CALCASIEU PARISH, LOUISIANA

Prepared By:

Louisiana Department of Health and Hospitals
Office of Public Health
Section of Environmental Epidemiology and
Toxicology
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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I. INTRODUCTION

As part of the Louisiana Department of Health and Hospitals/Office of Public Health's (LDHH/OPH) ongoing environmental health investigation in Mossville, Louisiana, this report examines cancer incidence data for Calcasieu Parish from 1988- 2004. In a previous review of *Cancer in Calcasieu Parish, Louisiana 1988-1997*, cancers found with elevated incidence included bladder cancer, lung cancer, skin cancer, and soft tissue tumors.¹

II. BACKGROUND AND STATEMENT OF ISSUES

Mossville is a small, unincorporated community in Calcasieu Parish, near Lake Charles, Louisiana. For years, residents have expressed health and quality of life concerns related to industrial activity in the area. An exposure investigation of blood dioxin levels in 28 Mossville residents, conducted by the Agency for Toxic Substances & Disease Registry (ATSDR) in 1998, detected elevated dioxin levels in some residents.²

Dioxins are a family of compounds commonly referred to as polychlorinated dioxins (CDDs). CDDs are known to occur naturally, and are also produced by human activities. They are naturally produced from the incomplete combustion of organic material by forest fires or volcanic activity. They are unintentionally produced by industrial, municipal, and domestic incineration and combustion processes. Currently, it is believed that CDD emissions associated with waste incineration and combustion activities are the predominant environmental source. CDDs are found in the environment together with other structurally related chlorinated chemicals, such as chlorinated dibenzofurans (CDFs) and PCBs. Therefore, people are generally exposed to mixtures of CDDs and other classes of toxicologically and structurally similar compounds.³

CDDs are found everywhere in the environment, and most people are exposed to very small background levels of CDDs when they breath air, consume food or milk, or have skin contact with materials contaminated with CDDs. Also, nursing infants may be exposed through their mother's breast milk. Exposure to dioxins causes skin disease and possibly cancer in humans. In animal studies, dioxin exposure has been linked to diseases of the skin, liver, reproductive system, and immune system.³

Public concerns about dioxins and other chemical pollutants in the Mossville/Lake Charles area warranted thoughtful public health response. A review of cancer incidence rates was an important component of such a response and was conducted by the Louisiana Department of Health and Hospitals (LDHH). Previous LDHH actions had included: a residential needs assessment of the Mossville community; creation of a residential steering group; facilitating enrollment of area residents into Medicare, Medicaid, and the Louisiana Children's Health Insurance Program; and educating local physicians on the health effects of dioxins.¹

The *Cancer in Calcasieu Parish, Louisiana 1988-1997* cancer review compared cancer incidence of Calcasieu Parish and the State of Louisiana. Age-adjusted rates of all cancers combined and cancers of 22 specific anatomic sites were examined for the following demographic groups: black females, white females, black males, and white males. Overall cancer incidence in Calcasieu Parish from 1988 to 1997 did not differ significantly from the State of Louisiana for

black females, white females and white males. Black males in Calcasieu Parish had significantly lower overall cancer incidence than in the state. Among specific types of cancers with elevated incidence, bladder cancer, lung cancer, skin cancer, and soft tissue tumors have risk factors that include chemical exposures.¹

III. METHODOLOGY

This report reviews cancer incidence in Calcasieu Parish and compares it with the entire State of Louisiana. Cancer *incidence* is the number of new cancer cases diagnosed, often expressed as a rate over a specified period of time. In this document, the rate is the average number of new cases diagnosed in a year per 100,000 people.

Because cancer is diagnosed more frequently among the elderly and because some geographic areas have a larger proportion of elderly residents than others, age-adjusted rates are used to allow meaningful comparisons of rates from different areas by removing the effect of varying age distributions. These are weighted averages of age-specific rates, where the weights represent the distribution of a standard population, in this case the U.S. 2000 population.

The Louisiana Tumor Registry calculated age-adjusted cancer incidence rates for 24 distinct types of cancer and all cancers combined. Since cancer rates vary by race and sex, parish- state comparisons were made separately for black females, black males, white females, and white males for each type of cancer.

Site specific comparisons of incidence rates for Calcasieu Parish and Louisiana are shown on Tables 1, 2, 3, and 4 as rate ratios with 95% confidence intervals. The terms “higher” or “lower” are used when the rate ratios differ significantly from 1.0 ($p < 0.05$). When both the rate ratio and its confidence intervals were less than 1.0, the parish rate was significantly lower than the state rate; when they were greater than 1.0, the parish rate was significantly higher than the state rate. Otherwise, the rates were considered comparable, or not significantly different.

IV. RESULTS

Tables 1, 2, 3, and 4 contain average annual age-adjusted (adjusted to the 2000 U.S. standard population) cancer incidence rates per 100,000 for black males, white males, black females, and white females residing in Calcasieu Parish and the State of Louisiana from 1988 through 2004. Site specific comparisons of incidence rates for Calcasieu Parish and Louisiana are shown as rate ratios with 95% confidence intervals. Rate ratios were calculated by dividing the Calcasieu incidence rate by the Louisiana incidence rate for each individual site. All of these data were provided by the Louisiana Tumor Registry (LTR).

Table 1: Cancer Incidence in Calcasieu Parish and Louisiana, 1988 – 2004: Black Females (average annual per 100,000, * rate ratios, and 95% confidence intervals)

Sites	Black Females				
	Calcasieu Rates	Louisiana Rates	Rate ratio	Confidence Intervals	Significant Difference
All cancers combined	403.7	387.6	1.0415	0.9822, 1.1036	
Oral cavity	6.7	5.4	1.2407	0.7452, 1.9317	
Esophagus	3.7	3.5	1.0571	0.5529, 1.9088	
Stomach	8.6	11.1	0.7748	0.4952, 1.1480	
Colon & rectum	68.3	55.0	1.2418	1.0717, 1.4323	Higher
Liver & HBD	4.7	2.9	1.6207	0.8751, 2.7977	
Pancreas	15.4	14.9	1.0336	0.7391, 1.3942	
Larynx	1.6	2.3	0.6957	0.2195, 1.6066	
Lung and Bronchus	64.8	47.8	1.3556	1.1639, 1.5683	Higher
Melanoma of the Skin	1.0	0.9	1.1111	0.2070, 3.1331	
Breast	110.2	114.0	0.9667	0.8642, 1.0786	
Cervix Uteri	15.5	17.9	0.8659	0.6377, 1.1443	
Uterus	15.7	17.7	0.8870	0.6467, 1.1852	
Ovary	6.7	10.1	0.6634	0.4074, 1.0264	
Urinary Bladder	4.5	6.2	0.7258	0.3662, 1.2512	
Kidney	6.1	9.4	0.6489	0.3855, 1.0235	
Brain and central nervous system	4.5	3.8	1.1842	0.6517, 1.9776	
Thyroid	8.4	5.5	1.5273	0.9971, 2.2313	
Hodgkin lymphoma	1.8	1.6	1.1250	0.3893, 2.4724	
Non-Hodgkin lymphoma	12.3	10.1	1.2178	0.8435, 1.7021	
Myeloma	5.6	9.0	0.6222	0.3427, 1.0226	
Leukemia	9.0	7.6	1.1842	0.7692, 1.7216	
Soft tissue sarcoma	4.0	3.1	1.2857	0.6469, 2.2775	

***age adjusted to the 2000 U.S. standard population**

Table 2: Cancer Incidence in Calcasieu Parish and Louisiana, 1988 – 2004: White Females (average annual per 100,000, * rate ratios, and 95% confidence intervals)

Sites	White Females				
	Calcasieu Rates	Louisiana Rates	Rate ratio	Confidence Intervals	Significant Difference
All cancers combined	410.3	396.9	1.0338	1.0049, 1.0635	Higher
Oral cavity	5.7	6.7	0.8507	0.6665, 1.0898	
Esophagus	1.7	1.9	0.8947	0.5355, 1.3254	
Stomach	4.2	4.4	0.9545	0.7166, 1.2638	
Colon & rectum	52.4	48.8	1.0738	0.9910, 1.1619	
Liver & HBD	2.6	2.4	1.0833	0.7490, 1.5624	
Pancreas	9.3	10.2	0.9118	0.7407, 1.0931	
Larynx	2.2	2.5	0.8800	0.6001, 1.3345	
Lung and Bronchus	62.1	56.5	1.0991	1.0211, 1.1798	Higher
Melanoma of the Skin	14.9	9.3	1.6022	1.3744, 1.8789	Higher
Breast	119.7	121.2	0.9876	0.9364, 1.0410	
Cervix Uteri	11.8	9.0	1.3111	1.0973, 1.5648	Higher
Uterus	17.3	17.0	1.0176	0.8830, 1.1667	
Ovary	10.5	12.8	0.8203	0.6795, 0.9754	Lower
Urinary Bladder	9.5	9.1	1.0440	0.8654, 1.2593	
Kidney	10.8	10.3	1.0485	0.8696, 1.2420	
Brain and central nervous system	4.1	5.6	0.7321	0.5399, 0.9718	Lower
Thyroid	9.2	9.2	1.0000	0.8189, 1.2182	
Hodgkin lymphoma	2.9	2.7	1.0741	0.7632, 1.5557	
Non-Hodgkin lymphoma	20.2	16.6	1.2169	1.0695, 1.3844	Higher
Myeloma	3.7	4.0	0.9250	0.6837, 1.2492	
Leukemia	9.4	9.8	0.9592	0.7956, 1.1645	
Soft tissue sarcoma	3.1	2.3	1.3315	0.9311, 1.8528	

***age adjusted to the 2000 U.S. standard population**

Table 3: Cancer Incidence in Calcasieu Parish and Louisiana, 1988 – 2004: Black Males (average annual per 100,000, * rate ratios, and 95% confidence intervals)

Sites	Calcasieu Rates	Louisiana Rates	Black Males		
			Rate ratio	Confidence Intervals	Significant Difference
All cancers combined	651.5	680.9	0.9568	0.9049, 1.0107	
Oral cavity	19.5	20.8	0.9375	0.6940, 1.2433	
Esophagus	17.2	14.3	1.2028	0.8428, 1.6541	
Stomach	25.6	23.3	1.0987	0.7970, 1.4628	
Colon & rectum	71.4	72.9	0.9794	0.8243, 1.1543	
Liver & HBD	10.6	8.8	1.2045	0.7415, 1.8403	
Pancreas	23.0	19.3	1.1917	0.8557, 1.6031	
Larynx	12.8	16.1	0.7950	0.5437, 1.1275	
Lung and Bronchus	145.4	145.4	1.0000	0.8856, 1.1246	
Melanoma of the Skin	1.8	1.3	1.3846	0.3562, 3.6379	
Prostate	197.1	227.6	0.8660	0.7810, 0.9577	Lower
Testis	1.5	1.3	1.1538	0.3401, 2.7709	
Urinary Bladder	26.7	19.2	1.3906	1.0268, 1.8433	Higher
Kidney	15.7	18.2	0.8626	0.6037, 1.1977	
Brain and CNS	5.7	4.6	1.2391	0.6929, 2.1108	
Thyroid	1.3	1.4	0.9286	0.1787, 2.7085	
Hodgkin lymphoma	4.0	2.1	1.9048	0.9555, 3.4809	
Non-Hodgkin lymphoma	18.2	14.8	1.2297	0.8735, 1.6792	
Myeloma	11.3	14.7	0.7687	0.4793, 1.1647	
Leukemia	11.8	13.0	0.9077	0.5629, 1.3811	
Soft Tissue sarcoma	2.0	3.5	0.5828	0.2074, 1.3238	

***age adjusted to the 2000 U.S. standard population**

Table 4: Cancer Incidence in Calcasieu Parish and Louisiana, 1988 – 2004: White Males (average annual per 100,000, * rate ratios, and 95% confidence intervals)

Sites	Calcasieu Rates	Louisiana Rates	White Males		
			Rate ratio	Confidence Intervals	Significant Difference
All cancers combined	611.2	599.1	1.0202	0.9929, 1.0481	
Oral cavity	18.2	19.6	0.9286	0.7905, 1.079	
Esophagus	8.2	7.6	1.0789	0.8406, 1.3645	
Stomach	9.9	10.1	0.9802	0.7715, 1.2136	
Colon & rectum	71.9	71.2	1.0098	0.9310, 1.0957	
Liver & HBD	8.6	7.3	1.1781	0.9257, 1.4937	
Pancreas	12.2	14.5	0.8414	0.6853, 1.0155	
Larynx	10.7	10.4	1.0288	0.8339, 1.2451	
Lung and Bronchus	118.1	118.0	1.0008	0.9417, 1.0626	
Melanoma of the Skin	20.3	15.4	1.3182	1.1364, 1.5278	Higher
Prostate	173.4	161.1	1.0764	1.0225, 1.1329	Higher
Testis	5.4	5.3	1.0189	0.7670, 1.3080	
Urinary Bladder	37.4	39.5	0.9468	0.8441, 1.0583	
Kidney	18.2	19.1	0.9529	0.8107, 1.1056	
Brain and CNS	6.9	8.1	0.8519	0.6663, 1.0859	
Thyroid	4.1	3.5	1.1714	0.8267, 1.6282	
Hodgkin lymphoma	3.3	3.3	1.0000	0.6774, 1.4228	
Non-Hodgkin lymphoma	26.5	23.3	1.1373	0.9940, 1.2998	
Myeloma	7.0	6.1	1.1475	0.8762, 1.4749	
Leukemia	14.9	16.5	0.9030	1.0732, 0.2532	
Soft Tissue sarcoma	4.3	3.8	1.1529	0.8275, 1.5677	

***age adjusted to the 2000 U.S. standard population**

V. DISCUSSION

Cancers have both genetic (inherited) and external risk factors. Some individuals have genes that predispose them to cancer, irrespective of environmental influences. Genetic factors alone, however, account for a minority of cancers, an estimated 5 to 10 percent.⁵ External factors, acting in concert with genetic factors, cause the majority of cancers. The sources of external exposures are various: diet, smoking, sunlight, household chemicals, alcohol consumption, reproductive behaviors, pollution, radiation, chemicals, infectious agents, etc. The roles of these risk factors differ depending on the type of cancer. Excessive exposure to sunlight, for example, is the primary cause of skin cancer, but does not cause cancer at other sites.

Incidence rates for all cancers combined for black and white males and black females in Calcasieu Parish from 1988-2004 did not differ significantly from those for their Louisiana

counterparts in Louisiana as a whole. For white females, however, the rate for all cancers combined was a significantly higher in Calcasieu Parish than in Louisiana. Calcasieu parish rates that are statistically significantly ($p < 0.05$) higher or lower than the state rates will be examined. Rate ratios were calculated by dividing the Calcasieu incidence rate by the Louisiana incidence rate for each site. Lung and bronchus cancer, melanoma of the skin, cervical cancer, and non-Hodgkin lymphoma are the main contributors to the statistically higher significance in white females in Calcasieu Parish from 1988-2004.

Black and white females in Calcasieu Parish had significantly higher lung cancer incidence rates than in Louisiana, but males did not. Cigarette smoking is the primary risk factor for lung cancer in the United States.⁶ Other documented risk factors include radiation, asbestos, bis-chloromethyl ether, chloromethyl methyl ether, beryllium, mustard “gas”, and metal fumes (nickel, arsenic, chromium, lead).⁷ These risk factors are not mutually exclusive. In fact, exposure to multiple carcinogens can have synergistic effects, whereby the combined risk is greater than the sum of the individual risks. The risk of lung cancer in smokers with a history of asbestos exposure, for example, is 10 times that of non-smoking asbestos workers and 5 times that of smokers without a history of asbestos exposure.⁸

Given available estimates of tobacco use in Calcasieu Parish, cigarette smoking does not seem to account for the elevated lung cancer incidence. The reported smoking rate in the parish (23.4%) nearly matches that of the state (22.5%).⁹ This estimate, however, does not take into account gender-specific data, cigarettes per day, or years of tobacco use. Furthermore, the latency between exposure and the development of lung cancer limits the relevance of current tobacco use statistics to current lung cancer incidence.

White females and white males in Calcasieu Parish had significantly higher incidence rates for melanoma of the skin rates than in Louisiana. Melanoma cancer data available through the LTR do not include basal cell or squamous cell carcinomas. Ultraviolet exposure from sunlight is the primary risk factor for melanoma.¹⁰ People who work outdoors are at an increased risk, as are people with multiple sunburns. Caucasians are at much higher risk of skin cancer than African-Americans because of their relative lack of pigmentation.

White males in Calcasieu Parish had significantly higher prostate cancer incidence rates than in Louisiana, but black males in Calcasieu Parish had significantly lower prostate cancer incidence rates than statewide. Prostate cancer is the most common cancer among men. The risk of prostate cancer increases with age, rising after 50 years of age. Family history is also a risk factor for prostate cancer.¹¹

Black males in Calcasieu Parish had significantly higher bladder cancer incidence rates than in Louisiana. The risk of getting bladder cancer increases as people age. Cigarette smokers are two to three times more likely than nonsmokers to be diagnosed with bladder cancer. White persons are twice as more likely to get bladder cancer than black persons, and males are two to three times more likely to get bladder cancer than females. Other risk factors for bladder cancer include occupation, i.e., rubber, chemical, and leather industries, parasite infections, family or personal history of bladder cancer, and treatment with arsenic.¹²

Black females in Calcasieu Parish had significantly higher colon and rectum cancer incidence rates than in Louisiana. According to the American Cancer Society, the risk factors of colon and rectum cancers include obesity, a diet rich in red meats and low in fruits and vegetables, ulcerative colitis, and familial polyposis.

White females in Calcasieu Parish had significantly higher cervical cancer incidence rates than in Louisiana. Risk factors for cervical cancer include human papilloma virus infection and, to a lesser extent, cigarette smoking. Maternal use of diethylstilbestrol, a drug once given to women to prevent miscarriages, is also a risk factor for cervical cancer. Barrier contraception, sexual abstinence, and early detection of precancerous lesions by Pap smears help prevent this disease.¹³ In addition, the vaccine Gardasil, given to pre-adolescent and adolescent females, prevents subsequent infection with the most common HPV infections that cause cervical cancer.

White females in Calcasieu Parish had significantly lower ovarian cancer incidence rates than in Louisiana. Risk factors for ovarian cancer include being a female over the age of 55 or an older female who has never been pregnant, having family or personal history of cancer, or taking menopausal hormone therapy.¹⁴

White females in Calcasieu Parish had significantly lower brain and central nervous system cancer incidence rates than in Louisiana. Brain tumors are more common in males than females, and often occur more often among white people than among other races. Other risk factors include family history, old age, and exposure to radiation or certain chemicals such as vinyl chloride or formaldehyde at work.¹⁵

White females in Calcasieu Parish had significantly higher non-Hodgkin lymphoma incidence than those statewide. Risk factors for adult non-Hodgkin lymphoma include being an older white male, having an inherited immune disorder or an autoimmune disorder, having the Epstein-Barr virus or a history of *Helicobacter pylori* infection, being exposed to certain pesticides, taking immunosuppressant drugs after an organ transplant, eating a diet high in meats and fat, or receiving past treatment for Hodgkin lymphoma.¹⁶

In epidemiologic studies, dioxin exposure has been associated with increased mortality from cancer at all sites combined, lung cancer, lymphomas, soft tissue sarcomas and multiple myelomas.¹⁷ In this review, however, soft tissue sarcoma did not exhibit a higher or lower incidence in Calcasieu vs. statewide. Although lung cancer in black and white females in Calcasieu Parish had significantly higher lung cancer incidence rates than in Louisiana, it cannot be concluded that the lung cancer incidence is associated with dioxin exposure since there was not a significant increase in lung cancer in males.

In the *Cancer in Calcasieu Parish, Louisiana 1988-1997* report, Standard Incidence Ratios (SIRs) were calculated rather than rates and rate ratios, as in this review, since the sample size was small. Also, 22 specific cancer sites were evaluated in the 1988-1997 cancer incidence analysis rather than 24 distinct cancer sites evaluated in the 1988- 2004 report. In addition, this review was expanded to include 17 years of cancer incidence data, and, therefore, encompasses a larger sample size providing greater statistical power to support the conclusion that there is no

clear pattern indicating that Calcasieu parish has any consistently higher than expected rates for most cancers.

The U.S. Environmental Protection Agency has classified dioxins as a probable human carcinogen (cancer causing chemical); there is not sufficient evidence to prove that dioxins cause cancer from exposure to low levels normally found in the environment. The health outcome cancer data results in this review, stratified by race and gender, cannot be linked to an environmental cause.

A community that is afflicted with an unusual number of cancers will naturally look for an environmental cause. Correlations are sometimes found, but it is usually not possible to confirm that a causal relationship exists. This is primarily due to a lack of information about environmental exposures or the contribution of other risk factors to the development of the disease.

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. This system was established in 1984 by the Centers for Disease Control and Prevention (CDC). More than 350,000 adults are interviewed each year, making the BRFSS the largest telephone health survey in the world. States use BRFSS data to identify emerging health problems, establish and track health objectives, and develop and evaluate public health policies and programs. Adults in Calcasieu Parish reported on selected health risks such as health status, exercise, diabetes, flu vaccination, current smoking, binge drinking and obesity in the 2004 BRFSS report. According to the 2004 BRFSS report, adults living in Calcasieu Parish reported a higher amount of exercise and smoking than in Louisiana. Adults living in Calcasieu Parish reported a lower health status, lower incidence of diabetes, received less flu vaccinations, were less obese, and exhibited less binge drinking than in Louisiana.

VI. CONCLUSION

Overall, cancer incidence in Calcasieu parish from 1988 to 2004 differed from that in the 1988-1997 cancer incidence analysis. In the *Cancer in Calcasieu Parish, Louisiana 1988-1997* report, Standard Incidence Ratios (SIRs) were calculated since the sample size was small. Also, 22 specific cancer sites were evaluated in the 1988-1997 cancer incidence analysis rather than 24 distinct cancer sites evaluated in the 1988-2004 report. Since this 1988-2004 review was expanded to include 17 years of cancer incidence data, and, therefore, encompasses a larger sample size, it provides greater statistical power to conclude that there is no clear pattern indicating that Calcasieu parish has any consistently higher than expected rates for most cancers. The exceptions are melanoma of the skin which was consistently elevated in whites and cancer of the lung which was consistently elevated in women. Although dioxins are possibly linked to some cancers such as lung cancer, lymphomas, soft tissue sarcomas and multiple myelomas, correlations are not consistent across the board, and they cannot yet be applied to Calcasieu Parish. A Health Consultation, *Follow-up Exposure Investigation, Calcasieu Estuary (a.k.a Mossville)*, made public by the ATSDR on March 13, 2006, supports the conclusion that cancer in

Calcasieu Parish cannot be predicted from the blood dioxin levels in the Exposure Investigation participants.

VII. PUBLIC HEALTH ACTION PLAN

LDHH/OPH/SEET will present these findings to the community and provide additional public health cancer prevention information. Health education will be provided to the community in order to reduce the risk factors contributing to the cancers.

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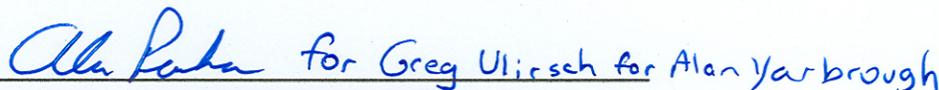
CERTIFICATION

This Calcasieu Parish site assessment of cancer incidence, health consultation was prepared by Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated. Editorial review was completed by the Louisiana cooperative agreement partner.



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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



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