Naegleria Infection

(nigh-GLEER-e-uh)

What is *Naegleria*?

Naegleria is an ameba commonly found in warm freshwater and soil. Only one species of *Naegleria* infects people, Naegleria fowleri. It causes a very rare but severe brain infection. Most infections are fatal.

How does infection with *Naegleria* occur?

Naegleria infects people by entering the body through the nose. Generally, this occurs when people use warm freshwater for activities like swimming or diving. The ameba travels up the nose to the brain and spinal cord where it destroys the brain tissue. Infections do not occur as a result of drinking contaminated water.

Where is *Naegleria* found?

Naegleria fowleri is found around the world. In the United States, it has caused infections in 15 southern tier states (AR, AZ, CA, FL, GA, LA, MO, MS, NC, NM, NV, OK, SC, TX, and VA). The ameba grows best in warm or hot water. Most commonly, the ameba may be found in:

- Bodies of warm freshwater, such as lakes or rivers
- Geothermal (naturally hot) water such as hot springs
- Geothermal (naturally hot) drinking water sources
- Warm water discharge from industrial plants
- Poorly maintained and minimally-chlorinated or unchlorinated swimming pools
- Soil

Naegleria is not found in salt water locations like the ocean.

Can I get a *Naegleria* infection from a disinfected swimming pool?

No. You cannot get a *Naegleria* infection from a properly cleaned, maintained, and disinfected swimming pool.

How common are *Naegleria* infections in the United States?

Infections are very rare even though *Naegleria* is commonly found in freshwater. In the 10 years from 1998 to 2007, 33 infections were reported in the U.S. Thirty-one people had contact with recreational water and two people had contact with water from a geothermal (naturally hot) water supply.

When do *Naegleria* infections most commonly occur?

While infections with *Naegleria* are very rare, they occur mainly during the summer months of July, August, and September. These infections are more likely to occur in southern tier states. They usually occur when it is hot for prolonged periods causing higher water

temperatures and lower water levels. Infections can increase during heat wave years.

Can infection be spread from one person to another?

No. *Naegleria* infection cannot be spread from one person to another.

What are the symptoms of *Naegleria* infection?

Infection with *Naegleria* causes the disease primary amebic meningoencephalitis (PAM), a brain infection that leads to the destruction of brain tissue. In its early stages, *Naegleria* infection may be similar to bacterial meningitis.

Initial symptoms of PAM start 1 to 14 days after infection. The initial symptoms include headache, fever, nausea, vomiting, and stiff neck. Later symptoms include confusion, lack of attention to people and surroundings, loss of balance, seizures, and hallucinations. After the start of symptoms, the disease progresses rapidly and usually causes death within 3 to 7 days.

Is there effective treatment for infection with *Naegleria*?

It is not clear. Several drugs are effective against *Naegleria* in the laboratory. However, their effectiveness is unclear since almost all infections have been fatal even when people were treated.

What should I do if I have been swimming or playing in warm freshwater and now I think I have symptoms associated with *Naegleria*?

Infection with *Naegleria* is very rare. The early symptoms of *Naegleria* infection are more likely to be caused by other more common illnesses, such as meningitis. People should seek medical care immediately whenever they develop a sudden onset of fever, headache, stiff neck, and vomiting particularly if they have been in warm fresh water within the previous 2 weeks.

How common is *Naegleria* in the environment?

Naegleria is commonly found in most lakes in southern tier states during the summer. This means that recreational water users should be aware that there will always be a low level risk of infection when entering these waters.

Is there a routine and rapid test for *Naegleria* in the water?

No. It can take weeks to grow and identify the ameba. Newer genetic detection tests for ameba are still under development. Water testing suggests that the amebae are so common that recreational water users should assume that there is a low level of risk when entering all warm fresh water in southern tier states.

How does the risk of *Naegleria fowleri* infection compare with other water-related risks?

Although the infections are severe, the risk of *Naegleria fowleri* infection is very low. There have been 33 reported infections in the U.S. during the 10 years from 1998 to 2007, despite millions of recreational water exposures each year. By comparison, during the ten years from 1996 to 2005, there were over 36,000 drowning deaths in the U.S.

How will the public know if a lake or other water body has *Naegleria*?

Recreational water users should assume that there is always a low level of risk whenever they enter warm freshwater (for example swimming, waterskiing) in southern tier states. Posting signs is unlikely to be an effective way to prevent infections. This is because the location and number of amebae in the water can vary a lot over time. In addition, posted signs might create a misconception that bodies of water without signs are *Naegleria*-free. Information about the risks of *Naegleria* infection should be put into public health messages discussing general issues of water safety and risk.

How can I reduce the risk of infection with *Naegleria*?

Naegleria is found in many warm freshwater lakes and rivers in the United States, particularly in southern tier states. It is likely that a low risk of *Naegleria* infection will always exist with recreational use of warm freshwater lakes, rivers, and hot springs. The low number of infections makes it difficult to know why some people have been infected compared to the millions of other people using the same or similar waters across the U.S. The only known way to prevent *Naegleria* infections is to refrain from water-related activities. However, some measures that might reduce risk by limiting the chance of contaminated water going up the nose include:

- Avoid water-related activities in bodies of warm freshwater, hot springs, and thermally-polluted water such as water around power plants.
- Avoid water-related activities in warm freshwater during periods of high water temperature and low water levels.
- Hold the nose shut or use nose clips when taking part in water-related activities in bodies of warm freshwater such as lakes, rivers, or hot springs.
- Avoid digging in or stirring up the sediment while taking part in water-related activities in shallow, warm freshwater areas.

For further information on protecting yourself from recreational water illnesses, go to http://www.cdc.gov/healthyswimming.

Developed by the *Naegleria* Workgroup sponsored by the Council of State and Territorial Epidemiologists and CDC, April 30, 2008.

This fact sheet is for information only and is not meant to be used for self-diagnosis or as a substitute for consultation with a health care provider. If you have any questions about the disease described above or think that you may have a parasitic infection, consult a health care provider.

From http:www.cdc.gov/ncidod/dpd/parasites/naegleria/factsht_naegleria.htm

Recreational water illness

Primary amebic meningoencephalitis (PAM) and guidelines for prevention

Follow these safeguards to prevent infection when swimming in lakes, rivers

The following "white paper" was prepared by LCRA's Water Resource Protection Department, September 2007

Primary amebic meningoencephalitis (PAM) is a rare and usually deadly disease caused by infection with the ameba (*Naegleria fowleri*). The pathogenic potential in a human host was first described in 1965; the first reported case of PAM in Texas occurred in 1972, according to the Texas Department of State Health Services.

Lake LBJ
In August 2007, a 12-year-old boy became ill with PAM after spending two previous weeks at a summer camp on Lake LBJ. He was admitted to a hospital on Aug. 10 and, after being diagnosed with PAM, died Aug. 15. A second case involved a 22-year-old Lubbock man who contracted PAM after a trip to Lake LBJ on the weekend of Aug. 24. He reportedly sustained a ruptured eardrum while wake boarding. He was admitted to a Lubbock hospital on Aug. 31 and died Sept. 4. Both cases were confirmed by the Department of State Health Services.

Naegleria fowleri
According to information provided by the Department of State Health Services, the ameba that causes the infection lives in soil and in freshwater ponds, lakes, rivers, poorly or nonchlorinated pools, discharge or holding basins, and hot springs throughout the world. *Naegleria* thrives in warm, stagnant bodies of fresh water when temperatures are above 80 degrees. Consequently, cases of the disease usually occur from June through September. When water temperatures are below 80 degrees, the ameba exists in a cyst form that is not capable of causing infection. Naegleria fowleri is unique in that it exists in two different forms – pseudopod and flagellated. Transformation of ameba into flagellates is a distinctive feature of *Naegleria*.

Although the ameba is commonly found in the environment, cases of PAM are very rare. In the last 30 years, only a few hundred cases have been reported worldwide. Twenty-four infections were documented in the United States between 1989 and 2000. Prior to 2007, there were 34 cases of PAM in Texas since 1972, all fatal. The last reported case in Texas was in 2005 from Lake Somerville. One previous PAM case involving the Highland Lakes has

Q&A: A WATER RECREATION DISEASE

Where is this ameba found?
It is found worldwide, most commonly, in:

- Warm bodies of fresh water, such as lakes, rivers
- Geothermal water such as hot springs
- Warm water discharge from industrial plants
- Minimally chlorinated swimming pools
- Soil

How common is this infection?
Although the ameba is commonly found in the environment, infection occurs rarely. Only 23 infections were documented in the United States between 1995 and 2004, according to the Centers for Disease Control and Prevention.

How does infection occur?
Infection with *Naegleria* occurs when the ameba enters the body through the nose. Generally this occurs when people are participating in water-related activities such as swimming underwater, diving, or other water sports that result in water going up the nose. The ameba then travels to the brain and spinal cord where it destroys the brain tissue.

What are the signs and symptoms of *Naegleria* infection?
Infection with *Naegleria* causes the disease primary amebic meningoencephalitis (PAM), a brain inflammation, which leads to the destruction of brain tissue. Initial signs and symptoms of PAM start one to 14 days after infection and include headache, fever, nausea, vomiting and stiff neck. As the amebae cause more extensive destruction of brain tissue, this leads to confusion, lack of attention to people and surroundings, loss of balance, seizures and hallucinations. The disease progresses rapidly, and infection usually results in death within three to seven days.

Is there treatment for infection with *Naegleria*?
Several drugs are effective against *Naegleria* in

been reported in the past. In 1980, a 23-year-old female died after water skiing on Lake Austin.

According to Florida health officials, 46 percent of the lakes tested in Florida have the pathogenic amebae, and it is believed that an all-inclusive study would reveal that most state lakes harbor the organism. From 1962 to 2000, 18 cases had been documented in Florida, most originating from the central region of the state. There have been three reported cases in Florida this year.

Epidemiology
According to the Department of State Health Services, *Naegleria* is believed to enter the body through the nose and travel to the brain via the olfactory nerve. The disease is not spread from person to person. A diagnosis of PAM is based on the results of an examination of the fluid in the patient's spinal cord or through the post mortem examination of brain tissue.

Initial signs and symptoms of PAM include headache, fever, nausea, vomiting and stiff neck. As the ameba causes more extensive destruction of brain tissue this leads to confusion, lack of attention, loss of balance and bodily control, seizures and hallucinations. The disease progresses rapidly, and infection usually results in death within three to seven days.

Prevention information
While the likelihood of exposure to *Naegleria* is high, the risk of infection is low. Additionally, the Department of State Health Services states that there are things swimmers should know and can do to lower the risk of infection.

- Avoid swimming or jumping into bodies of warm fresh water.
- Do not swim in areas posted as "no swimming."
- Hold your nose or use nose plugs when jumping or diving into water.
- Use earplugs, swim goggles, or masks if you tend to get ear or eye infections.
- Wash open skin cuts and scrapes with clean water and soap.

the laboratory. However, although a variety of treatments have been used to treat infected persons, their effectiveness is unclear because most infections have still been fatal.

Can infection be spread from person to person?
No. PAM cannot be spread from person-to-person contact.

How can I prevent an infection?

- Avoid swimming or jumping into bodies of warm freshwater, hot springs and thermally polluted water such as water around power plants.
- Avoid swimming or jumping into freshwater during periods of high temperature and low water volume.
- Hold the nose shut or use nose clips when jumping or diving into bodies of warm fresh water such as lakes, rivers or hot springs.
- Avoid digging in or stirring up the sediment while swimming in shallow water areas.
- Do not swim in areas posted as "no swimming."

Source: Centers for Disease Control and Prevention

Go to these sites to learn more:

- Download a fact sheet on *Naegleria* from the Centers for Disease Control and Prevention
- FAQs from the Texas State Department of Health Services
- Graphic showing how the disease works from the Centers for Disease Control and Prevention
- For more information on protecting yourself from recreational water illnesses, go to the Healthy Swimming section on the Centers for Disease Control's Web site

LCRA current activities/programs
LCRA's routine bimonthly water quality monitoring program currently samples approximately 70 sites. There are four chemical sites (Wirtz Dam, Granite Shoals, Kingsland and headwaters) and two field parameter sites (FM 2900 and FM 1431) on Lake LBJ and all are located in the main channel (not coves). *E. coli* is the bacteriological test run. While LCRA routinely tests for E. coli bacteria, amebae are not bacteria, and therefore relating bacteria levels to amebae presence or absence cannot be correlated. While it is possible to test for the presence of the *Naegleria fowleri* , the test requires up to two weeks culturing the organism (the flagellated form is required for identification), and the test is not quantitative (presences/absences only).

In addition to the routine sampling program, LCRA supports a host of volunteer monitors through the Colorado River Watch Network (CRWN). More than 200 locations are sampled on a regular basis by these monitors. All monitors report water temperature, and several are trained to report bacteria levels (*E. coli*). LCRA also maintains two autoprofiling buoys at lakes Travis and LBJ. These unattended monitors record vertical profiles (temperature, dissolved oxygen, pH and specific conductance) through the water column twice per day. LCRA issues a water quality index monthly as part of its role as a steward of the lower Colorado River. The index characterizes the general quality of the river, tributaries and Highland Lakes using ratings of excellent, good, fair and poor. The index is based on a list of parameters, including dissolved oxygen, *E. coli* bacteria, nutrients (nitrogen and phosphorus), temperature and total dissolved solids.

The water quality index is intended to give the public a snapshot of overall water quality conditions. But conditions can change quickly. High water quality index ratings do not preclude the existence of

bacteria that may cause infections. Swimming in a river, lake or pond, rather than a disinfected swimming pool, carries some risk. The public needs to take precautions at all times, such as avoiding stagnant water and staying out of the water after rains.

Summary
Although the ameba that causes the disease is common, cases of PAM remain very rare. The publication Disease Prevention News - July 21, 1997 (Texas Department of State Health Services) reported the most effective prevention efforts are focused on public education regarding personal precautions.

Testing for *Naegleria fowleri* will not necessarily provide the public with definitive information. Also, testing takes two weeks to get results, and there are no public health criteria established for what levels of amebae present are acceptable or unacceptable.

— Updated September 25, 2007 04:23 PM

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Powerlines & Cancer FAQs

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From: jmoulder@its.mcw.edu (John Moulder)
Newsgroups: sci.med.physics
Subject: Powerlines & Cancer FAQs
Date: Wed, 18 Jun 2003 09:38:34 -0500
Message-ID: <jmoulder-180603.1@admin-one.radbio.mcw.edu>
Reply-To: jmoulder@its.mcw.edu (John Moulder)
Summary: Questions and Answers on the connection between
  power lines, electrical occupations and cancer.
Keywords: power lines, magnetic fields, cancer, EMF, non-ionizing
  radiation, FAQ
User-Agent: YA-NewsWatcher/3.1.8

Archive-name: medicine/powerlines-cancer-faq
Posting-Frequency: monthly
Last-modified: 17-June-2003
Version: 7.9.4
URL: http://www.mcw.edu/gcrc/cop/powerlines-cancer-faq/toc.html
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** Frequently Asked Questions (FAQs) on Power-Frequency Fields (EMF)
and Cancer

**Summary**
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Questions and Answers on the connection between power lines, electrical occupations and cancer: discussion of the biophysics of interactions with EM sources, summaries of the laboratory and human studies, information on standards, and a bibliography.

Most of the concern about power lines ("EMF") and cancer stems from studies of people living near power lines (Question 12) and people working in "electrical" occupations (Question 15). Some of these studies appear to show a weak association between exposure to power-frequency magnetic fields and the incidence of cancer.

However, epidemiological studies done in recent years show little evidence that power lines are associated with an increase in cancer (Question 19), laboratory studies have shown essentially no evidence of a link between power-frequency fields and cancer (Question 16), and a connection between power line fields and cancer remains biophysically implausible (Question 18).

A 1996 review by the U.S. National Academy of Science concluded that:

> "No conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."(Question 27E)

A 1999 review by the U.S. National Institutes of Health concluded that:

> "The scientific evidence suggesting that [power-frequency electromagnetic field] exposures pose any health risk is weak."(Question 27G).

A 2001 review by the U.K. National Radiation Protection Board (NRPB) concluded that:

> "Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general." (Question 27H)

A 2001 review of the epidemiological literature by the International Commission on Non-Ionizing Radiation Protection concludes that:

> "In the absence of evidence from cellular or animal studies, and given the methodological uncertainties and in may cases inconsistencies of the existing epidemiologic literature, there is no chronic disease for which an etiological [causal] relation to [power-frequency fields] can be regarded as established."

The largest studies of childhood leukemia and power lines ever done reported in 1997-2000 that they could find no significant evidence for an association of power lines with childhood leukemia (Q19H through 19K). In contrast, two studies published in 2000 reported that if all the studies for which magnetic fields were measured (or could be calculated) were pooled, a statistically significant association could be found for childhood leukemia in the children with the highest average fields.

On the other hand, a series of studies have shown what life-time exposure of animals to intense power-frequency magnetic fields does not cause cancer or any other health problems. (Q16B)

Overall, most scientists consider the evidence that power line fields cause or contribute to cancer to be weak to nonexistent.

The full version of this FAQ is available on the web at:
http://www.mcw.edu/gcrc/cop/powerlines-cancer-faq/toc.html

NOTE THAT "faq" is lower-case. UPPER-CASE MAY OR MAY NOT WORK

The USENET version contains only the Table of Contents and a list of recent revisions.

Preguntas y respuestas sobre líneas electricas y cancer esta disponible en espanol:
http://www.mcw.edu/gcrc/cop/lineas-electricas-cancer/toc.html

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There are two related FAQs:
FAQs about Cell Phone Base Antennas and Human Health
http://www.mcw.edu/gcrc/cop/cell-phone-health-faq/toc.html
Static Electromagnetic Fields and Cancer FAQs
http://www.mcw.edu/gcrc/cop/static-fields-cancer-faq/toc.html

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** Revisions Notes

(v7.9, May/June 2003):
- Blood cells were exposed to a 800 microT 60-Hz field for 24 hours and/or to a chemical mutagen; no evidence of genotoxic injury was found for the field alone, but exposure to the field enhanced the

genotoxicity caused by the chemical [G118].
- Blood cells were exposed to a 230-700 microT 50-Hz fields for 12 hours and/or to gamma irradiation; no evidence of genotoxic injury was found for the field alone, and exposure to the field did not enhance the chromosome injury caused by the ionizing radiation [G119].
- A study of men with both occupational and residential exposure to power-frequency fields found no effects of the exposure on melatonin levels [E43].
- Calculated residential magnetic field exposure was associated with melanoma in women, but not in men; estimated occupational magnetic field exposure was not associated with melanoma [C65].
- Occupational exposure to power-frequency magnetic fields was associated with prostate cancer [D52].
- Human cancer cells were exposed to 2000- 13000 microT fields at 50Hz for 2 or 4 days; above 6000 microT cell division was inhibited and cell death was increased [H70].
- Exposure of human white blood cells to 80 or 800 microT 50-Hz fields did not cause genotoxic injury, and did not significantly enhance genotoxic injury produced by a genotoxic drug; but the 800 microT exposure showed some evidence for enhancement of cell division [G117].
- Exposure of pregnant rats to 5-500 microT 60-Hz fields for 6-20 days had no effect on the mothers or on the offspring [J31].

(v7.8, Jan/Feb-2003):
- Occupational exposure to power-frequency fields was associated with brain cancer, but only if there was also exposure to lead, solvents or pesticide/herbicides [D51].
- Exposure to power line electric fields in the UK was not associated with the incidence of childhood cancer [C64].
- Residence near powerlines in Norway was not associated with an increased risk of birth defects [J30].
- Exposure to a 2000 microT field for 52 weeks did not promote skin cancer in rats [G116].
- Exposure of human volunteers to power-frequency fields had no effect on nighttime secretion of melatonin or other hormones [E35].
- Exposure of human immune system cells to 2-500 microT fields had no effects on their function [H69].
- Exposure of cultured cells to a 1000 microT field caused DNA stand breaks if the exposure was intermittent, but not if the exposure was continuous [G115].
- Two studies of electrical utility workers found no evidence that exposure to power-frequency fields was associated with heart disease [E37, E38].

** Table of Contents

1. Is there a concern about power lines and cancer?
2. What is the difference between the electromagnetic (EM) energy associated with power lines and other forms of EM energy such as microwaves or x-rays?
3. Why do different types of EM sources produce different biological effects?
4. What is difference between EM radiation and EM fields?
5. Do power lines produce EM radiation?
6. How do ionizing EM sources cause biological effects?
7. How do RF and MW sources cause biological effects?
8. How do the power-frequency EM fields cause biological effects?
9. Do non-ionizing EM sources cause non-thermal as well as thermal effects?
10. What sort of power-frequency fields are common in residences and workplaces?
11. Can power-frequency fields in homes and workplaces be reduced?
12. What is known about the relationship between power line corridors and cancer rates?
13. How big is the "cancer risk" associated with living next to a power line?
    a. What is the risk of cancer in general?
    b. What is the risk of childhood leukemia?
14. How close do you have to be to a power line to be considered exposed to power-frequency magnetic fields?
15. What is known about the relationship between electrical occupations and cancer rates?
16. Do laboratory studies indicate that power-frequency fields can cause cancer?
    a. Do power-frequency fields show genotoxic activity in humans?
    b. Do power-frequency fields cause cancer in animals?
    c. Do power-frequency fields show genotoxic activity in cell culture?
    d. Do power-frequency magnetic fields cause or enhance neoplastic cell transformation?
    e. Are power-frequency magnetic fields cancer promoters?
    f. Do power-frequency magnetic fields enhance the effects of other genotoxic agents?
17. Do laboratory studies indicate that power-frequency fields have any biological effects that might be relevant to cancer?
    a. How do lab studies of the effects of power-frequency fields on cell and tumor growth relate to the question of cancer risk?

b. How do lab studies of the effects of power-frequency fields on immune function relate to the question of cancer risk?
c. How do lab studies of the effects of power-frequency fields on melatonin relate to the question of cancer risk?

18. Do power-frequency fields show any reproducible biological effects in laboratory studies?
    a. Do power-frequency fields of the intensity encountered in occupational and residential settings show reproducible biological effects?
    b. Are there known mechanisms by which power-frequency fields of the intensity encountered in occupational and residential settings could cause biological effects?
    c. Haven't some new mechanisms been proposed that could explain how power-frequency magnetic fields could cause biological effects?
    d. Could the presence of transients or harmonics in power-frequency fields provide a biophysical mechanism for biological effects?
19. What about the "new studies" showing a link between power-frequency fields and cancer?
    a. What about the European (Scandinavian) epidemiological studies showing a link between power lines and cancer?
    b. What about the studies showing a link between occupational exposure to power-frequency fields and cancer?
    c. What about the studies showing a link between electrical occupation and breast cancer?
    d. What about the studies showing a link between pulsed electric fields and lung cancer?
    e. What about the studies linking the use of electrical appliances with cancer?
    f. What about Sweden's/Denmark's decision to regulate fields power line fields?
    g. What about the study showing that it is the interaction between power- frequency fields and the Earth static field that causes cancer?
    h. What about the 1997 NCI study showing no link between power lines and childhood leukemia?
    j. What about the 1999 Canadian studies of power lines and childhood leukemia?
    k. What about the 1999-2000 UK studies of power lines and childhood leukemia?
    l. Could exposure to power-frequency electric rather than magnetic fields be linked with cancer?
20. What criteria do scientists use to evaluate all the laboratory and epidemiologic studies of power-frequency magnetic fields and cancer?
    a. Criterion One: How strong is the association between exposure to

power-frequency fields and the risk of cancer?
   b. Criterion Two: How consistent are the studies of associations between exposure to power-frequency fields and the risk of cancer?
   c. Criterion Three: Is there a dose-response relationship between exposure to power-frequency fields and the risk of cancer?
   d. Criterion Four: Is there laboratory evidence for an association between exposure to power-frequency fields and the risk of cancer?
   e. Criterion Five: Are there plausible biological mechanisms that suggest an association between exposure to power-frequency fields and the risk of cancer?
21. If exposure to power-frequency magnetic fields does not explain the residential and occupations studies which show increased cancer incidence, what other factors could?
   a. Could problems with dose assessment affect the validity of the epidemiologic studies of power-frequency fields and cancer?
   b. Are there other cancer risk factors that could be causing a false association between power-frequency fields and cancer?
   c. Could the epidemiologic studies of power-frequency fields and cancer be biased by the methods used to select control groups?
   d. Could analysis of the epidemiologic studies of power-frequency fields and cancer be skewed by publication bias?
   e. Could analysis of the epidemiologic studies of power-frequency fields and cancer be biased by multiple-comparison artifacts?
   f. Does the evidence that childhood leukemia has an infectious basis mean that the weak association sometimes seen between power-frequency fields and childhood leukemia is an artifact?
22. What is the strongest evidence for a connection between power-frequency fields and cancer?
23. What is the strongest evidence against a connection between power-frequency fields and cancer?
24. What studies are needed to resolve the cancer-EMF issue?
25. Is there any evidence that power-frequency fields cause any effects on human health, such as miscarriages, birth defects, Alzheimer's disease, multiple sclerosis, suicide or sleep disorders?
26. What are some good overview articles?
27. Are there exposure guidelines for power-frequency fields?
   a. What are there guidelines for power-frequency field exposure of the general public?
   b. What are there guidelines for occupational power-frequency field exposure?
   c. Are there special exposure guidelines for people with cardiac pacemakers
   d. Is a US government agency about to recommend strict limits on

occupational and residential exposure to power-frequency fields?
e. What does the 1996 report from the U.S. National Research Council say?
f. Does a 1998 report from the U.S. National Institute of Environmental Health Sciences (NIEHS) say that power-frequency fields are a "possible" carcinogen?
g. What does the 1999 report from the U.S. National Institute of Environmental Health Sciences (NIEHS) to the US Congress say about power-frequency fields and cancer?
h. What does the 2001 report from the U.K. National Radiation Protection Board (NRPB) say about power-frequency fields and cancer?
j. Does a 2002 report from the International Agency for Research on Cancer (IARC) say that power-frequency fields are a "possible" carcinogen?
k. What does the 2002 report from the State of California say about possible human health hazards from exposure to power-frequency fields?
28. What effect do power lines have on property values?
29. What equipment do you need to measure power-frequency magnetic fields?
30. How are power-frequency magnetic fields measured?
31. Do the issues discussed in this FAQ sheet apply to EM fields other than power-frequency fields?
a. Low-frequency fields other than sinusoidal power-frequency fields
b. Static electric and magnetic fields
c. Radiofrequency and microwave frequencies
32. What about the new study claiming that radon exposure is increased by the presence of electromagnetic fields.
33. What about the reports that some people are sensitive to (allergic to) the presence of electromagnetic fields?
34. Should I buy a house next to a power line?
35. Who wrote this FAQ?

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3. Epidemiology of Residential Exposure to Power-Frequency Fields
4. Epidemiology of Occupational Exposure to Power-Frequency Fields
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6. Biophysics and Dosimetry of Power-Frequency Fields
7. Laboratory Studies of Power-Frequency Fields and Cancer
8. Laboratory Studies Indirectly Related to Power-Frequency Fields and

Cancer
9. Studies of Power-Frequency Fields and Reproductive Toxicity
10. Reviews of Laboratory Studies of Power-Frequency Fields
11. Miscellaneous Items
12. Regulations and Standards for Ionizing and Non-ionizing EM Sources.

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Matagorda County-Mad Island Marsh [TXMM]

Texas Region
28.6833 degrees North x -95.9833 degrees West
Christmas Bird Count
Count Year: 109

Species	Number	Number / Party Hr.	Flags	Editorial Flags
Black-bellied Whistling-Duck *(Dendrocygna autumnalis)*	612	2.0537		
Fulvous Whistling-Duck *(Dendrocygna bicolor)*	1	0.0034		**GD, PS**
Greater White-fronted Goose *(Anser albifrons)*	4614	15.4832		
Snow Goose *(Chen caerulescens)*	29809	100.0302		
Ross's Goose *(Chen rossii)*	443	1.4866		

Cackling Goose *(Branta hutchinsii)*	343	1.151	**LC**
Canada Goose *(Branta canadensis)*	303	1.0168	**LC**
Wood Duck *(Aix sponsa)*	11	0.0369	**LC**
Gadwall *(Anas strepera)*	3609	12.1107	
American Wigeon *(Anas americana)*	1039	3.4866	**HC**
Mallard *(Anas platyrhynchos)*	98	0.3289	**HC**
Mottled Duck *(Anas fulvigula)*	220	0.7383	**LC**
Blue-winged Teal *(Anas discors)*	3811	12.7886	**HC**
Cinnamon Teal *(Anas cyanoptera)*	3	0.0101	
Northern Shoveler *(Anas clypeata)*	1479	4.9631	**HC**
Northern Pintail *(Anas acuta)*	6878	23.0805	**HC**
American Green-winged Teal *(Anas crecca)*	3269	10.9698	
Canvasback *(Aythya valisineria)*	1	0.0034	**LC**
Redhead *(Aythya americana)*	15005	50.3523	**HC**
Ring-necked Duck *(Aythya collaris)*	378	1.2685	**HC**
Greater Scaup *(Aythya marila)*	14	0.047	
Lesser Scaup *(Aythya affinis)*	1346	4.5168	
Surf Scoter *(Melanitta perspicillata)*	1	0.0034	**LC**
Bufflehead *(Bucephala albeola)*	54	0.1812	**LC**
Common Goldeneye *(Bucephala clangula)*	81	0.2718	
Hooded Merganser *(Lophodytes cucullatus)*	139	0.4664	**HC**
Red-breasted Merganser *(Mergus serrator)*	144	0.4832	

Ruddy Duck *(Oxyura jamaicensis)*	104	0.349	
Wild Turkey *(Meleagris gallopavo)*	1	0.0034	
Northern Bobwhite *(Colinus virginianus)*	49	0.1644	
Common Loon *(Gavia immer)*	12	0.0403	
Least Grebe *(Tachybaptus dominicus)*	12	0.0403	**HC**
Pied-billed Grebe *(Podilymbus podiceps)*	363	1.2181	
Horned Grebe *(Podiceps auritus)*	7	0.0235	**LC**
Eared Grebe *(Podiceps nigricollis)*	11	0.0369	**LC**
Northern Gannet *(Morus bassanus)*	10	0.0336	
American White Pelican *(Pelecanus erythrorhynchos)*	3002	10.0738	
Brown Pelican *(Pelecanus occidentalis)*	534	1.7919	
Neotropic Cormorant *(Phalacrocorax brasilianus)*	325	1.0906	
Double-crested Cormorant *(Phalacrocorax auritus)*	1288	4.3221	
Anhinga *(Anhinga anhinga)*	21	0.0705	
American Bittern *(Botaurus lentiginosus)*	10	0.0336	
Least Bittern *(Ixobrychus exilis)*	1	0.0034	
Great Blue Heron (Blue form) *(Ardea herodias)*	596	2	
Great Egret *(Ardea alba)*	1201	4.0302	
Snowy Egret	657	2.2047	

(Egretta thula)				
Little Blue Heron *(Egretta caerulea)*	127	0.4262		
Tricolored Heron *(Egretta tricolor)*	105	0.3523	**LC**	
Reddish Egret *(Egretta rufescens)*	28	0.094		
Cattle Egret *(Bubulcus ibis)*	37	0.1242	**LC**	
Green Heron *(Butorides virescens)*	11	0.0369	**HC**	
Black-crowned Night-Heron *(Nycticorax nycticorax)*	217	0.7282		
Yellow-crowned Night-Heron *(Nyctanassa violacea)*	6	0.0201	**LC**	
White Ibis *(Eudocimus albus)*	3047	10.2248		
Glossy Ibis *(Plegadis falcinellus)*	2	0.0067		
White-faced Ibis *(Plegadis chihi)*	1295	4.3456		
Roseate Spoonbill *(Platalea ajaja)*	984	3.302	**HC**	
Wood Stork *(Mycteria americana)*	1	0.0034	**US**	**GD**
Black Vulture *(Coragyps atratus)*	1063	3.5671	**HC**	
Turkey Vulture *(Cathartes aura)*	2332	7.8255	**HC**	
Osprey *(Pandion haliaetus)*	79	0.2651	**LC**	
White-tailed Kite *(Elanus leucurus)*	7	0.0235	**LC**	
Bald Eagle *(Haliaeetus leucocephalus)*	25	0.0839	**HC**	
Northern Harrier *(Circus cyaneus)*	308	1.0336		
Sharp-shinned Hawk *(Accipiter striatus)*	15	0.0503	**HC**	
Cooper's Hawk *(Accipiter cooperii)*	16	0.0537		
Red-shouldered Hawk	63	0.2114		

(Buteo lineatus)				
White-tailed Hawk *(Buteo albicaudatus)*	47	0.1577	**HC**	
Red-tailed Hawk *(Buteo jamaicensis)*	139	0.4664		
Crested Caracara *(Caracara cheriway)*	221	0.7416	**HC**	
American Kestrel *(Falco sparverius)*	117	0.3926	**LC**	
Merlin *(Falco columbarius)*	9	0.0302	**LC**	
Aplomado Falcon *(Falco femoralis)*	2	0.0067	**HC**	**PH**
Peregrine Falcon *(Falco peregrinus)*	15	0.0503	**HC**	
Yellow Rail *(Coturnicops noveboracensis)*	20	0.0671	**HC**	
Black Rail *(Laterallus jamaicensis)*	1	0.0034		
Clapper Rail *(Rallus longirostris)*	15	0.0503	**LC**	
King Rail *(Rallus elegans)*	37	0.1242		
Virginia Rail *(Rallus limicola)*	28	0.094		
Sora *(Porzana carolina)*	52	0.1745		
Purple Gallinule *(Porphyrio martinica)*	1	0.0034	**HC**	**GD**
Common Moorhen *(Gallinula chloropus)*	262	0.8792		
American Coot *(Fulica americana)*	6400	21.4765		
Sandhill Crane *(Grus canadensis)*	10000	33.557	**HC**	
Black-bellied Plover *(Pluvialis squatarola)*	349	1.1711		
Snowy Plover *(Charadrius alexandrinus)*	76	0.255	**HC**	
Semipalmated Plover *(Charadrius semipalmatus)*	88	0.2953	**HC**	
Piping Plover	112	0.3758	**HC**	

(Charadrius melodus)			
Killdeer *(Charadrius vociferus)*	1389	4.6611	
American Oystercatcher *(Haematopus palliatus)*	6	0.0201	**LC**
Black-necked Stilt *(Himantopus mexicanus)*	105	0.3523	
American Avocet *(Recurvirostra americana)*	616	2.0671	
Spotted Sandpiper *(Actitis macularia)*	116	0.3893	**HC**
Solitary Sandpiper *(Tringa solitaria)*	0	0	**CW**
Greater Yellowlegs *(Tringa melanoleuca)*	289	0.9698	
Willet *(Catoptrophorus semipalmatus)*	439	1.4732	
Lesser Yellowlegs *(Tringa flavipes)*	157	0.5268	
Whimbrel *(Numenius phaeopus)*	4	0.0134	
Long-billed Curlew *(Numenius americanus)*	111	0.3725	**LC**
Marbled Godwit *(Limosa fedoa)*	107	0.3591	**HC**
Ruddy Turnstone *(Arenaria interpres)*	155	0.5201	**HC**
Red Knot *(Calidris canutus)*	1	0.0034	**LC**
Sanderling *(Calidris alba)*	470	1.5772	**HC**
Western Sandpiper *(Calidris mauri)*	3916	13.1409	
Least Sandpiper *(Calidris minutilla)*	1404	4.7114	**HC**
Dunlin *(Calidris alpina)*	3389	11.3725	
Stilt Sandpiper *(Calidris himantopus)*	5	0.0168	

peep sp. *(Scolopacidae)*	25	0.0839		
Short-billed Dowitcher *(Limnodromus griseus)*	630	2.1141	**HC**	
Long-billed Dowitcher *(Limnodromus scolopaceus)*	743	2.4933		
dowitcher sp. *(Limnodromus)*	2166	7.2685		
Wilson's Snipe *(Gallinago delicata)*	699	2.3456	**HC**	
American Woodcock *(Scolopax minor)*	19	0.0638		
Laughing Gull *(Larus atricilla)*	789	2.6477	**LC**	
Franklin's Gull *(Larus pipixcan)*	8	0.0268	**HC**	**GD, MO**
Bonaparte's Gull *(Larus philadelphia)*	30	0.1007	**LC**	
Ring-billed Gull *(Larus delawarensis)*	331	1.1107	**LC**	
Herring Gull *(Larus argentatus)*	82	0.2752		
Lesser Black-backed Gull *(Larus fuscus)*	1	0.0034	**US**	**GD, EO**
Gull-billed Tern *(Gelochelidon nilotica)*	32	0.1074	**LC**	
Caspian Tern *(Hydroprogne caspia)*	199	0.6678		
Common Tern *(Sterna hirundo)*	2	0.0067	**LC**	
Forster's Tern *(Sterna forsteri)*	516	1.7315	**LC**	
Royal Tern *(Thalasseus maximus)*	577	1.9362	**HC**	
Sandwich Tern *(Thalasseus sandvicensis)*	11	0.0369		
Black Skimmer *(Rynchops niger)*	951	3.1913		
Rock Pigeon *(Columba livia)*	47	0.1577		

Eurasian Collared-Dove *(Streptopelia decaocto)*	125	0.4195	**HC**	
White-winged Dove *(Zenaida asiatica)*	75	0.2517		
Mourning Dove *(Zenaida macroura)*	593	1.9899		
Inca Dove *(Columbina inca)*	27	0.0906	**LC**	
Common Ground-Dove *(Columbina passerina)*	8	0.0268	**LC**	
Groove-billed Ani *(Crotophaga sulcirostris)*	0	0	**CW**	**PS**
Barn Owl *(Tyto alba)*	30	0.1007		
Great Horned Owl *(Bubo virginianus)*	38	0.1275		
Burrowing Owl *(Athene cunicularia)*	5	0.0168	**HC**	
Barred Owl *(Strix varia)*	43	0.1443		
Short-eared Owl *(Asio flammeus)*	4	0.0134	**LC**	
Buff-bellied Hummingbird *(Amazilia yucatanensis)*	1	0.0034	**LC**	
Ruby-throated Hummingbird *(Archilochus colubris)*	1	0.0034	**LC**	
Black-chinned Hummingbird *(Archilochus alexandri)*	1	0.0034	**LC**	
Belted Kingfisher *(Ceryle alcyon)*	67	0.2248	**LC**	
Red-bellied Woodpecker *(Melanerpes carolinus)*	155	0.5201		
Yellow-bellied Sapsucker *(Sphyrapicus varius)*	34	0.1141	**LC**	
Ladder-backed Woodpecker *(Picoides scalaris)*	4	0.0134	**LC**	

Downy Woodpecker *(Picoides pubescens)*	25	0.0839	**LC**	
Northern (Yellow-shafted) Flicker *(Colaptes auratus)*	23	0.0772	**LC**	
Pileated Woodpecker *(Dryocopus pileatus)*	66	0.2215		
Eastern Wood-Pewee *(Contopus virens)*	1	0.0034	**US**	**PH, EO**
Least Flycatcher *(Empidonax minimus)*	3	0.0101		
Empidonax sp. *(Empidonax)*	2	0.0067		
Eastern Phoebe *(Sayornis phoebe)*	597	2.0034	**LC**	
Vermilion Flycatcher *(Pyrocephalus rubinus)*	20	0.0671		
Ash-throated Flycatcher *(Myiarchus cinerascens)*	3	0.0101	**LC**	
Great Kiskadee *(Pitangus sulphuratus)*	2	0.0067	**US**	**GD**
Couch's Kingbird *(Tyrannus couchii)*	1	0.0034	**LC**	
Eastern Kingbird *(Tyrannus tyrannus)*	1	0.0034	**US**	**GD**
Loggerhead Shrike *(Lanius ludovicianus)*	120	0.4027	**LC**	
White-eyed Vireo *(Vireo griseus)*	28	0.094		
Blue-headed Vireo *(Vireo solitarius)*	28	0.094		
Blue Jay *(Cyanocitta cristata)*	18	0.0604	**LC**	
American Crow *(Corvus brachyrhynchos)*	727	2.4396		
Horned Lark *(Eremophila alpestris)*	5	0.0168	**LC**	
Tree Swallow	161	0.5403		

(Tachycineta bicolor)				
Northern Rough-winged Swallow *(Stelgidopteryx serripennis)*	54	0.1812	**HC**	
Cave Swallow *(Petrochelidon fulva)*	35	0.1174		
Barn Swallow *(Hirundo rustica)*	17	0.057	**HC**	
Carolina Chickadee *(Poecile carolinensis)*	315	1.057		
Tufted Titmouse *(Baeolophus bicolor)*	133	0.4463	**LC**	
Brown Creeper *(Certhia americana)*	1	0.0034	**LC**	
Carolina Wren *(Thryothorus ludovicianus)*	162	0.5436		
Bewick's Wren *(Thryomanes bewickii)*	6	0.0201		
House Wren *(Troglodytes aedon)*	124	0.4161		
Winter Wren *(Troglodytes troglodytes)*	13	0.0436	**HC**	
Sedge Wren *(Cistothorus platensis)*	477	1.6007	**HC**	
Marsh Wren *(Cistothorus palustris)*	112	0.3758		
Golden-crowned Kinglet *(Regulus satrapa)*	6	0.0201		
Ruby-crowned Kinglet *(Regulus calendula)*	510	1.7114		
Blue-gray Gnatcatcher *(Polioptila caerulea)*	291	0.9765		
Eastern Bluebird *(Sialia sialis)*	80	0.2685		
Hermit Thrush *(Catharus guttatus)*	61	0.2047		
Wood Thrush *(Hylocichla mustelina)*	1	0.0034		**GD**

American Robin *(Turdus migratorius)*	257	0.8624		
Gray Catbird *(Dumetella carolinensis)*	40	0.1342		
Northern Mockingbird *(Mimus polyglottos)*	229	0.7685	**LC**	
Brown Thrasher *(Toxostoma rufum)*	38	0.1275		
Long-billed Thrasher *(Toxostoma longirostre)*	5	0.0168		
European Starling *(Sturnus vulgaris)*	1425	4.7819		
American Pipit *(Anthus rubescens)*	1460	4.8993	**HC**	
Sprague's Pipit *(Anthus spragueii)*	44	0.1477	**HC**	
Cedar Waxwing *(Bombycilla cedrorum)*	31	0.104		
Tennessee Warbler *(Vermivora peregrina)*	1	0.0034	**US**	**MD, MO**
Orange-crowned Warbler *(Vermivora celata)*	169	0.5671		
Nashville Warbler *(Vermivora ruficapilla)*	2	0.0067		
Yellow Warbler *(Dendroica petechia)*	1	0.0034		**PH**
Yellow-rumped (Audubon's) Warbler *(Dendroica coronata)*	1	0.0034		
Yellow-rumped (Myrtle) Warbler *(Dendroica coronata)*	922	3.094		
Black-throated Green Warbler *(Dendroica virens)*	2	0.0067		
Pine Warbler *(Dendroica pinus)*	19	0.0638		
Palm Warbler *(Dendroica palmarum)*	27	0.0906		

Common Yellowthroat *(Geothlypis trichas)*	228	0.7651	
Wilson's Warbler *(Wilsonia pusilla)*	3	0.0101	
Yellow-breasted Chat *(Icteria virens)*	2	0.0067	
Spotted Towhee *(Pipilo maculatus)*	1	0.0034	
Eastern Towhee *(Pipilo erythrophthalmus)*	1	0.0034	
Chipping Sparrow *(Spizella passerina)*	124	0.4161	**LC**
Field Sparrow *(Spizella pusilla)*	59	0.198	**LC**
Vesper Sparrow *(Pooecetes gramineus)*	35	0.1174	
Lark Sparrow *(Chondestes grammacus)*	27	0.0906	**HC**
Savannah Sparrow *(Passerculus sandwichensis)*	2524	8.4698	**LC**
Grasshopper Sparrow *(Ammodramus savannarum)*	9	0.0302	**LC**
Le Conte's Sparrow *(Ammodramus leconteii)*	24	0.0805	**LC**
Nelson's Sharp-tailed Sparrow *(Ammodramus nelsoni)*	4	0.0134	**LC**
Seaside Sparrow *(Ammodramus maritimus)*	186	0.6242	
Fox Sparrow *(Passerella iliaca)*	1	0.0034	
Song Sparrow *(Melospiza melodia)*	34	0.1141	**LC**
Lincoln's Sparrow *(Melospiza lincolnii)*	139	0.4664	
Swamp Sparrow *(Melospiza georgiana)*	205	0.6879	**LC**
White-throated	141	0.4732	

Sparrow *(Zonotrichia albicollis)*				
Harris's Sparrow *(Zonotrichia querula)*	3	0.0101		
White-crowned Sparrow *(Zonotrichia leucophrys)*	96	0.3221		
Dark-eyed (Slate-colored) Junco *(Junco hyemalis)*	1	0.0034		
Northern Cardinal *(Cardinalis cardinalis)*	683	2.2919	**LC**	
Black-headed Grosbeak *(Pheucticus melanocephalus)*	1	0.0034	**US**	**GD**
Indigo Bunting *(Passerina cyanea)*	4	0.0134		
Red-winged Blackbird *(Agelaius phoeniceus)*	415000	1392.6174	**LC**	
Eastern Meadowlark *(Sturnella magna)*	1226	4.1141		
Western Meadowlark *(Sturnella neglecta)*	7	0.0235		
meadowlark sp. *(Sturnella)*	63	0.2114		
Yellow-headed Blackbird *(Xanthocephalus xanthocephalus)*	5	0.0168		
Brewer's Blackbird *(Euphagus cyanocephalus)*	499	1.6745		
Common Grackle *(Quiscalus quiscula)*	5000	16.7785		
Boat-tailed Grackle *(Quiscalus major)*	23459	78.7215	**HC**	
Great-tailed Grackle *(Quiscalus mexicanus)*	10700	35.906		
Bronzed Cowbird *(Molothrus aeneus)*	8	0.0268		

Brown-headed Cowbird *(Molothrus ater)*	26100	87.5839	**LC**
Baltimore Oriole *(Icterus galbula)*	1	0.0034	
Pine Siskin *(Carduelis pinus)*	2	0.0067	
American Goldfinch *(Carduelis tristis)*	1341	4.5	**HC**
House Sparrow *(Passer domesticus)*	187	0.6275	**HC**

Back to Species

Weather & Effort

Count Date:	Dec 15, 2008
Number of Participants:	97
Number of Party Hours:	298.0
Species Reported:	0
Low Temperature:	38
High Temperature:	66
AM Weather:	Foggy Rain: Light Snow: None
PM Weather:	Cloudy Rain: None Snow: None

Participants:

Sponsor: Matagorda Co. Birding Nature Center, Texas Parks & Wildlife Dep., South TX Nuclear Project, LCRA, Lyondell-Basel, Oxea Chemical, Wells Fargo, Bay City Abstract & Title, All Star Realty, City of Bay City, Bay City Chamber of Commerce

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Jim Harrison
Erin Hatchett
Susan Heath
Petra Hockey
Bernice Hotman
Jan Huebner
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Mary Bell Ingram
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Jimmy Jackson
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Jared Judy
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Marcus O'Connor
Brent Ortego
David Plunkett
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Sumita Prasad
Warren Pruess
Jim Renfro
Rachel Roehler
Bron Rorex
Breck Sacra
Francine Sanders
Bill Saulmon
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Heather Serrill
Linda Serrill
Richard Serrill
Dave Shaw
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Karen Straub
Betsy Terrel
Jane Tillman
cathy Wakefield
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Jennifer Wilson
Jo Wilson
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AT A GLANCE

Preventing and Controlling Cancer

The Nation's Second Leading Cause of Death

2007

Clark J. Mischler Photo/Courtesy of Alaska Native Tribal Health Consortium

"In the battle against cancer, we know that no one group or individual can do it all. Collaboration is a fundamental and necessary process to promote cancer prevention, improve cancer detection, increase access to health and social services, and reduce the burden of cancer."

Eddie Reed, MD
Director, Division of Cancer Prevention and Control
National Center for Chronic Disease Prevention and Health Promotion, CDC

January 2007

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION
COORDINATING CENTER FOR HEALTH PROMOTION

The Burden of Cancer

Every year, cancer claims the lives of more than half a million Americans. Cancer is the second leading cause of death in the United States, exceeded only by heart disease. According to *United States Cancer Statistics: 2003 Incidence and Mortality*, which tracks cancer incidence for about 96% of the U.S. population and mortality for the entire country, more than 556,000 Americans died of cancer, and over 1.29 million had a diagnosis of cancer in 2003.

The financial costs of cancer are overwhelming. According to the National Institutes of Health, in 2006, cancers will cost the United States an estimated $206 billion, including $128 billion for lost productivity and $78 billion in direct medical costs.

Racial and Ethnic Differences

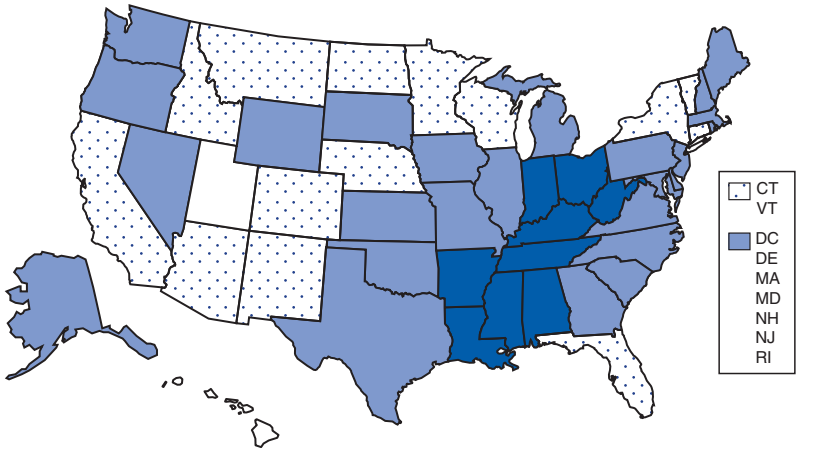
Cancer does not affect all races equally. African Americans are more likely to die of cancer than people of any other racial or ethnic group. In 2003, the age-adjusted death rate per 100,000 people for all types of cancer combined was 235 for African Americans, 188 for white Americans, 127 for Hispanic Americans, 121 for American Indians/Alaska Natives, and 114 for Asians/Pacific Islanders.

Effective Cancer Prevention Measures

The number of new cancer cases can be reduced, and many cancer deaths can be prevented. A person's cancer risk can be significantly reduced by adopting a healthy lifestyle, avoiding tobacco use, increasing physical activity, achieving optimal weight, improving nutrition, and avoiding sun exposure.

Making cancer screening, information, and referral services available and accessible to all Americans can lower the high rates of cancer and cancer deaths. Screening tests for breast, cervical, and colorectal cancers decrease deaths from these diseases by finding them early, often as treatable precancerous conditions.

Rates of Death Due to Cancer, 2003*



144.9–164.6 | 164.7–184.4 | 184.5–204.2 | 204.3–223.9

* Deaths per 100,000, age adjusted to the 2000 standard U.S. population.
Source: *United States Cancer Statistics: 2003 Incidence and Mortality*. CDC and the National Cancer Institute; 2006.

CDC's Leadership in Detecting, Preventing, and Controlling Cancer

CDC is committed to ensuring that all people, especially those at greater risk for health disparities, will achieve their optimal lifespan with the best possible quality of health in every stage of life. With new health protection goals that support healthy people in healthy places across all life stages, CDC is setting the agenda to enable people to enjoy a healthy life by delaying death and the onset of illness and disability by accelerating improvements in public health.

With fiscal year 2006 funding of $306.2 million for cancer prevention and control activities, CDC is a leader in this area. CDC's Division of Cancer Prevention and Control (DCPC) works with national organizations, state health agencies, and other key groups to develop, implement, and promote effective cancer prevention and control practices.

CDC's comprehensive and collaborative approach to addressing the nation's cancer burden includes the following:

- **Monitoring.** CDC helps states, territories, and tribes and tribal organizations collect data on cancer incidence and deaths, cancer risk factors, and the use of cancer screening tests. Public health professionals use these data to identify and track cancer trends, strengthen cancer prevention and control activities, and prioritize use of resources.

- **Conducting research and evaluation.** CDC conducts and supports studies to help the cancer community better understand factors that increase cancer risk and identify opportunities to prevent cancer. CDC also evaluates the feasibility and effectiveness of strategies designed to prevent and control cancer.
- **Building capacity and partnerships.** CDC works with many partners to translate research into public health programs, practices, and services. CDC helps states, U.S. territories, and tribes and tribal organizations apply scientific advances to the development of strong cancer control programs for the people who most need them.
- **Educating.** CDC develops communication campaigns and materials for teaching health professionals, policy makers, the media, and the public about the importance of cancer prevention and control.

CDC's Cancer Programs

Since its inception in 1991, the **National Breast and Cervical Cancer Early Detection Program** (NBCCEDP) has provided more than 6.5 million breast and cervical cancer screening and diagnostic exams to more than 2.7 million women in need, such as those who are uninsured, have low incomes, or have health insurance that does not pay for screening services. The NBCCEDP supports early detection programs in all 50 states, the District of Columbia, 4 U.S. territories, and 13 tribes or tribal organizations. CDC supports public education, client recruitment, case management services, and program evaluation to increase screening rates among priority populations.

The **National Comprehensive Cancer Control Program** (NCCCP) funds states, U.S. territories, tribes and tribal organizations to establish coalitions, assess the burden of cancer, determine priorities, and develop and implement comprehensive cancer control (CCC) programs. CCC is a collaborative process through which a community pools resources to reduce the burden of cancer, resulting in risk reduction, early detection, better treatment, and enhanced survivorship. CDC supports all 50 states, the District of Columbia, 6 U.S. territories, and 6 tribes or tribal organizations to develop and implement cancer control plans.

The **National Program of Cancer Registries** (NPCR) collects data on cancer occurrence; the type, extent, and location of cancers; and the type of initial treatment. To provide high-quality data on cancer and cancer care, CDC supports registries in 45 states, the District of Columbia, and 3 U.S. territories. The NPCR and the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program collaborate to publish annual cancer incidence and death data in the *United States Cancer Statistics: Incidence and Mortality* reports.

Ongoing Initiatives

Colorectal cancer prevention and control. CDC and its partners promote colorectal cancer screening by supporting education and research programs. For example, CDC's *Screen for Life: National Colorectal Cancer Action Campaign* educates Americans about the importance of regular screening for this disease beginning at age 50. CDC is funding a 3-year demonstration program at the community level to learn how best to implement colorectal cancer screening for low-income adults.

Prostate cancer control. CDC provides the public, doctors, and policy makers with information they need to make informed decisions about the potential risks and benefits of prostate cancer screening and to improve quality of life after diagnosis. CDC produces three versions of *Prostate Cancer Screening: A Decision Guide*: one for all English-speaking men, another for African American men, and the third in Spanish for Hispanic men. CDC also developed a slide presentation for primary care physicians called *Screening for Prostate Cancer: Sharing the Decision*.

Skin cancer primary prevention and education. CDC conducts monitoring, research, education, and interventions for skin cancer. CDC published the *Guidelines for School Programs to Prevent Skin Cancer* to promote strategies that have reduced skin cancer risks among students aged 5–18. CDC is working with state and local education agencies and other partners to put these strategies into practice in schools in Colorado, Michigan, and North Carolina.

Hematologic cancer. CDC funds efforts to improve awareness and understanding of the diagnosis and treatment of hematologic cancers, which are cancers of the blood and bone marrow. These efforts help the public and people living with hematologic cancers (as well as their friends and families) get resources to better understand these diseases, receive optimal treatment, and find community support networks.

Ovarian cancer. CDC works with academic and medical institutions, state health departments, and advocacy groups to conduct research to improve early detection and treatment of ovarian cancer, about which little is known. Cancer registries in Maryland, California, and New York currently collaborate with the NPCR to evaluate care and outcomes for patients with ovarian cancer. In addition, the NCCCP funds ovarian cancer projects in Alabama, Colorado, Maine, New York, Utah, and West Virginia.

Gynecologic cancer. In 2006, CDC received congressional funding to implement a national education campaign that targets gynecologic cancers, which originate in the female reproductive organs. This campaign is expected to provide information for the general public about risk factors, research, appropriate screening and prevention opportunities, treatment, and survivorship resources.

Cervical cancer. In June 2006, CDC's Advisory Committee on Immunization Practices recommended use of the first FDA-licensed vaccine for human papillomavirus (HPV) for girls and women to prevent cervical cancer, cervical precancers, and genital warts. All women receiving the HPV vaccine should continue to receive regular cervical cancer screening (Pap tests) according to current screening recommendations.

Lung cancer. CDC works to prevent and control lung cancer by collecting critical data about diagnoses and deaths in the United States; supporting programs in states, U.S. territories, and tribes and tribal organizations to prevent and control tobacco use and promote a healthy diet; and implementing public health interventions and counter-marketing strategies to reduce smoking.

Cancer survivorship. Because of advances in the detection and treatment of cancer, more people are living longer after a cancer diagnosis, and survivors often face a range of health challenges. CDC works with national, state, and local partners to create and implement successful strategies to help the millions of people who live with, through, and beyond cancer. For example, DCPC and the Lance Armstrong Foundation worked together to develop *A National Action Plan for Cancer Survivorship: Advancing Public Health Strategies*.

State Program in Action: Louisiana

When Hurricane Katrina devastated New Orleans in 2005, the **Louisiana Breast and Cervical Cancer Early Detection Program** (BCCEDP) was left with little of its normal infrastructure—no offices, no available services, and a population that had fled to higher ground. Some big questions faced the program: How do we keep going, how can we rebuild, and how can we do it quickly? Fortunately, key partnerships and a newly discovered reservoir of ingenuity and positive attitude helped put the Louisiana BCCEDP back together faster than anyone had dreamed possible.

Within weeks after Katrina, one staff member working from a home with a damaged roof began recreating the program's entire data system. Other BCCEDP employees worked in space borrowed from a program partner in Baton Rouge, shifting resources to parts of Louisiana where New Orleans residents had sought refuge. When New Orleans reopened and its residents began coming home, the BCCEDP began to rebuild services in the city in partnership with a reopened community clinic.

The BCCEDP in New Orleans now offers both cervical and breast cancer screening, including mammography and other diagnostic tests at its own service provider's site. Perhaps most amazing is that the program not only kept up operations, it served more than 6,900 women during 2005–2006. This figure represents the most women ever seen in the state in one fiscal year, and it includes more than 600 women served in New Orleans since Katrina hit. To prepare for future emergencies, the BCCEDP is launching a new data system that will allow online data entry and reports, as well as off-site data storage, in Idaho. As a result, participant records will be available any place with an Internet connection, which will help to ensure the availability of ongoing, life-saving breast and cervical cancer screening services to women in Louisiana.

Future Directions

To help ensure that people are healthy at every stage of life, CDC is committed to the following actions:

- Collaborating with partners, policy makers, and other individuals and groups working to ease the burden of cancer in the United States and abroad.
- Expanding the use of information technology in cancer surveillance, particularly in cancer registries.
- Improving the cost-effectiveness of the National Breast and Cervical Cancer Early Detection Program.
- Expanding CDC's focus to include malignancies not previously addressed.
- Defining the proper role for managing chronic diseases, including cancer, during catastrophic disasters.

For more information or copies of publications referenced in this document, please contact
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National Center for Chronic Disease Prevention and Health Promotion
4770 Buford Highway NE, Mail Stop K–64, Atlanta, GA 30341-3717
Telephone: 800-CDC-INFO (232-4636) • TTY: 888-232-6348
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CS107827

2008 Texas Water Quality Inventory
Water Bodies with Concerns for Use Attainment and Screening Levels (March 19, 2008)

Explanation of Column Headings

SegID and Name: May be one of two types of numbers for SegID. The first type is a classified segment number (4 digits, e.g. 0218), as defined in the Texas Surface Water Quality Standards. The second type is an unclassified water body (0218A), not defined in the Standards, associated with a classified water body because it is in the same watershed.

Area: AU_ID (*e.g.* 0101A_01) and description of the specific area in which one or more water quality standards are not met.

Parameter(s): These are pollutants or water quality conditions that assessment procedures indicate are the reason the water quality standards are not met.

Level of Concern: **CN** - Concern for near-nonattainment of the Water Quality Standards
CS - Concern for water quality based on screening levels

0101 Canadian River Below Lake Meredith

		Level of Concern
0101_03	*portion in Hutchinson County*	
	ammonia	**CS**

0101A Dixon Creek (unclassified water body)

		Level of Concern
0101A_01	*Dixon Creek downstream of Phillips*	
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
0101A_02	*Dixon Creek upstream of Phillips*	
	chlorophyll-a	**CS**

0101B Rock Creek (unclassified water body)

		Level of Concern
0101B_01	*Perennial stream from the confluence with the Canadian River up to SH 136 in the City of Borger*	
	nitrate	**CS**

0102 Lake Meredith

		Level of Concern
0102_01	*Downstream half of lake including Big Blue Creek arm*	
	mercury in fish tissue	**CS**
0102_02	*Upstream half of lake, above Big Blue Creek arm*	
	mercury in fish tissue	**CS**

0103A East Amarillo Creek (unclassified water body)

		Level of Concern
0103A_01	*Entire water body*	
	chlorophyll-a	**CS**
	nitrate	**CS**

0104 Wolf Creek

		Level of Concern
0104_03	*Lake Fryer to upstream end of segment*	
	chlorophyll-a	**CS**

0105 Rita Blanca Lake

		Level of Concern
0105_01	*Entire segment*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	total phosphorus	**CS**

0199A Palo Duro Reservoir (unclassified water body)

		Level of Concern
0199A_01	*Entire reservoir*	
	ammonia	**CS**

0201 Lower Red River

		Level of Concern
0201_01	*Arkansas State Line to Walnut Bayou (Oklahoma)*	
	chlorophyll-a	**CS**

0201A Mud Creek (unclassified water body)

		Level of Concern
0201A_01	*Entire water body*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

0202 Red River Below Lake Texoma

		Level of Concern
0202_01	*End of segment to Pecan Bayou confluence*	
	chlorophyll-a	**CS**
0202_02	*Pecan Bayou to Pine Creek*	
	chlorophyll-a	**CS**
0202_03	*Pine Creek to Bois d'Arc Creek*	
	chlorophyll-a	**CS**
0202_04	*Bois d'Arc Creek to SH 78*	
	chlorophyll-a	**CS**

0202C Pecan Bayou (unclassified water body)

		Level of Concern
0202C_01	*Entire water body*	
	chlorophyll-a	**CS**

0202D Pine Creek (unclassified water body)

		Level of Concern
0202D_01	*Perennial and intermittent stream from the confluence with the Red River upstream to the dam forming Lake Crook*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**

0202E Post Oak Creek (unclassified water body)

		Level of Concern
0202E_01	*Entire segment*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**

0202F Choctaw Creek (unclassified water body)

		Level of Concern
0202F_01	*Entire water body*	
	nitrate	**CS**
	orthophosphorus	**CS**

0202G Smith Creek (unclassified water body)

		Level of Concern
0202G_01	*Entire segment*	
	depressed dissolved oxygen	**CN**
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0203 Lake Texoma

		Level of Concern
0203_01	*Near dam*	
	chloride in finished drinking water	**CS**
	orthophosphorus	**CS**
	total dissolved solids in finished drinking water	**CS**
0203_02	*Little Mineral arm*	
	chloride in finished drinking water	**CS**
	total dissolved solids in finished drinking water	**CS**
0203_03	*Mid-lake near Big Mineral arm*	
	chlorophyll-a	**CS**
	total dissolved solids in finished drinking water	**CS**
	chloride in finished drinking water	**CS**
0203_04	*Upper end of lake*	
	chloride in finished drinking water	**CS**
	chlorophyll-a	**CS**
	total dissolved solids in finished drinking water	**CS**
0203_05	*Remainder of lake*	
	chloride in finished drinking water	**CS**
	total dissolved solids in finished drinking water	**CS**

0203A Big Mineral Creek (unclassified water body)

		Level of Concern
0203A_01	*From Lake Texoma upstream to the confl. with an unnamed 2nd order trib. on North Branch 2.4 km upstream of US 377 and upstream to the confl. with an unnamed 2nd order trib. on South Branch 1.1 km upstream of US 377 north of the City of Whitesboro*	
	ammonia	**CS**
	orthophosphorus	**CS**

0204 Red River Above Lake Texoma

		Level of Concern
0204_01	*Segment end to Fish Creek*	
	chlorophyll-a	**CS**
	bacteria	**CN**

0205 Red River Below Pease River

		Level of Concern
0205_01	*From lower end of segment to IH 44*	
	chlorophyll-a	**CS**
0205_02	*China Creek to upstream end of segment*	
	bacteria	**CN**
	chlorophyll-a	**CS**

0206B South Groesbeck Creek (unclassified water body)

		Level of Concern
0206B_01	*Entire segment*	
	bacteria	**CN**
	nitrate	**CS**

0207 Lower Prairie Dog Town Fork Red River

		Level of Concern
0207_04	*SH 70 to upstream end of segment*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**

0207A Buck Creek (unclassified water body)

		Level of Concern
0207A_01	*From Oklahoma state line to House Log Creek*	
	nitrate	**CS**

0209 Pat Mayse Lake

		Level of Concern
0209_01	*Lower half of lake*	
	manganese in sediment	**CS**
0209_02	*Upper half of lake*	
	manganese in sediment	**CS**

0211 Little Wichita River

		Level of Concern
0211_02	*East Fork confluence to dam*	
	chlorophyll-a	**CS**

0212 Lake Arrowhead

		Level of Concern
0212_01	*Entire lake*	
	total phosphorus	**CS**
	orthophosphorus	**CS**

0214 Wichita River Below Diversion Lake Dam

		Level of Concern
0214_01	*Lower end of segment to FM 2393*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
0214_02	*FM 2393 to River Road WWTP*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0214_03	*From River Road WWTP to confluence with Buffalo Creek*	
	chlorophyll-a	**CS**
0214_05	*From Beaver Creek to Diversion Dam*	
	chlorophyll-a	**CS**

0214A Beaver Creek (unclassified water body)

		Level of Concern
0214A_01	*From Wichita River to confluence with Bull Creek*	
	depressed dissolved oxygen	**CN**
0214A_02	*From Bull Creek to Santa Rosa Lake dam*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

0219 Lake Wichita

		Level of Concern
0219_01	*Entire segment*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	chlorophyll-a	**CS**

0226 South Fork Wichita River

		Level of Concern
0226_02	*From SH 6 to confluence with Willow Creek*	
	ammonia	**CS**
0226_03	*From confluence with Willow Creek to confluence with Long Canyon Creek*	
	ammonia	**CS**

0229 Upper Prairie Dog Town Fork Red River

		Level of Concern
0229_01	*Lower end of segment to Palo Duro State Park northern boundary*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0229_02	*Palo Duro Canyon State Park upstream boundary to upper end of segment at Tanglewood Dam*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

0229A Lake Tanglewood (unclassified water body)

		Level of Concern
0229A_01	*Entire lake*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**

0230A Paradise Creek (unclassified water body)

		Level of Concern
0230A_03	*Lower 5 miles of water body*	
	chlorophyll-a	**CS**
	nitrate	**CS**
0230A_04	*Remainder of water body*	
	chlorophyll-a	**CS**
	nitrate	**CS**

0301 Sulphur River Below Wright Patman Lake

		Level of Concern
0301_01	*Lower 9 miles*	
	chlorophyll-a	**CS**
0301_02	*Upper 10 miles*	
	chlorophyll-a	**CS**

0302 Wright Patman Lake

		Level of Concern
0302_01	*800 acres near dam*	
	chlorophyll-a	**CS**
0302_02	*300 acres at International Paper intake*	
	ammonia	**CS**
	chlorophyll-a	**CS**
0302_04	*500 acres in the northeast corner of lake*	
	ammonia	**CS**
	chlorophyll-a	**CS**
0302_06	*Big Creek arm*	
	chlorophyll-a	**CS**
0302_09	*5000 acres mid-lake, below Hwy 8*	
	chlorophyll-a	**CS**
0302_10	*4000 acres in upper portion of lake*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**

0303 Sulphur/South Sulphur River

		Level of Concern
0303_01	*Lower 25 miles*	
	chlorophyll-a	**CS**
0303_02	*Middle 25 miles*	
	chlorophyll-a	**CS**

0303A Big Creek Lake (unclassified water body)

		Level of Concern
0303A_01	*Entire segment*	
	atrazine in finished drinking water	**CS**

0303B White Oak Creek (unclassified water body)

		Level of Concern
0303B_03	*Upper 25 miles of segment*	
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

0304 Days Creek

		Level of Concern
0304_01	*Entire segment*	
	naphthalene in sediment	**CS**
	acenaphthene in sediment	**CS**
	pyrene in sediment	**CS**
	phenanthrene in sediment	**CS**
	nitrate	**CS**
	fluoranthene in sediment	**CS**
	chrysene in sediment	**CS**
	benz(a)antracene in sediment	**CS**
	benzo(a)pyrene in sediment	**CS**

0304C Wagner Creek (unclassified water body)

		Level of Concern
0304C_01	*Entire segment*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**

0305 North Sulphur River

		Level of Concern
0305_02	*Upper 23 miles*	
	impaired habitat	**CS**

0306 Upper South Sulphur River

		Level of Concern
0306_02	*25 miles above SH 11*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	chlorophyll-a	**CS**

0401 Caddo Lake

		Level of Concern
0401_01	*Lower 5000 acres*	
	manganese in sediment	**CS**
	mercury in fish tissue	**CS**
	ammonia	**CS**
0401_02	*Harrison Bayou arm*	
	mercury in fish tissue	**CS**
0401_03	*Goose Prairie arm*	
	mercury in fish tissue	**CS**
0401_05	*Clinton Lake*	
	ammonia	**CS**
	mercury in fish tissue	**CS**
0401_07	*Mid-lake near Uncertain*	
	manganese in sediment	**CS**
	mercury in fish tissue	**CS**
0401_08	*Remainder of segment*	
	mercury in fish tissue	**CS**

0401B Kitchen Creek (unclassified water body)

		Level of Concern
0401B_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

0402 Big Cypress Creek Below Lake O' the Pines

		Level of Concern
0402_01	*Lower 9 miles*	
	chlorophyll-a	**CS**
0402_02	*11 miles below Black Cypress Creek*	
	depressed dissolved oxygen	**CN**

0402A Black Cypress Bayou (unclassified water body)

		Level of Concern
0402A_01	*Lower 15 miles of water body*	
	copper in water	**CN**
	lead in water	**CN**
0402A_03	*Middle 1 mile, Pruitt Lake*	
	cadmium in water	**CN**
	copper in water	**CN**
	depressed dissolved oxygen	**CN**
	chlorophyll-a	**CS**
	mercury in fish tissue	**CS**
0402A_04	*Middle 13 miles near FM 250*	
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**

0402B Hughes Creek (unclassified water body)

		Level of Concern
0402B_01	*Entire Segment*	
	impaired macrobenthos community	**CN**
	impaired habitat	**CS**

0402E Kelly Creek (unclassified water body)

		Level of Concern
0402E_01	*Entire segment*	
	impaired macrobenthos community	**CN**
	impaired habitat	**CS**

0404 Big Cypress Creek Below Lake Bob Sandlin

		Level of Concern
0404_01	*Lower 15 miles*	
	depressed dissolved oxygen	**CN**
	nitrate	**CS**
0404_02	*Upper 18 miles*	
	toxic sediment (LOE)	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0404A Ellison Creek Reservoir (unclassified water body)

		Level of Concern
0404A_01	*Entire reservoir*	
	PCBs in fish tissue	**CS**
	zinc in sediment	**CS**
	nickel in sediment	**CS**
	lead in sediment	**CS**
	iron in sediment	**CS**
	cadmium in sediment	**CS**
	manganese in sediment	**CS**

0404B Tankersley Creek (unclassified water body)

		Level of Concern
0404B_01	*Lower 3 miles*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0404B_03	*3 miles below Tankersley Lake*	
	bacteria	**CN**
	impaired fish community	**CN**
	impaired macrobenthos community	**CN**

0404C Hart Creek (unclassified water body)

		Level of Concern
0404C_01	*Entire water body*	
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**

0404E Dry Creek (unclassified water body)

		Level of Concern
0404E_01	*Entire segment*	
	nitrate	**CS**

0404J Prairie Creek (unclassified water body)

		Level of Concern
0404J_01	*Entire segment*	
	depressed dissolved oxygen	**CN**

0404K Walkers Creek (unclassified water body)

		Level of Concern
0404K_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

0404N Lake Daingerfield (unclassified water body)

		Level of Concern
0404N_01	*Entire lake*	
	mercury in fish tissue	**CS**

0405 Lake Cypress Springs

		Level of Concern
0405_02	*Upper 2600 acres*	
	depressed dissolved oxygen	**CN**
0405_03	*Panther Arm*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**

0406 Black Bayou

		Level of Concern
0406_01	*Lower 12 miles*	
	depressed dissolved oxygen	**CS**
0406_02	*Upper 12 miles*	
	depressed dissolved oxygen	**CS**

0407 James' Bayou

		Level of Concern
0407_01	*Lower 15 miles of segment*	
	ammonia	**CS**

0408 Lake Bob Sandlin

		Level of Concern
0408_01	*Lower 2000 acres near dam*	
	cadmium in water	**CN**

0408C Brushy Creek (unclassified water body)

		Level of Concern
0408C_01	*Entire segment*	
	impaired habitat	**CS**

0409 Little Cypress Bayou (Creek)

		Level of Concern
0409_03	*Middle 25 miles below Hwy 271*	
	bacteria	**CN**
	depressed dissolved oxygen	**CN**
	impaired macrobenthos community	**CN**
0409_04	*Upper 25 miles*	
	bacteria	**CN**

0409B South Lilly Creek (unclassified water body)

		Level of Concern
0409B_01	*Entire segment*	
	depressed dissolved oxygen	**CS**

0501 Sabine River Tidal

		Level of Concern
0501_01	*Lower 10 miles of segment*	
	bacteria	**CN**

0501B Little Cypress Bayou (unclassified water body)

		Level of Concern
0501B_01	*Lower 4.2 miles of bayou*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
0501B_02	*0.3 mile upstream to 0.5 mile downstream of Bear Path Road*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
0501B_03	*Upper 3.2 miles of bayou*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**

0502A Nichols Creek (unclassified water body)

		Level of Concern
0502A_01	*Lower 25 miles of creek*	
	bacteria	**CN**

0502B Caney Creek (unclassified water body)

		Level of Concern
0502B_02	*From Davison Street upstream to the confluence with Caney Branch and Little Caney Branch*	
	bacteria	**CN**

0504 Toledo Bend Reservoir

		Level of Concern
0504_06	*Tenaha Creek arm*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
0504_07	*Uppermost 5120 acres of reservoir*	
	depressed dissolved oxygen	**CS**
	chlorophyll-a	**CN**
0504_10	*San Patricia arm*	
	depressed dissolved oxygen	**CS**
0504_11	*Toledo Bend reservoir near Buzzard Bend*	
	chlorophyll-a	**CS**

0504D Tenaha Creek (unclassified water body)

		Level of Concern
0504D_01	*Entire segment*	
	orthophosphorus	**CS**

0505 Sabine River Above Toledo Bend Reservoir

		Level of Concern
0505_03	*22 mile reach near SH 149*	
	bacteria	**CN**

0505B Grace Creek (unclassified water body)

		Level of Concern
0505B_02	*Upper 12.3 miles*	
	bacteria	**CN**
	depressed dissolved oxygen	**CN**

0505D Rabbit Creek (unclassified water body)

		Level of Concern
0505D_01	*Perennial stream from the confluence with the Sabine River in Gregg County up to the confluence with Little Rabbit Creek in Rusk County*	
	bacteria	**CN**

0506A Harris Creek (unclassified water body)

		Level of Concern
0506A_01	*Entire segment*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

0506C Wiggins Creek (unclassified water body)

		Level of Concern
0506C_01	*Appendix D - From the confluence with Harris Creek upstream to Smith County WWTP*	
	bacteria	**CN**
	ammonia	**CS**
	orthophosphorus	**CS**
0506C_02	*From Smith County WWTP upstream to dam impounding unnamed reservoir*	
	depressed dissolved oxygen	**CS**

0506G Little White Oak Creek (unclassified water body)

		Level of Concern
0506G_01	*Entire water body*	
	bacteria	**CN**
	depressed dissolved oxygen	**CN**

0507 Lake Tawakoni

		Level of Concern
0507_01	*Lowermost 5,120 acres of reservoir, adjacent to dam*	
	chlorophyll-a	**CS**
0507_02	*Kitsee Inlet*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
0507_03	*South Fork of Sabine River cove*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**
0507_04	*Cowleech Fork of Sabine River arm*	
	chlorophyll-a	**CS**
0507_05	*5120 acres near SH 276*	
	chlorophyll-a	**CS**
0507_06	*5120 acres near Spring Point*	
	chlorophyll-a	**CS**

0507A Cowleech Fork Sabine River (unclassified water body)

		Level of Concern
0507A_01	*Lower 10 miles, downstream of Long Branch confluence*	
	orthophosphorus	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**

0507B Long Branch (unclassified water body)

		Level of Concern
0507B_01	*Entire creek*	
	nitrate	**CS**

0507G South Fork of Sabine River (unclassified water body)

		Level of Concern
0507G_01	*Entire segment*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

0507H Caddo Creek (unclassified water body)

		Level of Concern
0507H_01	*Entire creek*	
	depressed dissolved oxygen	**CS**

0508 Adams Bayou Tidal

		Level of Concern
0508_01	*Lower 3 miles of segment*	
	depressed dissolved oxygen	**CS**
0508_02	*2 mile reach near Western Avenue*	
	depressed dissolved oxygen	**CS**
0508_03	*1 mile reach near Green Avenue*	
	depressed dissolved oxygen	**CS**
0508_04	*Upper 2 miles of segment*	
	pH	**CN**
	depressed dissolved oxygen	**CS**

0508C Hudson Gully (unclassified water body)

		Level of Concern
0508C_01	*Entire creek*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**

0509 Murvaul Lake

		Level of Concern
0509_01	*Entire reservoir*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**

0510 Lake Cherokee

		Level of Concern
0510_01	*Lower 2352 acres of reservoir*	
	orthophosphorus	**CS**
0510_02	*Upper 1629 acres of reservoir*	
	orthophosphorus	**CS**
	depressed dissolved oxygen	**CS**

0511 Cow Bayou Tidal

		Level of Concern
0511_01	*Lower 5 miles*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**
0511_02	*6 mile reach near FM 105*	
	depressed dissolved oxygen	**CS**
0511_03	*5 mile reach near FM 1442 (north crossing)*	
	depressed dissolved oxygen	**CS**
0511_04	*Upper 4 miles*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

0511A Cow Bayou Above Tidal (unclassified water body)

		Level of Concern
0511A_01	*Lower 5.3 miles of above-tidal reach*	
	bacteria	**CN**
0511A_02	*Upper 5.3 miles of above-tidal reach*	
	depressed dissolved oxygen	**CS**

0511B Coon Bayou (unclassified water body)

		Level of Concern
0511B_01	*Entire tidal reach*	
	depressed dissolved oxygen	**CS**

0511C Cole Creek (unclassified water body)

		Level of Concern
0511C_01	*Entire tidal reach*	
	depressed dissolved oxygen	**CS**

0511E Terry Gully (unclassified water body)

		Level of Concern
0511E_01	*Entire creek*	
	orthophosphorus	**CS**
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**

0512 Lake Fork Reservoir

		Level of Concern
0512_03	*Running Creek cove, centering on FM 2966*	
	orthophosphorus	**CS**
0512_05	*Uppermost 5120 acres of Lake Fork Creek arm*	
	chlorophyll-a	**CS**

0512A Running Creek (unclassified water body)

		Level of Concern
0512A_01	*Entire creek*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**

0512B Elm Creek (unclassified water body)

		Level of Concern
0512B_01	*Entire creek*	
	depressed dissolved oxygen	**CN**
	ammonia	**CS**
	depressed dissolved oxygen	**CS**

0514 Big Sandy Creek

		Level of Concern
0514_02	*From just upstream of FM 49 to upper end of segment*	
	depressed dissolved oxygen	**CS**

0601 Neches River Tidal

		Level of Concern
0601_01	*Lower boundary to top of first oxbow*	
	malathion in water	**CN**

0601A Star Lake Canal (unclassified water body)

		Level of Concern
0601A_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

0602 Neches River Below B. A. Steinhagen Lake

		Level of Concern
0602_01	*Lower boundary to confluence with Village Creek (0608)*	
	mercury in fish tissue	**CS**
0602_02	*confluence with Village Creek (0608) to 18.4 miles upstream Evadale*	
	mercury in fish tissue	**CS**
0602_03	*18.4 miles upstream Evadale to 5.4 miles upstream FM 1013*	
	mercury in fish tissue	**CS**
0602_04	*5.4 miles upstream FM 1013 to Town Bluff Dam*	
	mercury in fish tissue	**CS**

0603A Sandy Creek (unclassified water body)

		Level of Concern
0603A_01	*Lower 11.5 miles*	
	bacteria	**CN**

0603B Wolf Creek (unclassified water body)

		Level of Concern
0603B_01	*Entire creek*	
	bacteria	**CN**

0604 Neches River Below Lake Palestine

		Level of Concern
0604_01	*Lower boundary to US 69*	
	ammonia	**CS**
0604_04	*From SH 21 to US 84*	
	chlorophyll-a	**CS**
0604_05	*From US 84 to Blackburn Crossing Dam in Anderson/Cherokee County*	
	chlorophyll-a	**CS**

0604A Cedar Creek (unclassified water body)

		Level of Concern
0604A_02	*Upper area upstream of FM 2497*	
	total phosphorus	**CS**
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

0604C Jack Creek (unclassified water body)

		Level of Concern
0604C_01	*Entire water body*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	ammonia	**CS**

0604D Piney Creek (unclassified water body)

		Level of Concern
0604D_01	*Lower 25 miles*	
	depressed dissolved oxygen	**CS**

0604M Biloxi Creek (unclassified water body)

		Level of Concern
0604M_02	*Lower portion below CR 228*	
	bacteria	**CN**
0604M_03	*Upper portion above CR 228*	
	total phosphorus	**CS**

0605 Lake Palestine

		Level of Concern
0605_01	*Lower portion of reservoir near dam*	
	depressed dissolved oxygen	**CS**
0605_03	*Mid-lake near Tyler PWS intake*	
	toxic sediment (LOE)	**CN**
	chlorophyll-a	**CS**
	manganese in sediment	**CS**
0605_04	*Upper lake (Neches arm)*	
	nitrate	**CS**
	orthophosphorus	**CS**
	depressed dissolved oxygen	**CS**
	ammonia	**CS**
	total phosphorus	**CS**
0605_07	*Headwaters (Kickapoo Creek arm)*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0605_08	*Flat Creek Headwaters*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0605_09	*Flat Creek arm*	
	chlorophyll-a	**CS**
0605_10	*Upper Lake*	
	chlorophyll-a	**CS**

0605A Kickapoo Creek (unclassified water body)

		Level of Concern
0605A_01	*Downstream of FM 1803*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0606 Neches River Above Lake Palestine

		Level of Concern
0606_01	*Lower boundary to Prairie Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**
0606_02	*Prairie Creek to river mile 7.0*	
	depressed dissolved oxygen	**CS**
0606_03	*River mile 7.0 to headwaters*	
	depressed dissolved oxygen	**CN**

0607 Pine Island Bayou

		Level of Concern
0607_01	*Mouth to river mile 5.7*	
	depressed dissolved oxygen	**CS**
0607_04	*River Mile 35.4 at confluence with Willow Creek (0607C) to mile 60.4*	
	depressed dissolved oxygen	**CS**

0607A Boggy Creek (unclassified water body)

		Level of Concern
0607A_01	*Entire creek*	
	impaired habitat	**CS**
	depressed dissolved oxygen	**CN**

0607B Little Pine Island Bayou (unclassified water body)

		Level of Concern
0607B_01	*Lower 25 miles*	
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**

0607C Willow Creek (unclassified water body)

		Level of Concern
0607C_01	*Entire creek*	
	depressed dissolved oxygen	**CS**

0608 Village Creek

		Level of Concern
0608_01	*From confluence with Neches River to FM 418*	
	mercury in fish tissue	**CS**
0608_02	*From FM 418 to Lake Kimble dam*	
	mercury in fish tissue	**CS**

0608A Beech Creek (unclassified water body)

		Level of Concern
0608A_01	*Lower 20 miles of water body*	
	pH	**CN**
0608A_02	*Upper 19 miles of water body*	
	pH	**CN**
	impaired habitat	**CS**

0608B Big Sandy Creek (unclassified water body)

		Level of Concern
0608B_02	*Upper 16.9 miles of segment*	
	bacteria	**CN**

0608C Cypress Creek (unclassified water body)

		Level of Concern
0608C_01	*Entire water body*	
	impaired habitat	**CS**
	depressed dissolved oxygen	**CN**
	pH	**CN**
	depressed dissolved oxygen	**CS**

0608E Mill Creek (unclassified water body)

		Level of Concern
0608E_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

0610 Sam Rayburn Reservoir

		Level of Concern
0610_01	*Main pool by the dam*	
	ammonia	**CS**
0610_02	*Lower Angelina River arm*	
	ammonia	**CS**
	mercury in fish tissue	**CS**
0610_03	*Mid-Angelina River arm (SH 147)*	
	ammonia	**CS**
	arsenic in sediment	**CS**
	iron in sediment	**CS**
	manganese in sediment	**CS**
0610_04	*Upper mid-Angelina River arm*	
	ammonia	**CS**
	nitrate	**CS**
0610_05	*Lower Attoyac Bayou arm*	
	ammonia	**CS**
	nitrate	**CS**
0610_08	*Bear Creek arm*	
	ammonia	**CS**
	nitrate	**CS**
0610_09	*Lower Ayish Bayou arm*	
	nitrate	**CS**
	ammonia	**CS**

0611 Angelina River Above Sam Rayburn Reservoir

		Level of Concern
0611_03	*FM 343 to US 84*	
	ammonia	**CS**

0611A East Fork Angelina River (unclassified water body)

		Level of Concern
0611A_04	*Wooten Creek to headwaters*	
	bacteria	**CN**

0611D West Mud Creek (unclassified water body)

		Level of Concern
0611D_01	*Entire Segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0611Q Lake Nacogdoches (unclassified water body)

		Level of Concern
0611Q_01	*Entire reservoir*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

0611R Lake Striker (unclassified water body)

		Level of Concern
0611R_01	*Entire Lake*	
	nitrate	**CS**
	ammonia	**CS**

0612 Attoyac Bayou

		Level of Concern
0612_01	*Mouth to 8.2 miles downstream of SH 7*	
	bacteria	**CN**
0612_02	*8.2 miles below SH 7 to Bear Creek confluence*	
	ammonia	**CS**
0612_03	*Bear Creek to headwaters*	
	bacteria	**CN**
	ammonia	**CS**

0615 Angelina River/Sam Rayburn Reservoir

		Level of Concern
0615_01	*Upstream of Papermill Creek*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0615_02	*Downstream of Papermill Creek*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0615A Papermill Creek (unclassified water body)

		Level of Concern
0615A_01	*Lower 9 miles*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	depressed dissolved oxygen	**CN**

0701 Taylor Bayou Above Tidal

		Level of Concern
0701_01	*From saltwater lock to 8 miles upstream*	
	chlorophyll-a	**CS**
0701_02	*from 8 miles upstream of saltwater lock to the confluence of N and S Forks Taylor Bayou*	
	chlorophyll-a	**CS**

0701D Shallow Prong Lake (unclassified water body)

		Level of Concern
0701D_01	*Entire water body*	
	arsenic in fish tissue	**CS**
	depressed dissolved oxygen	**CS**

0702A Alligator Bayou (unclassified water body)

		Level of Concern
0702A_02	*Lower portion from SH82 to its confluence with Taylor Bayou*	
	chlorophyll-a	**CS**
	chrysene in sediment	**CS**
	lead in sediment	**CS**
	phenanthrene in sediment	**CS**
	pyrene in sediment	**CS**

0704 Hillebrandt Bayou

		Level of Concern
0704_01	*From confluence with Taylor Bayou to confluence with Bayou Din*	
	chlorophyll-a	**CS**
0704_02	*From confluence with Bayou Din to upper end of segment*	
	chlorophyll-a	**CS**
	ammonia	**CS**

0801B Old River (unclassified water body)

		Level of Concern
0801B_01	*Entire Segment*	
	chlorophyll-a	**CS**

0802 Trinity River Below Lake Livingston

		Level of Concern
0802_01	*Lower 17 miles of segment*	
	chlorophyll-a	**CS**
0802_03	*11 miles upstream to approx. 9 miles downstream of FM 787*	
	chlorophyll-a	**CS**
0802_04	*5 miles upstream to 11 miles downstream of US 59*	
	chlorophyll-a	**CS**
0802_05	*Upper 6 miles of segment*	
	chlorophyll-a	**CS**

0803 Lake Livingston

		Level of Concern
0803_01	*Lowermost portion of reservoir, adjacent to dam*	
	nitrate	**CS**
	orthophosphorus	**CS**
0803_04	*Middle portion of reservoir, East Pointblank*	
	nitrate	**CS**
	orthophosphorus	**CS**
0803_05	*Middle portion of reservoir, downstream of Kickapoo Creek*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0803_06	*Middle portion of reservoir, centering on US 190*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0803_07	*Upper portion of reservoir, west of Carlisle*	
	pH	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0803_08	*Cove off upper portion of reservoir, East Trinity*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0803_09	*West Carolina Creek cove, off upper portion of reservoir*	
	depressed dissolved oxygen	**CS**
0803_10	*Upper portion of reservoir, centering on SH 19*	
	total phosphorus	**CS**
	depressed dissolved oxygen	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
0803_11	*Riverine portion of reservoir, centering on SH 21*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0804 Trinity River Above Lake Livingston

		Level of Concern
0804_01	*Lower 25 miles of segment*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0804_02	*12 miles upstream to 13 miles downstream US 79*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
0804_03	*9.5 miles upstream to 15.5 miles downstream of US 287*	
	nitrate	**CS**
	orthophosphorus	**CS**
0804_04	*Upper 22 miles of segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0804G Catfish Creek (unclassified water body)

		Level of Concern
0804G_01	*Entire Segment*	
	bacteria	**CN**

0805 Upper Trinity River

		Level of Concern
0805_01	*25 mile reach near FM 85*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0805_02	*25 mile reach near SH 34*	
	bacteria	**CN**
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	chlorophyll-a	**CS**
0805_03	*11 mile reach near S. Loop 12*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0805_04	*Upper 8 miles*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0805_06	*From 15.57 mi. upstream of SH 34 to 4.71 mi. downstream of S Loop 12*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**

0806 West Fork Trinity River Below Lake Worth

		Level of Concern
0806_01	*Lower 22 miles of the segment*	
	chlorophyll-a	**CS**
	bacteria	**CN**

0806D Marine Creek (unclassified water body)

		Level of Concern
0806D_01	*Marine Creek from the confluence with W. Fork Trinity River 2 miles upstream to Tenmile Bridge Rd. in Ft. Worth*	
	bacteria	**CN**

0807 Lake Worth

		Level of Concern
0807_01	*Entire reservoir*	
	chlorophyll-a	**CS**

0809 Eagle Mountain Reservoir

		Level of Concern
0809_01	*Lowermost portion of reservoir near east end of dam*	
	depressed dissolved oxygen	**CS**
0809_03	*Ash Creek cove*	
	ammonia	**CS**
0809_08	*Middle portion of reservoir near Cole subdivision*	
	chlorophyll-a	**CS**
0809_09	*Indian Creek cove*	
	chlorophyll-a	**CS**
0809_10	*Upper portion of reservoir near Indian Creek cove*	
	chlorophyll-a	**CS**
0809_12	*Upper portion of reservoir near Newark Beach*	
	chlorophyll-a	**CS**
0809_14	*Mid-Lake,from just above Walnut Cr. Cove to Oakwood Rd. peninsula*	
	chlorophyll-a	**CS**

0810D Salt Creek (unclassified water body)

		Level of Concern
0810D_01	*Eleven mile stretch of Salt Creek running upstream from confluence with Garrett Creek, Wise County.*	
	bacteria	**CN**

0814 Chambers Creek Above Richland-Chambers Reservoir

		Level of Concern
0814_03	*Lower 8.5 miles of segment*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0815 Bardwell Reservoir

		Level of Concern
0815_01	*Entire reservoir*	
	nitrate	**CS**

0815A Waxahachie Creek (unclassified water body)

		Level of Concern
0815A_01	*Entire creek*	
	nitrate	**CS**

0817 Navarro Mills Lake

		Level of Concern
0817_01	*Entire reservoir*	
	nitrate	**CS**

0818 Cedar Creek Reservoir

		Level of Concern
0818_01	*1674*	
	chlorophyll-a	**CS**
0818_02	*Caney Creek cove*	
	ammonia	**CS**
0818_04	*Lower portion of reservoir east of Key Ranch Estates*	
	chlorophyll-a	**CS**
0818_05	*Cove off lower portion of reservoir adjacent to Clearview Estates*	
	ammonia	**CS**
0818_06	*Middle portion of reservoir downstream of Twin Creeks cove*	
	chlorophyll-a	**CS**
0818_08	*Prairie Creek cove*	
	chlorophyll-a	**CS**
	ammonia	**CS**
0818_09	*Upper portion of reservoir adjacent to Lacy Fork cove*	
	chlorophyll-a	**CS**
0818_10	*Lacy Fork cove*	
	chlorophyll-a	**CS**
0818_11	*Upper portion of reservoir east of Tolosa*	
	chlorophyll-a	**CS**
0818_13	*Cedar Creek cove*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0819 East Fork Trinity River

		Level of Concern
0819_01	*Entire segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	total phosphorus	**CS**
	chlorophyll-a	**CS**

0820 Lake Ray Hubbard

		Level of Concern
0820_01	*Lower portion of East Fork arm, centering on IH 30*	
	chlorophyll-a	**CS**
	nitrate	**CS**
0820_02	*Middle portion of East Fork arm, centering on SH 66*	
	chlorophyll-a	**CS**
0820_04	*Lower portion of main body of reservoir extending up from dam to Yankee Cr. Arm.*	
	nitrate	**CS**
0820_05	*Mid-reservoir, I30 crossing Rowlett Cr. Arm to Yankee Cr. Arm*	
	nitrate	**CS**

0820C Muddy Creek (unclassified water body)

		Level of Concern
0820C_01	*Entire creek*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**

0821 Lake Lavon

		Level of Concern
0821_01	*Lowermost portion of reservoir*	
	nitrate	**CS**

0822 Elm Fork Trinity River Below Lewisville Lake

		Level of Concern
0822_01	*Lower 11 miles of segment*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
0822_04	*Upper 1.5 miles of segment*	
	chlorophyll-a	**CS**

0822A Cottonwood Branch (unclassified water body)

		Level of Concern
0822A_01	*A 2.5 mile stretch of Cottonwood Branch running upstream from confluence with Hackberry Creek to approx. 0.5 miles downstream of N. Story Rd., Dallas Co.*	
	chlorophyll-a	**CS**

0822D Ski Lake (unclassified water body)

		Level of Concern
0822D_01	*Entire segment.*	
	chlorophyll-a	**CS**

0823 Lewisville Lake

		Level of Concern
0823_02	*Stewart Creek arm*	
	bacteria	**CN**
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0823_04	*Little Elm Creek arm*	
	nitrate	**CS**

0823A Little Elm Creek (unclassified water body)

		Level of Concern
0823A_01	*From the confluence with Lake Lewisville in Denton Co., up to FM 455 in Collin Co. (Lower 12 miles of segment).*	
	depressed dissolved oxygen	**CS**

0823B Stewart Creek (unclassified water body)

		Level of Concern
0823B_01	*Entire segment.*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0824 Elm Fork Trinity River Above Ray Roberts Lake

		Level of Concern
0824_01	*Lower 7.5 miles of segment*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
0824_02	*2 mile reach near unmarked county road, 1.4 km downstream Gainesville WWTP*	
	nitrate	**CS**
	orthophosphorus	**CS**
0824_03	*3.5 mile reach near SH 51*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

0826 Grapevine Lake

		Level of Concern
0826_01	*Lowermost portion of reservoir*	
	nitrate	**CS**
0826_05	*Middle portion of reservoir east of Meadowmere Park*	
	nitrate	**CS**
0826_06	*Middle portion of reservoir southeast of Walnut Grove Park*	
	nitrate	**CS**
0826_07	*Upper portion of reservoir east of Marshall Creek Park*	
	nitrate	**CS**

0826A Denton Creek (unclassified water body)

		Level of Concern
0826A_01	*Lower 7.9 miles of creek*	
	nitrate	**CS**

0827A White Rock Creek (unclassified water body)

		Level of Concern
0827A_01	*Entire segment.*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

0828 Lake Arlington

		Level of Concern
0828_02	*Lowermost portion of lake along eastern half of dam*	
	chlorophyll-a	**CS**
0828_05	*Western half of upper portion of lake*	
	chlorophyll-a	**CS**
0828_06	*Eastern half of upper portion of lake*	
	chlorophyll-a	**CS**

0830 Benbrook Lake

		Level of Concern
0830_01	*Lower portion of reservoir*	
	ammonia	**CS**
	chlorophyll-a	**CS**
0830_02	*Middle portion of reservoir*	
	ammonia	**CS**
	chlorophyll-a	**CS**
0830_03	*Upper portion of reservoir*	
	chlorophyll-a	**CS**

0831 Clear Fork Trinity River Below Lake Weatherford

		Level of Concern
0831_01	*Lower 12.75 miles, downstream from South Fork Trinity River confluence*	
	orthophosphorus	**CS**
0831_04	*2 mi upstream of South Fork Trinity River confluence to Squaw Ck. Confluence*	
	depressed dissolved oxygen	**CN**
0831_05	*From the confluence of Squaw Ck. to Lake Weatherford Dam*	
	depressed dissolved oxygen	**CS**

0831A South Fork Trinity River (unclassified water body)

		Level of Concern
0831A_01	*Eleven mile stretch of S. Fork Trinity River running upstream from confluence with Clear Fork Trinity River to confluence with Willow Creek, Parker Co.*	
	orthophosphorus	**CS**
	total phosphorus	**CS**

0833 Clear Fork Trinity River Above Lake Weatherford

		Level of Concern
0833_02	*Upper 11 miles of segment*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
0833_03	*From the confluence of McKnight Branch to the confluence of Cottonwood Ck.*	
	depressed dissolved oxygen	**CS**
0833_04	*From the confluence with Dobbs Branch to confluence with McKnight Branch*	
	depressed dissolved oxygen	**CN**

0836 Richland-Chambers Reservoir

		Level of Concern
0836_04	*Upper portion of Chambers Creek arm*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**
0836_05	*Lower portion of Richland Creek arm*	
	chlorophyll-a	**CS**
0836_06	*Upper portion of Richland Creek arm*	
	chlorophyll-a	**CS**

0838B Sugar Creek (unclassified water body)

		Level of Concern
0838B_01	*Entire segment.*	
	bacteria	**CN**

0840 Ray Roberts Lake

		Level of Concern
0840_01	*Lowermost portion of reservoir adjacent to dam*	
	nitrate	**CS**
0840_02	*Lower portion of Jordan Creek arm west of Pilot Point*	
	nitrate	**CS**
0840_03	*Upper portion of Jordan Creek arm*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	bacteria	**CN**
	ammonia	**CS**
0840_04	*Buck Creek cove*	
	ammonia	**CS**
	nitrate	**CS**

0841 Lower West Fork Trinity River

		Level of Concern
0841_01	*Lower 14 miles of segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
0841_02	*Upper 13 miles of segment*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**

0841D Big Bear Creek (unclassified water body)

		Level of Concern
0841D_01	*Entire segment.*	
	bacteria	**CN**

0841H Delaware Creek (unclassified water body)

		Level of Concern
0841H_01	*Entire segment.*	
	chlorophyll-a	**CS**

0841K Fish Creek (unclassified water body)

		Level of Concern
0841K_01	*Entire segment.*	
	bacteria	**CN**

0841L Johnson Creek (unclassified water body)

		Level of Concern
0841L_01	*Entire segment.*	
	depressed dissolved oxygen	**CS**

0841M Kee Branch (unclassified water body)

		Level of Concern
0841M_01	*Entire segment.*	
	depressed dissolved oxygen	**CS**

0841N Kirby Creek (unclassified water body)

		Level of Concern
0841N_01	*Entire segment*	
	bacteria	**CN**

1002 Lake Houston

		Level of Concern
1002_01	*Confluence with Red Gully to FM 1960 East Pass*	
	nitrate	**CS**
	orthophosphorus	**CS**
1002_02	*West Lake Houston Parkway to FM 1960 West Pass*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1002_03	*FM 1960 to Missouri Pacific Railroad Tracks*	
	nitrate	**CS**
	orthophosphorus	**CS**
1002_04	*Missouri Pacific Railroad to Foley Road*	
	orthophosphorus	**CS**
1002_05	*From Foley Road to Dam*	
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
1002_06	*Confluence with Spring Creek to West Lake Houston Pkwy*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1002B Luce Bayou (unclassified water body)

		Level of Concern
1002B_02	*From confluence with Tarkington Bayou to upstream of Key Gully*	
	depressed dissolved oxygen	**CS**
1002B_03	*Upstream of Key Gully to confluence with Lake Houston*	
	depressed dissolved oxygen	**CS**

1004 West Fork San Jacinto River

		Level of Concern
1004_02	*IH 45 to the Spring Creek confluence*	
	orthophosphorus	**CS**
	nitrate	**CS**
	bacteria	**CN**

1004E Stewarts Creek (unclassified water body)

		Level of Concern
1004E_02	*From Airport Rd to confluence with West Fork San Jacinto River*	
	depressed dissolved oxygen	**CS**

1005 Houston Ship Channel/San Jacinto River Tidal

		Level of Concern
1005_01	*Downstream I-10 to Lynchburg Ferry Road*	
	nitrate	**CS**
1005_02	*Lynchburg Ferry Road to Goose Island*	
	bacteria	**CN**

1006 Houston Ship Channel Tidal

		Level of Concern
1006_01	*Houston Ship Channel Tidal-Greens Bayou confluence to Patrick Bayou confluence*	
	ammonia	**CS**
	nitrate	**CS**
1006_02	*Houston Ship Channel Tidal- Patrick Bayou confluence to lower segment boundary*	
	ammonia	**CS**
	nitrate	**CS**
1006_03	*Greens Bayou Tidal*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	bacteria	**CN**
1006_04	*Patrick Bayou Tidal*	
	acenaphthylene in sediment	**CS**
	ammonia	**CS**
	fluorene in sediment	**CS**
	mercury in sediment	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	phenanthrene in sediment	**CS**
	pyrene in sediment	**CS**
	total phosphorus	**CS**
	acenaphthene in sediment	**CS**
1006_05	*Goodyear Creek Tidal*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	depressed dissolved oxygen	**CS**
	ammonia	**CS**

1006D Halls Bayou (unclassified water body)

		Level of Concern
1006D_01	*From the confluence with Greens Bayou to US 59*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
1006D_02	*From Hirsch Road to Homestead Road*	
	ammonia	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

1007 Houston Ship Channel/Buffalo Bayou Tidal

		Level of Concern
1007_01	*Houston Ship Channel/Buffalo Bayou Tidal*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	ammonia	**CS**
	depressed dissolved oxygen	**CN**
1007_02	*Sims Bayou Tidal (upstream of SH 35 to Houston Ship Channel confluence)*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
1007_03	*Hunting Bayou Tidal (I-10 to confluence with Houston Ship Channel)*	
	bacteria	**CN**
	nitrate	**CS**
1007_04	*Brays Bayou Tidal (downstream of I 45 to confluence with the Houston Ship Channel)*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1007_05	*Vince Bayou Tidal (SH 225 to confluence with the Houston Ship Channel*	
	nitrate	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	total phosphorus	**CS**
1007_06	*Berry Bayou Tidal (2.4 km upstream of the Sims Bayou confluence)*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1007_07	*Buffalo Bayou (US 59 to upstream of 69th Street WWTP)*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1007B Brays Bayou Above Tidal (unclassified water body)

		Level of Concern
1007B_01	*From 11.5km upstream of confluence with Brays Bayou Tidal to SH 6*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1007B_02	*SH 6 to Clodine Road*	
	ammonia	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

1007C Keegans Bayou Above Tidal (unclassified water body)

		Level of Concern
1007C_01	*From Harris County line to confluence with Brays Bayou*	
	nitrate	**CS**
	total phosphorus	**CS**

1007D Sims Bayou Above Tidal (unclassified water body)

		Level of Concern
1007D_01	*From 0.4 miles north of Beltway 8 to Hiram Clark*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1007D_02	*From Hirman Clark to 11 miles upstream of the confluence with the Houston Ship Channel*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1007D_03	*From 11 miles upstream of the Houston Ship Channel confluence to SH 35*	
	nitrate	**CS**
	total phosphorus	**CS**
	ammonia	**CS**

1007F Berry Bayou Above Tidal (unclassified water body)

		Level of Concern
1007F_01	*1.5 miles upstream from confluence with Sims Bayou to SH 3*	
	total phosphorus	**CS**
	nitrate	**CS**

1007G Kuhlman Gully Above Tidal (unclassified water body)

		Level of Concern
1007G_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1007K Country Club Bayou Above Tidal (unclassified water body)

		Level of Concern
1007K_01	*From just downstream of South Lockwood Drive to the confluence with Brays Bayou*	
	depressed dissolved oxygen	**CS**

1007O Unnamed Non-Tidal Tributary of Buffalo Bayou (unclassified water body)

		Level of Concern
1007O_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1007R Hunting Bayou Above Tidal (unclassified water body)

		Level of Concern
1007R_01	*From Bain Street to Sayers Street (South Fork)*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
1007R_03	*From Falls Street to Loop 610 East*	
	nitrate	**CS**
1007R_04	*From Loop 610 East to IH 10*	
	nitrate	**CS**

1008 Spring Creek

		Level of Concern
1008_03	*SH 249 to IH 45*	
	impaired habitat	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1008_04	*IH 45 to confluence with Lake Houston*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1008B Upper Panther Branch (unclassified water body)

		Level of Concern
1008B_01	*From Old Conroe Road to the confluence with Bear Branch*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1008B_02	*From the confluence with Bear Branch to confluence with Lake Woodlands*	
	total phosphorus	**CS**

1008C Lower Panther Branch (unclassified water body)

		Level of Concern
1008C_01	*From the Lake Woodlands Dam to Saw Dust Road*	
	bacteria	**CN**
	orthophosphorus	**CS**
1008C_02	*From Saw Dust Road to confluence with Spring Creek*	
	total phosphorus	**CS**
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**

1008F Lake Woodlands (unclassified water body)

		Level of Concern
1008F_01	*Upper end of segment to Northshore Park/Woodlock Forest*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	depressed dissolved oxygen	**CS**
1008F_02	*Northshore Park/Woodlock Forest to inflow from unnamed tributary*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1008F_03	*From inflow of unnamed tributary to dam*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1008F_04	*Arm near dam adjacent to West Isle Drive and Pleasure Cove Drive*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

1008H Willow Creek (unclassified water body)

		Level of Concern
1008H_01	*Entire water body*	
	nitrate	**CS**
	total phosphorus	**CS**

1009 Cypress Creek

		Level of Concern
1009_01	*Upper portion of segment to downstream of US 290*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	depressed dissolved oxygen	**CS**
1009_02	*US 290 to SH 249*	
	impaired habitat	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1009_03	*SH 249 to IH 45*	
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1009_04	*IH 45 to confluence with Spring Creek*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**

1009C Faulkey Gully (unclassified water body)

		Level of Concern
1009C_01	*From an unnamed lake 0.3 miles southeast of Telge Road to the confluence with Cypress Creek*	
	nitrate	**CS**
	total phosphorus	**CS**

1009D Spring Gully (unclassified water body)

		Level of Concern
1009D_01	*Entire water body*	
	nitrate	**CS**
	total phosphorus	**CS**

1009E Little Cypress Creek

		Level of Concern
1009E_01	*Entire water body*	
	ammonia	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

1010 Caney Creek

		Level of Concern
1010_04	*FM 2090 to lower segment boundary*	
	bacteria	**CN**

1011 Peach Creek

		Level of Concern
1011_02	*US Hwy 59 to confluence with Caney Creek*	
	bacteria	**CN**

1012 Lake Conroe

		Level of Concern
1012_03	*Lewis Creek arm*	
	chlorophyll-a	**CS**
1012_04	*Caney Creek arm to Hunters Point*	
	chlorophyll-a	**CS**
1012_05	*Johnson Bluff to FM 1097*	
	chlorophyll-a	**CS**
1012_06	*Little Lake Creek arm to Walden Estates*	
	chlorophyll-a	**CS**
1012_07	*Lewis Creek arm to Bowsprit Point*	
	chlorophyll-a	**CS**
1012_11	*Walden Estates to dam*	
	chlorophyll-a	**CS**

1013 Buffalo Bayou Tidal

		Level of Concern
1013_01	*Entire segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1013A Little White Oak Bayou (unclassified water body)

		Level of Concern
1013A_01	*From the confluence of White Oak Bayou upstream to the RR Tracks north of IH 610*	
	ammonia in water	**CS**
	depressed dissolved oxygen	**CS**

1014 Buffalo Bayou Above Tidal

		Level of Concern
1014_01	*Entire segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1014A Bear Creek (unclassified water body)

		Level of Concern
1014A_01	*Confluence with South Mayde Creek to a point upstream of an unnamed tributary north of Langenbaugh Road*	
	nitrate	**CS**
	total phosphorus	**CS**

1014B Buffalo Bayou (unclassified water body)

		Level of Concern
1014B_01	*From SH6 to the confluence with Willow Fork Buffalo Bayou*	
	nitrate	**CS**

1014E Langham Creek (unclassified water body)

		Level of Concern
1014E_01	*Confluence with Bear Creek upstream to the confluence with Dinner Creek*	
	nitrate	**CS**
	total phosphorus	**CS**

1014H South Mayde Creek (unclassified water body)

		Level of Concern
1014H_01	*From the confluence with Buffalo Bayou upstream to the confluence with an unnamed tributary 0.62 km east of Barker-Cypress Road*	
	nitrate	**CS**
	total phosphorus	**CS**
1014H_02	*From the confluence with an unnamed tributary 0.62 km east of Barker-Cypress Road upstream to an unnamed tributary 1.05 km south of Clay Road*	
	bacteria	**CN**
	nitrate	**CS**
	total phosphorus	**CS**

1014L Mason Creek (unclassified water body)

		Level of Concern
1014L_01	*Confluence with Buffalo Bayou upstream to the channelization south of Franz Rd.*	
	nitrate	**CS**
	total phosphorus	**CS**

1014M Neimans Bayou (unclassified water body)

		Level of Concern
1014M_01	*Entire water body*	
	orthophosphorus	**CS**
	depressed dissolved oxygen	**CS**

1014N Rummel Creek (unclassified water body)

		Level of Concern
1014N_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1016 Greens Bayou Above Tidal

		Level of Concern
1016_01	*Upper segment boundary (FM 1960) to IH 45*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
1016_02	*IH 45 to US 59*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1016_03	*US 59 to lower segment boundary at the Halls Bayou confluence*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1016A Garners Bayou (unclassified water body)

		Level of Concern
1016A_02	*From the confluence with Williams Gully upstream to 1.5 km north of Atascosita Road*	
	total phosphorus	**CS**
	depressed dissolved oxygen	**CS**
1016A_03	*From the confluence with Greens Bayou upstream to the confluence with Williams Gully*	
	total phosphorus	**CS**
	nitrate	**CS**

1016C Unnamed Tributary of Greens Bayou (unclassified water body)

		Level of Concern
1016C_01	*Entire water body*	
	nitrate	**CS**
	total phosphorus	**CS**

1017 Whiteoak Bayou Above Tidal

		Level of Concern
1017_01	*Huffsmith Rd to the confluence with Vogel Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1017_02	*Vogel Creek to the Cole Creek confluence*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1017_03	*Cole Creek confluence to the Brickhouse Gully confluence*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
1017_04	*Brickhouse Gully confluence to lower segment boundary*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**

1017A Brickhouse Gully/Bayou (unclassified water body)

		Level of Concern
1017A_01	*Entire water body*	
	nitrate	**CS**

1017D Unnamed Tributary of Whiteoak Bayou (unclassified water body)

		Level of Concern
1017D_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1101 Clear Creek Tidal

		Level of Concern
1101_01	*Upper segment boundary to Chigger Creek confluence*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
1101_02	*Chigger Creek confluence to IH 45*	
	nitrate	**CS**
	total phosphorus	**CS**
1101_03	*IH45 to Cow Bayou confluence*	
	nitrate	**CS**
	orthophosphorus	**CS**
	bacteria	**CN**
	chlorophyll-a	**CS**
	total phosphorus	**CS**

1101B Chigger Creek (unclassified water body)

		Level of Concern
1101B_02	*FM 528 to the confluence with Clear Creek*	
	bacteria	**CN**

1101D Robinson Bayou (unclassified water body)

		Level of Concern
1101D_01	*From headwater to Abilene St.*	
	depressed dissolved oxygen	**CS**
1101D_02	*From Abilene St. to confluence with Clear Lake*	
	depressed dissolved oxygen	**CS**

1102 Clear Creek Above Tidal

		Level of Concern
1102_01	*Upper segment boundary (Rouen Road) to SH 288*	
	depressed dissolved oxygen	**CS**
1102_02	*SH 288 to Hickory Slough confluence*	
	depressed dissolved oxygen	**CS**
	impaired habitat	**CS**
	orthophosphorus	**CS**
1102_03	*Hickory Slough confluence to Turkey Creek confluence*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1102_04	*Turkey Creek confluence to Mary's Creek confluence*	
	depressed dissolved oxygen	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1102_05	*Mary's Creek confluence to lower segment boundary*	
	bacteria	**CN**
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

1102A Cowart Creek (unclassified water body)

		Level of Concern
1102A_01	*Sunset Drive to SH35*	
	bacteria	**CN**

1102B Mary's Creek/ North Fork Mary's Creek (unclassified water body)

		Level of Concern
1102B_01	*Entire segment*	
	orthophosphorus	**CS**
	total phosphorus	**CS**

1102C Hickory Slough (unclassified water body)

		Level of Concern
1102C_01	*From confluence with Clear Creek to (approx. 0.3 miles) upstream of CR 93*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

1102D Turkey Creek (unclassified water body)

		Level of Concern
1102D_01	*Confluence with Clear Creek to IH 45*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	depressed dissolved oxygen	**CS**

1102E Mud Gully (unclassified water body)

		Level of Concern
1102E_01	*Beamer Road to confluence with Clear Creek*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

1103B Bordens Gully (unclassified water body)

		Level of Concern
1103B_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1103C Geisler Bayou (unclassified water body)

		Level of Concern
1103C_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1104 Dickinson Bayou Above Tidal

		Level of Concern
1104_02	*From FM 517 upstream to FM 528*	
	depressed dissolved oxygen	**CS**

1107 Chocolate Bayou Tidal

		Level of Concern
1107_01	*Entire segment*	
	chlorophyll-a	**CS**

1108 Chocolate Bayou Above Tidal

		Level of Concern
1108_01	*Entire segment*	
	depressed dissolved oxygen	**CS**
	impaired habitat	**CS**

1110 Oyster Creek Above Tidal

		Level of Concern
1110_02	*4 mi upstream South Texas Water Co. Canal to just above Ramsey Prison Unit*	
	ammonia	**CS**
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
1110_03	*From just upstream of Ramsey Prison Unit (Cow Cr) to CR 290/S Walker St.*	
	chlorophyll-a	**CS**

1111 Old Brazos River Channel Tidal

		Level of Concern
1111_01	*Entire segment*	
	nitrate	**CS**

1113 Armand Bayou Tidal

		Level of Concern
1113_01	*Upper segment boundary to confluence with Big Island Slough*	
	depressed dissolved oxygen	**CS**
1113_02	*Big Island Slough confluence to Horsepen Bayou confluence*	
	chlorophyll-a	**CS**
1113_03	*Horsepen Bayou confluence to lower segment boundary (Nasa Rd 1)*	
	chlorophyll-a	**CS**

1113A Armand Bayou Above Tidal (unclassified water body)

		Level of Concern
1113A_01	*0.5 miles downstream of Genoa Red Bluff to Preston Road*	
	depressed dissolved oxygen	**CS**

1113B Horsepen Bayou (unclassified water body)

		Level of Concern
1113B_01	*Confluence with Armand Bayou to SH 3*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1201 Brazos River Tidal

		Level of Concern
1201_01	*Entire segment*	
	nitrate	**CS**

1202H Allen's Creek (unclassified water body)

		Level of Concern
1202H_01	*Entire water body*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**

1202J Big Creek (unclassified water body)

		Level of Concern
1202J_01	*Upstream portion of water body to Whaley-Longpoint Road*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	impaired habitat	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1202J_02	*Downstream portion of water body*	
	chlorophyll-a	**CS**

1202K Mill Creek (unclassified water body)

		Level of Concern
1202K_01	*Downstream portion of creek to confluence with Brazos River*	
	impaired fish community	**CN**

1203 Whitney Lake

		Level of Concern
1203_01	*Portion near dam*	
	depressed dissolved oxygen	**CN**
1203_05	*Nolan River Arm*	
	chlorophyll-a	**CS**
	nitrate	**CS**
1203_06	*Brazos River Arm*	
	chlorophyll-a	**CS**

1205 Lake Granbury

		Level of Concern
1205_01	*Upstream portion of lake*	
	chloride in finished drinking water	**CS**
	demineralization costs	**CS**
	total dissolved solids in finished drinking water	**CS**
1205_02	*Portion of lake adjacent to the City of Oak Trail Shores*	
	chloride in finished drinking water	**CS**
	demineralization costs	**CS**
	total dissolved solids in finished drinking water	**CS**
1205_03	*Portion of lake adjacent to the City of Granbury*	
	chloride in finished drinking water	**CS**
	demineralization costs	**CS**
	total dissolved solids in finished drinking water	**CS**
1205_04	*Portion of lake downstream of Granbury*	
	chloride in finished drinking water	**CS**
	demineralization costs	**CS**
	total dissolved solids in finished drinking water	**CS**
1205_05	*Downstream portion of lake*	
	total dissolved solids in finished drinking water	**CS**
	demineralization costs	**CS**
	chloride in finished drinking water	**CS**

1206 Brazos River Below Possum Kingdom Lake

		Level of Concern
1206_01	*Downstream portion of segment*	
	impaired habitat	**CN**
1206_02	*Middle Portion of Segment*	
	impaired habitat	**CS**

1207 Possum Kingdom Lake

		Level of Concern
1207_01	*Rock Creek arm of lake*	
	demineralization costs	**CS**
1207_02	*Deep Elm Creek arm*	
	demineralization costs	**CS**
1207_03	*Portion of segment west of SH 16*	
	demineralization costs	**CS**
1207_04	*Portion of lake containing Costello Island*	
	demineralization costs	**CS**
1207_07	*Portion of lake adjacent to northeast corner of state park*	
	demineralization costs	**CS**
1207_08	*Caddo Creek arm of lake*	
	demineralization costs	**CS**
1207_09	*Portion of lake south of FM 2951*	
	demineralization costs	**CS**
1207_10	*Bluff Creek arm of lake*	
	demineralization costs	**CS**
1207_11	*Jewell Creek arm of lake*	
	demineralization costs	**CS**
1207_12	*Downstream portion of lake*	
	demineralization costs	**CS**

1208 Brazos River Above Possum Kingdom Lake

		Level of Concern
1208_01	*From confluence with Possum Kingdom upstream to confluence with spring Branch*	
	chlorophyll-a	**CS**
	bacteria	**CN**
1208_05	*From confluence with Millers Creek upstream to confluence with Lake Creek*	
	chlorophyll-a	**CS**

1208A Millers Creek Reservoir (unclassified water body)

		Level of Concern
1208A_01	*entire water body*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

1209 Navasota River Below Lake Limestone

		Level of Concern
1209_01	*From lower segment boundary to confluence with Rocky Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**

1209A Country Club Lake (unclassified water body)

		Level of Concern
1209A_01	*Entire reservoir*	
	orthophosphorus	**CS**
	total phosphorus	**CS**

1209B Fin Feather Lake (unclassified water body)

		Level of Concern
1209B_01	*Entire reservoir*	
	orthophosphorus	**CS**
	copper in sediment	**CS**
	arsenic in sediment	**CS**
	ammonia	**CS**
	chromium in sediment	**CS**

1209C Carters Creek (unclassified water body)

		Level of Concern
1209C_01	*Entire water body*	
	orthophosphorus	**CS**
	nitrate	**CS**

1209G Cedar Creek (unclassified water body)

		Level of Concern
1209G_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1209H Duck Creek (unclassified water body)

		Level of Concern
1209H_02	*From FM 2096 to Twin Oak Reservoir dam*	
	depressed dissolved oxygen	**CS**

1209J Shepherd Creek (unclassified water body)

		Level of Concern
1209J_01	*Entire water body*	
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**

1209L Burton Creek (unclassified water body)

		Level of Concern
1209L_01	*entire water body*	
	nitrate	**CS**
	orthophosphorus	**CS**

1210 Lake Mexia

		Level of Concern
1210_01	*Eastern end of reservoir, from dam to RR 2681 east of Washington Park*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
1210_02	*Western end, from point where reservoir begins to widen, to upper end*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	orthophosphorus	**CS**

1212 Somerville Lake

		Level of Concern
1212_01	*Eastern end of reservoir near dam*	
	chlorophyll-a	**CS**
1212_03	*Middle of reservoir near Birch Creek State Park*	
	chlorophyll-a	**CS**
1212_04	*Western end of reservoir near upper segment boundary*	
	chlorophyll-a	**CS**

1212B East Yegua Creek (unclassified water body)

		Level of Concern
1212B_01	*Lower 25 miles*	
	bacteria	**CN**

1213 Little River

		Level of Concern
1213_01	*From the confluence with Brazos River upstream to confluence with City of Cameron WWTP receiving water*	
	atrazine in finished drinking water	**CS**
	nitrate	**CS**
1213_02	*From the City of Cameron WWTP receiving water upstream to the confluence with the San Gabriel River*	
	atrazine in finished drinking water	**CS**
	nitrate	**CS**
1213_03	*From confluence with San Gabriel River upstream to confl. with Boggy Creek*	
	atrazine in finished drinking water	**CS**
	nitrate	**CS**
1213_04	*From confluence with Boggy Creek upstream to its confluence with Leon and Lampasas Rivers*	
	atrazine in finished drinking water	**CS**
	bacteria	**CN**

1214 San Gabriel River

		Level of Concern
1214_01	*From confluence with Little River upstream to confl. with Alligator Creek*	
	nitrate	**CS**

1218 Nolan Creek/ South Nolan Creek

		Level of Concern
1218_01	*Entire segment*	
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1219 Leon River Below Belton Lake

		Level of Concern
1219_01	*Entire segment*	
	nitrate	**CS**
	orthophosphorus	**CS**

1220 Belton Lake

		Level of Concern
1220_03	*Leon River Arm*	
	nitrate	**CS**

1221 Leon River Below Proctor Lake

		Level of Concern
1221_01	*Directly upstream of Lake Belton*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
1221_04	*From the confluence with Plum Creek, upstream to the confluence with Pecan Creek*	
	bacteria	**CN**
1221_05	*From confluence with Pecan Creek, upstream to confluence with South Leon Creek*	
	depressed dissolved oxygen	**CS**
	chlorophyll-a	**CS**
1221_06	*From confluence with South Leon Creek upstream to confluence with Walnut Creek*	
	chlorophyll-a	**CS**
1221_07	*From the confluence with Walnut Creek upstream to Lake Proctor*	
	depressed dissolved oxygen	**CS**
	chlorophyll-a	**CS**

1221A Resley Creek (unclassified water body)

		Level of Concern
1221A_01	*Downstream portion, from confluence with Leon River upstream to conf. with unnamed tributary, approx. 1.0 mile N. of Comanche County Line*	
	bacteria	**CN**
	chlorophyll-a	**CS**
1221A_02	*From confluence with unnamed tributary, upstream to end of water body, approx. 1.0 mile north west of Dublin*	
	nitrate	**CS**
	orthophosphorus	**CS**

1221B South Leon River (unclassified water body)

		Level of Concern
1221B_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1221D Indian Creek (unclassified water body)

		Level of Concern
1221D_01	*From confluence with Leon River, upstream to confluence with Armstrong Creek*	
	depressed dissolved oxygen	**CN**
1221D_02	*From confluence with Armstrong Creek upstream to headwaters of water body*	
	nitrate	**CS**
	orthophosphorus	**CS**

1222 Proctor Lake

		Level of Concern
1222_01	*Sabana River arm of lake*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
1222_02	*Copperas / Duncan Creeks arm of lake.*	
	chlorophyll-a	**CS**
1222_03	*Portion of water body near dam*	
	chlorophyll-a	**CS**

1222A Duncan Creek (unclassified water body)

		Level of Concern
1222A_01	*Entire creek*	
	chlorophyll-a	**CS**

1223 Leon River Below Leon Reservoir

		Level of Concern
1223_01	*Entire Segment*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1224 Leon Reservoir

		Level of Concern
1224_01	*Portion near dam*	
	manganese in sediment	**CS**
1224_02	*Headwater portion*	
	manganese in sediment	**CS**

1225 Waco Lake

		Level of Concern
1225_01	*North Bosque River arm of lake*	
	chlorophyll-a	**CS**
	nitrate	**CS**
1225_02	*Portion of lake near dam*	
	nitrate	**CS**
1225_03	*Middle/South Bosque River arm of lake*	
	chlorophyll-a	**CS**
	nitrate	**CS**

1226 North Bosque River

		Level of Concern
1226_02	*Portion of segment near Clifton*	
	depressed dissolved oxygen	**CN**
1226_03	*Portion of segment near Meridian*	
	chlorophyll-a	**CS**
1226_04	*Upstream portion of segment near Hico*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**

1226B Green Creek (unclassified water body)

		Level of Concern
1226B_01	*Entire water body*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1226E Indian Creek (unclassified water body)

		Level of Concern
1226E_01	*Entire water body*	
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**

1226K Little Duffau Creek (unclassified water body)

		Level of Concern
1226K_01	*entire water body*	
	orthophosphorus	**CS**
	total phosphorus	**CS**

1226M Little Green Creek (unclassified water body)

		Level of Concern
1226M_01	*entire water body*	
	bacteria	**CN**

1226N Indian Creek Reservoir (unclassified water body)

		Level of Concern
1226N_01	*entire water body*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
	chlorophyll-a	**CS**

1226O Sims Creek Reservoir (unclassified water body)

		Level of Concern
1226O_01	*entire water body*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1227 Nolan River

		Level of Concern
1227_01	*Downstream portion, including Mustang Creek confluence*	
	chlorophyll-a	**CS**
	nitrate	**CS**
1227_02	*Upstream portion, to Lake Pat Cleburne*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1229A Squaw Creek Reservoir (unclassified water body)

		Level of Concern
1229A_01	*Entire water body*	
	orthophosphorus	**CS**
	total phosphorus	**CS**

1231 Lake Graham

		Level of Concern
1231_01	*Entire segment*	
	total dissolved solids	**CN**

1232 Clear Fork Brazos River

		Level of Concern
1232_02	*From confluence with Hubbard Creek upstream to confluence with Deadman Creek*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1232_03	*From confluence with Deadman Creek upstream to conf. With Bitter Creek*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1232A California Creek (unclassified water body)

		Level of Concern
1232A_01	*Middle 25 miles near RR 142*	
	chlorophyll-a	**CS**
	nitrate	**CS**

1232B Deadman Creek (unclassified water body)

		Level of Concern
1232B_01	*From the confluence with Clear Fork Brazos, upstream to city of Abilene WWTP receiving water*	
	nitrate	**CS**
	orthophosphorus	**CS**

1233 Hubbard Creek Reservoir

		Level of Concern
1233_02	*Hubbard Creek Arm*	
	depressed dissolved oxygen	**CS**

1233A Big Sandy Creek (unclassified water body)

		Level of Concern
1233A_01	*entire water body*	
	bacteria	**CN**

1235 Lake Stamford

		Level of Concern
1235_01	*Entire segment*	
	chloride in finished drinking water	**CS**
	depressed dissolved oxygen	**CS**

1236 Fort Phantom Hill Reservoir

		Level of Concern
1236_01	*Entire segment* demineralization costs	**CS**

1238 Salt Fork Brazos River

		Level of Concern
1238_01	*25 miles near Hwy 83* depressed dissolved oxygen	**CS**
1238_02	*25 miles near Hwy 380 at Swenson* temperature	**CN**

1240 White River Lake

		Level of Concern
1240_01	*Entire segment* sulfate	**CN**

1241 Double Mountain Fork Brazos River

		Level of Concern
1241_01	*25 miles near Hwy 83* total dissolved solids	**CN**
1241_02	*Remainder of segment* total dissolved solids	**CN**

1241A North Fork Double Mountain Fork Brazos River (unclassified water body)

		Level of Concern
1241A_01	*From confluence with Dbl. Mtn. Frk. Of Brazos to Lake Ransom Canyon*	
	ammonia	**CS**
	chlorophyll-a	**CS**
1241A_02	*Upstream portion, from confluence with Yellow House Draw to Lake Buffalo Springs*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**

1241C Buffalo Springs Lake (unclassified water body)

		Level of Concern
1241C_01	*entire water body*	
	chlorophyll-a	**CS**

1242 Brazos River Above Navasota River

		Level of Concern
1242_01	*Downstream portion of segment*	
	demineralization costs	**CS**
1242_02	*Portion of segment upstream of Bryan*	
	demineralization costs	**CS**
1242_03	*Middle portion of segment*	
	demineralization costs	**CS**
1242_04	*Portion of segment downstream of Marlin*	
	demineralization costs	**CS**
1242_05	*Portion of Segment downstream of Waco*	
	demineralization costs	**CS**
1242_06	*Portion of Segment within Waco City Limits*	
	demineralization costs	**CS**

1242A Marlin City Lake System (unclassified water body)

		Level of Concern
1242A_01	*Old Marlin City Lake*	
	atrazine in finished drinking water	**CS**
	chlorophyll-a	**CS**
	total phosphorus	**CS**
1242A_02	*New Marlin City Lake*	
	atrazine in finished drinking water	**CS**
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1242B Cottonwood Branch (unclassified water body)

		Level of Concern
1242B_01	*Downstream portion, downstream of Sanderson Farms receiving water*	
	nitrate	**CS**
	orthophosphorus	**CS**
1242B_02	*Upstream portion, upstream of Sanderson Farms receiving water*	
	bacteria	**CN**

1242C Still Creek (unclassified water body)

		Level of Concern
1242C_01	*Downstream of Bryan WWTP*	
	nitrate	**CS**
	orthophosphorus	**CS**

1242D Thompson Creek (unclassified water body)

		Level of Concern
1242D_01	*Portion downstream of the confluence with Still Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**
1242D_02	*Portion of segment upstream of confluence with Still Creek*	
	ammonia	**CS**
	chlorophyll-a	**CS**

1242F Pond Creek (unclassified water body)

		Level of Concern
1242F_01	*From the Brazos confluence upstream to Live Oak Creek confluence*	
	bacteria	**CN**
	nitrate	**CS**

1242I Campbells Creek (unclassified water body)

		Level of Concern
1242I_01	*Entire water body*	
	bacteria	**CN**

1242J Deer Creek (unclassified water body)

		Level of Concern
1242J_01	*Entire water body*	
	nitrate	**CS**

1242M Spring Creek (unclassified water body)

		Level of Concern
1242M_01	*Entire water body*	
	bacteria	**CN**

1243 Salado Creek

		Level of Concern
1243_01	*Downstream portion of segment from confluence with Lampasas River, just upstream of Stagecoach outfall*	
	nitrate	**CS**
1243_02	*From confluence with unnamed tributary just upstream of Stagecoach discharge upstream to end of segment*	
	nitrate	**CS**

1244 Brushy Creek

		Level of Concern
1244_03	*From confluence with Cottonwood Branch upstream to City of Round Rock WWTP outfall*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1244A Brushy Creek Above South Brushy Creek (unclassified water body)

		Level of Concern
1244A_01	*Entire segment*	
	orthophosphorus	**CS**

1244D South Brushy Creek (unclassified water body)

		Level of Concern
1244D_01	*entire water body*	
	nitrate	**CS**

1245 Upper Oyster Creek

		Level of Concern
1245_01	*From the confluence with the Brazos River upstream to Dam #3*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1245_02	*From Dam #3 upstream to Harmon St. crossing in Sugar Land*	
	bacteria	**CN**
1245_03	*From Harmon St. crossing in Sugar Land upstream to the end of the segment*	
	depressed dissolved oxygen	**CN**
	chlorophyll-a	**CS**

1245B Brown's Bayou (unclassified water body)

		Level of Concern
1245B_01	*entire water body*	
	bacteria	**CN**

1246 Middle Bosque/South Bosque River

		Level of Concern
1246_01	*Middle Bosque River*	
	nitrate	**CS**
1246_02	*South Bosque River*	
	nitrate	**CS**

1246D Tonk Creek (unclassified water body)

		Level of Concern
1246D_01	*Entire water body*	
	nitrate	**CS**

1246E Wasp Creek (unclassified water body)

		Level of Concern
1246E_01	*Entire water body*	
	nitrate	**CS**

1247 Granger Lake

		Level of Concern
1247_01	*Eastern end of lake near the dam*	
	nitrate	**CS**
1247_02	*Willis Creek arm of lake*	
	nitrate	**CS**
1247_03	*Western end of lake on the San Gabriel River*	
	nitrate	**CS**

1247A Willis Creek (unclassified water body)

		Level of Concern
1247A_01	*Entire water body*	
	nitrate	**CS**

1248B Huddleston Branch (unclassified water body)

		Level of Concern
1248B_01	*Entire reach*	
	bacteria	**CN**
	nitrate	**CS**

1248C Mankins Branch (unclassified water body)

		Level of Concern
1248C_01	*Entire water body*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1250 South Fork San Gabriel River

		Level of Concern
1250_03	*From CR 279 crossing to upper end of segment*	
	depressed dissolved oxygen	**CS**

1252 Lake Limestone

		Level of Concern
1252_01	*South end of lake near dam*	
	depressed dissolved oxygen	**CS**
1252_05	*Navasota River Arm near headwaters*	
	chlorophyll-a	**CS**

1253 Navasota River Below Lake Mexia

		Level of Concern
1253_02	*From confluence with Plummer's Creek upstream to Springfield Lake*	
	depressed dissolved oxygen	**CS**
1253_03	*From headwaters of Springfield Lake upstream to confluence with Lake Mexia*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1253A Springfield Lake (unclassified water body)

		Level of Concern
1253A_01	*Entire water body*	
	depressed dissolved oxygen	**CN**
	chlorophyll-a	**CS**

1254 Aquilla Reservoir

		Level of Concern
1254_01	*South end of reservoir near dam*	
	atrazine in finished drinking water	**CS**
	nitrate	**CS**
1254_02	*Aquilla Creek arm on the west*	
	atrazine in finished drinking water	**CS**
	nitrate	**CS**
1254_03	*Hackberry Creek arm on the east*	
	nitrate	**CS**
	nickel in sediment	**CS**
	atrazine in finished drinking water	**CS**
	arsenic in sediment	**CS**

1255 Upper North Bosque River

		Level of Concern
1255_01	*Lower portion of segment downstream of Stephenville*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	bacteria	**CN**
1255_02	*Upper portion of segment, upstream of Stephenville*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**

1255A Goose Branch (unclassified water body)

		Level of Concern
1255A_01	*Entire water body*	
	ammonia	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	bacteria	**CN**
	orthophosphorus	**CS**

1255B North Fork Upper North Bosque River (unclassified water body)

		Level of Concern
1255B_01	*Entire water body*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1255C Scarborough Creek (unclassified water body)

		Level of Concern
1255C_01	*Entire water body*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1255D South Fork North Bosque River (unclassified water body)

		Level of Concern
1255D_01	*Entire water body*	
	chlorophyll-a	**CS**

1255H South Fork Upper North Bosque River Reservoir (unclassified water body)

		Level of Concern
1255H_01	*entire water body*	
	depressed dissolved oxygen	**CS**

1255J Goose Branch Reservoir (unclassified water body)

		Level of Concern
1255J_01	*entire water body*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**
	ammonia	**CS**
	total phosphorus	**CS**

1255K Scarborough Creek Reservoir (unclassified water body)

		Level of Concern
1255K_01	*entire water body*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1256 Brazos River/Lake Brazos

		Level of Concern
1256_02	*Lake Brazos portion of segment*	
	chlorophyll-a	**CS**

1301 San Bernard River Tidal

		Level of Concern
1301_01	*Entire Segment*	
	chlorophyll-a	**CS**

1302 San Bernard River Above Tidal

		Level of Concern
1302_02	*25 miles from just upstream of FM 442 to downstream of US 90A*	
	depressed dissolved oxygen	**CS**
1302_03	*25 miles from downstream of US 90A to upstream of FM 3013*	
	depressed dissolved oxygen	**CS**

1302A Gum Tree Branch (unclassified water body)

		Level of Concern
1302A_01	*The entire 15 miles of the segment*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

1302B West Bernard Creek (unclassified water body)

		Level of Concern
1302B_01	*Lower 15 miles of segment*	
	depressed dissolved oxygen	**CS**
1302B_02	*Upper 25 miles of segment*	
	depressed dissolved oxygen	**CS**

1304 Caney Creek Tidal

		Level of Concern
1304_01	*Lower 25 miles of segment*	
	depressed dissolved oxygen	**CS**
	depressed dissolved oxygen	**CN**
	chlorophyll-a	**CS**
1304_02	*Upper 7 miles of segment*	
	bacteria	**CN**

1304A Linnville Bayou (unclassified water body)

		Level of Concern
1304A_01	*Entire water body*	
	nitrate	**CS**

1305 Caney Creek Above Tidal

		Level of Concern
1305_02	*25 miles surrounding SH 35*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
1305_03	*Upper 55 miles of segment*	
	depressed dissolved oxygen	**CN**

1401 Colorado River Tidal

		Level of Concern
1401_01	*Entire segment*	
	nitrate	**CS**

1402 Colorado River Below La Grange

		Level of Concern
1402_01	*Lower end to Wharton County line*	
	chlorophyll-a	**CS**
1402_02	*Wharton County line to US 59*	
	chlorophyll-a	**CS**
1402_06	*Cummins Creek to 5 mi above Fayette County line*	
	nitrate	**CS**
1402_07	*Upper 17 miles of segment*	
	orthophosphorus	**CS**
	nitrate	**CS**

1402A Cummins Creek (unclassified water body)

		Level of Concern
1402A_01	*From the confluence with the Colorado River upstream to the confluence of Boggy Creek at FM 1291 in Colorado County*	
	impaired habitat	**CS**

1402C Buckners Creek (unclassified water body)

		Level of Concern
1402C_01	*Entire water body*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1402G Fayette Reservoir (unclassified water body)

		Level of Concern
1402G_02	*Near intake canal*	
	chlorophyll-a	**CS**
1402G_03	*Mid-lake near dam*	
	chlorophyll-a	**CS**

1402H Skull Creek (unclassified water body)

		Level of Concern
1402H_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

1403 Lake Austin

		Level of Concern
1403_01	*From Tom Miller dam to Loop 360 bridge*	
	manganese in sediment	**CS**

1403D Barrow Preserve Tributary (unclassified water body)

		Level of Concern
1403D_01	*Entire water body*	
	nitrate	**CS**

1403E Stillhouse Hollow (unclassified water body)

		Level of Concern
1403E_01	*Entire water body*	
	nitrate	**CS**

1403K Taylor Slough South (unclassified water body)

		Level of Concern
1403K_01	*Entire water body*	
	nitrate	**CS**

1404 Lake Travis

		Level of Concern
1404_05	*From the confluence with Cow Creek upstream to the confluence of the Pedernales River*	
	depressed dissolved oxygen	**CS**
1404_06	*From the confluence with the Pedernales River upstream to Muleshoe Bend*	
	depressed dissolved oxygen	**CS**

1406 Lake Lyndon B. Johnson

		Level of Concern
1406_01	*From Alvin Wirtz Dam upstream to Granite Shoals*	
	depressed dissolved oxygen	**CS**
1406_06	*From a point near Pair Lane in Kingsland upstream to Roy Inks Dam*	
	depressed dissolved oxygen	**CS**

1407 Inks Lake

		Level of Concern
1407_01	*From Roy Inks Dam upstream to the Clear Creek Arm*	
	manganese in sediment	**CS**
1407_02	*From Clear Creel Arm upstream to Buchanan Dam*	
	depressed dissolved oxygen	**CS**

1407A Clear Creek

		Level of Concern
1407A_01	*From the confluence with Inks Lake upstream to FM 2341*	
	pH	**CN**
	sulfate	**CN**
	total dissolved solids	**CN**

1408 Lake Buchanan

		Level of Concern
1408_05	*From the Willow Slough area upstream to the Headwaters near the Yancey Creek confluence*	
	chlorophyll-a	**CS**

1410 Colorado River Below O. H. Ivie Reservoir

		Level of Concern
1410_01	*From the confluence of the San Saba River upstream to the confluence of Indian Creek*	
	chlorophyll-a	**CS**

1411 E. V. Spence Reservoir

		Level of Concern
1411_01	*Main pool from the dam upstream to the Rough Creek confluence area*	
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**
1411_02	*From the Rough Creek confluence area upstream to the confluence of Little Silver Creek*	
	harmful algal bloom/golden alga	**CN**

1412 Colorado River Below Lake J. B. Thomas

		Level of Concern
1412_01	*From the confluence of Little Silver Creek upstream to the confluence of Beals Creek*	
	chlorophyll-a	**CS**
1412_02	*From the confluence of Beals Creek upstream to the dam below Barber Reservoir pump station*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
1412_03	*From the dam below Barber Reservoir pump station upstream to the confluence of Deep Creek*	
	chlorophyll-a	**CS**

1412A Lake Colorado City (unclassified water body)

		Level of Concern
1412A_01	*Entire water body*	
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**

1412B Beals Creek (unclassified water body)

		Level of Concern
1412B_03	*From the confluence of Gutherie Draw upstream to the confluence of Mustang Draw and Sulphur Springs Draw*	
	bacteria	**CN**
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1416A Brady Creek (unclassified water body)

		Level of Concern
1416A_02	*From the confluence of an unnamed tributary approximately 5 km east of FM 2309 east of Brady upstream to FM 714*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1416A_03	*From FM 714 upstream to Brady Lake dam*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1417 Lower Pecan Bayou

		Level of Concern
1417_01	*Entire water body*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**

1418 Lake Brownwood

		Level of Concern
1418_01	*Mid-lake near dam*	
	manganese in sediment	**CS**

1420 Pecan Bayou Above Lake Brownwood

		Level of Concern
1420_01	*Lower 25 miles*	
	chlorophyll-a	**CS**

1421 Concho River

		Level of Concern
1421_01	*Downstream end to Chandler Lake confluence*	
	chlorophyll-a	**CS**
1421_02	*From Chandler Lake confluence upstream to confluence of Puddle Ck.*	
	nitrate	**CS**
	orthophosphorus	**CS**
1421_03	*From the confluence of Puddle Creek upstream to the confluence of Willow Creek*	
	orthophosphorus	**CS**
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
1421_04	*From the confluence of Willow Creek upstream to the confluence of an unnamed tributary near Chandler Road*	
	nitrate	**CS**
	chlorophyll-a	**CS**
1421_05	*From the confluence of an unnamed tributary near Chandler Rd. upstream to the confluence of Red Ck.*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
1421_06	*From the confluence of Red Creek upstream to the dam near Vines Rd.*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
1421_07	*From the dam near Vines Road upstream to the confluence of the North Concho River and the South Concho River*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
1421_08	*North Concho River, from the confluence with the South Concho River upstream to O.C. Fisher dam*	
	chlorophyll-a	**CS**
1421_09	*South Concho River, from the confluence with the North Concho upstream to Nasworthy Dam*	
	depressed dissolved oxygen	**CS**

1421A Dry Hollow Creek (unclassified water body)

		Level of Concern
1421A_01	*Entire water body*	
	nitrate	**CS**

1423 Twin Buttes Reservoir

		Level of Concern
1423_01	*North pool*	
	nitrate	**CS**
	orthophosphorus	**CS**
1423_02	*South pool*	
	orthophosphorus	**CS**

1423B Dove Creek (unclassified water body)

		Level of Concern
1423B_01	*From the confluence of Spring Creek upstream to RR 915*	
	depressed dissolved oxygen	**CS**

1425 O. C. Fisher Lake

		Level of Concern
1425_01	*Entire reservoir*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1425A North Concho River (unclassified water body)

		Level of Concern
1425A_02	*Sterling County line to SH 163*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

1426 Colorado River Below E. V. Spence Reservoir

		Level of Concern
1426_01	*Lower end of segment to Country Club Lake*	
	chlorophyll-a	**CS**
1426_02	*Country Club Lake to Coke County line*	
	chlorophyll-a	**CS**
1426_03	*Coke County line to SH 208*	
	chlorophyll-a	**CS**
1426_04	*SH 208 to dam*	
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**

1426A Oak Creek Reservoir (unclassified water body)

		Level of Concern
1426A_01	*Entire water body*	
	sulfate in finished drinking water	**CS**

1426C Bluff Creek (unclassified water body)

		Level of Concern
1426C_01	*From the confluence with Elm Creek upstream to the confluence of Mill Creek*	
	nitrate	**CS**

1426D Coyote Creek (unclassified water body)

		Level of Concern
1426D_01	*Entire water body*	
	nitrate	**CS**

1427A Slaughter Creek (unclassified water body)

		Level of Concern
1427A_01	*Entire water body*	
	depressed dissolved oxygen	**CN**

1427G Granada Hills Tributary to Slaughter Creek (unclassified water body)

		Level of Concern
1427G_01	*Entire water body*	
	nitrate	**CS**

1428 Colorado River Below Town Lake

		Level of Concern
1428_01	*Lower end of segment to Gilleland Creek confluence*	
	impaired fish community	**CN**
	impaired macrobenthos community	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1428B Walnut Creek (unclassified water body)

		Level of Concern
1428B_01	*From the Colorado River upstream to FM 969*	
	bacteria	**CN**
1428B_04	*From Dessau Rd. upstream to MoPac/Loop 1*	
	impaired macrobenthos community	**CN**
1428B_05	*From MoPac/Loop 1 upstream to railroad tracks west of Loop 1*	
	bacteria	**CN**

1428C Gilleland Creek (unclassified water body)

		Level of Concern
1428C_01	*From the Colorado River upstream to Taylor Lane*	
	orthophosphorus	**CS**
	nitrate	**CS**
1428C_02	*From Taylor Lane upstream to Old Highway 20*	
	bacteria	**CN**
	nitrate	**CS**
1428C_03	*From Old Highway 20 to Cameron Road*	
	bacteria	**CN**
1428C_04	*From Cameron Road to the spring source*	
	bacteria	**CN**

1429 Town Lake

		Level of Concern
1429_01	*Longhorn Dam upstream to Lamar Street bridge*	
	nitrate	**CS**

1429C Waller Creek (unclassified water body)

		Level of Concern
1429C_01	*From the confluence with Town Lake to East MLK Blvd.*	
	bacteria	**CN**
1429C_02	*From East MLK Blvd. to East 41st Street*	
	fluoranthene in sediment	**CS**
	pyrene in sediment	**CS**
	phenanthrene in sediment	**CS**
	bacteria	**CN**
	lead in sediment	**CS**
	chrysene in sediment	**CS**
	benz(a)antracene in sediment	**CS**
	benzo(a)pyrene in sediment	**CS**
	dibenz(a,h)anthracene in sediment	**CS**

1429D East Bouldin Creek (unclassified water body)

		Level of Concern
1429D_01	*Entire water body*	
	pyrene in sediment	**CS**
	benz(a)antracene in sediment	**CS**
	cadmium in sediment	**CS**
	chrysene in sediment	**CS**
	dibenz(a,h)anthracene in sediment	**CS**
	fluoranthene in sediment	**CS**
	lead in sediment	**CS**
	phenanthrene in sediment	**CS**

1430 Barton Creek

		Level of Concern
1430_02	*From Barton Springs Pool upstream dam to a point 2 miles upstream of Loop 1*	
	toxic sediment (LOE)	**CN**
1430_04	*SH 71 upstream to Hays County Line*	
	depressed dissolved oxygen	**CS**

1430A Barton Springs (unclassified water body)

		Level of Concern
1430A_01	*Barton Springs Pool - entire water body*	
	toxic sediment (LOE)	**CN**

1430B Tributaries to Barton Creek (unclassified water bodies)

		Level of Concern
1430B_01	*Tributaries entering Barton Cr from a point 2 mi upstream of Loop 1 upstream to Barton Creek Blvd.*	
	nitrate	**CS**

1431 Mid Pecan Bayou

		Level of Concern
1431_01	*Entire water body*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1434 Colorado River above La Grange

		Level of Concern
1434_02	*Southern-Pacific RR upstream to the confluence of Reeds Creek west of Smithville*	
	nitrate	**CS**
	orthophosphorus	**CS**
1434_03	*From the confluence of Reeds Creek west of Smithville upstream to the end of segment*	
	nitrate	**CS**
	orthophosphorus	**CS**

1434B Cedar Creek (unclassified water body)

		Level of Concern
1434B_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

1501 Tres Palacios Creek Tidal

		Level of Concern
1501_01	*Entire segment*	
	chlorophyll-a	**CS**

1602 Lavaca River Above Tidal

		Level of Concern
1602_01	*Upper 29 miles of segment*	
	chlorophyll-a	**CS**

1604 Lake Texana

		Level of Concern
1604_01	*Navidad River arm of Lake Texana*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
1604_02	*East Mustang Creek arm of Lake Texana*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1604_03	*Upstream middle portion of Lake Texana*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1604_04	*Downstream middle portion of Lake Texana*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1604_05	*Downstream portion of Lake Texana*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1701 Victoria Barge Canal

		Level of Concern
1701_01	*Entire segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**

1801 Guadalupe River Tidal

		Level of Concern
1801_01	*Entire segment*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**

1802 Guadalupe River Below San Antonio River

		Level of Concern
1802_01	*Entire segment*	
	nitrate	**CS**

1803C Peach Creek (unclassified water body)

		Level of Concern
1803C_01	*Lower 25 miles of water body*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**
1803C_03	*From approx. 1.2 mi. downstream of FM 1680 in Gonzales Co. to confluence with Elm Cr. In Fayette Co.*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

1804A Geronimo Creek (unclassified water body)

		Level of Concern
1804A_01	*Entire water body*	
	nitrate	**CS**

1805 Canyon Lake

		Level of Concern
1805_02	*North end of Crane's Mill Park peninsula to south end of Canyon Park*	
	orthophosphorus	**CS**
1805_03	*Upper end of segment*	
	orthophosphorus	**CS**
1805_04	*Lower end of reservoir from dam upstream to Canyon Park*	
	orthophosphorus	**CS**

1810 Plum Creek

		Level of Concern
1810_01	*Confluence with San Marcos River to approx. 2.5 mi. upstream of the confluence with Clear Fork Plum Creek*	
	nitrate	**CS**
1810_02	*From approx. 2.5 mi. upstream of confluence with Clear Fork Plum Ck to approx. 0.5 mi upstream of SH21*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1810_03	*From approx. 0.5 mi. upstream of SH 21 to upper end of segment*	
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

1813 Upper Blanco River

		Level of Concern
1813_05	*From Hays CR 1492 to Blanco CR 406*	
	depressed dissolved oxygen	**CS**

1817 North Fork Guadalupe River

		Level of Concern
1817_01	*Entire segment*	
	depressed dissolved oxygen	**CS**

1901 Lower San Antonio River

		Level of Concern
1901_01	*25 miles downstream of the confluence with Manahuilla Creek*	
	total phosphorus	**CS**
	nitrate	**CS**
1901_02	*25 miles upstream of Manahuilla Creek*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	bacteria	**CN**
	nitrate	**CS**
1901_03	*From 25 miles upstream of Manahuilla Cr to 9 mi downstream of Escondido Cr*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1901_04	*9 miles downstream of Escondido Creek*	
	bacteria	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1901_05	*From upstream end of segment to Escondido Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**
	impaired fish community	**CN**
	total phosphorus	**CS**
1901_06	*Lower 31 miles of segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1902 Lower Cibolo Creek

		Level of Concern
1902_01	*Lower 5 miles of segment*	
	bacteria	**CN**
	nitrate	**CS**
1902_03	*From FM 541 to confluence with Clifton Branch*	
	impaired fish community	**CN**
1902_04	*From confluence with Clifton Branch to the confluence with Elm Creek*	
	nitrate	**CS**
	orthophosphorus	**CS**
1902_05	*Upper end of segment*	
	total phosphorus	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

1903 Medina River Below Medina Diversion Lake

		Level of Concern
1903_01	*Lower 5 miles of segment*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	nitrate	**CS**
1903_02	*From 5 mi upstream of San Antonio River to 1.5 mi upstream of Leon Creek*	
	nitrate	**CS**
	total phosphorus	**CS**
1903_03	*From 1.5 miles upstream of Leon Cr to confluence with Live Oak Slough*	
	impaired fish community	**CN**
	nitrate	**CS**
1903_04	*From confluence with Live Oak Slough to upstream 25 miles*	
	nitrate	**CS**
1903_05	*Upper 32 miles of segment*	
	impaired fish community	**CN**

1905 Medina River Above Medina Lake

		Level of Concern
1905_01	*From lower end of segment to RR 470, upstream of Bandera*	
	impaired habitat	**CS**
1905_02	*Remainder of segment*	
	impaired fish community	**CN**

1906 Lower Leon Creek

		Level of Concern
1906_01	*Lower 3 miles of segment*	
	nitrate	**CS**
	silver in sediment	**CS**
1906_02	*From 3 miles upstream lower end of segment to confluence with Indian Creek*	
	silver in sediment	**CS**
1906_03	*From confluence with Indian Creek to Hwy 353*	
	silver in sediment	**CS**
1906_04	*From Hwy 353 to two miles upstream*	
	bacteria	**CN**
	silver in sediment	**CS**
1906_05	*From 2 miles upstream of Hwy 353 to Hwy 90*	
		CS
	silver in sediment	**CS**
1906_06	*Remainder of segment*	
	impaired fish community	**CN**
	ammonia	**CS**
	impaired habitat	**CS**
	silver in sediment	**CS**

1908 Upper Cibolo Creek

		Level of Concern
1908_01	*From confl. with Balcones Ck. to approx. 2 mi. upstream of Hwy 87 in Boerne*	
	impaired habitat	**CS**
	orthophosphorus	**CS**
1908_02	*From approx. 2 mi. upstream of Hwy 87 in Boerne to upper end of segment*	
	ammonia	**CS**

1910 Salado Creek

		Level of Concern
1910_02	*From confluence with Rosillo Creek to Roland Road*	
	impaired fish community	**CN**
1910_03	*From Roland Road to Rice Road*	
	depressed dissolved oxygen	**CS**
1910_05	*From IH 10 to approx 1.5 miles upstream of IH 35*	
	impaired fish community	**CN**
1910_06	*From approx. 1.5 miles upstream of IH 35 to Hwy 368*	
	bacteria	**CN**
	impaired fish community	**CN**
1910_07	*From Hwy 368 to approx 1.5 miles upstream of Loop 410*	
	depressed dissolved oxygen	**CS**
	impaired habitat	**CS**

1910A Walzem Creek (unclassified water body)

		Level of Concern
1910A_01	*Lower 0.25 miles*	
	bacteria	**CN**

1911 Upper San Antonio River

		Level of Concern
1911_01	*Lower 6 miles of segment*	
	nitrate	**CS**
	total phosphorus	**CS**
1911_02	*From 6 miles upstream of lower end of segment to confluence with Picosa Cr*	
	nitrate	**CS**
	total phosphorus	**CS**
1911_03	*From confluence with Picosa Creek to approx. 2.5 miles upstream of FM 536*	
	nitrate	**CS**
1911_04	*From approx. 2.5 miles upstream of FM 528 to Bexar CR 125*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
1911_05	*From Bexar CR 125 to approx. 2 miles downstream confluence with Medina R.*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1911_06	*From 2 miles downstream of confluence with Medina River to confluence*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1911_07	*From the confluence with the Medina River to 3 miles upstream*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1911_10	*From confluence with Sixmile Creek to confluence with San Pedro Creek*	
	nitrate	**CS**
	bacteria	**CN**
1911_11	*Upper 8 miles of segment*	
	impaired fish community	**CN**
	nitrate	**CS**

1912 Medio Creek

		Level of Concern
1912_01	*Entire segment*	
	impaired fish community	**CN**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

1912A Upper Medio Creek (unclassified water body)

		Level of Concern
1912A_01	*Entire water body*	
	total phosphorus	**CS**
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**

1913 Mid Cibolo Creek

		Level of Concern
1913_01	*Lower 7 miles of segment from IH 10 to Bexar CR 320*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	ammonia	**CS**
1913_02	*From Bexar CR 320 to approx. 0.50 miles upstream of Buffalo Lane in Cibolo*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
1913_03	*From approx. 0.50 mi. upstream of Buffalo Lane in Cibolo to upper end of segment*	
	ammonia	**CS**
	nitrate	**CS**

2003 Aransas River Tidal

		Level of Concern
2003_01	*Entire segment*	
	orthophosphorus	**CS**

2004 Aransas River Above Tidal

		Level of Concern
2004_02	*Upper 18 miles of segment*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	depressed dissolved oxygen	**CS**

2004A Aransas Creek (unclassified water body)

		Level of Concern
2004A_01	*Entire 20 miles of segment*	
	depressed dissolved oxygen	**CS**
	depressed dissolved oxygen	**CN**

2101 Nueces River Tidal

		Level of Concern
2101_01	*Entire segment*	
	chlorophyll-a	**CS**

2102 Nueces River Below Lake Corpus Christi

		Level of Concern
2102_01	*Lower 25 miles of segment*	
	chlorophyll-a	**CS**

2103 Lake Corpus Christi

		Level of Concern
2103_01	*Mid-lake near dam*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
2103_02	*Area approx. 4 mi. SE of FM 3162 and FM 534 intersection near western shore*	
	chlorophyll-a	**CS**
2103_06	*Remainder of lake*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**

2104 Nueces River Above Frio River

		Level of Concern
2104_01	*Lower 20 miles of segment*	
	impaired habitat	**CS**
	impaired fish community	**CN**
	impaired macrobenthos community	**CN**
2104_02	*25 miles surrounding State Highway 16*	
	impaired fish community	**CN**
2104_03	*Upper 46 miles of segment*	
	impaired fish community	**CN**

2105 Nueces River Above Holland Dam

		Level of Concern
2105_01	*Lower 25 miles of segment*	
	depressed dissolved oxygen	**CS**

2107 Atascosa River

		Level of Concern
2107_01	*Lower 25 miles of segment*	
	chlorophyll-a	**CS**
2107_02	*25 miles surrounding FM 541*	
	bacteria	**CN**
	orthophosphorus	**CS**
2107_03	*25 miles surrounding State Highway 97*	
	chlorophyll-a	**CS**
	impaired habitat	**CS**

2108 San Miguel Creek

		Level of Concern
2108_01	*Lower 25 miles of segment*	
	chlorophyll-a	**CS**

2109 Leona River

		Level of Concern
2109_01	*Lower 25 miles of segment*	
	nitrate	**CS**
2109_02	*25 miles surrounding US Highway 57*	
	nitrate	**CS**
2109_03	*Upper 28 miles of segment*	
	bacteria	**CN**
	nitrate	**CS**

2113 Upper Frio River

		Level of Concern
2113_01	*Lower 25 miles of segment*	
	impaired habitat	**CS**
2113_02	*Upper 22 miles of segment*	
	impaired habitat	**CS**

2116 Choke Canyon Reservoir

		Level of Concern
2116_05	*Southern arm near mid lake and Rec. Road 7 west of Calliham*	
	depressed dissolved oxygen	**CS**
2116_06	*Western end of lake up to RR 99 bridge*	
	depressed dissolved oxygen	**CN**
	depressed dissolved oxygen	**CS**

2117 Frio River Above Choke Canyon Reservoir

		Level of Concern
2117_01	*Lower 25 miles of segment*	
	nitrate	**CS**
2117_02	*From 1.5 mi. downstream of SH 97 to 23.5 mi. upstream of SH 97 crossing*	
	nitrate	**CS**
2117_03	*33 mi. surrounding State Highway 85*	
	nitrate	**CS**
2117_04	*40 miles surrounding US Highway 57*	
	nitrate	**CS**

2201 Arroyo Colorado Tidal

		Level of Concern
2201_01	*Lower 9.0 miles of segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**
2201_02	*Approx. 2 miles upstream to approx. 2 miles downstream of Marker 22*	
	chlorophyll-a	**CS**
	nitrate	**CS**
2201_03	*Approx. 3 miles upstream to 2 miles downstream of Marker 27*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
2201_04	*Approx. 1 mile upstream to 3 miles downstream of Camp Perry*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
2201_05	*Upper 4 miles of segment*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
	bacteria	**CN**
	chlorophyll-a	**CS**

2202 Arroyo Colorado Above Tidal

		Level of Concern
2202_01	*Lower 4 miles of segment*	
	orthophosphorus	**CS**
	total phosphorus	**CS**
	nitrate	**CS**
	chlorophyll-a	**CS**
	ammonia	**CS**
2202_02	*Approx. 11 miles upstream to approx. 4 miles downstream of US 77*	
	total phosphorus	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
2202_03	*Approx 14 miles upstream to approx. 11 miles downstream of FM 1015*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
2202_04	*Upper 19 miles of segment*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

2202B Unnamed Drainage Ditch Tributary (B) to S. Arroyo Colorado (unclassified water body)

		Level of Concern
2202B_01	*Entire 0.8 miles of segment*	
	bacteria	**CN**
	ammonia	**CS**
	chlorophyll-a	**CS**

2202C Unnamed Drainage Ditch Tributary (C) to S. Arroyo Colorado (unclassified water body)

		Level of Concern
2202C_01	*Entire 1.1 miles of segment*	
	bacteria	**CN**
	ammonia	**CS**

2203 Petronila Creek Tidal

		Level of Concern
2203_01	*Entire segment*	
	chlorophyll-a	**CS**

2204 Petronila Creek Above Tidal

		Level of Concern
2204_01	*Lower 25 miles of segment*	
	chlorophyll-a	**CS**

2301 Rio Grande Tidal

		Level of Concern
2301_01	*Upper segment boundary to 25 miles upstream of lower segment boundary (mouth of Rio Grande)*	
	bacteria	**CN**
	chlorophyll-a	**CS**
2301_02	*25 miles upstream of lower segment boundary (mouth of Rio Grande)*	
	chlorophyll-a	**CS**

2302 Rio Grande Below Falcon Reservoir

		Level of Concern
2302_01	*Falcon Dam to Arroyo Los Olmos confluence*	
	mercury in fish tissue	**CS**
2302_02	*Arroyo Los Olmos confluence to Los Ebanos Ferry Crossing*	
	mercury in fish tissue	**CS**
2302_03	*Los Ebanos Ferry Crossing to Anzalduas Dam*	
	mercury in fish tissue	**CS**
2302_04	*Anzalduas Dam to McAllen Int'l Bridge (US 281)*	
	mercury in fish tissue	**CS**
2302_05	*McAllen Int'l Bridge(US 281) to Progresso Int'l Bridge (FM 1015)*	
	mercury in fish tissue	**CS**
2302_06	*Progresso Int'l Bridge (FM 1015) to the Rancho Viejo Floodway area*	
	mercury in fish tissue	**CS**
2302_07	*Rancho Viejo Floodway area to El Jardin Pump Station*	
	mercury in fish tissue	**CS**
	depressed dissolved oxygen	**CS**

2303 International Falcon Reservoir

		Level of Concern
2303_02	*Area around Zapata WTP intake*	
	toxicity in ambient water	**CN**

2304 Rio Grande Below Amistad Reservoir

		Level of Concern
2304_01	*Amistad Dam to San Felipe Creek confluence*	
	depressed dissolved oxygen	**CS**
2304_04	*Hwy 277 (Eagle Pass) to El Indio*	
	bacteria	**CN**
2304_07	*World Trade Center Bridge to Laredo water treatment plant intake*	
	toxicity in ambient water	**CN**
2304_08	*Laredo water treatment plant intake to International Bridge #2*	
	toxicity in ambient water	**CN**

2305 International Amistad Reservoir

		Level of Concern
2305_02	*Devils River arm*	
	nitrate	**CS**

2306 Rio Grande Above Amistad Reservoir

		Level of Concern
2306_01	*Confluence with Rio Conchos to Alamito Creek*	
	chlorophyll-a	**CS**
2306_03	*Mouth of Santa Elena Canyon to Johnson Ranch*	
	chlorophyll-a	**CS**
2306_05	*Mariscal Canyon to Boquillas Canyon*	
	chlorophyll-a	**CS**
2306_06	*Boquillas Canyon to FM 2627*	
	chlorophyll-a	**CS**
2306_08	*Dryden Crossing to lower segment boundary downstream of Ramsey Canyon*	
	total phosphorus	**CS**

2307 Rio Grande Below Riverside Diversion Dam

		Level of Concern
2307_01	*Downstream of Riverside Dam to Guadalupe Bridge*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
2307_02	*Guadalupe Bridge to the Alamo Grade Structure*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	depressed dissolved oxygen	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
2307_03	*Alamo Grade Structure to Little Box Canyon*	
	chlorophyll-a	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	ammonia	**CS**
2307_05	*25 miles upstream of the Rio Conchos confluence (lower segment boundary)*	
	chlorophyll-a	**CS**

2308 Rio Grande Below International Dam

		Level of Concern
2308_01	*Entire segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

2310 Lower Pecos River

		Level of Concern
2310_01	*Upper segment boundary to Big Hackberry Canyon*	
	harmful algal bloom/golden alga	**CN**
2310_02	*From FM 2083 near Pan Dale Rd to the lower segment boundary*	
	harmful algal bloom/golden alga	**CN**

2311 Upper Pecos River

		Level of Concern
2311_01	*Red Bluff Dam to FM 652*	
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**
2311_02	*FM 652 to SH 302*	
	harmful algal bloom/golden alga	**CN**
2311_03	*SH 302 to Barstow Dam*	
	harmful algal bloom/golden alga	**CN**
2311_04	*Barstow Dam to US 80 (Bus 20)*	
	bacteria	**CN**
	harmful algal bloom/golden alga	**CN**
2311_05	*US 80 (Bus 20) to FM 1776*	
	chlorophyll-a	**CS**
	harmful algal bloom/golden alga	**CN**
2311_06	*FM 1776 to US 67*	
	harmful algal bloom/golden alga	**CN**
	depressed dissolved oxygen	**CS**
2311_07	*US 67 to US 290*	
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**
2311_08	*US 290 to lower segment boundary*	
	harmful algal bloom/golden alga	**CN**

2312 Red Bluff Reservoir

		Level of Concern
2312_01	*Texas/New Mexico State Line to Mid-lake*	
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**
2312_02	*Mid-lake to dam*	
	depressed dissolved oxygen	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	harmful algal bloom/golden alga	**CN**
	chlorophyll-a	**CS**

2314 Rio Grande Above International Dam

		Level of Concern
2314_02	*Upstream of Anthony Drain to International Dam*	
	chlorophyll-a	**CS**

2421 Upper Galveston Bay

		Level of Concern
2421_01	*Red Bluff to Five Mile Cut to Houston Point to Morgans Point*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	total phosphorus	**CS**
2421_02	*Western portion of the bay*	
	chlorophyll-a	**CS**
	nitrate	**CS**
2421_03	*Eastern portion of the bay*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

2422 Trinity Bay

		Level of Concern
2422_01	*Upper half of bay*	
	nitrate	**CS**
2422_02	*Lower half of bay*	
	chlorophyll-a	**CS**

2422B Double Bayou West Fork (unclassified water body)

		Level of Concern
2422B_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

2423 East Bay

		Level of Concern
2423_02	*Remainder of segment*	
	chlorophyll-a	**CS**

2424A Highland Bayou (unclassified water body)

		Level of Concern
2424A_01	*From the headwaters to FM 2004*	
	depressed dissolved oxygen	**CS**
2424A_04	*From Fairwood Road to Bayou Lane*	
	bacteria	**CN**

2424C Marchand Bayou (unclassified water body)

		Level of Concern
2424C_01	*Entire water body*	
	bacteria	**CN**
	depressed dissolved oxygen	**CS**

2425 Clear Lake

		Level of Concern
2425_01	*Entire segment*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

2425B Jarbo Bayou (unclassified water body)

		Level of Concern
2425B_01	*From headwaters to Lawrence Road*	
	bacteria	**CN**

2426 Tabbs Bay

		Level of Concern
2426_01	*Entire segment*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	ammonia	**CS**
	nitrate	**CS**

2427 San Jacinto Bay

		Level of Concern
2427_01	*Entire segment*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

2428 Black Duck Bay

		Level of Concern
2428_01	*Entire segment*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**

2429 Scott Bay

		Level of Concern
2429_01	*Entire segment*	
	total phosphorus	**CS**
	ammonia	**CS**
	chlorophyll-a	**CS**
	orthophosphorus	**CS**

2430 Burnett Bay

		Level of Concern
2430_01	*Entire segment*	
	total phosphorus	**CS**
	orthophosphorus	**CS**
	nitrate	**CS**
	ammonia	**CS**
	chlorophyll-a	**CS**

2432B Willow Bayou

		Level of Concern
2432B_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

2432C Halls Bayou Tidal

		Level of Concern
2432C_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

2436 Barbours Cut

		Level of Concern
2436_01	*Entire segment*	
	ammonia	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

2437 Texas City Ship Channel

		Level of Concern
2437_01	*Entire segment*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**
	ammonia	**CS**

2438 Bayport Channel

		Level of Concern
2438_01	*Entire segment*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**

2439 Lower Galveston Bay

		Level of Concern
2439_01	*Area adjacent to the Texas City Ship Channel and Moses Lake*	
	nitrate	**CS**
2439_02	*Main portion of the bay*	
	chlorophyll-a	**CS**

2441 East Matagorda Bay

		Level of Concern
2441_01	*Caney Creek am and western shoreline area*	
	nitrate	**CS**
	orthophosphorus	**CS**
2441_02	*Remainder of segment*	
	nitrate	**CS**
	orthophosphorus	**CS**

2451 Matagorda Bay/Powderhorn Lake

		Level of Concern
2451_01	*Northern end of Matagorda Bay*	
	orthophosphorus	**CS**
	nitrate	**CS**
2451_02	*Remainder of segment*	
	nitrate	**CS**
	orthophosphorus	**CS**

2452 Tres Palacios Bay/Turtle Bay

		Level of Concern
2452_03	*Tres Palacios Creek Arm*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**

2452A Tres Palacios Harbor (unclassified water body)

		Level of Concern
2452A_01	*Entire water body*	
	ammonia	**CS**

2453 Lavaca Bay/Chocolate Bay

		Level of Concern
2453_02	*North-northeastern portion of the bay near Point Comfort*	
	chlorophyll-a	**CS**

2454 Cox Bay

		Level of Concern
2454_01	*North end of bay near Cox Creek*	
	nitrate	**CS**
2454_02	*Remainder of Cox Bay*	
	nitrate	**CS**

2454A Cox Lake (unclassified water body)

		Level of Concern
2454A_01	*Entire water body*	
	chlorophyll-a	**CS**
	nitrate	**CS**
	total phosphorus	**CS**

2456 Carancahua Bay

		Level of Concern
2456_02	*Upper half of bay*	
	nitrate	**CS**
	orthophosphorus	**CS**
	total phosphorus	**CS**
	chlorophyll-a	**CS**

2456A West Carancahua Creek Tidal (unclassified water body)

		Level of Concern
2456A_01	*Entire water body*	
	depressed dissolved oxygen	**CS**

2461 Espiritu Santo Bay

		Level of Concern
2461_01	*Entire segment*	
	nitrate	**CS**

2462 San Antonio Bay/Hynes Bay/Guadalupe Bay

		Level of Concern
2462_01	*San Antonio and Hynes Bays*	
	nitrate	**CS**

2473 St. Charles Bay

		Level of Concern
2473_01	*Entire bay*	
	depressed dissolved oxygen	**CS**

2484 Corpus Christi Inner Harbor

		Level of Concern
2484_01	*Entire segment*	
	ammonia	**CS**
	chlorophyll-a	**CS**
	nitrate	**CS**

2485 Oso Bay

		Level of Concern
2485_01	*Upper bay (Holly Road to County Hwy 24)*	
	chlorophyll-a	**CS**
2485_02	*Middle bay (State Park Road 22 to Holly Road)*	
	chlorophyll-a	**CS**
2485_03	*Lower portion of bay (Ocean Drive to State Park Road 22)*	
	chlorophyll-a	**CS**
	total phosphorus	**CS**
	ammonia	**CS**

2485A Oso Creek (unclassified water body)

		Level of Concern
2485A_01	*Entire water body*	
	nitrate	**CS**
	total phosphorus	**CS**
	chlorophyll-a	**CS**

2491 Laguna Madre

		Level of Concern
2491_01	*Upper portion of bay north of the Arroyo Colorado confluence*	
	chlorophyll-a	**CS**
2491_02	*Area adjacent to the Arroyo Colorado confluence*	
	bacteria	**CN**
	chlorophyll-a	**CS**
	nitrate	**CS**

2492 Baffin Bay/Alazan Bay/Cayo del Grullo/Laguna Salada

		Level of Concern
2492_01	*Entire segment*	
	chlorophyll-a	**CS**

2492A San Fernando Creek (unclassified water body)

		Level of Concern
2492A_01	*Entire water body*	
	nitrate	**CS**
	total phosphorus	**CS**

2494 Brownsville Ship Channel

		Level of Concern
2494_01	*Brownsville Ship Channel*	
	depressed dissolved oxygen	**CS**

2494A Port Isabel Fishing Harbor (unclassified water body)

		Level of Concern
2494A_01	*Entire water body*	
	nitrate	**CS**
	bacteria	**CN**

2008 Texas 303(d) List (March 19, 2008)

As required under Sections 303(d) and 304(a) of the federal Clean Water Act, this list identifies the water bodies in or bordering Texas for which effluent limitations are not stringent enough to implement water quality standards, and for which the associated pollutants are suitable for measurement by maximum daily load.

In addition, the TCEQ also develops a schedule identifying Total Maximum Daily Loads (TMDLs) that will be initiated in the next two years for priority impaired waters. Issuance of permits to discharge into 303(d)-listed water bodies is described in the TCEQ regulatory guidance document *Procedures to Implement the Texas Surface Water Quality Standards* (August 2002, RG-194).

Impairments are limited to the geographic area described by the Assessment Unit and identified with a six or seven-digit AU_ID. A TMDL for each impaired parameter will be developed to allocate pollutant loads from contributing sources that affect the parameter of concern in each Assessment Unit. The TMDL will be identified and counted using a four or five-digit SegID. Water Quality permits that are issued before a TMDL is approved will not increase pollutant loading that would contribute to the impairment identified for the Assessment Unit.

Information Provided

SegID and Name: The unique identifier (SegID), segment name, and location of the water body. The SegID may be one of two types of numbers. The first type is a classified segment number (4 digits, *e.g.*, 0218), as defined in Appendix A of the Texas Surface Water Quality Standards (TSWQS). The second type (five digits, e.g., 0218A) is a partially classified water body described in Appendix D of the TSWQS, or an unclassified water body, not defined in the TSWQS, though associated with a classified water body because it is in the same watershed. The segment name and description immediately follow SegID.

Area: Identifies the assessment unit (AU_ID, six or seven digits, *e.g.*, 0101A_01) and describes the location of the specific area in which one or more water quality standards are not met.

Parameter(s): Pollutants or water quality conditions that assessment procedures indicate do not meet assigned water quality standards.

Category: In the 2008 Assessment, one of three subcategories was assigned to each impaired parameter to provide information about water quality status and management activities on that water body. The categories are defined below:

Category 5: The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.

Category 5a - A TMDL is underway, scheduled, or will be scheduled.

Category 5b - A review of the water quality standards for this water body will be conducted before a TMDL is scheduled.

Category 5c - Additional data and information will be collected before a TMDL is scheduled.

Year First Listed: The assessment year the pollutant or water quality condition in this water body initially did not meet water quality standards as indicated in any of the areas assessed (AU_IDs).

http://www.tceq.state.tx.us/assets/public/compliance/monops/water/08twqi/2008_303d.pdf
Colorado River segment 1401 on page 90
See RAI response letter for July 2, 2008 on reference.

SegID: 0101A **Dixon Creek (unclassified water body)**
From confluence of the Canadian River to the upstream perennial portion of the stream east of Borger in Hutchinson County

Area		Category	Year First Listed
0101A_01	*Dixon Creek downstream of Phillips*		
	bacteria	5c	2000
	depressed dissolved oxygen	5b	2000

SegID: 0101B **Rock Creek (unclassified water body)**
Perennial stream from the confluence with the Canadian River up to SH 136 in the City of Borger

Area		Category	Year First Listed
0101B_01	*Perennial stream from the confluence with the Canadian River up to SH 136 in the City of Borger*		
	bacteria	5c	2006

SegID: 0102 **Lake Meredith**
From Sanford Dam in Hutchinson County to a point immediately upstream of the confluence of Camp Creek in Potter County, up to normal pool level of 2936.5 feet (impounds Canadian River)

Area		Category	Year First Listed
0102_01	*Downstream half of lake including Big Blue Creek arm*		
	chloride	5c	2006
	mercury in edible tissue	5c	2002
	sulfate	5c	2006
	total dissolved solids	5c	2006
0102_02	*Upstream half of lake, above Big Blue Creek arm*		
	chloride	5c	2006
	mercury in edible tissue	5c	2002
	sulfate	5c	2006
	total dissolved solids	5c	2006

SegID: 0103 **Canadian River Above Lake Meredith**
From a point immediately upstream of the confluence of Camp Creek in Potter County to the New Mexico State Line in Oldham County

Area		Category	Year First Listed
0103_01	*Lake Meredith headwaters to Sand Creek*		
	chloride	5c	2006
0103_02	*Sand Creek to Punta de Agua Creek*		
	chloride	5c	2006
0103_03	*Punta de Agua Creek to New Mexico State Line*		
	chloride	5c	2006

SegID: 0105 **Rita Blanca Lake**
From Rita Blanca Dam in Hartley County up to normal pool level of 3860 feet (impounds Rita Blanca Creek)

Area		Category	Year First Listed
0105_01	*Entire segment*		
	pH	5c	2004

SegID: 0199A **Palo Duro Reservoir (unclassified water body)**
From Palo Duro dam up to normal pool elevation of 2,892 feet north of Spearman in Hansford County (impounds Palo Duro Creek)

Area		Category	Year First Listed
0199A_01	*Entire reservoir*		
	depressed dissolved oxygen	5c	2000

SegID: 0201A **Mud Creek (unclassified water body)**
From the confluence of the Red River to the upstream perennial portion of the stream northwest of De Kalb in Bowie County

Area		Category	Year First Listed
0201A_01	*Entire water body*		
	bacteria	5c	2002
	depressed dissolved oxygen	5c	2006

SegID: 0202G **Smith Creek (unclassified water body)**
From the confluence with Pine Creek north of Paris to the upstream portion of the stream in north Paris in Lamar County

Area		Category	Year First Listed
0202G_01	*Entire segment*		
	bacteria	5c	2006

SegID: 0206B **South Groesbeck Creek (unclassified water body)**
From the confluence of Groesbeck Creek NNW of Quanah in Hardeman County to the upstream portion 7.8 miles (12.6 Km) southwest of Childress

Area		Category	Year First Listed
0206B_01	*Entire segment*		
	bacteria	5c	2006

SegID: 0207 **Lower Prairie Dog Town Fork Red River**
From a point immediately upstream of the confluence of Buck Creek in Hardeman County to the confluence of a point 100 meters (110 yards) upstream of the confluence of Salt Fork Creek in Armstrong County

Area		Category	Year First Listed
0207_04	*SH 70 to upstream end of segment*		
	bacteria	5c	2006

SegID: 0207A **Buck Creek (unclassified water body)**
From Oklahoma State Line east of Childress in Childress County to the upstream perennial portion of the stream west of Wellington in Collinsworth County

Area		Category	Year First Listed
0207A_01	*From Oklahoma state line to House Log Creek*		
	bacteria	5c	2000

SegID: 0211 **Little Wichita River**
From the confluence with the Red River in Clay County to Lake Arrowhead Dam in Clay County

Area		Category	Year First Listed
0211_02	*East Fork confluence to dam*		
	depressed dissolved oxygen	5b	1996

SegID: 0214 **Wichita River Below Diversion Lake Dam**
From the confluence with the Red River in Clay County to Diversion Dam in Archer County

Area		Category	Year First Listed
0214_02	*FM 2393 to River Road WWTP*		
	bacteria	5c	2006
0214_05	*From Beaver Creek to Diversion Dam*		
	bacteria	5c	2006

SegID: 0214A **Beaver Creek (unclassified water body)**
From the confluence of the Wichita River west of Wichita Falls in Wichita County to the upstream perennial portion of the stream south of Vernon in Wilbarger County

Area		Category	Year First Listed
0214A_02	*From Bull Creek to Santa Rosa Lake dam*		
	bacteria	5c	2006

SegID: 0226 **South Fork Wichita River**
From the confluence with the North Fork Wichita River in Knox County to a point 15.0 kilometers (9.3 miles) upstream of US 82 in Dickens County

Area		Category	Year First Listed
0226_01	*Lower end of segment to SH 6*		
	chloride	5c	2006
0226_02	*From SH 6 to confluence with Willow Creek*		
	chloride	5c	2006
0226_03	*From confluence with Willow Creek to confluence with Long Canyon Creek*		
	chloride	5c	2006
0226_04	*Low-water dam to 0.5 mile upstream*		
	chloride	5c	2006

SegID: 0229 **Upper Prairie Dog Town Fork Red River**
From a point 100 meters (110 yards) upstream of the confluence of Salt Fork Creek in Armstrong County to Lake Tanglewood Dam in Randall County

Area		Category	Year First Listed
0229_02	*Palo Duro Canyon State Park upstream boundary to upper end of segment at Tanglewood Dam*		
	pH	5c	2006

SegID: 0230A **Paradise Creek (unclassified water body)**
From the confluence with the Pease River east of Vernon to the upstream perennial portion near Thalia in Foard County

Area		Category	Year First Listed
0230A_03	*Lower 5 miles of water body*		
	bacteria	5c	2006

SegID: 0299A **Sweetwater Creek (unclassified water body)**
From the Oklahoma State Line in Wheeler County to the upstream perennial portion of the stream northwest of Wheeler in Wheeler County (tributary of North Fork Red River)

Area		Category	Year First Listed
0299A_01	*From Oklahoma State Line to confluence with Graham Creek*		
	bacteria	5c	2002

SegID: 0302 **Wright Patman Lake**
From Wright Patman Lake Dam in Bowie/Cass County to a point 1.5 kilometers (0.9 miles) downstream of Bassett Creek in Bowie/Cass County, up to the normal pool elevation of 225 feet (impounds the Sulphur River)

Area		Category	Year First Listed
0302_02	*300 acres at International Paper intake*		
	depressed dissolved oxygen	5a	1996
	pH	5a	2000
0302_04	*500 acres in the northeast corner of lake*		
	pH	5a	2000
0302_05	*200 acres in the northwestern tip of lake*		
	pH	5a	2000
0302_06	*Big Creek arm*		
	pH	5a	2000
0302_07	*4000 acres mid-lake*		
	pH	5a	2000
0302_08	*1600 acres in upper mid-lake*		
	pH	5a	2000
0302_10	*4000 acres in upper portion of lake*		
	depressed dissolved oxygen	5a	1996

SegID: 0303B **White Oak Creek (unclassified water body)**
From the confluence of the Sulphur River north of Naples in Morris County to the upstream perennial portion of the stream east of Sulphur Springs in Hopkins County

Area		Category	Year First Listed
0303B_01	*Lower 25 miles of segment*		
	depressed dissolved oxygen	5b	2000
0303B_02	*Middle 25 miles near Hwy 271*		
	depressed dissolved oxygen	5b	2000
0303B_03	*Upper 25 miles of segment*		
	depressed dissolved oxygen	5b	2000
	bacteria	5c	2006

SegID: 0304A **Swampoodle Creek (unclassified water body)**
From the confluence of Days Creek in central Texarkana in Bowie County to the upstream perennial portion of the stream in northern Texarkana in Bowie County

Area		Category	Year First Listed
0304A_01	*Entire segment*		
	impaired fish community	5c	2006
	impaired macrobenthic community	5c	2006

SegID: 0304B **Cowhorn Creek (unclassified water body)**
From the confluence of Wagner Creek in southern Texarkana in Bowie County to the upstream perennial portion of the stream in northern Texarkana in Bowie County

Area		Category	Year First Listed
0304B_01	*Entire water body*		
	impaired fish community	5c	2006
	impaired macrobenthic community	5c	2006

SegID: 0305 **North Sulphur River**
From the confluence with the South Sulphur River in Lamar County to a point 6.7 km (4.2 miles) upstream of FM 68 in Fannin County

Area		Category	Year First Listed
0305_02	*Upper 23 miles*		
	impaired fish community	5b	2006
	impaired macrobenthic community	5b	2006

SegID: 0306 **Upper South Sulphur River**
From a point 1.0 km (0.6 miles) upstream of SH 71 in Delta/Hopkins County to SH 78 in Fannin County

Area		Category	Year First Listed
0306_02	*25 miles above SH 11*		
	pH	5b	2008

SegID: 0307 **Cooper Lake**
from Cooper Lake dam in Delta/Hopkins County to a point 1.0 kilometers (0.6 mile) upstream of SH 71 on the South Sulphur River arm in Delta/Hopkins County and 300 meters (330 yards) below the confluence of Barnett Creek on the Middle Sulphur River arm in Delta County, up to a conservation pool elevation of 440 feet (impounds the Middle Sulphur/South Sulphur River)

Area		Category	Year First Listed
0307_01	*Lower 5000 acres near dam*		
	pH	5b	2000
0307_02	*Lower 3000 acre Doctors Creek arm*		
	pH	5b	2000
0307_03	*Middle 5000 acres*		
	pH	5b	2000
0307_04	*Middle 2000 acre Johns Creek arm*		
	pH	5b	2000

SegID: 0401 **Caddo Lake**

From the Louisiana State Line in Harrison/Marion County to a point 12.3 km (7.6 miles) downstream of SH 43 in Harrison/Marion County, up to pool elevation of 168.5 feet (impounds Big Cypress Creek)

Caddo Lake is currently under consideration in the Triennial Review of the Texas Water Quality Standards for subdivision of the segment into two segments, "Caddo Lake" and "Caddo Swamp". TCEQ will continue to evaluate appropriate water quality standards for Caddo as part of the long-term effort to address the 303(d) listing in Category 5c.

Area		Category	Year First Listed
0401_01	*Lower 5000 acres*		
	mercury in edible tissue	5c	1996
0401_02	*Harrison Bayou arm*		
	depressed dissolved oxygen	5c	2000
	mercury in edible tissue	5c	1996
	pH	5c	1996
0401_03	*Goose Prairie arm*		
	depressed dissolved oxygen	5c	2000
	mercury in edible tissue	5c	1996
	pH	5c	1996
0401_05	*Clinton Lake*		
	mercury in edible tissue	5c	1996
	pH	5c	1996
	depressed dissolved oxygen	5c	2000
0401_07	*Mid-lake near Uncertain*		
	mercury in edible tissue	5c	1996
	depressed dissolved oxygen	5c	2000
0401_08	*Remainder of segment*		
	mercury in edible tissue	5c	1996

SegID: 0401A **Harrison Bayou (unclassified water body)**

From the confluence of Caddo Lake east of Karnack in Harrison County to the upstream perennial portion of the stream east of Marshall in Harrison County

Area		Category	Year First Listed
0401A_01	*Lower 5 miles*		
	depressed dissolved oxygen	5c	2000
0401A_02	*Middle 3 miles near FM 134*		
	depressed dissolved oxygen	5c	2000

SegID: 0402 **Big Cypress Creek Below Lake O' the Pines**
From a point 12.3 km (7.6 miles) downstream of SH 43 in Harrison/Marion County to Ferrell's Bridge Dam in Marion County

Area		Category	Year First Listed
0402_01	*Lower 9 miles*		
	pH	5b	2000
	mercury in edible tissue	5c	1998
0402_02	*11 miles below Black Cypress Creek*		
	pH	5b	2000
	mercury in edible tissue	5c	1998
0402_03	*Middle 15 miles near Jefferson*		
	mercury in edible tissue	5c	1998
0402_04	*Upper 7 miles*		
	mercury in edible tissue	5c	1998

SegID: 0402A **Black Cypress Bayou (unclassified water body)**
Perennial stream from the confluence with Big Cypress in Marion County up to 7.5 miles above FM 250 in Cass County.

Area		Category	Year First Listed
0402A_01	*Lower 15 miles of water body*		
	depressed dissolved oxygen	5b	2000
0402A_02	*Middle 17 miles near CR 1617*		
	bacteria	5c	2006
	depressed dissolved oxygen	5b	2000
0402A_03	*Middle 1 mile, Pruitt Lake*		
	depressed dissolved oxygen	5b	2000
	mercury in edible tissue	5c	2000
0402A_04	*Middle 13 miles near FM 250*		
	bacteria	5c	2006
0402A_05	*Upper 10 miles of water body*		
	depressed dissolved oxygen	5b	2000

SegID: 0404 **Big Cypress Creek Below Lake Bob Sandlin**
From a point 1.0 km (0.6 miles) downstream of US 259 in Morris/Upshur Counties to Fort Sherman Dam in Camp/Titus Counties

Area		Category	Year First Listed
0404_02	*Upper 18 miles*		
	bacteria	5a	1996

SegID: 0404A **Ellison Creek Reservoir (unclassified water body)**
From the Morris County Dam up to normal pool elevation near Lone Star in Morris County (impounds Ellison Creek)

Area		Category	Year First Listed
0404A_01	*Entire reservoir*		
	PCBs in edible tissue	5c	2006
	toxicity in sediment	5c	2006

SegID: 0404B **Tankersley Creek (unclassified water body)**
Perennial stream from the confluence with Big Cypress Creek upstream to the confluence with an unnamed tributary 250 meters upstream of IH 30

Area		Category	Year First Listed
0404B_01	*Lower 3 miles*		
	bacteria	5a	2000
0404B_02	*Middle 2 miles near FM 127*		
	bacteria	5a	2000
0404B_03	*3 miles below Tankersley Lake*		
	bacteria	5a	2000

SegID: 0404C **Hart Creek (unclassified water body)**
Perennial stream from the confluence with Big Cypress Creek upstream to 0.2 km upstream of FM 1402

Area		Category	Year First Listed
0404C_01	*Entire water body*		
	bacteria	5a	2006

SegID: 0404N **Lake Daingerfield (unclassified water body)**
Southeast of the City of Daingerfield in Daingerfield State Park in Morris County

Area		Category	Year First Listed
0404N_01	*Entire lake*		
	mercury in edible tissue	5c	2006

SegID: 0405 **Lake Cypress Springs**
From Franklin County Dam in Franklin County up to the normal pool elevation of 378 feet (impounds Big Cypress Creek)

Area		Category	Year First Listed
0405_03	*Panther Arm*		
	depressed dissolved oxygen	5c	2006

SegID: 0406 **Black Bayou**
From the Louisiana State Line in Cass County to FM 96 in Cass County

Area		Category	Year First Listed
0406_01	*Lower 12 miles*		
	depressed dissolved oxygen	5b	1996
	pH	5b	2006
	bacteria	5c	2006
0406_02	*Upper 12 miles*		
	depressed dissolved oxygen	5b	1996
	pH	5b	2006

SegID: 0407 **James' Bayou**
From the Louisiana State Line in Marion County to Club Lake Road northwest of Linden in Cass County

Area		Category	Year First Listed
0407_01	*Lower 15 miles of segment*		
	depressed dissolved oxygen	5b	2000
0407_02	*Upper 25 miles of segment*		
	depressed dissolved oxygen	5b	2000
	pH	5b	2008
	bacteria	5c	2006

SegID: 0409 **Little Cypress Bayou (Creek)**
From the confluence of Big Cypress Creek in Harrison/Marion County to a point 1.0 km (0.6 miles) upstream of FM 2088 in Wood County

Area		Category	Year First Listed
0409_01	*Lower 25 miles of segment*		
	bacteria	5c	2006
	depressed dissolved oxygen	5b	2000
0409_02	*Middle 18 miles above Hwy 154*		
	bacteria	5c	2006
	depressed dissolved oxygen	5b	2000
0409_03	*Middle 25 miles below Hwy 271*		
	depressed dissolved oxygen	5b	2000
0409_04	*Upper 25 miles*		
	bacteria	5c	2006

SegID: 0409B **South Lilly Creek (unclassified water body)**
From the confluence of Lilly Creek to approximately 2 miles west of FM 1647

Area		Category	Year First Listed
0409B_01	*Entire segment*		
	bacteria	5c	2006

SegID: 0501 **Sabine River Tidal**
From the confluence with Sabine Lake in Orange County to West Bluff in Orange County

Area		Category	Year First Listed
0501_02	*Upper 14 miles of segment*		
	bacteria	5c	2006

SegID: 0501B **Little Cypress Bayou (unclassified water body)**
From the confluence with the Sabine River to the headwaters west of Reese in Orange County.

Area		Category	Year First Listed
0501B_01	*Lower 4.2 miles of bayou*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2006
	toxicity in water	5c	2004
0501B_02	*0.3 mile upstream to 0.5 mile downstream of Bear Path Road*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2006
	toxicity in water	5c	2004
0501B_03	*Upper 3.2 miles of bayou*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2006
	toxicity in water	5c	2004

SegID: 0502A **Nichols Creek (unclassified water body)**
From the confluence of the Sabine River to the upstream perennial portion of the stream south of Kirbyville in Newton and Jasper Counties

Area		Category	Year First Listed
0502A_01	*Lower 25 miles of creek*		
	bacteria	5c	2002
	depressed dissolved oxygen	5c	2002
	toxicity in water	5c	2002

SegID: 0502B **Caney Creek (unclassified water body)**
Perennial stream from the Sabine River upstream to the confluence with Martin Branch

Area		Category	Year First Listed
0502B_02	*From Davison Street upstream to the confluence with Caney Branch and Little Caney Branch*		
	bacteria	5c	2006

SegID: 0504 **Toledo Bend Reservoir**
From Toledo Bend Dam in Newton County to a point immediately upstream of the confluence of Murvaul Creek in Panola County, up to the normal pool elevation of 172 feet (impounds the Sabine River)

Area		Category	Year First Listed
0504_01	*Lowermost 5200 acres of reservoir, adjacent to dam, including Indian Creek arm*		
	mercury in edible tissue	5c	1998
0504_02	*Six Mile Boat Lane arm*		
	mercury in edible tissue	5c	1998
0504_03	*Sunshine Bay arm*		
	mercury in edible tissue	5c	1998
0504_04	*Near SH 21*		
	mercury in edible tissue	5c	1998
0504_05	*Patroon Bayou Branch arm*		
	mercury in edible tissue	5c	1998
0504_06	*Tenaha Creek arm*		
	mercury in edible tissue	5c	1998
	depressed dissolved oxygen	5c	2000
0504_07	*Uppermost 5120 acres of reservoir*		
	mercury in edible tissue	5c	1998
0504_08	*Negreet Bayou arm*		
	mercury in edible tissue	5c	1998
0504_09	*San Miguel arm*		
	mercury in edible tissue	5c	1998
0504_10	*San Patricia arm*		
	mercury in edible tissue	5c	1998
0504_11	*Toledo Bend reservoir near Buzzard Bend*		
	mercury in edible tissue	5c	1998
0504_12	*Remainder of reservoir*		
	mercury in edible tissue	5c	1998

SegID: 0504C **Palo Gaucho Bayou (unclassified water body)**
From the confluence with Toledo Bend Reservoir in Sabine County to the headwaters northeast of San Augustine in San Augustine County

Area		Category	Year First Listed
0504C_01	*Entire segment*		
	toxicity in water	5c	2002

SegID: 0504E **Clear Lake**
Oxbow lake 12 miles northwest of Logansport, LA

Area		Category	Year First Listed
0504E_01	*Oxbow lake 12 miles northwest of Logansport, LA*		
	mercury in edible tissue	5c	2006

SegID: 0505 **Sabine River Above Toledo Bend Reservoir**
From a point immediately upstream of the confluence of Murvaul Creek in Panola County to a point 100 meters (110 yards) downstream of US 271 in Gregg County

Area		Category	Year First Listed
0505_03	*22 mile reach near SH 149*		
	bacteria	5a	2002

SegID: 0505B **Grace Creek (unclassified water body)**
Perennial stream from the confluence with the Sabine River up to FM 1844 in Gregg County

Area		Category	Year First Listed
0505B_02	*Upper 12.3 miles*		
	bacteria	5c	2000
	depressed dissolved oxygen	5c	2000

SegID: 0505G **Wards Creek (unclassified water body)**
From the confluence with Hatley Creek to the headwaters east of Hallsville in Harrison County

Area		Category	Year First Listed
0505G_01	*Wards Creek from the confluence with Sewell Creek upstream to the confluence with unnamed 2nd order stream*		
	depressed dissolved oxygen	5c	2000

SegID: 0505O **Hills Lake**
Oxbow lake 13 miles east of Carthage

Area		Category	Year First Listed
0505O_01	*Entire segment*		
	mercury in edible tissue	5c	2006

SegID: 0506A **Harris Creek (unclassified water body)**
From the confluence of the Sabine River northeast of Winona in Smith County to the upstream perennial portion of the stream east of Tyler in Smith County

Area		Category	Year First Listed
0506A_01	*Entire segment*		
	depressed dissolved oxygen	5b	2000

SegID: 0506G **Little White Oak Creek (unclassified water body)**
From the confluence with the Sabine River to the headwaters southwest of Gilmer in Upshur County

Area		Category	Year First Listed
0506G_01	*Entire water body*		
	toxicity in water	5c	2004

SegID: 0507 **Lake Tawakoni**
From Iron Bridge Dam in Rains County up to normal pool elevation of 437 feet (impounds Sabine River)

Area		Category	Year First Listed
0507_04	*Cowleech Fork of Sabine River arm*		
	pH	5c	2008

SegID: 0507G **South Fork of Sabine River (unclassified water body)**
From the confluence with Lake Tawakoni upstream to the confluence with Klutts and Sabine Creeks

Area		Category	Year First Listed
0507G_01	*Entire segment*		
	bacteria	5c	2006

SegID: 0512A **Running Creek (unclassified water body)**
From the confluence with Lake Fork Reservoir to the headwaters southeast of Martin Springs in Hopkins County

Area		Category	Year First Listed
0512A_01	*Entire creek*		
	bacteria	5c	2002

SegID: 0512B **Elm Creek (unclassified water body)**
From the confluence with Lake Fork Reservoir in Rains County to the headwaters northwest of Shirley in Hopkins County

Area		Category	Year First Listed
0512B_01	*Entire creek*		
	bacteria	5c	2002

SegID: 0514 **Big Sandy Creek**
From the confluence with the Sabine River in Upshur County to a point 2.6 km (1.6 miles) upstream of SH 11 in Hopkins County

Area		Category	Year First Listed
0514_02	*From just upstream of FM 49 to upper end of segment*		
	bacteria	5c	2006

SegID: 0603 **B. A. Steinhagen Lake**
From Town Bluff Dam in Jasper/Tyler County to a point immediately upstream of the confluence of Hopson Mill Creek on the Neches River Arm in Jasper/Tyler County and to a point immediately upstream of the confluence of Indian Creek on the Angelina River Arm in Jasper County, up to the normal pool elevation of 83 feet (impounds Neches River)

Area		Category	Year First Listed
0603_01	*Main pool by dam*		
	mercury in edible tissue	5c	1998
0603_02	*Remainder of reservoir*		
	mercury in edible tissue	5c	1998

SegID: 0603A **Sandy Creek (unclassified water body)**
From the confluence of B.A. Steinhagen Lake southwest of Jasper in Jasper County to the confluence of Big and Little Sandy Creeks in Jasper in Jasper County

Area		Category	Year First Listed
0603A_01	*Lower 11.5 miles*		
	bacteria	5c	2000

SegID: 0603B **Wolf Creek (unclassified water body)**
From the confluence of B. A. Steinhagen Lake southeast of Colmesneil in Tyler County to the upstream perennial portion of the stream south of Colmesneil in Tyler County

Area		Category	Year First Listed
0603B_01	*Entire creek*		
	bacteria	5c	2006

SegID: 0604 **Neches River Below Lake Palestine**
From a point immediately upstream of the confluence of Hopson Mill Creek in Jasper/Tyler County to Blackburn Crossing Dam in Anderson/Cherokee County

Area		Category	Year First Listed
0604_04	*From SH 21 to US 84*		
	lead in water	5c	2002

SegID: 0604A **Cedar Creek (unclassified water body)**
From the confluence of the Neches River southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County

Area		Category	Year First Listed
0604A_01	*Lower area downstream of FM 2497*		
	bacteria	5c	2000
0604A_02	*Upper area upstream of FM 2497*		
	bacteria	5c	2000

SegID: 0604B **Hurricane Creek (unclassified water body)**
Perennial stream from the confluence with Cedar Creek to the confluence of two unnamed tributaries 100 meters upstream of SH Loop 287 in Lufkin

Area		Category	Year First Listed
0604B_01	*Entire Segment as described in Appendix D*		
	bacteria	5c	2000

SegID: 0604C **Jack Creek (unclassified water body)**
From the confluence of Cedar Creek southwest of Lufkin in Angelina County to the upstream perennial portion of the stream in northeast Lufkin in Angelina County

Area		Category	Year First Listed
0604C_01	*Entire water body*		
	bacteria	5c	2000

SegID: 0604D **Piney Creek (unclassified water body)**
From the confluence of the Neches River at the Polk/Tyler/Angelina County lines east of Corrigan to the upstream perennial portion of the stream east of Crockett in Houston County

Area		Category	Year First Listed
0604D_01	*Lower 25 miles*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2004

SegID: 0604M **Biloxi Creek (unclassified water body)**
From the confluence with the Neches River southeast of Diboll to FM 325 east of Lufkin in Angelina County

Area		Category	Year First Listed
0604M_02	*Lower portion below CR 228*		
	bacteria	5c	2004
0604M_03	*Upper portion above CR 228*		
	bacteria	5c	2004
	depressed dissolved oxygen	5c	2006

SegID: 0604T **Lake Ratcliff (unclassified water body)**
Lake in Houston County 3.4 miles northeast of Kennard

Area		Category	Year First Listed
0604T_01	*Entire lake*		
	mercury in edible tissue	5c	2002

SegID: 0605 **Lake Palestine**
From Blackburn Crossing Dam in Anderson/Cherokee County to a point 6.7km (4.2 miles) downstream of FM 279 in Henderson/Smith County, up to normal pool elevation of 345 feet (impounds Neches River)

Area		Category	Year First Listed
0605_03	*Mid-lake near Tyler PWS intake*		
	pH	5c	2006
0605_09	*Flat Creek arm*		
	pH	5c	2006
0605_10	*Upper Lake*		
	pH	5c	2006

SegID: 0605A **Kickapoo Creek (unclassified water body)**
From the confluence of Lake Palestine east of Brownsboro in Henderson County to the upstream perennial portion of the stream northeast of Murchinson in Henderson County

Area		Category	Year First Listed
0605A_01	*Downstream of FM 1803*		
	bacteria	5c	2000
	depressed dissolved oxygen	5c	2006

SegID: 0606 **Neches River Above Lake Palestine**
From a point 6.7 km (4.2 miles) downstream of FM 279 in Henderson/Smith County to Rhines Lake Dam in Van Zandt County

Area		Category	Year First Listed
0606_01	*Lower boundary to Prairie Creek*		
	bacteria	5c	2008
0606_02	*Prairie Creek to river mile 7.0*		
	depressed dissolved oxygen	5c	1996
	pH	5c	2002
	zinc in water	5c	1996
0606_03	*River mile 7.0 to headwaters*		
	depressed dissolved oxygen	5c	1996
	pH	5c	2002

SegID: 0606A **Prairie Creek (unclassified water body)**
Perennial stream from the confluence with the Neches River to an unnamed tributary approximately 0.6km downstream of the US 69 bridge crossing.

Area		Category	Year First Listed
0606A_01	*Perennial stream form the confluence with the Neches River to a point immediately upstream of the confluence of Caney Creek*		
	bacteria	5c	2002

SegID: 0607 **Pine Island Bayou**
From the confluence with the Neches River in Hardin/Jefferson County to FM 787 in Hardin County

Area		Category	Year First Listed
0607_01	*Mouth to river mile 5.7*		
	depressed dissolved oxygen	5b	1996
0607_02	*River Mile 5.7 to mile 12.1*		
	depressed dissolved oxygen	5b	1996
0607_03	*River Mile 12.1 to mile 35.4 at confluence with Willow Creek (0607C)*		
	depressed dissolved oxygen	5b	1996
	bacteria	5c	2008
0607_04	*River Mile 35.4 at confluence with Willow Creek (0607C) to mile 60.4*		
	depressed dissolved oxygen	5b	1996
0607_05	*River Mile 60.4 to top of segment at FM 787*		
	depressed dissolved oxygen	5b	1996

SegID: 0607A **Boggy Creek (unclassified water body)**
From the confluence of Pine Island Bayou south of Lumberton in Hardin County to the upstream perennial portion of the stream west of Lumberton in Hardin County

Area		Category	Year First Listed
0607A_01	*Entire creek*		
	depressed dissolved oxygen	5b	2000

SegID: 0607B **Little Pine Island Bayou (unclassified water body)**
From the confluence of Pine Island Bayou southwest of Lumberton in Hardin County to the upstream perennial portion of the stream west of Kountze in Hardin County

Area		Category	Year First Listed
0607B_01	*Lower 25 miles*		
	depressed dissolved oxygen	5b	2000
	bacteria	5c	2006

SegID: 0607C **Willow Creek (unclassified water body)**
From the confluence of Pine Island Bayou north of Nome in Jefferson County to the upstream perennial portion of the stream east of Devers in Liberty County

Area		Category	Year First Listed
0607C_01	*Entire creek*		
	depressed dissolved oxygen	5b	2000

SegID: 0608 **Village Creek**
From the confluence with the Neches River in Hardin County to Lake Kimble Dam in Hardin County

Area		Category	Year First Listed
0608_02	*From FM 418 to Lake Kimble dam*		
	pH	5b	2000

SegID: 0608A **Beech Creek (unclassified water body)**
From the confluence of Village Creek northeast of Kountze in Hardin County to the upstream perennial portion of the stream southeast of Woodville in Tyler County

Area		Category	Year First Listed
0608A_01	*Lower 20 miles of water body*		
	bacteria	5c	2006

SegID: 0608B **Big Sandy Creek (unclassified water body)**
From the confluence of Village Creek northwest of Kountze in Hardin County to the upstream perennial portion of the stream northeast of Livingston in Polk County

Area		Category	Year First Listed
0608B_01	*Lower 30 miles downstream of US 190*		
	bacteria	5c	2000

SegID: 0608C **Cypress Creek (unclassified water body)**
From the confluence of Village Creek east of Kountze in Hardin County to the upstream perennial portion of the stream northwest of Kountze in Hardin County

Area		Category	Year First Listed
0608C_01	*Entire water body*		
	depressed dissolved oxygen	5b	2000
	aluminum in water	5c	2004
	bacteria	5c	2006

SegID: 0608E **Mill Creek (unclassified water body)**
From the confluence of Village Creek southwest of Silsbee in Hardin County to the upstream perennial portion of the stream northwest of Silsbee in Hardin County

Area		Category	Year First Listed
0608E_01	*Entire water body*		
	depressed dissolved oxygen	5c	2006

SegID: 0608F **Turkey Creek (unclassified water body)**
From the confluence of Village Creek north of Kountze in Hardin County to the upstream perennial portion of the stream southeast of Woodville in Tyler County

Area		Category	Year First Listed
0608F_01	*Lower 25 miles of segment*		
	bacteria	5c	2000

SegID: 0608G **Lake Kimball (unclassified water body)**
From Kimble Creek Dam northwest of Kountze in Hardin County to normal pool elevation in Tyler County (impounds Kimble and Village Creeks)

Area		Category	Year First Listed
0608G_01	*Entire lake*		
	mercury in edible tissue	5c	2000

SegID: 0610 **Sam Rayburn Reservoir**
From Sam Rayburn Dam in Jasper County to a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry on the Angelina River Arm in Angelina/Nacogdoches County and to a point 3.9 km (2.4 miles) downstream of Curry Creek on the Attoyac Bayou Arm in Nacogdoches/San Augustine County, up to the normal pool elevation of 164 ft (except on the Angelina River Arm)(impounds Angelina River and Attoyac Bayou)

Area		Category	Year First Listed
0610_01	*Main pool by the dam*		
	mercury in edible tissue	5c	1996
0610_02	*Lower Angelina River arm*		
	mercury in edible tissue	5c	1996
0610_03	*Mid-Angelina River arm (SH 147)*		
	mercury in edible tissue	5c	1996
0610_04	*Upper mid-Angelina River arm*		
	mercury in edible tissue	5c	1996
0610_05	*Lower Attoyac Bayou arm*		
	mercury in edible tissue	5c	1996
0610_06	*Upper Attoyac Bayou arm*		
	mercury in edible tissue	5c	1996
0610_07	*Upper Angelina River arm*		
	mercury in edible tissue	5c	1996
0610_08	*Bear Creek arm*		
	mercury in edible tissue	5c	1996
0610_09	*Lower Ayish Bayou arm*		
	mercury in edible tissue	5c	1996
0610_10	*Upper Ayish Bayou arm*		
	mercury in edible tissue	5c	1996

SegID: 0610A **Ayish Bayou (unclassified water body)**
Perennial stream from the headwaters of Sam Rayburn Reservoir to the dam impounding Bland Lake approximately 0.1km upstream of FM 1279 near the City of San Augustine

Area		Category	Year First Listed
0610A_01	*Lower portion downstream of US 96*		
	bacteria	5a	2000
0610A_02	*Middle portion from US 96 to SH 21*		
	bacteria	5a	2000
0610A_03	*Upper portion from SH 21 to headwaters*		
	bacteria	5a	2000

SegID: 0611 **Angelina River Above Sam Rayburn Reservoir**
From the aqueduct crossing 1.0 km (0.6 miles) upstream of the confluence of Paper Mill Creek in Angelina/Nacogdoches County to the confluence of Barnhardt Creek and Mill Creek at FM 225 in Rusk County

Area		Category	Year First Listed
0611_01	*Lower boundary to FM 1911*		
	bacteria	5a	2000
0611_03	*FM 343 to US 84*		
	bacteria	5a	2000

SegID: 0611A **East Fork Angelina River (unclassified water body)**
From the confluence of the Angelina River at the Rusk/Nacogdoches county line to the upstream perennial portion of the stream west of Mount Enterprise in Rusk County

Area		Category	Year First Listed
0611A_01	*Confluence with Grassy Lake area*		
	bacteria	5a	2002
	lead in water	5c	2000
0611A_02	*Grassy Lake area to county road near Happy Valley*		
	lead in water	5c	2000
0611A_03	*County road near Happy Valley to Wooten Creek*		
	lead in water	5c	2000
0611A_04	*Wooten Creek to headwaters*		
	lead in water	5c	2000

SegID: 0611B **La Nana Bayou (unclassified water body)**
From the confluence of the Angelina River south of Nacogdoches in Nacogdoches County to the upstream perennial portion of the stream north of Nacogdoches in Nacogdoches County

Area		Category	Year First Listed
0611B_01	*Mouth to unimproved road near FM 3228/1275*		
	bacteria	5a	2000
0611B_02	*Unimproved road near FM 3228/1275 to SH 7*		
	bacteria	5a	2000

SegID: 0612 **Attoyac Bayou**
From a point 3.9 km (2.4 miles) downstream of Curry Creek in Nacogdoches/San Augustine County to FM 95 in Rusk County

Area		Category	Year First Listed
0612_01	*Mouth to 8.2 miles downstream of SH 7*		
	bacteria	5a	2004
0612_02	*8.2 miles below SH 7 to Bear Creek confluence*		
	bacteria	5a	2004
0612_03	*Bear Creek to headwaters*		
	bacteria	5a	2004

SegID: 0615 **Angelina River/Sam Rayburn Reservoir**
The riverine portion of Sam Rayburn Reservoir from a point 5.6 kilometers (3.5 miles) upstream of Marion's Ferry to a point 2.75 kilometers (1.71 miles) upstream of the confluence of Paper Mill Creek

Area		Category	Year First Listed
0615_01	*Upstream of Papermill Creek*		
	depressed dissolved oxygen	5c	2002
	mercury in edible tissue	5c	2002
0615_02	*Downstream of Papermill Creek*		
	depressed dissolved oxygen	5c	2002
	impaired fish community	5c	2002
	mercury in edible tissue	5c	2002
	bacteria	5c	2006

SegID: 0615A **Papermill Creek (unclassified water body)**
From the confluence of Sam Rayburn Reservoir (Angelina River Arm) northeast of Lufkin in Angelina County to the upstream perennial portion of the stream in Lufkin in Angelina County

Area		Category	Year First Listed
0615A_01	*Lower 9 miles*		
	bacteria	5c	2006

SegID: 0701 **Taylor Bayou Above Tidal**
From the saltwater lock 7.7 km (4.8 miles) downstream of SH 73 in Jefferson County to the Lower Neches Valley Authority Canal in Jefferson County

Area		Category	Year First Listed
0701_01	*From saltwater lock to 8 miles upstream*		
	depressed dissolved oxygen	5a	1996
0701_02	*from 8 miles upstream of saltwater lock to the confluence of N and S Forks Taylor Bayou*		
	depressed dissolved oxygen	5a	1996

SegID: 0701D **Shallow Prong Lake (unclassified water body)**
Reservoir on Big Hill Bayou located approximately 3.5 miles downstream of the confluence with Taylor Bayou in Jefferson County

Area		Category	Year First Listed
0701D_01	*Entire water body*		
	depressed dissolved oxygen	5a	2004

SegID: 0702A **Alligator Bayou (unclassified water body)**
From the Alligator Bayou pump station at the Jefferson County hurricane protection levee one mile downstream of Spur 215 in Port Arthur to a point immediately upstream of the confluence with Jefferson county Drainage District No. 7 city outfall canal

Area		Category	Year First Listed
0702A_02	*Lower portion from SH82 to its confluence with Taylor Bayou*		
	impaired fish community	5c	2002
	toxicity in sediment	5c	1998
0702A_03	*Upper portion from its headwaters at the Port Arthur Canal to SH82*		
	toxicity in water	5c	1998
0702A_04	*Drainage canal leading into Alligator Bayou approx. 0.8 miles north of SH82*		
	toxicity in water	5c	1998

SegID: 0704 **Hillebrandt Bayou**
From the confluence of Taylor Bayou in Jefferson County to a point 100 meters (110 yards) upstream of SH 124 in Jefferson County

Area		Category	Year First Listed
0704_02	*From confluence with Bayou Din to upper end of segment*		
	depressed dissolved oxygen	5a	1998

SegID: 0801C **Cotton Bayou (unclassified water body)**
From the confluence of Cotton Lake southeast of Mont Belvieu in Chambers County upstream to a point approximately 1 mile north of IH 10 in Chambers County

Area		Category	Year First Listed
0801C_01	*Upper half of bayou*		
	depressed dissolved oxygen	5b	2006

SegID: 0803 **Lake Livingston**
From Livingston Dam in Polk/San Jacinto County to a point 1.8 km (1.1 miles) upstream of Boggy Creek in Houston/Leon County, up to normal pool elevation of 131 feet (impounds Trinity River)

Area		Category	Year First Listed
0803_01	*Lowermost portion of reservoir, adjacent to dam*		
	pH	5c	2008
	sulfate	5c	2006
0803_02	*Lower portion of reservoir, East Wolf Creek*		
	sulfate	5c	2006
0803_03	*Lower portion of reservoir, East Willow Springs*		
	sulfate	5c	2006
0803_04	*Middle portion of reservoir, East Pointblank*		
	sulfate	5c	2006
0803_05	*Middle portion of reservoir, downstream of Kickapoo Creek*		
	sulfate	5c	2006
0803_06	*Middle portion of reservoir, centering on US 190*		
	pH	5c	2008
	sulfate	5c	2006
0803_07	*Upper portion of reservoir, west of Carlisle*		
	sulfate	5c	2006
0803_08	*Cove off upper portion of reservoir, East Trinity*		
	sulfate	5c	2006
0803_09	*West Carolina Creek cove, off upper portion of reservoir*		
	sulfate	5c	2006
0803_10	*Upper portion of reservoir, centering on SH 19*		
	sulfate	5c	2006
0803_11	*Riverine portion of reservoir, centering on SH 21*		
	sulfate	5c	2006
0803_12	*Remainder of reservoir*		
	sulfate	5c	2006

SegID: 0804G **Catfish Creek (unclassified water body)**
Twenty mile stretch of Catfish Creek running upstream from US 287 in Anderson Co., to Catfish Creek Ranch Lake just upstream of SH 19 in Henderson Co.

Area		Category	Year First Listed
0804G_01	*Entire Segment*		
	depressed dissolved oxygen	5c	2006
	impaired macrobenthic community	5c	2006

SegID: 0805 **Upper Trinity River**
From a point immediately upstream of the confluence of the Cedar Creek Reservoir discharge canal in Henderson/Navarro County to a point immediately upstream of the confluence of Elm Fork Trinity River in Dallas County

Area		Category	Year First Listed
0805_01	*25 mile reach near FM 85*		
	PCBs in edible tissue	5a	2002
0805_02	*25 mile reach near SH 34*		
	PCBs in edible tissue	5a	2002
0805_03	*11 mile reach near S. Loop 12*		
	bacteria	5a	1996
	PCBs in edible tissue	5a	2002
0805_04	*Upper 8 miles*		
	bacteria	5a	1996
	PCBs in edible tissue	5a	2002
0805_05	*Remainder of segment*		
	PCBs in edible tissue	5a	2002
0805_06	*From 15.57 mi. upstream of SH 34 to 4.71 mi. downstream of S Loop 12*		
	PCBs in edible tissue	5a	2002

SegID: 0806 **West Fork Trinity River Below Lake Worth**
From a point immediately upstream of the confluence of Village Creek in Tarrant County to Lake Worth Dam in Tarrant County

Area		Category	Year First Listed
0806_01	*Lower 22 miles of the segment*		
	PCBs in edible tissue	5a	1996

SegID: 0806D **Marine Creek (unclassified water body)**
Two mile stretch of Marine Creek running upstream from confluence with the W. Fork of Trinity River to Tenmile Bridge Road in Fort Worth.

Area		Category	Year First Listed
0806D_01	*Marine Creek from the confluence with W. Fork Trinity River 2 miles upstream to Tenmile Bridge Rd. in Ft. Worth*		
	bacteria	5a	2006

SegID: 0806E **Sycamore Creek (unclassified water body)**
Five mile stretch of Sycamore Creek running upstream from confluence with the W. Fork of Trinity River to confluence with Echo Lake Tributary in Fort Worth.

Area		Category	Year First Listed
0806E_01	*Five mile stretch of Sycamore Creek running upstream from confluence with the W. Fork of Trinity River to confluence with Echo Lake Tributary in Fort Worth*		
	bacteria	5a	2006

SegID: 0810 **West Fork Trinity River Below Bridgeport Reservoir**
From a point 0.6 km (0.4 miles) downstream of the confluence of Oates Branch in Wise County to Bridgeport Dam in Wise County

Area		Category	Year First Listed
0810_01	*Lower 25 miles of segment*		
	bacteria	5a	1998

SegID: 0810A **Big Sandy Creek (unclassified water body)**
Fifteen mile stretch of Sycamore Creek running upstream from confluence with Waggoner Creek to FM 1810, west of Alvord, Wise County

Area		Category	Year First Listed
0810A_01	*Fifteen mile stretch of Big Sandy Creek running from confluence with Waggoner Creek to FM 1810 West of Alvord, Wise Co.*		
	bacteria	5a	2006

SegID: 0810B **Garrett Creek (unclassified water body)**
Eighteen mile stretch of Garrett Creek running upstream from confluence with Salt Creek to Wise County Road approximately 14 miles upstream of SH114, Wise County

Area		Category	Year First Listed
0810B_01	*Eighteen mile stretch of Garrett Creek running upstream from confluence with Salt Creek to Wise County Road approximately 14 miles upstream of SH114, Wise Co.*		
	bacteria	5a	2006

SegID: 0810C **Martin Branch (unclassified water body)**
The eight mile stretch of Martin Branch running upstream from confluence with Center Creek to FM 730 south of Decatur, Wise County.

Area		Category	Year First Listed
0810C_01	*Eight mile stretch of Martin Branch running upstream from confluence with Center Creek to FM 730 south of Decatur, Wise County.*		
	bacteria	5a	2006

SegID: 0810D **Salt Creek (unclassified water body)**
Eleven mile stretch of Salt Creek running upstream from confluence with Garrett Creek, Wise County.

Area		Category	Year First Listed
0810D_01	*Eleven mile stretch of Salt Creek running upstream from confluence with Garrett Creek, Wise County.*		
	bacteria	5a	2006

SegID: 0812 **West Fork Trinity River Above Bridgeport Reservoir**
From a point immediately upstream of the confluence of Bear Hollow in Jack County to SH 79 in Archer County

Area		Category	Year First Listed
0812_01	*Lower 25 miles of segment*		
	chloride	5b	1998
	depressed dissolved oxygen	5b	1998
	total dissolved solids	5b	1998
0812_02	*Upper 60 miles of segment*		
	total dissolved solids	5b	1998
	chloride	5b	1998

SegID: 0818 **Cedar Creek Reservoir**
From Joe B. Hoggsett Dam in Henderson County up to normal pool elevation of 322 feet (impounds Cedar Creek)

Area		Category	Year First Listed
0818_01	*1674*		
	pH	5c	2002
0818_02	*Caney Creek cove*		
	pH	5c	2002
0818_03	*Clear Creek cove*		
	pH	5c	2002
0818_04	*Lower portion of reservoir east of Key Ranch Estates*		
	pH	5c	2002
0818_05	*Cove off lower portion of reservoir adjacent to Clearview Estates*		
	pH	5c	2002
0818_06	*Middle portion of reservoir downstream of Twin Creeks cove*		
	pH	5c	2002
0818_07	*Twin Creeks cove*		
	pH	5c	2002
0818_08	*Prairie Creek cove*		
	pH	5c	2002
0818_09	*Upper portion of reservoir adjacent to Lacy Fork cove*		
	pH	5c	2002
0818_11	*Upper portion of reservoir east of Tolosa*		
	pH	5c	2002
0818_12	*Uppermost portion of reservoir downstream of Kings Creek*		
	pH	5c	2002

SegID: 0819 **East Fork Trinity River**
From the confluence with the Trinity River in Kaufman County to Rockwall-Forney Dam in Kaufman County

Area		Category	Year First Listed
0819_01	*Entire segment*		
	sulfate	5b	2008
	total dissolved solids	5b	2008
	chloride	5b	2008

SegID: 0820C **Muddy Creek (unclassified water body)**
From the confluence with Lake Ray Hubbard, in Dallas County, to the headwaters east of Allen, in Collin County

Area		Category	Year First Listed
0820C_01	*Entire creek*		
	bacteria	5c	2002

SegID: 0822 **Elm Fork Trinity River Below Lewisville Lake**
From the confluence with the West Fork Trinity River in Dallas County to Lewisville Dam in Denton County

Area		Category	Year First Listed
0822_02	*4.5 miles upstream to 7.5 miles downstream DWU intake*		
	bacteria	5a	2006

SegID: 0822A **Cottonwood Branch (unclassified water body)**
A 6 mile stretch of Cottonwood Branch running upstream from confluence with Hackberry Creek, to Valley View Road in Dallas County.

Area		Category	Year First Listed
0822A_02	*A 3. 5 mile stretch of Cottonwood Branch running upstream from approximately 0.5 miles downstream of N. Story Rd. to Valley View Rd, Dallas, Co.*		
	bacteria	5a	2006

SegID: 0822B **Grapevine Creek (unclassified water body)**
A 5.5 mile stretch of Grapevine Creek running upstream from Coppell Rd. in Coppell, Dallas Co., to approximately 1. 5 miles upstream of SH 21, Tarrant County.

Area		Category	Year First Listed
0822B_01	*A 5.5 mile stretch of Grapevine Creek running upstream from Coppell Rd. in Coppell, Dallas Co., to approximately 1. 5 miles upstream of SH 21, Tarrant County.*		
	bacteria	5a	2006

SegID: 0829 **Clear Fork Trinity River Below Benbrook Lake**
From the confluence with the West Fork Trinity River in Tarrant County to Benbrook Dam in Tarrant County

Area		Category	Year First Listed
0829_01	*Lower mile of segment*		
	PCBs in edible tissue	5a	1996

SegID: 0831 **Clear Fork Trinity River Below Lake Weatherford**
From a point 200 meters (220 yards) downstream of US 377 in Tarrant County to Weatherford Dam in Parker County

Area		Category	Year First Listed
0831_04	*2 mi upstream of South Fork Trinity River confluence to Squaw Ck. Confluence*		
	depressed dissolved oxygen	5b	1996
0831_05	*From the confluence of Squaw Ck. to Lake Weatherford Dam*		
	depressed dissolved oxygen	5b	1996

SegID: 0833 **Clear Fork Trinity River Above Lake Weatherford**
From a point 3.1 km (1.9 miles) upstream of FM 1707 in Parker County, to FM 3107 in Parker County

Area		Category	Year First Listed
0833_02	*Upper 11 miles of segment*		
	depressed dissolved oxygen	5b	1998
0833_03	*From the confluence of McKnight Branch to the confluence of Cottonwood Ck.*		
	depressed dissolved oxygen	5b	1998
0833_04	*From the confluence with Dobbs Branch to confluence with McKnight Branch*		
	depressed dissolved oxygen	5b	1998

SegID: 0838C **Walnut Creek (unclassified water body)**
A 7 mile stretch of Walnut Creek running upstream from Holland Road, to confluence with Willow Branch, NW Mansfield, Tarrant County.

Area		Category	Year First Listed
0838C_01	*Entire segment.*		
	bacteria	5c	2006

SegID: 0841 **Lower West Fork Trinity River**
From a point immediately upstream of the confluence of the Elm Fork Trinity River in Dallas County to a point immediately upstream of the confluence of Village Creek in Tarrant County

Area		Category	Year First Listed
0841_01	*Lower 14 miles of segment*		
	bacteria	5a	1996
	PCBs in edible tissue	5a	1996
0841_02	*Upper 13 miles of segment*		
	PCBs in edible tissue	5a	1996

SegID: 0841B **Bear Creek (unclassified water body)**
A 10 mile stretch of Bear Creek running upstream from confluence with West Fork Trinity River, to just upstream of HWY 183, Dallas County.

Area		Category	Year First Listed
0841B_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841C **Arbor Creek (unclassified water body)**
A 2.2 mile stretch of Arbor Creek running upstream from confluence with Johnson Creek, to approx. 0.5 miles upstream of Tarrant/Dallas county line.

Area		Category	Year First Listed
0841C_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841D **Big Bear Creek (unclassified water body)**
An 8 mile stretch of Big Bear Creek running upstream from confluence with Little Bear Creek to SH 26, Tarrant Co.

Area		Category	Year First Listed
0841D_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841E **Copart Branch Mountain Creek (unclassified water body)**
A 2.8 mile stretch of Copart Branch running upstream from confluence with Mountain Creek to approximately 0.3 miles upstream of Camden Road on Dallas Naval Academy, Dallas County.

Area		Category	Year First Listed
0841E_01	*Entire segment.*		
	bacteria	5c	2006

SegID: 0841F **Cottonwood Creek (unclassified water body)**
A 6.5 mile stretch of Cottonwood Creek running upstream from approx. 0.1 mi. upstream of Mountain Creek Reservoir in Dallas Co., to SH 360 in, Tarrant Co.

Area		Category	Year First Listed
0841F_01	*Entire segment.*		
	bacteria	5c	2006

SegID: 0841G **Dalworth Creek (unclassified water body)**
A 2.2 mile stretch of Dalworth Creek running upstream from confluence with Lower W. Fork Trinity to County Line Road in Grand Prairie, Dallas Co.

Area		Category	Year First Listed
0841G_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841H **Delaware Creek (unclassified water body)**
An 8.5 mile stretch of Delaware Creek running upstream from confluence with Lower W. Fork Trinity to Finley Road in Irving.

Area		Category	Year First Listed
0841H_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841J **Estelle Creek (unclassified water body)**
A 4 mile stretch of Estelle Creek running upstream from confluence with Bear Creek to Valley View Lane in Irving, Dallas County.

Area		Category	Year First Listed
0841J_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841K **Fish Creek (unclassified water body)**
A 10.5 mile stretch of Fish Creek running upstream from approx. 100 m downstream of FM 382 in Grand Prairie, Dallas Co., to approx. 0.25 mi. upstream of Collins Rd. in Arlington, Tarrant Co. Includes north and south branches of Fish Creek.

Area		Category	Year First Listed
0841K_01	*Entire segment.*		
	bacteria	5c	2006

SegID: 0841M **Kee Branch (unclassified water body)**
Three mile stretch of Kee Branch running upstream from confluence with Rush Creek to approx. 300 m upstream of Polly-Webb Road in Arlington, Tarrant Co. Sta. ID 10792

Area		Category	Year First Listed
0841M_01	*Entire segment.*		
	bacteria	5a	2006

SegID: 0841N **Kirby Creek (unclassified water body)**
Four mile stretch of Kirby Creek running upstream from confluence with Fish Creek in Grand Prairie, Dallas Co., to just upstream of Great Southwest Parkway in Arlington, Tarrant Co.

Area		Category	Year First Listed
0841N_01	*Entire segment*		
	bacteria	5c	2006

SegID: 0841S **Vilbig Lakes (unclassified water body)**
A 5 acre area in NW corner of Vilbig Lakes, near confluence with unnamed creek, approx. 100 m south of intersection of Rusdell Rd./Marvel Dr. in Irving, Dallas, Co.

Area		Category	Year First Listed
0841S_01	*A 5 acre area in NW corner of Vilbig Lakes, near confluence with unnamed creek, approx. 100 m south of intersection of Rusdell Rd./Marvel Dr. in Irving, Dallas, Co.*		
	bacteria	5c	2006

SegID: 0841U **West Irving Creek (unclassified water body)**
A 4 mile stretch of West Irving Branch running upstream from approx. 0.4 mi. downstream of Oakdale Rd. to just south of Sowers Road in Irving, Dallas Co.

Area		Category	Year First Listed
0841U_01	*A 4 mile stretch of West Irving Branch running upstream from approx. 0.4 mi. downstream of Oakdale Rd. to just south of Sowers Road in Irving, Dallas Co.*		
	bacteria	5c	2006

SegID: 0901 **Cedar Bayou Tidal**
From the confluence with Galveston Bay 1.0 km (0.6 miles) downstream of Tri-City Beach Road in Chambers County to a point 2.2 km (1.4 miles) upstream of IH 10 in Chambers/Harris County

Area		Category	Year First Listed
0901_01	*Entire segment*		
	dioxin in edible tissue	5a	2002
	PCBs in edible tissue	5a	2008
	bacteria	5c	2006

SegID: 0902 **Cedar Bayou Above Tidal**
From a point 2.2 km (1.4 miles) upstream of IH 10 in Chambers/Harris County to a point 7.4 km (4.6 miles) upstream of FM 1960 in Liberty County

Area		Category	Year First Listed
0902_01	*Entire segment*		
	impaired macrobenthic community	5c	2006

SegID: 1001 **San Jacinto River Tidal**
From a point 100 meters (110yards) downstream of IH 10 in Harris County to Lake Houston Dam in Harris County

Area		Category	Year First Listed
1001_01	*From Lake Houston Dam to US Hwy 90*		
	dioxin in edible tissue	5a	2000
1001_02	*From US Hwy 90 to IH 10*		
	dioxin in edible tissue	5a	2000
	PCBs in edible tissue	5a	2002

SegID: 1002 **Lake Houston**
From Lake Houston Dam in Harris County to the confluence of Spring Creek on the West Fork San Jacinto Arm in Harris/Montgomery County and to the confluence of Caney Creek on the East Fork San Jacinto Arm in Harris County, up to normal pool elevation of 44.5 feet (impounds San Jacinto River)

Area		Category	Year First Listed
1002_06	*Confluence with Spring Creek to West Lake Houston Pkwy*		
	bacteria	5a	2006

SegID: 1003 **East Fork San Jacinto River**
From the confluence of Caney Creek in Harris County to US 190 in Walker County

Area		Category	Year First Listed
1003_01	*Confluence with Caney Creek upstream to US 59*		
	bacteria	5a	2006
1003_02	*US Hwy 59 to 25 miles upstream (just upstream of Clear Creek confluence)*		
	bacteria	5a	2006
1003_03	*25 miles upstream of US 59 to US 190 (upper segment boundary)*		
	bacteria	5a	2006

SegID: 1004 **West Fork San Jacinto River**
From the confluence of Spring Creek in Harris/Montgomery County to Conroe Dam in Montgomery County

Area		Category	Year First Listed
1004_02	*IH 45 to the Spring Creek confluence*		
	bacteria	5a	1996

SegID: 1004D **Crystal Creek (unclassified water body)**
From the confluence of the east and west forks of Crystal Creek to the confluence with the West Fork of the San Jacinto River.

Area		Category	Year First Listed
1004D_01	*Confluence with West Fork San Jacinto River upstream to confluence of the East and West Forks of Crystal Creek*		
	bacteria	5a	2006

SegID: 1004E **Stewarts Creek (unclassified water body)**
From headwaters northwest of old Montgomery Rd to confluence with West Fork of the San Jacinto River.

Area		Category	Year First Listed
1004E_02	*From Airport Rd to confluence with West Fork San Jacinto River*		
	bacteria	5a	2006

SegID: 1005 **Houston Ship Channel/San Jacinto River Tidal**
From the confluence with Galveston Bay at Morgan's Point in Harris/Chambers County to a point 100 meters (110 yards) downstream of IH 10 in Harris County

Area		Category	Year First Listed
1005_01	*Downstream I-10 to Lynchburg Ferry Road*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1005_02	*Lynchburg Ferry Road to Goose Island*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
	bacteria	5c	2006
1005_03	*Goose Island to SH 146*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1005_04	*SH 146 to Morgans Point*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002

SegID: 1006 **Houston Ship Channel Tidal**
From the confluence with the San Jacinto River in Harris County to a point immediately upstream of Greens Bayou in Harris County, including tidal portions of tributaries

Area		Category	Year First Listed
1006_01	*Houston Ship Channel Tidal-Greens Bayou confluence to Patrick Bayou confluence*		
	dioxin in edible tissue	5a	1996
	bacteria	5c	2006
	PCBs in edible tissue	5a	2002
1006_02	*Houston Ship Channel Tidal- Patrick Bayou confluence to lower segment boundary*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1006_03	*Greens Bayou Tidal*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1006_04	*Patrick Bayou Tidal*		
	dioxin in edible tissue	5a	1996
	mercury in water	5a	1998
	PCBs in edible tissue	5a	2002
	toxicity in sediment	5c	2000
1006_05	*Goodyear Creek Tidal*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2006
	PCBs in edible tissue	5a	2002
	dioxin in edible tissue	5a	1996

SegID: 1006D **Halls Bayou (unclassified water body)**
Perennial stream from the confluence with Greens Bayou up to US 59 in Harris County

Area		Category	Year First Listed
1006D_01	*From the confluence with Greens Bayou to US 59*		
	bacteria	5a	2002
1006D_02	*From Hirsch Road to Homestead Road*		
	bacteria	5a	2002

SegID: 1006F **Big Gulch Above Tidal (unclassified water body)**
From the confluence with Greens Bayou Tidal to Wallisville Road in Harris County

Area		Category	Year First Listed
1006F_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1006H **Spring Gully Above Tidal (unclassified water body)**
From confluence with Greens Bayou to US 90 in Harris County

Area		Category	Year First Listed
1006H_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1006I **Unnamed Tributary of Halls Bayou (unclassified water body)**
From the confluence with Halls Bayou to a point 0.13 miles upstream of Richland Drive in Harris County

Area		Category	Year First Listed
1006I_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1006J **Unnamed Tributary of Halls Bayou (unclassified water body)**
From the confluence of Halls Bayou (east of US 59 and south of Langley Road) to Mount Houston Road in Harris County

Area		Category	Year First Listed
1006J_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007 **Houston Ship Channel/Buffalo Bayou Tidal**
From a point immediately upstream of Greens Bayou in Harris County to a point 100 meters (110 yards) upstream of US 59 in Harris County, including tidal portion of tributaries

Area		Category	Year First Listed
1007_01	*Houston Ship Channel/Buffalo Bayou Tidal*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
	bacteria	5c	2006
1007_02	*Sims Bayou Tidal (upstream of SH 35 to Houston Ship Channel confluence)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1007_03	*Hunting Bayou Tidal (I-10 to confluence with Houston Ship Channel)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1007_04	*Brays Bayou Tidal (downstream of I 45 to confluence with the Houston Ship Channel)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1007_05	*Vince Bayou Tidal (SH 225 to confluence with the Houston Ship Channel*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
	bacteria	5c	2006
	toxicity in sediment	5c	2000
1007_06	*Berry Bayou Tidal (2.4 km upstream of the Sims Bayou confluence)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
1007_07	*Buffalo Bayou (US 59 to upstream of 69th Street WWTP)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002
	bacteria	5c	2006
1007_08	*Little Vince Bayou Tidal (From confluence with Vince Bayou to SH 225)*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2002

SegID: 1007A **Canal C-147 tributary of Sims Bayou Above Tidal (unclassified water body)**
Houston Ship Channel/Buffalo Bayou Tidal tributary

Area		Category	Year First Listed
1007A_01	*From confluence with an unnamed flood control ditch near Corsair St to the confluence with Sims Bayou*		
	bacteria	5c	2006

SegID: 1007B **Brays Bayou Above Tidal (unclassified water body)**
Perennial stream from 11.5 km upstream of confluence with Houston Ship Channel up to SH 6

Area		Category	Year First Listed
1007B_01	*From 11.5km upstream of confluence with Brays Bayou Tidal to SH 6*		
	bacteria	5a	2002
1007B_02	*SH 6 to Clodine Road*		
	bacteria	5a	2002

SegID: 1007C **Keegans Bayou Above Tidal (unclassified water body)**
Perennial stream from confluence with Brays Bayou upstream to Harris County line

Area		Category	Year First Listed
1007C_01	*From Harris County line to confluence with Brays Bayou*		
	bacteria	5a	2002

SegID: 1007D **Sims Bayou Above Tidal (unclassified water body)**
Perennial stream from 11.0 km upstream of confluence with Houston Ship Channel upstream to Hiram Clark Drive

Area		Category	Year First Listed
1007D_01	*From 0.4 miles north of Beltway 8 to Hiram Clark*		
	bacteria	5a	2002
1007D_02	*From Hirman Clark to 11 miles upstream of the confluence with the Houston Ship Channel*		
	bacteria	5a	2002
1007D_03	*From 11 miles upstream of the Houston Ship Channel confluence to SH 35*		
	bacteria	5a	2002

SegID: 1007E **Willow Waterhole Bayou Above Tidal (unclassified water body)**
Perennial stream from confluence with Brays Bayou upstream to South Garden (in Missouri City)

Area		Category	Year First Listed
1007E_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007F **Berry Bayou Above Tidal (unclassified water body)**
Perennial stream from 2.4 km upstream from the confluence with Sims Bayou to the southern city limits of South Houston

Area		Category	Year First Listed
1007F_01	*1.5 miles upstream from confluence with Sims Bayou to SH 3*		
	bacteria	5a	2002

SegID: 1007G **Kuhlman Gully Above Tidal (unclassified water body)**
From confluence with Brays Bayou in Harris County to Atchison, Topeka and Santa Fe Railroad tracks in Harris County

Area		Category	Year First Listed
1007G_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007H **Pine Gully Above Tidal (unclassified water body)**
From the confluence with Sims Bayou in Harris County to Broadway in Harris County

Area		Category	Year First Listed
1007H_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007I **Plum Creek Above Tidal (unclassified water body)**
From the confluence with Sims Bayou in Harris County to Telephone Road in Harris County

Area		Category	Year First Listed
1007I_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007K **Country Club Bayou Above Tidal (unclassified water body)**
From just downstream of South Lockwood Drive to the confluence with Brays Bayou to approximately 0.5 miles upstream of North Wayside Drive in Harris County

Area		Category	Year First Listed
1007K_01	*From just downstream of South Lockwood Drive to the confluence with Brays Bayou*		
	depressed dissolved oxygen	5c	2002
	bacteria	5a	2002

SegID: 1007L **Unnamed Non-Tidal Tributary of Brays Bayou (unclassified water body)**
From the confluence with Brays Bayou near Fondren Road to a point 0.60 miles upstream in Harris County

Area		Category	Year First Listed
1007L_01	*Entire perennial portion of water body*		
	bacteria	5a	2002

SegID: 1007M **Unnamed Non-Tidal Tributary of Hunting Bayou (unclassified water body)**
From the confluence with Hunting Bayou to Mercury Road in Harris County

Area		Category	Year First Listed
1007M_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007N **Unnamed Non-Tidal Tributary of Sims Bayou (unclassified water body)**
From confluence with Sims Bayou, south of Airport Road, to Reed Road, east of SH 288 in Harris County

Area		Category	Year First Listed
1007N_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1007O **Unnamed Non-Tidal Tributary of Buffalo Bayou (unclassified water body)**
From confluence with Buffalo Bayou to IH-10 between Hirsch Road and Lockwood in Harris County

Area		Category	Year First Listed
1007O_01	*Entire water body*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002

SegID: 1007R **Hunting Bayou Above Tidal (unclassified water body)**
From the confluence with Hunting Bayou Tidal at IH-10 to Maury Street on the north fork and Bain Street on the south fork

Area		Category	Year First Listed
1007R_01	*From Bain Street to Sayers Street (South Fork)*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002
1007R_02	*From just east of Elysian Street to Falls Street (North Fork)*		
	bacteria	5a	2002
1007R_03	*From Falls Street to Loop 610 East*		
	bacteria	5a	2002
1007R_04	*From Loop 610 East to IH 10*		
	bacteria	5a	2002

SegID: 1008 **Spring Creek**
From the confluence with the West Fork San Jacinto River in Harris/Montgomery County to the most upstream crossing of FM 1736 in Waller County

Area		Category	Year First Listed
1008_02	*Field Store Road to SH 249*		
	bacteria	5a	1996
	depressed dissolved oxygen	5b	1996
1008_03	*SH 249 to IH 45*		
	bacteria	5a	1996
1008_04	*IH 45 to confluence with Lake Houston*		
	bacteria	5a	1996

SegID: 1008B **Upper Panther Branch (unclassified water body)**
Intermittent stream with perennial pools from the normal pool elevation of 125 feet of Lake Woodlands upstream to Old Conroe Road

Area		Category	Year First Listed
1008B_01	*From Old Conroe Road to the confluence with Bear Branch*		
	bacteria	5a	2006

SegID: 1008H **Willow Creek (unclassified water body)**
From 0.3 miles north of Juergen Rd to the confluence with Spring Creek

Area		Category	Year First Listed
1008H_01	*Entire water body*		
	bacteria	5a	2006

SegID: 1009 **Cypress Creek**
From the confluence with Spring Creek in Harris County to the confluence of Snake Creek and Mound Creek in Waller County

Area		Category	Year First Listed
1009_01	*Upper portion of segment to downstream of US 290*		
	bacteria	5a	1996
1009_02	*US 290 to SH 249*		
	bacteria	5a	1996
1009_03	*SH 249 to IH 45*		
	bacteria	5a	1996
1009_04	*IH 45 to confluence with Spring Creek*		
	bacteria	5a	1996

SegID: 1009C **Faulkey Gully (unclassified water body)**
Perennial stream from its confluence with Cypress Creek upstream 3.2 km, which is approximately 1.0 km upstream of Louetta Road

Area		Category	Year First Listed
1009C_01	*From an unnamed lake 0.3 miles southeast of Telge Road to the confluence with Cypress Creek*		
	bacteria	5c	2006

SegID: 1009D **Spring Gully (unclassified water body)**
Perennial stream from a point 1 km upstream of Louetta Road upstream to Spring Cypress Road

Area		Category	Year First Listed
1009D_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1009E **Little Cypress Creek**
From the confluence with Cypress Creek upstream to Hwy 290A.

Area		Category	Year First Listed
1009E_01	*Entire water body*		
	bacteria	5a	2006

SegID: 1010 **Caney Creek**
From the confluence with the East Fork San Jacinto River in Harris County to SH 150 in Walker County

Area		Category	Year First Listed
1010_02	*FM 1097 to SH 105*		
	bacteria	5a	2006
1010_04	*FM 2090 to lower segment boundary*		
	bacteria	5a	2006

SegID: 1011 **Peach Creek**
From the confluence with Caney Creek in Montgomery County to SH 150 in Walker County

Area		Category	Year First Listed
1011_02	*US Hwy 59 to confluence with Caney Creek*		
	bacteria	5a	2006

SegID: 1013 **Buffalo Bayou Tidal**
From a point 100 meters (110 yards) upstream of US 59 in Harris County to a point 400 meters (440 yards) upstream of Shepard Drive in Harris County

Area		Category	Year First Listed
1013_01	*Entire segment*		
	bacteria	5a	1996

SegID: 1013A **Little White Oak Bayou (unclassified water body)**
From the confluence with Whiteoak Bayou to Yale Street

Area		Category	Year First Listed
1013A_01	*From the confluence of White Oak Bayou upstream to the RR Tracks north of IH 610*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002

SegID: 1013C **Unnamed Non-Tidal Tributary of Buffalo Bayou Tidal (unclassified water body)**
Located approximately 1.8 miles upstream of the Buffalo Bayou/White Oak Bayou confluence between IH-10 and Memorial Drive west of IH-45 in Harris County

Area		Category	Year First Listed
1013C_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1014 **Buffalo Bayou Above Tidal**
From a point 400 meters (440 yards) upstream of Shepherd Drive in Harris County to SH 6 in Harris County

Area		Category	Year First Listed
1014_01	*Entire segment*		
	bacteria	5a	1996

SegID: 1014A **Bear Creek (unclassified water body)**
Perennial stream from the confluence with South Mayde Creek upstream to the confluence with an unnamed tributary 1.24 km north of Logenbaugh Road

Area		Category	Year First Listed
1014A_01	*Confluence with South Mayde Creek to a point upstream of an unnamed tributary north of Langenbaugh Road*		
	bacteria	5a	2006

SegID: 1014B **Buffalo Bayou (unclassified water body)**
Perennial stream from SH 6 in Harris County upstream to the confluence with Willow Fork Buffalo Bayou in Fort Bend County

Area		Category	Year First Listed
1014B_01	*From SH6 to the confluence with Willow Fork Buffalo Bayou*		
	bacteria	5a	2006

SegID: 1014E **Langham Creek (unclassified water body)**
Perennial stream from the confluence with Dinner Creek upstream to FM 529

Area		Category	Year First Listed
1014E_01	*Confluence with Bear Creek upstream to the confluence with Dinner Creek*		
	bacteria	5a	2006

SegID: 1014H **South Mayde Creek (unclassified water body)**
Perennial stream in the Addicks Reservoir flood pool area, from the confluence with Buffalo Bayou upstream to the confluence with an unnamed tributary 0.62 km east of Barker-Cypress Road.

Area		Category	Year First Listed
1014H_01	*From the confluence with Buffalo Bayou upstream to the confluence with an unnamed tributary 0.62 km east of Barker-Cypress Road*		
	bacteria	5a	2002
1014H_02	*From the confluence with an unnamed tributary 0.62 km east of Barker-Cypress Road upstream to an unnamed tributary 1.05 km south of Clay Road*		
	bacteria	5a	2002

SegID: 1014K **Turkey Creek (unclassified water body)**
Perennial stream from the confluence with South Mayde Creek in Harris County upstream to the headwaters south of Clay Road in Harris County

Area		Category	Year First Listed
1014K_01	*From the confluence with South Mayde Creek upstream to a point south of Clay Road*		
	bacteria	5a	2002
1014K_02	*From south of Clay Road upstream to north of Tanner Road*		
	bacteria	5a	2002

SegID: 1014L **Mason Creek (unclassified water body)**
Perennial stream from the confluence with Buffalo Bayou upstream to channelization, 1.55 km south of Franz Road

Area		Category	Year First Listed
1014L_01	*Confluence with Buffalo Bayou upstream to the channelization south of Franz Rd.*		
	bacteria	5a	2006

SegID: 1014M **Neimans Bayou (unclassified water body)**
From confluence with Buffalo Bayou Above Tidal to upstream of IH 10

Area		Category	Year First Listed
1014M_01	*Entire water body*		
	depressed dissolved oxygen	5c	2002
	bacteria	5a	2002

SegID: 1014N **Rummel Creek (unclassified water body)**
From confluence with Buffalo Bayou Above Tidal in Harris County to IH 10/Beltway 8 in Harris County

Area		Category	Year First Listed
1014N_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1014O **Spring Branch (unclassified water body)**
From confluence with Buffalo Bayou in Harris County to Blalock Road in Harris County

Area		Category	Year First Listed
1014O_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1016 **Greens Bayou Above Tidal**
From a point 0.7 km (0.4 miles) above the confluence of Halls Bayou in Harris County to a point 100 meters (110 yards) above FM 1960 in Harris County

Area		Category	Year First Listed
1016_01	*Upper segment boundary (FM 1960) to IH 45*		
	bacteria	5a	1996
1016_02	*IH 45 to US 59*		
	bacteria	5a	1996
1016_03	*US 59 to lower segment boundary at the Halls Bayou confluence*		
	bacteria	5a	1996

SegID: 1016A **Garners Bayou (unclassified water body)**
Perennial stream from the confluence with Williams Gully upstream to 1.5 km north of Atoscocita Road

Area		Category	Year First Listed
1016A_02	*From the confluence with Williams Gully upstream to 1.5 km north of Atascosita Road*		
	bacteria	5a	2002
1016A_03	*From the confluence with Greens Bayou upstream to the confluence with Williams Gully*		
	bacteria	5a	2002

SegID: 1016B **Unnamed Tributary of Greens Bayou (unclassified water body)**
From confluence with Greens Bayou to Hirsch Road in Harris County

Area		Category	Year First Listed
1016B_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1016C **Unnamed Tributary of Greens Bayou (unclassified water body)**
From the confluence with Greens Bayou, east of Aldine Westfield Road, to the Hardy Toll Road in Harris County

Area		Category	Year First Listed
1016C_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1016D **Unnamed Tributary of Greens Bayou (unclassified water body)**
From confluence with Greens Bayou, west of El Dorado Country Club to Lee Road, west of US Hwy 59 in Harris County

Area		Category	Year First Listed
1016D_01	*Entire water body*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002

SegID: 1017 **Whiteoak Bayou Above Tidal**
From a point immediately upstream of the confluence of Little White Oak Bayou in Harris County to a point 3.0 km (1.9 miles) upstream of FM 1960 in Harris County

Area		Category	Year First Listed
1017_01	*Huffsmith Rd to the confluence with Vogel Creek*		
	bacteria	5a	1996
1017_02	*Vogel Creek to the Cole Creek confluence*		
	bacteria	5a	1996
1017_03	*Cole Creek confluence to the Brickhouse Gully confluence*		
	bacteria	5a	1996
1017_04	*Brickhouse Gully confluence to lower segment boundary*		
	bacteria	5a	1996

SegID: 1017A **Brickhouse Gully/Bayou (unclassified water body)**
Perennial stream from the confluence with Whiteoak Bayou up to Gessner Road

Area		Category	Year First Listed
1017A_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1017B **Cole Creek (unclassified water body)**
Perennial stream from the confluence with White Oak Bayou up to south of Beltway 8

Area		Category	Year First Listed
1017B_02	*From Flintlock Street to confluence with White Oak Bayou*		
	bacteria	5a	2002

SegID: 1017D **Unnamed Tributary of Whiteoak Bayou (unclassified water body)**
From confluence with Whiteoak Bayou downstream of TC Jester, to Hempstead Hwy, north of US Hwy 290 in Harris County

Area		Category	Year First Listed
1017D_01	*Entire water body*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002

SegID: 1017E **Unnamed Tributary of White Oak Bayou (unclassified water body)**
From the confluence with White Oak Bayou, near W 11th Street, to just upstream of W 26th Street, south of Loop 610 W in Harris County

Area		Category	Year First Listed
1017E_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1101 **Clear Creek Tidal**
From the confluence with Clear Lake at a point 3.2 km (2.0 miles) downstream of El Camino Real in Galveston/Harris County to a point 100 m (110 yards) upstream of FM528 in Galveston/Harris County

Area		Category	Year First Listed
1101_01	*Upper segment boundary to Chigger Creek confluence*		
	bacteria	5a	1996
1101_02	*Chigger Creek confluence to IH 45*		
	bacteria	5a	1996
1101_03	*IH45 to Cow Bayou confluence*		
	bacteria	5a	1996

SegID: 1101B **Chigger Creek (unclassified water body)**
From the confluence of Clear Creek Tidal to the Brazos River Authority Canal near CR 143 in Galveston County

Area		Category	Year First Listed
1101B_01	*From the headwaters to FM 528*		
	bacteria	5a	2002
1101B_02	*FM 528 to the confluence with Clear Creek*		
	bacteria	5a	2002

SegID: 1101D **Robinson Bayou (unclassified water body)**
From confluence with Clear Creek to 0.33 mile upstream of Webster Street in Galveston County

Area		Category	Year First Listed
1101D_01	*From headwater to Abilene St.*		
	bacteria	5c	2006
1101D_02	*From Abilene St. to confluence with Clear Lake*		
	bacteria	5c	2006

SegID: 1102 **Clear Creek Above Tidal**
From a point 100 meters (110 yards) upstream of FM 528 in Galveston/Harris County to Rouen Road in Fort Bend County

Area		Category	Year First Listed
1102_01	*Upper segment boundary (Rouen Road) to SH 288*		
	bacteria	5a	1996
1102_02	*SH 288 to Hickory Slough confluence*		
	bacteria	5a	1996
	impaired fish community	5c	2006
1102_03	*Hickory Slough confluence to Turkey Creek confluence*		
	bacteria	5a	1996
1102_04	*Turkey Creek confluence to Mary's Creek confluence*		
	bacteria	5a	1996
1102_05	*Mary's Creek confluence to lower segment boundary*		
	bacteria	5a	1996

SegID: 1102A **Cowart Creek (unclassified water body)**
Intermittent stream with perennial pools from the confluence with Clear Creek in Galveston County to SH 35 in Brazoria County

Area		Category	Year First Listed
1102A_01	*Sunset Drive to SH35*		
	bacteria	5a	2002
1102A_02	*Confluence with Clear Creek to Sunset Drive*		
	bacteria	5a	2002

SegID: 1102B **Mary's Creek/ North Fork Mary's Creek (unclassified water body)**
Perennial stream from the confl. with Clear Creek upstrm to confl. with N. and S. Fork Mary's Creek near FM 1128, approx. 5 km SW of Pearland. Includes perennial portion of N. Fork Mary's Creek to confl. with unnamed trib approx. 3.2 km upstrm of FM 1128

Area		Category	Year First Listed
1102B_01	*Entire segment*		
	bacteria	5a	2002

SegID: 1102C **Hickory Slough (unclassified water body)**
From approximately 0.3 miles upstream of CR 92 to the confluence with Clear Creek.

Area		Category	Year First Listed
1102C_01	*From confluence with Clear Creek to (approx. 0.3 miles) upstream of CR 93*		
	bacteria	5c	2006

SegID: 1102D **Turkey Creek (unclassified water body)**
From IH 45 to confluence with Clear Creek

Area		Category	Year First Listed
1102D_01	*Confluence with Clear Creek to IH 45*		
	bacteria	5c	2006

SegID: 1102E **Mud Gully (unclassified water body)**
From Beamer Rd to the confluence with Clear Creek

Area		Category	Year First Listed
1102E_01	*Beamer Road to confluence with Clear Creek*		
	bacteria	5c	2006

SegID: 1103 **Dickinson Bayou Tidal**
From the confluence with Dickinson Bay 2.1 km (1.3 miles) downstream of SH 146 in Galveston County to a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County

Area		Category	Year First Listed
1103_01	*From 2.5 miles downstream of FM 517 to the Bordens Gully confluence*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996
1103_02	*From the Bordens Gully confluence to the Benson Bayou confluence*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996
1103_03	*From the Benson Bayou confluence to the confluence with Gum Bayou*		
	bacteria	5a	1996
	depressed dissolved oxygen	5a	1996

SegID: 1103A **Bensons Bayou (unclassified water body)**
From the confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646 in Galveston County

Area		Category	Year First Listed
1103A_01	*From confluence with Dickinson Bayou Tidal to 0.37 miles upstream of FM 646*		
	bacteria	5a	2002

SegID: 1103B **Bordens Gully (unclassified water body)**
From confluence with Dickinson Bayou Tidal to upstream of Calder Road in Galveston County

Area		Category	Year First Listed
1103B_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1103C **Geisler Bayou (unclassified water body)**
From confluence with Dickinson Bayou tidal to IH 45 in Galveston County

Area		Category	Year First Listed
1103C_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1104 **Dickinson Bayou Above Tidal**
From a point 4.0 km (2.5 miles) downstream of FM 517 in Galveston County to FM 528 in Galveston County

Area		Category	Year First Listed
1104_01	*From lower segment boundary upstream to FM 517*		
	bacteria	5a	1996
	depressed dissolved oxygen	5c	2006
1104_02	*From FM 517 upstream to FM 528*		
	bacteria	5a	1996

SegID: 1110 **Oyster Creek Above Tidal**
From a point 100 meters (110 yards) upstream of FM 2004 in Brazoria County to the Brazos River Authority diversion dam 1.8 km (1.1 miles) upstream of SH 6 in Fort Bend County

Area		Category	Year First Listed
1110_02	*4 mi upstream South Texas Water Co. Canal to just above Ramsey Prison Unit*		
	bacteria	5c	2006
1110_03	*From just upstream of Ramsey Prison Unit (Cow Cr) to CR 290/S Walker St.*		
	depressed dissolved oxygen	5b	1996
	bacteria	5c	2006

SegID: 1113 **Armand Bayou Tidal**
From the confluence with Clear Lake (at NASA Road 1 bridge) in Harris County to a point 0.8 km (0.5 miles) downstream of Genoa-Red Bluff road in Pasadena in Harris County (includes Mud Lake)

Area		Category	Year First Listed
1113_01	*Upper segment boundary to confluence with Big Island Slough*		
	depressed dissolved oxygen	5b	1996
1113_02	*Big Island Slough confluence to Horsepen Bayou confluence*		
	depressed dissolved oxygen	5b	1996
	bacteria	5c	2006

SegID: 1113A **Armand Bayou Above Tidal (unclassified water body)**
From a point 0.8 km (0.5 miles) downstream of Genoa-Red Bluff Road in Pasadena in Harris County

Area		Category	Year First Listed
1113A_01	*0.5 miles downstream of Genoa Red Bluff to Preston Road*		
	bacteria	5a	1998
	depressed dissolved oxygen	5c	1998

SegID: 1113B **Horsepen Bayou (unclassified water body)**
From SH3 to the confluence of Armand Bayou Tidal

Area		Category	Year First Listed
1113B_01	*Confluence with Armand Bayou to SH 3*		
	bacteria	5c	2006

SegID: 1202H **Allen's Creek (unclassified water body)**
From the confluence with the Brazos River, two miles northeast of Wallis, to the headwaters one mile north of IH 10 in Austin County.

Area		Category	Year First Listed
1202H_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1202J **Big Creek (unclassified water body)**
From the confluence of Cottonwood and Coon Creeks, 5 miles north of Needville in Fort Bend County, downstream to the confluence with the Brazos River

Area		Category	Year First Listed
1202J_01	*Upstream portion of water body to Whaley-Longpoint Road*		
	impaired fish community	5b	2006
	bacteria	5c	2002

SegID: 1205 **Lake Granbury**
From DeCordova Bend Dam in Hood County to a point 100 meters (110 yards) upstream of FM 2580 in Parker County, up to normal pool elevation of 693 feet (impounds Brazos River)

Area		Category	Year First Listed
1205_01	*Upstream portion of lake*		
	chloride	5c	2008
1205_02	*Portion of lake adjacent to the City of Oak Trail Shores*		
	chloride	5c	2008
1205_03	*Portion of lake adjacent to the City of Granbury*		
	chloride	5c	2008
1205_04	*Portion of lake downstream of Granbury*		
	chloride	5c	2008
1205_05	*Downstream portion of lake*		
	chloride	5c	2008

SegID: 1206 **Brazos River Below Possum Kingdom Lake**
From a point 100 meters (110 yards) upstream of FM 2580 in Parker County to Morris Shepard Dam in Palo Pinto County

Area		Category	Year First Listed
1206_01	*Downstream portion of segment*		
	chloride	5b	2006
	impaired macrobenthic community	5c	2008
1206_02	*Middle Portion of Segment*		
	chloride	5b	2006
	impaired macrobenthic community	5c	2008
1206_03	*Upstream portion of segment*		
	chloride	5b	2006

SegID: 1208 **Brazos River Above Possum Kingdom Lake**
From a point immediately upstream of the confluence of Cove Creek at Salem Bend in Young County to the confluence of the Double Mountain Fork Brazos River and the Salt Fork Brazos River in Stonewall County

Area		Category	Year First Listed
1208_01	*From confluence with Possum Kingdom upstream to confluence with spring Branch*		
	bacteria	5c	2008
1208_02	*Portion of segment from confluence with Spring Branch upstream to confluence with Fish Creek*		
	bacteria	5c	2008
1208_04	*From confluence with Boggy Creek upstream to confluence with Millers Creek*		
	bacteria	5c	2008
1208_05	*From confluence with Millers Creek upstream to confluence with Lake Creek*		
	bacteria	5c	2008

SegID: 1209 **Navasota River Below Lake Limestone**
From the confluence with the Brazos River in Grimes County to Sterling C. Robertson Dam in Leon/Robertson County

Area		Category	Year First Listed
1209_02	*From confluence with Rocky Creek to confluence with Sandy Branch*		
	bacteria	5a	2002
1209_03	*From confluence with Sandy Branch to confluence with Shepherd Branch*		
	bacteria	5a	2002
1209_05	*From confluence with Camp Creek to 25 miles upstream*		
	bacteria	5a	2002

SegID: 1209A **Country Club Lake (unclassified water body)**
From the Country Club Branch Dam up to normal pool elevation in Bryan in Brazos County

Area		Category	Year First Listed
1209A_01	*Entire reservoir*		
	toxicity in sediment	5c	1999

SegID: 1209B **Fin Feather Lake (unclassified water body)**
From Fin Feather Dam up to normal pool elevation in northwest Bryan in Brazos County

Area		Category	Year First Listed
1209B_01	*Entire reservoir*		
	toxicity in sediment	5c	2000

SegID: 1209C **Carters Creek (unclassified water body)**
Perennial stream from the confluence with the Navasota River southeast of College Station in Brazos County upstream to the confluence of an unnamed tributary 0.5 km upstream of FM 158 in Brazos County

Area		Category	Year First Listed
1209C_01	*Entire water body*		
	bacteria	5a	1999

SegID: 1209D **Country Club Branch (unclassified water body)**
From the confluence with Country Club Lake in Bryan in Brazos County to the dam at Fin Feather Lake in Bryan

Area		Category	Year First Listed
1209D_01	*entire water body*		
	bacteria	5c	2006

SegID: 1209E **Wickson Creek (unclassified water body)**
Perennial stream from the confluence with an unnamed first order tributary (approximately 1.3 km upstream of Reliance Road crossing) upstream to the confluence with an unnamed first order tributary approximately 15 meters upstream of Dilly Shaw Road

Area		Category	Year First Listed
1209E_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1209G **Cedar Creek (unclassified water body)**
From the confluence with the Navasota River in Brazos County to the confluence with Moores Branch and Rocky Branch in Robertson County

Area		Category	Year First Listed
1209G_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1209H **Duck Creek (unclassified water body)**
From the confluence with the Navasota river in Robertson County to Twin Oak Reservoir dam in Robertson County

Area		Category	Year First Listed
1209H_01	*From the lower end of the creek to FM 2096*		
	bacteria	5c	2006
1209H_02	*From FM 2096 to Twin Oak Reservoir dam*		
	bacteria	5c	2006

SegID: 1209I **Gibbons Creek (unclassified water body)**
From confluence with Navasota River in Grimes County to SH 90 in Grimes County

Area		Category	Year First Listed
1209I_01	*From lower end to confluence with Dry Creek*		
	bacteria	5c	2002

SegID: 1209J **Shepherd Creek (unclassified water body)**
From the confluence with the Navasota River in Madison County to a point 0.7 miles upstream of FM 1452 in Madison County

Area		Category	Year First Listed
1209J_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1209K **Steele Creek (unclassified water body)**
From confluence with Navasota River in Robertson County to a point 2.4 miles upstream of FM 147 in Limestone County

Area		Category	Year First Listed
1209K_02	*From the confluence with Willow Creek upstream to the end of the water body*		
	bacteria	5c	2002

SegID: 1209L **Burton Creek (unclassified water body)**
From the confluence with Carters Creek in College Station, upstream to its headwaters located 0.4 miles east of Fin Feather Lake in Brazos County.

Area		Category	Year First Listed
1209L_01	*entire water body*		
	bacteria	5c	2006

SegID: 1210A **Navasota River above Lake Mexia (unclassified water body)**
From the confluence with the headwaters of Lake Mexia in Limestone County to a point 1.25 miles upstream of SH 31 in Hill County

Area		Category	Year First Listed
1210A_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1211A **Davidson Creek (unclassified water body)**
Intermittent stream with perennial pools from the confluence with Yegua Creek to 0.2 km above SH 21 near Caldwell in Burleson County

Area		Category	Year First Listed
1211A_02	*Upper 25 miles*		
	bacteria	5c	2002

SegID: 1212 **Somerville Lake**
From Somerville Dam in Burleson/Washington County up to normal pool elevation of 238 feet (impounds Yegua Creek)

Area		Category	Year First Listed
1212_01	*Eastern end of reservoir near dam*		
	depressed dissolved oxygen	5c	2008
	pH	5c	2002
1212_03	*Middle of reservoir near Birch Creek State Park*		
	pH	5c	2002

SegID: 1212B **East Yegua Creek (unclassified water body)**
From the confluence with Middle Yegua and Yegua Creeks southeast of Dime Box in Lee County to the upstream portion of the stream, south of Alcoa Lake in Milam County

Area		Category	Year First Listed
1212B_01	*Lower 25 miles*		
	bacteria	5c	2002

SegID: 1213 **Little River**
From the confluence with the Brazos River in Milam County to the confluence of the Leon River and the Lampasas River in Bell County

Area		Category	Year First Listed
1213_01	*From the confluence with Brazos River upstream to confluence with City of Cameron WWTP receiving water*		
	bacteria	5c	2006

SegID: 1214 **San Gabriel River**
From the confluence with the Little River in Milam County to Granger Lake Dam in Williamson County

Area		Category	Year First Listed
1214_01	*From confluence with Little River upstream to confl. with Alligator Creek*		
	chloride	5c	2008
	sulfate	5c	2006
	bacteria	5a	2006
1214_02	*From confluence with Alligator Creek upstream to Lake Granger*		
	sulfate	5c	2006
	chloride	5c	2008

SegID: 1217 **Lampasas River Above Stillhouse Hollow Lake**
From a point immediately upstream of the confluence of Rock Creek in Bell County to FM 2005 in Hamilton County

Area		Category	Year First Listed
1217_04	*From the FM 1690 crossing to the CR 117 crossing*		
	bacteria	5c	2002
1217_05	*From CR 117 crossing to the upper end of the segment*		
	bacteria	5c	2002

SegID: 1217D **North Fork Rocky Creek (unclassified water body)**
From its confluence with South Rocky Creek, upstream to its headwaters 7 miles west of US Hwy 183 in Burnet County

Area		Category	Year First Listed
1217D_01	*entire water body*		
	depressed dissolved oxygen	5b	2006

SegID: 1218 **Nolan Creek/ South Nolan Creek**
From the confluence with the Leon River in Bell County to a point 100 meters (110 yards) upstream to the most upstream crossing of US 190 and Loop 172 in Bell County

Area		Category	Year First Listed
1218_01	*Entire segment*		
	bacteria	5a	1996

SegID: 1220A **Cowhouse Creek (unclassified water body)**
From the confluence of Belton Lake in Bell County south of Gatesville in Coryell County to the upstream perennial portion of the stream north of Goldthwaite in Mills County

Area		Category	Year First Listed
1220A_03	*Upstream portion of water body*		
	bacteria	5c	2006

SegID: 1221 **Leon River Below Proctor Lake**
From a point 100 meters (110 yards) upstream of FM 236 in Coryell County to Proctor Dam in Comanche County

Area		Category	Year First Listed
1221_01	*Directly upstream of Lake Belton*		
	bacteria	5a	1996
1221_04	*From the confluence with Plum Creek, upstream to the confluence with Pecan Creek*		
	bacteria	5a	1996
1221_05	*From confluence with Pecan Creek, upstream to confluence with South Leon Creek*		
	bacteria	5a	1996
1221_06	*From confluence with South Leon Creek upstream to confluence with Walnut Creek*		
	bacteria	5a	1996
1221_07	*From the confluence with Walnut Creek upstream to Lake Proctor*		
	bacteria	5a	1996

SegID: 1221A **Resley Creek (unclassified water body)**
From the confluence of the Leon River east of Gustine in Comanche County to the upstream perennial portion of the stream north of Gustine in Comanche County

Area		Category	Year First Listed
1221A_01	*Downstream portion, from confluence with Leon River upstream to conf. with unnamed tributary, approx. 1.0 mile N. of Comanche County Line*		
	depressed dissolved oxygen	5c	2006
	bacteria	5c	2004
1221A_02	*From confluence with unnamed tributary, upstream to end of water body, approx. 1.0 mile north west of Dublin*		
	bacteria	5c	2004

SegID: 1221B **South Leon River (unclassified water body)**
From the confluence of the Leon River south of Gustine in Comanche County to the upstream perennial portion of the stream south of Comanche in Comanche County

Area		Category	Year First Listed
1221B_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1221C **Pecan Creek (unclassified water body)**
Perennial stream from the confluence with the Leon River upstream to the confluence with an unnamed tributary approximately 3.5 km upstream of SH 36 near the City of Hamilton

Area		Category	Year First Listed
1221C_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1221D **Indian Creek (unclassified water body)**
Perennial stream from an unnamed second order tributary (approximately 0.7 km downstream of Live Oak Street crossing) upstream to the confluence with Bachelor Prong Creek

Area		Category	Year First Listed
1221D_01	*From confluence with Leon River, upstream to confluence with Armstrong Creek*		
	bacteria	5c	2006
1221D_02	*From confluence with Armstrong Creek upstream to headwaters of water body*		
	bacteria	5c	2006

SegID: 1221F **Walnut Creek (unclassified water body)**
From its confluence with Leon River upstream to its headwaters 2.4 miles west of Dublin in Erath County

Area		Category	Year First Listed
1221F_01	*entire water body*		
	bacteria	5c	2006

SegID: 1222A **Duncan Creek (unclassified water body)**
From the confluence of Proctor Lake northeast of Comanche in Comanche County to the upstream perennial portion of the stream west of Comanche in Comanche County

Area		Category	Year First Listed
1222A_01	*Entire creek*		
	bacteria	5c	1999

SegID: 1222B **Rush-Copperas Creek (unclassified water body)**
From the confluence of Proctor Lake northeast of Comanche in Comanche County to the upstream perennial portion of the stream northwest of Comanche in Comanche County

Area		Category	Year First Listed
1222B_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1222C **Sabana River (unclassified water body)**
From the confluence of Proctor Lake northeast of Comanche in Comanche County to the upstream perennial portion of the stream northwest of Rising Star in Eastland County

Area		Category	Year First Listed
1222C_01	*Downstream portion of segment*		
	bacteria	5c	2006

SegID: 1222E **Sweetwater Creek (unclassified water body)**
From its confluence with Copperas Creek, upstream to its headwaters, 6.3 miles west of Comanche in Comanche County

Area		Category	Year First Listed
1222E_01	*entire water body*		
	bacteria	5c	2006

SegID: 1223 **Leon River Below Leon Reservoir**
From a point immediately upstream of the confluence of Mill Branch in Comanche County to Leon Dam in Eastland County

Area		Category	Year First Listed
1223_01	*Entire Segment*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2008

SegID: 1223A **Armstrong Creek (unclassified water body)**
From its confluence with the Leon River downstream of Leon Reservoir, upstream to its headwaters in Erath County 6.2 miles east of State Hwy 16.

Area		Category	Year First Listed
1223A_01	*entire water body*		
	bacteria	5c	2006

SegID: 1226B **Green Creek (unclassified water body)**
From the confluence of the North Bosque River south of Clairette in Erath County to the upstream perennial portion of the stream south of Stephenville in Erath County

Area		Category	Year First Listed
1226B_01	*Entire water body*		
	depressed dissolved oxygen	5c	2006

SegID: 1226E **Indian Creek (unclassified water body)**
From the confluence with the North Bosque River in Erath County to the headwaters 3.5 miles east of Stephenville in Erath County

Area		Category	Year First Listed
1226E_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1226F **Sims Creek (unclassified water body)**
From the confluence with the North Bosque River in Erath County to the headwaters 6 miles southeast of Stephenville in Erath County

Area		Category	Year First Listed
1226F_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1226K **Little Duffau Creek (unclassified water body)**
From its confluence with Duffau Creek, upstream to its headwaters 2.4 miles south west of US 67 in Erath County

Area		Category	Year First Listed
1226K_01	*entire water body*		
	bacteria	5c	2006

SegID: 1227 **Nolan River**
From a point immediately upstream of the confluence of Rock Creek in Hill County to Cleburne Dam in Johnson County

Area		Category	Year First Listed
1227_01	*Downstream portion, including Mustang Creek confluence*		
	chloride	5b	2006
	sulfate	5b	2002
	total dissolved solids	5b	2006
1227_02	*Upstream portion, to Lake Pat Cleburne*		
	chloride	5b	2006
	sulfate	5b	2002
	total dissolved solids	5b	2006

SegID: 1229 **Paluxy River /North Paluxy River**
From the confluence with the Brazos River in Somervell County to the confluence of Rough Creek in Erath County

Area		Category	Year First Listed
1229_01	*Lower 7 miles*		
	sulfate	5c	2008
	total dissolved solids	5c	2008
1229_02	*Middle 25 miles*		
	chloride	5c	2008
	sulfate	5c	2008
	total dissolved solids	5c	2008
1229_03	*Upper 25 miles*		
	chloride	5c	2008
	sulfate	5c	2008
	total dissolved solids	5c	2008

SegID: 1232B **Deadman Creek (unclassified water body)**
From the confluence of the Clear Fork Brazos River south of Lueders in Jones County to the upstream perennial portion of the stream north of Hamby in Jones County

Area		Category	Year First Listed
1232B_01	*From the confluence with Clear Fork Brazos, upstream to city of Abilene WWTP receiving water*		
	bacteria	5c	2006

SegID: 1238 **Salt Fork Brazos River**
From the confluence of the Double Mountain Fork Brazos River in Stonewall County to the most upstream crossing of SH 207 in Crosby County

Area		Category	Year First Listed
1238_01	*25 miles near Hwy 83*		
	chloride	5b	2002
1238_02	*25 miles near Hwy 380 at Swenson*		
	chloride	5b	2002
1238_03	*Remainder of segment*		
	chloride	5b	2002

SegID: 1240 **White River Lake**
From White River Dam in Crosby County up to normal pool elevation of 2369 feet (impounds White River)

Area		Category	Year First Listed
1240_01	*Entire segment*		
	total dissolved solids	5c	2006
	chloride	5c	2002

SegID: 1241 **Double Mountain Fork Brazos River**
From the confluence with the Salt Fork Brazos River in Stonewall County to the confluence of the North Fork Double Mountain Fork Brazos River in Kent County

Area		Category	Year First Listed
1241_01	*25 miles near Hwy 83*		
	chloride	5b	2006
1241_02	*Remainder of segment*		
	chloride	5b	2006

SegID: 1241A **North Fork Double Mountain Fork Brazos River (unclassified water body)**
Perennial stream from the confluence with Double Mountain Fork Brazos River to the dam forming Lake Ransom Canyon

Area		Category	Year First Listed
1241A_02	*Upstream portion, from confluence with Yellow House Draw to Lake Buffalo Springs*		
	bacteria	5c	2004

SegID: 1242B **Cottonwood Branch (unclassified water body)**
Intermittent stream with perennial pools from the confluence with Still Creek upstream 0.95 km to the confluence with an unnamed tributary

Area		Category	Year First Listed
1242B_01	*Downstream portion, downstream of Sanderson Farms receiving water*		
	bacteria	5c	2006
1242B_02	*Upstream portion, upstream of Sanderson Farms receiving water*		
	bacteria	5c	2006

SegID: 1242C **Still Creek (unclassified water body)**
Perennial stream from the confluence with Thompsons Creek upstream to the confluence with Cottonwood Branch

Area		Category	Year First Listed
1242C_01	*Downstream of Bryan WWTP*		
	bacteria	5c	2006
1242C_02	*Portion upstream of city of Bryan WWTP*		
	bacteria	5c	2006

SegID: 1242D **Thompson Creek (unclassified water body)**
Intermittent stream with perennial pools from the confluence with the Brazos River upstream to the confluence with Thompson Branch north of FM 1687

Area		Category	Year First Listed
1242D_01	*Portion downstream of the confluence with Still Creek*		
	bacteria	5c	2002
1242D_02	*Portion of segment upstream of confluence with Still Creek*		
	bacteria	5c	2002
	depressed dissolved oxygen	5c	2004

SegID: 1242I **Campbells Creek (unclassified water body)**
From the confluence with the Little Brazos River upstream to the headwaters, one mile west of Old San Antonio Road

Area		Category	Year First Listed
1242I_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1242J **Deer Creek (unclassified water body)**
From the confluence with the Brazos River upstream to the confluence of West Fork Deer Creek and East Fork Deer Creek in Falls County

Area		Category	Year First Listed
1242J_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1242K **Mud Creek (unclassified water body)**
From confluence with the Little Brazos River, upstream to the confluence with Touchstone Branch and Wolf Den Branch, in Robertson County

Area		Category	Year First Listed
1242K_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1242L **Pin Oak Creek (unclassified water body)**
From the confluence with the Little Brazos River in Robertson County upstream to the headwaters, 2.07 miles south of Franklin

Area		Category	Year First Listed
1242L_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1242M **Spring Creek (unclassified water body)**
From the confluence with the Little Brazos River in Robertson County, upstream to the headwaters, 1.5 miles north of FM 391

Area		Category	Year First Listed
1242M_01	*Entire water body*		
	bacteria	5a	2002

SegID: 1242N **Tehuacana Creek (unclassified water body)**
From the confluence with the Brazos River in McLennan county upstream to the headwaters 2 miles south of Penelope in Hill County

Area		Category	Year First Listed
1242N_01	*Downstream portion of water body, from confluence with Brazos River upstream to confl. with Little Tehuacana Creek*		
	bacteria	5a	2002

SegID: 1242O **Walnut Creek (unclassified water body)**
From the confluence with the Little Brazos River in Robertson County, upstream to the headwaters, one mile south of White Rock

Area		Category	Year First Listed
1242O_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1242P **Big Creek (unclassified water body)**
From the confluence with Little Brazos River in Falls County upstream to the confluence with unnamed creeks near Mart in the northeast corner of Falls County

Area		Category	Year First Listed
1242P_01	*Downstream portion of water body*		
	bacteria	5c	2002

SegID: 1244 **Brushy Creek**
From the confluence with the San Gabriel River in Milam County to the confluence of South Brushy Creek in Williamson County

Area		Category	Year First Listed
1244_03	*From confluence with Cottonwood Branch upstream to City of Round Rock WWTP outfall*		
	bacteria	5a	2006
1244_04	*From immediately upstream of City of Round Rock WWTP outfall upstream to end of segment*		
	bacteria	5a	2006

SegID: 1245 **Upper Oyster Creek**
From Steep Bank Creek/Brazos River confluence in Fort Bend County to pumping station on Jones Creek confluence at Brazos River in Fort Bend County (includes portions of Steep Bank Creek, Flat Bank Creek, and Jones Creek)

Area		Category	Year First Listed
1245_01	*From the confluence with the Brazos River upstream to Dam #3*		
	depressed dissolved oxygen	5a	1996
1245_02	*From Dam #3 upstream to Harmon St. crossing in Sugar Land*		
	depressed dissolved oxygen	5a	1996
1245_03	*From Harmon St. crossing in Sugar Land upstream to the end of the segment*		
	depressed dissolved oxygen	5a	1996

SegID: 1245C **Bullhead Bayou (unclassified water body)**
From its confluence with Steep Bank Creek in Fort Colony, upstream to its headwaters in Pecan Grove in Fort Bend County

Area		Category	Year First Listed
1245C_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1245D **Unnamed tributary of Bullhead Bayou (unclassified water body)**
Tributary to Bullhead Bayou in Fort Bend County

Area		Category	Year First Listed
1245D_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1246E **Wasp Creek (unclassified water body)**
From the confluence with Tonk Creek in Crawford in McLennan County, upstream to the headwaters in Coryell County, 0.15 mile east of FM 185

Area		Category	Year First Listed
1246E_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1247A **Willis Creek (unclassified water body)**
From the confluence with the headwaters of Granger Lake in Williamson County to CR 313 in Williamson County

Area		Category	Year First Listed
1247A_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1248C **Mankins Branch (unclassified water body)**
Perennial stream from the confluence with the San Gabriel River in Williamson County to the intersection of CR 105 and 104 in Williamson County

Area		Category	Year First Listed
1248C_01	*Entire water body*		
	bacteria	5c	2004

SegID: 1255 **Upper North Bosque River**
From a point immediately above the confluence of Indian Creek in Erath County to the confluence of the North Fork and South Fork of the Bosque River in Erath County

Area		Category	Year First Listed
1255_01	*Lower portion of segment downstream of Stephenville*		
	bacteria	5c	1996
1255_02	*Upper portion of segment, upstream of Stephenville*		
	bacteria	5c	1996
	depressed dissolved oxygen	5c	2008

SegID: 1255A **Goose Branch (unclassified water body)**
From the confluence with the south fork of the North Bosque River 2.5 miles (4.0 km) west of Stephenville, upstream to the headwaters 0.5 miles (0.8 km) north of FM 8 in Erath County

Area		Category	Year First Listed
1255A_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1255B **North Fork Upper North Bosque River (unclassified water body)**
From the confluence with the South Fork of the Upper North Bosque River in Stephenville, upstream to the headwaters, 2.0 miles north of FM 219

Area		Category	Year First Listed
1255B_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1255C **Scarborough Creek (unclassified water body)**
From the confluence with the North Fork of the upper North Bosque River, upstream to the headwaters 0.1 miles (0.2 km) southeast of FM 219 in Erath County

Area		Category	Year First Listed
1255C_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1255E **Unnamed tributary of Goose Branch (unclassified water body)**
From the confluence with Goose Branch in Erath County to its headwaters, 0.2 miles southeast of the intersection of FM 8 and Farm Road 1219

Area		Category	Year First Listed
1255E_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1255F **Unnamed tributary of Scarborough Creek (unclassified water body)**
From the confluence with Scarborough Creek, 1.0 mile west of SH 108 in Erath County, upstream to the headwaters, 0.3 mile north of FM 219

Area		Category	Year First Listed
1255F_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1255G **Woodhollow Branch (unclassified water body)**
From the confluence with the South Fork of the North Bosque River, 6 miles northwest of Stephenville, upstream to the headwaters, 1.5 miles north of FM 219 in Erath County

Area		Category	Year First Listed
1255G_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1301 **San Bernard River Tidal**
From the confluence with the Intracoastal Waterway in Brazoria County to a point 3.2 km (2.0 miles) upstream of SH 35 in Brazoria County

Area		Category	Year First Listed
1301_01	*Entire Segment*		
	bacteria	5c	2006

SegID: 1302 **San Bernard River Above Tidal**
From a point 3.2 km (2.0 miles) upstream of SH 35 in Brazoria County to the county road southeast of New Ulm in Austin County

Area		Category	Year First Listed
1302_01	*Lower 25 miles of segment*		
	bacteria	5a	2002
1302_02	*25 miles from just upstream of FM 442 to downstream of US 90A*		
	bacteria	5a	2002
1302_03	*25 miles from downstream of US 90A to upstream of FM 3013*		
	bacteria	5a	2002

SegID: 1302A **Gum Tree Branch (unclassified water body)**
From the confluence with West Bernard Creek near Wharton CR 252 to the headwaters approximately 15 miles upstream near RR 102

Area		Category	Year First Listed
1302A_01	*The entire 15 miles of the segment*		
	bacteria	5c	2006

SegID: 1302B **West Bernard Creek (unclassified water body)**
From the confluence with the San Bernard River Above Tidal downstream of US highway 59 to the headwaters approximately 40 miles upstream near FM 1093

Area		Category	Year First Listed
1302B_01	*Lower 15 miles of segment*		
	depressed dissolved oxygen	5c	2006
1302B_02	*Upper 25 miles of segment*		
	bacteria	5c	2006

SegID: 1304 **Caney Creek Tidal**
From the confluence with the Intracoastal Waterway in Matagorda County to a point 1.9 km (1.2 miles) upstream of the confluence of Linnville Bayou in Matagorda County

Area		Category	Year First Listed
1304_01	*Lower 25 miles of segment*		
	bacteria	5c	2006

SegID: 1305 **Caney Creek Above Tidal**
From a point 1.9 km (1.2 miles) upstream of the confluence of Linnville Bayou in Matagorda County to Old Caney Road in Wharton County

Area		Category	Year First Listed
1305_02	*25 miles surrounding SH 35*		
	bacteria	5a	2002
	depressed dissolved oxygen	5b	1999
1305_03	*Upper 55 miles of segment*		
	depressed dissolved oxygen	5b	1999

SegID: 1401 **Colorado River Tidal**
From the confluence with the Gulf of Mexico in Matagorda County to a point 2.1 km (1.3 miles) downstream of the Missouri-Pacific Railroad in Matagorda County

Area		Category	Year First Listed
1401_01	*Entire segment*		
	bacteria	5a	2006

SegID: 1402H **Skull Creek (unclassified water body)**
From the confluence with the Colorado River west of Eagle Lake in Colorado County to the upstream perennial portion southwest of Columbus

Area		Category	Year First Listed
1402H_01	*Entire water body*		
	depressed dissolved oxygen	5b	2008

SegID: 1403A **Bull Creek (unclassified water body)**
From the confluence of Lake Austin in northwest Austin in Travis County to the upstream perennial portion of the stream north of Austin in Travis County

Area		Category	Year First Listed
1403A_04	*From Spicewood Springs Rd. crossing near Yaupon Dr. upstream to the Spicewood Springs Dr. crossing near Oak Grove cemetery*		
	impaired macrobenthic community	5c	2002

SegID: 1403J **Spicewood Tributary to Shoal Creek (unclassified water body)**
From the MoPac Expressway in north Austin in Travis County to a point west of Hart Lane in Travis County

Area		Category	Year First Listed
1403J_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1403K **Taylor Slough South (unclassified water body)**
Form the confluence of Lake Austin in Travis County to a point west of Pecos Street in Austin in Travis County

Area		Category	Year First Listed
1403K_01	*Entire water body*		
	bacteria	5c	2002

SegID: 1403R **Westlake-Davenport Tributary to Lake Austin (unclassified water body)**
From the confluence of Lake Austin in Travis County to a point east of Loop 360 and The High Road in Travis County

Area		Category	Year First Listed
1403R_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1412 **Colorado River Below Lake J. B. Thomas**
From a point immediately upstream of the confluence of Little Silver Creek in Coke County to Colorado River Dam in Scurry County

Area		Category	Year First Listed
1412_02	*From the confluence of Beals Creek upstream to the dam below Barber Reservoir pump station*		
	bacteria	5c	2008

SegID: 1413 **Lake J. B. Thomas**
From Colorado River Dam in Scurry County up to normal pool elevation of 2258 feet (impounds Colorado River)

Area		Category	Year First Listed
1413_01	*Entire water body*		
	chloride	5c	2008

SegID: 1416 **San Saba River**
From the confluence with the Colorado River in San Saba County to the confluence of the North Valley Prong and the Middle Valley Prong in Schleicher County

Area		Category	Year First Listed
1416_01	*From the confluence with the Colorado River in San Saba County upstream to the US 190*		
	bacteria	5c	2008

SegID: 1416A **Brady Creek (unclassified water body)**
From the confluence of the San Saba River southwest of San Saba in San Saba County to Brady Lake Dam west of Brady in McCulloch County

Area		Category	Year First Listed
1416A_03	*From FM 714 upstream to Brady Lake dam*		
	depressed dissolved oxygen	5c	2004

SegID: 1421 **Concho River**
From a point 2 km (1.2 miles) above the confluence of Fuzzy Creek in Concho County to San Angelo Dam on the North Concho River in Tom Green County and to Nasworthy Dam on the South Concho River in Tom Green County

Area		Category	Year First Listed
1421_07	*From the dam near Vines Road upstream to the confluence of the North Concho River and the South Concho River*		
	impaired macrobenthic community	5c	2002
1421_08	*North Concho River, from the confluence with the South Concho River upstream to O.C. Fisher dam*		
	bacteria	5c	2008
	depressed dissolved oxygen	5c	2008

SegID: 1425 **O. C. Fisher Lake**
From San Angelo Dam in Tom Green County up to normal pool elevation of 1908 feet (impounds North Concho River)

Area		Category	Year First Listed
1425_01	*Entire reservoir*		
	chloride	5c	2002

SegID: 1427A **Slaughter Creek (unclassified water body)**
Intermittent stream with perennial pools from the confluence with Onion Creek to above US 290 west of Austin

Area		Category	Year First Listed
1427A_01	*Entire water body*		
	impaired macrobenthic community	5b	2002

SegID: 1428 **Colorado River Below Town Lake**
From a point 100 meters (110 yards) upstream of FM 969 near Utley in Bastrop County to Longhorn Dam in Travis County

Area		Category	Year First Listed
1428_03	*Walnut Creek to Longhorn Dam*		
	bacteria	5c	2006

SegID: 1428B **Walnut Creek (unclassified water body)**
From the confluence of the Colorado River in east Austin in Travis County to the upstream perennial portion of the stream in north Austin in Travis County

Area		Category	Year First Listed
1428B_01	*From the Colorado River upstream to FM 969*		
	bacteria	5c	2006
1428B_03	*From old Manor Road upstream to Dessau Road*		
	bacteria	5c	2006
1428B_05	*From MoPac/Loop 1 upstream to railroad tracks west of Loop 1*		
	bacteria	5c	2006

SegID: 1428C **Gilleland Creek (unclassified water body)**
Perennial stream and intermittent stream with perennial pools from the confluence with the Colorado River up to the spring source (Ward Spring) northwest of Pflugerville, in Travis County

Area		Category	Year First Listed
1428C_01	*From the Colorado River upstream to Taylor Lane*		
	bacteria	5a	1999

SegID: 1429B **Eanes Creek (unclassified water body)**
From the confluence of Town Lake in central Austin in Travis County to the upstream perennial portion of the stream in west Austin in Travis County

Area		Category	Year First Listed
1429B_01	*Entire water body*		
	bacteria	5c	1999

SegID: 1429C **Waller Creek (unclassified water body)**
From the confluence of Town Lake in central Austin in Travis County to the upstream portion of the stream in north Austin in Travis County

Area		Category	Year First Listed
1429C_01	*From the confluence with Town Lake to East MLK Blvd.*		
	bacteria	5c	2004
	impaired macrobenthic community	5c	2002
1429C_03	*Upper portion of creek*		
	bacteria	5c	2004

SegID: 1431 **Mid Pecan Bayou**
From a point immediately upstream of the confluence of Mackinally Creek in Brown County to a point immediately upstream of Willis Creek in Brown County

Area		Category	Year First Listed
1431_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1501 **Tres Palacios Creek Tidal**
From the confluence with Tres Palacios Bay in Matagorda County to a point 1.0 km (0.6 miles) upstream of the confluence of Wilson creek in Matagorda County

Area		Category	Year First Listed
1501_01	*Entire segment*		
	bacteria	5a	2006
	depressed dissolved oxygen	5b	1996

SegID: 1502 **Tres Palacios Creek Above Tidal**
From a point 1.0 km (0.6 miles) upstream of the confluence of Wilson Creek in Matagorda County to US 59 in Wharton County

Area		Category	Year First Listed
1502_01	*Middle 23 miles of segment*		
	bacteria	5c	1996

SegID: 1602 **Lavaca River Above Tidal**
From a point 8.6 km (5.3 miles) downstream of US 59 in Jackson County to a point 5.5 km (3.4 miles) upstream of SH 95 in Lavaca County

Area		Category	Year First Listed
1602_01	*Upper 29 miles of segment*		
	depressed dissolved oxygen	5b	2004
1602_02	*Middle 34 miles of segment between SH111 and US90*		
	bacteria	5c	2008
1602_03	*Lower 31 miles of segment*		
	bacteria	5c	2008

SegID: 1803A **Elm Creek (unclassified water body)**
From the confluence of Sandies Creek east of Smiley in Gonzales County to the upstream perennial portion of the stream southwest of Smiley in Gonzales County

Area		Category	Year First Listed
1803A_01	*Entire water body*		
	depressed dissolved oxygen	5a	1999

SegID: 1803B **Sandies Creek (unclassified water body)**
From the confluence of the Guadalupe River west of Cuero in DeWitt County to the upstream perennial portion of the stream northwest of Smiley in Gonzales County

Area		Category	Year First Listed
1803B_01	*From the confluence with the Guadalupe River to the confluence with Elm Ck.*		
	depressed dissolved oxygen	5a	1999
	bacteria	5a	2002
1803B_02	*From the confluence with Elm Creek to upper end of water body*		
	depressed dissolved oxygen	5a	1999

SegID: 1803C **Peach Creek (unclassified water body)**
From the confluence of the Guadalupe River southeast of Gonzales in Gonzales County to the upstream perennial portion of the stream northeast of Waelder in Gonzales County

Area		Category	Year First Listed
1803C_01	*Lower 25 miles of water body*		
	bacteria	5a	2002
1803C_03	*From approx. 1.2 mi. downstream of FM 1680 in Gonzales Co. to confluence with Elm Cr. In Fayette Co.*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2006

SegID: 1804A **Geronimo Creek (unclassified water body)**
From the confluence of the Guadalupe River south of Seguin in Guadalupe County to the upstream perennial portion north of Seguin in Guadalupe County

Area		Category	Year First Listed
1804A_01	*Entire water body*		
	bacteria	5c	2006

SegID: 1805 **Canyon Lake**
From Canyon Dam in Comal County to a point 2.7 km (1.7 miles) downstream of Rebecca Creek Road in Comal County, up to normal pool elevation of 909 feet (impounds Guadalupe River)

Area		Category	Year First Listed
1805_01	*Cove around Jacob's Creek Park*		
	mercury in edible tissue	5c	2006
1805_02	*North end of Crane's Mill Park peninsula to south end of Canyon Park*		
	mercury in edible tissue	5c	2006
1805_03	*Upper end of segment*		
	mercury in edible tissue	5c	2006
1805_04	*Lower end of reservoir from dam upstream to Canyon Park*		
	mercury in edible tissue	5c	2006

SegID: 1806A **Camp Meeting Creek (unclassified water body)**
From the confluence of Flatrock Lake in southeast Kerrville in Kerr County to the upstream perennial portion of the stream west of Kerrville in Kerr County

Area		Category	Year First Listed
1806A_03	*Upper 9 miles*		
	depressed dissolved oxygen	5b	1999

SegID: 1810 **Plum Creek**
From the confluence with the San Marcos River in Caldwell County to FM 2770 in Hays County

Area		Category	Year First Listed
1810_01	*Confluence with San Marcos River to approx. 2.5 mi. upstream of the confluence with Clear Fork Plum Creek*		
	bacteria	5c	2004
1810_03	*From approx. 0.5 mi. upstream of SH 21 to upper end of segment*		
	bacteria	5c	2004

SegID: 1901 **Lower San Antonio River**
From the confluence with the Guadalupe River in Refugio/Victoria County to a point 600 meters (660 yards) downstream of FM 791 at Mays crossing near Falls City in Karnes County

Area		Category	Year First Listed
1901_01	*25 miles downstream of the confluence with Manahuilla Creek*		
	bacteria	5a	2000
1901_02	*25 miles upstream of Manahuilla Creek*		
	bacteria	5a	2000
1901_03	*From 25 miles upstream of Manahuilla Cr to 9 mi downstream of Escondido Cr*		
	bacteria	5a	2000
1901_04	*9 miles downstream of Escondido Creek*		
	bacteria	5a	2000
1901_05	*From upstream end of segment to Escondido Creek*		
	bacteria	5a	2000

SegID: 1902 **Lower Cibolo Creek**
From the confluence with the San Antonio River in Karnes County to a point 100 meters (110 yards) downstream of IH 10 in Bexar/Guadalupe County

Area		Category	Year First Listed
1902_01	*Lower 5 miles of segment*		
	bacteria	5a	2004
1902_02	*From 5 miles upstream of confluence with the San Antonio River to FM 541*		
	bacteria	5a	2004
	impaired fish community	5c	2006
1902_03	*From FM 541 to confluence with Clifton Branch*		
	bacteria	5a	2004

SegID: 1906 **Lower Leon Creek**
From the confluence with the Medina River in Bexar County to a point 100 meters (110 yards) upstream of SH 16 northwest of San Antonio in Bexar County

Area		Category	Year First Listed
1906_02	*From 3 miles upstream lower end of segment to confluence with Indian Creek*		
	depressed dissolved oxygen	5c	1999
1906_04	*From Hwy 353 to two miles upstream*		
	bacteria	5a	1996
	depressed dissolved oxygen	5c	1999
1906_05	*From 2 miles upstream of Hwy 353 to Hwy 90*		
	depressed dissolved oxygen	5c	1999
	PCBs in edible tissue	5a	2004
1906_06	*Remainder of segment*		
	bacteria	5a	1996

SegID: 1908 **Upper Cibolo Creek**
From the Missouri-Pacific Railroad Bridge west of Bracken in Comal County to a point 1.5 km (0.9 miles) upstream of the confluence of Champee Springs in Kendall County

Area		Category	Year First Listed
1908_02	*From approx. 2 mi. upstream of Hwy 87 in Boerne to upper end of segment*		
	bacteria	5c	2006

SegID: 1910 **Salado Creek**
From the confluence with the San Antonio River in Bexar County to Rocking Horse Lane west of Camp Bullis in Bexar County

Area		Category	Year First Listed
1910_03	*From Roland Road to Rice Road*		
	impaired fish community	5b	2004
	impaired macrobenthic community	5b	2006
1910_07	*From Hwy 368 to approx 1.5 miles upstream of Loop 410*		
	impaired fish community	5b	2004
	impaired macrobenthic community	5b	2006

SegID: 1911 **Upper San Antonio River**
From a point 600 meters (660 yards) downstream of FM 791 at Mays Crossing near Falls City in Karnes County to a point 100 meters (110 yards) upstream of Hildebrand Avenue at San Antonio in Bexar County

Area		Category	Year First Listed
1911_09	*From confluence with Salado Creek to confluence with Sixmile Creek*		
	impaired fish community	5c	2006

SegID: 1913 **Mid Cibolo Creek**
From a point 100 meters (110 yards) downstream of IH 10 in Bexar/Guadalupe County to the Missouri-Pacific Railroad bridge west of Bracken in Comal County

Area		Category	Year First Listed
1913_03	*From approx. 0.50 mi. upstream of Buffalo Lane in Cibolo to upper end of segment*		
	bacteria	5c	2006

SegID: 2001 **Mission River Tidal**
From the confluence with Mission Bay in Refugio County to a point 7.4 kilometers (4.6 miles) downstream of US 77 in Refugio County

Area		Category	Year First Listed
2001_01	*Entire segment*		
	bacteria	5a	2004

SegID: 2003 **Aransas River Tidal**
From the confluence with Copano Bay in Aransas/Refugio County to a point 1.6 kilometers (1.0 mile) upstream of US 77 in Refugio/San Patricio County

Area		Category	Year First Listed
2003_01	*Entire segment*		
	bacteria	5a	2004

SegID: 2004A **Aransas Creek (unclassified water body)**
From confluence with the Aransas River to the headwaters of the stream about 10 km upstream of US Highway 59.

Area		Category	Year First Listed
2004A_01	*Entire 20 miles of segment*		
	bacteria	5c	2006

SegID: 2106 **Nueces/Lower Frio River**
From a point 100 meters (110 yards) upstream of US 59 in Live Oak County to Choke Canyon Dam in Live Oak County

Area		Category	Year First Listed
2106_01	*Lower 17 miles of segment*		
	total dissolved solids	5c	2006
2106_02	*Upper 10 miles of segment*		
	total dissolved solids	5c	2006

SegID: 2107 **Atascosa River**
From the confluence with the Frio River in Live Oak County to the confluence of the West Prong Atascosa River and the North Prong Atascosa River in Atascosa County

Area		Category	Year First Listed
2107_01	*Lower 25 miles of segment*		
	bacteria	5a	1996
2107_02	*25 miles surrounding FM 541*		
	bacteria	5a	1996
	depressed dissolved oxygen	5b	1996
	impaired fish community	5b	2006
2107_03	*25 miles surrounding State Highway 97*		
	depressed dissolved oxygen	5b	1996
	impaired fish community	5b	2006

SegID: 2108 **San Miguel Creek**
From a point immediately upstream of the confluence of Mustang Branch in McMullen County to the confluence of San Francisco Perez Creek and Chacon Creek in Frio County

Area		Category	Year First Listed
2108_01	*Lower 25 miles of segment*		
	bacteria	5c	2006

SegID: 2109 **Leona River**
From the confluence with the Frio River in Frio County to US 83 in Uvalde County

Area		Category	Year First Listed
2109_01	*Lower 25 miles of segment*		
	bacteria	5c	2006
2109_02	*25 miles surrounding US Highway 57*		
	bacteria	5c	2006
2109_03	*Upper 28 miles of segment*		
	bacteria	5c	2006

SegID: 2113 **Upper Frio River**
From a point 100 meters (110 yards) upstream of US 90 in Uvalde County to the confluence of the West Frio River and the East Frio River in Real County

Area		Category	Year First Listed
2113_01	*Lower 25 miles of segment*		
	impaired fish community	5c	2006
	impaired macrobenthic community	5c	2006
2113_02	*Upper 22 miles of segment*		
	impaired fish community	5c	2006

SegID: 2116 **Choke Canyon Reservoir**
From Choke Canyon Dam in Live Oak County to a point 4.2 km (2.6 miles) downstream of SH 16 on the Frio River Arm in McMullen County and to a point 100 meters (110 yards) upstream of the confluence of Mustang Branch on the San Miguel Creek Arm in McMullen County, up to the normal pool elevation of 220.5 feet (impounds Frio River)

Area		Category	Year First Listed
2116_06	*Western end of lake up to RR 99 bridge*		
	depressed dissolved oxygen	5c	2006

SegID: 2117 **Frio River Above Choke Canyon Reservoir**
From a point 4.2 km (2.6 miles) downstream of SH 16 in McMullen County to a point 100 meters (110 yards) upstream of US 90 in Uvalde County

Area		Category	Year First Listed
2117_02	*From 1.5 mi. downstream of SH 97 to 23.5 mi. upstream of SH 97 crossing*		
	bacteria	5c	2008

SegID: 2201 **Arroyo Colorado Tidal**
From confluence with Laguna Madre in Cameron/Willacy County to a point 100 meters (110 yards) downstream of Cemetery Road south of Port Harlingen in Cameron County

Area		Category	Year First Listed
2201_03	*Approx. 3 miles upstream to 2 miles downstream of Marker 27*		
	bacteria	5c	2006
2201_04	*Approx. 1 mile upstream to 3 miles downstream of Camp Perry*		
	depressed dissolved oxygen	5a	1996
	bacteria	5c	2006
2201_05	*Upper 4 miles of segment*		
	depressed dissolved oxygen	5a	1996
	bacteria	5c	2006
	mercury in edible tissue	5c	2008
	PCBs in edible tissue	5c	2008

SegID: 2202 **Arroyo Colorado Above Tidal**
From a point 100 meters (110 yards) downstream of Cemetery Road south of Port Harlingen in Cameron County to FM 2062 in Hidalgo County

Area		Category	Year First Listed
2202_01	*Lower 4 miles of segment*		
	bacteria	5a	1996
	PCBs in edible tissue	5c	2008
	mercury in edible tissue	5c	2008
2202_02	*Approx. 11 miles upstream to approx. 4 miles downstream of US 77*		
	bacteria	5a	1996
	mercury in edible tissue	5c	2008
	PCBs in edible tissue	5c	2008
2202_03	*Approx 14 miles upstream to approx. 11 miles downstream of FM 1015*		
	bacteria	5a	1996
	mercury in edible tissue	5c	2008
	PCBs in edible tissue	5c	2008
2202_04	*Upper 19 miles of segment*		
	bacteria	5a	1996
	mercury in edible tissue	5c	2008
	PCBs in edible tissue	5c	2008

SegID: 2302 **Rio Grande Below Falcon Reservoir**
From a point 10.8 km (6.7 miles) downstream of the International Bridge in Cameron County to Falcon Dam in Starr County

Area		Category	Year First Listed
2302_07	*Rancho Viejo Floodway area to El Jardin Pump Station*		
	bacteria	5c	1996

SegID: 2302A **Arroyo Los Olmos (unclassified water body)**
From confluence with the Rio Grande at Rio Grande City to El Sauz in Starr County

Area		Category	Year First Listed
2302A_01	*Entire water body*		
	bacteria	5c	2004

SegID: 2304 **Rio Grande Below Amistad Reservoir**
From the confluence of the Arroyo Salado (Mexico) in Zapata County to Amistad Dam in Val Verde County

Area		Category	Year First Listed
2304_02	*San Felipe Creek confluence to the Las Moras Creek confluence*		
	bacteria	5c	1996
2304_08	*Laredo water treatment plant intake to International Bridge #2*		
	bacteria	5c	1996
2304_09	*International Bridge # 2 to just below Chacon Creek confluence*		
	bacteria	5c	1996
2304_10	*Chacon Creek confluence to the Arroyo Salado confluence*		
	bacteria	5c	1996

SegID: 2306 **Rio Grande Above Amistad Reservoir**
From a point 1.8 km (1.1 miles) downstream of the confluence of Ramsey Canyon in Val Verde County to the confluence of the Rio Conchos (Mexico) in Presidio County

Area		Category	Year First Listed
2306_01	*Confluence with Rio Conchos to Alamito Creek*		
	bacteria	5c	1999

SegID: 2307 **Rio Grande Below Riverside Diversion Dam**
From the confluence of the Rio Conchos (Mexico) in Presidio County to Riverside Diversion Dam in El Paso County

Area		Category	Year First Listed
2307_01	*Downstream of Riverside Dam to Guadalupe Bridge*		
	bacteria	5c	1996
	chloride	5c	1996
	total dissolved solids	5c	1996
2307_02	*Guadalupe Bridge to the Alamo Grade Structure*		
	bacteria	5c	1996
	chloride	5c	1996
	total dissolved solids	5c	1996
2307_03	*Alamo Grade Structure to Little Box Canyon*		
	total dissolved solids	5c	1996
	chloride	5c	1996
2307_04	*Little Box Canyon to 25 miles upstream of Rio Conchos confluence*		
	total dissolved solids	5c	1996
	chloride	5c	1996
2307_05	*25 miles upstream of the Rio Conchos confluence (lower segment boundary)*		
	chloride	5c	1996
	total dissolved solids	5c	1996

SegID: 2311 **Upper Pecos River**
From a point immediately upstream of the confluence of Independence Creek in Crockett/Terrell County to Red Bluff Dam in Loving/Reeves County

Area		Category	Year First Listed
2311_05	*US 80 (Bus 20) to FM 1776*		
	depressed dissolved oxygen	5c	2006
2311_06	*FM 1776 to US 67*		
	depressed dissolved oxygen	5c	2006

SegID: 2314 **Rio Grande Above International Dam**
From International Dam in El Paso County to the New Mexico State Line in El Paso County

Area		Category	Year First Listed
2314_02	*Upstream of Anthony Drain to International Dam*		
	bacteria	5c	1996

SegID: 2421 **Upper Galveston Bay**

Area		Category	Year First Listed
2421_01	*Red Bluff to Five Mile Cut to Houston Point to Morgans Point*		
	bacteria (oyster waters)	5a	1996
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2004
2421_02	*Western portion of the bay*		
	bacteria (oyster waters)	5a	1996

SegID: 2422 **Trinity Bay**

Area		Category	Year First Listed
2422_01	*Upper half of bay*		
	bacteria (oyster waters)	5a	1998

SegID: 2422B **Double Bayou West Fork (unclassified water body)**
From the confluence with Trinity Bay to Belton Road in Chambers County

Area		Category	Year First Listed
2422B_01	*Entire water body*		
	bacteria	5c	2006
	depressed dissolved oxygen	5c	2004

SegID: 2423 **East Bay**

Area		Category	Year First Listed
2423_01	*Area adjacent to the ICWW (Segment 0702)*		
	bacteria (oyster waters)	5a	1998

SegID: 2424 **West Bay**

Area		Category	Year First Listed
2424_02	*Area adjacent to Lower Galveston Island*		
	bacteria (oyster waters)	5a	1996

SegID: 2424A **Highland Bayou (unclassified water body)**
From confluence with Jones Bay to Avenue Q 0.5 miles (0.8 km) north of SH 6 between Arcadia and Alta Loma in Galveston County

Area		Category	Year First Listed
2424A_01	*From the headwaters to FM 2004*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002
2424A_02	*From FM 2001 to FM 519*		
	bacteria	5a	2002
2424A_04	*From Fairwood Road to Bayou Lane*		
	bacteria	5a	2002

SegID: 2424C **Marchand Bayou (unclassified water body)**
From confluence with Highland Bayou to 0.45 mile north of IH 45 in Galveston County

Area		Category	Year First Listed
2424C_01	*Entire water body*		
	bacteria	5a	2002
	depressed dissolved oxygen	5c	2002

SegID: 2425B **Jarbo Bayou (unclassified water body)**
From confluence with Clear Lake to 0.6 mile upstream of FM 518 in Galveston County

Area		Category	Year First Listed
2425B_01	*From headwaters to Lawrence Road*		
	bacteria	5c	2002

SegID: 2426 **Tabbs Bay**

Area		Category	Year First Listed
2426_01	*Entire segment*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2004

SegID: 2427 **San Jacinto Bay**

Area		Category	Year First Listed
2427_01	*Entire segment*		
	dioxin in edible tissue	5a	1996
	PCBs in edible tissue	5a	2004

SegID: 2428 Black Duck Bay

Area		Category	Year First Listed
2428_01	*Entire segment*		
	dioxin in edible tissue	5a	1998
	PCBs in edible tissue	5a	2004

SegID: 2429 Scott Bay

Area		Category	Year First Listed
2429_01	*Entire segment*		
	dioxin in edible tissue	5a	1998
	PCBs in edible tissue	5a	2004

SegID: 2430 Burnett Bay

Area		Category	Year First Listed
2430_01	*Entire segment*		
	dioxin in edible tissue	5a	1998
	PCBs in edible tissue	5a	2004

SegID: 2432 Chocolate Bay

Area		Category	Year First Listed
2432_01	*Entire segment*		
	bacteria (oyster waters)	5a	1996

SegID: 2433 Bastrop Bay/Oyster Lake

Area		Category	Year First Listed
2433_02	*Oyster Lake*		
	bacteria (oyster waters)	5a	2006

SegID: 2434 Christmas Bay

Area		Category	Year First Listed
2434_01	*Area adjacent to West Bay*		
	bacteria (oyster waters)	5a	2006

SegID: 2436 Barbours Cut

Area		Category	Year First Listed
2436_01	*Entire segment*		
	dioxin in edible tissue	5a	1998
	PCBs in edible tissue	5a	2004

SegID: 2438 Bayport Channel

Area		Category	Year First Listed
2438_01	*Entire segment*		
	dioxin in edible tissue	5a	2000
	PCBs in edible tissue	5a	2004

SegID: 2439 Lower Galveston Bay

Area		Category	Year First Listed
2439_01	*Area adjacent to the Texas City Ship Channel and Moses Lake*		
	bacteria (oyster waters)	5a	1996

SegID: 2441 East Matagorda Bay

Area		Category	Year First Listed
2441_01	*Caney Creek am and western shoreline area*		
	bacteria (oyster waters)	5a	1998

SegID: 2442 Cedar Lakes

Area		Category	Year First Listed
2442_01	*Entire segment*		
	bacteria (oyster waters)	5a	1998

SegID: 2451 Matagorda Bay/Powderhorn Lake

Area		Category	Year First Listed
2451_01	*Northern end of Matagorda Bay*		
	bacteria (oyster waters)	5a	1996

SegID: 2452 Tres Palacios Bay/Turtle Bay

Area		Category	Year First Listed
2452_02	*Turtle Bay*		
	bacteria (oyster waters)	5a	1998
2452_03	*Tres Palacios Creek Arm*		
	bacteria (oyster waters)	5a	1998

SegID: 2453 Lavaca Bay/Chocolate Bay

Area		Category	Year First Listed
2453_02	*North-northeastern portion of the bay near Point Comfort*		
	bacteria (oyster waters)	5a	1996
2453_03	*Chocolate Bay area*		
	bacteria (oyster waters)	5a	1996

SegID: 2453A Garcitas Creek Tidal (unclassified water body)
From the confluence of Lavaca Bay in Jackson County to a point 8.5 miles upstream of FM 616 in Jackson County

Area		Category	Year First Listed
2453A_01	*Entire water body*		
	depressed dissolved oxygen	5b	1999

SegID: 2453D Lavaca Bay Ship Channel Area (unclassified water body)

Area		Category	Year First Listed
2453D_01	*Entire water body*		
	depressed dissolved oxygen	5c	2006

SegID: 2454 Cox Bay

Area		Category	Year First Listed
2454_01	*North end of bay near Cox Creek*		
	bacteria (oyster waters)	5a	2006

SegID: 2455 Keller Bay

Area		Category	Year First Listed
2455_01	*Upper arm*		
	bacteria (oyster waters)	5a	2006

SegID: 2456 Carancahua Bay

Area		Category	Year First Listed
2456_02	*Upper half of bay*		
	bacteria	5c	2006
	bacteria (oyster waters)	5a	1996

SegID: 2456A West Carancahua Creek Tidal (unclassified water body)
From the confluence with Carancahua Bay in Jackson County to Jackson CR 440, 6.3 miles upstream of FM 616 in Jackson County

Area		Category	Year First Listed
2456A_01	*Entire water body*		
	depressed dissolved oxygen	5c	2006

SegID: 2462 San Antonio Bay/Hynes Bay/Guadalupe Bay

Area		Category	Year First Listed
2462_02	*Guadalupe Bay* bacteria (oyster waters)	5a	1996

SegID: 2472 Copano Bay/Port Bay/Mission Bay

Area		Category	Year First Listed
2472_01	*Mission Bay, Aransas River arm, Port Bay, and eastern shoreline* bacteria (oyster waters)	5a	1998

SegID: 2483 Redfish Bay

Area		Category	Year First Listed
2483_01	*Entire segment* bacteria (oyster waters)	5a	2006

SegID: 2485 Oso Bay

Area		Category	Year First Listed
2485_01	*Upper bay (Holly Road to County Hwy 24)*		
	bacteria (oyster waters)	5a	2006
	depressed dissolved oxygen	5b	1996
2485_02	*Middle bay (State Park Road 22 to Holly Road)*		
	bacteria (oyster waters)	5a	2006
	depressed dissolved oxygen	5b	1996
2485_03	*Lower portion of bay (Ocean Drive to State Park Road 22)*		
	bacteria (oyster waters)	5a	2006
	depressed dissolved oxygen	5b	1996

SegID: 2485A Oso Creek (unclassified water body)
From the confluence with Oso Bay in southern Corpus Christi to a point 3 miles upstream of SH 44, west of Corpus Christi in Nueces County

Area		Category	Year First Listed
2485A_01	*Entire water body*		
	bacteria	5a	2002

SegID: 2491 Laguna Madre

Area		Category	Year First Listed
2491_01	*Upper portion of bay north of the Arroyo Colorado confluence*		
	depressed dissolved oxygen	5b	1999
2491_02	*Area adjacent to the Arroyo Colorado confluence*		
	depressed dissolved oxygen	5b	1999
	bacteria (oyster waters)	5a	2006

SegID: 2492A **San Fernando Creek (unclassified water body)**
From the confluence with Cayo Del Grullo in Kleberg County to the Lake Alice Dam in Jim Wells County

Area		Category	Year First Listed
2492A_01	*Entire water body*		
	bacteria	5c	2006

SegID: 2501 **Gulf of Mexico**
From the Gulf shoreline to the limit of Texas jurisdiction between Sabine Pass and the Rio Grande

Area		Category	Year First Listed
2501_01	*Sabine Pass to Sea Rim Park area*		
	mercury in edible tissue	5c	1998
2501_02	*Jefferson-Chambers County line area*		
	mercury in edible tissue	5c	1998
2501_03	*Bolivar Point to San Luis Pass area*		
	mercury in edible tissue	5c	1998
2501_04	*Freeport Area*		
	mercury in edible tissue	5c	1998
2501_05	*Area between Freeport and Port Aransas*		
	mercury in edible tissue	5c	1998
2501_06	*Port Aransas Area*		
	mercury in edible tissue	5c	1998
2501_07	*Area between Port Aransas and Port Mansfield*		
	mercury in edible tissue	5c	1998
2501_08	*Port Mansfield area*		
	mercury in edible tissue	5c	1998
2501_09	*Area between Port Mansfield and Port Isabel*		
	mercury in edible tissue	5c	1998
2501_10	*Port Isabel area*		
	mercury in edible tissue	5c	1998

TEXAS PARKS AND WILDLIFE

Rare, Threatened, and Endangered Species of Texas

Search by...

Type full or partial County Name and click "GO"

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Species Search Results for 'Matagorda'

Taxon	Common Name	Scientific Name	Federal Status	State Status	County Range
Birds	Henslow's Sparrow	Ammodramus henslowii			View Map
Birds	Western Burrowing Owl	Athene cunicularia hypugaea			View Map
Birds	White-tailed Hawk	Buteo albicaudatus		T	View Map
Birds	Snowy Plover	Charadrius alexandrinus			View Map
Birds	Western Snowy Plover	Charadrius alexandrinus nivosus			View Map
Birds	Southeastern Snowy Plover	Charadrius alexandrinus tenuirostris			View Map
Birds	Piping Plover	Charadrius melodus	LT	T	View Map
Birds	Reddish Egret	Egretta rufescens		T	View Map
Birds	Northern Aplomado Falcon	Falco femoralis septentrionalis	LE	E	View Map
Birds	Peregrine Falcon	Falco peregrinus	DL	T	View Map
Birds	American Peregrine Falcon	Falco peregrinus anatum	DL	T	View Map
Birds	Arctic Peregrine Falcon	Falco peregrinus tundrius	DL		View Map
Birds	Whooping Crane	Grus americana	LE	E	View Map
Birds	Bald Eagle	Haliaeetus leucocephalus	DL	T	View Map
Birds	Black Rail	Laterallus jamaicensis			View Map
Birds	Wood Stork	Mycteria americana		T	View Map
Birds	Eskimo Curlew	Numenius borealis	LE	E	View Map
Birds	Brown Pelican	Pelecanus occidentalis	DL	E	View Map
Birds	White-faced Ibis	Plegadis chihi		T	View Map
Birds	Sooty Tern	Sterna fuscata		T	View Map
Crustaceans	A crayfish	Cambarellus texanus			View Map
Fishes	American eel	Anguilla rostrata			View Map
Fishes	Blue sucker	Cycleptus elongatus		T	View Map
Fishes	Smalltooth sawfish	Pristis pectinata	LE	E	View Map
Insects	Gulf Coast clubtail	Gomphus modestus			View Map
Mammals	Red wolf	Canis rufus	LE	E	View Map
Mammals	Ocelot	Leopardus pardalis	LE	E	View Map

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Main | 1/25/2010 3:38:31 PM

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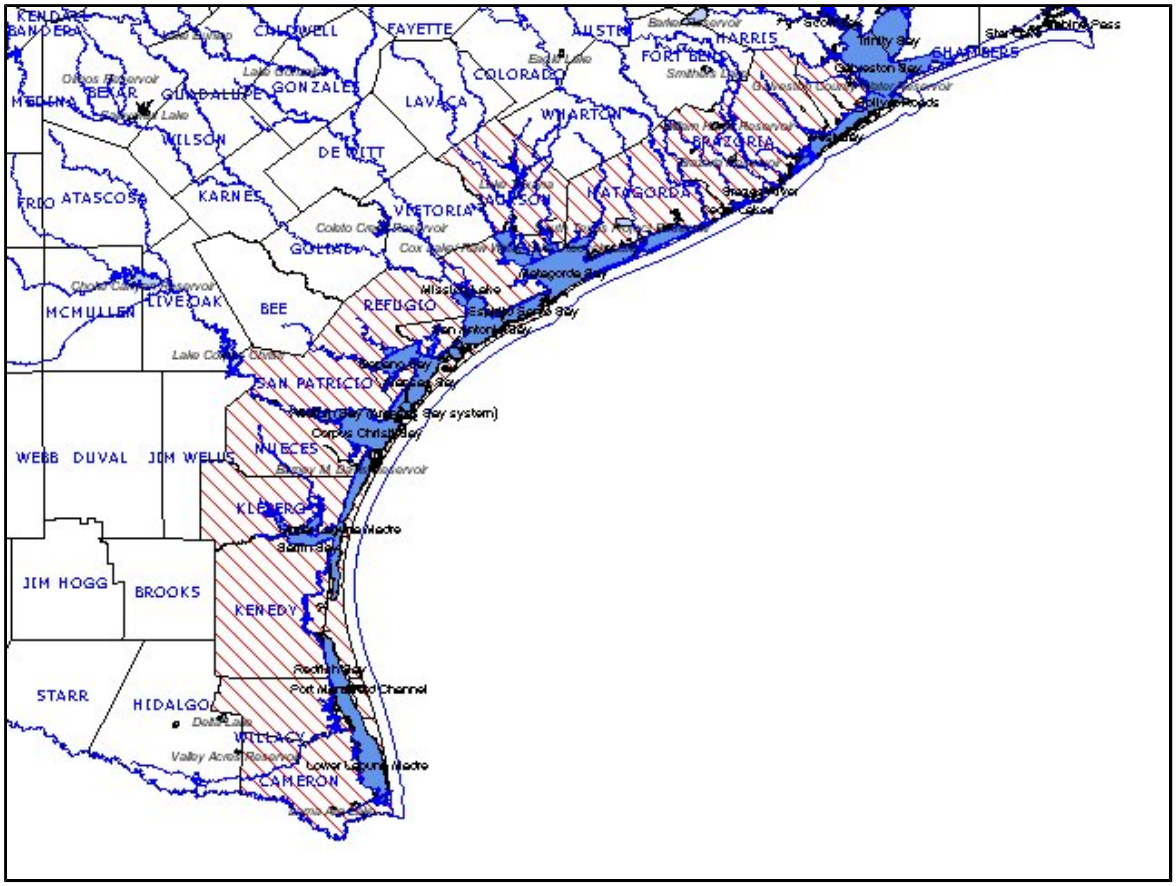
West Indian manatee — ***Trichechus manatus***

Federal Status: LE — **State Status: E**

Gulf and bay system; opportunistic, aquatic herbivore

Revision Date: 01/11/2006

potential or known presence within county



Aransas, Brazoria, Calhoun, Cameron, Galveston, Jackson, Kenedy, Kleberg, Matagorda, Nueces, Refugio, San Patricio, Willacy County(ies)

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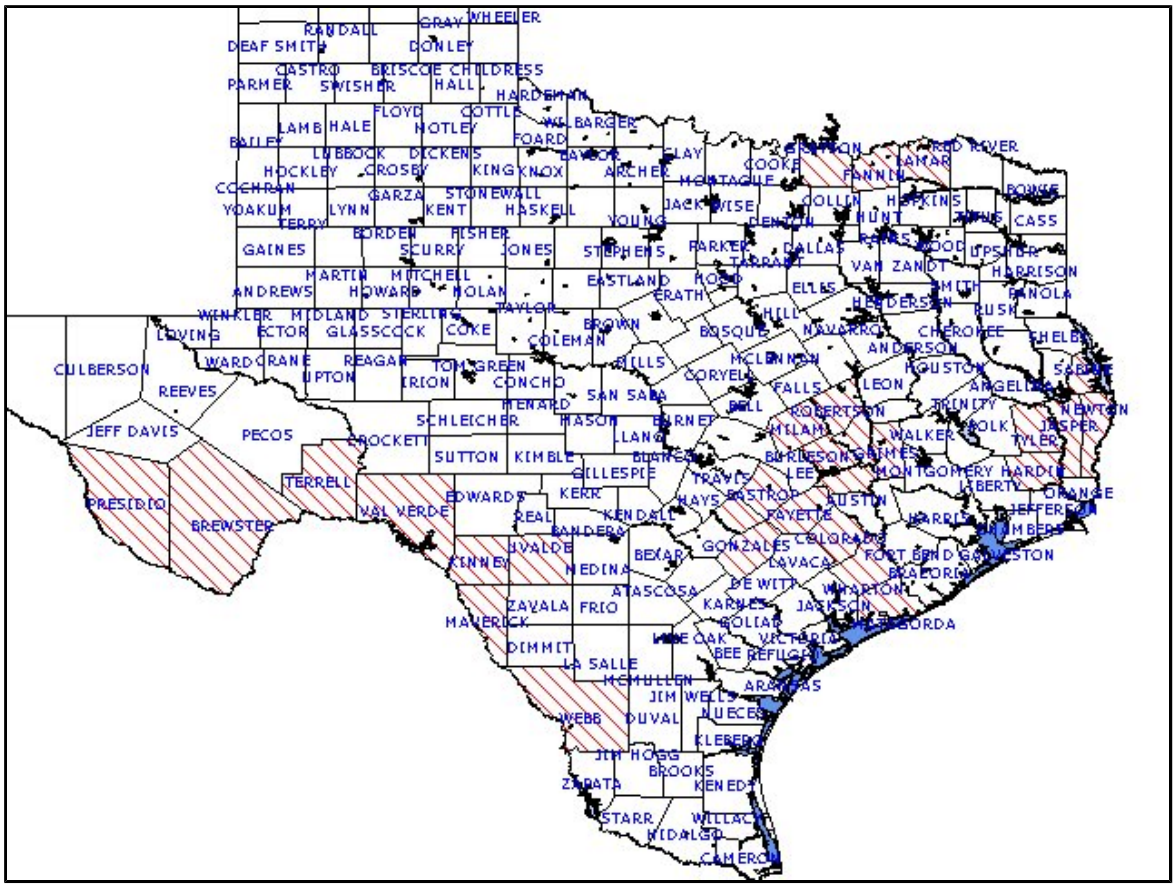
Blue sucker — ***Cycleptus elongatus***

Federal Status: — **State Status: T**

larger portions of major rivers in Texas; usually in channels and flowing pools with a moderate current; bottom type usually of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles

Revision Date: 10/28/2009

potential or known presence within county



Bastrop, Brazos, Brewster, Burleson, Caldwell, Colorado, Fannin, Fayette, Gonzales, Grayson, Grimes, Hardin, Jasper, Kinney, Lamar, Matagorda, Maverick, Milam, Newton, Presidio, Robertson, Sabine, Terrell, Tyler, Uvalde, Val Verde, Washington, Webb, Wharton County(ies)

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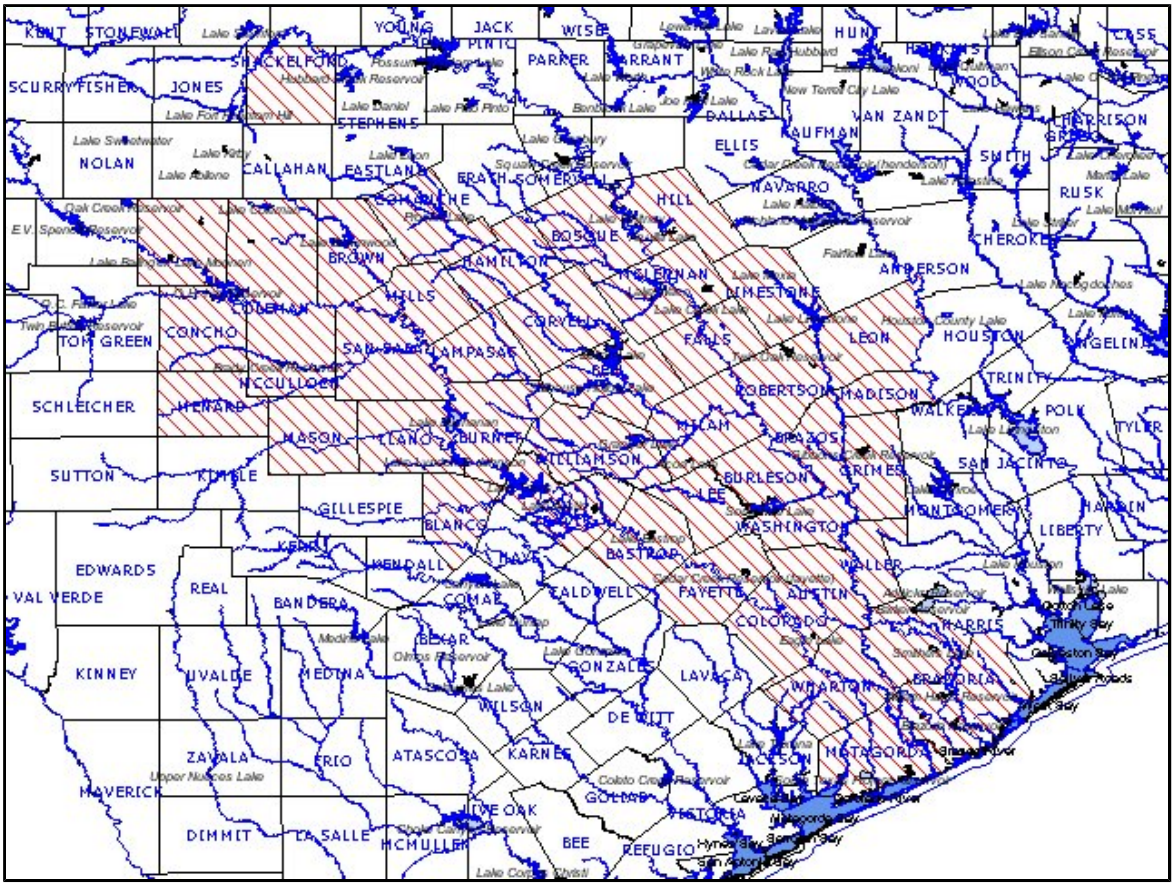
Smooth pimpleback — ***Quadrula houstonensis***

Federal Status: — **State Status: T**

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

Revision Date: 01/15/2010

potential or known presence within county



Austin, Bastrop, Bell, Blanco, Bosque, Brazoria, Brazos, Brown, Burleson, Burnet, Coleman, Colorado, Comanche, Concho, Coryell, Falls, Fayette, Fort Bend, Grimes, Hamilton, Hill, Lampasas, Lee, Leon, Limestone, Llano, Madison, Mason, Matagorda, McCulloch, McLennan, Menard, Milam, Mills, Robertson, Runnels, San Saba, Shackelford, Travis, Waller, Washington, Wharton, Williamson County(ies)

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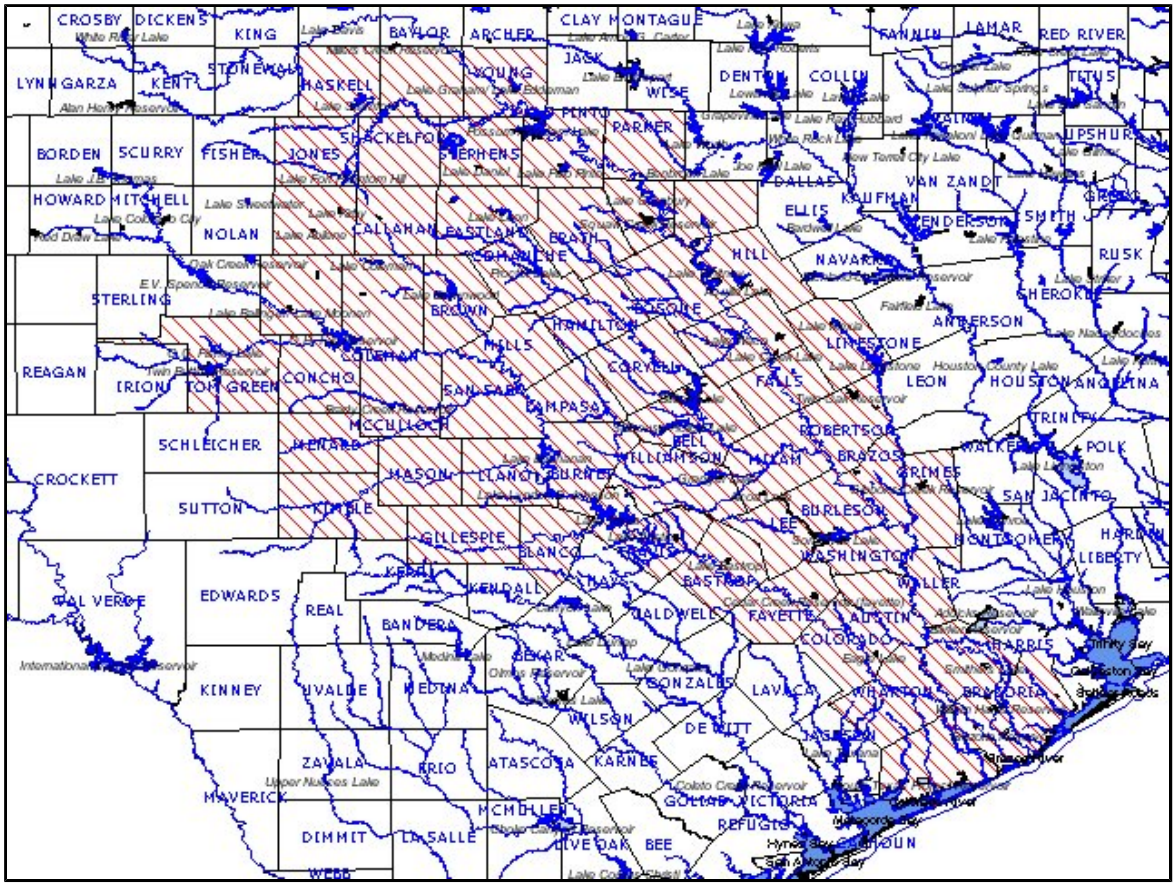
Texas fawnsfoot — ***Truncilla macrodon***

Federal Status: — **State Status: T**

little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins

Revision Date: 01/15/2010

potential or known presence within county



Austin, Bastrop, Bell, Blanco, Bosque, Brazoria, Brazos, Brown, Burleson, Burnet, Callahan, Coleman, Colorado, Comanche, Concho, Coryell, Eastland, Erath, Falls, Fayette, Fort Bend, Gillespie, Grimes, Hamilton, Haskell, Hill, Hood, Johnson, Jones, Kimble, Lampasas, Lee, Limestone, Llano, Mason, Matagorda, McCulloch, McLennan, Menard, Milam, Mills, Palo Pinto, Parker, Robertson, Runnels, San Saba, Shackelford, Somervell, Stephens, Taylor, Throckmorton, Tom Green, Travis, Waller, Washington, Wharton, Williamson, Young County(ies)

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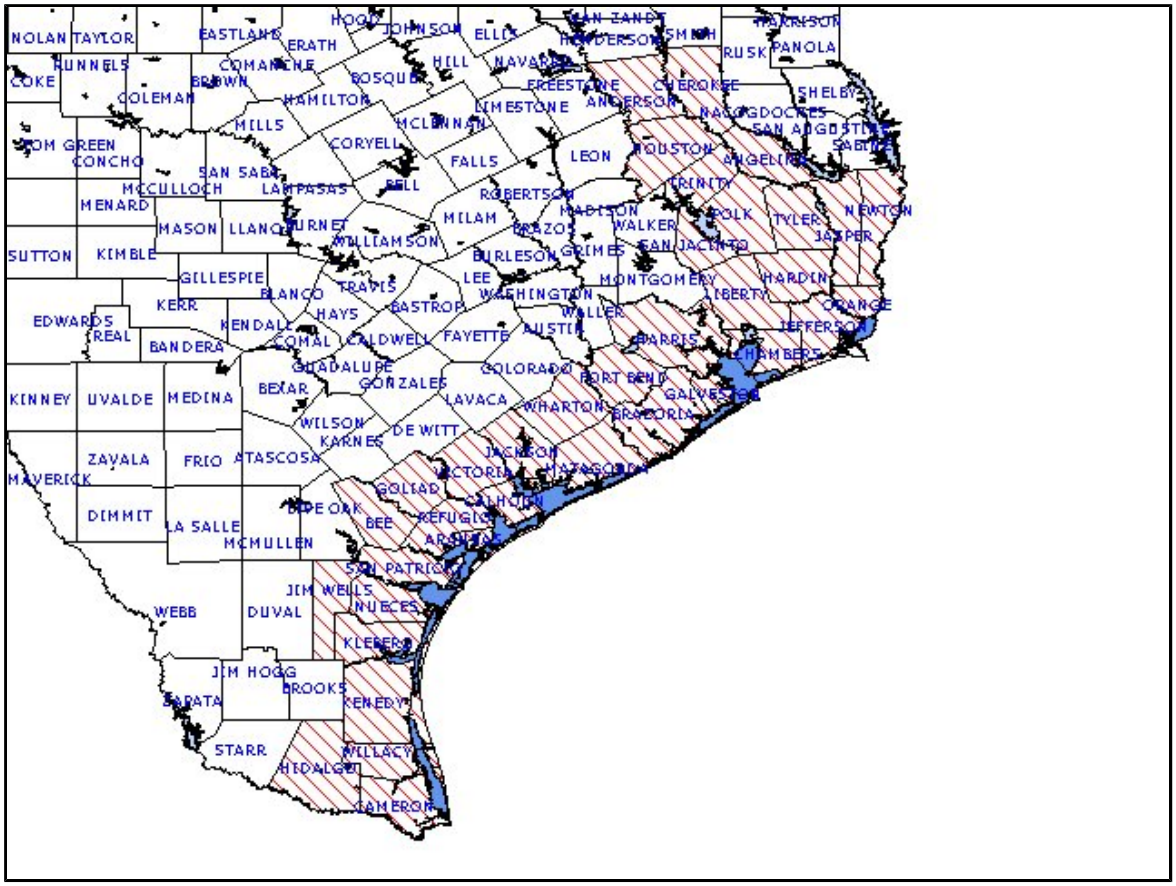
American eel — ***Anguilla rostrata***

Federal Status: **State Status:**

coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Revision Date: 07/15/2005

potential or known presence within county



Anderson, Angelina, Aransas, Bee, Brazoria, Calhoun, Cameron, Chambers, Cherokee, Fort Bend, Galveston, Goliad, Hardin, Harris, Hidalgo, Houston, Jackson, Jasper, Jefferson, Jim Wells, Kenedy, Kleberg, Liberty, Matagorda, Newton, Nueces, Orange, Polk, Refugio, San Jacinto, San Patricio, Trinity, Tyler, Victoria, Wharton, Willacy County(ies)

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Type full or partial Scientific Name and click "GO"

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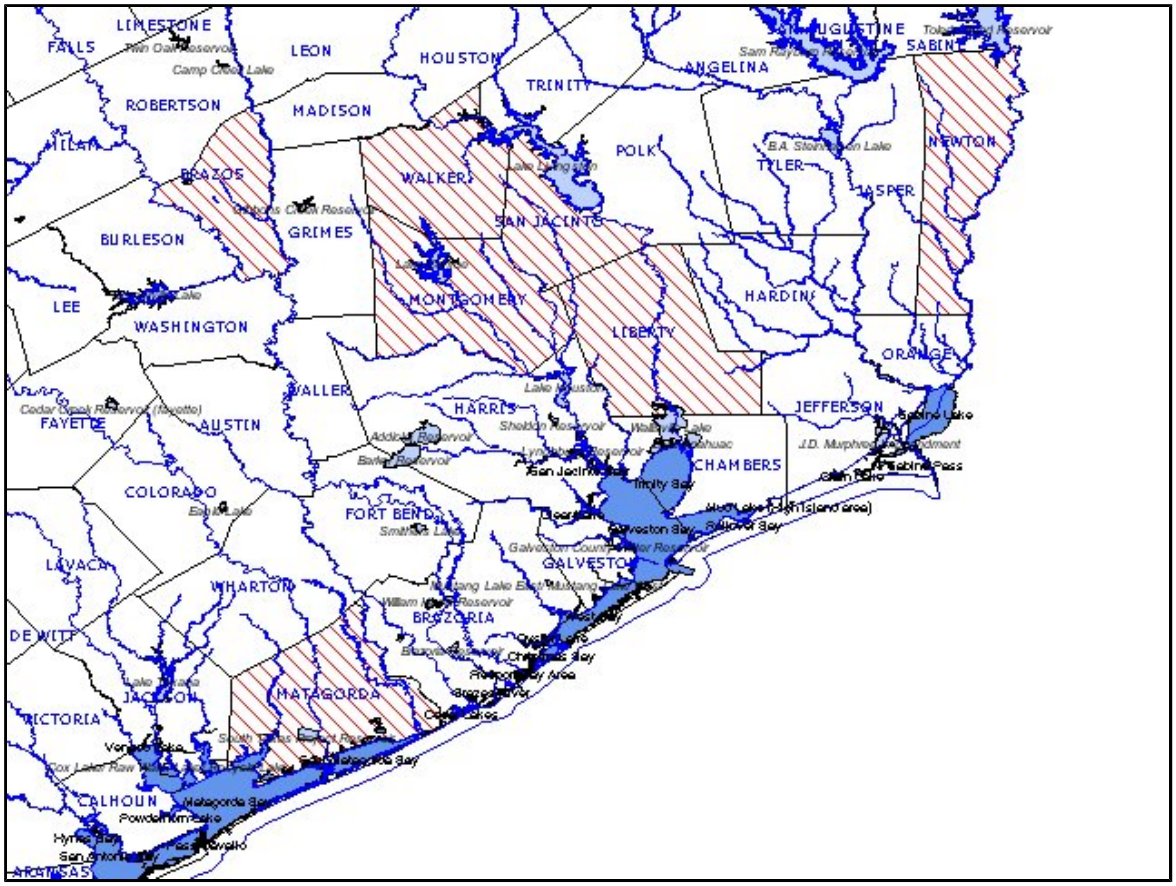
Gulf Coast clubtail — ***Gomphus modestus***

Federal Status: **State Status:**

medium river, moderate gradient,and streams with silty sand or rocky bottoms; adults forage in trees, males perch near riffles to wait for females, larvae overwinter; flight season late Apr - late Jun

Revision Date: 03/27/2006

potential or known presence within county



Brazos, Liberty, Matagorda, Montgomery, Newton, San Jacinto, Walker County(ies)

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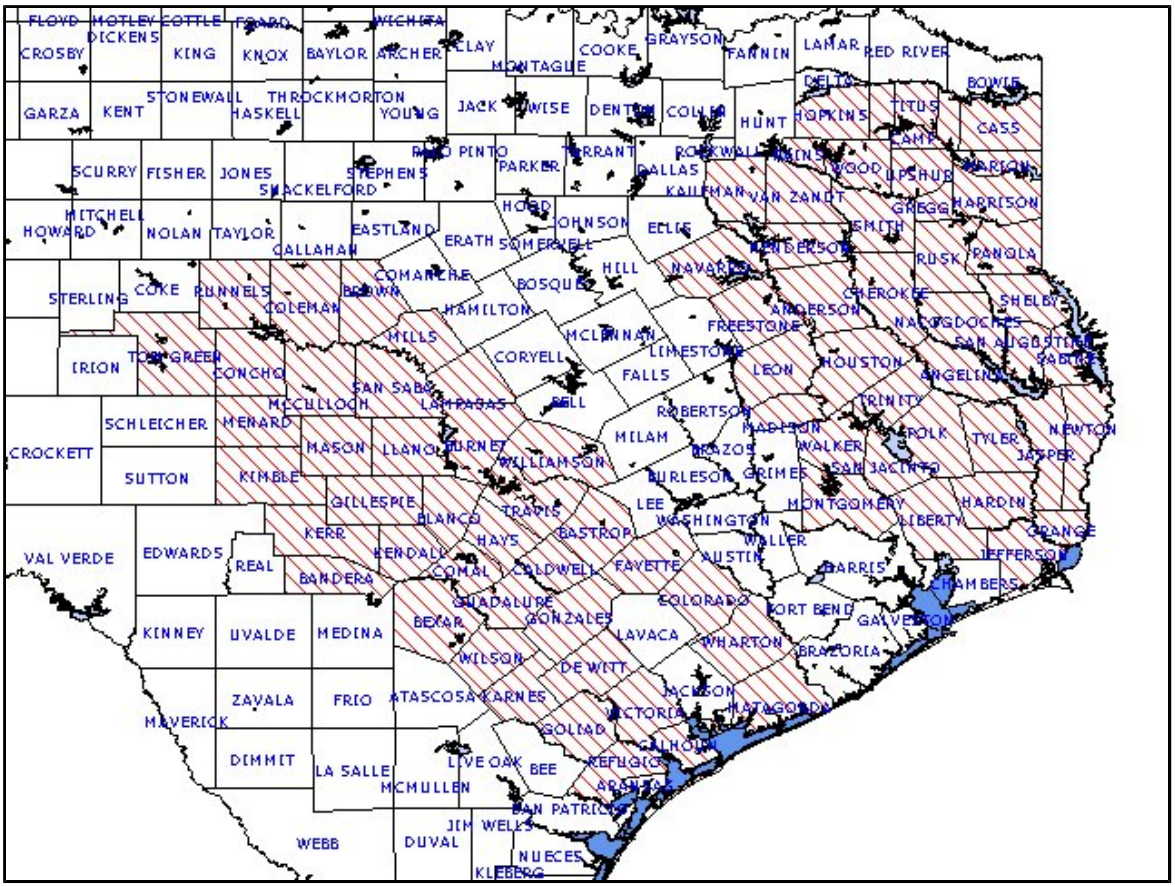
Creeper (squawfoot) — ***Strophitus undulatus***

Federal Status: **State Status:**

small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins

Revision Date: 03/21/2006

potential or known presence within county



Anderson, Angelina, Bandera, Bastrop, Bexar, Blanco, Brown, Burnet, Caldwell, Calhoun, Camp, Cass, Cherokee, Coleman, Colorado, Comal, Concho, De Witt, Fayette, Franklin, Freestone, Gillespie, Goliad, Gonzales, Gregg, Guadalupe, Hardin, Harrison, Hays, Henderson, Hopkins, Houston, Jasper, Jefferson, Karnes, Kaufman, Kendall, Kerr, Kimble, Lampasas, Leon, Liberty, Llano, Madison, Marion, Mason, Matagorda, McCulloch, Menard, Mills, Montgomery, Morris, Nacogdoches, Navarro, Newton, Orange, Panola, Polk, Rains, Refugio, Runnels, Rusk, Sabine, San Augustine, San Jacinto, San Saba, Shelby, Smith, Titus, Tom Green, Travis, Trinity, Tyler, Upshur, Van Zandt, Victoria, Walker, Wharton, Williamson, Wilson, Wood County(ies)

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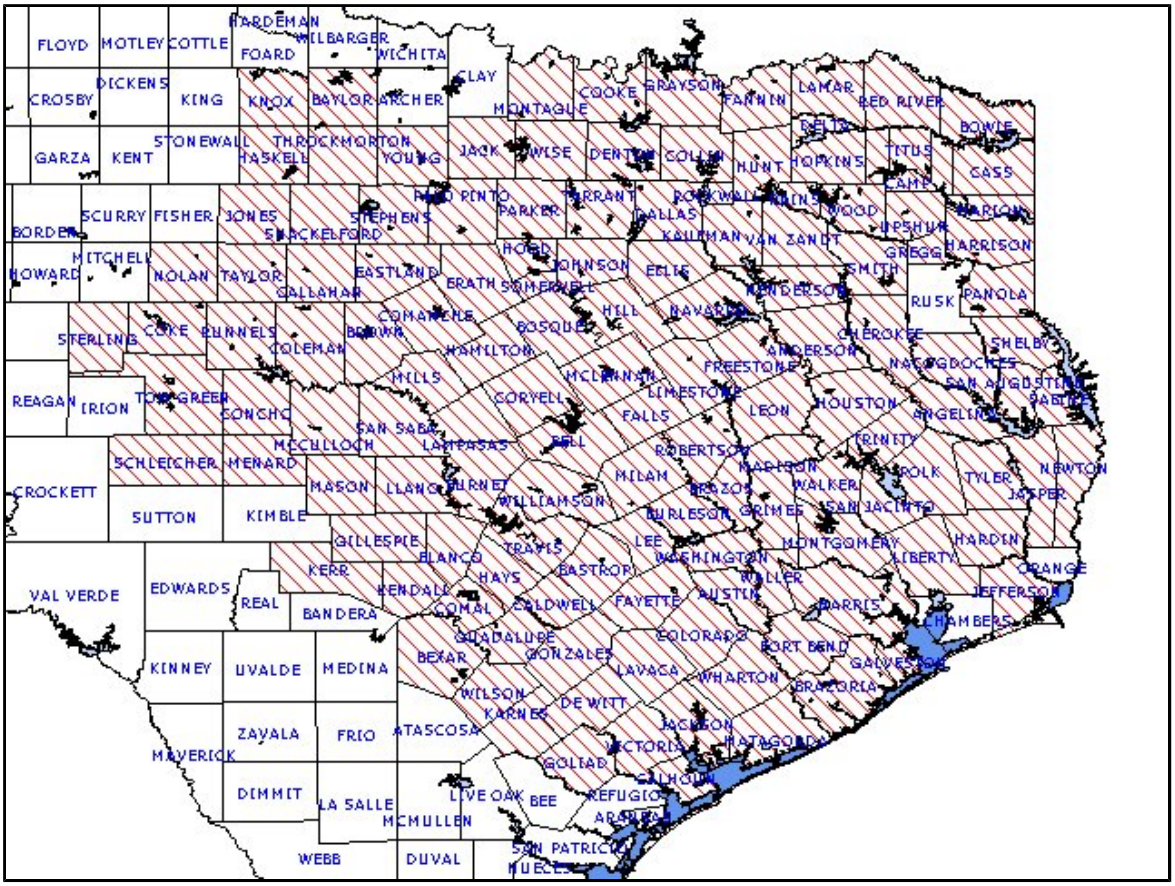
Pistolgrip — ***Tritogonia verrucosa***

Federal Status: **State Status:**

stable substrate, rock, hard mud, silt, and soft bottoms, often buried deeply; east and central Texas, Red through San Antonio River basins

Revision Date: 03/21/2006

potential or known presence within county



Anderson, Angelina, Austin, Bastrop, Baylor, Bell, Bexar, Blanco, Bosque, Bowie, Brazoria, Brazos, Brown, Burleson, Burnet, Caldwell, Calhoun, Callahan, Camp, Cass, Cherokee, Coke, Coleman, Collin, Colorado, Comal, Comanche, Concho, Cooke, Coryell, Dallas, De Witt, Delta, Denton, Eastland, Ellis, Erath, Falls, Fannin, Fayette, Fort Bend, Franklin, Freestone, Galveston, Gillespie, Goliad, Gonzales, Grayson, Gregg, Grimes, Guadalupe, Hamilton, Hardin, Harris, Harrison, Haskell, Hays, Henderson, Hill, Hood, Hopkins, Houston, Hunt, Jack, Jackson, Jasper, Jefferson, Johnson, Jones, Karnes, Kaufman, Kendall, Kerr, Knox, Lamar, Lampasas, Lavaca, Lee, Leon, Liberty, Limestone, Llano, Madison, Marion, Mason, Matagorda, McCulloch, McLennan, Menard, Milam, Mills, Montague, Montgomery, Morris, Nacogdoches, Navarro, Newton, Nolan, Palo Pinto, Panola, Parker, Polk, Rains, Red River, Robertson, Rockwall, Runnels, Sabine, San Augustine, San Jacinto, San Saba, Schleicher, Shackelford, Shelby, Smith, Somervell, Stephens, Sterling, Tarrant, Taylor, Throckmorton, Titus, Tom Green, Travis, Trinity, Tyler, Upshur, Van Zandt, Victoria, Walker, Waller, Washington, Wharton, Williamson, Wilson, Wise, Wood, Young County(ies)

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2006 Total Population Estimates for Texas Counties

Estimates of the Total Populations of Counties and Places in Texas for July 1, 2006 and January 1, 2007

produced by:

Population Estimates and Projections Program
Texas State Data Center
Office of the State Demographer
Institute for Demographic and Socioeconomic Research
The University of Texas at San Antonio

September 2007

The attached are estimates of the total population for counties and places in Texas for July 1, 2006 and January 1, 2007 completed by personnel from the Texas State Data Center offices in the Institute for Demographic and Socioeconomic Research at the University of Texas at San Antonio. In this brief report, the methodology used to prepare the estimates is described. Because of space limitations, only a summary of the methodology is presented. Those wishing to obtain a more complete description of the estimation procedures and of the historical and sensitivity analyses used to select the methods employed in these estimates should contact program personnel in the Texas State Data Center at the University of Texas at San Antonio.

Estimation Methodology

Methodology for County Estimates

The estimates reported for counties are the averages of estimates made using ratio-correlation, component-method II, and housing-unit methods. Ratio-correlation procedures utilize multiple regression techniques with the ratio of variable values for adjacent time periods rather than simply the variable values themselves being used as independent and dependent variables. After an extensive evaluation of the relative accuracy of alternative procedures (including difference-rate, ratio-correlation and rate-correlation methods) and an analysis of alternative variables, a simple ratio-correlation model was employed to complete the final estimates. This model used the variables of births, deaths, elementary school enrollment, vehicle registration, and voter registration.

The component-method II procedure employed utilizes data on births, deaths and elementary school enrollment to estimate population. In this method, migration of the school-age population is assumed to be indicative of migration in the total population (with adjustments being made for the historical differences between the school-age migration rate and the total population's rate of migration). Data on public school enrollment from the Texas Education Agency and data from the Texas State Data Center's survey of private schools in Texas are used to estimate change in the school-age population. Data on institutional populations were obtained from applicable institutions, while data on other special

populations, such as the elderly population were obtained from the U.S. Bureau of the Census.

The housing-unit method used is of the standard form with change in the number of housing units in the housing stock of an area, from the base date (in this case, the 2000 Census) to the estimate date (in this case, July 1, 2006), being used to estimate population change. New housing additions and demolitions are taken from the U.S. Bureau of the Census survey of building permits and demolitions and the Texas State Data Center survey of counties and cities issuing permits for residential buildings and demolitions. Both the U.S. Census Bureau's building permit survey and the Texas State Data Center's survey can only collect data from permit issuing county and city jurisdictions (methods for dealing with non-permit issuing places are discussed later). Assumptions about vacancy rates and average household size are then used in conjunction with data on the number of housing units in an estimate area (including those in the area at the base date and the net number of units added to, or subtracted from, the base housing stock for the time period between the base date and the estimate date). Separate estimates are completed by type of structure with the types used being single-family structures, 2-to-4 unit structures, structures with 5 or more units, and mobile homes. For purposes of the 2006 estimates, 2000 vacancy rates and average household sizes for each of the housing structure types were assumed to prevail as of the estimate date of July 1, 2006. For 2006, the estimates of the number of new mobile homes added to an area's housing stock were obtained from the Texas State Data Center's survey of building permits and demolitions. The sum of mobile homes from the survey was subtracted from the U.S. Bureau of the Census' estimate of the total number of mobile homes shipped to Texas. The difference was allocated to jurisdictions on the basis of the change in units in jurisdictions for other housing types from 2000 to the estimate date of July 1, 2006.

The average of the component-method II, ratio-correlation and housing- unit population estimates is used as the population estimate for July 1, 2006 with the total for all counties being controlled to the July 1, 2006 estimate for the State obtained from the U.S. Bureau of the Census. Prior to the release of these estimates, county estimates were evaluated for consistency and reasonableness by comparing them to those from other State and local agencies.

The January 1, 2007 estimates are obtained by adding births to, and subtracting deaths from July 1, 2006 through December 31, 2006, to the July 1, 2006 estimates and assuming that July 1, 2005 to July 1, 2006 rates of migration continue from July 1, 2006 to January 1, 2007. The State and county estimates are obtained using the same method with the sum of the county estimates controlled to the State estimate.

Methodology for Place Estimates

For places, population estimates were made using the same three methods as used for county estimates. To complete the component-method II estimates for places for 2006, standard component procedures were applied to 2000 Census population counts for places. County-level birth and death data for 2000-06 from the Texas Department of State Health Services and 2000-06 data from the Texas Education Agency on public school enrollment and from the Texas State Data Center survey of private schools on enrollment in private schools were used in this procedure. In addition, data on Medicare enrollment and on the net movement of persons from the military to the civilian population were obtained for counties from the U.S. Bureau of the Census. Values for each of these items were allocated from counties to places prior to the completion of the place estimates. Such allocation procedures were necessary because data items that were available for places (such as birth and death data) showed year-to-year fluctuations and reporting errors that made the direct use of place-level data problematic. The general allocation procedures used for these items involved population subgroups closely associated with the item being allocated (i.e., women of child-bearing age for fertility, school-age population for school enrollment, the total population for deaths, persons 65+ years of age for Medicare enrollment, and the population 14-17 years of age for net movement). The number in the appropriate subgroups for each place and the remainder of the county in each county in 2000 were survived (using state-level survival rates for 1999-2001) to July 1, 2006, and the sum of the survived groups in each place and the remainder of the county were controlled to the county total for the item as reported from the appropriate agency to obtain the value for each place. Place estimates were completed for July 1, 2006 and adjusted to account for population changes due to annexations or other boundary changes as

obtained from the annual Texas State Data Center Boundary and Annexation Survey.

The housing unit estimates for places were completed using the same general procedures delineated above (for counties) except that it was necessary to use procedures to allocate new housing units and demolitions to places that were not reporting jurisdictions. This was done by taking the difference between the county totals for new building permits and demolitions and the sum of values for places for which data were reported for a county and proportionally allocating the difference to the nonreporting places. For the 2006 estimates, the allocation was done on the basis of the nonreporting places' proportions of county housing stocks as reported in the 2000 Census.

The third method used is the ratio-correlation method. Ratio correlation estimates were made to allocate county populations to places (and non-place areas) using births, deaths and housing units for places as estimation items.

The estimates for place populations from the three methods were averaged to provide a July 1, 2006 estimate of the total population for each place. The sum of the estimated populations for places in each county (and for that part of each county's population not living in places) were controlled to county totals to ensure consistency with the county estimates.

The January 1, 2007 place estimates are prepared using the same extrapolative procedures as described above for the State and county. Place estimates for each county for January 1, 2007 are controlled to the county estimate for January 1, 2007.

Comparisons to U.S. Census Bureau Estimates

The estimates presented here differ from those from sources such as those periodically produced by the U.S. Census Bureau for several reasons. These estimates have been made using techniques that are different than those used by the Bureau. The Census Bureau uses only the distributive housing unit method to estimate place populations and the administrative records method to estimate county populations. Because the administrative records method uses income tax data that are not available to analysts outside the Census Bureau, this technique can not be used by other agencies. In addition, the estimates reported in the following pages utilize more recent data than those used by the U.S. Bureau of the Census. The Census Bureau's county estimates utilize 2005 birth and death data, whereas 2006 values were employed in the Texas State Data Center estimates reported here. Also, the Census Bureau utilizes birth and death data only in their county level estimates while the Texas State Data Center includes current births and deaths in both county and place level estimates. Finally, the Census Bureau estimates do not include information on annexation and boundary changes for places later than 2003 whereas information through 2006 was included in the estimates completed by the Texas program. Because of these differences, the population estimates presented here and those from the U.S. Bureau of the Census are not directly comparable.

If you have any questions concerning these estimates, please contact:

Dr. Karl Eschbach
Texas State Data Center
Institute for Demographic and Socioeconomic Research
University of Texas at San Antonio
One UTSA Circle
San Antonio, Texas 78249-0704
(210) 458-6543

Table 1

Texas State Data Center Population Estimates Program July 1, 2006 and January 1, 2007 Estimates of the Total Population of Counties and 2000-2006 and 2000-2007 Population Change for All Counties in Texas

County	2000 Census Count	July 1, 2006 Population Estimate	January 1, 2007 Population Estimate	Numerical Change 2000-06	Numerical Change 2000-07	Percent Change 2000-06	Percent Change 2000-07
Anderson	55,109	56,202	56,314	1,093	1,205	2.0	2.2
Andrews	13,004	13,154	13,352	150	348	1.2	2.7
Angelina	80,130	82,424	82,593	2,294	2,463	2.9	3.1
Aransas	22,497	24,900	25,087	2,403	2,590	10.7	11.5
Archer	8,854	9,065	9,009	211	155	2.4	1.8
Armstrong	2,148	2,170	2,183	22	35	1.0	1.6
Atascosa	38,628	42,414	42,659	3,786	4,031	9.8	10.4
Austin	23,590	26,928	27,335	3,338	3,745	14.2	15.9
Bailey	6,594	6,514	6,495	-80	-99	-1.2	-1.5
Bandera	17,645	19,773	19,886	2,128	2,241	12.1	12.7
Bastrop	57,733	71,726	72,859	13,993	15,126	24.2	26.2
Baylor	4,093	4,041	4,048	-52	-45	-1.3	-1.1
Bee	32,359	33,207	33,214	848	855	2.6	2.6
Bell	237,974	269,073	273,458	31,099	35,484	13.1	14.9
Bexar	1,392,931	1,550,160	1,569,794	157,229	176,863	11.3	12.7
Blanco	8,418	9,383	9,378	965	960	11.5	11.4
Borden	729	710	705	-19	-24	-2.6	-3.3
Bosque	17,204	18,272	18,329	1,068	1,125	6.2	6.5
Bowie	89,306	93,286	93,726	3,980	4,420	4.5	4.9
Brazoria	241,767	286,773	291,729	45,006	49,962	18.6	20.7
Brazos	152,415	167,228	170,436	14,813	18,021	9.7	11.8
Brewster	8,866	9,231	9,217	365	351	4.1	4.0
Briscoe	1,790	1,573	1,587	-217	-203	-12.1	-11.3
Brooks	7,976	7,729	7,772	-247	-204	-3.1	-2.6
Brown	37,674	38,617	38,839	943	1,165	2.5	3.1
Burleson	16,470	18,101	18,223	1,631	1,753	9.9	10.6
Burnet	34,147	40,642	41,219	6,495	7,072	19.0	20.7
Caldwell	32,194	35,562	35,622	3,368	3,428	10.5	10.6
Calhoun	20,647	20,843	20,958	196	311	0.9	1.5
Callahan	12,905	13,510	13,520	605	615	4.7	4.8
Cameron	335,227	389,571	395,161	54,344	59,934	16.2	17.9
Camp	11,549	12,706	12,731	1,157	1,182	10.0	10.2
Carson	6,516	6,497	6,499	-19	-17	-0.3	-0.3
Cass	30,438	30,567	30,672	129	234	0.4	0.8
Castro	8,285	7,554	7,494	-731	-791	-8.8	-9.5
Chambers	26,031	32,383	32,664	6,352	6,633	24.4	25.5
Cherokee	46,659	48,320	48,257	1,661	1,598	3.6	3.4
Childress	7,688	7,728	7,736	40	48	0.5	0.6
Clay	11,006	11,161	11,098	155	92	1.4	0.8
Cochran	3,730	3,590	3,595	-140	-135	-3.8	-3.6
Coke	3,864	3,897	3,863	33	-1	0.9	-0.0

Coleman	9,235	8,860	8,856	-375	-379	-4.1	-4.1
Collin	491,675	696,306	717,439	204,631	225,764	41.6	45.9
Collingsworth	3,206	2,933	2,881	-273	-325	-8.5	-10.1
Colorado	20,390	21,629	21,925	1,239	1,535	6.1	7.5
Comal	78,021	102,032	105,431	24,011	27,410	30.8	35.1
Comanche	14,026	14,097	14,156	71	130	0.5	0.9
Concho	3,966	3,801	3,778	-165	-188	-4.2	-4.7
Cooke	36,363	39,852	40,372	3,489	4,009	9.6	11.0
Coryell	74,978	76,007	76,246	1,029	1,268	1.4	1.7
Cottle	1,904	1,627	1,615	-277	-289	-14.5	-15.2
Crane	3,996	3,854	3,859	-142	-137	-3.6	-3.4
Crockett	4,099	3,986	3,962	-113	-137	-2.8	-3.3
Crosby	7,072	6,611	6,614	-461	-458	-6.5	-6.5
Culberson	2,975	2,646	2,625	-329	-350	-11.1	-11.8
Dallam	6,222	6,244	6,244	22	22	0.4	0.4
Dallas	2,218,899	2,340,063	2,359,595	121,164	140,696	5.5	6.3
Dawson	14,985	14,192	14,127	-793	-858	-5.3	-5.7
Deaf Smith	18,561	18,640	18,656	79	95	0.4	0.5
Delta	5,327	5,267	5,265	-60	-62	-1.1	-1.2
Denton	432,976	590,120	606,428	157,144	173,452	36.3	40.1
De Witt	20,013	20,432	20,341	419	328	2.1	1.6
Dickens	2,762	2,699	2,628	-63	-134	-2.3	-4.9
Dimmit	10,248	10,033	10,002	-215	-246	-2.1	-2.4
Donley	3,828	3,907	3,908	79	80	2.1	2.1
Duval	13,120	12,600	12,459	-520	-661	-4.0	-5.0
Eastland	18,297	18,361	18,325	64	28	0.3	0.2
Ector	121,123	127,212	128,578	6,089	7,455	5.0	6.2
Edwards	2,162	1,923	1,860	-239	-302	-11.1	-14.0
Ellis	111,360	139,104	142,270	27,744	30,910	24.9	27.8
El Paso	679,622	743,319	751,588	63,697	71,966	9.4	10.6
Erath	33,001	34,308	34,420	1,307	1,419	4.0	4.3
Falls	18,576	18,035	18,005	-541	-571	-2.9	-3.1
Fannin	31,242	34,042	34,125	2,800	2,883	9.0	9.2
Fayette	21,804	23,763	24,132	1,959	2,328	9.0	10.7
Fisher	4,344	4,213	4,196	-131	-148	-3.0	-3.4
Floyd	7,771	7,263	7,351	-508	-420	-6.5	-5.4
Foard	1,622	1,493	1,498	-129	-124	-8.0	-7.6
Fort Bend	354,452	487,047	503,315	132,595	148,863	37.4	42.0
Franklin	9,458	10,270	10,385	812	927	8.6	9.8
Freestone	17,867	19,381	19,551	1,514	1,684	8.5	9.4
Frio	16,252	16,323	16,287	71	35	0.4	0.2
Gaines	14,467	15,122	15,229	655	762	4.5	5.3
Galveston	250,158	282,126	285,484	31,968	35,326	12.8	14.1
Garza	4,872	5,075	5,109	203	237	4.2	4.9
Gillespie	20,814	24,083	24,343	3,269	3,529	15.7	17.0
Glasscock	1,406	1,241	1,231	-165	-175	-11.7	-12.4

Goliad	6,928	7,195	7,238	267	310	3.9	4.5
Gonzales	18,628	19,256	19,135	628	507	3.4	2.7
Gray	22,744	22,437	22,577	-307	-167	-1.3	-0.7
Grayson	110,595	118,438	118,908	7,843	8,313	7.1	7.5
Gregg	111,379	117,743	119,208	6,364	7,829	5.7	7.0
Grimes	23,552	24,802	24,780	1,250	1,228	5.3	5.2
Guadalupe	89,023	111,122	114,736	22,099	25,713	24.8	28.9
Hale	36,602	35,921	35,822	-681	-780	-1.9	-2.1
Hall	3,782	3,660	3,623	-122	-159	-3.2	-4.2
Hamilton	8,229	8,480	8,565	251	336	3.1	4.1
Hansford	5,369	5,119	5,030	-250	-339	-4.7	-6.3
Hardeman	4,724	4,436	4,393	-288	-331	-6.1	-7.0
Hardin	48,073	50,419	50,511	2,346	2,438	4.9	5.1
Harris	3,400,578	3,830,130	3,899,122	429,552	498,544	12.6	14.7
Harrison	62,110	63,715	63,818	1,605	1,708	2.6	2.7
Hartley	5,537	5,520	5,566	-17	29	-0.3	0.5
Haskell	6,093	5,662	5,672	-431	-421	-7.1	-6.9
Hays	97,589	133,913	137,940	36,324	40,351	37.2	41.3
Hemphill	3,351	3,438	3,439	87	88	2.6	2.6
Henderson	73,277	79,331	79,704	6,054	6,427	8.3	8.8
Hidalgo	569,463	708,235	723,433	138,772	153,970	24.4	27.0
Hill	32,321	34,886	35,157	2,565	2,836	7.9	8.8
Hockley	22,716	22,352	22,253	-364	-463	-1.6	-2.0
Hood	41,100	49,058	49,793	7,958	8,693	19.4	21.2
Hopkins	31,960	33,910	34,225	1,950	2,265	6.1	7.1
Houston	23,185	23,630	23,779	445	594	1.9	2.6
Howard	33,627	32,918	32,831	-709	-796	-2.1	-2.4
Hudspeth	3,344	3,483	3,443	139	99	4.2	3.0
Hunt	76,596	83,050	83,359	6,454	6,763	8.4	8.8
Hutchinson	23,857	22,739	22,887	-1,118	-970	-4.7	-4.1
Irion	1,771	1,748	1,741	-23	-30	-1.3	-1.7
Jack	8,763	8,844	8,888	81	125	0.9	1.4
Jackson	14,391	14,559	14,598	168	207	1.2	1.4
Jasper	35,604	34,863	34,574	-741	-1,030	-2.1	-2.9
Jeff Davis	2,207	2,486	2,480	279	273	12.6	12.4
Jefferson	252,051	245,922	245,277	-6,129	-6,774	-2.4	-2.7
Jim Hogg	5,281	5,090	5,093	-191	-188	-3.6	-3.6
Jim Wells	39,326	41,102	41,335	1,776	2,009	4.5	5.1
Johnson	126,811	150,981	153,299	24,170	26,488	19.1	20.9
Jones	20,785	20,366	20,217	-419	-568	-2.0	-2.7
Karnes	15,446	15,408	15,437	-38	-9	-0.2	-0.1
Kaufman	71,313	93,807	96,095	22,494	24,782	31.5	34.8
Kendall	23,743	30,547	31,350	6,804	7,607	28.7	32.0
Kenedy	414	392	397	-22	-17	-5.3	-4.1
Kent	859	815	834	-44	-25	-5.1	-2.9
Kerr	43,653	47,235	47,351	3,582	3,698	8.2	8.5

Kimble	4,468	4,612	4,626	144	158	3.2	3.5
King	356	359	379	3	23	0.8	6.5
Kinney	3,379	3,327	3,321	-52	-58	-1.5	-1.7
Kleberg	31,549	30,415	30,256	-1,134	-1,293	-3.6	-4.1
Knox	4,253	3,972	3,965	-281	-288	-6.6	-6.8
Lamar	48,499	49,787	49,772	1,288	1,273	2.7	2.6
Lamb	14,709	14,640	14,555	-69	-154	-0.5	-1.0
Lampasas	17,762	20,461	20,787	2,699	3,025	15.2	17.0
La Salle	5,866	5,914	5,882	48	16	0.8	0.3
Lavaca	19,210	19,368	19,382	158	172	0.8	0.9
Lee	15,657	16,798	16,885	1,141	1,228	7.3	7.8
Leon	15,335	16,218	16,206	883	871	5.8	5.7
Liberty	70,154	77,176	77,382	7,022	7,228	10.0	10.3
Limestone	22,051	22,378	22,245	327	194	1.5	0.9
Lipscomb	3,057	3,146	3,145	89	88	2.9	2.9
Live Oak	12,309	12,061	11,967	-248	-342	-2.0	-2.8
Llano	17,044	18,948	19,136	1,904	2,092	11.2	12.3
Loving	67	60	59	-7	-8	-10.4	-11.9
Lubbock	242,628	253,601	255,168	10,973	12,540	4.5	5.2
Lynn	6,550	6,237	6,232	-313	-318	-4.8	-4.9
McCulloch	8,205	8,113	8,104	-92	-101	-1.1	-1.2
McLennan	213,517	224,167	225,027	10,650	11,510	5.0	5.4
McMullen	851	863	863	12	12	1.4	1.4
Madison	12,940	13,534	13,584	594	644	4.6	5.0
Marion	10,941	10,880	10,864	-61	-77	-0.6	-0.7
Martin	4,746	4,820	4,896	74	150	1.6	3.2
Mason	3,738	3,719	3,645	-19	-93	-0.5	-2.5
Matagorda	37,957	37,063	36,930	-894	-1,027	-2.4	-2.7
Maverick	47,297	52,162	52,562	4,865	5,265	10.3	11.1
Medina	39,304	43,472	43,805	4,168	4,501	10.6	11.5
Menard	2,360	2,297	2,282	-63	-78	-2.7	-3.3
Midland	116,009	124,383	126,801	8,374	10,792	7.2	9.3
Milam	24,238	25,618	25,633	1,380	1,395	5.7	5.8
Mills	5,151	5,240	5,211	89	60	1.7	1.2
Mitchell	9,698	9,596	9,616	-102	-82	-1.1	-0.8
Montague	19,117	19,773	19,796	656	679	3.4	3.6
Montgomery	293,768	399,941	412,665	106,173	118,897	36.1	40.5
Moore	20,121	19,944	19,901	-177	-220	-0.9	-1.1
Morris	13,048	13,155	13,233	107	185	0.8	1.4
Motley	1,426	1,381	1,406	-45	-20	-3.2	-1.4
Nacogdoches	59,203	62,867	63,272	3,664	4,069	6.2	6.9
Navarro	45,124	48,715	48,984	3,591	3,860	8.0	8.6
Newton	15,072	14,338	14,215	-734	-857	-4.9	-5.7
Nolan	15,802	15,038	14,972	-764	-830	-4.8	-5.3
Nueces	313,645	318,651	319,222	5,006	5,577	1.6	1.8
Ochiltree	9,006	9,300	9,355	294	349	3.3	3.9

Oldham	2,185	2,200	2,198	15	13	0.7	0.6
Orange	84,966	84,026	83,921	-940	-1,045	-1.1	-1.2
Palo Pinto	27,026	28,038	28,189	1,012	1,163	3.7	4.3
Panola	22,756	23,225	23,299	469	543	2.1	2.4
Parker	88,495	106,811	108,478	18,316	19,983	20.7	22.6
Parmer	10,016	9,788	9,759	-228	-257	-2.3	-2.6
Pecos	16,809	16,422	16,505	-387	-304	-2.3	-1.8
Polk	41,133	46,349	46,562	5,216	5,429	12.7	13.2
Potter	113,546	121,375	122,322	7,829	8,776	6.9	7.7
Presidio	7,304	8,105	8,175	801	871	11.0	11.9
Rains	9,139	10,645	10,665	1,506	1,526	16.5	16.7
Randall	104,312	111,427	112,115	7,115	7,803	6.8	7.5
Reagan	3,326	3,041	3,011	-285	-315	-8.6	-9.5
Real	3,047	3,295	3,315	248	268	8.1	8.8
Red River	14,314	13,972	13,966	-342	-348	-2.4	-2.4
Reeves	13,137	11,606	11,606	-1,531	-1,531	-11.7	-11.7
Refugio	7,828	7,497	7,493	-331	-335	-4.2	-4.3
Roberts	887	860	855	-27	-32	-3.0	-3.6
Robertson	16,000	16,171	16,131	171	131	1.1	0.8
Rockwall	43,080	69,658	74,034	26,578	30,954	61.7	71.9
Runnels	11,495	11,020	10,907	-475	-588	-4.1	-5.1
Rusk	47,372	48,093	48,294	721	922	1.5	1.9
Sabine	10,469	10,449	10,471	-20	2	-0.2	0.0
San Augustine	8,946	9,217	9,298	271	352	3.0	3.9
San Jacinto	22,246	24,739	24,809	2,493	2,563	11.2	11.5
San Patricio	67,138	69,477	69,559	2,339	2,421	3.5	3.6
San Saba	6,186	6,102	6,066	-84	-120	-1.4	-1.9
Schleicher	2,935	2,911	2,944	-24	9	-0.8	0.3
Scurry	16,361	15,895	15,886	-466	-475	-2.8	-2.9
Shackelford	3,302	3,257	3,260	-45	-42	-1.4	-1.3
Shelby	25,224	25,687	25,800	463	576	1.8	2.3
Sherman	3,186	3,108	2,996	-78	-190	-2.4	-6.0
Smith	174,706	194,792	197,093	20,086	22,387	11.5	12.8
Somervell	6,809	7,979	8,093	1,170	1,284	17.2	18.9
Starr	53,597	62,432	63,015	8,835	9,418	16.5	17.6
Stephens	9,674	9,495	9,445	-179	-229	-1.9	-2.4
Sterling	1,393	1,223	1,174	-170	-219	-12.2	-15.7
Stonewall	1,693	1,490	1,497	-203	-196	-12.0	-11.6
Sutton	4,077	4,205	4,229	128	152	3.1	3.7
Swisher	8,378	8,097	8,097	-281	-281	-3.4	-3.4
Tarrant	1,446,219	1,667,306	1,690,517	221,087	244,298	15.3	16.9
Taylor	126,555	128,115	128,256	1,560	1,701	1.2	1.3
Terrell	1,081	1,006	995	-75	-86	-6.9	-8.0
Terry	12,761	12,362	12,309	-399	-452	-3.1	-3.5
Throckmorton	1,850	1,762	1,848	-88	-2	-4.8	-0.1
Titus	28,118	30,191	30,444	2,073	2,326	7.4	8.3

Tom Green	104,010	103,123	103,288	-887	-722	-0.9	-0.7
Travis	812,280	928,037	943,726	115,757	131,446	14.3	16.2
Trinity	13,779	14,247	14,206	468	427	3.4	3.1
Tyler	20,871	21,042	20,973	171	102	0.8	0.5
Upshur	35,291	37,379	37,594	2,088	2,303	5.9	6.5
Upton	3,404	3,169	3,211	-235	-193	-6.9	-5.7
Uvalde	25,926	25,719	25,263	-207	-663	-0.8	-2.6
Val Verde	44,856	47,362	47,372	2,506	2,516	5.6	5.6
Van Zandt	48,140	51,827	52,403	3,687	4,263	7.7	8.9
Victoria	84,088	86,334	86,756	2,246	2,668	2.7	3.2
Walker	61,758	64,026	64,245	2,268	2,487	3.7	4.0
Waller	32,663	38,475	39,439	5,812	6,776	17.8	20.7
Ward	10,909	10,369	10,331	-540	-578	-5.0	-5.3
Washington	30,373	32,181	32,360	1,808	1,987	6.0	6.5
Webb	193,117	234,498	237,396	41,381	44,279	21.4	22.9
Wharton	41,188	42,252	42,262	1,064	1,074	2.6	2.6
Wheeler	5,284	5,069	5,076	-215	-208	-4.1	-3.9
Wichita	131,664	130,521	131,412	-1,143	-252	-0.9	-0.2
Wilbarger	14,676	14,115	14,209	-561	-467	-3.8	-3.2
Willacy	20,082	20,884	20,987	802	905	4.0	4.5
Williamson	249,967	349,982	359,979	100,015	110,012	40.0	44.0
Wilson	32,408	39,142	39,643	6,734	7,235	20.8	22.3
Winkler	7,173	6,805	6,883	-368	-290	-5.1	-4.0
Wise	48,793	56,495	57,119	7,702	8,326	15.8	17.1
Wood	36,752	41,661	42,559	4,909	5,807	13.4	15.8
Yoakum	7,322	7,264	7,274	-58	-48	-0.8	-0.7
Young	17,943	18,067	18,263	124	320	0.7	1.8
Zapata	12,182	14,125	14,264	1,943	2,082	15.9	17.1
Zavala	11,600	11,694	11,695	94	95	0.8	0.8
State of Texas	20,851,820	23,507,783	23,834,206	2,655,963	2,982,386	12.7	14.3

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Website Statistics

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007**

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Private industry[6]		114,833.4	4.2	2.1	1.2	0.9	2.1
Goods-producing[6]		23,500.5	5.4	2.9	1.5	1.4	2.5
Natural resources and mining[6,7]		1,638.4	4.4	2.5	1.6	.8	1.9
Agriculture, forestry, fishing and hunting[6]	11	997.6	5.4	2.8	1.8	1.0	2.5
Crop production[6]	111	431.6	5.2	2.8	1.6	1.2	2.4
Oilseed and grain farming[6]	1111	12.7	4.1	.9	.6	.3	3.2
Vegetable and melon farming[6]	1112	86.7	4.2	2.7	1.4	1.3	1.5
Fruit and tree nut farming[6]	1113	140.4	5.0	2.6	1.8	.8	2.4
Greenhouse, nursery, and floriculture production[6]	1114	154.3	5.9	3.2	1.5	1.7	2.7
Other crop farming[6]	1119	37.5	5.9	2.7	2.3	.5	3.1
Animal production[6]	112	155.7	7.0	3.6	2.3	1.3	3.4
Cattle ranching and farming[6]	1121	84.6	7.0	3.4	2.7	.7	3.6
Beef cattle ranching and farming, including feedlots[6]	11211	25.1	9.0	4.2	3.2	1.0	4.7
Dairy cattle and milk production[6]	11212	59.5	6.3	3.1	2.5	.6	3.2
Hog and pig farming[6]	1122	19.2	8.4	3.8	2.1	1.7	4.6
Poultry and egg production[6]	1123	36.4	6.0	3.8	1.4	2.4	2.2
Other animal production[6]	1129	10.9	7.8	4.5	2.7	1.9	3.3
Forestry and logging	113	68.0	5.2	2.5	2.3	.2	2.6
Timber tract operations	1131	3.7	2.2	.7	–	.5	1.4
Forest nurseries and gathering of forest products	1132	2.6	6.2	4.1	3.9	–	2.1
Logging	1133	61.6	5.3	2.6	2.4	.2	2.7
Fishing, hunting and trapping	114	9.0	3.1	1.0	.7	.3	2.0
Fishing	1141	7.0	2.4	.7	.5	–	1.7
Hunting and trapping	1142	1.9	5.1	2.0	1.6	–	3.0
Support activities for agriculture and forestry	115	333.5	4.8	2.6	1.7	.9	2.2
Support activities for crop production	1151	289.3	4.8	2.5	1.6	.9	2.2
Support activities for crop production	11511	289.3	4.8	2.5	1.6	.9	2.2
Cotton ginning	115111	9.6	6.8	1.7	1.7	–	5.1
Soil preparation, planting, and cultivating	115112	23.5	3.4	2.0	1.5	.5	1.4
Crop harvesting, primarily by machine	115113	11.3	5.0	2.0	1.2	.8	3.0
Postharvest crop activities (except cotton ginning)	115114	74.9	6.8	3.5	2.2	1.3	3.3
Farm labor contractors and crew leaders	115115	154.4	3.4	2.0	1.3	.7	1.4
Farm management services	115116	15.5	7.1	3.9	1.8	2.0	3.2
Support activities for animal production	1152	28.2	4.4	2.8	2.0	.8	1.6
Support activities for forestry	1153	15.9	5.4	2.9	2.7	.1	2.6

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Mining[7]	21	640.8	3.1	2.0	1.4	0.6	1.1
Oil and gas extraction	211	139.4	1.7	1.2	1.0	.2	.5
Oil and gas extraction	2111	139.4	1.7	1.2	1.0	.2	.5
Oil and gas extraction	21111	139.4	1.7	1.2	1.0	.2	.5
Crude petroleum and natural gas extraction	211111	134.6	1.7	1.2	1.0	.2	.5
Mining (except oil and gas)[8]	212	221.3	3.7	2.5	1.8	.7	1.2
Coal mining[8]	2121	77.4	4.7	3.2	2.9	.3	1.4
Coal mining[8]	21211	77.4	4.7	3.2	2.9	.3	1.4
Bituminous coal and lignite surface mining[8]	212111	36.5	2.2	1.5	1.3	.1	.7
Bituminous coal underground mining[8]	212112	40.1	6.9	4.9	4.4	.5	2.0
Anthracite mining[8]	212113	.8	5.3	3.3	3.3	–	2.0
Metal ore mining[8]	2122	34.0	3.3	2.1	1.2	.9	1.2
Iron ore mining[8]	21221	5.1	2.5	1.2	.8	.4	1.3
Gold ore and silver ore mining[8]	21222	12.0	2.8	1.7	.8	.9	1.1
Gold ore mining[8]	212221	10.8	2.6	1.6	.8	.8	1.0
Silver ore mining[8]	212222	1.2	5.1	3.4	–	2.3	1.7
Copper, nickel, lead, and zinc mining[8]	21223	12.7	4.0	2.8	1.6	1.2	1.2
Lead ore and zinc ore mining[8]	212231	2.1	6.4	3.8	1.9	1.9	2.6
Copper ore and nickel ore mining[8]	212234	10.6	3.6	2.6	1.5	1.1	1.0
Other metal ore mining[8]	21229	4.3	3.5	2.0	1.5	.5	1.5
Uranium-radium-vanadium ore mining[8]	212291	.8	–	–	–	–	–
All other metal ore mining[8]	212299	3.5	3.7	2.2	1.7	.5	1.5
Nonmetallic mineral mining and quarrying[8]	2123	109.9	3.1	2.0	1.2	.8	1.0
Stone mining and quarrying[8]	21231	51.3	3.3	2.2	1.3	.9	1.1
Dimension stone mining and quarrying[8]	212311	8.9	4.1	3.0	2.0	1.1	1.1
Crushed and broken limestone mining and quarrying[8]	212312	25.7	3.1	2.0	1.1	.8	1.1
Crushed and broken granite mining and quarrying[8]	212313	6.0	2.7	1.7	.8	.9	1.0
Other crushed and broken stone mining and quarrying[8]	212319	10.8	3.7	2.3	1.3	1.0	1.3
Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying[8]	21232	45.2	2.6	1.7	1.1	.7	.9
Construction sand and gravel mining[8]	212321	33.6	2.6	1.7	1.1	.6	.8
Kaolin and ball clay mining[8]	212324	3.7	2.4	1.6	.9	.7	.8
Clay and ceramic and refractory minerals mining[8]	212325	4.3	3.3	2.1	1.2	.9	1.2
Other nonmetallic mineral mining and quarrying[8]	21239	13.3	3.8	2.5	1.4	1.1	1.3
Potash, soda, and borate mineral mining[8]	212391	3.5	4.2	3.0	1.8	1.2	1.2
Phosphate rock mining[8]	212392	1.7	3.1	1.9	–	1.4	1.3
Other chemical and fertilizer mineral mining[8]	212393	2.9	4.2	2.8	1.9	.9	1.4
All other nonmetallic mineral mining[8]	212399	5.2	3.3	2.0	1.3	.7	1.3
Support activities for mining	213	280.2	3.2	1.9	1.2	.7	1.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Support activities for mining	2131	280.2	3.2	1.9	1.2	0.7	1.3
Support activities for mining	21311	280.2	3.2	1.9	1.2	.7	1.3
Drilling oil and gas wells	213111	82.0	4.6	2.8	1.7	1.2	1.8
Support activities for oil and gas operations	213112	185.7	2.7	1.6	1.0	.5	1.1
Construction		7,790.6	5.4	2.8	1.9	.9	2.6
Construction	23	7,790.6	5.4	2.8	1.9	.9	2.6
Construction of buildings	236	1,863.9	4.7	2.3	1.7	.7	2.3
Residential building construction	2361	1,031.5	4.8	2.5	2.0	.5	2.3
Nonresidential building construction	2362	832.3	4.5	2.1	1.2	.9	2.3
Heavy and civil engineering construction	237	1,001.0	4.9	2.6	1.6	1.0	2.2
Utility system construction	2371	443.4	4.7	2.6	1.7	.9	2.1
Water and sewer line and related structures construction	23711	212.5	5.7	3.0	1.9	1.1	2.7
Oil and gas pipeline and related structures construction	23712	90.3	2.5	1.5	1.0	.5	1.0
Power and communication line and related structures construction	23713	140.6	4.9	2.9	1.9	1.0	2.0
Land subdivision	2372	98.1	3.2	1.2	.9	.3	2.0
Highway, street, and bridge construction	2373	347.0	5.9	3.2	1.9	1.3	2.7
Other heavy and civil engineering construction	2379	112.5	3.5	2.0	1.3	.8	1.4
Specialty trade contractors	238	4,925.8	5.7	3.0	2.1	.9	2.7
Foundation, structure, and building exterior contractors	2381	1,116.8	6.8	3.9	2.6	1.3	2.9
Poured concrete foundation and structure contractors	23811	251.3	6.2	3.5	2.0	1.5	2.6
Structural steel and precast concrete contractors	23812	100.3	7.7	4.3	2.8	1.6	3.3
Framing contractors	23813	146.2	8.1	4.8	3.3	1.5	3.3
Masonry contractors	23814	249.1	5.1	2.9	2.4	.5	2.2
Glass and glazing contractors	23815	61.9	9.8	4.4	3.0	1.4	5.4
Roofing contractors	23816	205.0	6.5	3.9	2.9	1.0	2.5
Siding contractors	23817	48.9	–	3.2	2.6	.5	2.4
Other foundation, structure, and building exterior contractors	23819	54.0	9.7	5.5	1.8	–	4.2
Building equipment contractors	2382	2,061.2	5.9	2.8	1.9	.8	3.1
Electrical contractors	23821	925.5	5.0	2.4	1.7	.7	2.6
Plumbing, heating, and air-conditioning contractors	23822	1,008.2	6.8	3.1	2.2	.9	3.6
Other building equipment contractors	23829	127.5	4.6	2.1	1.4	.7	2.5
Building finishing contractors	2383	1,028.1	5.2	2.9	2.1	.8	2.2
Drywall and insulation contractors	23831	359.8	6.3	3.4	2.2	1.2	2.8
Painting and wall covering contractors	23832	249.5	4.0	1.9	1.5	.5	–
Flooring contractors	23833	88.7	4.9	2.8	2.4	.5	2.1
Tile and terrazzo contractors	23834	76.1	4.8	3.2	1.9	1.3	1.6
Finish carpentry contractors	23835	181.6	4.5	2.9	2.4	.5	1.6
Other building finishing contractors	23839	72.5	6.1	3.8	2.8	.9	2.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Other specialty trade contractors	2389	719.6	4.6	2.4	1.6	0.8	2.2
Site preparation contractors	23891	387.0	4.6	2.2	1.6	.6	2.4
All other special trade contractors	23899	332.6	4.5	2.6	1.6	1.0	1.9
Manufacturing		14,071.4	5.6	3.0	1.3	1.7	2.5
Manufacturing	31-33	14,071.4	5.6	3.0	1.3	1.7	2.5
Food manufacturing	311	1,482.7	6.8	4.4	1.5	2.8	2.5
Animal food manufacturing	3111	50.4	5.4	2.8	1.4	1.4	2.5
Animal food manufacturing	31111	50.4	5.4	2.8	1.4	1.4	2.5
Dog and cat food manufacturing	311111	18.6	4.3	2.0	.7	1.4	2.3
Other animal food manufacturing	311119	31.8	6.0	3.3	1.8	1.5	2.7
Grain and oilseed milling	3112	61.2	5.5	3.1	1.4	1.7	2.3
Flour milling and malt manufacturing	31121	18.2	6.6	3.5	1.8	1.7	3.1
Flour milling	311211	13.0	6.9	4.0	2.0	2.0	2.9
Rice milling	311212	4.4	5.4	2.0	1.0	1.0	3.4
Malt manufacturing	311213	.8	8.0	2.1	2.1	–	5.9
Starch and vegetable fats and oils manufacturing	31122	27.7	4.0	1.8	.8	1.0	2.2
Wet corn milling	311221	8.3	3.3	1.2	.6	.7	2.0
Soybean processing	311222	11.7	4.1	1.8	.7	1.1	2.2
Fats and oils refining and blending	311225	5.7	4.3	2.2	1.2	1.0	2.1
Breakfast cereal manufacturing	31123	15.4	6.9	5.2	2.1	3.1	1.7
Sugar and confectionery product manufacturing	3113	74.8	6.1	3.3	1.4	1.9	2.8
Sugar manufacturing	31131	12.9	11.2	4.4	2.3	2.2	6.7
Sugarcane mills	311311	4.2	8.2	3.2	2.4	.8	5.0
Cane sugar refining	311312	2.7	10.9	5.2	1.5	3.7	5.7
Beet sugar manufacturing	311313	6.1	13.8	5.1	2.5	2.5	8.7
Chocolate and confectionery manufacturing from cacao beans	31132	7.9	3.9	2.8	.8	1.9	1.1
Confectionery manufacturing from purchased chocolate	31133	35.9	4.6	2.8	1.3	1.5	1.8
Nonchocolate confectionery manufacturing	31134	18.0	6.1	3.6	1.3	2.3	2.5
Fruit and vegetable preserving and specialty food manufacturing	3114	175.4	6.2	3.6	1.4	2.2	2.5
Frozen food manufacturing	31141	87.8	5.8	3.7	1.4	2.3	2.1
Frozen fruit, juice, and vegetable manufacturing	311411	31.4	7.1	4.0	1.7	2.4	3.0
Frozen specialty food manufacturing	311412	56.5	5.1	3.5	1.2	2.3	1.6
Fruit and vegetable canning, pickling, and drying	31142	87.5	6.5	3.5	1.4	2.1	3.0
Fruit and vegetable canning	311421	65.7	6.8	3.5	1.5	2.0	3.3
Specialty canning	311422	11.0	4.6	3.0	.9	2.1	1.7
Dried and dehydrated food manufacturing	311423	10.8	6.9	4.3	1.5	2.8	2.6
Dairy product manufacturing	3115	130.9	8.0	5.3	2.7	2.6	2.7
Dairy product (except frozen) manufacturing	31151	110.5	8.1	5.4	2.7	2.7	2.8

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Fluid milk manufacturing	311511	55.7	8.8	6.1	3.2	2.9	2.6
Cheese manufacturing	311513	38.9	7.9	5.0	2.5	2.6	2.9
Dry, condensed, and evaporated dairy product manufacturing	311514	14.0	6.4	3.4	1.4	2.1	3.0
Ice cream and frozen dessert manufacturing	31152	20.4	6.8	4.4	2.3	2.2	2.4
Animal slaughtering and processing	3116	502.7	8.4	5.5	1.2	4.3	2.8
Animal slaughtering and processing	31161	502.7	8.4	5.5	1.2	4.3	2.8
Animal (except poultry) slaughtering	311611	145.2	12.1	8.1	1.5	6.5	4.0
Meat processed from carcasses	311612	111.3	8.2	5.3	1.7	3.6	2.9
Rendering and meat byproduct processing	311613	8.4	7.8	5.0	2.9	2.1	2.8
Poultry processing	311615	237.9	6.1	4.1	.7	3.3	2.1
Seafood product preparation and packaging	3117	40.0	8.9	4.7	3.2	1.5	4.2
Seafood product preparation and packaging	31171	40.0	8.9	4.7	3.2	1.5	4.2
Seafood canning	311711	5.4	11.1	6.1	4.4	1.8	4.9
Fresh and frozen seafood processing	311712	34.6	8.6	4.5	3.0	1.5	4.1
Bakeries and tortilla manufacturing	3118	284.5	5.2	3.5	1.6	2.0	1.6
Bread and bakery product manufacturing	31181	213.4	5.3	3.7	1.7	1.9	1.6
Retail bakeries	311811	69.2	2.9	1.8	1.3	.5	1.0
Commercial bakeries	311812	133.3	6.0	4.2	1.9	2.4	1.8
Frozen cakes, pies, and other pastries manufacturing	311813	10.9	6.8	4.9	1.8	3.1	1.9
Cookie, cracker, and pasta manufacturing	31182	54.1	5.3	3.4	1.2	2.2	1.9
Cookie and cracker manufacturing	311821	32.8	5.7	3.6	1.1	2.5	2.1
Flour mixes and dough manufacturing from purchased flour	311822	14.1	5.0	3.3	1.3	2.0	1.7
Dry pasta manufacturing	311823	7.3	4.6	2.7	1.1	1.6	1.8
Tortilla manufacturing	31183	17.0	3.1	2.2	1.0	1.2	.9
Other food manufacturing	3119	162.9	5.3	3.5	1.5	1.9	1.9
Snack food manufacturing	31191	44.7	5.2	3.3	1.4	1.9	1.9
Roasted nuts and peanut butter manufacturing	311911	11.9	6.0	3.9	1.4	2.4	2.2
Other snack food manufacturing	311919	32.8	4.9	3.1	1.3	1.7	1.8
Coffee and tea manufacturing	31192	14.7	7.1	4.8	2.0	2.7	2.4
Flavoring syrup and concentrate manufacturing	31193	10.6	2.9	1.6	1.1	.5	1.4
Seasoning and dressing manufacturing	31194	33.2	5.1	3.7	1.5	2.2	1.4
Mayonnaise, dressing, and other prepared sauce manufacturing	311941	13.4	6.1	4.6	1.9	2.7	1.5
Spice and extract manufacturing	311942	19.7	4.4	3.1	1.2	1.9	1.3
All other food manufacturing	31199	59.7	5.6	3.5	1.6	1.9	2.1
Perishable prepared food manufacturing	311991	32.5	6.8	4.4	2.1	2.2	2.4
All other miscellaneous food manufacturing	311999	27.1	4.2	2.6	1.1	1.5	1.7
Beverage and tobacco product manufacturing	312	200.0	7.3	5.0	2.2	2.8	2.4
Beverage manufacturing	3121	176.4	7.8	5.3	2.3	3.0	2.4
Soft drink and ice manufacturing	31211	105.0	9.4	6.8	2.9	3.9	2.6
Soft drink manufacturing	312111	80.6	10.0	7.3	3.1	4.2	2.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Bottled water manufacturing	312112	16.0	7.9	5.9	2.4	3.4	2.0
Ice manufacturing	312113	8.4	4.4	2.1	1.7	.4	2.2
Breweries	31212	26.3	4.3	2.4	.9	1.5	1.9
Wineries	31213	37.4	5.3	3.0	1.4	1.7	2.3
Distilleries	31214	7.6	6.6	3.4	1.4	2.0	3.2
Tobacco manufacturing	3122	23.6	3.9	2.0	1.3	.7	1.9
Tobacco stemming and redrying	31221	2.8	7.3	4.2	2.3	1.9	3.1
Tobacco product manufacturing	31222	20.9	3.5	1.8	1.2	.6	1.8
Cigarette manufacturing	312221	12.6	3.1	1.6	1.5	.1	1.4
Other tobacco product manufacturing	312229	8.2	4.2	1.9	.7	1.2	2.2
Textile mills	313	179.3	4.0	2.2	.9	1.3	1.8
Fiber, yarn, and thread mills	3131	44.1	3.7	1.9	.5	1.4	1.7
Fiber, yarn, and thread mills	31311	44.1	3.7	1.9	.5	1.4	1.7
Yarn spinning mills	313111	33.0	3.5	1.8	.4	1.4	1.7
Yarn texturizing, throwing, and twisting mills	313112	9.1	3.9	2.2	1.0	1.2	1.7
Thread mills	313113	2.0	5.5	3.5	1.0	2.5	2.0
Fabric mills	3132	80.6	3.8	2.0	.9	1.1	1.8
Broadwoven fabric mills	31321	45.1	3.5	1.8	.7	1.1	1.8
Narrow fabric mills and schiffli machine embroidery	31322	10.6	4.0	1.9	1.1	.8	2.2
Narrow fabric mills	313221	9.7	4.4	2.0	1.2	.9	2.4
Nonwoven fabric mills	31323	14.4	3.7	1.7	.9	.8	2.0
Knit fabric mills	31324	10.6	4.9	3.4	1.6	1.8	1.5
Weft knit fabric mills	313241	4.6	6.6	5.2	2.2	3.0	1.4
Other knit fabric and lace mills	313249	5.9	3.6	2.1	1.1	1.0	1.5
Textile and fabric finishing and fabric coating mills	3133	54.6	4.5	2.6	1.1	1.5	1.9
Textile and fabric finishing mills	31331	45.3	3.8	2.3	1.0	1.3	1.5
Broadwoven fabric finishing mills	313311	24.8	3.8	2.0	1.0	1.0	1.8
Textile and fabric finishing (except broadwoven fabric) mills	313312	20.4	3.8	2.6	1.0	1.7	1.2
Fabric coating mills	31332	9.3	7.8	4.2	1.7	2.5	3.6
Textile product mills	314	156.4	4.2	2.4	.9	1.6	1.8
Textile furnishings mills	3141	87.5	3.9	2.3	.7	1.6	1.6
Carpet and rug mills	31411	47.1	3.6	2.1	.5	1.6	1.5
Curtain and linen mills	31412	40.4	4.2	2.6	.9	1.7	1.6
Curtain and drapery mills	314121	14.9	5.1	2.7	1.3	1.4	2.4
Other household textile product mills	314129	25.4	3.8	2.5	.7	1.8	1.3
Other textile product mills	3149	68.9	4.7	2.7	1.2	1.5	2.0
Textile bag and canvas mills	31491	30.2	5.6	3.2	1.5	1.7	2.4
Textile bag mills	314911	8.0	3.9	1.4	.7	.6	2.6
Canvas and related product mills	314912	22.2	6.2	3.9	1.7	2.1	2.4
All other textile product mills	31499	38.7	3.9	2.2	.9	1.3	1.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Rope, cordage, and twine mills	314991	3.9	8.7	3.8	1.7	2.1	4.8
Tire cord and tire fabric mills	314992	3.9	5.5	2.5	.4	2.1	3.0
All other miscellaneous textile product mills	314999	30.9	3.0	2.0	.9	1.0	1.0
Apparel manufacturing	315	234.6	2.6	1.4	.6	.7	1.3
Apparel knitting mills	3151	32.0	4.2	2.4	1.0	1.5	1.8
Hosiery and sock mills	31511	19.6	4.6	2.3	.9	1.4	2.4
Sheer hosiery mills	315111	6.5	4.7	2.7	1.0	1.7	2.0
Other hosiery and sock mills	315119	13.1	4.6	2.1	.8	1.3	2.6
Other apparel knitting mills	31519	12.5	3.5	2.7	1.1	1.6	.8
Outerwear knitting mills	315191	10.4	3.1	2.6	.7	1.9	.5
Underwear and nightwear knitting mills	315192	2.0	5.5	3.4	3.3	–	–
Cut and sew apparel manufacturing	3152	182.9	2.2	1.1	.6	.5	1.1
Cut and sew apparel contractors	31521	73.7	1.3	.6	.2	.4	.6
Men's and boys' cut and sew apparel contractors	315211	15.6	3.2	1.5	.4	1.1	1.7
Women's, girls', and infants' cut and sew apparel contractors	315212	58.2	.8	.4	.2	.2	.4
Men's and boys' cut and sew apparel manufacturing	31522	46.6	4.1	2.0	1.1	.8	2.1
Men's and boys' cut and sew suit, coat, and overcoat manufacturing	315222	14.0	5.2	2.2	1.7	.5	3.0
Men's and boys' cut and sew trouser, slack, and jean manufacturing	315224	4.2	4.6	2.7	.9	1.8	1.9
Men's and boys' cut and sew work clothing manufacturing	315225	11.3	3.8	2.3	.9	1.4	1.5
Men's and boys' cut and sew other outerwear manufacturing	315228	8.6	3.5	1.5	.9	.7	2.0
Women's and girls' cut and sew apparel manufacturing	31523	43.7	1.5	.8	.5	.2	.7
Women's and girls' cut and sew suit, coat, tailored jacket, and skirt manufacturing	315234	3.5	2.7	1.4	1.4	–	–
Women's and girls' cut and sew other outerwear manufacturing	315239	19.5	1.8	.6	.3	.3	1.2
Other cut and sew apparel manufacturing	31529	18.8	2.9	1.4	.5	.9	1.5
All other cut and sew apparel manufacturing	315299	16.6	3.1	1.6	.6	1.0	1.5
Apparel accessories and other apparel manufacturing	3159	19.7	4.0	2.0	1.0	1.0	2.1
Apparel accessories and other apparel manufacturing	31599	19.7	4.0	2.0	1.0	1.0	2.1
Hat, cap, and millinery manufacturing	315991	5.9	5.8	1.9	.5	1.4	3.9
Leather and allied product manufacturing	316	35.8	5.4	2.9	1.4	1.5	2.5
Leather and hide tanning and finishing	3161	5.8	7.6	4.8	2.5	2.2	2.8
Footwear manufacturing	3162	17.3	5.6	3.1	1.4	1.7	2.5
Footwear manufacturing	31621	17.3	5.6	3.1	1.4	1.7	2.5
Rubber and plastics footwear manufacturing	316211	2.4	9.3	6.2	3.5	2.7	3.0
Men's footwear (except athletic) manufacturing	316213	7.3	5.8	3.0	1.2	1.8	2.8
Women's footwear (except athletic) manufacturing	316214	4.7	3.8	1.8	.6	1.1	2.1
Other leather and allied product manufacturing	3169	12.8	4.1	1.8	1.0	.8	2.3
Other leather and allied product manufacturing	31699	12.8	4.1	1.8	1.0	.8	2.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Luggage manufacturing	316991	4.0	5.9	3.2	2.4	0.9	2.7
Women's handbag and purse manufacturing	316992	1.4	4.5	1.2	–	1.1	3.3
Personal leather good (except women's handbag and purse) manufacturing	316993	1.7	4.2	–	–	–	3.4
All other leather good manufacturing	316999	5.7	2.6	1.2	.4	.8	1.4
Wood product manufacturing	321	537.6	7.8	4.1	2.1	2.0	3.7
Sawmills and wood preservation	3211	115.4	7.7	3.9	2.5	1.4	3.7
Sawmills and wood preservation	32111	115.4	7.7	3.9	2.5	1.4	3.7
Sawmills	321113	103.9	7.7	3.9	2.5	1.4	3.9
Wood preservation	321114	11.5	6.9	4.2	3.0	1.2	2.7
Veneer, plywood, and engineered wood product manufacturing	3212	115.8	6.4	3.4	1.4	1.9	3.1
Veneer, plywood, and engineered wood product manufacturing	32121	115.8	6.4	3.4	1.4	1.9	3.1
Hardwood veneer and plywood manufacturing	321211	22.4	6.3	3.0	1.5	1.5	3.3
Softwood veneer and plywood manufacturing	321212	20.1	4.2	2.5	1.1	1.4	1.7
Engineered wood member (except truss) manufacturing	321213	8.4	5.7	4.0	1.2	2.9	1.7
Truss manufacturing	321214	46.2	9.0	4.5	1.9	2.7	4.5
Reconstituted wood product manufacturing	321219	18.7	3.3	1.7	.8	.9	1.6
Other wood product manufacturing	3219	306.3	8.4	4.5	2.3	2.2	4.0
Millwork	32191	153.3	6.5	3.5	1.7	1.8	3.1
Wood window and door manufacturing	321911	76.0	6.4	3.3	1.5	1.8	3.1
Cut stock, resawing lumber, and planing	321912	18.0	7.8	4.0	2.0	2.0	3.8
Other millwork (including flooring)	321918	59.3	6.4	3.5	1.8	1.7	2.9
Wood container and pallet manufacturing	32192	59.3	10.2	5.2	3.5	1.8	4.9
All other wood product manufacturing	32199	93.6	10.5	5.7	2.5	3.1	4.8
Manufactured home (mobile home) manufacturing	321991	42.5	13.0	7.1	2.5	4.6	5.9
Prefabricated wood building manufacturing	321992	25.3	9.5	5.5	2.8	2.7	4.0
All other miscellaneous wood product manufacturing	321999	25.8	7.4	3.6	2.4	1.2	3.8
Paper manufacturing	322	463.3	4.0	2.2	1.1	1.1	1.8
Pulp, paper, and paperboard mills	3221	133.6	3.5	1.9	1.1	.8	1.6
Pulp mills	32211	6.5	3.3	2.3	1.2	1.0	1.1
Paper mills	32212	92.1	3.8	2.1	1.2	.9	1.7
Paper (except newsprint) mills	322121	83.0	3.8	2.1	1.2	.9	1.7
Newsprint mills	322122	9.2	3.3	1.8	1.2	.6	1.5
Paperboard mills	32213	35.0	3.0	1.4	.9	.5	1.5
Converted paper product manufacturing	3222	329.7	4.2	2.3	1.1	1.3	1.8
Paperboard container manufacturing	32221	174.6	4.1	2.2	1.0	1.3	1.9
Corrugated and solid fiber box manufacturing	322211	112.0	4.2	2.3	.9	1.4	1.9
Folding paperboard box manufacturing	322212	33.3	4.5	2.5	1.4	1.1	2.0
Setup paperboard box manufacturing	322213	4.5	3.0	1.6	1.1	.5	1.4
Fiber can, tube, drum, and similar products manufacturing	322214	10.6	3.9	1.7	1.0	.8	2.2

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Nonfolding sanitary food container manufacturing	322215	14.1	3.1	1.8	0.6	1.2	1.3
Paper bag and coated and treated paper manufacturing	32222	73.6	4.4	2.5	1.3	1.2	1.9
Coated and laminated packaging paper and plastics film manufacturing	322221	16.2	4.3	2.0	1.1	.8	2.4
Coated and laminated paper manufacturing	322222	33.1	3.9	2.3	1.3	1.0	1.6
Plastics, foil, and coated paper bag manufacturing	322223	8.5	4.8	3.2	1.2	2.0	1.6
Uncoated paper and multiwall bag manufacturing	322224	11.9	5.0	2.8	1.3	1.6	2.2
Laminated aluminum foil manufacturing for flexible packaging uses	322225	1.6	3.6	2.2	1.4	–	1.5
Surface-coated paperboard manufacturing	322226	2.3	6.5	4.7	1.7	3.0	1.8
Stationery product manufacturing	32223	32.7	5.0	2.9	1.3	1.6	2.1
Die-cut paper and paperboard office supplies manufacturing	322231	10.7	5.5	3.4	1.3	2.1	2.1
Envelope manufacturing	322232	17.1	4.6	2.8	1.3	1.5	1.7
Stationery, tablet, and related product manufacturing	322233	4.8	5.3	2.2	1.3	.9	3.1
Other converted paper product manufacturing	32229	48.9	3.7	2.1	1.1	1.1	1.6
Sanitary paper product manufacturing	322291	31.7	3.5	2.0	.8	1.2	1.5
All other converted paper product manufacturing	322299	17.2	4.0	2.4	1.5	.8	1.7
Printing and related support activities	323	633.3	3.8	2.2	1.0	1.1	1.6
Printing and related support activities	3231	633.3	3.8	2.2	1.0	1.1	1.6
Printing	32311	584.6	3.8	2.2	1.1	1.2	1.6
Commercial lithographic printing	323110	244.9	4.2	2.4	1.2	1.2	1.8
Commercial gravure printing	323111	16.0	4.3	2.4	.8	1.6	1.9
Commercial flexographic printing	323112	39.0	4.3	2.5	1.1	1.4	1.9
Commercial screen printing	323113	69.3	2.9	1.5	.8	.7	1.4
Quick printing	323114	66.5	1.7	1.0	.6	.3	.8
Manifold business forms printing	323116	34.9	3.7	2.4	.9	1.4	1.3
Books printing	323117	30.7	5.1	2.9	1.3	1.6	2.2
Blankbook, looseleaf binders, and devices manufacturing	323118	8.8	3.5	2.0	1.1	.9	1.5
Other commercial printing	323119	51.1	5.9	3.7	1.7	2.0	2.2
Support activities for printing	32312	48.7	3.0	1.7	.9	.8	1.3
Tradebinding and related work	323121	23.0	4.1	2.5	1.1	1.4	1.5
Prepress services	323122	25.7	2.0	1.0	.6	.3	1.0
Petroleum and coal products manufacturing	324	116.7	2.8	1.7	.8	.9	1.2
Petroleum and coal products manufacturing	3241	116.7	2.8	1.7	.8	.9	1.2
Petroleum refineries	32411	72.3	1.6	1.0	.3	.7	.6
Asphalt paving, roofing, and saturated materials manufacturing	32412	29.3	5.3	3.0	1.5	1.6	2.2
Asphalt paving mixture and block manufacturing	324121	15.4	6.7	3.7	2.0	1.7	3.0
Asphalt shingle and coating materials manufacturing	324122	13.8	3.9	2.3	.9	1.5	1.5
Other petroleum and coal products manufacturing	32419	15.2	4.3	2.4	1.5	.9	1.9
Petroleum lubricating oil and grease manufacturing	324191	9.8	4.8	2.6	1.5	1.1	2.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Chemical manufacturing	325	891.2	3.1	1.7	0.8	0.9	1.4
Basic chemical manufacturing	3251	148.1	2.7	1.3	.7	.6	1.4
Petrochemical manufacturing	32511	28.0	1.1	.7	.2	.5	.4
Industrial gas manufacturing	32512	18.3	1.7	1.0	.4	.6	.7
Synthetic dye and pigment manufacturing	32513	16.9	2.3	1.5	.7	.9	.7
Inorganic dye and pigment manufacturing	325131	9.9	2.1	1.3	.6	.7	.7
Synthetic organic dye and pigment manufacturing	325132	6.9	2.6	1.8	.7	1.1	.7
Other basic inorganic chemical manufacturing	32518	41.6	3.3	1.3	.7	.6	2.0
Alkalies and chlorine manufacturing	325181	7.8	2.7	1.7	1.0	.7	1.0
Carbon black manufacturing	325182	1.8	3.2	1.4	–	–	1.8
All other basic inorganic chemical manufacturing	325188	32.0	3.5	1.2	.6	.6	2.3
Other basic organic chemical manufacturing	32519	43.4	3.6	1.7	1.0	.6	1.9
Gum and wood chemical manufacturing	325191	1.8	3.9	2.0	1.6	–	1.9
Cyclic crude and intermediate manufacturing	325192	1.3	3.3	–	–	–	2.4
Ethyl alcohol manufacturing	325193	6.4	6.7	1.9	1.1	.8	4.8
All other basic organic chemical manufacturing	325199	33.9	3.0	1.6	1.1	.6	1.3
Resin, synthetic rubber, and artificial and synthetic fibers and filaments manufacturing	3252	106.3	3.2	1.8	.9	1.0	1.4
Resin and synthetic rubber manufacturing	32521	74.5	3.5	2.0	1.0	1.0	1.5
Plastics material and resin manufacturing	325211	61.7	3.4	2.0	1.0	1.0	1.4
Synthetic rubber manufacturing	325212	12.9	4.0	1.9	.7	1.2	2.1
Artificial and synthetic fibers and filaments manufacturing	32522	31.8	2.6	1.4	.6	.8	1.2
Cellulosic organic fiber manufacturing	325221	9.7	1.8	1.1	.5	.5	.7
Noncellulosic organic fiber manufacturing	325222	22.1	2.9	1.6	.6	1.0	1.3
Pesticide, fertilizer, and other agricultural chemical manufacturing	3253	37.3	2.8	1.7	.9	.8	1.1
Fertilizer manufacturing	32531	22.0	3.1	2.0	1.2	.8	1.2
Nitrogenous fertilizer manufacturing	325311	7.0	3.7	2.5	1.7	.8	1.2
Fertilizer (mixing only) manufacturing	325314	7.9	3.1	2.2	1.1	1.1	1.0
Pesticide and other agricultural chemical manufacturing	32532	15.4	2.4	1.3	.4	.8	1.1
Pharmaceutical and medicine manufacturing	3254	319.1	2.4	1.4	.6	.7	1.0
Pharmaceutical and medicine manufacturing	32541	319.1	2.4	1.4	.6	.7	1.0
Medicinal and botanical manufacturing	325411	23.8	2.9	1.6	.8	.8	1.3
Pharmaceutical preparation manufacturing	325412	252.9	2.4	1.3	.6	.7	1.0
In-vitro diagnostic substance manufacturing	325413	17.7	2.2	1.2	.6	.6	1.0
Biological product (except diagnostic) manufacturing	325414	24.7	2.6	1.6	.7	1.0	1.0
Paint, coating, and adhesive manufacturing	3255	65.6	4.4	2.9	1.4	1.5	1.6
Paint and coating manufacturing	32551	44.0	4.9	3.3	1.6	1.7	1.6
Adhesive manufacturing	32552	21.5	3.4	1.9	.8	1.1	1.5
Soap, cleaning compound, and toilet preparation manufacturing	3256	111.4	3.8	2.3	1.1	1.3	1.5
Soap and cleaning compound manufacturing	32561	54.9	3.7	2.1	1.1	1.0	1.6

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Soap and other detergent manufacturing	325611	24.5	3.4	1.9	1.1	0.8	1.5
Polish and other sanitation good manufacturing	325612	25.3	4.1	2.5	1.2	1.4	1.5
Toilet preparation manufacturing	32562	56.5	3.9	2.5	1.0	1.5	1.4
Other chemical product and preparation manufacturing	3259	103.4	4.2	2.2	1.0	1.2	2.0
Printing ink manufacturing	32591	11.9	3.9	1.6	.5	1.1	2.3
Explosives manufacturing	32592	6.2	4.7	2.4	.9	1.5	2.3
All other chemical product and preparation manufacturing	32599	85.3	4.2	2.3	1.1	1.2	2.0
Custom compounding of purchased resins	325991	20.4	5.7	2.7	1.3	1.4	3.0
All other miscellaneous chemical product and preparation manufacturing	325998	36.5	4.2	2.5	1.3	1.2	1.8
Plastics and rubber products manufacturing	326	762.8	6.4	3.7	1.6	2.1	2.7
Plastics product manufacturing	3261	615.4	6.3	3.7	1.6	2.1	2.7
Unsupported plastics film, sheet, and bag manufacturing	32611	87.7	5.5	3.3	1.3	1.9	2.3
Unsupported plastics bag manufacturing	326111	29.3	4.3	2.4	1.1	1.3	1.9
Unsupported plastics packaging film and sheet manufacturing	326112	10.7	4.9	3.2	1.5	1.7	1.7
Unsupported plastics film and sheet (except packaging) manufacturing	326113	47.7	6.4	3.8	1.4	2.4	2.6
Plastics pipe, pipe fitting, and unsupported profile shape manufacturing	32612	60.5	6.9	3.7	1.9	1.9	3.2
Unsupported plastics profile shape manufacturing	326121	26.3	7.9	3.9	2.3	1.5	4.0
Plastics pipe and pipe fitting manufacturing	326122	34.2	6.2	3.6	1.5	2.1	2.6
Laminated plastics plate, sheet, and shape manufacturing	32613	19.9	7.0	3.6	1.2	2.4	3.3
Polystyrene foam product manufacturing	32614	30.5	5.8	3.5	1.8	1.7	2.3
Urethane and other foam product (except polystyrene) manufacturing	32615	34.8	7.0	4.2	1.7	2.5	2.7
Plastics bottle manufacturing	32616	36.2	5.6	3.5	1.1	2.5	2.1
Other plastics product manufacturing	32619	345.7	6.5	3.7	1.6	2.1	2.7
Plastics plumbing fixture manufacturing	326191	23.2	6.8	4.6	1.8	2.8	2.2
All other plastics product manufacturing	326199	317.5	6.5	3.7	1.6	2.1	2.8
Rubber product manufacturing	3262	147.4	6.6	3.9	1.6	2.3	2.7
Tire manufacturing	32621	57.9	6.9	4.4	1.5	2.9	2.5
Tire manufacturing (except retreading)	326211	50.2	7.1	4.6	1.5	3.0	2.5
Rubber and plastics hoses and belting manufacturing	32622	27.8	5.8	3.2	1.5	1.7	2.6
Other rubber product manufacturing	32629	61.7	6.7	3.8	1.8	2.0	2.9
Rubber product manufacturing for mechanical use	326291	37.6	7.0	4.1	1.8	2.3	2.9
All other rubber product manufacturing	326299	24.2	6.3	3.3	1.7	1.5	3.0
Nonmetallic mineral product manufacturing	327	513.3	6.5	3.9	1.9	2.0	2.7
Clay product and refractory manufacturing	3271	58.3	6.7	3.7	1.9	1.8	3.0
Pottery, ceramics, and plumbing fixture manufacturing	32711	22.5	6.2	3.2	1.6	1.6	3.0

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Vitreous china plumbing fixture and china and earthenware bathroom accessories manufacturing	327111	5.8	7.1	4.5	1.9	2.6	2.5
Vitreous china, fine earthenware, and other pottery product manufacturing	327112	10.4	4.5	2.5	1.4	1.1	2.0
Porcelain electrical supply manufacturing	327113	6.4	7.9	3.0	1.7	1.3	4.9
Clay building material and refractories manufacturing	32712	35.8	7.0	4.0	2.1	1.9	3.0
Brick and structural clay tile manufacturing	327121	13.2	6.8	3.6	1.8	1.8	3.2
Ceramic wall and floor tile manufacturing	327122	8.5	6.0	4.0	1.7	2.3	2.0
Clay refractory manufacturing	327124	5.9	7.6	5.8	2.7	3.1	1.8
Nonclay refractory manufacturing	327125	6.1	9.1	3.5	2.5	1.0	5.6
Glass and glass product manufacturing	3272	101.6	7.0	4.0	1.3	2.7	3.0
Glass and glass product manufacturing	32721	101.6	7.0	4.0	1.3	2.7	3.0
Flat glass manufacturing	327211	12.5	6.9	3.9	1.0	2.9	3.0
Other pressed and blown glass and glassware manufacturing	327212	21.8	4.8	2.8	.9	1.9	2.0
Glass container manufacturing	327213	16.9	7.7	4.2	1.3	2.9	3.5
Glass product manufacturing made of purchased glass	327215	50.5	7.8	4.4	1.5	2.9	3.4
Cement and concrete product manufacturing	3273	251.3	6.6	4.0	2.1	2.0	2.6
Ready-mix concrete manufacturing	32732	127.1	5.7	3.4	2.1	1.3	2.3
Concrete pipe, brick, and block manufacturing	32733	37.6	8.8	5.7	2.6	3.1	3.2
Concrete block and brick manufacturing	327331	25.0	8.2	4.7	2.3	2.4	3.5
Concrete pipe manufacturing	327332	12.6	10.1	7.5	3.1	4.4	2.6
Other concrete product manufacturing	32739	68.8	7.8	4.7	1.9	2.8	3.1
Lime and gypsum product manufacturing	3274	18.9	3.1	1.6	1.3	.3	1.5
Gypsum product manufacturing	32742	14.6	3.7	1.9	1.5	.4	1.8
Other nonmetallic mineral product manufacturing	3279	83.0	6.4	3.9	2.0	1.8	2.5
Abrasive product manufacturing	32791	11.1	7.7	3.8	2.0	1.8	3.9
All other nonmetallic mineral product manufacturing	32799	71.9	6.1	3.9	2.0	1.9	2.3
Cut stone and stone product manufacturing	327991	32.5	7.8	4.5	3.1	1.5	3.3
Ground or treated mineral and earth manufacturing	327992	5.2	3.6	1.7	.8	.9	1.9
Mineral wool manufacturing	327993	20.0	3.9	2.6	1.0	1.6	1.3
All other miscellaneous nonmetallic mineral product manufacturing	327999	14.3	6.9	5.2	1.9	3.3	1.8
Primary metal manufacturing	331	461.5	8.1	4.3	2.0	2.3	3.7
Iron and steel mills and ferroalloy manufacturing	3311	98.4	4.6	2.5	1.3	1.2	2.2
Iron and steel mills and ferroalloy manufacturing	33111	98.4	4.6	2.5	1.3	1.2	2.2
Iron and steel mills	331111	95.6	4.6	2.5	1.3	1.2	2.1
Steel product manufacturing from purchased steel	3312	61.7	7.7	4.1	2.1	2.1	3.6
Iron and steel pipe and tube manufacturing from purchased steel	33121	27.4	8.4	4.5	2.0	2.5	3.9
Rolling and drawing of purchased steel	33122	34.3	7.0	3.8	2.1	1.7	3.2
Rolled steel shape manufacturing	331221	24.3	7.7	4.1	2.5	1.7	3.5

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Steel wire drawing	331222	10.0	5.5	3.0	1.3	1.7	2.5
Alumina and aluminum production and processing	3313	72.4	6.5	3.5	1.6	1.9	3.0
Alumina and aluminum production and processing	33131	72.4	6.5	3.5	1.6	1.9	3.0
Primary aluminum production	331312	12.4	8.6	3.5	1.6	1.9	5.1
Secondary smelting and alloying of aluminum	331314	6.3	8.8	4.9	2.8	2.1	3.8
Aluminum sheet, plate, and foil manufacturing	331315	16.3	3.7	2.0	.6	1.3	1.7
Aluminum extruded product manufacturing	331316	28.3	6.8	4.0	1.8	2.2	2.8
Other aluminum rolling and drawing	331319	6.8	7.3	4.3	2.2	2.1	3.0
Nonferrous metal (except aluminum) production and processing	3314	70.3	6.5	3.9	1.8	2.0	2.7
Nonferrous metal (except aluminum) smelting and refining	33141	9.8	6.4	4.0	1.2	2.8	2.3
Primary smelting and refining of copper	331411	2.4	4.2	2.0	1.2	.7	2.2
Primary smelting and refining of nonferrous metal (except copper and aluminum)	331419	7.4	7.1	4.7	1.2	3.5	2.4
Copper rolling, drawing, extruding, and alloying	33142	36.8	6.7	4.0	2.1	1.9	2.8
Copper rolling, drawing, and extruding	331421	15.3	7.9	4.6	2.0	2.6	3.3
Copper wire (except mechanical) drawing	331422	20.3	5.3	3.1	1.9	1.2	2.2
Secondary smelting, refining, and alloying of copper	331423	1.2	14.6	9.4	4.6	4.9	5.2
Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying	33149	23.7	6.3	3.6	1.7	1.9	2.7
Nonferrous metal (except copper and aluminum) rolling, drawing, and extruding	331491	14.3	6.2	3.5	1.8	1.6	2.7
Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum)	331492	9.4	6.4	3.8	1.5	2.3	2.6
Foundries	3315	158.7	11.8	6.2	2.7	3.5	5.6
Ferrous metal foundries	33151	90.4	13.0	6.7	2.7	4.1	6.2
Iron foundries	331511	55.8	13.6	6.7	2.8	3.9	6.9
Steel investment foundries	331512	13.1	8.6	5.0	2.0	3.1	3.6
Steel foundries (except investment)	331513	21.5	13.8	7.9	2.7	5.2	6.0
Nonferrous metal foundries	33152	68.3	10.3	5.5	2.7	2.8	4.8
Aluminum die-casting foundries	331521	22.6	9.4	5.2	2.0	3.2	4.2
Nonferrous (except aluminum) die-casting foundries	331522	8.8	6.1	4.2	2.1	2.0	1.9
Aluminum foundries (except die-casting)	331524	23.0	9.0	5.5	2.3	3.2	3.5
Copper foundries (except die-casting)	331525	6.3	10.9	6.0	3.2	2.8	4.9
Other nonferrous foundries (except die-casting)	331528	7.7	–	7.6	6.6	.9	–
Fabricated metal product manufacturing	332	1,564.5	7.2	3.5	1.8	1.8	3.6
Forging and stamping	3321	110.9	8.3	4.1	2.0	2.1	4.2
Forging and stamping	33211	110.9	8.3	4.1	2.0	2.1	4.2
Iron and steel forging	332111	27.3	10.0	5.3	2.5	2.8	4.7
Nonferrous forging	332112	7.1	7.5	3.6	1.7	1.9	3.9
Custom roll forming	332114	6.5	5.2	2.8	1.1	1.7	2.4

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Metal stamping	332116	57.9	8.1	3.9	1.9	2.0	4.2
Powder metallurgy part manufacturing	332117	9.9	6.7	3.1	1.3	1.8	3.5
Cutlery and handtool manufacturing	3322	52.4	6.2	2.7	1.4	1.3	3.5
Cutlery and handtool manufacturing	33221	52.4	6.2	2.7	1.4	1.3	3.5
Cutlery and flatware (except precious) manufacturing	332211	8.2	7.4	3.0	1.4	1.6	4.4
Hand and edge tool manufacturing	332212	34.5	5.3	2.3	1.1	1.2	3.0
Saw blade and handsaw manufacturing	332213	6.4	8.8	4.0	2.8	1.2	4.9
Kitchen utensil, pot, and pan manufacturing	332214	3.2	7.9	3.7	2.1	1.6	4.1
Architectural and structural metals manufacturing	3323	416.6	8.7	4.4	2.2	2.3	4.3
Plate work and fabricated structural product manufacturing	33231	183.1	9.0	4.5	2.4	2.1	4.5
Prefabricated metal building and component manufacturing	332311	35.2	6.3	3.2	1.2	1.9	3.2
Fabricated structural metal manufacturing	332312	97.7	10.0	5.4	3.0	2.3	4.6
Plate work manufacturing	332313	50.3	8.9	3.6	1.9	1.7	5.3
Ornamental and architectural metal products manufacturing	33232	233.5	8.6	4.4	2.0	2.4	4.2
Metal window and door manufacturing	332321	81.9	8.4	4.9	1.6	3.3	3.5
Sheet metal work manufacturing	332322	109.2	8.0	3.8	2.0	1.8	4.2
Ornamental and architectural metal work manufacturing	332323	42.4	10.3	5.0	2.8	2.2	5.3
Boiler, tank, and shipping container manufacturing	3324	97.2	7.4	3.6	1.8	1.7	3.8
Power boiler and heat exchanger manufacturing	33241	22.6	6.7	3.1	1.2	1.9	3.6
Metal tank (heavy gauge) manufacturing	33242	30.5	8.6	4.4	2.4	2.0	4.2
Metal can, box, and other metal container (light gauge) manufacturing	33243	44.0	6.8	3.2	1.7	1.4	3.6
Metal can manufacturing	332431	22.7	4.7	2.1	1.1	1.0	2.5
Other metal container manufacturing	332439	21.3	9.4	4.4	2.5	2.0	4.9
Hardware manufacturing	3325	33.9	5.6	2.9	1.0	1.9	2.6
Spring and wire product manufacturing	3326	57.5	7.1	3.6	1.9	1.7	3.5
Spring and wire product manufacturing	33261	57.5	7.1	3.6	1.9	1.7	3.5
Spring (heavy gauge) manufacturing	332611	4.7	9.5	4.5	2.8	1.7	4.9
Spring (light gauge) manufacturing	332612	11.8	7.4	4.6	1.8	2.8	2.7
Other fabricated wire product manufacturing	332618	40.9	6.8	3.2	1.8	1.4	3.6
Machine shops; turned product; and screw, nut, and bolt manufacturing	3327	359.2	6.3	2.7	1.5	1.2	3.6
Machine shops	33271	273.1	6.1	2.4	1.5	.9	3.7
Turned product and screw, nut, and bolt manufacturing	33272	86.0	7.0	3.7	1.6	2.1	3.3
Precision turned product manufacturing	332721	42.9	8.3	4.4	1.8	2.6	3.9
Bolt, nut, screw, rivet, and washer manufacturing	332722	43.2	5.8	3.0	1.3	1.7	2.8
Coating, engraving, heat treating, and allied activities	3328	148.2	7.1	4.0	2.0	2.0	3.1
Coating, engraving, heat treating, and allied activities	33281	148.2	7.1	4.0	2.0	2.0	3.1
Metal heat treating	332811	18.8	6.8	3.6	1.9	1.7	3.2

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Metal coating, engraving (except jewelry and silverware), and allied services to manufacturers	332812	56.4	7.0	3.9	1.8	2.1	3.0
Electroplating, plating, polishing, anodizing, and coloring	332813	73.0	7.3	4.1	2.1	2.0	3.2
Other fabricated metal product manufacturing	3329	288.7	5.9	3.1	1.4	1.7	2.8
Metal valve manufacturing	33291	94.7	5.0	2.8	1.1	1.8	2.2
Industrial valve manufacturing	332911	25.6	5.8	3.3	1.2	2.1	2.5
Fluid power valve and hose fitting manufacturing	332912	36.1	4.5	2.6	.9	1.7	1.9
Plumbing fixture fitting and trim manufacturing	332913	12.8	4.3	1.9	.5	1.4	2.4
Other metal valve and pipe fitting manufacturing	332919	20.2	5.1	3.1	1.4	1.7	1.9
All other fabricated metal product manufacturing	33299	193.9	6.4	3.2	1.5	1.7	3.2
Ball and roller bearing manufacturing	332991	33.7	6.1	2.8	1.1	1.6	3.3
Small arms ammunition manufacturing	332992	10.2	4.5	2.3	1.4	.9	2.2
Ammunition (except small arms) manufacturing	332993	16.8	2.3	1.3	.4	.9	1.0
Small arms manufacturing	332994	10.1	5.4	2.5	1.5	1.0	3.0
Other ordnance and accessories manufacturing	332995	4.8	2.0	1.2	.8	.4	.8
Fabricated pipe and pipe fitting manufacturing	332996	32.3	6.4	3.2	1.9	1.3	3.1
Industrial pattern manufacturing	332997	5.9	4.5	2.1	1.8	.3	2.5
Enameled iron and metal sanitary ware manufacturing	332998	14.3	6.6	3.0	.8	2.2	3.5
All other miscellaneous fabricated metal product manufacturing	332999	65.8	8.3	4.4	2.0	2.4	3.9
Machinery manufacturing	333	1,176.5	5.8	2.7	1.3	1.4	3.1
Agriculture, construction, and mining machinery manufacturing	3331	223.1	6.3	3.1	1.4	1.7	3.2
Agricultural implement manufacturing	33311	76.4	7.3	3.6	1.6	2.0	3.7
Farm machinery and equipment manufacturing	333111	58.2	8.0	3.9	1.8	2.1	4.1
Lawn and garden tractor and home lawn and garden equipment manufacturing	333112	18.2	4.8	2.4	1.0	1.4	2.4
Construction machinery manufacturing	33312	77.7	7.5	3.7	1.6	2.1	3.8
Mining and oil and gas field machinery manufacturing	33313	69.0	4.2	2.1	1.1	1.0	2.1
Mining machinery and equipment manufacturing	333131	11.6	7.8	4.3	2.7	1.6	3.5
Oil and gas field machinery and equipment manufacturing	333132	57.4	3.6	1.7	.8	.9	1.9
Industrial machinery manufacturing	3332	124.0	6.3	2.5	1.3	1.1	3.8
Sawmill and woodworking machinery manufacturing	33321	7.6	11.2	4.5	3.0	1.5	6.7
Plastics and rubber industry machinery manufacturing	33322	18.9	8.4	2.7	1.0	1.7	5.7
Other industrial machinery manufacturing	33329	97.5	5.5	2.3	1.3	1.0	3.2
Paper industry machinery manufacturing	333291	10.9	5.3	1.9	1.2	.7	3.4
Textile machinery manufacturing	333292	7.0	4.1	1.7	1.1	.5	2.5
Printing machinery and equipment manufacturing	333293	13.1	4.1	2.0	1.2	.9	2.0
Food product machinery manufacturing	333294	18.3	–	3.9	1.9	2.1	6.0
Semiconductor machinery manufacturing	333295	18.2	2.0	1.2	.8	.4	.8
All other industrial machinery manufacturing	333298	30.0	5.8	2.3	1.3	1.0	3.5
Commercial and service industry machinery manufacturing	3333	107.1	4.6	2.3	1.0	1.3	2.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Commercial and service industry machinery manufacturing	33331	107.1	4.6	2.3	1.0	1.3	2.3
Automatic vending machine manufacturing	333311	4.8	6.7	3.5	1.8	1.6	3.3
Commercial laundry, drycleaning, and pressing machine manufacturing	333312	3.9	9.1	3.4	1.6	1.8	5.8
Office machinery manufacturing	333313	10.3	3.1	1.9	.6	–	1.2
Optical instrument and lens manufacturing	333314	22.4	3.0	1.6	.8	.8	1.4
Photographic and photocopying equipment manufacturing	333315	12.2	2.5	1.6	1.1	.5	.9
Other commercial and service industry machinery manufacturing	333319	53.5	5.6	2.6	1.0	1.7	2.9
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	3334	153.8	6.1	3.1	1.3	1.9	3.0
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	33341	153.8	6.1	3.1	1.3	1.9	3.0
Air purification equipment manufacturing	333411	17.5	7.0	3.5	1.6	1.9	3.5
Industrial and commercial fan and blower manufacturing	333412	12.0	8.0	3.6	1.9	1.7	4.3
Heating equipment (except warm air furnaces) manufacturing	333414	19.4	7.5	4.0	1.6	2.4	3.5
Air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing	333415	104.8	5.5	2.9	1.1	1.8	2.6
Metalworking machinery manufacturing	3335	196.3	6.0	2.5	1.4	1.1	3.5
Metalworking machinery manufacturing	33351	196.3	6.0	2.5	1.4	1.1	3.5
Industrial mold manufacturing	333511	41.0	5.8	2.1	1.0	1.1	3.8
Machine tool (metal cutting types) manufacturing	333512	28.5	6.3	2.2	1.3	.9	4.1
Machine tool (metal forming types) manufacturing	333513	14.1	7.7	2.7	1.6	1.1	5.0
Special die and tool, die set, jig, and fixture manufacturing	333514	72.6	5.8	2.6	1.5	1.2	3.1
Cutting tool and machine tool accessory manufacturing	333515	27.0	5.2	2.2	1.4	.9	3.0
Rolling mill machinery and equipment manufacturing	333516	4.1	11.9	7.1	4.9	2.1	4.8
Engine, turbine, and power transmission equipment manufacturing	3336	100.0	4.2	2.1	1.0	1.1	2.2
Engine, turbine, and power transmission equipment manufacturing	33361	100.0	4.2	2.1	1.0	1.1	2.2
Turbine and turbine generator set units manufacturing	333611	20.6	2.3	1.2	.7	.5	1.0
Speed changer, industrial high-speed drive, and gear manufacturing	333612	14.3	6.3	2.3	1.1	1.1	4.0
Mechanical power transmission equipment manufacturing	333613	16.4	6.8	3.8	1.8	2.0	3.0
Other engine equipment manufacturing	333618	48.7	3.7	1.8	.8	1.0	1.9
Other general purpose machinery manufacturing	3339	272.2	6.0	3.0	1.4	1.5	3.1
Pump and compressor manufacturing	33391	53.9	5.0	2.6	1.2	1.4	2.4
Pump and pumping equipment manufacturing	333911	28.8	5.1	2.9	1.3	1.6	2.2
Air and gas compressor manufacturing	333912	22.2	5.2	2.5	1.2	1.3	2.7
Measuring and dispensing pump manufacturing	333913	2.9	2.8	–	–	–	2.3
Material handling equipment manufacturing	33392	78.7	8.3	4.3	2.2	2.1	4.0
Elevator and moving stairway manufacturing	333921	9.0	10.1	5.3	2.7	2.6	4.8
Conveyor and conveying equipment manufacturing	333922	30.0	8.3	3.9	2.0	1.9	4.4

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Overhead traveling crane, hoist, and monorail system manufacturing	333923	15.0	7.5	5.1	2.8	2.3	2.4
Industrial truck, tractor, trailer, and stacker machinery manufacturing	333924	24.7	8.1	4.1	2.0	2.1	4.0
All other general purpose machinery manufacturing	33399	139.5	5.1	2.3	1.1	1.2	2.8
Power-driven handtool manufacturing	333991	10.7	4.3	2.2	1.0	1.2	2.1
Welding and soldering equipment manufacturing	333992	15.0	4.8	2.4	1.3	1.1	2.4
Packaging machinery manufacturing	333993	17.7	4.1	2.0	.7	1.3	2.2
Industrial process furnace and oven manufacturing	333994	12.8	7.0	2.6	1.2	1.3	4.5
Fluid power cylinder and actuator manufacturing	333995	18.0	6.4	2.7	1.3	1.5	3.7
Fluid power pump and motor manufacturing	333996	19.6	3.8	1.7	.6	1.1	2.2
Scale and balance (except laboratory) manufacturing	333997	4.2	3.1	1.5	.7	.7	1.6
All other miscellaneous general purpose machinery manufacturing	333999	41.6	5.6	2.6	1.4	1.2	3.0
Computer and electronic product manufacturing	334	1,294.0	2.0	1.0	.5	.5	1.0
Computer and peripheral equipment manufacturing	3341	187.9	1.1	.6	.3	.3	.5
Computer and peripheral equipment manufacturing	33411	187.9	1.1	.6	.3	.3	.5
Electronic computer manufacturing	334111	99.1	.7	.5	.3	.2	.2
Computer storage device manufacturing	334112	28.9	1.5	.7	.3	.4	.8
Computer terminal manufacturing	334113	15.7	.7	.3	.3	–	.4
Other computer peripheral equipment manufacturing	334119	44.2	2.0	.9	.5	.4	1.1
Communications equipment manufacturing	3342	132.8	1.9	1.0	.4	.6	.9
Telephone apparatus manufacturing	33421	38.2	1.5	.7	.2	.5	.8
Radio and television broadcasting and wireless communications equipment manufacturing	33422	69.6	2.0	1.2	.5	.8	.8
Other communications equipment manufacturing	33429	25.0	2.2	1.0	.5	.5	1.2
Audio and video equipment manufacturing	3343	30.2	3.0	1.2	.5	.7	1.8
Semiconductor and other electronic component manufacturing	3344	463.2	2.2	1.1	.6	.6	1.1
Semiconductor and other electronic component manufacturing	33441	463.2	2.2	1.1	.6	.6	1.1
Electron tube manufacturing	334411	7.1	2.0	.8	.5	.3	1.2
Bare printed circuit board manufacturing	334412	55.5	2.9	1.2	.6	.5	1.7
Semiconductor and related device manufacturing	334413	231.1	1.5	.8	.4	.4	.7
Electronic capacitor manufacturing	334414	7.6	3.3	1.8	.9	1.0	1.5
Electronic resistor manufacturing	334415	5.3	7.2	2.4	1.2	1.1	4.8
Electronic coil, transformer, and other inductor manufacturing	334416	11.4	3.8	1.4	.7	.7	2.4
Electronic connector manufacturing	334417	19.7	4.3	2.2	1.0	1.3	2.1
Printed circuit assembly (electronic assembly) manufacturing	334418	56.4	2.3	1.4	.7	.7	1.0
Other electronic component manufacturing	334419	69.1	2.8	1.5	.8	.7	1.3
Navigational, measuring, electromedical, and control instruments manufacturing	3345	440.6	1.9	.9	.4	.5	1.0

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Navigational, measuring, electromedical, and control instruments manufacturing	33451	440.6	1.9	0.9	0.4	0.5	1.0
Electromedical and electrotherapeutic apparatus manufacturing	334510	63.7	2.1	1.1	.5	.6	1.0
Search, detection, navigation, guidance, aeronautical, and nautical system and instrument manufacturing	334511	155.2	1.2	.6	.3	.3	.6
Automatic environmental control manufacturing for residential, commercial, and appliance use	334512	24.6	3.0	1.5	.7	.8	1.5
Instruments and related products manufacturing for measuring, displaying, and controlling industrial process variables	334513	63.6	2.3	1.1	.5	.6	1.2
Totalizing fluid meter and counting device manufacturing	334514	12.3	4.7	2.7	1.1	1.6	2.0
Instrument manufacturing for measuring and testing electricity and electrical signals	334515	40.8	1.5	.8	.4	.4	.7
Analytical laboratory instrument manufacturing	334516	32.9	1.9	.9	.5	.4	1.0
Irradiation apparatus manufacturing	334517	12.3	1.5	.9	.4	.5	.6
Watch, clock, and part manufacturing	334518	5.2	2.3	.6	.3	.3	1.6
Other measuring and controlling device manufacturing	334519	30.2	3.6	1.0	.6	.4	2.5
Manufacturing and reproducing magnetic and optical media	3346	39.4	2.0	1.2	.4	.8	.8
Manufacturing and reproducing magnetic and optical media	33461	39.4	2.0	1.2	.4	.8	.8
Software reproducing	334611	14.0	.5	.1	–	–	.3
Prerecorded compact disc (except software), tape, and record reproducing	334612	19.5	3.3	2.1	.6	1.5	1.2
Magnetic and optical recording media manufacturing	334613	5.9	1.5	.9	.6	.3	.5
Electrical equipment, appliance, and component manufacturing	335	435.2	4.7	2.6	1.0	1.6	2.1
Electric lighting equipment manufacturing	3351	59.7	5.6	3.0	1.3	1.6	2.6
Electric lamp bulb and part manufacturing	33511	12.7	6.1	3.6	2.7	.9	2.5
Lighting fixture manufacturing	33512	47.0	5.5	2.8	1.0	1.8	2.7
Residential electric lighting fixture manufacturing	335121	12.4	7.6	4.0	1.6	2.4	3.6
Commercial, industrial, and institutional electric lighting fixture manufacturing	335122	23.8	4.5	2.3	.8	1.5	2.2
Other lighting equipment manufacturing	335129	10.9	5.3	2.5	.7	1.7	2.8
Household appliance manufacturing	3352	76.4	4.7	2.3	.7	1.5	2.4
Small electrical appliance manufacturing	33521	16.4	5.7	2.8	1.2	1.6	2.8
Electric housewares and household fan manufacturing	335211	11.8	5.6	3.0	1.3	1.7	2.6
Major appliance manufacturing	33522	60.1	4.4	2.1	.6	1.5	2.3
Household cooking appliance manufacturing	335221	17.3	4.3	2.2	.9	1.3	2.1
Household refrigerator and home freezer manufacturing	335222	16.5	4.0	1.9	.4	1.4	2.2
Electrical equipment manufacturing	3353	159.4	4.1	2.2	.9	1.3	1.9
Electrical equipment manufacturing	33531	159.4	4.1	2.2	.9	1.3	1.9
Power, distribution, and specialty transformer manufacturing	335311	27.7	5.8	3.5	1.6	1.9	2.3
Motor and generator manufacturing	335312	48.3	4.9	2.3	.9	1.4	2.6

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Switchgear and switchboard apparatus manufacturing	335313	33.2	4.3	2.7	0.9	1.8	1.7
Relay and industrial control manufacturing	335314	50.2	2.1	1.0	.5	.6	1.1
Other electrical equipment and component manufacturing	3359	139.7	5.0	3.1	1.1	2.0	2.0
Battery manufacturing	33591	26.6	5.3	3.3	1.2	2.1	2.0
Communication and energy wire and cable manufacturing	33592	22.6	4.2	2.9	.6	2.3	1.3
Fiber optic cable manufacturing	335921	9.1	2.7	1.7	.4	1.3	1.0
Other communication and energy wire manufacturing	335929	13.5	5.3	3.7	.8	2.9	1.6
Wiring device manufacturing	33593	53.9	5.4	3.5	1.5	1.9	1.9
Current-carrying wiring device manufacturing	335931	41.0	4.6	3.0	1.0	2.0	1.6
Noncurrent-carrying wiring device manufacturing	335932	12.9	7.6	4.8	3.0	1.8	2.8
All other electrical equipment and component manufacturing	33599	36.6	4.9	2.5	.8	1.7	2.4
Carbon and graphite product manufacturing	335991	7.8	6.3	3.9	1.4	2.5	2.4
All other miscellaneous electrical equipment and component manufacturing	335999	28.8	4.5	2.1	.6	1.4	2.4
Transportation equipment manufacturing	336	1,731.9	6.9	3.6	1.4	2.3	3.2
Motor vehicle manufacturing	3361	234.0	9.3	5.0	1.5	3.5	4.3
Automobile and light duty motor vehicle manufacturing	33611	198.3	9.3	5.0	1.4	3.6	4.3
Automobile manufacturing	336111	134.2	8.1	4.8	1.4	3.4	3.3
Light truck and utility vehicle manufacturing	336112	64.1	11.9	5.5	1.3	4.2	6.4
Heavy duty truck manufacturing	33612	35.6	9.3	4.7	2.0	2.6	4.6
Motor vehicle body and trailer manufacturing	3362	171.1	10.6	4.9	2.0	3.0	5.6
Motor vehicle body and trailer manufacturing	33621	171.1	10.6	4.9	2.0	3.0	5.6
Motor vehicle body manufacturing	336211	65.7	9.6	5.2	1.9	3.3	4.4
Truck trailer manufacturing	336212	38.9	10.4	4.6	2.1	2.6	5.8
Motor home manufacturing	336213	20.6	12.5	5.2	1.5	3.6	7.4
Travel trailer and camper manufacturing	336214	45.9	11.3	4.7	2.2	2.6	6.6
Motor vehicle parts manufacturing	3363	631.6	6.9	3.7	1.2	2.5	3.2
Motor vehicle gasoline engine and engine parts manufacturing	33631	71.3	5.9	2.8	1.0	1.8	3.1
Carburetor, piston, piston ring, and valve manufacturing	336311	13.8	6.6	3.4	1.3	2.1	3.2
Gasoline engine and engine parts manufacturing	336312	57.5	5.8	2.7	.9	1.7	3.1
Motor vehicle electrical and electronic equipment manufacturing	33632	85.6	4.6	2.5	1.0	1.6	2.0
Vehicular lighting equipment manufacturing	336321	15.0	4.8	2.6	1.0	1.6	2.2
Other motor vehicle electrical and electronic equipment manufacturing	336322	70.6	4.5	2.5	1.0	1.5	2.0
Motor vehicle steering and suspension components (except spring) manufacturing	33633	39.6	6.7	3.7	1.2	2.4	3.1
Motor vehicle brake system manufacturing	33634	37.8	5.4	3.0	1.1	1.9	2.4
Motor vehicle transmission and power train parts manufacturing	33635	78.4	7.1	3.5	1.1	2.5	3.6
Motor vehicle seating and interior trim manufacturing	33636	62.2	9.0	5.8	1.5	4.3	3.2
Motor vehicle metal stamping	33637	91.5	8.7	4.0	1.3	2.6	4.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Other motor vehicle parts manufacturing	33639	165.3	7.2	4.1	1.5	2.6	3.2
Motor vehicle air-conditioning manufacturing	336391	10.9	7.2	4.4	1.4	3.0	2.8
All other motor vehicle parts manufacturing	336399	154.3	7.2	4.0	1.5	2.6	3.2
Aerospace product and parts manufacturing	3364	480.3	3.9	2.1	.9	1.2	1.8
Aerospace product and parts manufacturing	33641	480.3	3.9	2.1	.9	1.2	1.8
Aircraft manufacturing	336411	225.6	4.1	2.4	1.0	1.4	1.7
Aircraft engine and engine parts manufacturing	336412	84.3	3.6	1.8	.9	.9	1.8
Other aircraft parts and auxiliary equipment manufacturing	336413	94.6	5.3	2.7	1.1	1.7	2.6
Guided missile and space vehicle manufacturing	336414	53.7	1.3	.7	.3	.3	.6
Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing	336415	14.4	2.1	1.1	.5	.6	.9
Other guided missile and space vehicle parts and auxiliary equipment manufacturing	336419	7.7	1.8	.6	.3	.3	1.2
Railroad rolling stock manufacturing	3365	28.1	6.2	3.3	1.5	1.8	2.9
Ship and boat building	3366	146.8	8.9	5.0	2.6	2.4	3.8
Ship and boat building	33661	146.8	8.9	5.0	2.6	2.4	3.8
Ship building and repairing	336611	98.1	8.7	5.2	2.8	2.3	3.5
Boat building	336612	48.7	9.1	4.7	2.2	2.5	4.5
Other transportation equipment manufacturing	3369	40.1	6.3	3.0	1.4	1.5	3.4
Other transportation equipment manufacturing	33699	40.1	6.3	3.0	1.4	1.5	3.4
Motorcycle, bicycle, and parts manufacturing	336991	17.8	6.8	3.5	1.7	1.8	3.3
All other transportation equipment manufacturing	336999	16.0	7.0	3.2	1.4	1.8	3.9
Furniture and related product manufacturing	337	544.3	6.7	3.6	1.6	2.0	3.1
Household and institutional furniture and kitchen cabinet manufacturing	3371	359.5	6.8	3.7	1.6	2.1	3.1
Wood kitchen cabinet and countertop manufacturing	33711	173.6	6.9	3.9	1.9	2.0	3.0
Household and institutional furniture manufacturing	33712	185.9	6.7	3.5	1.4	2.1	3.2
Upholstered household furniture manufacturing	337121	76.0	7.1	3.7	1.2	2.4	3.5
Nonupholstered wood household furniture manufacturing	337122	66.8	5.8	3.2	1.4	1.8	2.5
Metal household furniture manufacturing	337124	9.4	5.3	3.0	1.0	2.0	2.3
Household furniture (except wood and metal) manufacturing	337125	6.8	7.8	3.4	1.4	2.0	4.4
Institutional furniture manufacturing	337127	24.2	8.2	4.1	2.1	2.0	4.1
Wood television, radio, and sewing machine cabinet manufacturing	337129	2.7	2.1	1.7	–	.9	–
Office furniture (including fixtures) manufacturing	3372	135.1	6.8	3.3	1.5	1.7	3.5
Office furniture (including fixtures) manufacturing	33721	135.1	6.8	3.3	1.5	1.7	3.5
Wood office furniture manufacturing	337211	24.7	5.3	2.4	1.1	1.3	2.9
Custom architectural woodwork and millwork manufacturing	337212	20.1	7.6	2.6	1.5	1.1	5.0
Office furniture (except wood) manufacturing	337214	27.7	4.6	2.5	.8	1.7	2.1
Showcase, partition, shelving, and locker manufacturing	337215	62.7	8.1	4.1	2.0	2.2	4.0

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Other furniture related product manufacturing	3379	49.6	5.6	3.5	1.6	1.9	2.1
Mattress manufacturing	33791	29.1	6.2	3.8	1.8	2.0	2.4
Blind and shade manufacturing	33792	20.5	4.8	3.1	1.3	1.8	1.7
Miscellaneous manufacturing	339	656.5	3.9	2.0	.9	1.1	1.9
Medical equipment and supplies manufacturing	3391	314.5	3.2	1.6	.7	.9	1.6
Medical equipment and supplies manufacturing	33911	314.5	3.2	1.6	.7	.9	1.6
Laboratory apparatus and furniture manufacturing	339111	–	3.5	1.9	.8	1.1	1.6
Surgical and medical instrument manufacturing	339112	115.2	2.8	1.5	.7	.8	1.3
Surgical appliance and supplies manufacturing	339113	89.6	4.4	2.1	.9	1.2	2.4
Dental equipment and supplies manufacturing	339114	15.5	4.3	2.8	1.2	1.5	1.5
Ophthalmic goods manufacturing	339115	32.6	2.8	1.8	.7	1.0	1.0
Dental laboratories	339116	49.8	1.6	.6	.4	.1	1.0
Other miscellaneous manufacturing	3399	342.0	4.6	2.4	1.1	1.3	2.2
Jewelry and silverware manufacturing	33991	40.2	3.0	1.5	.8	.7	1.5
Jewelry (except costume) manufacturing	339911	27.8	2.5	1.4	.8	.6	1.1
Jewelers' material and lapidary work manufacturing	339913	4.0	1.5	1.0	–	.6	–
Costume jewelry and novelty manufacturing	339914	6.5	6.1	1.4	.5	.9	4.7
Sporting and athletic goods manufacturing	33992	52.1	6.3	3.0	1.3	1.7	3.3
Doll, toy, and game manufacturing	33993	17.0	3.7	2.1	1.3	.8	1.6
Doll and stuffed toy manufacturing	339931	2.8	3.6	2.5	1.3	1.2	1.1
Game, toy, and children's vehicle manufacturing	339932	14.2	3.7	2.0	1.3	.7	1.7
Office supplies (except paper) manufacturing	33994	20.5	3.9	2.0	.9	1.1	1.8
Pen and mechanical pencil manufacturing	339941	6.0	2.8	2.0	.7	1.3	.8
Lead pencil and art good manufacturing	339942	6.5	4.3	2.7	1.0	1.7	1.6
Carbon paper and inked ribbon manufacturing	339944	2.2	3.5	2.3	1.3	1.0	1.2
Sign manufacturing	33995	79.9	4.5	2.3	1.3	1.0	2.2
All other miscellaneous manufacturing	33999	132.3	4.6	2.6	1.0	1.6	2.0
Gasket, packing, and sealing device manufacturing	339991	35.4	3.7	2.1	.9	1.2	1.6
Musical instrument manufacturing	339992	13.0	7.0	4.2	2.0	2.2	2.7
Fastener, button, needle, and pin manufacturing	339993	6.2	5.9	2.9	.7	2.2	3.0
Broom, brush, and mop manufacturing	339994	10.9	5.3	3.0	1.1	1.9	2.3
Burial casket manufacturing	339995	5.6	9.8	5.6	2.2	3.4	4.2
All other miscellaneous manufacturing	339999	61.2	4.0	2.2	.8	1.5	1.7
Service-providing		91,332.9	3.8	1.9	1.1	.8	1.9
Trade, transportation, and utilities[9]		26,565.8	4.9	2.8	1.6	1.2	2.1
Wholesale trade	42	6,031.9	4.0	2.4	1.3	1.1	1.6
Merchant wholesalers, durable goods	423	3,120.3	3.9	2.2	1.2	1.0	1.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Motor vehicle and motor vehicle parts and supplies merchant wholesalers	4231	351.8	6.0	3.5	2.0	1.6	2.5
Furniture and home furnishing merchant wholesalers	4232	116.9	3.3	2.4	1.1	1.3	1.0
Lumber and other construction materials merchant wholesalers	4233	265.7	5.4	3.8	1.9	1.9	1.6
Professional and commercial equipment and supplies merchant wholesalers	4234	656.5	1.8	1.0	.5	.4	.8
Metal and mineral (except petroleum) merchant wholesalers	4235	131.7	8.0	4.8	2.3	–	3.2
Electrical goods merchant wholesalers	4236	352.5	2.1	1.0	.6	.4	1.1
Hardware, and plumbing and heating equipment and supplies merchant wholesalers	4237	258.6	4.1	2.2	1.2	1.0	1.9
Machinery, equipment, and supplies merchant wholesalers	4238	688.0	4.7	2.3	1.4	.8	2.4
Miscellaneous durable goods merchant wholesalers	4239	298.5	3.8	2.1	1.1	1.0	–
Sporting and recreational goods and supplies merchant wholesalers	42391	50.5	–	2.4	1.3	1.1	–
Recyclable material merchant wholesalers	42393	109.1	5.1	3.1	1.7	1.4	2.0
Jewelry, watch, precious stone, and precious metal merchant wholesalers	42394	45.4	.9	.4	.1	.3	.4
Other miscellaneous durable goods merchant wholesalers	42399	69.4	3.0	1.7	.9	.8	1.3
Merchant wholesalers, nondurable goods	424	2,072.3	5.1	3.3	1.7	1.6	1.8
Paper and paper product merchant wholesalers	4241	149.6	4.3	2.2	1.0	1.2	–
Drugs and druggists' sundries merchant wholesalers	4242	218.6	2.2	1.4	1.0	.5	.7
Apparel, piece goods, and notions merchant wholesalers	4243	154.1	1.8	1.1	.5	.6	.7
Grocery and related product merchant wholesalers	4244	724.7	6.8	4.9	2.3	2.6	1.9
Farm product raw material merchant wholesalers	4245	72.2	6.3	2.5	1.6	.9	3.8
Chemical and allied products merchant wholesalers	4246	132.3	3.4	1.6	1.0	.7	1.7
Petroleum and petroleum products merchant wholesalers	4247	101.9	3.7	2.1	1.6	.5	1.7
Beer, wine, and distilled alcoholic beverage merchant wholesalers	4248	155.3	8.5	5.6	2.9	2.7	2.8
Miscellaneous nondurable goods merchant wholesalers	4249	363.7	4.0	2.5	1.4	1.1	1.6
Wholesale electronic markets and agents and brokers	425	839.3	1.8	.9	.6	.3	1.0
Retail trade	44-45	15,675.9	4.8	2.5	1.4	1.2	2.3
Motor vehicle and parts dealers	441	1,929.5	4.5	1.8	1.3	.5	2.7
Automobile dealers	4411	1,250.1	4.5	1.7	1.2	.4	2.8
New car dealers	44111	1,117.6	4.7	1.8	1.3	.5	2.9
Used car dealers	44112	132.5	–	.9	.7	.2	1.3
Other motor vehicle dealers	4412	174.3	4.2	1.7	1.3	.4	2.5
Recreational vehicle dealers	44121	40.5	7.6	1.8	1.1	.6	5.8
Motorcycle, boat, and other motor vehicle dealers	44122	133.8	3.2	1.6	1.3	.3	1.5
Automotive parts, accessories, and tire stores	4413	505.1	4.6	2.1	1.4	.7	2.6
Automotive parts and accessories stores	44131	336.6	3.9	1.8	1.3	.5	2.1
Tire dealers	44132	168.5	5.9	2.6	1.6	1.0	3.3

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Furniture and home furnishings stores	442	589.1	4.5	2.6	1.4	1.1	1.9
Furniture stores	4421	297.7	4.3	2.8	1.3	1.5	1.5
Home furnishings stores	4422	291.4	4.6	2.3	1.6	–	2.4
Floor covering stores	44221	98.7	2.4	1.1	.9	.2	1.3
Other home furnishings stores	44229	192.7	6.2	3.1	2.1	–	3.1
Electronics and appliance stores	443	557.7	2.6	1.3	–	.5	1.3
Electronics and appliance stores	4431	557.7	2.6	1.3	–	.5	1.3
Appliance, television, and other electronics stores	44311	401.0	3.2	1.5	.9	.6	1.6
Computer and software stores	44312	140.6	1.4	.8	.5	.3	.6
Building material and garden equipment and supplies dealers	444	1,335.7	6.6	4.0	1.7	2.2	2.6
Building material and supplies dealers	4441	1,189.4	6.8	4.1	1.8	2.4	2.6
Home centers	44411	680.6	7.7	4.9	1.8	3.2	2.8
Paint and wallpaper stores	44412	42.2	3.2	2.3	1.1	1.2	.9
Hardware stores	44413	165.4	5.0	2.7	1.4	1.3	2.2
Other building material dealers	44419	301.1	6.0	3.3	2.0	1.3	2.7
Lawn and garden equipment and supplies stores	4442	146.3	4.9	2.4	1.4	1.0	2.5
Outdoor power equipment stores	44421	32.8	3.9	1.9	1.6	–	2.1
Nursery and garden centers	44422	113.5	5.2	2.6	1.4	1.2	2.6
Food and beverage stores	445	2,866.8	5.9	3.1	1.7	1.4	2.8
Grocery stores	4451	2,493.1	6.2	3.3	1.8	1.5	3.0
Supermarkets and other grocery (except convenience) stores	44511	2,351.0	6.5	3.4	1.8	1.6	3.1
Convenience stores	44512	142.1	–	1.2	.8	.4	–
Specialty food stores	4452	234.9	4.1	2.4	1.4	1.0	1.7
Meat markets	44521	49.1	4.3	2.6	2.1	.5	1.7
Fruit and vegetable markets	44523	41.5	5.0	2.8	1.7	1.1	2.2
Other specialty food stores	44529	130.8	3.8	2.4	1.1	1.2	1.4
Beer, wine, and liquor stores	4453	138.8	–	2.0	1.3	.7	1.4
Health and personal care stores	446	1,003.0	2.4	1.1	.8	.4	1.3
Health and personal care stores	4461	1,003.0	2.4	1.1	.8	.4	1.3
Pharmacies and drug stores	44611	734.0	2.6	1.2	.8	.4	1.4
Cosmetics, beauty supplies, and perfume stores	44612	106.7	1.3	.5	.5	–	.8
Optical goods stores	44613	64.2	1.5	.8	–	–	.7
Other health and personal care stores	44619	98.1	–	1.4	.9	.6	1.4
Gasoline stations	447	874.8	3.2	1.3	.9	.4	1.8
Gasoline stations	4471	874.8	3.2	1.3	.9	.4	1.8
Gasoline stations with convenience stores	44711	761.0	3.2	1.4	.9	.4	1.9
Other gasoline stations	44719	113.8	2.8	1.3	.8	.4	1.5
Clothing and clothing accessories stores	448	1,511.2	2.9	1.0	.7	.3	1.9
Clothing stores	4481	1,147.5	3.4	1.2	.8	.4	2.3
Women's clothing stores	44812	288.0	3.3	.6	.5	([10])	2.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Children's and infants' clothing stores	44813	70.3	4.4	1.7	1.3	–	2.7
Family clothing stores	44814	536.6	3.8	1.4	.9	0.5	2.3
Clothing accessories stores	44815	50.3	–	2.7	1.9	–	1.1
Other clothing stores	44819	124.3	–	.9	.8	.1	2.0
Shoe stores	4482	192.9	–	.6	.4	.2	–
Jewelry, luggage, and leather goods stores	4483	170.9	.7	.5	.4	–	.1
Jewelry stores	44831	155.6	.4	.3	.3	([10])	.1
Luggage and leather goods stores	44832	15.3	3.4	3.0	1.9	–	–
Sporting goods, hobby, book, and music stores	451	663.2	3.6	1.2	.8	.4	2.4
Sporting goods, hobby, and musical instrument stores	4511	476.9	4.4	1.5	1.0	.5	2.9
Sporting goods stores	45111	242.5	3.2	1.2	.8	.4	2.0
Hobby, toy, and game stores	45112	146.7	7.1	2.0	1.5	.5	5.0
Sewing, needlework, and piece goods stores	45113	52.7	4.9	.9	.7	–	4.1
Musical instrument and supplies stores	45114	35.0	2.8	1.9	.7	1.2	–
Book, periodical, and music stores	4512	186.3	1.6	.7	.5	.2	1.0
Book stores and news dealers	45121	152.1	1.9	.8	.5	.2	1.2
Prerecorded tape, compact disc, and record stores	45122	34.1	.4	.3	–	–	.1
General merchandise stores	452	3,020.7	6.4	3.9	1.7	2.2	2.5
Department stores	4521	1,608.2	5.7	3.5	1.6	1.8	2.3
Other general merchandise stores	4529	1,412.5	7.0	4.3	1.8	2.5	2.7
Warehouse clubs and superstores	45291	1,078.7	7.1	4.8	1.8	3.0	2.2
All other general merchandise stores	45299	333.8	6.6	2.3	1.6	.7	4.4
Miscellaneous store retailers	453	888.3	3.7	2.1	1.3	.7	1.6
Florists	4531	94.9	2.5	1.0	.9	.1	1.5
Office supplies, stationery, and gift stores	4532	372.8	3.0	1.5	.9	.6	1.5
Office supplies and stationery stores	45321	171.3	–	1.9	1.0	.9	1.3
Gift, novelty, and souvenir stores	45322	201.5	–	1.1	.8	.3	1.7
Used merchandise stores	4533	116.6	5.6	3.2	–	1.5	2.5
Other miscellaneous store retailers	4539	304.0	4.0	2.6	1.8	.8	1.4
Pet and pet supplies stores	45391	97.7	8.6	5.7	3.5	2.2	2.9
Manufactured (mobile) home dealers	45393	23.4	2.7	1.4	1.3	–	1.2
All other miscellaneous store retailers	45399	158.8	–	1.5	1.2	.3	.9
Nonstore retailers	454	435.9	5.0	3.1	1.8	1.3	1.9
Electronic shopping and mail-order houses	4541	242.1	3.1	2.0	.9	1.1	1.1
Electronic shopping and mail-order houses	45411	242.1	3.1	2.0	.9	1.1	1.1
Electronic shopping	454111	75.1	1.8	1.3	.7	.6	.5
Mail-order houses	454113	162.1	3.7	2.4	.9	1.4	1.4
Vending machine operators	4542	50.3	6.3	3.0	2.1	.9	3.3
Direct selling establishments	4543	143.5	7.6	5.0	3.3	–	2.6
Fuel dealers	45431	89.6	7.3	4.2	–	1.1	–

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Transportation and warehousing[9]	48-49	4,309.2	6.4	4.3	2.7	1.6	2.1
Air transportation	481	490.0	9.9	7.3	5.2	2.1	2.6
Scheduled air transportation	4811	444.8	10.7	8.0	5.7	2.3	2.7
Scheduled air transportation	48111	444.8	10.7	8.0	5.7	2.3	2.7
Scheduled passenger air transportation	481111	432.0	10.9	8.1	5.8	2.3	2.8
Scheduled freight air transportation	481112	12.7	5.7	3.5	2.5	1.0	2.2
Nonscheduled air transportation	4812	45.3	2.9	1.4	1.1	.3	1.4
Rail transportation[9]	482	–	2.3	1.7	1.5	.2	.6
Water transportation	483	64.5	–	2.6	2.1	.5	–
Deep sea, coastal, and Great Lakes water transportation	4831	40.6	3.8	2.4	2.0	.4	1.4
Deep sea, coastal, and Great Lakes water transportation	48311	40.6	3.8	2.4	2.0	.4	1.4
Deep sea passenger transportation	483112	4.2	1.9	1.5	–	1.3	.4
Inland water transportation	4832	24.0	–	2.8	2.1	.7	–
Inland water transportation	48321	24.0	–	2.8	2.1	.7	–
Inland water freight transportation	483211	20.0	–	2.9	2.2	.8	–
Inland water passenger transportation	483212	4.0	2.1	1.8	1.7	–	–
Truck transportation	484	1,456.6	5.6	3.5	2.6	.9	2.1
General freight trucking	4841	1,019.0	5.7	3.5	2.6	.9	2.1
General freight trucking, local	48411	241.2	5.3	3.4	2.6	.8	1.9
General freight trucking, long-distance	48412	777.7	5.8	3.6	2.7	.9	2.2
Specialized freight trucking	4842	437.6	5.5	3.4	2.4	1.0	2.1
Used household and office goods moving	48421	102.3	7.3	4.6	3.0	1.6	2.7
Specialized freight (except used goods) trucking, local	48422	213.1	4.3	2.8	2.1	.7	1.5
Specialized freight (except used goods) trucking, long-distance	48423	122.2	6.1	3.6	2.5	1.0	2.6
Transit and ground passenger transportation	485	402.4	5.3	3.3	2.4	.9	2.0
Urban transit systems	4851	35.4	8.0	5.2	3.5	1.7	2.8
Interurban and rural bus transportation	4852	19.2	7.0	3.8	2.9	.9	3.2
Taxi and limousine service	4853	71.9	3.9	2.6	1.9	.6	1.3
Taxi service	48531	31.8	4.4	2.9	2.0	1.0	1.5
Limousine service	48532	40.0	3.4	2.3	1.9	–	1.1
School and employee bus transportation	4854	176.0	5.5	3.0	2.2	.8	2.6
Charter bus industry	4855	31.1	3.9	2.3	1.8	.5	1.6
Other transit and ground passenger transportation	4859	68.8	4.8	3.6	2.8	.8	1.2
Pipeline transportation	486	39.9	2.0	.9	.5	.4	1.2
Pipeline transportation of crude oil	4861	7.7	1.6	1.0	.9	–	.6
Pipeline transportation of natural gas	4862	26.4	2.0	.7	.5	.2	1.3
Scenic and sightseeing transportation	487	29.3	4.2	2.4	2.0	.4	1.8
Scenic and sightseeing transportation, land	4871	10.8	5.7	4.0	3.4	.5	1.8
Scenic and sightseeing transportation, water	4872	15.8	2.8	1.3	1.2	.2	1.4

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Support activities for transportation	488	581.7	4.9	3.2	1.9	1.3	1.7
Support activities for air transportation	4881	158.2	6.2	4.3	2.2	2.1	1.9
Support activities for water transportation	4883	101.2	7.2	4.9	3.6	1.3	2.2
Marine cargo handling	48832	47.6	9.1	6.1	4.5	1.6	3.0
Navigational services to shipping	48833	20.7	3.5	2.0	1.5	.6	1.5
Other support activities for water transportation	48839	9.9	5.0	3.3	1.7	1.6	1.7
Support activities for road transportation	4884	83.8	4.9	2.9	1.9	.9	2.0
Motor vehicle towing	48841	50.7	4.4	3.0	2.0	1.0	1.4
Other support activities for road transportation	48849	33.1	5.7	2.7	1.9	.8	3.0
Freight transportation arrangement	4885	185.5	2.2	1.4	.8	.6	.8
Other support activities for transportation	4889	29.0	4.8	2.7	1.4	1.2	2.1
Couriers and messengers	492	583.0	9.8	6.8	3.3	3.5	3.0
Couriers	4921	537.5	10.5	7.3	3.5	3.8	3.2
Local messengers and local delivery	4922	45.5	3.2	2.2	1.8	.5	.9
Warehousing and storage	493	657.0	7.7	5.5	2.1	3.3	2.2
Warehousing and storage	4931	657.0	7.7	5.5	2.1	3.3	2.2
General warehousing and storage	49311	555.7	7.9	5.6	2.1	3.5	2.2
Refrigerated warehousing and storage	49312	47.3	8.2	5.9	2.8	3.1	2.2
Farm product warehousing and storage	49313	9.6	5.2	3.7	1.7	2.0	1.5
Other warehousing and storage	49319	44.4	5.8	3.3	1.7	1.6	2.5
Utilities	22	548.9	4.0	2.1	1.2	.9	1.9
Utilities	221	548.9	4.0	2.1	1.2	.9	1.9
Electric power generation, transmission and distribution	2211	395.1	3.6	1.8	1.0	.7	1.9
Electric power generation	22111	232.8	2.7	1.5	.8	.7	1.2
Hydroelectric power generation	221111	37.3	2.7	1.3	.5	.8	1.4
Fossil fuel electric power generation	221112	133.5	3.4	1.9	1.1	.9	1.4
Nuclear electric power generation	221113	52.8	.9	.4	.2	.2	.5
Other electric power generation	221119	9.1	4.7	2.9	1.6	1.3	1.7
Electric power transmission, control, and distribution	22112	162.2	4.9	2.1	1.4	.8	2.8
Natural gas distribution	2212	106.4	4.7	2.9	1.6	1.3	1.8
Water, sewage and other systems	2213	47.4	5.7	3.2	2.1	1.0	2.5
Water supply and irrigation systems	22131	37.4	6.0	3.3	2.2	1.2	2.7
Sewage treatment facilities	22132	8.2	4.6	2.8	2.3	.5	1.7
Steam and air-conditioning supply	22133	1.8	3.9	1.3	1.2	–	2.6
Information		3,001.3	2.0	1.1	.7	.4	1.0
Information	51	3,001.3	2.0	1.1	.7	.4	1.0
Publishing industries (except Internet)	511	908.4	1.8	.9	.6	.3	.9

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Newspaper, periodical, book, and directory publishers	5111	659.5	2.4	1.3	0.8	0.5	1.1
Newspaper publishers	51111	358.4	3.4	1.9	1.2	.7	1.5
Periodical publishers	51112	146.4	1.2	.4	.3	.2	.8
Book publishers	51113	81.0	1.0	.4	.3	.2	.6
Directory and mailing list publishers	51114	46.3	1.5	.8	.6	.2	.8
Other publishers	51119	27.4	2.5	1.3	.6	.7	1.2
Software publishers	5112	248.9	.4	.2	.1	.1	.3
Motion picture and sound recording industries	512	399.7	2.7	.8	.6	.2	1.9
Motion picture and video industries	5121	377.4	2.8	.9	.6	.3	1.9
Motion picture and video exhibition	51213	137.0	5.5	1.2	.8	.4	4.3
Postproduction services and other motion picture and video industries	51219	19.6	1.0	.5	.2	.3	.5
Sound recording industries	5122	22.2	1.8	.3	.2	–	–
Broadcasting (except Internet)	515	330.3	2.4	1.4	.7	.6	1.1
Radio and television broadcasting	5151	239.9	1.8	.7	.6	.2	1.1
Radio broadcasting	51511	112.6	.9	.3	.2	–	.7
Television broadcasting	51512	127.3	2.5	1.1	.8	.3	1.4
Cable and other subscription programming	5152	90.4	4.0	2.8	1.1	1.7	1.1
Telecommunications	517	914.0	2.5	1.5	1.0	.5	.9
Wired telecommunications carriers	5171	444.1	2.2	1.4	1.2	.3	.8
Wireless telecommunications carriers (except satellite)	5172	191.9	1.0	.4	.3	.1	.5
Telecommunications resellers	5173	–	1.4	.8	.5	.2	.7
Satellite telecommunications	5174	13.4	3.7	2.7	.7	2.0	1.0
Cable and other program distribution	5175	–	6.3	3.9	1.8	2.1	2.4
Internet service providers, web search portals, and data processing services	518	355.6	.9	.4	.3	.1	.5
Internet service providers and web search portals	5181	–	.3	.2	.1	([10])	.1
Data processing, hosting, and related services	5182	271.0	1.1	.5	.4	.2	.6
Other information services	519	53.6	1.2	.6	.5	.1	.6
Other information services	5191	53.6	1.2	.6	.5	.1	.6
Libraries and archives	51912	29.2	1.3	.8	.7	–	.4
Financial activities		8,260.8	1.4	.7	.5	.2	.8
Finance and insurance	52	6,092.5	.9	.4	.3	.1	.6
Monetary authorities - central bank	521	21.5	1.1	.7	.3	.4	.4
Credit intermediation and related activities	522	2,951.9	1.0	.4	.3	.1	.6
Depository credit intermediation	5221	1,835.4	1.3	.5	.4	.1	.8
Commercial banking	52211	1,355.1	1.2	.4	.4	.1	.8
Savings institutions	52212	232.6	–	.5	.5	–	.9

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Credit unions	52213	226.8	1.7	0.7	0.5	0.2	1.0
Nondepository credit intermediation	5222	769.4	.6	.3	.2	.1	.4
Credit card issuing	52221	113.7	.7	.2	.2	([10])	.4
Sales financing	52222	109.4	.7	.2	.1	.1	.4
Other nondepository credit intermediation	52229	546.2	.6	.3	.2	([10])	.3
Activities related to credit intermediation	5223	347.1	.6	.2	.2	.1	.3
Financial transactions processing, reserve, and clearinghouse activities	52232	104.7	1.0	.4	.3	.1	.6
Other activities related to credit intermediation	52239	99.9	.7	.4	–	.1	.3
Securities, commodity contracts, and other financial investments and related activities	523	843.3	.3	.1	.1	([10])	.2
Securities and commodity contracts intermediation and brokerage	5231	506.5	.3	.1	([10])	([10])	.2
Investment banking and securities dealing	52311	177.1	.2	([10])	([10])	–	.2
Securities brokerage	52312	304.5	.2	.1	([10])	([10])	.2
Portfolio management	52392	127.3	.2	.1	.1	([10])	.1
Investment advice	52393	130.0	.1	([10])	([10])	–	.1
All other financial investment activities	52399	45.8	.8	.4	.3	–	.4
Insurance carriers and related activities	524	2,178.4	1.1	.4	.3	.1	.7
Insurance carriers	5241	1,267.8	1.3	.5	.4	.1	.9
Direct life, health, and medical insurance carriers	52411	648.8	1.3	.4	.2	.1	.9
Direct insurance (except life, health, and medical) carriers	52412	591.1	1.4	.6	.5	.1	.9
Agencies, brokerages, and other insurance related activities	5242	910.6	.8	.4	.3	.1	.4
Insurance agencies and brokerages	52421	678.5	.6	.3	.2	.1	.3
Other insurance related activities	52429	232.1	1.3	.7	.6	.1	.6
Funds, trusts, and other financial vehicles	525	97.3	1.1	.5	.4	.2	.6
Insurance and employee benefit funds	5251	49.0	1.2	.6	.5	–	.6
Other insurance funds	52519	20.0	1.6	.9	–	–	.8
Other investment pools and funds	5259	48.4	1.0	.4	.2	.2	.6
Open-end investment funds	52591	23.7	.5	.3	.1	.1	.2
Real estate and rental and leasing	53	2,168.4	2.9	1.6	1.0	.5	1.4
Real estate	531	1,495.1	2.7	1.4	1.0	.4	1.3
Lessors of real estate	5311	564.8	3.3	1.7	1.2	.5	1.6
Lessors of residential buildings and dwellings	53111	350.7	4.2	2.2	1.6	.6	–
Lessors of nonresidential buildings (except miniwarehouses)	53112	139.7	1.7	.5	.4	.1	1.2
Lessors of miniwarehouses and self-storage units	53113	38.7	2.2	1.8	.8	1.0	.3
Lessors of other real estate property	53119	35.7	2.1	1.3	.6	.7	.8
Offices of real estate agents and brokers	5312	391.8	1.4	.8	.4	–	.6
Activities related to real estate	5313	538.5	3.0	1.5	1.2	.4	1.5
Real estate property managers	53131	451.9	3.5	1.8	1.4	.4	1.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Rental and leasing services	532	645.5	3.5	1.9	1.1	0.8	1.6
Automotive equipment rental and leasing	5321	197.8	4.5	2.1	1.3	.7	2.4
Passenger car rental and leasing	53211	138.2	3.4	1.8	1.2	.5	1.6
Consumer goods rental	5322	266.3	2.6	1.6	1.1	.6	1.0
Consumer electronics and appliances rental	53221	30.5	4.0	2.9	1.8	1.1	1.1
Video tape and disc rental	53223	124.5	1.1	.4	.3	–	.8
Other consumer goods rental	53229	97.7	3.6	2.4	1.5	.9	1.2
General rental centers	5323	56.1	5.2	3.7	1.8	2.0	1.5
Commercial and industrial machinery and equipment rental and leasing	5324	125.3	2.8	1.4	.8	.6	1.4
Construction, transportation, mining, and forestry machinery and equipment rental and leasing	53241	68.2	2.9	1.4	.8	.6	1.5
Other commercial and industrial machinery and equipment rental and leasing	53249	46.3	3.0	1.7	.8	.9	1.3
Lessors of nonfinancial intangible assets (except copyrighted works)	533	27.8	1.0	.7	.6	.1	.3
Professional and business services		17,977.8	2.1	1.0	.6	.4	1.1
Professional, scientific, and technical services	54	7,670.7	1.3	.5	.3	.2	.8
Professional, scientific, and technical services	541	7,670.7	1.3	.5	.3	.2	.8
Legal services	5411	1,196.3	.6	.3	.3	([10])	.3
Accounting, tax preparation, bookkeeping, and payroll services	5412	936.8	.8	.3	–	.1	.6
Accounting, tax preparation, bookkeeping, and payroll services	54121	936.8	.8	.3	–	.1	.6
Offices of certified public accountants	541211	418.2	.1	([10])	([10])	–	.1
Other accounting services	541219	248.0	–	.5	.4	.1	1.1
Architectural, engineering, and related services	5413	1,427.9	1.4	.7	.4	.3	.7
Architectural services	54131	213.8	.3	.1	([10])	–	.2
Landscape architectural services	54132	44.9	2.5	2.3	2.0	–	–
Engineering services	54133	902.6	1.4	.7	.4	.3	.7
Testing laboratories	54138	150.1	1.2	.6	.3	.3	.7
Specialized design services	5414	145.7	1.9	.5	.2	–	–
Computer systems design and related services	5415	1,347.8	.5	.1	.1	.1	.3
Computer systems design and related services	54151	1,347.8	.5	.1	.1	.1	.3
Custom computer programming services	541511	583.6	.5	.1	([10])	.1	.4
Computer systems design services	541512	603.2	.4	.1	.1	([10])	.3
Computer facilities management services	541513	56.9	.9	.3	.2	.1	.6
Other computer related services	541519	104.0	.6	.3	.2	([10])	.3
Management, scientific, and technical consulting services	5416	983.0	1.0	.3	.2	–	–
Management consulting services	54161	773.8	–	.2	.1	.1	–
Environmental consulting services	54162	77.6	1.8	1.2	.4	–	.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Other scientific and technical consulting services	54169	131.6	1.7	0.2	0.2	–	–
Scientific research and development services	5417	585.3	1.8	.5	.3	0.2	–
Advertising and related services	5418	470.4	–	.4	.2	.2	–
Other professional, scientific, and technical services	5419	577.6	4.9	1.5	1.0	.5	3.4
Marketing research and public opinion polling	54191	115.3	1.0	.3	.2	–	.7
Photographic services	54192	86.5	1.0	.3	.2	.1	.7
Veterinary services	54194	287.6	8.7	2.6	1.7	.9	6.1
All other professional, scientific, and technical services	54199	74.3	1.6	.8	.5	.3	.7
Management of companies and enterprises	55	1,853.2	1.9	.9	.5	.4	1.0
Administrative and support and waste management and remediation services	56	8,453.9	3.3	1.8	1.2	.6	1.5
Administrative and support services	561	8,098.8	3.1	1.7	1.1	.5	1.5
Facilities support services	5612	124.2	6.2	2.6	1.9	.6	3.6
Employment services	5613	3,592.5	2.3	1.0	.7	.3	1.3
Employment placement agencies	56131	278.1	–	.3	.3	([10])	–
Temporary help services	56132	2,617.5	2.5	1.2	.8	.4	1.3
Employee leasing services	56133	696.9	2.5	1.1	.7	.4	1.3
Business support services	5614	809.3	1.2	.6	.3	.2	.7
Document preparation services	56141	45.8	.4	–	–	–	.3
Telephone call centers	56142	401.3	1.2	.5	.4	.1	.7
Business service centers	56143	95.4	1.5	.8	.4	.4	.7
Collection agencies	56144	155.5	.8	.4	.3	.1	.4
Credit bureaus	56145	24.9	–	1.8	–	–	2.3
Other business support services	56149	86.5	1.4	.6	.4	.2	.8
Travel arrangement and reservation services	5615	229.0	1.0	.4	.2	.2	.6
Travel agencies	56151	107.5	.7	.1	([10])	.1	.6
Tour operators	56152	30.5	.6	.3	.3	–	.3
Other travel arrangement and reservation services	56159	91.1	1.4	.8	.4	.4	.6
Investigation and security services	5616	801.1	2.4	1.3	1.0	.3	1.1
Investigation, guard, and armored car services	56161	686.9	2.3	1.3	1.0	.3	1.1
Investigation services	561611	44.7	1.2	.6	.4	–	.6
Security guards and patrol services	561612	607.8	2.2	1.2	.9	.3	1.0
Armored car services	561613	34.4	5.4	2.7	1.7	.9	2.8
Security systems services	56162	114.3	2.7	1.3	1.1	.1	1.5
Services to buildings and dwellings	5617	1,847.4	5.0	2.8	2.0	.8	2.2
Exterminating and pest control services	56171	99.0	5.2	2.7	1.9	.8	2.4
Janitorial services	56172	942.5	4.1	2.4	1.7	.7	1.7
Landscaping services	56173	680.4	5.9	3.3	2.2	1.1	2.6

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Carpet and upholstery cleaning services	56174	46.7	4.8	2.8	2.1	0.7	2.0
Other services to buildings and dwellings	56179	78.7	–	2.5	2.1	.4	–
Other support services	5619	307.2	3.7	2.3	1.4	.9	1.5
Waste management and remediation services	562	355.1	6.4	4.1	2.4	1.7	2.3
Waste collection	5621	136.6	7.5	4.9	3.0	1.9	2.5
Waste collection	56211	136.6	7.5	4.9	3.0	1.9	2.5
Solid waste collection	562111	115.3	7.7	5.1	3.1	2.0	2.6
Hazardous waste collection	562112	8.7	5.0	2.5	1.9	.6	2.5
Other waste collection	562119	12.6	6.4	4.1	3.3	.8	2.2
Waste treatment and disposal	5622	102.1	6.7	4.3	2.2	2.1	2.3
Waste treatment and disposal	56221	102.1	6.7	4.3	2.2	2.1	2.3
Solid waste landfill	562212	45.3	7.2	4.7	2.7	2.1	2.4
Solid waste combustors and incinerators	562213	4.5	5.1	3.1	1.5	1.6	2.0
Other nonhazardous waste treatment and disposal	562219	15.7	7.1	4.3	2.5	1.7	2.9
Remediation and other waste management services	5629	116.4	4.7	2.9	1.8	1.0	1.9
Remediation services	56291	70.7	4.8	2.6	1.8	.8	2.3
All other waste management services	56299	34.8	3.9	2.9	1.7	1.2	1.0
Education and health services		17,368.6	5.2	2.4	1.3	1.0	2.9
Educational services	61	2,291.8	2.4	1.0	.7	.3	1.5
Educational services	611	2,291.8	2.4	1.0	.7	.3	1.5
Elementary and secondary schools	6111	634.7	2.9	1.3	.8	.4	1.7
Junior colleges	6112	44.5	2.5	.7	.5	.1	1.8
Colleges, universities, and professional schools	6113	1,062.2	2.6	1.0	.7	.3	1.5
Business schools and computer and management training	6114	76.1	1.2	.6	–	–	.6
Business and secretarial schools	61141	13.2	.8	.3	.2	–	.4
Professional and management development training	61143	44.9	.8	.3	.2	–	.5
Technical and trade schools	6115	111.1	1.8	.7	.4	.3	1.1
Other schools and instruction	6116	276.9	1.5	.4	.3	–	1.1
Fine arts schools	61161	65.7	.4	.3	.3	–	–
Sports and recreation instruction	61162	71.1	1.4	.7	.4	–	.8
All other schools and instruction	61169	125.2	2.1	.4	.3	.1	1.7
Health care and social assistance	62	15,076.9	5.6	2.5	1.4	1.1	3.1
Ambulatory health care services	621	5,454.7	3.0	1.0	.6	.3	2.0
Offices of physicians	6211	2,205.8	2.1	.4	.3	.1	1.6
Offices of physicians	62111	2,205.8	2.1	.4	.3	.1	1.6
Offices of physicians (except mental health specialists)	621111	2,160.7	2.1	.4	.3	.1	1.7
Offices of physicians, mental health specialists	621112	45.1	2.2	1.4	1.2	.2	.8

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Offices of dentists	6212	804.7	2.4	0.2	0.2	0.1	2.1
Offices of other health practitioners	6213	598.5	1.1	.5	.3	.2	.5
Outpatient care centers	6214	511.2	4.6	1.2	.9	.4	3.4
Medical and diagnostic laboratories	6215	212.1	3.1	1.0	.6	.4	2.1
Home health care services	6216	896.8	4.3	2.3	1.5	.7	2.1
Other ambulatory health care services	6219	225.7	10.0	4.6	2.6	1.9	5.4
Ambulance services	62191	135.0	11.8	5.3	3.4	2.0	6.4
All other ambulatory health care services	62199	90.7	7.5	3.4	1.6	1.9	4.0
Hospitals	622	4,442.1	7.7	3.0	1.7	1.3	4.6
General medical and surgical hospitals	6221	4,178.9	7.7	3.0	1.7	1.3	4.7
Psychiatric and substance abuse hospitals	6222	95.6	8.5	3.9	2.0	1.8	4.6
Specialty (except psychiatric and substance abuse) hospitals	6223	167.6	6.6	3.6	2.3	1.3	3.1
Nursing and residential care facilities	623	2,920.2	8.8	5.2	2.6	2.6	3.5
Nursing care facilities	6231	1,586.9	9.7	6.2	3.0	3.2	3.5
Residential mental retardation, mental health and substance abuse facilities	6232	519.4	7.6	3.8	2.1	1.7	3.8
Community care facilities for the elderly	6233	649.8	8.0	4.7	2.5	2.3	3.3
Other residential care facilities	6239	164.2	7.0	3.1	2.0	1.1	3.9
Social assistance	624	2,259.9	3.9	1.9	1.3	.6	2.0
Individual and family services	6241	1,035.6	4.3	2.1	1.5	.6	2.2
Child and youth services	62411	163.5	4.5	2.5	1.4	1.1	2.0
Services for the elderly and persons with disabilities	62412	526.3	4.7	2.3	1.7	.5	2.4
Other individual and family services	62419	345.9	3.7	1.6	1.2	.4	2.0
Community food and housing, and emergency and other relief services	6242	132.9	3.3	1.7	1.2	.5	1.6
Community food services	62421	27.0	3.4	2.4	1.0	–	1.0
Community housing services	62422	79.2	3.5	1.7	1.3	.4	1.8
Emergency and other relief services	62423	26.8	2.5	1.0	1.0	–	1.5
Vocational rehabilitation services	6243	311.8	6.7	3.4	1.8	1.7	3.3
Child day care services	6244	779.4	2.3	1.1	.8	.3	1.2
Leisure and hospitality		13,586.8	4.5	1.7	1.1	.6	2.8
Arts, entertainment, and recreation	71	2,076.0	5.3	2.5	1.4	1.1	2.8
Performing arts, spectator sports, and related industries	711	411.6	6.8	3.1	1.8	1.4	3.7
Performing arts companies	7111	116.7	7.5	2.7	2.0	.7	4.8
Spectator sports	7112	133.9	10.3	5.7	2.7	3.1	4.5
Spectator sports	71121	133.9	10.3	5.7	2.7	3.1	4.5
Sports teams and clubs	711211	64.9	16.2	10.0	3.8	6.2	6.1
Racetracks	711212	44.3	6.9	3.0	2.5	.5	4.0
Other spectator sports	711219	24.7	4.6	2.0	1.0	–	2.5

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Promoters of performing arts, sports, and similar events	7113	87.1	6.0	1.9	1.4	0.5	4.1
Agents and managers for artists, athletes, entertainers, and other public figures	7114	19.9	.8	.6	.4	.2	.2
Independent artists, writers, and performers	7115	54.0	1.0	.4	.3	–	.6
Museums, historical sites, and similar institutions	712	124.9	4.8	2.0	1.1	.9	2.8
Amusement, gambling, and recreation industries	713	1,539.5	5.0	2.3	1.3	1.1	2.6
Amusement parks and arcades	7131	158.3	7.5	4.6	1.2	3.4	2.9
Amusement and theme parks	71311	139.7	8.1	5.0	1.3	3.7	3.0
Gambling industries	7132	263.3	5.3	2.4	1.3	1.1	2.9
Other amusement and recreation industries	7139	1,118.0	4.4	1.9	1.3	.6	2.5
Golf courses and country clubs	71391	347.5	5.3	2.1	1.5	.7	3.1
Skiing facilities	71392	33.5	16.5	8.3	3.8	4.5	8.2
Marinas	71393	33.1	6.0	2.5	2.2	.3	3.4
Fitness and recreational sports centers	71394	497.1	2.7	1.3	.8	.4	1.4
Bowling centers	71395	76.8	2.1	1.0	.7	.2	1.1
All other amusement and recreation industries	71399	130.0	5.2	2.2	1.6	.6	3.0
Accommodation and food services	72	11,510.8	4.4	1.6	1.0	.6	2.8
Accommodation	721	1,907.5	5.6	2.9	1.4	1.5	2.6
Traveler accommodation	7211	1,842.5	5.6	3.0	1.4	1.5	2.6
Hotels (except casino hotels) and motels	72111	1,491.0	5.7	3.1	1.5	1.6	2.6
Casino hotels	72112	324.2	5.3	2.6	1.1	1.4	2.7
Other traveler accommodation	72119	27.3	2.0	1.3	1.2	–	.7
RV (recreational vehicle) parks and recreational camps	7212	54.3	5.2	2.0	1.3	.7	3.2
RV (recreational vehicle) parks and recreational camps	72121	54.3	5.2	2.0	1.3	.7	3.2
Recreational and vacation camps (except campgrounds)	721214	28.0	5.5	1.6	1.0	.6	3.9
Rooming and boarding houses	7213	10.7	4.1	1.0	.9	–	3.1
Food services and drinking places	722	9,603.3	4.1	1.3	.9	.3	2.9
Full-service restaurants	7221	4,565.7	3.6	1.0	.7	.3	2.5
Limited-service eating places	7222	4,130.3	4.5	1.4	1.0	.4	3.1
Limited-service eating places	72221	4,130.3	4.5	1.4	1.0	.4	3.1
Limited-service restaurants	722211	3,504.1	4.5	1.4	1.0	.4	3.1
Cafeterias	722212	141.0	6.8	2.1	.9	1.2	4.7
Snack and nonalcoholic beverage bars	722213	485.3	3.5	1.2	1.1	.1	2.3
Special food services	7223	548.7	7.4	2.5	1.6	.8	4.9
Drinking places (alcoholic beverages)	7224	358.6	1.9	.6	.5	.1	1.3
Other services		4,571.7	3.1	1.5	1.0	.5	1.7
Other services, except public administration	81	4,571.7	3.1	1.5	1.0	.5	1.7

See footnotes at end of table.

TABLE 1. **Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007** — Continued

Industry[2]	NAICS code[3]	2007 Annual average employment[4] (thousands)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Repair and maintenance	811	1,270.9	3.9	1.8	1.4	0.5	2.0
Automotive repair and maintenance	8111	899.4	4.0	1.8	1.3	.5	2.2
Electronic and precision equipment repair and maintenance	8112	106.2	1.7	1.2	.8	.4	.6
Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance	8113	186.5	4.5	2.5	2.0	.5	2.0
Personal and household goods repair and maintenance	8114	78.7	–	1.9	1.4	.5	–
Personal and laundry services	812	1,320.2	2.6	1.3	.8	.5	1.2
Personal care services	8121	609.5	1.1	.4	.3	([10])	–
Death care services	8122	135.9	2.1	1.0	.9	.1	1.1
Drycleaning and laundry services	8123	344.7	4.4	2.8	1.3	1.5	1.6
Drycleaning and laundry services (except coin-operated)	81232	176.8	1.9	1.2	.9	.3	.7
Linen and uniform supply	81233	130.9	7.9	5.0	1.9	3.1	2.9
Linen supply	812331	75.2	8.0	5.3	2.1	3.2	2.7
Industrial launderers	812332	55.6	7.8	4.6	1.6	3.0	3.2
Other personal services	8129	230.1	3.1	1.4	1.0	.4	1.8
Pet care (except veterinary) services	81291	52.3	–	2.5	1.5	–	–
Photofinishing	81292	23.9	3.5	2.4	1.4	1.0	1.1
Parking lots and garages	81293	111.0	–	1.1	.9	.2	–
All other personal services	81299	42.8	.6	.4	.3	.1	.2
Religious, grantmaking, civic, professional, and similar organizations	813	1,336.2	2.8	1.2	.8	.4	1.6

[1] The incidence rates represent the number of injuries and illnesses per 100 full-time workers and were calculated as: (N/EH) x 200,000, where

N = number of injuries and illnesses
EH = total hours worked by all employees during the calendar year
200,000 = base for 100 equivalent full-time workers (working 40 hours per week, 50 weeks per year)

[2] Totals include data for industries not shown separately.
[3] *North American Industry Classification System* — United States, 2002
[4] Employment is expressed as an annual average and is derived primarily from the BLS-Quarterly Census of Employment and Wages (QCEW) program.
[5] Days-away-from-work cases include those that resulted in days away from work, some of which also included job transfer or restriction.
[6] Excludes farms with fewer than 11 employees.
[7] Data for Mining (Sector 21 in the *North American Industry Classification System*-- United States, 2002) include establishments not governed by the Mine Safety and Health Administration rules and reporting, such as those in Oil and Gas Extraction and related support activities. Data for mining operators in coal, metal, and nonmetal mining are provided to BLS by the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded from the coal, metal, and nonmetal mining industries. These data do not reflect the changes the Occupational Safety and Health Administration made to its recordkeeping requirements effective January 1, 2002; therefore, estimates for these industries are not comparable to estimates in other industries.
[8] Data for mining operators in this industry are provided to BLS by the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded. These data do not reflect the changes the Occupational Safety and Health Administration made to its recordkeeping requirements effective January 1, 2002; therefore, estimates for these industries are not comparable to estimates in other industries.
[9] Data for employers in railroad transportation are provided to BLS by the Federal Railroad Administration, U.S. Department of Transportation.
[10] Data too small to be displayed.

NOTE: Because of rounding, components may not add to totals. Dash indicates data do not meet publication guidelines.
SOURCE: Bureau of Labor Statistics, U.S. Department of Labor
October 2008

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Private industry[6]		8,408.5	3.4	1.9	0.9	1.0	1.5
Goods producing[6]		1,799.6	4.0	2.4	1.0	1.4	1.6
Natural resources and mining[6,7]		237.4	2.7	1.8	1.2	0.5	1.0
Agriculture, forestry, fishing and hunting[6]	11	43.4	5.3	3.2	2.2	1.0	2.1
Crop production[6]	111	12.9	5.2	3.3	2.3	1.0	1.9
Fruit and tree nut farming[6]	1113	0.6	9.6	9.6	9.6	([10])	([10])
Greenhouse, nursery, and floriculture production[6]	1114	8.8	6.9	4.1	2.5	1.6	2.8
Animal production[6]	112	13.8	6.5	3.6	1.8	1.8	3.0
Cotton ginning	115111	3.2	6.0	3.5	3.5	([10])	2.4
Crop harvesting, primarily by machine	115113	0.4	([10])	([10])	([10])	([10])	--
Postharvest crop activities (except cotton ginning)	115114	4.2	8.7	5.9	5.4	0.4	2.8
Mining[7]	21	194.0	2.2	1.5	1.1	0.4	0.8
Mining (except oil and gas)[8]	212	10.0	2.3	1.5	0.8	0.8	0.7
Support activities for mining	213	110.6	2.6	1.6	1.0	0.6	1.0
Support activities for mining	2131	110.6	2.6	1.6	1.0	0.6	1.0
Support activities for mining	21311	110.6	2.6	1.6	1.0	0.6	1.0
Support activities for oil and gas operations	213112	73.1	2.2	1.4	0.9	0.5	0.8
Construction		631.8	3.8	2.2	1.0	1.2	1.6
Construction	23	631.8	3.8	2.2	1.0	1.2	1.6
Construction of buildings	236	153.3	2.0	1.0	0.4	0.6	1.0
Residential building construction	2361	50.1	1.3	0.5	0.3	0.2	0.8
Nonresidential building construction	2362	103.2	2.3	1.2	0.5	0.7	1.1
Heavy and civil engineering construction	237	122.1	3.5	2.3	1.1	1.2	1.3
Utility system construction	2371	64.9	3.4	2.1	1.2	1.0	1.3
Highway, street, and bridge construction	2373	34.2	4.1	2.9	1.1	1.8	1.3

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Specialty trade contractors	238	356.4	4.8	2.8	1.2	1.6	2.0
Foundation, structure, and building exterior contractors	2381	78.6	5.2	3.8	1.0	--	1.3
Poured concrete foundation and structure contractors	23811	25.2	3.3	2.5	0.7	1.8	0.8
Structural steel and precast concrete contractors	23812	8.5	4.2	2.6	1.5	1.1	1.6
Framing contractors	23813	3.5	4.0	2.6	2.4	--	--
Masonry contractors	23814	14.9	5.3	2.6	1.8	0.8	2.7
Roofing contractors	23816	11.9	4.1	2.4	1.1	1.3	1.6
Siding contractors	23817	1.4	4.4	3.3	1.2	2.1	([10])
Building equipment contractors	2382	155.4	5.3	2.6	1.4	1.2	2.7
Electrical contractors	23821	73.7	4.2	2.1	1.2	0.9	2.1
Plumbing, heating, and air-conditioning contractors	23822	72.8	6.7	3.2	1.6	1.6	3.5
Other building equipment contractors	23829	8.8	2.7	1.6	0.7	0.9	1.1
Building finishing contractors	2383	64.0	4.4	2.3	0.9	1.4	2.1
Drywall and insulation contractors	23831	26.6	3.6	2.6	1.0	1.6	1.0
Painting and wall covering contractors	23832	15.6	6.8	2.1	--	1.6	4.7
Flooring contractors	23833	4.4	4.5	1.9	1.4	0.5	2.6
Tile and terrazzo contractors	23834	4.3	2.7	1.8	1.2	0.6	0.9
Finish carpentry contractors	23835	8.1	3.4	2.2	0.8	1.5	1.1
Other building finishing contractors	23839	5.0	3.7	2.4	1.7	0.6	1.3
Other specialty trade contractors	2389	58.5	3.4	2.4	1.3	1.2	0.9
Manufacturing		930.4	4.4	2.7	1.0	1.7	1.7
Manufacturing	31-33	930.4	4.4	2.7	1.0	1.7	1.7
Food manufacturing	311	90.1	6.5	4.6	1.3	3.3	1.9
Animal food manufacturing	3111	2.6	4.0	3.2	2.7	([10])	0.8
Grain and oilseed milling	3112	2.9	5.2	3.2	1.4	1.8	2.0
Sugar and confectionery product manufacturing	3113	3.4	7.7	5.0	1.6	3.4	2.7
Fruit and vegetable preserving and specialty food manufacturing	3114	7.1	4.4	3.1	1.2	1.9	1.3
Dairy product manufacturing	3115	6.1	6.0	3.4	1.4	2.1	2.6
Animal slaughtering and processing	3116	38.8	8.6	6.3	1.1	5.1	2.4
Animal slaughtering and processing	31161	38.8	8.6	6.3	1.1	5.1	2.4
Animal (except poultry) slaughtering	311611	15.1	14.1	10.7	1.6	9.0	3.4
Meat processed from carcasses	311612	8.1	5.3	3.4	1.1	2.3	1.8
Rendering and meat byproduct processing	311613	0.8	7.7	5.3	2.7	2.5	2.4

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Poultry processing	311615	14.8	5.6	3.9	0.7	3.2	1.8
Seafood product preparation and packaging	3117	1.4	4.7	2.9	1.7	1.1	1.8
Bakeries and tortilla manufacturing	3118	16.0	4.6	3.7	1.2	2.6	0.9
Bread and bakery product manufacturing	31181	11.1	4.9	4.0	1.2	2.8	0.9
Tortilla manufacturing	31183	3.7	3.7	3.1	1.4	1.7	0.6
Other food manufacturing	3119	11.9	4.0	2.7	1.5	1.2	1.2
Beverage and tobacco product manufacturing	312	11.3	6.6	5.1	1.8	3.3	1.4
Soft drink manufacturing	312111	6.8	8.7	6.8	2.2	4.6	1.8
Textile mills	313	3.1	4.3	1.5	([10])	1.1	2.8
Textile product mills	314	7.8	4.6	2.1	0.9	1.1	2.6
Apparel manufacturing	315	7.1	2.5	1.5	0.6	0.9	1.0
Apparel accessories and other apparel manufacturing	3159	2.0	6.0	3.3	--	2.0	2.7
Leather and allied product manufacturing	316	4.5	4.3	2.4	0.8	1.6	1.9
Leather and hide tanning and finishing	3161	0.6	6.2	5.7	([10])	3.3	([10])
Footwear manufacturing	3162	2.8	4.1	2.2	0.7	1.5	2.0
Wood product manufacturing	321	27.8	7.1	4.4	1.5	2.9	2.8
Sawmills and wood preservation	3211	4.2	4.2	3.2	1.6	1.5	1.1
Veneer, plywood, and engineered wood product manufacturing	3212	6.1	3.3	2.2	1.0	1.2	1.1
Other wood product manufacturing	3219	17.5	9.3	5.5	1.6	3.9	3.9
Millwork	32191	7.4	5.7	3.3	1.5	1.7	2.4
Paper manufacturing	322	20.3	3.3	1.7	0.8	0.9	1.6
Pulp, paper, and paperboard mills	3221	3.4	2.2	1.2	0.6	0.5	1.0
Converted paper product manufacturing	3222	16.9	3.6	1.9	0.8	1.0	1.7
Paperboard container manufacturing	32221	9.3	3.4	1.5	0.7	0.8	1.9
Printing and related support activities	323	34.8	3.4	3.1	1.0	2.1	0.4
Printing	32311	32.8	3.4	3.0	0.9	2.1	0.4
Chemical manufacturing	325	73.6	1.9	1.1	0.5	0.7	0.8
Basic chemical manufacturing	3251	32.2	0.8	0.4	0.1	0.2	0.4
Resin, synthetic rubber, and artificial and synthetic fibers and filaments manufacturing	3252	10.1	1.6	1.0	0.4	0.5	0.7
Pesticide, fertilizer, and other agricultural chemical manufacturing	3253	3.2	1.4	0.6	([10])	([10])	0.8
Pharmaceutical and medicine manufacturing	3254	9.8	2.7	1.8	0.5	1.2	0.9
Other chemical product and preparation manufacturing	3259	8.0	4.6	2.5	0.9	1.6	2.0
Plastics and rubber products manufacturing	326	45.3	5.4	3.8	1.3	2.5	1.6
Plastics product manufacturing	3261	40.3	5.2	3.7	1.3	2.4	1.5
Rubber product manufacturing	3262	5.0	6.8	4.5	1.4	3.1	2.3

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Nonmetallic mineral product manufacturing	327	44.7	4.6	2.8	1.1	1.7	1.8
Clay product and refractory manufacturing	3271	6.9	4.9	3.1	0.8	2.3	1.8
Glass and glass product manufacturing	3272	4.9	4.5	2.7	0.7	2.0	1.8
Cement and concrete product manufacturing	3273	23.7	4.4	2.6	1.2	1.4	1.8
Other nonmetallic mineral product manufacturing	3279	7.5	5.4	4.0	1.4	2.6	1.4
Primary metal manufacturing	331	26.2	7.2	4.3	1.5	2.8	2.9
Iron and steel mills and ferroalloy manufacturing	3311	6.1	5.4	3.0	1.1	2.0	2.4
Steel product manufacturing from purchased steel	3312	3.0	8.7	6.3	2.6	3.7	2.4
Alumina and aluminum production and processing	3313	6.7	5.6	3.6	1.1	2.5	2.0
Nonferrous metal (except aluminum) production and processing	3314	3.0	6.5	3.6	2.1	1.5	2.9
Foundries	3315	7.5	9.6	5.4	1.6	3.8	4.2
Fabricated metal product manufacturing	332	128.4	5.7	3.2	1.3	1.9	2.5
Forging and stamping	3321	4.8	6.9	4.7	1.8	2.9	2.2
Cutlery and handtool manufacturing	3322	1.8	2.8	1.0	0.8	([10])	1.8
Architectural and structural metals manufacturing	3323	47.9	7.5	4.2	1.3	2.9	3.3
Boiler, tank, and shipping container manufacturing	3324	9.1	5.4	2.4	0.9	1.5	3.0
Spring and wire product manufacturing	3326	4.4	3.8	2.6	1.3	1.3	1.2
Machine shops; turned product; and screw, nut, and bolt manufacturing	3327	23.1	6.1	2.6	1.6	1.0	3.5
Coating, engraving, heat treating, and allied activities	3328	10.2	6.2	4.0	2.1	1.9	2.2
Other fabricated metal product manufacturing	3329	25.8	2.6	1.9	0.8	1.1	0.7
Machinery manufacturing	333	91.5	4.0	2.0	0.8	1.2	2.0
Agriculture, construction, and mining machinery manufacturing	3331	43.3	3.5	1.7	0.7	1.0	1.9
Agricultural implement manufacturing	33311	3.0	7.7	4.3	1.1	3.2	3.4
Construction machinery manufacturing	33312	3.2	4.3	1.1	0.5	0.6	3.2
Mining and oil and gas field machinery manufacturing	33313	37.2	3.2	1.6	0.7	0.9	1.6
Commercial and service industry machinery manufacturing	3333	2.9	2.8	1.6	0.6	0.9	1.2
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	3334	14.7	4.7	2.5	0.7	1.7	2.2
Metalworking machinery manufacturing	3335	4.2	3.8	2.4	1.7	0.7	1.3
Other general purpose machinery manufacturing	3339	16.1	5.7	3.2	1.4	1.9	2.4
Computer and electronic product manufacturing	334	109.8	1.4	0.7	0.3	0.4	0.8
Computer and peripheral equipment manufacturing	3341	19.7	0.3	0.2	0.1	([10])	0.1
Audio and video equipment manufacturing	3343	0.6	([10])	([10])	([10])	([10])	([10])
Semiconductor and other electronic component manufacturing	3344	51.9	1.2	0.5	0.3	0.2	0.7
Navigational, measuring, electromedical, and control instruments manufacturing	3345	21.9	2.3	1.2	0.5	0.7	1.1
Manufacturing and reproducing magnetic and optical media	3346	1.6	([10])	([10])	([10])	([10])	([10])

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Electrical equipment, appliance, and component manufacturing	335	19.1	4.7	2.4	0.7	1.7	2.3
Electric lighting equipment manufacturing	3351	2.4	4.7	2.5	0.8	1.7	2.2
Household appliance manufacturing	3352	2.0	6.2	2.5	1.2	1.3	3.7
Electrical equipment manufacturing	3353	7.8	3.4	2.1	0.7	1.4	1.3
Other electrical equipment and component manufacturing	3359	6.9	5.8	2.7	0.4	2.3	3.1
Transportation equipment manufacturing	336	95.8	5.0	3.0	1.2	1.8	1.9
Motor vehicle manufacturing	3361	9.1	7.9	6.0	1.7	4.3	2.0
Motor vehicle body and trailer manufacturing	3362	9.7	10.1	4.3	1.7	2.7	5.8
Motor vehicle parts manufacturing	3363	17.0	6.5	4.2	1.5	2.7	2.3
Aerospace product and parts manufacturing	3364	48.3	2.8	1.6	0.8	0.8	1.2
Furniture and related product manufacturing	337	32.7	5.4	3.4	1.3	2.1	2.0
Household and institutional furniture and kitchen cabinet manufacturing	3371	22.6	5.6	3.2	1.0	2.2	2.3
Other furniture related product manufacturing	3379	4.7	4.5	3.1	1.0	2.0	1.4
Miscellaneous manufacturing	339	32.4	3.6	2.2	0.8	1.4	1.4
Medical equipment and supplies manufacturing	3391	12.6	3.8	2.0	0.8	1.2	1.8
Other miscellaneous manufacturing	3399	19.8	3.4	2.3	0.8	1.5	1.1
Service providing		6,608.9	3.3	1.7	0.9	0.8	1.5
Trade, transportation, and utilities[9]		2,074.0	4.2	2.7	1.3	1.3	1.6
Wholesale trade	42	511.2	3.2	2.0	0.8	1.2	1.2
Merchant wholesalers, durable goods	423	294.7	2.6	1.4	0.7	0.8	1.2
Motor vehicle and motor vehicle parts and supplies merchant wholesalers	4231	24.7	3.4	2.2	1.2	1.0	1.2
Furniture and home furnishing merchant wholesalers	4232	9.1	2.1	1.2	--	--	0.9
Lumber and other construction materials merchant wholesalers	4233	21.6	4.9	3.3	0.8	2.5	1.6
Metal and mineral (except petroleum) merchant wholesalers	4235	15.4	5.4	3.6	1.6	2.0	1.8
Electrical goods merchant wholesalers	4236	32.6	2.4	1.4	0.6	0.8	0.9
Hardware, and plumbing and heating equipment and supplies merchant wholesalers	4237	23.3	2.3	1.3	0.7	0.7	1.0
Machinery, equipment, and supplies merchant wholesalers	4238	73.6	2.9	1.1	0.6	0.5	1.8
Miscellaneous durable goods merchant wholesalers	4239	23.3	2.8	1.7	0.7	1.0	1.1
Merchant wholesalers, nondurable goods	424	159.3	4.9	3.3	1.4	2.0	1.5
Paper and paper product merchant wholesalers	4241	10.2	2.2	1.5	0.6	0.9	0.8
Grocery and related product merchant wholesalers	4244	54.5	8.0	6.1	2.2	3.9	1.9
Chemical and allied products merchant wholesalers	4246	16.4	0.9	0.6	0.4	--	--

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Petroleum and petroleum products merchant wholesalers	4247	13.8	2.5	1.1	0.7	0.4	1.4
Beer, wine, and distilled alcoholic beverage merchant wholesalers	4248	14.6	7.6	5.2	1.6	3.6	2.5
Miscellaneous nondurable goods merchant wholesalers	4249	21.6	3.5	2.3	1.7	0.7	1.2
Wholesale electronic markets and agents and brokers	425	57.2	1.3	1.1	0.4	0.7	0.2
Retail trade	44-45	1,152.9	4.3	2.5	1.1	1.4	1.8
Motor vehicle and parts dealers	441	155.7	3.1	1.2	0.7	0.6	1.9
Automobile dealers	4411	100.7	2.6	1.0	0.6	0.4	1.6
Automotive parts, accessories, and tire stores	4413	43.3	4.8	2.2	1.0	1.2	--
Furniture and home furnishings stores	442	45.5	5.0	3.7	1.7	--	1.2
Electronics and appliance stores	443	46.9	2.3	1.7	--	0.6	0.6
Building material and garden equipment and supplies dealers	444	93.6	6.1	4.0	1.7	2.2	2.1
Food and beverage stores	445	194.7	6.0	4.0	1.1	2.9	2.0
Grocery stores	4451	172.8	6.7	4.4	1.2	3.2	2.3
Supermarkets and other grocery (except convenience) stores	44511	160.3	7.1	4.6	1.2	3.5	2.5
Convenience stores	44512	12.5	2.3	1.7	1.4	--	0.6
Health and personal care stores	446	60.4	2.4	0.8	0.3	0.4	1.6
Gasoline stations	447	67.8	2.3	1.1	0.6	0.4	1.2
Clothing and clothing accessories stores	448	116.9	2.5	1.3	--	0.4	1.2
Sporting goods, hobby, book, and music stores	451	36.6	3.8	1.2	0.7	0.5	2.7
General merchandise stores	452	255.3	5.3	3.3	1.3	1.9	2.0
Department stores	4521	108.3	3.7	2.1	1.0	1.1	1.6
Other general merchandise stores	4529	146.9	6.3	4.1	1.6	2.6	2.2
Miscellaneous store retailers	453	59.3	3.2	2.3	1.4	0.9	0.9
Nonstore retailers	454	20.2	6.0	3.0	1.8	1.2	3.0
Transportation and warehousing[9]	48-49	364.9	5.8	4.0	2.7	1.3	1.8
Air transportation	481	63.8	10.5	8.5	7.3	1.2	2.0
Rail transportation[9]	482	--	2.1	1.6	1.5	0.2	0.5
Truck transportation	484	117.3	4.9	2.8	2.1	0.7	2.1
General freight trucking	4841	81.2	4.4	2.8	2.0	0.7	1.7
General freight trucking, long-distance	48412	66.2	4.5	2.7	1.9	0.8	1.8
Specialized freight trucking	4842	36.0	6.0	3.0	2.4	0.6	3.0
Used household and office goods moving	48421	9.8	4.3	2.6	1.8	0.8	1.7

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Specialized freight (except used goods) trucking, long-distance	48423	11.2	8.9	4.4	3.5	--	4.5
Transit and ground passenger transportation	485	16.5	5.7	3.7	2.8	0.9	1.9
Support activities for transportation	488	67.3	3.9	2.6	2.0	0.7	1.2
Couriers and messengers	492	37.8	10.2	6.4	3.1	3.3	3.8
Warehousing and storage	493	43.0	7.4	5.9	1.8	4.1	1.5
Warehousing and storage	4931	43.0	7.4	5.9	1.8	4.1	1.5
General warehousing and storage	49311	35.2	7.5	6.1	1.6	4.4	1.4
Refrigerated warehousing and storage	49312	3.3	10.4	8.0	4.2	3.8	2.3
Utilities	22	45.0	3.0	1.5	1.0	0.5	1.6
Utilities	221	45.0	3.0	1.5	1.0	0.5	1.6
Electric power generation, transmission and distribution	2211	32.3	3.1	1.3	0.9	0.4	1.8
Water, sewage and other systems	2213	5.6	2.8	2.1	1.6	0.5	0.7
Information		222.5	1.7	1.1	0.6	0.6	0.6
Information	51	222.5	1.7	1.1	0.6	0.6	0.6
Publishing industries (except Internet)	511	49.0	1.6	1.0	0.5	0.5	0.6
Newspaper, periodical, book, and directory publishers	5111	32.1	2.3	1.3	0.5	0.8	1.0
Broadcasting (except Internet)	515	27.8	3.5	1.8	1.0	0.7	1.8
Internet service providers, web search portals, and data processing services	518	35.6	0.4	0.2	0.1	0.1	0.2
Other information services	519	2.5	([10])	([10])	([10])	([10])	([10])
Financial activities		633.0	1.4	0.7	0.4	0.2	0.8
Finance and insurance	52	451.0	0.9	0.3	0.3	0.1	0.5
Monetary authorities - central bank	521	1.9	1.4	1.1	([10])	([10])	([10])
Credit intermediation and related activities	522	244.5	1.0	0.4	0.3	0.1	0.7
Securities, commodity contracts, and other financial investments and related activities	523	45.1	0.2	([10])	([10])	([10])	--
Insurance carriers and related activities	524	149.4	0.8	0.4	0.3	0.1	0.5
Funds, trusts, and other financial vehicles	525	10.1	0.3	0.3	([10])	--	([10])
Real estate and rental and leasing	53	182.0	2.9	1.5	0.9	0.7	1.4

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Real estate	531	118.3	2.8	1.5	1.0	0.5	1.4
Rental and leasing services	532	61.5	3.2	1.7	0.8	1.0	1.4
Professional and business services		1,282.9	1.8	0.9	0.5	0.3	0.9
Professional, scientific, and technical services	54	551.1	1.2	0.3	0.2	0.1	0.9
Professional, scientific, and technical services	541	551.1	1.2	0.3	0.2	0.1	0.9
Computer systems design and related services	5415	88.1	0.7	([10])	([10])	([10])	0.6
Other professional, scientific, and technical services	5419	41.7	3.9	1.1	0.7	--	2.8
Management of companies and enterprises	55	64.2	1.2	0.8	0.3	0.4	0.5
Administrative and support and waste management and remediation services	56	667.6	2.6	1.6	1.0	0.6	1.0
Administrative and support services	561	642.5	2.6	1.5	0.9	0.6	1.0
Facilities support services	5612	11.9	3.3	1.4	1.1	--	1.9
Investigation and security services	5616	60.6	2.2	1.1	0.7	0.4	1.1
Services to buildings and dwellings	5617	127.5	3.9	2.6	1.7	0.9	1.2
Exterminating and pest control services	56171	7.2	2.4	0.4	([10])	--	2.0
Janitorial services	56172	64.7	3.1	2.7	1.9	--	0.3
Landscaping services	56173	43.6	4.9	2.8	1.7	1.1	2.1
Carpet and upholstery cleaning services	56174	3.7	7.3	5.3	3.6	--	--
Waste management and remediation services	562	25.0	3.4	2.4	1.5	0.9	1.0
Education and health services		1,140.9	3.9	1.8	0.9	0.9	2.1
Educational services	61	102.0	1.5	0.7	0.4	0.2	0.9
Health care and social assistance	62	1,038.9	4.1	1.9	0.9	1.0	2.2
Ambulatory health care services	621	494.4	2.0	0.9	0.4	--	1.1
Hospitals	622	267.0	6.7	2.5	1.4	1.1	4.2
Nursing and residential care facilities	623	153.2	6.5	3.5	1.5	2.0	3.0
Social assistance	624	124.3	3.5	2.0	0.8	1.2	1.5
Leisure and hospitality		970.1	4.3	1.8	0.9	1.0	2.5

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Arts, entertainment, and recreation	71	106.1	3.8	2.0	0.9	1.1	1.8
Accommodation and food services	72	864.0	4.3	1.8	0.9	0.9	2.5
Accommodation	721	99.4	4.8	2.2	0.7	1.4	2.6
Traveler accommodation	7211	95.6	4.8	2.2	0.8	1.5	2.6
Hotels (except casino hotels) and motels	72111	94.5	4.8	2.3	0.8	1.5	2.6
Food services and drinking places	722	764.5	4.3	1.7	0.9	0.9	2.5
Other services		285.4	2.1	1.2	1.0	0.1	0.9
Other services, except public administration	81	285.4	2.1	1.2	1.0	0.1	0.9

See footnotes at end of table.

Table 6. Incidence rates[1] of nonfatal occupational injuries and illnesses by industry and case types, 2007 -- Continued

Texas

Industry[2]	NAICS code[3]	2007 Average annual employment[4] (000's)	Total recordable cases	Cases with days away from work, job transfer, or restriction			Other recordable cases
				Total	Cases with days away from work[5]	Cases with job transfer or restriction	
Repair and maintenance	811	106.4	2.2	1.5	1.4	0.1	--
Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance	8113	19.8	1.1	0.7	0.5	0.3	0.3

[1] Incidence rates represent the number of injuries and illnesses per 100 full-time workers and were calculated as: (N/EH) x 200,000 where

N = number of injuries and illnesses
EH = total hours worked by all employees during the calendar year
200,000 = base for 100 equivalent full-time workers (working 40 hours per week, 50 weeks per year).

[2] Totals include data for industries not shown separately.

[3] *North American Industry Classification System* 2002 Edition

[4] Employment is expressed as an annual average and is derived primarily from the BLS-State Quarterly Census of Employment and Wages.

[5] Days-away-from-work cases include those that result in days away from work with or without job transfer or restriction.

[6] Excludes farms with fewer than 11 employees.

[7] Data for mining (Sector 21 in the *North American Industry Classification System* -- United States, 2002) include establishments not governed by the Mine Safety and Health Administration (MSHA) rules and reporting, such as those in oil and gas extraction and related support activities. Data for mining operators in coal, metal, and nonmetal mining are provided to BLS by the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded from the coal, metal, and nonmetal mining industries. These data do not reflect the changes the Occupational Safety and Health Administration made to its recordkeeping requirements effective January 1, 2002; therefore estimates for these industries are not comparable to estimates in other industries.

[8] Data for mining operators in this industry are provided to BLS by the Mine Safety and Health Administration, U.S. Department of Labor. Independent mining contractors are excluded. These data do not reflect the changes the Occupational Safety and Health Administration made to its recordkeeping requirements effective January 1, 2002; therefore estimates for these industries are not comparable to estimates in other industries.

[9] Data for employers in rail transportation are provided to BLS by the Federal Railroad Administration, U.S. Department of Transportation.

[10] Data too small to be displayed.

NOTE: Because of rounding, components may not add to totals. Dash indicates data do not meet publication guidelines.

SOURCE: Bureau of Labor Statistics, U.S. Department of Labor, Survey of Occupational Injuries and Illnesses, in cooperation with participating State agencies.

Galveston District Projects

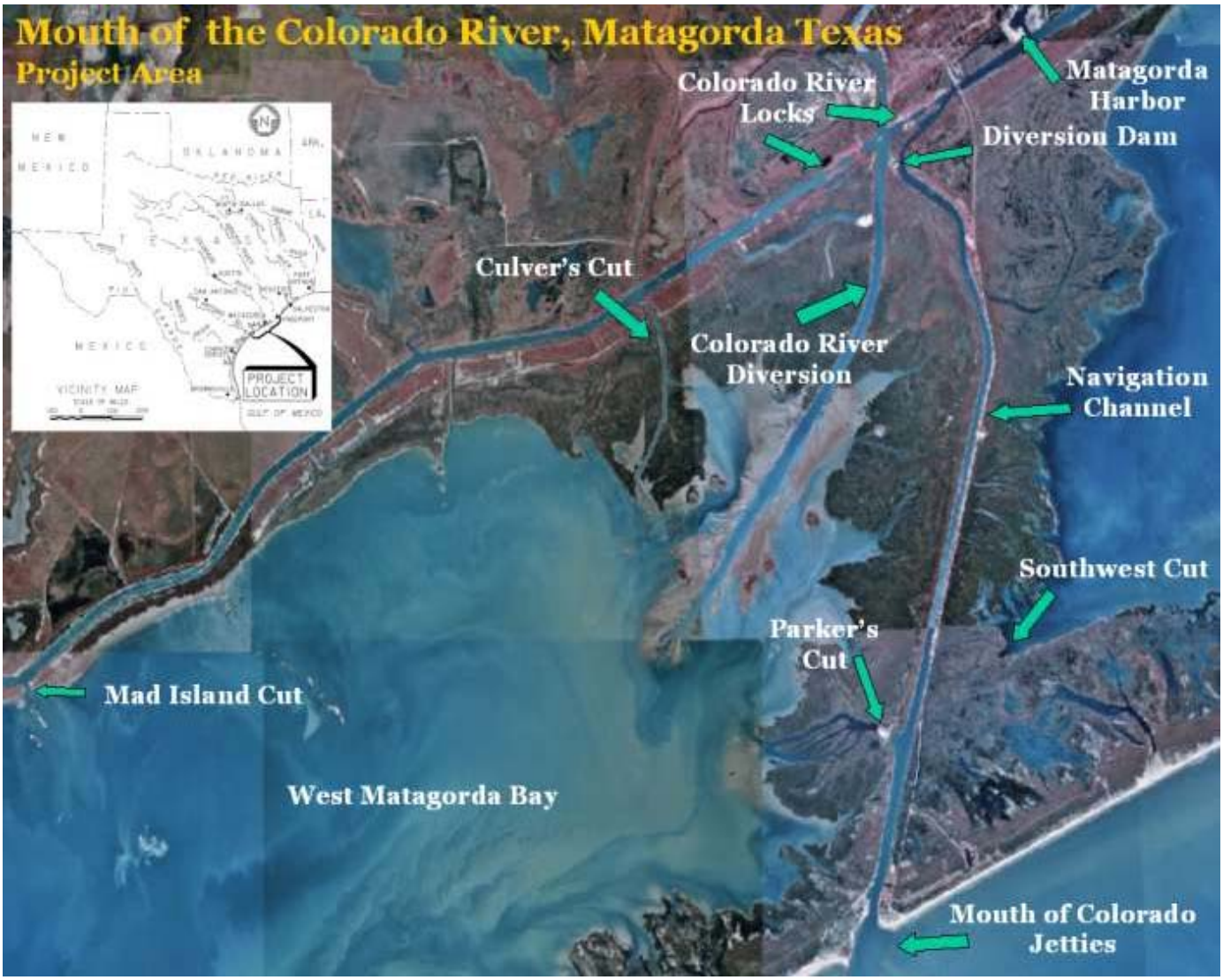
Mouth of the Colorado River

- Main Page
  - Mouth of Colorado River
    - Background
    - Issues
    - Limited Reevaluation Study Status
- GIWW Mods - Colorado River Locks
- Modeling Efforts
- What are our plans

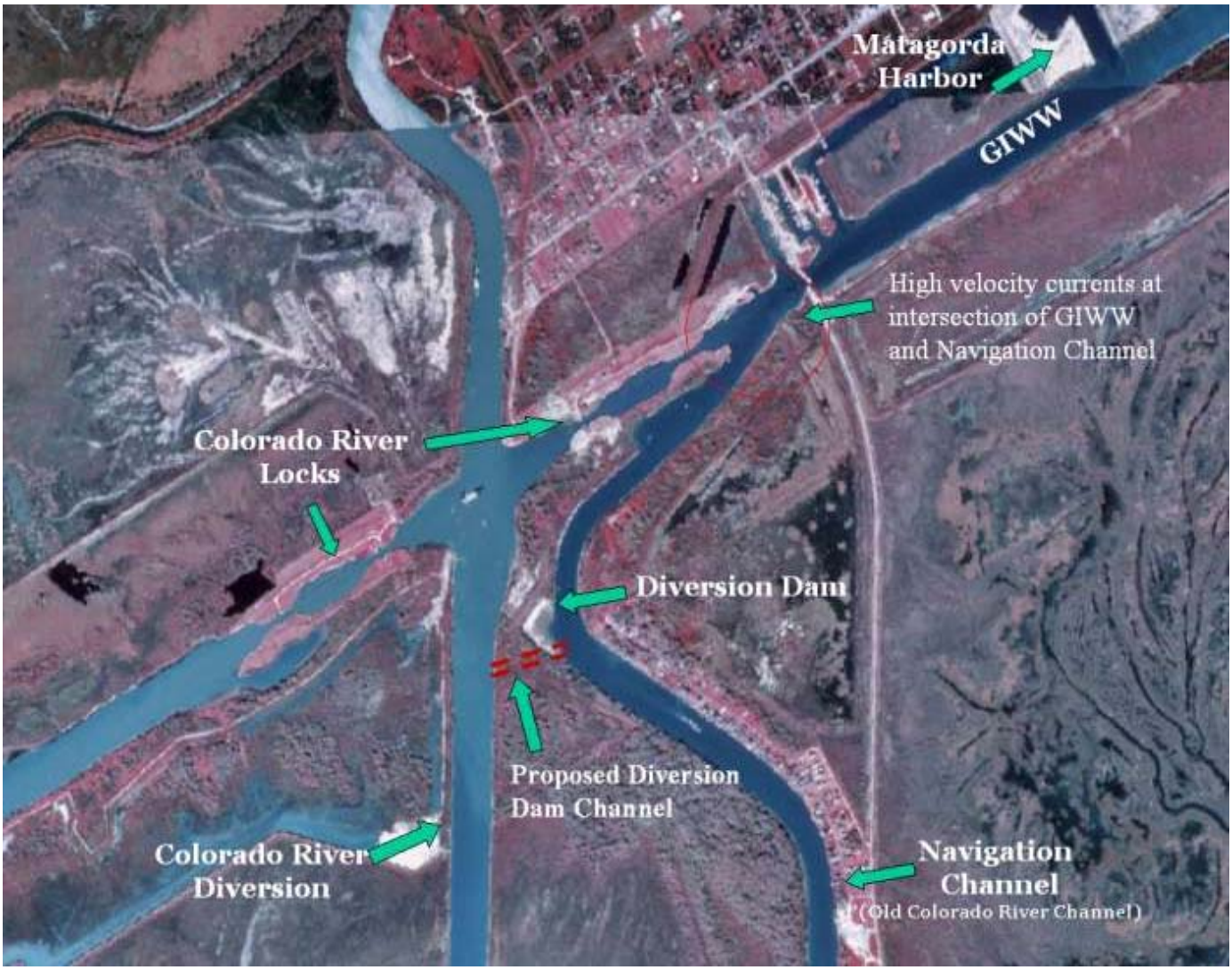
Project Name: Mouth of Colorado River, Texas

Location: Texas, Matagorda County, Colorado River below the Gulf Intracoastal Waterway

Description: The project was authorized by Section 101 of the River and harbor Act of 1968 as described in Senate Document No. 102, 90th Congress, 2nd Session. The project consists of navigation improvements with related recreational facilities and diversion of Colorado River flows into Matagorda Bay. Navigation features consist of a 6.5 mile navigation channel, 12 feet deep and 100 feet wide, an entrance channel 15 feet deep and 200 feet wide with jetties to protect the entrance in the Gulf, a harbor and turning basin adjacent to the Gulf Intracoastal Waterway, and two recreation areas. Diversion features consist of a 3.1 mile long channel 20 feet deep and 250 feet wide to divert the flow of the Colorado River into Matagorda Bay, a diversion dam and navigation connecting channel, closing of Parker's Cut, and creation of an oyster cultch in Matagorda Bay.


Mouth of the Colorado River, Matagorda Texas
Project Area
Colorado River Locks
Matagorda Harbor
Diversion Dam
Culver's Cut
Colorado River Diversion
Navigation Channel
Southwest Cut
Parker's Cut
Mad Island Cut
West Matagorda Bay
Mouth of Colorado Jetties
NEW MEXICO
OKLAHOMA
MEXICO
VICINITY MAP
PROJECT LOCATION
GULF OF MEXICO

Southwest Cut
Parker's
Cut



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Galveston District Projects

Mouth of the Colorado River

- Main Page
  - Mouth of Colorado River
    - Background
    - Issues
    - Limited Reevaluation Study Status
- GIWW Mods - Colorado River Locks
- Modeling Efforts
- What are our plans

Background

The project was authorized by Section 101 of the River and Harbor Act of 1968 as described in Senate Document No. 102, 90th Congress, 2nd Session. The project is located in Matagorda County, Texas.

The Mouth of the Colorado River project includes navigation features with related recreation facilities and diversion of Colorado River flows into Matagorda Bay. The navigation features consist of a harbor and turning basin at Matagorda, a navigation channel extending from the harbor to the Gulf, jetties and entrance channel, and recreational facilities adjacent to the east jetty. Features associated with the diversion of the Colorado River are the diversion channel itself, the diversion dam across the river, the dam across Parker's Cut, the connecting channel which joins the GIWW east of the East Lock with the navigation channel just south of the diversion dam, and an oyster cultch in Matagorda Bay.

During the post authorization phase of the project, a significant issue concerning the diversion feature of the project surfaced. The project's local sponsor, the Port of Bay City Authority, expressed opposition to the river diversion on the grounds that deposition of river sediments and debris would adversely affect the adjacent West Matagorda Bay fishery, and it withdrew sponsorship of the diversion features of the project. The U. S. Fish and Wildlife Service, with full support of the Texas Parks and Wildlife Department and the National Marine Fisheries Service, declared that introducing freshwater and sediment would create an estuary and thereby enhance the commercial fishery of Matagorda Bay.

With these opposing views, several years of interagency conflict followed. This involved the Washington level of the Corps of Engineers and resource agencies, the local interests, and members of Congress. Attempts were made to resolve issues associated with the diversion feature on the project to the satisfaction of all interested parties. A compromise was negotiated by the Director of Civil Works which allowed the project to proceed. However, when funds to initiate construction were appropriated in Fiscal Year 1979, the resource agencies and their constituents expressed their fears to the Congress that construction of the diversion feature might be delayed indefinitely. To protect

the resource agencies' position, Senator Lloyd Bentsen introduced legislation that required the diversion channel to be dredged at the same time that dredging of the navigation channel was accomplished.

Other legislation was introduced to relieve the local sponsor of the cost-sharing burden of the diversion. As a consequence, the 1986 Water Resources Development Act, Section 812, recognized the project's commercial fisheries enhancement benefits and modified the cost-sharing to provide construction of the diversion features at Federal expense, thus exempting the local sponsor of this financial burden. Construction of the last project feature was completed in March 1995.

The Mouth of the Colorado River project diverted all flows of the Colorado River from the Gulf of Mexico into Matagorda Bay. Parkers Cut was closed as a part of the diversion feature of the Mouth of Colorado project. The purpose of the diversion is to restore, to the extent possible, the nutrient rich water and sediments of the river to Matagorda Bay, as had been the case prior to the 1920s. The diversion was done with the full concurrence and encouragement of all Federal and state fish and wildlife resource agencies, the Environmental Protection Agency, Gulf of Mexico Fishery Management Council, and many private environmental organizations.

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Galveston District Projects

Mouth of the Colorado River

- Main Page
  - Mouth of Colorado River
    - Background
    - Issues
    - Limited Reevaluation Study Status
- GIWW Mods - Colorado River Locks
- Modeling Efforts
- What are our plans

Issues

Previous to project construction, access into Matagorda Bay was available through either Parker's Cut via the Colorado River, near the Gulf, or Culver Cut via the GIWW just west of the Colorado River. Although the diversion channel was never intended or represented as a functional navigation channel during project planning, it did provide access to the bay for recreational fisherman and small shrimp boats for several months after initial construction. Then the delta formation process began with the first river flood after diversion.

Since completion of the weir jetty and impoundment basin, the channel and sediment basin are requiring significantly more dredging than was estimated during the design of the improvements. The net annual rate of littoral drift at the mouth of the Colorado River is southerly and estimated to be about 300,000 cubic yards. The impoundment basin's design capacity is 600,000 cubic yards, providing an anticipated maintenance dredging cycle of once every two years. Even so, rapid shoaling problems in the navigation channel adjacent to the impoundment basin persist. Attempts to slightly adjust the basin to overcome this problem have not been successful. The project was studied by the Coastal Engineering Research Center (CERC) of the U. S. Army Corps of Engineers Waterways Experiment Station in Vicksburg, Mississippi as part of their Monitoring Completed Coastal Project Program. The CERC study was published in January 1998.

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Galveston District Projects

Mouth of the Colorado River

- Main Page
  - Mouth of Colorado River
    - Background
    - Issues
    - Limited Reevaluation Study Status
- GIWW Mods - Colorado River Locks
- Modeling Efforts
- What are our plans

The purpose of the Mouth of the Colorado River Limited Reevaluation Study is to 1) address hazardous navigation conditions at the intersection of the Gulf Intracoastal Waterway (GIWW) and the Navigation Channel caused by tidal currents and recreational boater traffic, 2) investigate measures to reduce shoaling at the Mouth of the Colorado River Jetties, and 3) investigate a permanent solution to erosion problems at the Southwest Point of the intersection of the Colorado River and the GIWW. These issues will be addressed individually in interim reports in order to seek implementation of recommended changes in a timely manner.

Preliminary Screening

In 2001 State and Federal agencies and stakeholders met to develop measures that could address issues that had arisen since the diversion of the Colorado River. In particular the high currents that occur at the intersection of the GIWW and Navigation Channel and poor water quality in the Navigation Channel. Previous studies by the US Army Corp of Engineer Research and Development Center (ERDC) had indicated that there was a potential to reduce peak currents at the intersection by as much as 25%. Galveston District commissioned a comprehensive modeling study by ERDC to evaluate the effects of opening the proposed Southwest Cut, Parker's Cut, the Diversion Dam Channel, or a combination of openings on the currents at the intersection and the effects the opening(s) would have on salinity, currents, and sedimentation. Supplemental model runs were made with the Diversion Dam Channel width increased from 20 ft to 50 ft, which would allow recreational boater access. A gate structure at the Diversion Dam was a recommendation made by ERDC to offset a slight increase in sedimentation in the Navigation Channel and to prohibit traffic during high flow events on the river. Further consideration of maintenance and operation of the structure led the team to decide it was not an acceptable alternative. Based on the model results 5 alternatives were identified for preliminary screening.

1) Sd - Diversion Dam 4x50 ft
2) Sm - Parker's Cut 4x350ft
3) Sn - SW Cut 5x200ft
4) Si - SW Cut 5x200ft and Parker's Cut 4x350ft
5) Sj - SW Cut 5x200ft and Diversion Dam 4x50ft

Preliminary costs and benefits were developed for the remaining 5 alternatives. Costs and benefits were for a screening level effort, which did not include maintenance costs that would require modeling to develop. At the same time environmental impacts of each of the alternatives were undergoing evaluation by both the Corps and State and Federal agencies. Environmental impacts were based on the ERDC model results. It was anticipated that this preliminary level of screening would allow several alternatives to be dropped from further consideration because model results indicated only a slight reduction in peak currents at the GIWW.

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Updated: December 09, 2005 December 09, 2005

Galveston District Projects

Colorado River Locks

- Main Page
  - Mouth of Colorado River
  - GIWW Mods - Colorado River Locks
  - Modeling Efforts
  - What are our plans

The Colorado River Locks were authorized by the River and harbor Act of 21 January 1927. Originally constructed as floodgates on each side of the Colorado River, construction was completed in September 1943. The floodgates were converted to locks in April 1954. A pair of steel sector gates located at each end encloses a 1,200-foot long lock chamber. The locks provide a horizontal clearance of 75 feet, and the sill elevation is -15 feet mean low tide. The 75-foot gated thruway is too narrow to accommodate the new modern wider barges posing a major safety threat. The crossing was designed when barges were carried astern on a towline rather than the current practice of pushing a string of barges, making navigation of the crossing more difficult. Many tows have to "trip" or break down and moor their barges while taking one barge across at a time, causing delays, particularly during high river stages.

In addition, the barge industry has expressed their belief that completion of the diversion feature of the Mouth of Colorado River project, including the closure of Parker's Cut and the opening of the bypass channel has created hazardous navigation conditions. Specifically they have complained of strong currents at the bypass channel intersection with the Gulf Intracoastal Waterway (GIWW) and a changed current pattern at the Colorado River crossing, the currents in the river have shifted more toward the west lock entrance.

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Galveston District Projects

Modeling Efforts

- Main Page
  - Mouth of Colorado River
  - GIWW Mods - Colorado River Locks
  - Modeling Efforts
    - ERDC
    - Modeling Efforts Table
  - What are our plans

Diversion Features

April 1990 modeling and simulation

April 1990 - District commissioned a modeling and simulation study by WES (Bypass Channel) - This investigation was conducted to develop hydrodynamic conditions (water levels and velocities) for use in a tow-simulation study of the influence of the Mouth of Colorado River, Texas, Project on the GIWW. Emphasis was placed upon the proposed intersection of the bypass channel at the GIWW.

Technical Report HL-92-11- Hydrodynamics at Mouth of Colorado River, Texas, Project. Numerical modeling of hydrodynamic conditions for Mouth of Colorado to determine water levels, velocities of flow, and wind stress. Results ere verified by actual field measurements during a 25-hour period in may 1990. Two preferred designs of the connecting channel were evaluated with a 27-day dynamic simulation of measured tides for the period 2 through 28 June 1990.

A tow simulation was performed using the information generated by the numerical modeling. The simulation involved one, two, and four barge tows at varying cross currents velocities generated by tidal flow. TWOA provided tow operators familiar with the GIWW and the Colorado River intersection. TWOA was satisfied with the simulation. Technical Report CHL 97-6 - Navigation Simulation Study, Mouth of the Colorado River, Matagorda, Texas, March 1997.

> The purpose of the study was to determine three things;
> 1. If the diversion of the river flows into the channel to Matagorda Bay will have a negative impact on tows crossing the Colorado River between the locks.
> 2. Tidal flows that may cause navigation problems for GIWW traffic in the vicinity of the navigation bypass channel.
> 3. At what frequency critical flow condition will occur and to develop operating procedures to minimize the impacts of these critical flows.

The simulation determined that single barge tows were not affected by the crosscurrents. Low tide flows did not have an affect on navigation, only high tidal flows. The flow velocities were isolated and determined that only flows exceeding 1.4 feet per second affected multiple barge tows. Using the numerical model it was determined that flow velocities exceeded 1.4 fps only 15% of the time.

Conclusions of the simulation were that only tows of more than one barge would be affected by cross currents exceeding 1.4 fps, which would occur 15% of the time.

Recommendations included further study be conducted to design a fender system for the area between the lock and Route 2031 bridge at the junction of the bypass. A physical model was suggested. Monitoring velocity gages should be installed in both the Colorado river upstream of the GIWW intersection and the bypass channel.

1992 Gage installed to monitor currents at bypass channel
1999 A gage was installed at the Colorado River Locks to monitor currents.

Physical Model Study

1997-2000 Colorado River Locks Physical Model Study - The purpose of this study was to identify possible solutions to user concerns for changed current conditions at the Colorado River Locks and the bypass channel since completion of the Mouth of Colorado River project. At the request of the Galveston District, navigation studies were proposed to:

a. Examine alternatives for improvement of navigation conditions in the Colorado/GIWW intersection.

b. Examine alternatives for improvement of navigation conditions between the swing bridge, bypass channel, and east lock.

The area modeled includes both lock areas and a short portion upstream and downstream from the crossing. The area extended eastward some distance beyond the swing bridge. The physical model was not constructed to evaluate impacts of opening parker's Cut or the proposed southwest cut. The study was initiated in 1997. The base model was completed in March 1998, with alternative testing completed in July 1999. The draft report was completed in October1999. Alternatives modeled were as follows:

1. Deflector dike upstream of the crossing in the Colorado River.
2. Deepening the crossing (dredging)
3. Restoration of the southwest point
4. Restriction of the bypass channel
5. Evaluation with flow through the west lock
6. Dredging of the southwest and southeast corners
7. Bypass channel rerouting
8. Removal of the south gate of the eastern gates of the west lock
9. Removal of both east gates of the west lock

Most plans showed very little to modest improvements, removal of the east gates of the west lock showed considerable improvement.

Colorado River Southwest Point Corner Stabilization

Colorado River Southwest Point Corner Stabilization (Oct 1999- Jan 2000) - WES letter report. The objective of this study is to develop alternatives to prevent erosion of the southwest corner of the intersection of the GIWW and the Colorado River. The protection alternatives must also be suitable for westbound tows to land against if they are unable to cross the Colorado River. This study is not intended to solve the navigation problem which was addressed in the physical model study. Alternatives evaluated as follows:

a. Periodically rebuild point with dredged material
b. Protect point with stable material that tows can land on.
c. Provide landing structure at southwest point so any protection can be used.
d. Solve navigation problem so any protection can be used.

Recommended alternative is placing dredged material on the southwest point should be considered before any structural alternatives like sandbag dikes or fenders.

Comprehensive Study

2001 proposed comprehensive WES study to evaluate the effects of opening the proposed southwest

cut, Parker's Cut, a small opening in the diversion dam, or some combination of openings on currents in the GIWW at the bypass channel and the effects the opening will have on salinity, currents, and sedimentation. The study is currently underway with a draft report scheduled for completion in December 2002.

Parker's Cut

1995 Request

Local Officials of Port of Bay City Authority and Matagorda County request to be allowed to open Parker's Cut. (1995-1996) To pursue consideration of additional access into Matagorda Bay, a meeting was held in October 1995 with local officials. During the meeting it was acknowledged that a model of a new opening would be necessary to determine its impacts on the salinity regime of the bay. A cost proposal was developed for three alternative levels of effort ranging from $218,000 to $608,000. The study costs were to be borne by non-Federal sponsoring entity. No action was taken to implement the studies.

LCRA Study

September 2000 - Lower Colorado River Authority (Parsons Engineering Science, Inc.) study of Matagorda Bay/Parkers Cut. Jointly funded by LCRA and Matagorda Bay Foundation. This study report was dated 12 September, 2000. The study consisted of modifying the LCRA TxBLEND model of Matagorda Bay to investigate the potential effects of re-opening Parker's Cut on the salinity regime of West Matagorda Bay. Parsons was contracted to perform the model revisions and simulate the re-opening of Parker's Cut wit both the target and critical flows runs from the original Matagorda Bay model. The model was originally developed in 1997. A 4 -foot deep channel was assumed through the cut. The model was run for two conditions, one, the water level the LCRA would like to provide, two, drought conditions. LCRA stated that a more comprehensive model would probably be needed for further consideration.

Southwest Cut

(1995 - 1996) Hydraulic feasibility of Proposed Southwest Cut, East Matagorda Bay, Texas - This study was commissioned by the Texas Department of Transportation at the request of County of Matagorda, Texas. The objective was to determine the hydraulic feasibility of a proposed water exchange cut in the southwest corner of East Matagorda Bay that would connect the bay to the Gulf of Mexico via the Colorado River Navigation channel. This study was authorized under joint sponsorship of TXDOT and the Texas Parks and Wildlife Department. Field monitoring and hydrodynamic modeling were conducted to assess the hydraulic feasibility of the southwest cut proposed to be opened in East Matagorda Bay, Texas, for increasing water exchange. The overall objective of the study was to determine if a clear reason exists based on the physical processes that might preclude construction of the cut. Sustained monitoring was conducted over a period of three months (Oct 95, to Jan 96) and included synchronized measurements of the water level and current at the eastern and western ends of the bay, wind measurement at the eastern end of the bay, and salinity and other common water-quality parameters at four location in the bay. A depth -integrated numerical simulation model consisting of 8,000 active cells was applied to compute the water level change and horizontal current velocity in East Matagorda Bay, the Gulf Intracoastal Waterway, Mitchell's Cut, the southern end of Caney Creek, the Colorado River Navigation channel, and the proposed southwest cut. The model included wind forcing and Gulf tidal forcing, and calibration was accomplished for a month-long period using measured water level at the eastern and western ends of the bay and at a gauge in the navigation channel, as well as the current measures at both ends of the bay.

The following is a summary of conclusions and recommendations obtained in this assessment:
1. The sw cut will remain open unless artificially closed. The flow in the cut will be ebb dominated because of a bias introduced by the wind, and the flow speed will regularly reach 2to 3 fps if design dimensions are maintained.

2. Scour in the wetland area adjacent to the channel of the cut is not expected to occur.

3. Opening of the cut the navigation channel will create only a small cross current in the channel if the design dimensions of he curt are maintained.

4. The cut will decrease the peak flow speed and discharge at the intersection of the GIWW ad the navigation channel by 25 percent. The decrease will be greater if the cut scours beyond its design dimensions.

Weir Jetty / Diversion

Monitor Completed Projects

(1990-1994) Report published in January 1998. The Monitoring Completed Coastal Projects (MCCP) program was established in 1981 by Headquarters, USACE to evaluate the performance of the Corps in planning, design, construction, and operation and maintenance of selected civil works coastal projects. The Colorado River project was nominated for inclusion in the MCCP by the Galveston District in 1984. It was approved for monitoring in FY90 because it met both genetic and site-specific selection criteria. The monitoring effort was conducted by CERC and private contractors in cooperation with Galveston District. The main objectives of the MCCP Monitoring program at the Colorado River project were as follows:

a. Evaluate the design and efficiency of the weir jetty and adjacent impoundment basin so that project maintenance requirements and costs could be more accurately established.

b. Develop and improve equations for computing longshore sediment transport in the vicinity of Colorado River, Texas.

c. Determine what sediment transport equations work best in the surf zone.

d. Collect data to aid in efforts to improve future designs of similar COE projects.

Conclusions reached that the principal management problem is caused by the inadequate size of the impoundment basin and its inefficiency in retaining sediments. Possible alternatives are, to enlarge the basin, extend the basin landward, or deepen the basin. Possible long term solution is possible redesign of the jetties.

1990-1992 - Contract Report CERC-95-3- Longshore Suspended Sediment Transport at the Mouth of the Colorado River, Matagorda, Texas - This contract report was prepared in partial fulfillment of contract with WES. Data was collected in 19990-1992 and was referenced in the WES monitoring report.

2001 - proposed WES study of weir jetty and deposition basin (Operations)

Operations contracted with WES as phase two of their studies to evaluate processes at weir jetty and deposition basin to assist in formulating alternatives for reducing frequency and volume of dredging at the mouth of the Colorado River. This work has been completed and a contract for construction of a training levee in the deposition basin area is scheduled for advertisement in the last quarter of 2002.

Parker's Cut Modeling
Southwest Cut Modeling
Bypass Channel gage monitoring
Physical Model Study
Weir Jetty Monitoring

TWOA Chronicle of events
Oct 1990 Simulator studies at WES
Jun 1991 TWOA diversion study 90% of flow
Oct, 1993 COE studying Yokohama Bumpers
Jul 1996 COE will examine Yokohama Bumpers
Oct, 1996 Physical Model
Feb 1997 COE rejects Yokohama Bumpers

Oct 1998 Yokohama Bumpers installed

WES
1. Physical model intersection navigation at CRL
2. Bypass channel intersection barge simulation model study
(CHL-97-6, HI-92-3, HL-92-11, CERC-95-3, CHL-98-2
3. Limited weir jetty sedimentation basin evaluation
Technical Report CHL-98-2 - MOC Monitoring Program (Sediment basin)
Technical Report HL-92-3 - Field data Collection Report MOC
CERC-95-3 - Longshore Suspended Sediment Transport at MOC

LCRA
Preliminary study Opening Parker's Cut

TPWL
TAMU-CC-CBI-96-03 - Hydraulic Feasibility of Proposed Southwest Cut, East Matagorda Bay, Texas

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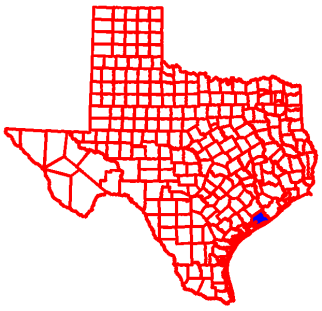
National Highway Traffic Safety Administration
Our Mission: Save lives, prevent injuries, reduce vehicle-related crashes

Traffic Safety Facts Matagorda County, Texas 2003-2007



Select State

Select County

Data Source: FARS 2003 - 2006 Final and Fars 2007 ARF

Fatalities by Person/Crash Type

Home Printer Friendly

Fatalities by Person/Crash Type

Fatality Type	Fatalities					Fatalities Per 100,000 Population				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
Total Fatalities	10	4	7	11	7	26.42	10.63	18.73	29.63	18.91
(1) Alcohol-Impaired Driving (BAC=.08+) Fatalities	2	3	3	7	1	5.28	7.98	8.03	18.86	2.70
(2) Single Vehicle Crash Fatalities	3	1	3	7	4	7.93	2.66	8.03	18.86	10.80
(3) Large Truck Involved Crash Fatalities	4	0	0	1	0	10.57	0.00	0.00	2.69	0.00

(4) Speeding Involved Crash Fatalities	1	1	2	6	1	2.64	2.66	5.35	16.16	2.70
(5) Rollover Involved Crash Fatalities	4	1	2	5	1	10.57	2.66	5.35	13.47	2.70
(6) Roadway Departure Involved Crash Fatalities	8	3	5	7	3	21.13	7.98	13.38	18.86	8.10
(7) Intersection (or Intersection Related) Crash Fatalities	1	1	0	2	1	2.64	2.66	0.00	5.39	2.70
Passenger Car Occupant Fatalities	3	3	3	3	3	7.93	7.98	8.03	8.08	8.10
Light Truck Occupant Fatalities	3	1	3	4	3	7.93	2.66	8.03	10.78	8.10
Motorcyclist Fatalities	1	0	0	0	1	2.64	0.00	0.00	0.00	2.70
Pedestrian Fatalities	1	0	1	1	0	2.64	0.00	2.68	2.69	0.00
Bicyclist (or Other Cyclist) Fatalities	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00

(1) Crash Involved at Least One Driver or Motorcycle Rider With a BAC of .08 or Above
(2) Crash Involved Only One Vehicle In Transport
(3) Crash Involved at Least One Large Truck
(4) Crash Involved at Least One Vehicle Speeding
(5) Crash Involved at Least One Vehicle That Rolled Over
(6) Crash Involved at Least One Vehicle That Departed the Roadway (FHWA Definition)
(7) Crash Occured Within an Intersection or Within the Approach to an Intersection
A Fatality Can Be in More Than One Category. Therefore Sum of the Individual Cells Will Not Equal the Total Due to Double Counting

Back to Top

Passenger Vehicle Occupant Fatalities by Restraint Use

Restraint Use	Fatalities					Fatalities Per 100,000 Population				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
Restrained	6	2	3	2	1	15.85	5.32	8.03	5.39	2.70
Unrestrained	0	2	3	5	4	0.00	5.32	8.03	13.47	10.80
Unknown Restraint Use	0	0	0	0	1	0.00	0.00	0.00	0.00	2.70
Total	6	4	6	7	6	15.85	10.63	16.05	18.86	16.21

Back to Top

Motorcyclist Fatalities by Helmet Use

Helmet Use	Fatalities					Fatalities Per 100,000 Population				
	2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
Helmet Used	1	0	0	0	1	2.64	0.00	0.00	0.00	2.70
No Helmet Used	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
Unknown Helmet Use	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00
Total	1	0	0	0	1	2.64	0.00	0.00	0.00	2.70

Back to Top

Fatalities by Person Type and Race/Hispanic Origin

Person Type by Race / Hispanic Origin		2003	2004	2005	2006
Occupants (All Vehicle Types)	Hispanic	2	1	3	2
	White Non-Hispanic	7	3	3	5
	Black, Non-Hispanic	0	0	0	0
	Unknown Race and Unknown Hispanic	0	0	0	2

Non-Occupants (Pedestrians, Pedalcyclists and Other/Unknown Non-Occupants)	*Total*	9	4	6	9
	Hispanic	0	0	1	0
	White Non-Hispanic	1	0	0	1
	Black, Non-Hispanic	0	0	0	1
	Unknown Race and Unknown Hispanic	0	0	0	0
	Total	1	0	1	2
Total	Hispanic	2	1	4	2
	White Non-Hispanic	8	3	3	6
	Black, Non-Hispanic	0	0	0	1
	Unknown Race and Unknown Hispanic	0	0	0	2
	Total	10	4	7	11

2007 Race/Hispanic Origin Data is not Presented Because it is Incomplete

Back to Top

National Highway Traffic Safety Administration
Our Mission: Save lives, prevent injuries, reduce vehicle-related crashes
www.nhtsa.gov

Traffic Safety Facts
Texas
2003-2007

Select State | Select County

Data Source: FARS 2003 - 2006 Final and Fars 2007 ARF

Performance Measures

Overall Highway Safety Funding

Ecomomic Impact of Motor Vehicle Crashes

Home Printer Friendly

Traffic Safety Performance (Core Outcome) Measures For Texas *

Core Outcome Measures		Year 2003	2004	2005	2006	2007
Traffic Fatalities	Total	3,821	3,699	3,536	3,531	3,363
	Rural	2,189	2,053	1,974	1,998	1,870
	Urban	1,632	1,646	1,557	1,532	1,491
	Unknown	0	0	5	1	2
Fatalities Per 100 Million Vehicle Miles Driven**	Total	1.71	1.60	1.50	1.48	1.38
	Rural	2.78	2.50	2.36	2.37	2.18
	Urban	1.13	1.11	1.03	1.00	0.95
Passenger Vehicle Occupant Fatalities (All Seat Positions)	Total	2,893	2,790	2,545	2,601	2,398
	Restrained	1,438	1,493	1,291	1,280	1,234
	Unrestrained	1,381	1,224	1,203	1,147	986
	Unknown	74	73	51	174	178
Alcohol-Impaired Driving Fatalities (BAC=.08+)***		1,405	1,336	1,320	1,400	1,292
Speeding-Related Fatalities		1,560	1,466	1,439	1,496	1,343
Motorcyclist Fatalities	Total	342	290	364	353	397
	Helmeted	113	116	146	128	155
	Unhelmeted	223	171	214	220	233

	Unknown	6	3	4	5	9
Drivers Involved in Fatal Crashes	Total	5,224	5,040	4,774	4,741	4,555
	Aged Under 15	16	13	14	12	8
	Aged 15-20	738	689	622	637	569
	Aged Under 21	754	702	636	649	577
	Aged 21 and Over	4,380	4,227	4,040	3,980	3,870
	Unknown Age	90	111	98	112	108
Pedestrian Fatalities		401	447	427	385	387

*These Performance Measures Were Developed By The National Highway Traffic Safety Administration (NHTSA) and the Governors Highway Safety Association (GHSA) (See Publication: DOT HS 811 025)
***Based on the BAC of All Involved Drivers and Motorcycle Riders Only

Back to Top

Fatality Rates: Texas , U.S. and Best State

	Year	Fatalities	Total Vehicle Miles Traveled (Millions)	Fatalities Per 100 Million Vehicle Miles Traveled	Total Population	Fatalities Per 100,000 Population
2003	Texas	3,821	223,418	1.71	22,085,973	17.30
	US	42,884	2,890,450	1.48	290,447,644	14.76
	Best State*			0.83		7.18
2004	Texas	3,699	231,008	1.60	22,454,811	16.47
	US	42,836	2,964,788	1.44	293,191,511	14.61
	Best State*			0.87		7.40
2005	Texas	3,536	235,170	1.50	22,843,999	15.48
	US	43,510	2,989,430	1.46	295,895,897	14.70
	Best State*			0.80		6.86
2006	Texas	3,531	238,256	1.48	23,407,629	15.08
	US	42,708	3,014,371	1.42	298,754,819	14.30
	Best State*			0.78		6.32
2007	Texas	3,363	243,443	1.38	23,904,380	14.07
	US	41,059	3,029,822	1.36	301,621,157	13.61
	Best State*			0.76		6.47

*State (or States) With Lowest Rates: Lowest VMT and Population Rates Could Be in Different States

Back to Top

Fatalities By The Highest Blood Alcohol Concentration (BAC) in the Crash**: Texas , U.S. and Best State

(Old Definition)

	Year	Total Fatalities in all Crashes	Highest BAC level in the Crash				
			BAC = .01+		BAC = .08+		
			Number	Percent	Number	Percent	Per 100 Million VMT
2003	Texas	3,821	1,771	46	1,551	41	0.69
	US	42,884	17,105	40	14,678	34	0.51
	Best State*			15		13	0.16
2004	Texas	3,699	1,704	46	1,481	40	0.64
	US	42,836	16,919	39	14,593	34	0.49
	Best State*			25		21	0.27
2005	Texas	3,536	1,672	47	1,462	41	0.62
	US	43,510	17,590	40	15,102	35	0.51
	Best State*			14		12	0.14
2006	Texas	3,531	1,745	49	1,540	44	0.65
	US	42,708	17,738	42	15,144	35	0.50
	Best State*			24		20	0.22
2007	Texas	3,363	1,620	48	1,424	42	0.58
	US	41,059	17,036	41	14,575	35	0.48
	Best State*			23		19	0.21

*State (or States) With Lowest Percents: Lowest Percents Could Be in Different States
**Based on the BAC of All Involved Drivers, Motorcycle Riders, Pedalcyclists and Pedestrians

Back to Top

Alcohol-Impaired Driving Fatalities**: Texas , U.S. and Best State

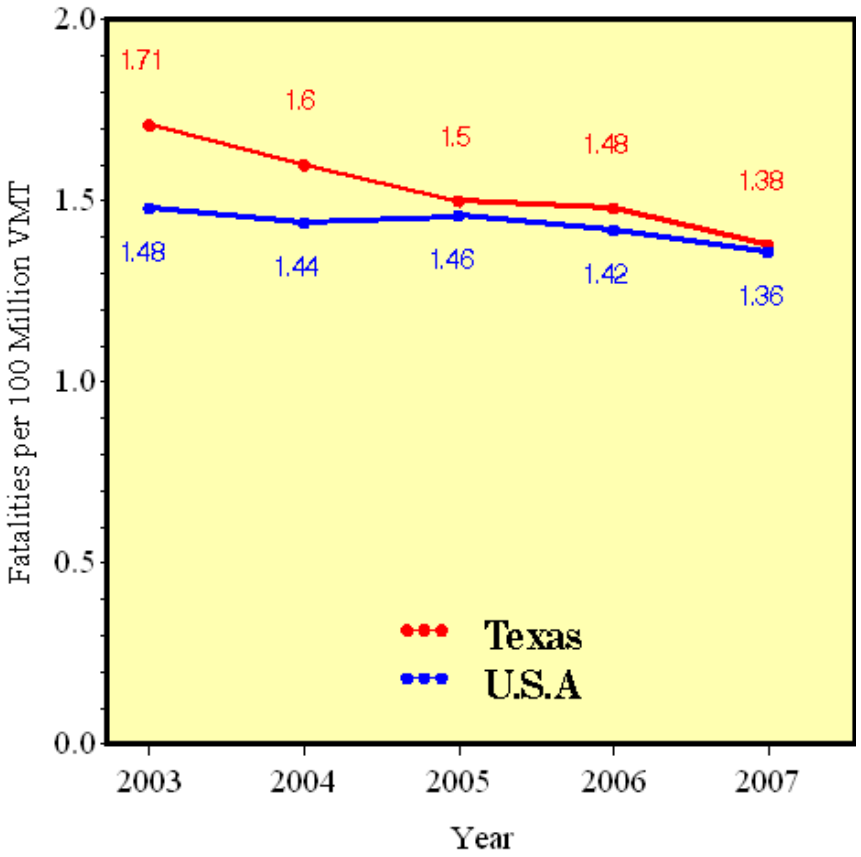
(New Definition)

	Year	Total Fatalities in all Crashes	Alcohol-Impaired Driving Fatalities (BAC = .08+)		
			Number	Percent	Per 100 Million VMT
2003	Texas	3,821	1,405	37	0.63
	US	42,884	13,096	31	0.45
	Best State*			12	0.15
2004	Texas	3,699	1,336	36	0.58
	US	42,836	13,099	31	0.44
	Best State*			20	0.25
2005	Texas	3,536	1,320	37	0.56
	US	43,510	13,582	31	0.45
	Best State*			12	0.13
2006	Texas	3,531	1,400	40	0.59
	US	42,708	13,491	32	0.45
	Best State*			18	0.20
2007	Texas	3,363	1,292	38	0.53
	US	41,059	12,998	32	0.43
	Best State*			17	0.19

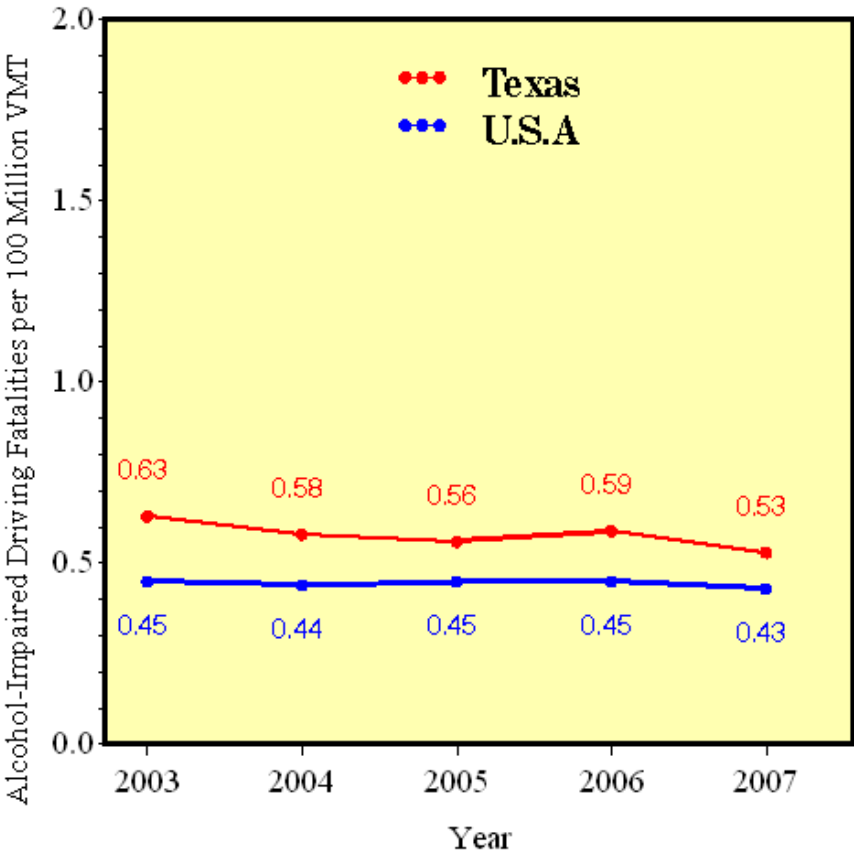
*State (or States) With Lowest Percents: Lowest Percents Could Be in Different States
**Based on the BAC of All Involved Drivers and Motorcycle Riders Only

Back to Top

Fatalities per 100 Million VMT



Alcohol-Impaired Driving Fatalities per 100 Million VMT



Back to Top

Blood Alcohol Concentration (BAC) Reporting Rates For Drivers/Motorcycle Rider (Operators) Involved in Fatal Crashes: Texas , U.S. and Best State

Year	Surviving Drivers/Motorcycle Rider		Killed Drivers/Motorcycle Rider		Total Drivers/Motorcycle Rider	
	Total	With Blood Alcohol Concentration (BAC) Results Reported to FARS	Total	With Blood Alcohol Concentration (BAC) Results Reported to FARS	Total	With Blood Alcohol Concentration (BAC) Results Reported to FARS

			Number	Percent		Number	Percent		Number	Percent
2003	Texas	2,855	628	22	2,369	1,221	52	5,224	1,849	35
	US	31,738	8,196	26	26,779	18,836	70	58,517	27,032	46
	Best State*			76			98			83
2004	Texas	2,847	600	21	2,193	1,201	55	5,040	1,801	36
	US	31,524	8,215	26	26,871	18,275	68	58,395	26,490	45
	Best State*			80			97			82
2005	Texas	2,667	549	21	2,107	982	47	4,774	1,531	32
	US	31,729	7,415	23	27,491	18,773	68	59,220	26,188	44
	Best State*			77			98			84
2006	Texas	2,541	433	17	2,200	735	33	4,741	1,168	25
	US	30,498	7,482	25	27,348	18,911	69	57,846	26,393	46
	Best State*			81			99			85
2007	Texas	2,416	279	12	2,139	817	38	4,555	1,096	24
	US	29,201	6,765	23	26,480	16,991	64	55,681	23,756	43
	Best State*			82			96			84

*State (or States) With Highest Percents: Highest Percents Could Be in Different States

Back to Top

Daytime Front Seat (Outboard Only) Passenger Vehicle Occupants, Aged 5 and Over, by Restraint Use: Fatalities and Observed Texas , U.S. and Best State

Year		Fatalities - Restrained**	Observed - Restrained***
		Percent	Percent
2003	Texas	66	84
	US	55	79
	Best State*	74	95

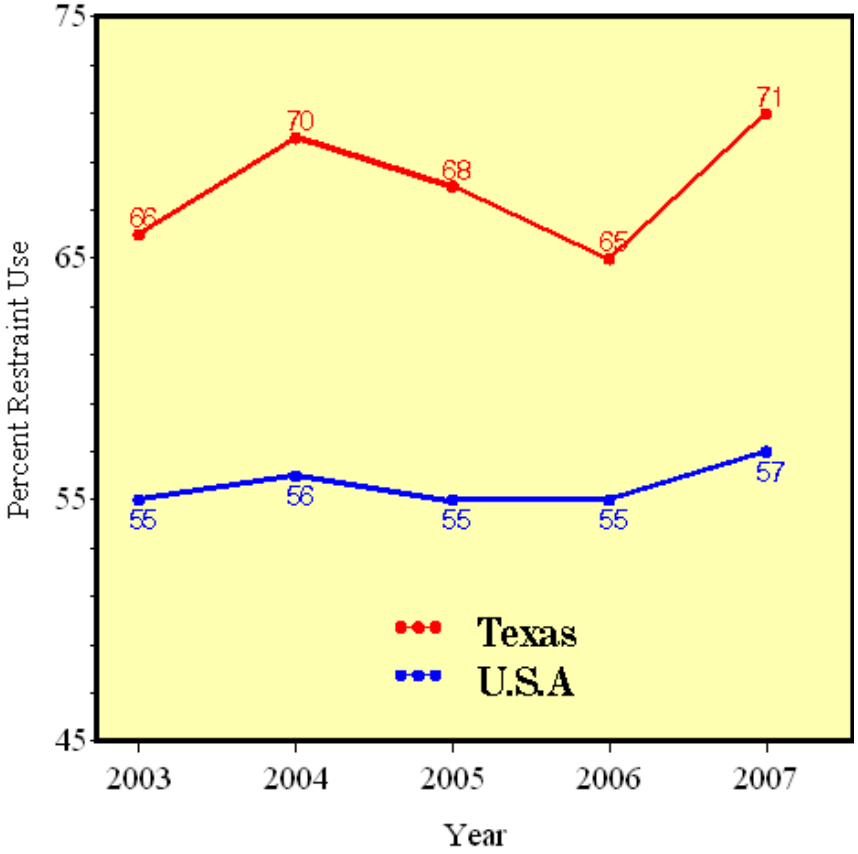
2004	Texas	70	83
	US	56	80
	Best State*	82	95
2005	Texas	68	90
	US	55	82
	Best State*	88	95
2006	Texas	65	90
	US	55	81
	Best State*	77	96
2007	Texas	71	92
	US	57	82
	Best State*	81	98

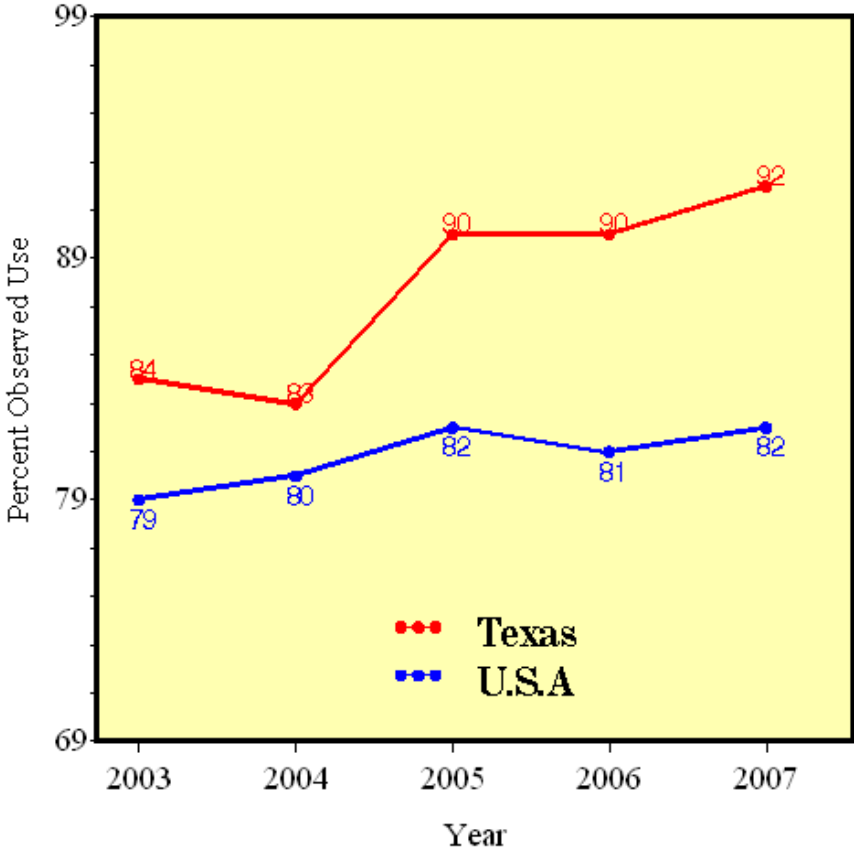
*State With Highest Percent. Fatal Crash and Observed Percents Can Be Different States
**Percent Based Only Where Restraint Use Was Known
***USA Data: National Occupant Protection Use Survey. Texas Data: State Survey
Note: The Purpose of this Table is to Compare (as closely as possible) the Use of Restraint Systems by Fatally Injured Occupants with Occupants in all Driving Situations

Back to Top

Daytime Front Seat (Outboard Only) Passenger Vehicle Occupant Fatalities Aged 5 and Over, by Percent Restraint Use*

Daytime Front Seat (Outboard Only) Passenger Vehicle Occupants Observed Aged 5 and Over, by Percent Restraint Use**





*Percent Based Only Where Restraint Use Was Known
**USA Data: National Occupant Protection Use Survey. Texas Data: State Survey

Back to Top

Passenger Vehicle Occupant Fatalities Aged 5 and Above by Restraint Use and Lives Saved Estimates

Year	Passenger Vehicle Occupant Fatalities Aged 5 and Above*					Passenger Vehicle Occupant Lives Saved Estimates**	
	Total	Restrained	Unrestrained	Unknown Restraint Use	Percent Known Restrained*	Lives Saved at Current Belt Use	Potential Additional Lives Savable at 100% Usage
2003	2,832	1,409	1,351	72	51	1,704	514
2004	2,716	1,455	1,193	68	55	1,777	540

2005	2,475	1,254	1,171	50	52	1,563	316
2006	2,550	1,249	1,129	172	53	1,611	376
2007	2,329	1,205	956	168	56	1,622	281

*Percent Based Only Where Restraint Use Was Known
**Lives Saved Estimates

Back to Top

Passenger Vehicle Occupant Fatalities Aged Under 5 by Restraint Use and Lives Saved Estimates

Year	Passenger Vehicle Occupant Fatalities Aged Under 5*					Passenger Vehicle Occupant Lives Saved Estimates**	
	Total	Restrained	Unrestrained	Unknown Restraint Use	Percent Known Restrained*	Lives Saved at Current Belt and Child Seat Usage	Potential Additional Lives Savable at 100% Usage
2003	56	28	27	1	51	7	18
2004	73	38	30	5	56	54	20
2005	62	33	29	0	53	45	22
2006	44	29	15	0	66	41	10
2007	54	29	24	1	55	43	

*Percent Based Only Where Restraint Use Was Known
**Lives Saved Estimates

Back to Top

Motorcyclist Fatalities by Helmet Use and Lives Saved Estimates

Year	Motorcycle Rider Fatalities*					Motorcycle Rider Lives Saved Estimates**	
	Total	Helmeted	Unhelmeted	Unknown Helmet Use	Percent Known Helmet Use*	Lives Saved at Current Helmet Use	Potential Additional Lives Savable at 100% Usage
2003	342	113	223	6	34	68	85
2004	290	116	171	3	40	69	65
2005	364	146	214	4	41	88	81
2006	353	128	220	5	37	74	82

2007	397	155	233	9	40	94	89

*Percent Based Only Where Helmet Use Was Known
**Lives Saved Estimates

Back to Top

Fatalities by Person Type

	Person Type	2003		2004		2005		2006		2007	
		Number	Percent*	Number	Percent*	Number	Percent*	Number	Percent*	Number	Percent*
Occupants	Passenger Car	1,521	40	1,473	40	1,270	36	1,256	36	1,158	34
	Light Truck - Pickup	720	19	692	19	704	20	752	21	698	21
	Light Truck - Utility	514	13	470	13	394	11	460	13	400	12
	Light Truck - Van	132	3	151	4	171	5	129	4	140	4
	Light Truck - Other	6	0	4	0	6	0	4	0	2	0
	Large Truck	89	2	74	2	76	2	90	3	78	2
	Bus	6	0	2	0	24	1	2	0	0	0
	Other/Unknown Occupants	26	1	25	1	31	1	25	1	38	1
	Total Occupants	3,014	79	2,891	78	2,676	76	2,718	77	2,514	75
Motorcyclists	*Total Motorcyclists*	342	9	290	8	364	10	353	10	397	12
Nonoccupants	Pedestrian	401	10	447	12	427	12	385	11	387	12
	Bicyclist and Other Cyclist	52	1	51	1	47	1	52	1	48	1
	Other/Unknown Nonoccupants	12	0	20	1	22	1	23	1	17	1
	Total Nonoccupants	465	12	518	14	496	14	460	13	452	13
Total	*Total*	3,821	100	3,699	100	3,536	100	3,531	100	3,363	100

*Sum of Percents May Not = 100 Due to Individual Cell Rounding

Back to Top

Fatalities by Crash Type

Crash Type	2003	2004	2005	2006	2007
Total Fatalities (All Crashes)*	3,821	3,699	3,536	3,531	3,363
- (1) Single Vehicle	1,964	1,906	1,907	1,931	1,786

- (2) Involving a Large Truck	487	483	506	500	493
- (3) Involving Speeding	1,560	1,466	1,439	1,496	1,343
- (4) Involving a Rollover	1,195	1,062	1,067	1,158	983
- (5) Involving a Roadway Departure	2,070	1,953	1,886	1,932	1,839
- (6) Involving an Intersection (or Intersection Related)	765	779	694	619	645

(1) Crash Involved Only One Coded Vehicle
(2) Crash Involved at Least One Large Truck
(3) Crash Involved at Least One Vehicle Speeding
(4) Crash Involved at Least One Vehicle That Rolled Over
(5) Crash Involved at Least One Vehicle That Departed the Roadway (FHWA Definition)
(6) Crash Occured Within an Intersection or Within the Approach to an Intersection
*A Fatality Can Be in More Than One Category. Therefore Sum of the Individual Cells Will Not Equal the Total Due to Double Counting

Back to Top

Motorcyclist Fatalities by Age

Year	Age							Total
	<20	20-29	30-39	40-49	50-59	>59	Unknown	
2003	30	97	84	78	36	17	0	342
2004	14	76	69	71	43	17	0	290
2005	30	104	84	66	51	29	0	364
2006	26	108	65	78	58	18	0	353
2007	15	107	81	96	67	29	2	397

Back to Top

Motorcyclist Fatalities Per 100,000 Registered Motorcycles

Year	Motorcyclist Fatalities	Total Motorcycle Registrations*	Motorcyclist Fatalities Per 100,000 Motorcycle Registrations
2003	342	261,553	130.8
2004	290	286,992	101.0
2005	364	331,213	109.9
2006	353	355,825	99.21
2007	397	387,915	102.3

*Data Source: FHWA

Back to Top

Fatalities by Person Type and Race/Hispanic Origin

Person Type by Race/Hispanic Origin		2003	2004	2005	2006
Occupants (All Vehicle Types)	Hispanic	921	999	945	722
	White Non-Hispanic	1,822	1,762	1,639	1,436
	Black, Non-Hispanic	331	298	308	252
	American Indian, Non-Hispanic/Unknown	7	7	8	10
	Asian, Non-Hispanic/Unknown	20	17	26	27
	Pacific Islander, Non-Hispanic/Unknown	0	0	1	0
	Multiple Races, Non-Hispanic/Unknown	0	0	1	0
	All Other Non-Hispanic or Race	39	30	29	19
	Unknown Race and Unknown Hispanic	216	68	83	605
	Total	3,356	3,181	3,040	3,071
Non-Occupants (Pedestrians, Pedalcyclists and Other/Unknown NonOccupants)	Hispanic	168	179	169	123
	White Non-Hispanic	177	222	213	153
	Black, Non-Hispanic	64	93	81	59
	American Indian, Non-Hispanic/Unknown	2	3	1	5
	Asian, Non-Hispanic/Unknown	2	2	4	8
	All Other Non-Hispanic or Race	9	10	10	2
	Unknown Race and Unknown Hispanic	43	9	18	110
	Total	465	518	496	460
Total	Hispanic	1,089	1,178	1,114	845
	White Non-Hispanic	1,999	1,984	1,852	1,589
	Black, Non-Hispanic	395	391	389	311
	American Indian, Non-Hispanic/Unknown	9	10	9	15
	Asian, Non-Hispanic/Unknown	22	19	30	35
	Pacific Islander, Non-Hispanic/Unknown	0	0	1	0
	Multiple Races, Non-Hispanic/Unknown	0	0	1	0
	All Other Non-Hispanic or Race	48	40	39	21

Unknown Race and Unknown Hispanic	**259**	**77**	**101**	**715**
Total	**3,821**	**3,699**	**3,536**	**3,531**

2007 Race/Hispanic Origin Data is Not Yet Complete

Back to Top

5 Year Trend For The Top 10 Counties of 2007 - Fatalities

Counties by 2007 Ranking		Fatalities					Percent of Total				
		2003	2004	2005	2006	2007	2003	2004	2005	2006	2007
1	Harris County	397	397	388	345	339	10	11	11	10	10
2	Dallas County	245	276	234	225	218	6	7	7	6	6
3	Tarrant County	128	131	145	165	156	3	4	4	5	5
4	Bexar County	155	196	169	148	133	4	5	5	4	4
5	Travis County	94	112	94	103	94	2	3	3	3	3
6	Hidalgo County	92	83	92	62	71	2	2	3	2	2
7	Montgomery County	79	64	64	74	69	2	2	2	2	2
8	El Paso County	66	63	65	44	50	2	2	2	1	1
9	Denton County	65	40	50	36	49	2	1	1	1	1
10	Jefferson County	44	44	61	64	45	1	1	2	2	1
Sub Total 1. *	***Top Ten Counties***	1,391	1,441	1,367	1,283	1,224	36	39	39	36	36
Sub Total 2. **	***All Other Counties***	2,430	2,258	2,168	2,248	2,139	64	61	61	64	64
Total	***All Counties***	3,821	3,699	3,535	3,531	3,363	100	100	100	100	100

*This Sub Total is the Total for the Top Ten Counties
**This Sub Total is the Total for all Counties Outside the Top Ten

Back to Top

5 Year Trend For The Top 10 Counties of 2007 - Fatalities Year to Year Percent Change

Counties by 2007 Ranking	Fatalities					Percent Change From Previous Year			
	2003	2004	2005	2006	2007	2004	2005	2006	2007

1	Harris County	397	397	388	345	339	0	-2	-11	-2
2	Dallas County	245	276	234	225	218	13	-15	-4	-3
3	Tarrant County	128	131	145	165	156	2	11	14	-5
4	Bexar County	155	196	169	148	133	26	-14	-12	-10
5	Travis County	94	112	94	103	94	19	-16	10	-9
6	Hidalgo County	92	83	92	62	71	-10	11	-33	15
7	Montgomery County	79	64	64	74	69	-19	0	16	-7
8	El Paso County	66	63	65	44	50	-5	3	-32	14
9	Denton County	65	40	50	36	49	-38	25	-28	36
10	Jefferson County	44	44	61	64	45	0	39	5	-30
*Sub Total 1. *	*Top Ten Counties*	1,391	1,441	1,367	1,283	1,224	4	-5	-6	-5
*Sub Total 2. **	*All Other Counties*	2,430	2,258	2,168	2,248	2,139	-7	-4	4	-5
Total	*All Counties*	3,821	3,699	3,535	3,531	3,363	-3	-4	-0	-5

*This Sub Total is the Total for the Top Ten Counties
**This Sub Total is the Total for all Counties Outside the Top Ten

Back to Top

5 Year Trend For The Top 10 Counties of 2007 - Fatality Rates

Median Rate for all U.S. Counties: 21.77

Counties by 2007 Ranking		Fatalities Per 100,000 Population				
		2003	2004	2005	2006	2007
1	Kenedy County	240.96	472.81	460.83	245.70	1,015.23
2	Borden County	302.11	449.78	157.98	0.00	341.88
3	Oldham County	139.93	235.96	239.01	381.68	337.35
4	Culberson County	36.26	74.93	229.45	118.06	281.80
5	Terrell County	98.52	207.68	103.20	0.00	214.13
6	Edwards County	100.86	0.00	260.42	0.00	206.40
7	Irion County	0.00	117.23	0.00	399.09	172.12
8	Brooks County	65.37	65.58	0.00	131.42	171.30
9	Robertson County	107.92	94.80	119.24	62.83	170.68

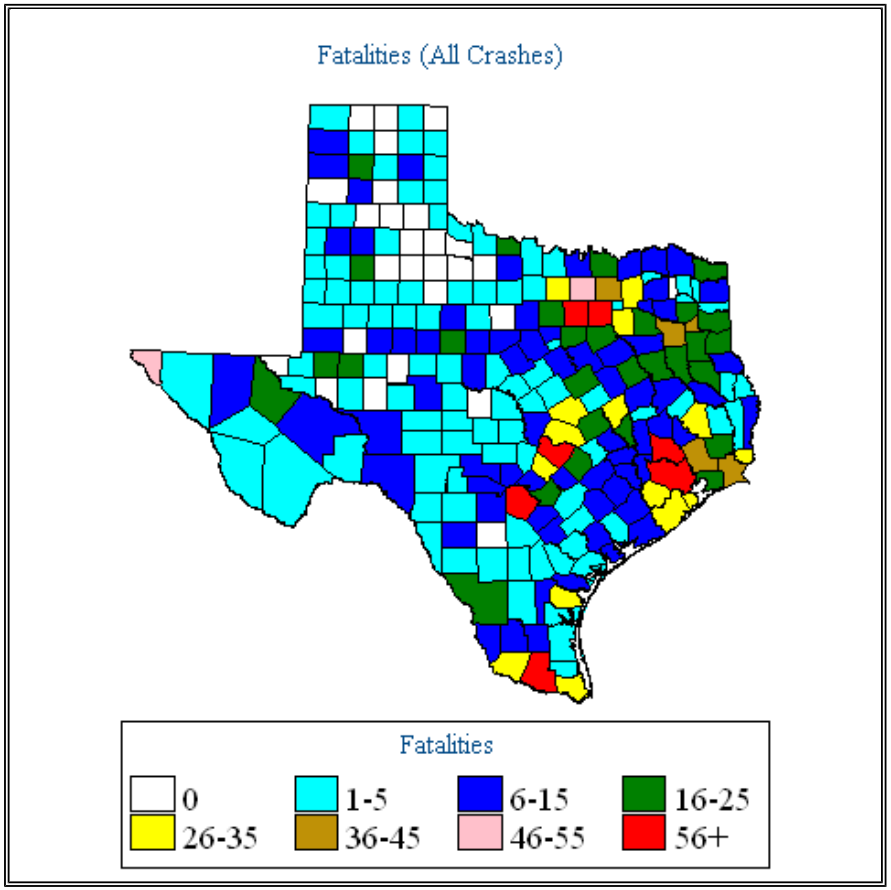
	10	Jim Hogg County	59.41	19.82	39.71	59.99	160.87
Sub Rate 1.	*	***Top Ten Counties***	**195.59**	**210.79**	**217.46**	**249.60**	**199.82**
Sub Rate 2.	**	***All Other Counties***	**17.05**	**16.19**	**15.28**	**14.86**	**13.77**
Total Rate		***All Counties***	**17.30**	**16.47**	**15.47**	**15.08**	**14.07**

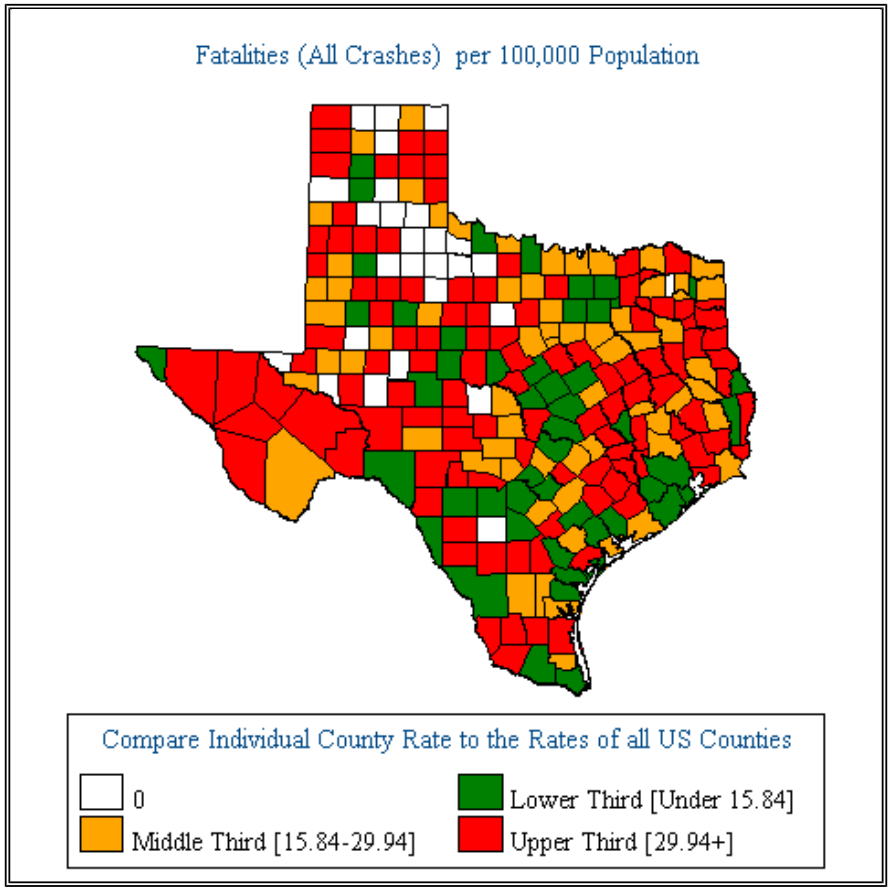
*This Sub Rate is the Rate for the Top Ten Counties
**This Sub Rate is the Rate for all Counties Outside the Top Ten

Back to Top

Fatalities (All Crashes)

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

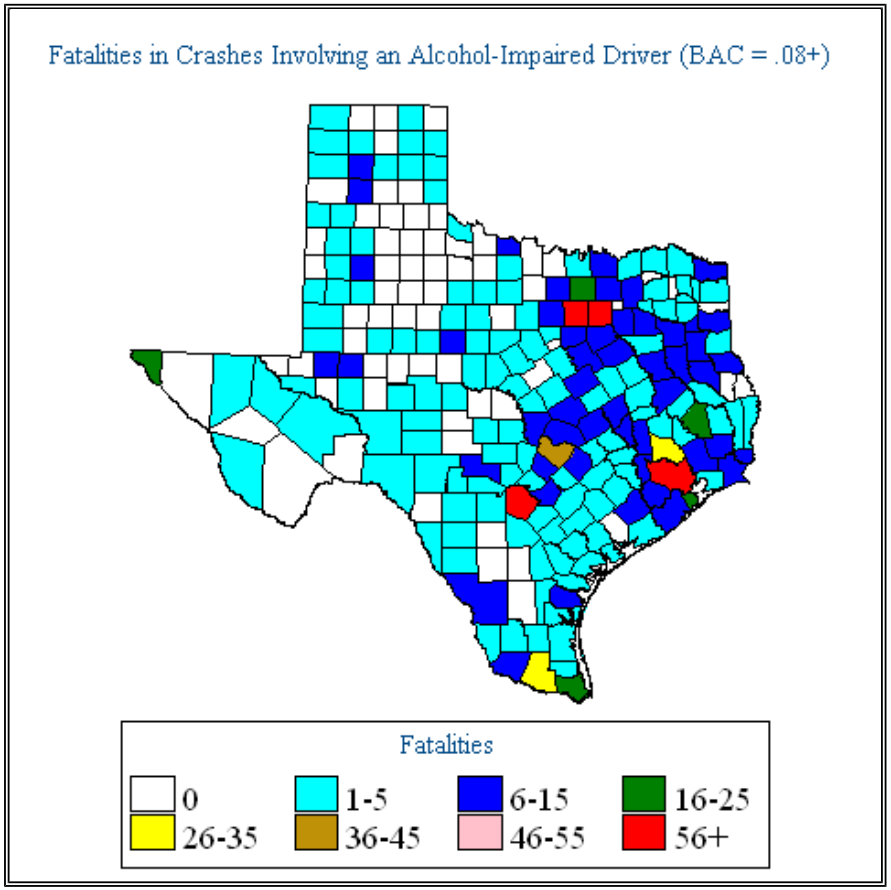


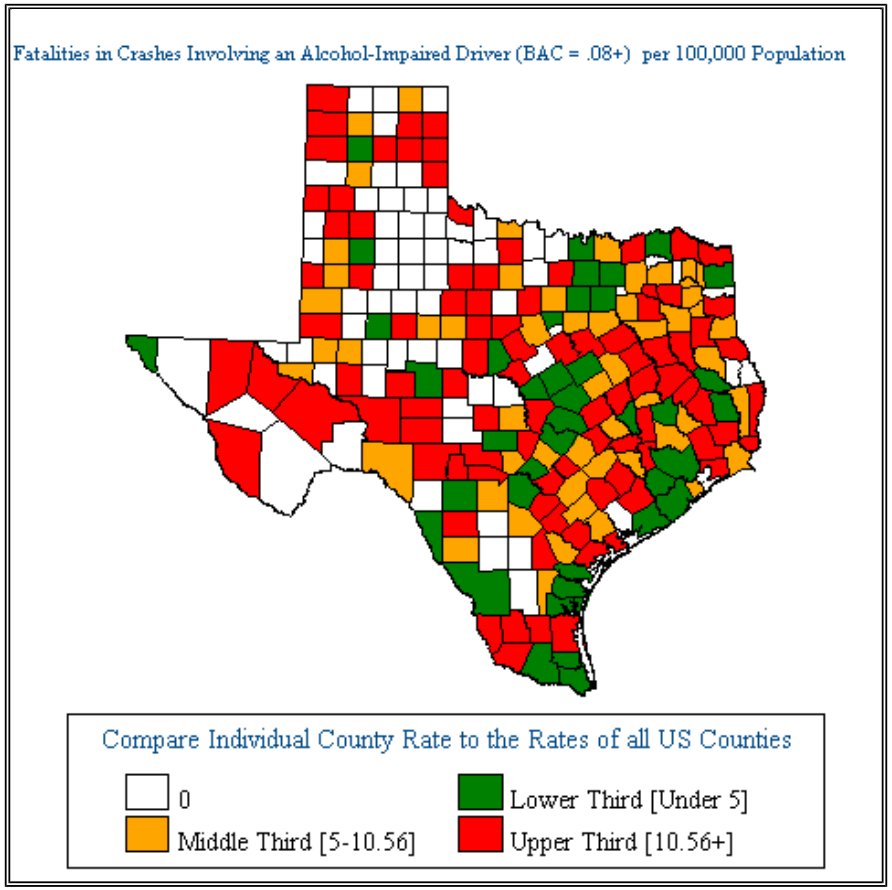


Back to Top

Fatalities in Crashes Involving an Alcohol-Impaired Driver (BAC = .08+)

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

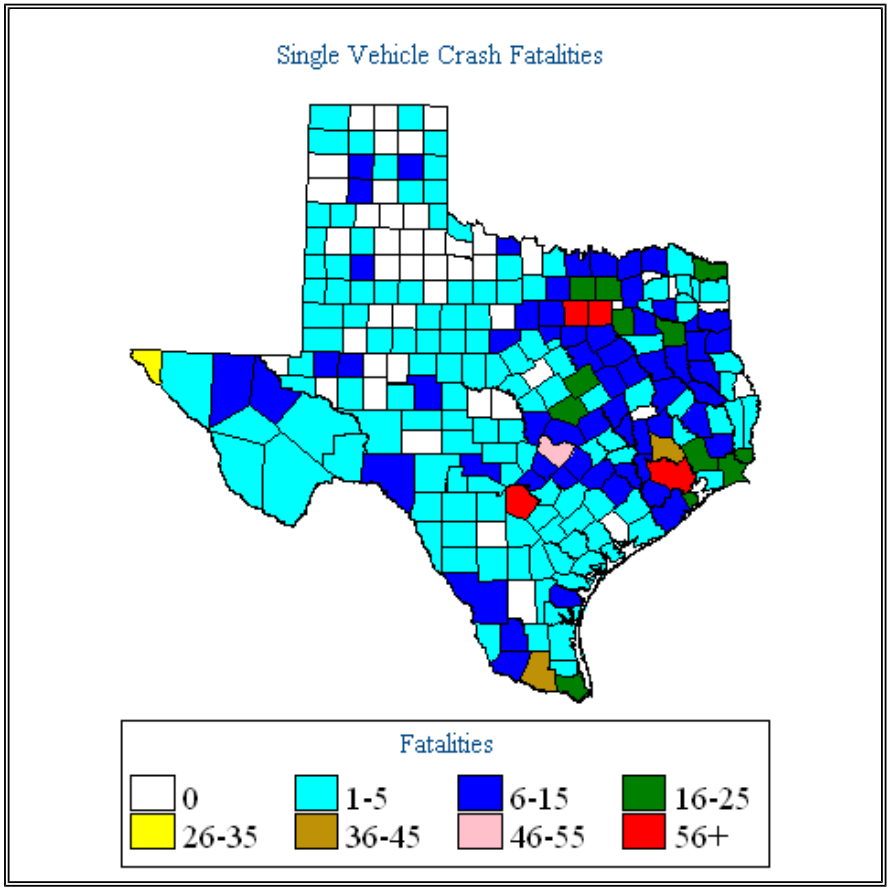


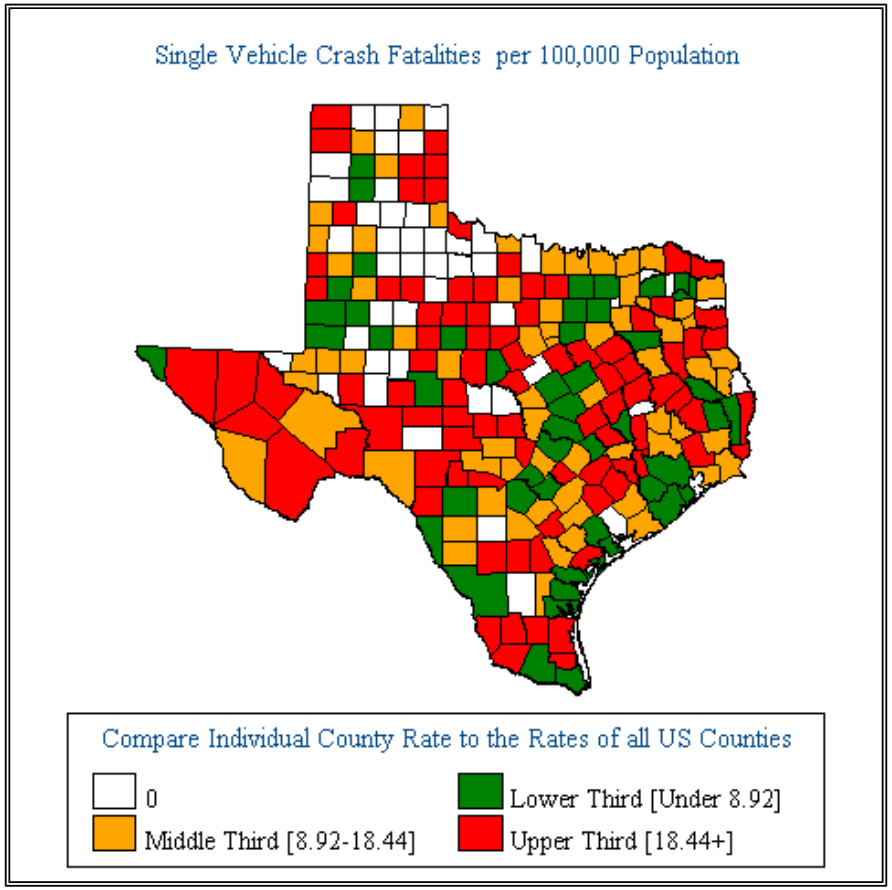


Back to Top

Single Vehicle Crash Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

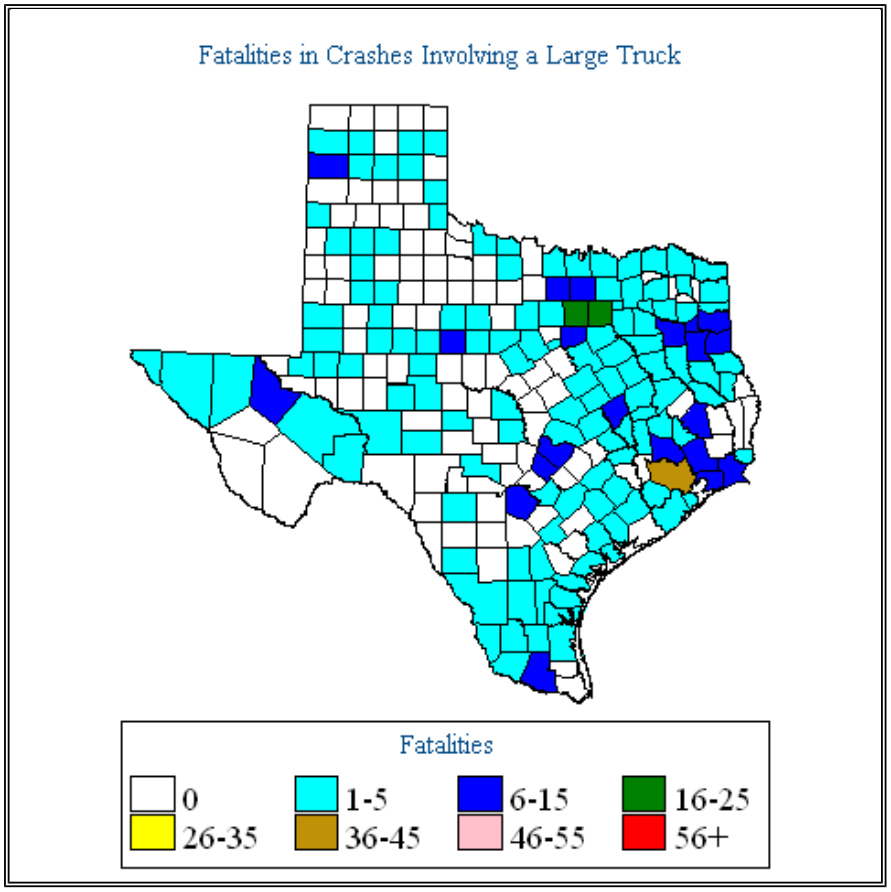


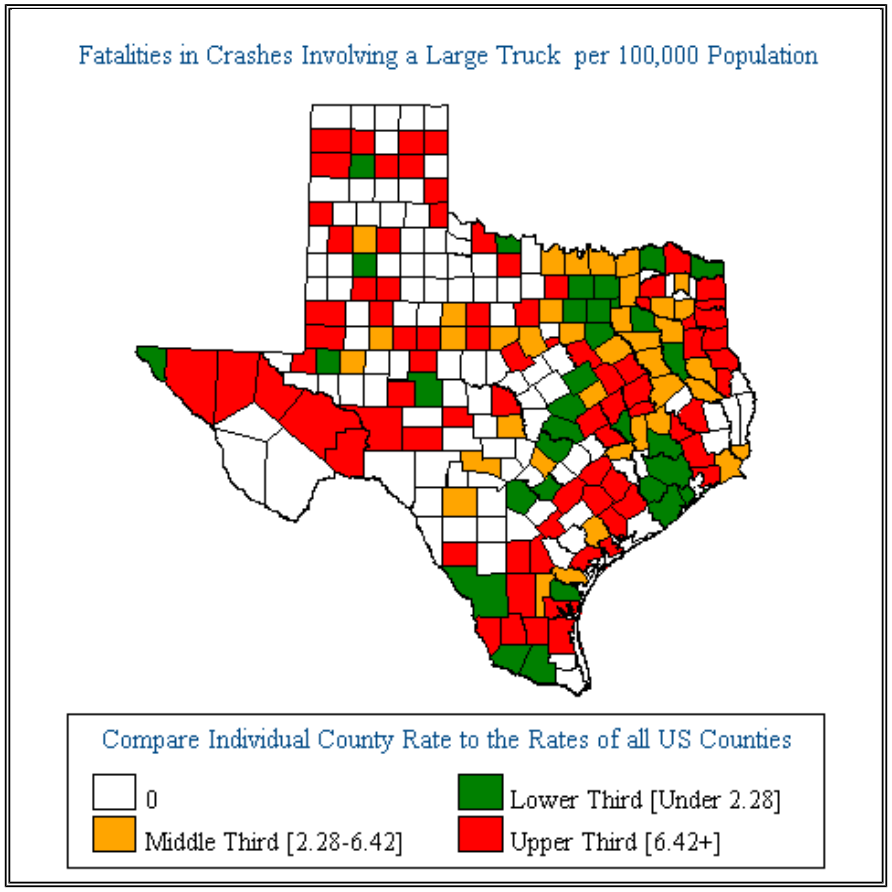


Back to Top

Fatalities in Crashes Involving a Large Truck

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

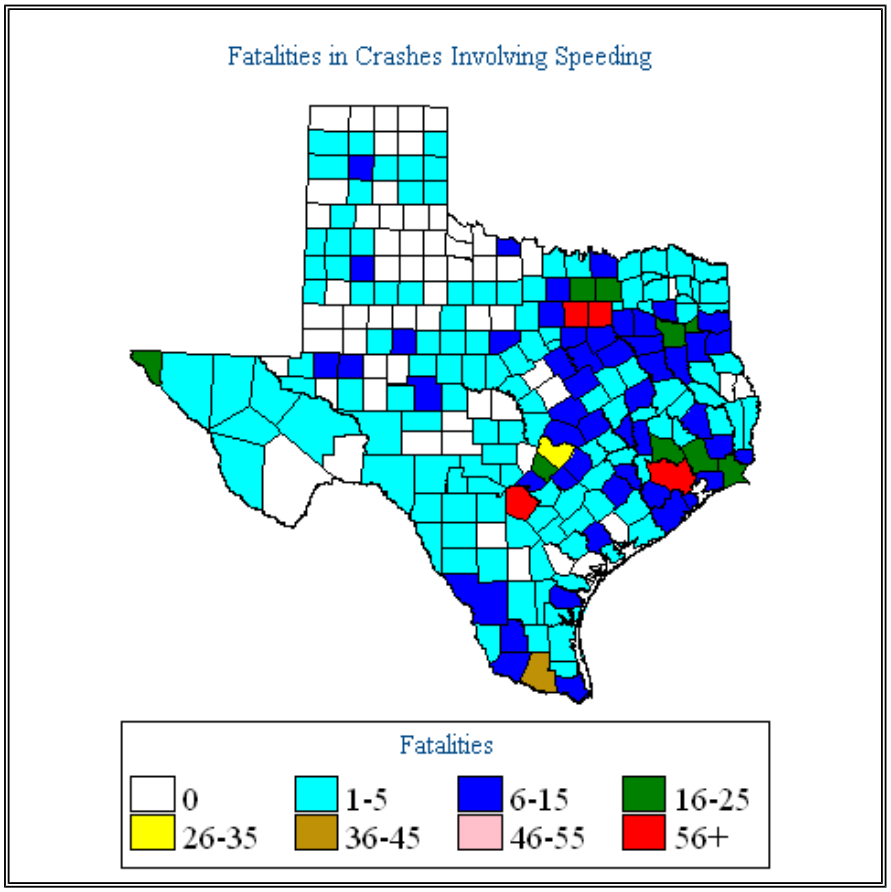


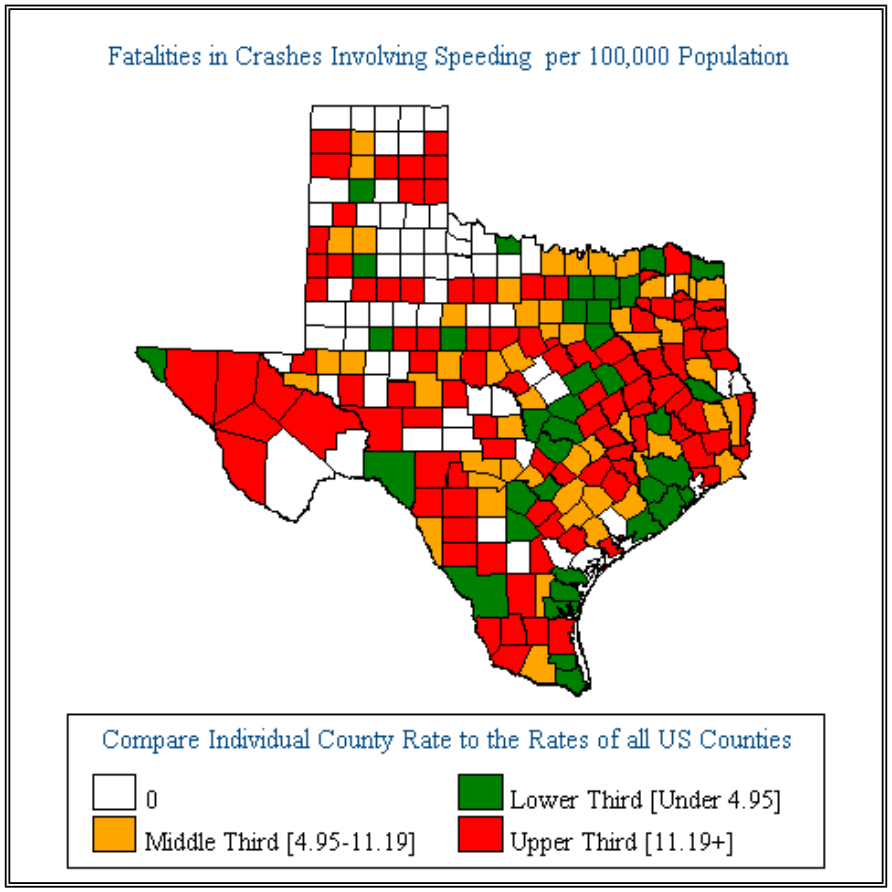


Back to Top

Fatalities in Crashes Involving Speeding

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

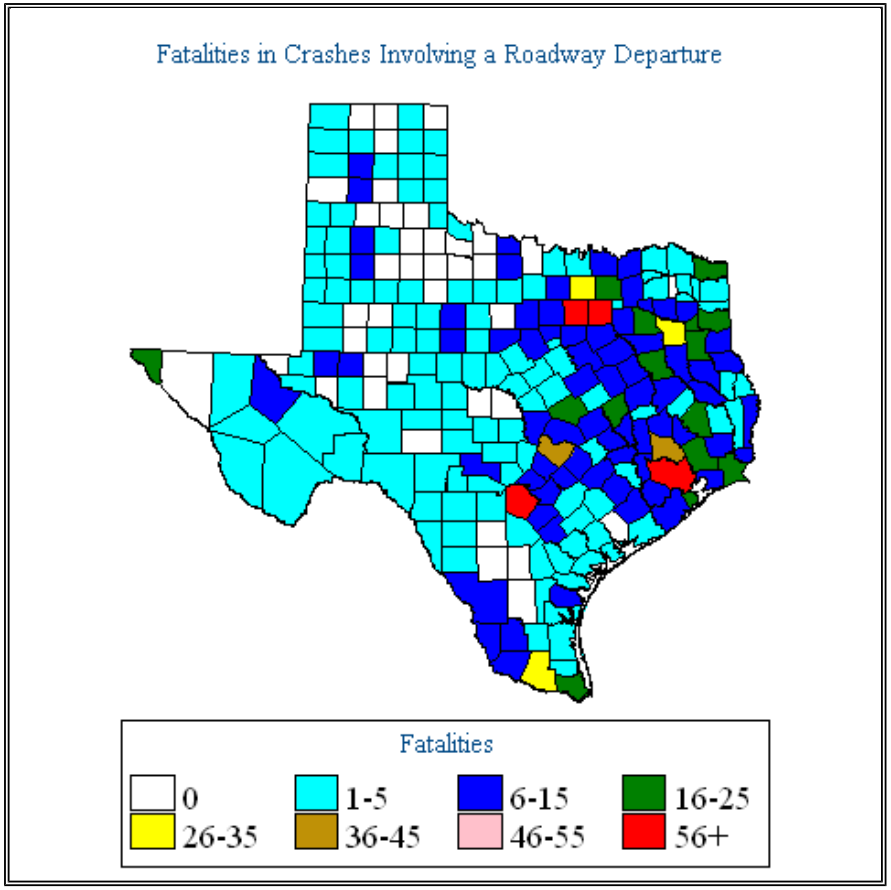


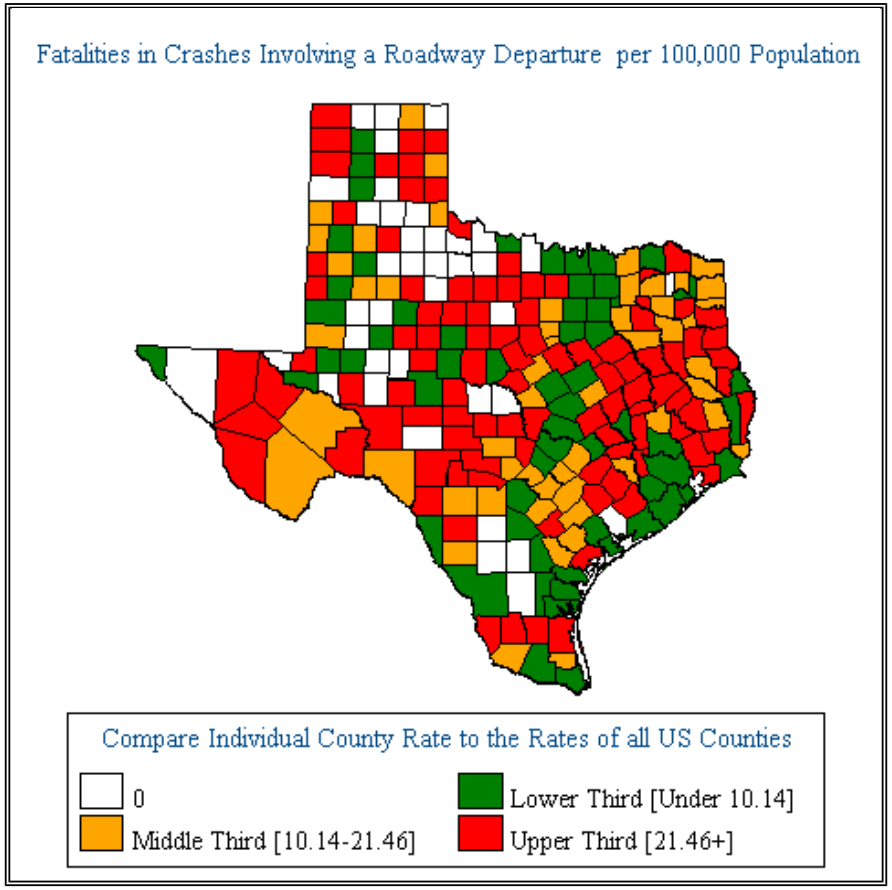


Back to Top

Fatalities in Crashes Involving a Roadway Departure

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

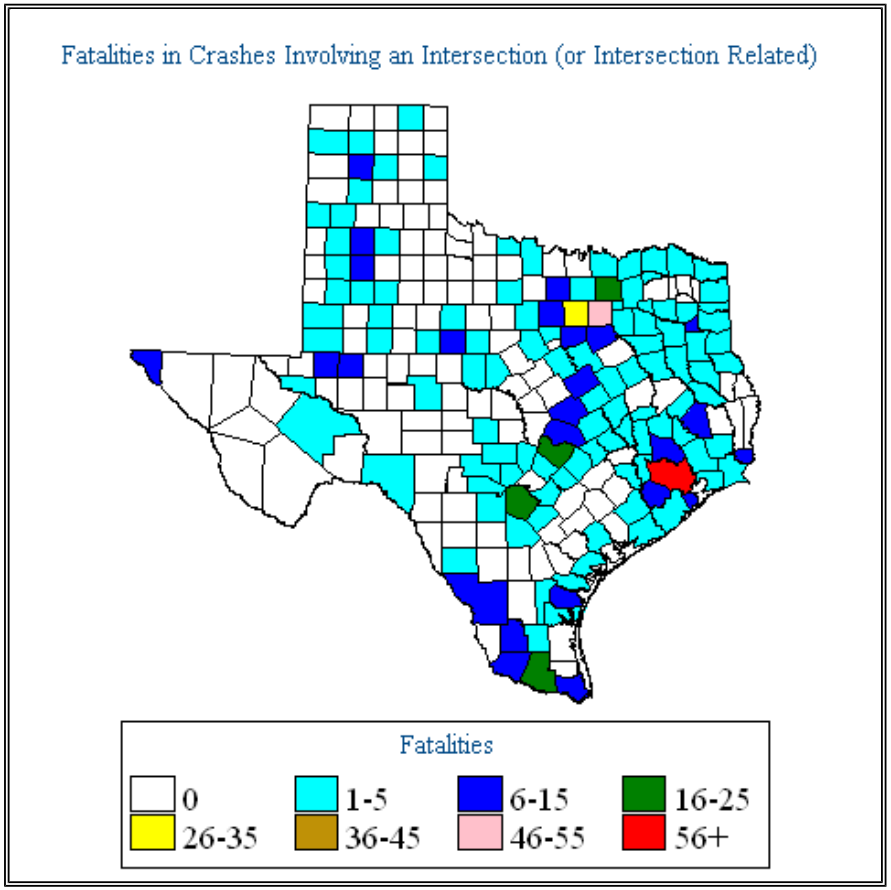


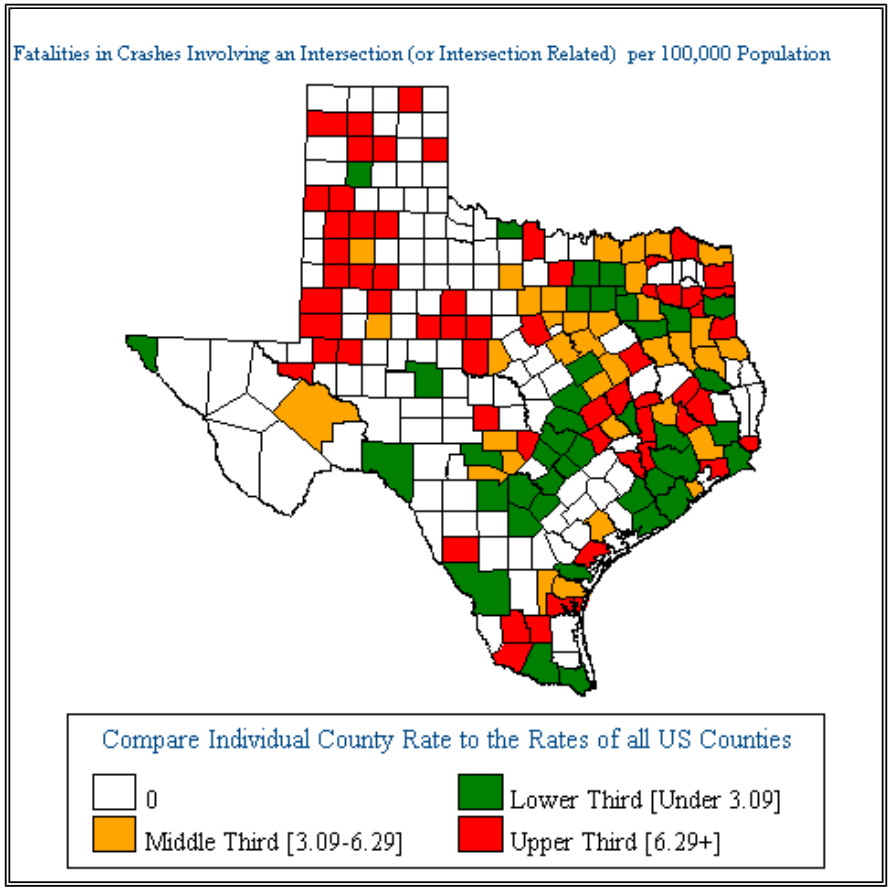


Back to Top

Fatalities in Crashes Involving an Intersection (or Intersection Related)

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

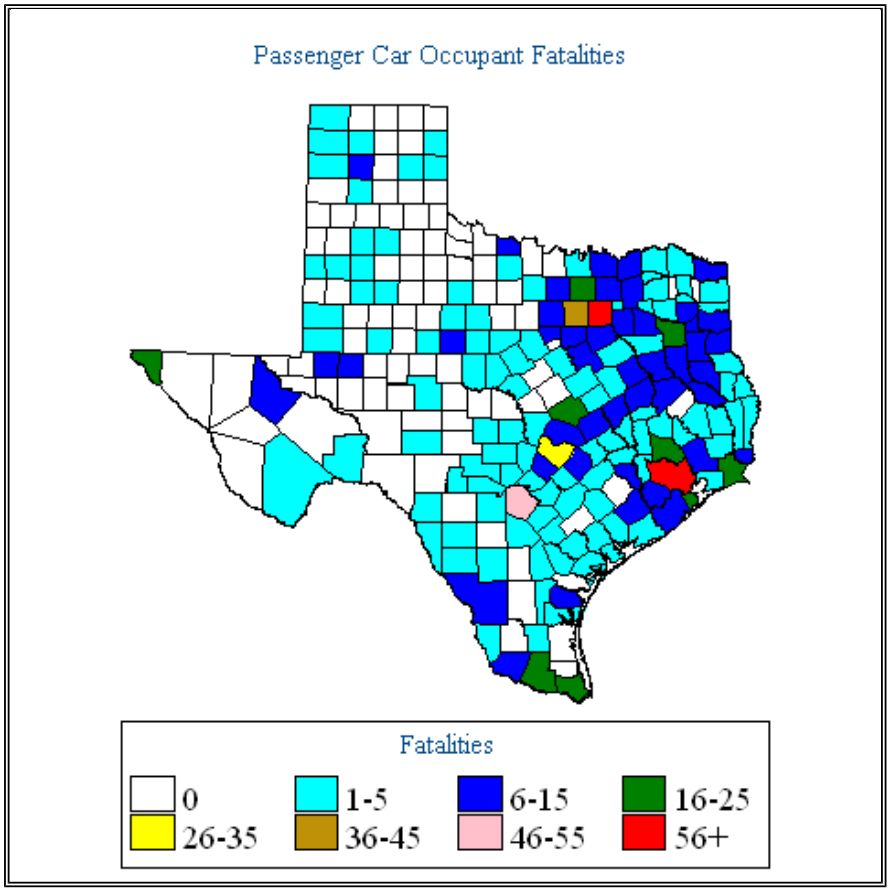


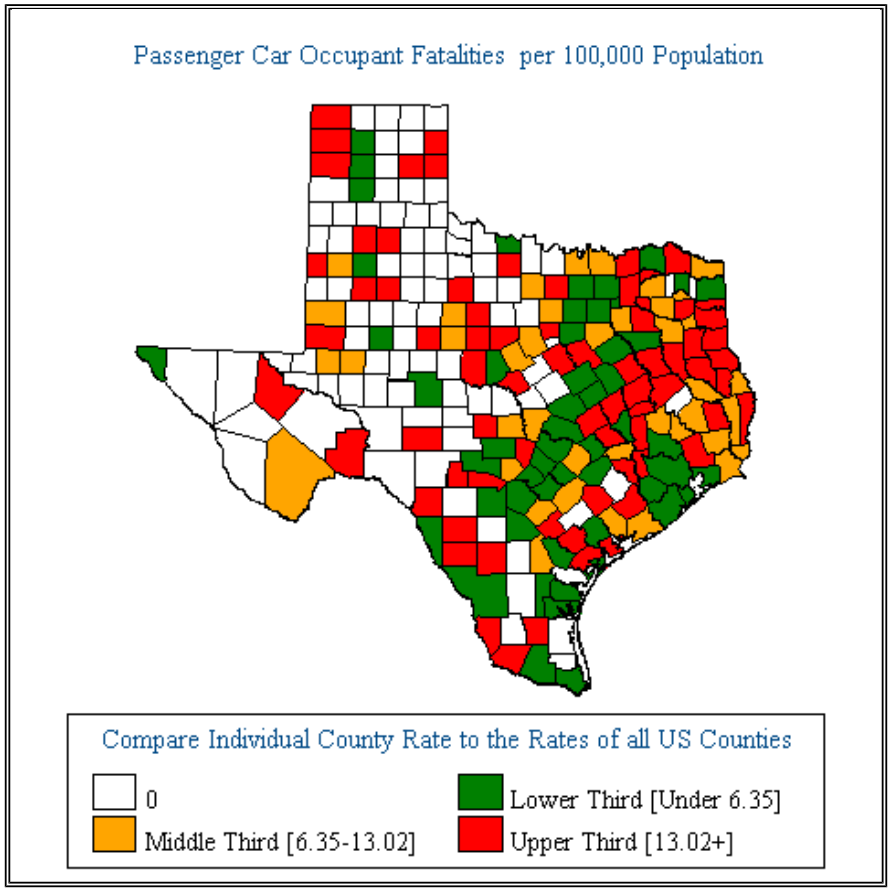


Back to Top

Passenger Car Occupant Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

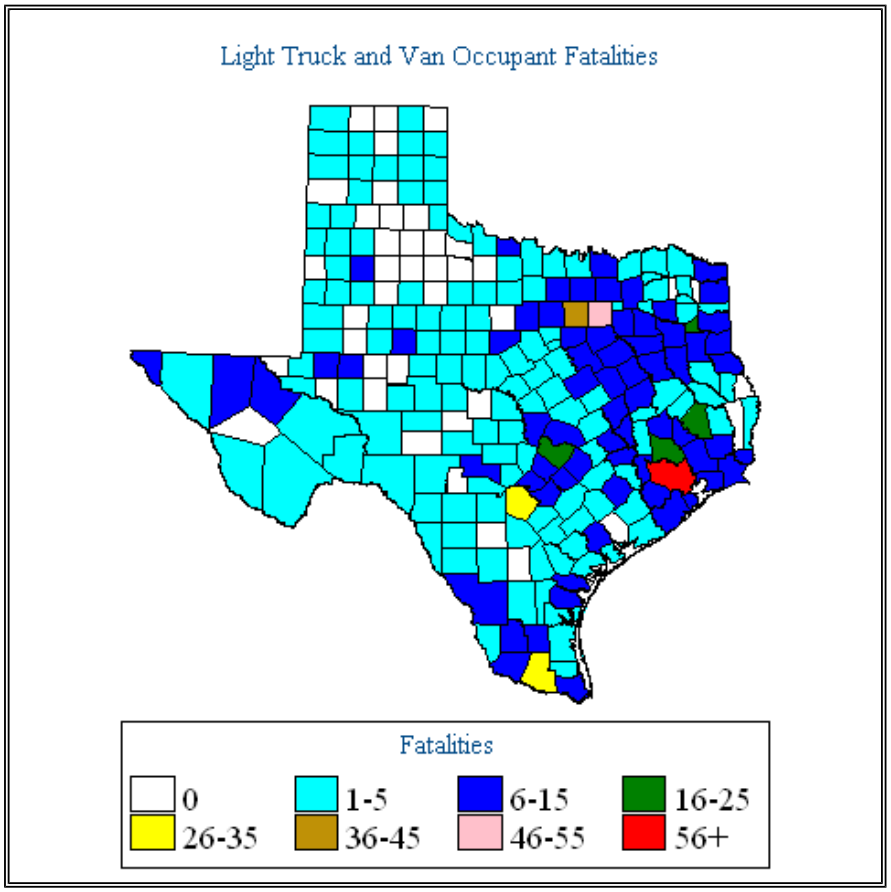


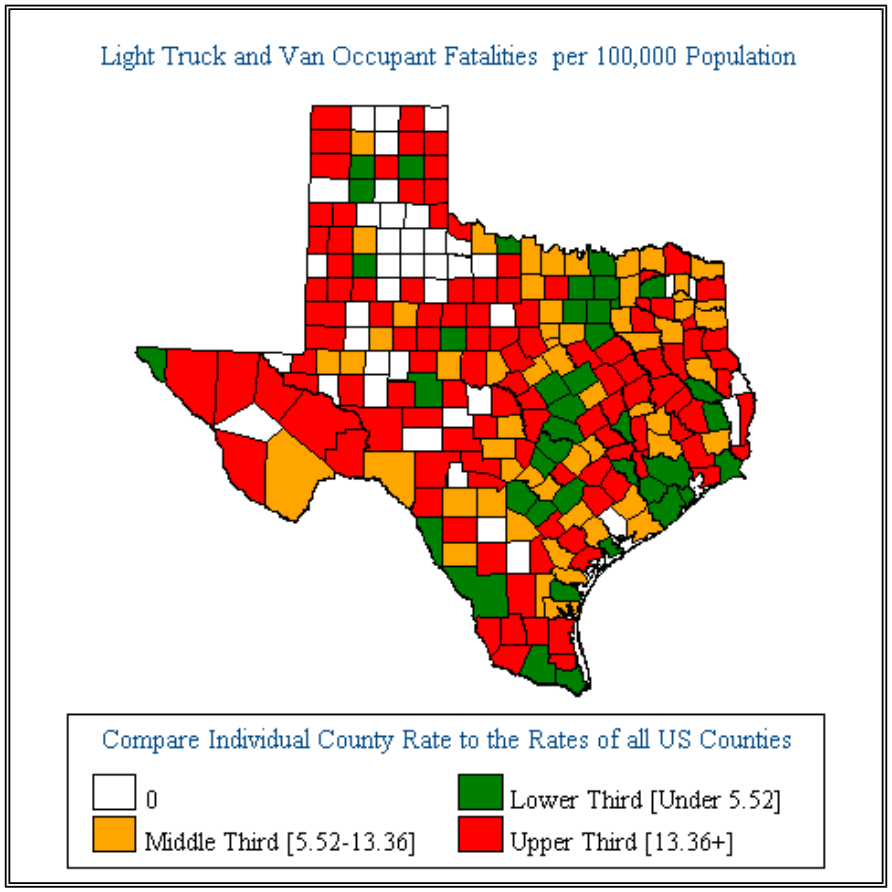


Back to Top

Light Truck and Van Occupant Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

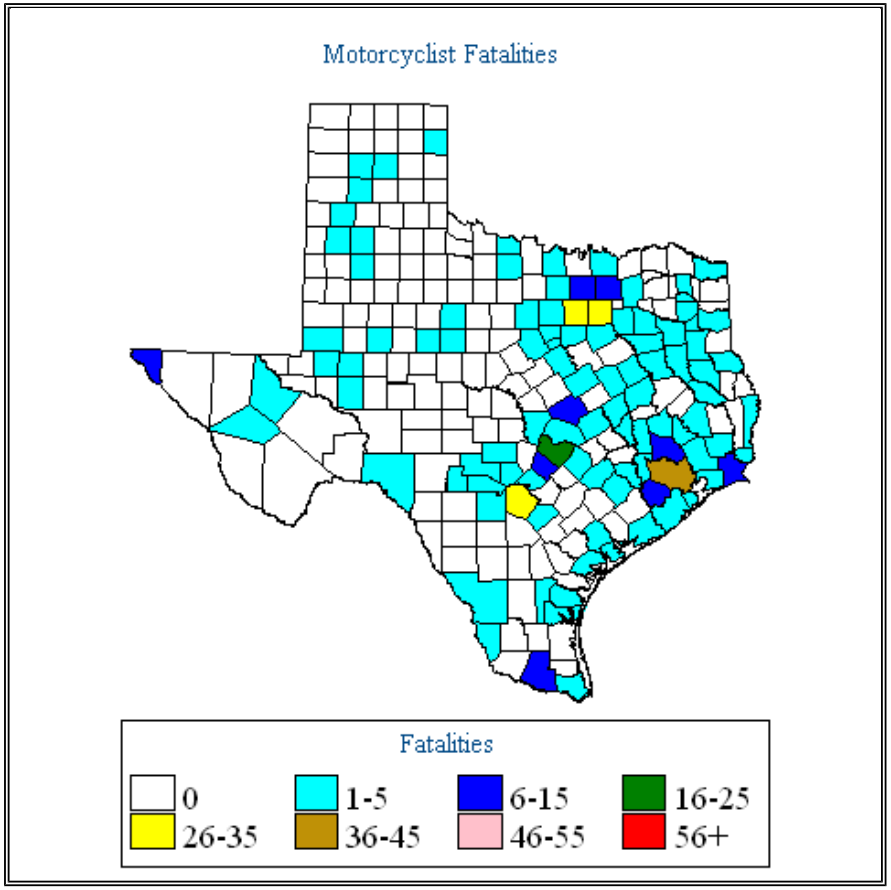


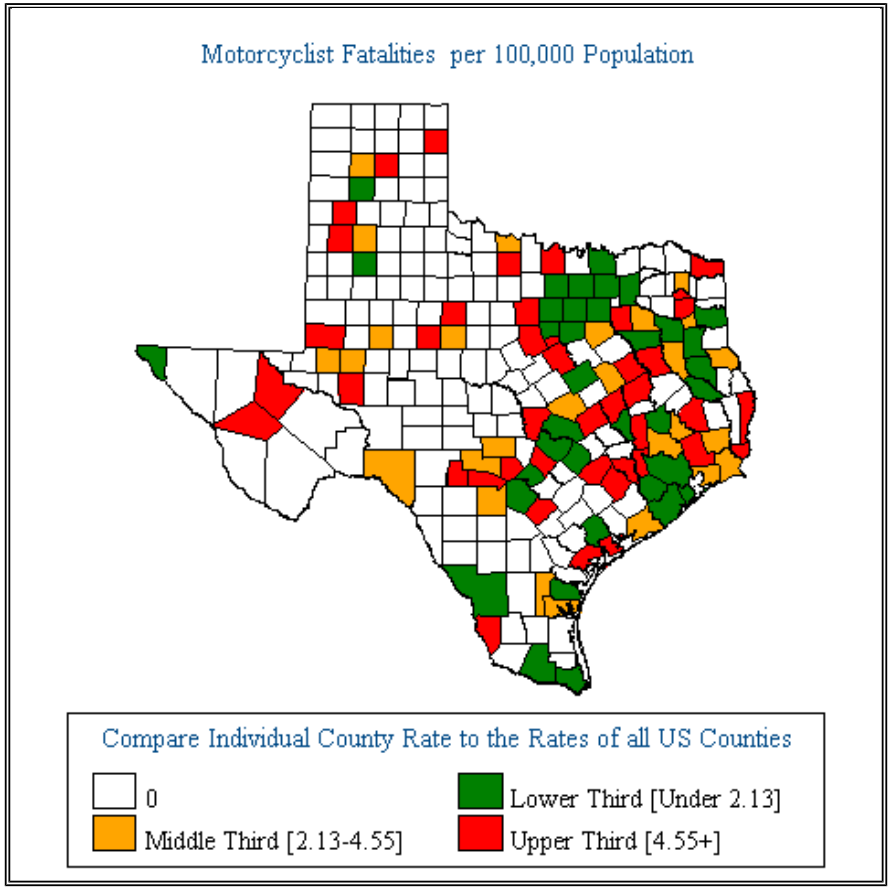


Back to Top

Motorcyclist Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

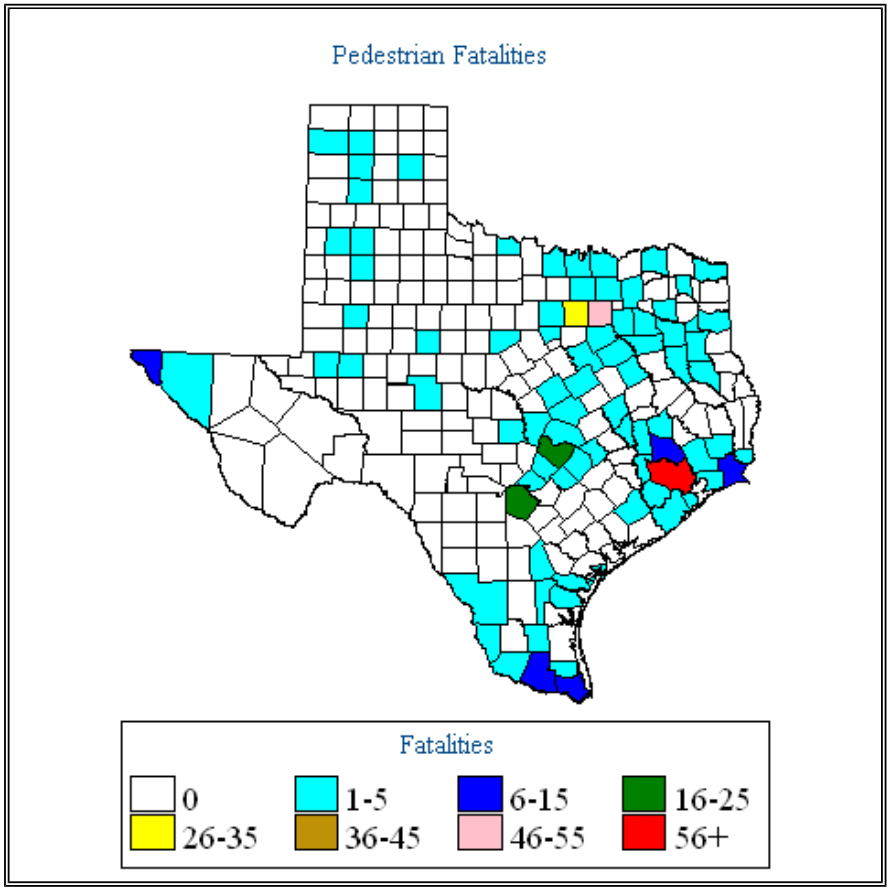


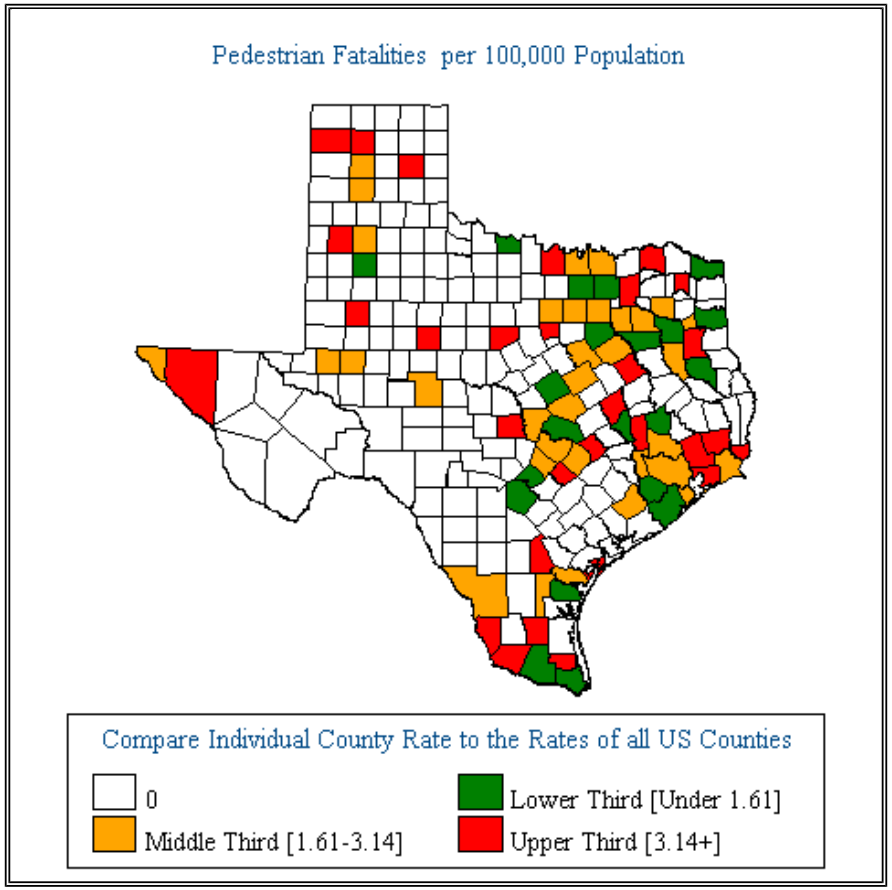


Back to Top

Pedestrian Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)

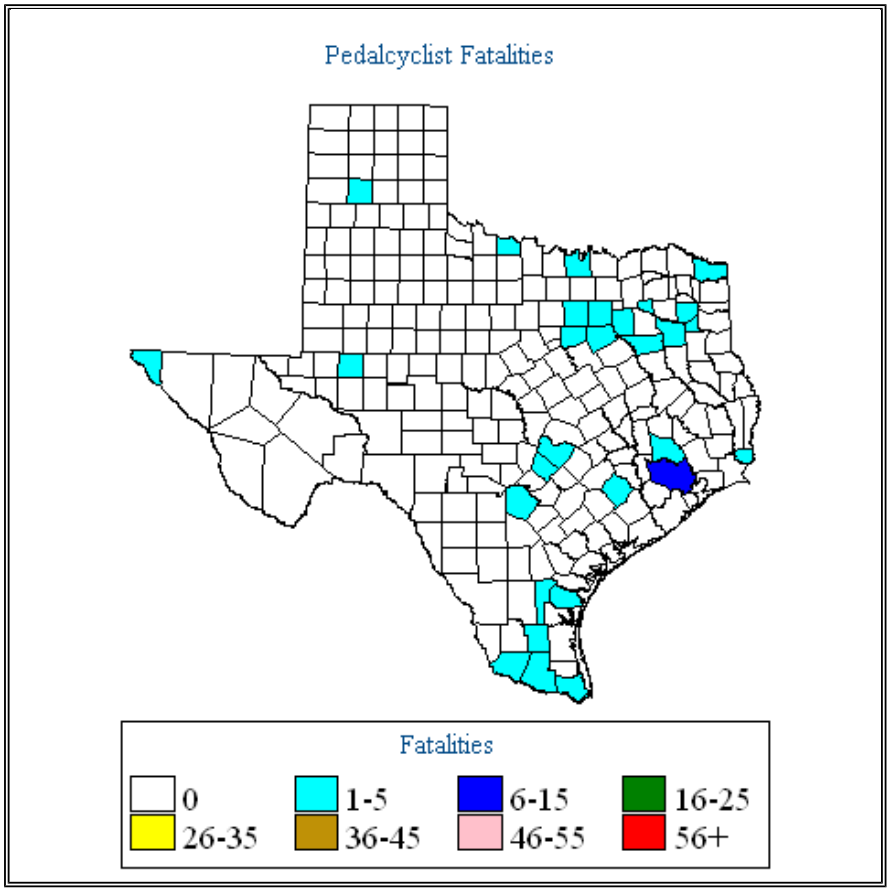


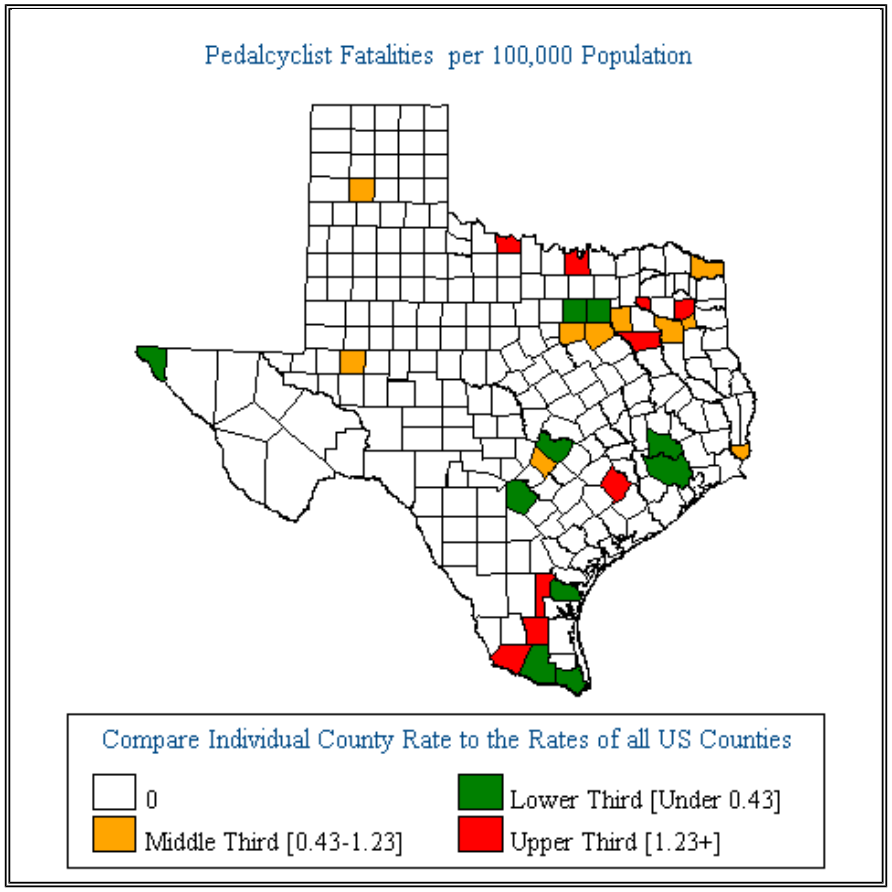


Back to Top

Pedalcyclist Fatalities

(Hover On the Map to See County Name and 2007 Fatality Count - Click on the Map to Access the Underlying Data in Report Form)


Pedalcyclist Fatalities
Fatalities
0
1-5
6-15
16-25
26-35
36-45
46-55
56+


Pedalcyclist Fatalities per 100,000 Population
Compare Individual County Rate to the Rates of all US Counties
0
Lower Third [Under 0.43]
Middle Third [0.43-1.23]
Upper Third [1.23+]

Back to Top

550/9-74-004

INFORMATION ON LEVELS OF ENVIRONMENTAL NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

MARCH 1974

PREPARED BY
THE U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF NOISE ABATEMENT AND CONTROL

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

FOREWORD

The Congress included among the requirements of the Noise Control Act of 1972 a directive that the Administrator of the Environmental Protection Agency "...develop and publish criteria with respect to noise..." and then "publish information on the levels of environmental noise the attainment and maintenance of which in defined areas under various conditions are requisite to protect the public health and welfare with an adequate margin of safety."

Not all of the scientific work that is required for basing such levels of environmental noise on precise objective factors has been completed. Some investigations are currently underway, and the need for others has been identified. These involve both special studies on various aspects of effects of noise on humans and the accumulation of additional epidemiological data. In some cases, a considerable period of time must elapse before the results will be meaningful, due to the long-term nature of the investigations involved. Nonetheless, there is information available from which extrapolations are possible and about which reasoned judgments can be made.

Given the foregoing, EPA has sought to provide information on the levels of noise requisite to protect public health and welfare with an adequate margin of safety. The information presented is based on analyses, extrapolations and evaluations of the present state of scientific knowledge. This approach is not unusual or different from that used for other environmental stressors and pollutants. As pointed out in "Air Quality Criteria"-Staff Report, Subcommittee on Air and Water Pollution, Committee on Public Works, U-S. Senate, July, 1968,

> The protection of public health is required action based upon best evidence of causation available. Sir E. B. Hill, 1962 appropriately expressed this philosophy, when he wrote: "All scientific work is incomplete-whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us freedom to lower the knowledge we already have, or to postpone the action that it appears to demand at a given time. The lessons of the past in general health and safety practices are easy to read. They are characterized by empirical decisions, by eternally persistent reappraisal of public health standards against available knowledge of causation, by consistently giving the public the benefit of the doubt, and by ever striving for improved environmental quality with the accompanying reduction in disease morbidity and mortality. The day of precise quantitative

Table of Contents
NPC Online Library

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measurement of health and welfare effects has not yet arrived. Until such measurement is possible, action must be based upon limited knowledge, guided by the principal of the enhancement of the quality of human life. Such action is based on a philosophy of preventive medicine."

The foregoing represents the approach taken by EPA in the preparation of this present document on noise. As the fund of knowledge is expanded, improved and refined, revisions of this document will occur.

The incorporation of a margin of safety in the identification of non-hazardous levels is not new. In most cases, a statistical determination is made of the lowest level at which harmful effects could occur, and then an additional correction is applied as a margin of safety. In the case of noise, the margin of safety has been developed through the application of a conservative approach at each stage of the data analysis. The cumulation of these results thus provides for the adequate margin of safety.

It should be borne in mind that this document is published to present information required by the Noise Control Act, Section 5(a)(2), and that its contents do not constitute Agency regulations or standards. Its statistical generalizations should not be applied to a particular individual. Moreover, States and localities will approach this information according to their individual needs and situations.

TABLE OF CONTENTS

Section	Page
Foreword	Foreword
INTRODUCTION	1
SUMMARY	1
LEGISLATIVE HISTORY	10
ENVIRONMENTAL NOISE EXPOSURE	17
RATIONALE FOR IDENTIFICATION OF LEVELS OF ENVIRONMENTAL NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE	17
BASIS FOR IDENTIFYING LEVELS	17
IDENTIFICATION OF MAXIMUM EXPOSURE LEVELS TO AVOID SIGNIFICANT (MEASURABLE ADVERSE EFFECTS	17
Hearing	17
Basic Considerations	17
Explanation of Identified Level for Hearing Loss	17
Adequate Margin of Safety	20
Activity Interference/Annoyance	20
Basic Considerations	20
Identified Levels of Interference	21
Adequate Margin of Safety	22
MAXIMUM EXPOSURE TO SPECIAL NOISES	24
Inaudible Sounds	24

Infrasound 24
Ultrasound 24

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section		Page
2.	Impulse Noise	25
	a. Hearing	25
	b. Non-Audible Effects of Impulsive Sound	27
	c. Sonic Booms	27
IDENTIFIED LEVELS OF ENVIRONMENTAL NOISE IN DEFINED AREAS		28
INDIVIDUAL LEVELS		28
USE OF IDENTIFIED ENVIRONMENTAL NOISE LEVELS		31
REFERENCES		33
GLOSSARY		Glossary-1
APPENDICES		
EQUIVALENT SOUND LEVEL AND ITS RELATIONSHIP TO OTHER NOISE MEASURES		A-1
LEVELS OF ENVIRONMENTAL NOISE IN THE U.S. AND TYPICAL EXPOSURE PATTERS OF INDIVIDUALS		B-1
NOISE-INDUCED HEARING LOSS		C-1
NOISE INTERFERENCE WITH HUMAN ACTIVITIES AND RESULTING OVERALL ANNOYANCE/HEALTH EFFECTS		D-1
GENERAL EFFECTS OF NOISE NOT DIRECTLY USED IN IDENTIFYING LEVELS OF NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE		E-1
EPA'S RESPONSIBILITY TO IDENTIFY SAFE LEVELS FOR OCCUPATIONAL NOISE EXPOSURE		F-1
IMPULSE NOISE AND OTHER SPECIAL NOISES		G-1

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

ABBREVIATIONS

AAOO	American Academy of Ophthalmology and Otolaryngology
AFR	Air Force Regulation
AI	Articulation Index
AMA	American Medical Association

ANSI	American National Standards Institute (formerly USASI)
ASHA	American Speech and Hearing Association
CHABA	Committee on Hearing and Bio-Acoustics
dBA	A-weighted decibel (decibels). Also written dB(A).
EPA	Environmental Protection Agency
IEC	International Electrotechnical Commission
ISO	Intentional Organization for Standardization
NIOSH	National Institute for Occupational Safety and Health
NIPTS	Noise-Induced Permanent Threshold Shift
NITTS	Noise-Induced Temporary Threshold Shift
NPL	Noise Pollution Level (also National Physical Laboratory in England)
NR	Noise Rating
OSHA	Occupational Safety and Health Act
RMS	Root Mean Square
SIL	Speech Interference Level
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

TTS_2	TTS determined 2 minutes after cessation of exposure
$L_{(t)}$	Time-varying noise level
L_A	A-weighted sound level
L_b	"Background" or "residual" sound level, A-weighted
L_d	Daytime equivalent A-weighted sound level between the hours of 0700 and 2200
L_e	Sound exposure level-the level of sound accumulated during a given event.
L_{dn}	Day-night average sound level-the 24 hour A-weighted equivalent sound level, with a 10 decibel penalty applied to nighttime levels
L_{eq}	Equivalent A-weighted sound level over a given time interval
$L_{eq(8)}$	Equivalent A-weighted sound level over eight hours
$L_{eq(24)}$	Equivalent A-weighted sound level over 24 hours
L_h	Hourly equivalent A-weighted sound level
L_n	Nighttime equivalent A-weighted sound level between the hours of 2200 and 0700
L_{max}	Maximum A-weighted sound level for a given time interval or event
L_x	X-percent sound level, the A-weighted sound level equaled or exceeded x% of time

Abbreviations-2

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section 1

INTRODUCTION

The Noise Control Act of 1972 established by statutory mandate a national policy "to promote an environment for all Americans free from noise that jeopardizes their public health and welfare". The Act provides for a division of powers between the Federal and state and local governments, in which the primary Federal responsibility is for noise source emission control, with the states and other political subdivisions retaining rights and authorities for primary responsibility to control the use of noise sources and the levels of noise to be permitted in their environment.

In order to provide adequately for the Federal emission control requirement and to insure Federal assistance and guidance to the state and localities, the Congress has established two separate but related requirements with regard to scientific information about health and welfare effects of noise. First, the Environmental Protection Agency was called upon to publish descriptive data on the effect of noise which might be expected from various levels and exposure situations. Such "criteria" statements are typical of other environmental regulatory schemes. Secondly, the Agency is required to publish "information" as to the levels of noise "requisite to protect the public health and welfare with an adequate margin of safety".

SUMMARY

The first requirement was completed in July, 1973, when the document "Public Health and Welfare Criteria for Noise" was published. The present document represents the second step. Much of the scientific material on which this document is based was drawn from the earlier "criteria document", while additional material was gathered from scientific publications and other sources, both from the U.S. and abroad. In addition, two review meetings were held which were attended by representatives of the Federal agencies as well as distinguished members of the professional community and representatives from industrial and environmental associations. The reviewers' suggestions, both oral and written, have received thoughtful attention, and their comments incorporated to the extent feasible and appropriate.

After a great deal of analysis and deliberation, levels were identified to protect public health and welfare for a large number of situations. These levels are subject to the

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

definitions and qualifications contained in the Foreword. They are summarized in Table I according to the public health and welfare effect to be protected against, the requisite sound level, and the areas which are appropriate for such protection.

In order to identify these levels, a number of considerations and hypotheses were necessary, which are listed below with reference to the appropriate appendices where they are discussed in detail.

1. In order to describe the effects of environmental noise in a simple, uniform and appropriate way, the best descriptors are the long-term equivalent A-weighted sound level (L_{eq}) and a variation with a nighttime weighting, the day-night sound level (L_{dn}) (see Appendix A).

2. To protect against hearing impairment (see Appendix C):

a. The human ear, when damaged by noise, is typically affected first at the audiometric frequency of 4000 Hz.

b. Changes in hearing level of less than 5 dB are generally not considered noticeable or significant.

c. One cannot be damaged by sounds considered normally audible, which one cannot hear.

d. Protecting the population up to a critical percentile (ranked according to decreasing ability to hear) will also protect those above that percentile, (in view of consideration 2c above) thereby protecting virtually the entire population.

3. To correct for intermittence and duration in identifying the appropriate level to protect against hearing loss (also, see Appendix C):

a. The Equal Energy Hypothesis

b. The TTS Hypothesis

4. To identify levels requisite to protect against activity interference (see Appendix D):

a. Annoyance due to noise, as measured by community surveys, is the consequence of activity interference.

b. Of the various kinds of activity interference, speech interference is the one that is most readily quantifiable.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table 1

SUMMARY OF NOISE LEVELS IDENTIFIED AS REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

(see Table 4 for a detailed description)

EFFECT	LEVEL	AREA
Hearing Loss	$L_{eq(24)}$ =< 70 dB	All areas
Outdoor activity interference and annoyance	L_{dn} =< 55 dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use
	$L_{eq(24)}$ =< 55 dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	L_{dn} =< 45 dB	Indoor residential areas
	$L_{eq(24)}$ =< 45 dB	Other indoor areas with human activities such as schools, etc.

Explanation of Table 1:

1. Detailed discussions of the terms L_{dn} and L_{eq} appear later in the document. Briefly, $L_{eq(24)}$ represents the sound energy averaged over a 24-hour period while L_{dn} represents the L_{eq} with a 10 dB nighttime weighting.

2. The hearing loss level identified here represents annual averages of the daily level over a period of forty years. (These are energy averages, not to be confused with arithmetic averages.)

3. Relationship of an $L_{eq(24)}$ of 70 dB to higher exposure levels.

EPA has determined that for purposes of hearing conservation alone, a level which is protective of that segment of the population at or below the 96th percentile will protect virtually the entire population. This level has been calculated to be an L_{eq} of 70 dB over a 24-hour day.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Given this quantity, it is possible to calculate levels which, when averaged over given durations shorter than 24 hours, result in equivalent amounts of energy. For example, the energy contained in an 8-hour exposure to 75 dB is equivalent to the energy contained in a 24-hour exposure to 70 dB. For practical purposes, the former exposure is only equivalent to the latter when the average level of the remaining 16 hours per day is negligible (I.e., no more than about 60 dB* for this case).

Since 8 hours is the typical daily work period, an $L_{eq(8)}$ of 75 is considered an appropriate level for this particular duration. In addition, the 24-hour exposure level was derived from data on 8-hour daily exposures over a 40-year working life. In planning community noise abatement activities, local governments should bear in mind the special needs of those residents who experience levels higher than
$L_{eq(8)}$ at 70 on their jobs.

These levels are not to be construed as standards as they do not take into account cost or feasibility. Nor should they be thought of as discrete numbers, since they are described in terms of energy equivalents. As specified in this document, it is EPA's judgment that the maintenance of levels of environmental noise at or below those specified above are requisite to protect the public from adverse health and welfare effects. Thus, as an individual moves from a relatively quiet home, through the transportation cycle, to a somewhat noisier occupational situation, and then back home again, his hearing will not be impaired if the daily equivalent of sound energy in his environment is no more than 70 decibels. Likewise, undue interference with activity and annoyance will not occur if outdoor levels are maintained at an energy equivalent of 55 dB and indoor levels at 45 dB. However, it is always assumed throughout that environmental levels will fluctuate, even though the identified energy equivalent is not exceeded. Likewise, human exposure to noise will vary during the day, even though the daily "dose" may correspond well to the identified levels.

Before progressing further, it would be helpful to differentiate between the terms "levels", "exposure" and "dose". As used in this document, the word "level" refers to the magnitude of sound in its physical dimension, whether or not there are humans present to hear it. "Exposure" is used to mean those sound levels which are transmitted to the human ear, and "dose" is the summed exposure over a period of time.

> * This is not to imply that 60 dB is a negligible exposure level in terms of health and welfare considerations, but rather that levels of 60 dB make a negligible contribution to the energy average of L_{eq} = 70 dB when an 8-hour exposure of 75 dB is included.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

LEGISLATIVE HISTORY

Pursuant to Section 5(a)(1), EPA developed and published on July 27, 1973, criteria

reflecting:

> ...the scientific knowledge most useful in indicating the kind and extent of all identifiable effects on the public health or welfare which may be expected from differing quantities and qualities of noise.

Under Section 5(a)(1), EPA was required to provide scientific data that, in its judgement, was most appropriate to characterize noise effects.

The present "levels information" document is required by Section 5(a)(2), which calls for EPA to publish,

> ...information on the levels of environmental noise the attainment and maintenance of which in defined areas under various conditions are requisite to protect the public health and welfare with an adequate margin of safety.

The present document, and its approach to identifying noise levels based on cumulative noise exposure is in response to the expressed intent of the Congress that the Agency develop such a methodology. The EPA Report to the President and Congress, under Title IV, PL 91-604, contained considerable material on the various schemes for measuring and -evaluating community noise response, and it contained a recommendation that the Federal government should make an assessment of the large number of varying systems, with a goal of "standardization, simplification, and interchangeability of data".

The need for such action was the subject of considerable Congressional interest in the hearings on the various noise control bills, which finally resulted in enactment of the Noise Control Act of 1972. The concept underlying this present document can be better appreciated from the following pertinent elements of the legislative history of the Act.

In the course of the hearings before the Subcommittee on Public Health and Environment of the Committee on Interstate and Foreign Commerce, House of Representatives ("Noise Control" HR Serial 92-30), the subject of the relation of physical noise measurements to human response was given considerable attention. The Committee, in reporting the bill (House of Representatives Report No. 92-842, Noise Control Act of 1972), stated the following on this matter:

> The Committee notes that most of the information relating to noise exposures was concerned with specific sources, rather than typical

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

> cumulative exposures to which urban and suburban dwellers are commonly exposed. There is a need for much greater effort to determine the magnitude and extent of such exposures and the Committee expects the EPA to promote studies on this subject and consider development of methods of uniform measurement of the impact of noise on communities.

The Committee went on in the Report to assign responsibility to the Administrator to coordinate all Federal noise programs, with a specific expression of concern over the "different systems of noise measurement" in use by the various Agencies. The following is especially important with respect to the purposes of this document:

> The Committee gave some consideration to the establishment of a Federal ambient noise standard, but rejected the concept. Establishment of a Federal ambient standard would in effect put the Federal Government in the position of establishing land use zoning requirements on the basis of noise. . . It is the Committee's view that this function is one more properly of the states and their political subdivisions, and that the Federal Government should provide guidance and leadership in undertaking that effort.

The need for EPA action on this subject under the legislative authority of the Act was presented in Agency testimony before the Subcommittee on Air and Water Pollution, Committee on Public Works, U. S. Senate. The following portion is important (Noise Pollution Serial 92-H35 U. S. Senate):

> A variety of specialized schemes have been evolved over the past years to quantify the relationship between these various conditions and their effects on humans. . . . Suffice it to say that no simplistic single number system can adequately provide for a uniform acceptable national ambient noise level value. This, however, does not preclude the undertaking of a noise abatement strategy involving the proper use of the available scientific data on the part of the Federal Government in conjunction with the state and local governments. . . . The complex nature of the considerations we have outlined above in our judgment require that the Federal Government undertake to provide the necessary information upon which to base judgments. . . .

Taking both the specific language of the Act, cited above, and the legislative history discussed in the foregoing, EPA interprets Section 5(a)(2) as directing the Agency to identify levels based only on health and welfare effects and not on technical feasibility or economic costs

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Throughout this report, the words "identified level" are used to express the result of the inquiry mandated by Section 5(a)(2). The words "goals", "standards", or "recommended levels" are not used since they are not appropriate. Neither Congress nor the Environmental Protection Agency has reached the conclusion that these identified levels should be adopted by states and localities. This is a decision which the Noise Control Act clearly leaves to the states and localities themselves.

Certain of the statutory phrases in Section 5(a)(2) need further definition and discussion in order to make clear the purpose of this document. Congress required that EPA "publish information on environmental noise" levels. This mandate is basically one of "description". Such description is to be made in the specific context of "defined areas" and "under various conditions". The phrase "in defined areas under various conditions" is used in both a geographical and an activity sense, for example, indoors in a school classroom or outdoors adjacent to an urban freeway. It also requires consideration not only of the human activity involved, but also of the nature of the noise impact.

The next and last statutory phrase in Section 5(a)(2) is most important. It is that the noise levels are to be discussed on the basis of what is requisite to protect "the public health and welfare with an adequate margin of safety". The use of the words "public health" requires a statistical approach to determine the order of magnitude of the population affected by a given level of noise. The concept of a margin of safety implies that every sector of the population which would reasonably be exposed to adverse noise levels should be included by the specifically described levels.

The phrase "health and welfare" as used herein is defined as "complete physical, mental and social well-being and not merely the absence of disease and infirmity". This definition would take into account sub-clinical and subjective responses (e.g., annoyance or other adverse psychological reactions) of the individual and the public. As will be discussed below, the available data demonstrate that the most serious clinical health and welfare effect caused

by noise is interference with the ability to hear. Thus, as used in this document, the phrase "health and welfare" will necessarily apply to those levels of noise that have been shown to interfere with the ability to hear.

The phrase "health and welfare" also includes personal comfort and well-being and the absence of mental anguish and annoyance.. In fact, a considerable portion of the data available on the "health and welfare" effects of noise is expressed in terms of annoyance. However, "annoyance" is a description of the human reaction to what is described as noise "interference"; and though annoyance appears to be statistically quantifiable, it is a subjective reaction to interference with some desired human activity. From a legal standpoint, annoyance per se is not a legal concept. Annoyance expresses the human response or results, not its cause. For this reason, the common law has never recognized annoyance as being a

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

compensable injury, in the absence of interference with a personal or property right. Of the many community surveys on noise which have been conducted, speech interference emerges as the most tangible component of annoyance, whereas sleep and other kinds of activity interference are important, but less well-defined contributors. Thus, although it is important to understand the importance of annoyance as a concept, it is the actual interference with activity on which the levels identified in this document are based.

There was a great deal of concern during the preparation of this document that the levels identified would be mistakenly interpreted as Federal noise standards. The information contained in this document should not be so interpreted. The general purpose of this document is rather to discuss environmental noise levels requisite for the protection of public health and welfare without consideration of those elements necessary to an actual

rule-making Those elements not considered in this document include economic and technological feasibility and attitudes about the desirability of undertaking an activity which produces interference effects. Instead, the levels identified here will provide State and local governments as well as the Federal Government and the private sector with an informational point of departure for the purpose of decision-making.

An even more important, but related point must be kept in mind when this document is read. The data on which the informational levels in this document are based are not "short run" or single event noises. Rather, they represent energy equivalent noise levels over a long period. For example, the exposure period which results in no more than 5 dB hearing loss at the identified level in Tables 1 and 4 is a period of forty years.

The definition of "environmental noise" is provided in Section 3(11) of the Noise Control Act of 1972. "The term 'environmental noise' means the intensity, duration, and the character of sounds from all sources." As discussed earlier, it is the intent of Congress that a simple, uniform measure of noise be developed. Not all information contained in the noise environment can be easily considered and analyzed. Instead, for practical purposes, it needs to be condensed to result in one indicator of the environmental quantity and quality of noise, which correlates with the overall long-term effects of noise on public health and welfare.

Many noise rating and evaluation procedures are available in the literature,[2,3] in voluntary national and international standards, and in commonly used engineering practices (see Appendix A). These methods and practices are well established, and it is not the purpose of this document to list them, elaborate on them, or imply a restriction of their use. Instead, the purpose is to discuss levels of environmental noise using a measure which correlates with other measures and can be applied to most situations. Based on the concept of the cumulative human exposure to environmental noise associated with the various life styles of the population, maximum long-term exposures for individuals and the corresponding environmental noise levels at various places can be identified. It is important to keep in mind that

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

the selected indicator of environment noise does not correlate uniquely with any specific effect on human health or performance. Admittedly, there are uncertainties with respect to effects in individual cases and situations. Such effects cannot be completely accounted for; thus, the necessity to employ a statistical approach.

Section 2 of the report addresses the details of characterizing and measuring human exposure to environmental noise. The equivalent sound level (L_{eq}) and a variation weighted for nighttime exposure
(L_{dn}) has been selected as the uniform descriptor. The relationship of
L_{eq} and L_{dn} to other measures in use is analyzed in Appendix A. Section 2 and Appendix B further detail the various human exposure patterns and give simplified examples of individual exposure patterns. The problem of separating occupational exposure from the balance of environmental exposure and the statutory responsibility for controlling occupational exposure is analyzed in Appendix F.

In Section 3, cause and effect relationships are summarized and presented as the basis and justification for the environmental noise levels identified in Section 4. Specifically, Section 3 develops conclusions with regard to levels at which hearing impairment and activity interference take place. These are discussed in terms of situational variation and the respective appropriateness of L_{eq} and L_{dn}. The factors providing for an adequate margin of safety and special types of noises are discussed. This section makes reference to material in Appendices C (on hearing loss), D (annoyance and activity interference) and G (special noises), which in turn rely upon material presented in EPA's document, Public Health and Welfare Criteria for Noise,[2] to which the reader is referred for more detailed information.

Section 4 discusses the levels of environmental noise requisite to protect public health and welfare for various indoor and outdoor areas in the public and private domain in terms of L_{eq} and L_{dn}. The summary table is supplemented by short explanations.

It is obvious that the practical application of the levels to the various purposes outlined earlier requires considerations of factors not discussed here. Although some guidance in this respect is included in Section 4, not all problems can be anticipated and some of these questions can only be resolved as the information contained in this report is considered and applied. Such practical experiences combined with results of further research will guide EPA in revising and updating the levels identified. In this regard, it should be recognized that certain of the levels herein might well be subject to revision when additional data are developed.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section 2

ENVIRONMENTAL NOISE EXPOSURE

A complete physical description of a sound must describe its magnitude, its frequency spectrum, and the variations of both of these parameters in time. However, one must choose between the ultimate refinement in measurement techniques and a practical approach that is no more complicated than necessary to predict the impact of noise on people. The Environmental Protection Agency's choice for the measurement of environmental noise is based on the following considerations:

1. The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.
2. The measure should correlate well with known effects of the noise environment on the individual and the public.
3. The measure should be simple, practical and accurate. In principle, it should be useful for planning as well as for enforcement or monitoring purposes.
4. The required measurement equipment, with standardized characteristics, should be commercially available.
5. The measure should be closely related to existing methods currently in use.
6. The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
7. The measure should lend itself to small, simple monitors which can be left unattended in public areas for long periods of time.

These considerations, when coupled with the physical attributes of sound that influence human response, lead EPA to the conclusion that the magnitude of sound is of most importance insofar as cumulative noise effects are concerned. Long-term average sound level, henceforth referred to as equivalent sound level (L_{eq}), is considered the best measure for the magnitude of environmental noise to fulfill the above seven requirements. Several versions of equivalent sound level will be used for identifying levels of sound in

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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specific places requisite to protect public health and welfare. These versions differ from each other primarily in the time intervals over which the sound levels are of interest, and the correction factor employed.

Equivalent A-weighted sound level is the constant sound level that, in a given situation and time period, conveys the same sound energy as the actual time-varying A-weighted sound.* The basic unit of equivalent sound levels is the decibel (see Appendix A), and the symbol for equivalent sound level is L_{eq}. Two sounds, one of which contains twice as much energy but lasts only half as long as the other, would be characterized by the same equivalent sound level; so would a sound with four times the energy lasting one fourth as long. The relation is often called the equal-energy rule. A more complete discussion of the computation of equivalent sound level, its evolution and application to environmental noise problems, and its relationship to other measures used to characterize environmental noise is provided in Appendix A.

The following caution is called to the attention of those who may prescribe levels: It should be noted that the use of equivalent sound level in measuring environmental noise will not directly exclude the existence of very high noise levels of short duration. For example, an equivalent sound level of 60 dB over a twenty-four hour day would permit sound levels of 1 10 dB but would limit them to less than one-second duration in the twenty-four hour period. Comparable relationships between maximum sound levels and their permissible durations can easily be obtained for any combination, relative to any equivalent sound level (see the charts provided in Appendix A).

Three basic situations are used in this document for the purpose of identifying levels of environmental noise:

1. Defined areas and conditions in which people are exposed to environmental noise for periods of time which are usually less than twenty-four hours, such as school classrooms, or occupational settings.
2. Defined areas and conditions in which people are exposed to environmental noise for extended periods of time, such as dwellings.
3. Total noise exposure of an individual, irrespective of area or condition.

*See Glossary for a detailed definition of terms. Note that when the term "sound level" is used throughout this document, it always implies the use of the A-weighting for frequency.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Three versions of equivalent sound level are used in this document in order to accommodate the various modes of noise exposure that occur in these situations. They are distinguished by the periods of time over which they are averaged and the way in which the averaging is done.

1. L_{eq} for an 8-hour period ($L_{eq(8)}$): This is the equivalent A-weighted sound level (in decibels relative to 20 micropascals) computed over any continuous time period of eight hours identified with the typical occupational exposure. As will be shown in later sections of this document, $L_{eq(8)}$ serves as a basis for identifying environmental noise which causes damage to hearing.
2. L_{eq} for 24-hour weighted for nighttime exposure (L_{dn}): This formula of equivalent level is used here to relate noise in residential environments to chronic annoyance by speech interference and in some part by sleep and activity interference. For these situations, where people are affected by environmental noise for extended periods of time, the natural choice of duration is the 24-hour day. Most noise environments are characterized by repetitive behavior from day to day, with some variation imposed by differences between weekday and weekend activity, as well as some seasonal variation. To account for these variations, it has been found useful to measure environmental noise in terms of the long-term yearly average of the daily levels.

In determining the daily measure of environmental noise, it is important to account for the difference in response of people in residential areas to noises that occur during sleeping hours as compared to waking hours. -During nighttime, exterior background ' noises generally drop in level from daytime values. Further, the activity of most households decreases at night, lowering the internally generated noise levels. Thus, noise events become more intrusive at night, since the increase in noise levels of the event over background noise is greater than it is during the daytime.

Methods for accounting for these differences between daytime and nighttime exposures have been developed in a number of different noise assessment methods employed around the world, (see Appendix A). In general, the method used is to characterize nighttime noise as more severe than corresponding daytime events; that is, to apply a weighting factor to noise that increases the numbers commensurate with their severity. Two approaches to identifying time periods have been employed: one divides the 24-hour day into two periods, the waking and sleeping hours, while the other divides the 24 hours into three periods--day, evening, and night. The weighting applied to the non-daytime periods differs slightly among the different countries, but most of them weight nighttime activities by about 10 dB. The evening weighting, if used, is 5 dB.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

An examination of the numerical values obtained by using two periods versus three periods per day shows that for any reasonable distribution of environmental noise levels, the two-period day and the three-period day are essentially identical; i.e., the 24-hour equivalent sound levels are equal within a few tenths of a decibel. Therefore, the simpler two-period day is used in this document, with daytime extending from 7 a.m. to 10 p.m. and nighttime extending from 10 p.m. to 7 a.m. The symbol for the 15-hour daytime equivalent sound level is L_d, the symbol for the 9-hour nighttime equivalent sound level is L_n, and the day-night weighted measure is symbolized as L_{dn}.

The L_{dn} is defined as the A-weighted average sound level in decibels (re 20 micropascals) during a 24-hour period with a 10 dB weighting applied to nighttime sound levels. Examples of the outdoor present day (1973) day-night noise level at typical locations are given in Figure 1.

3. L_{eq} for the 24-hour average sound level to which an individual is exposed ($L_{eq\ (24)}$): This situation is related to the cumulative noise exposure experienced by an individual irrespective of where, or under what situation, this exposure is received. The long-term health and welfare effects of noise on an individual are related to the cumulative noise exposure he receives over a lifetime.

Relatively little is known concerning the total effect of such lifetime exposures, but dose-effect relations have been studied for two selected situations:

a. The average long-term exposure to noise primarily in residential areas leading to annoyance reactions and complaints.

b. The long-term effects of occupational noise on hearing, with the daily exposure dose based on an eight-hour workday.

An ideal approach to identifying environmental noise levels in terms of their effect on public health and welfare would be to start by identifying the maximum noise not to be exceeded by individuals. However, the noise dose that an individual receives is a function of lifestyle. For example, exposure patterns of office workers, factory workers, housewives, and school children are quite different. Within each group the exposures will vary widely as a function of the working, recreational, and sleeping patterns of the individual. Thus, two individuals working in the same office will probably accumulate different total noise doses if they use different modes of transportation, live in different areas, and have different TV habits. Examples of these variations in noise dose for several typical life styles are provided in Appendix B. However, detailed statistical information on the distribution of actual noise doses and the relationship of these doses to long-term health and welfare effects is still missing. Therefore, a realistic approach to this problem is to identify appropriate noise levels for

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

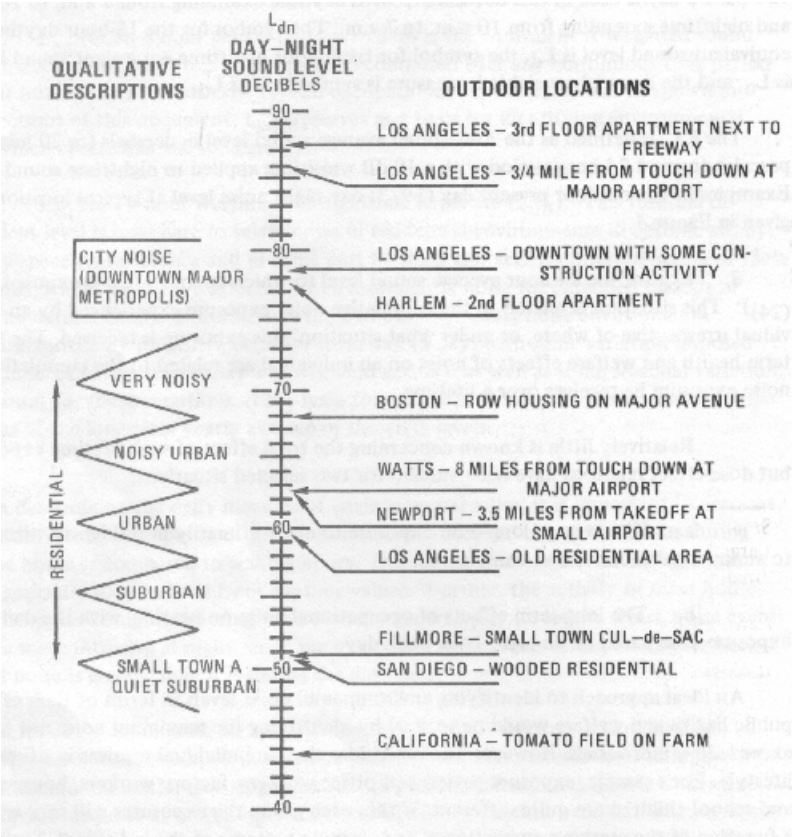

Figure 1. Outdoor Day-Night Sound Level in dB (re 20 micropascals) at Various Locations[4]

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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places occupied by people as a function of the activity in which they are engaged, including a gross estimate of typical average exposure times.

From a practical viewpoint, it is necessary to utilize the wealth of data relating to occupational noise exposure, some of it, albeit, subject to interpretation, in order to arrive at extrapolations upon which the identification of safe levels for daily (24-hour) exposures can be based.

in the following sections of this report, the various modes of exposure to noise and the human responses elicited will be discussed, leading to the identification of appropriate noise exposure levels. In order to assist the reader in associating these levels with numerical values of noise for familiar situations, typical noise levels encountered at various locations are fisted in Table 2. For further assistance, Figure 2 provides an estimate of outdoor noise levels for different residential areas.

Table 2

EQUIVALENT SOUND LEVELS IN DECIBELS NORMALLY OCCURRING INSIDE VARIOUS PLACES[6]

SPACE	L_{eq}(+)
Small Store (1-5 clerks)	60
Large Store (more than 5 clerks)	65
Small Office (1-2 desks)	58
Medium Office (3-10 desks)	63
Large Office (more than 10 desks)	67
Miscellaneous Business	63
Residences: Typical movement of people-no TV or radio Speech at 10 feet, normal voice TV listening at 10 feet, no other activity Stereo music	 40-45 55 55-60 50-70

(+) These measurements were taken over durations typical of the operation of these facilities.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

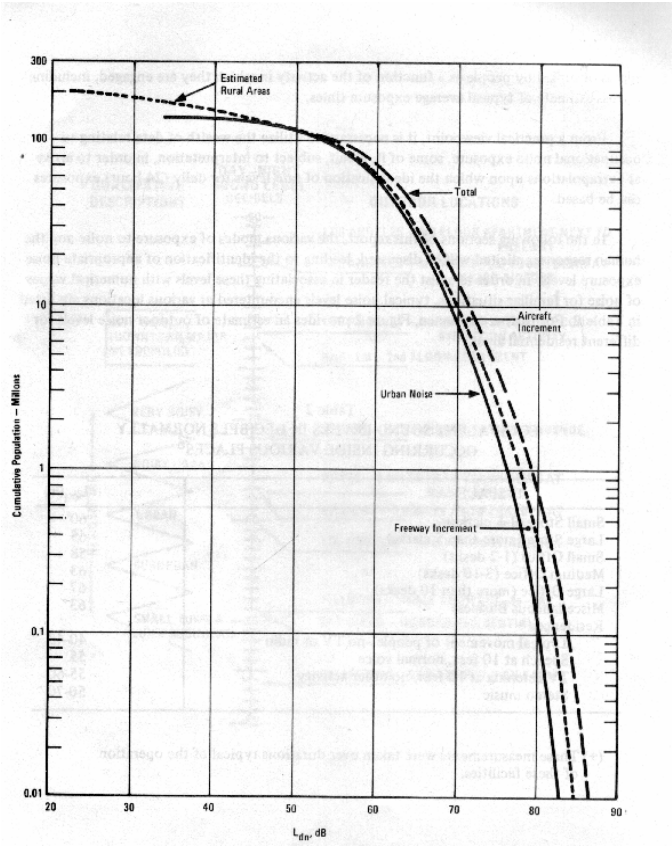

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section 3

RATIONALE FOR IDENTIFICATION OF LEVELS OF ENVIRONMENTAL NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE

BASIS FOR IDENTIFYING LEVELS

For the identification of levels to protect against the direct, disease-producing effects of noise, protection against hearing loss is the guiding consideration. At this time, there is insufficient scientific evidence that non-auditory diseases are caused by noise levels lower than those that cause noise-induced hearing loss. In the event that future research renders this conclusion invalid, this document will be revised accordingly (see Appendix E). in addition to direct disease-producing health effects, interference by noise with various human activities, such as speech-perception, sleep, and thought can lead to annoyance and indirect effects on well-being. All of these direct and indirect effects are considered here as effects on public health and welfare. It is important to note, however, the distinction between voluntary and involuntary exposures. Exposures to high levels of environmental noise are often produced or sought by the individual. For example, voluntary exposures to loud music are common. Consequently, the concept of total individual noise dose with regard to annoyance, must be applied only to involuntary exposure, although, of course, this argument does not apply to the effects of noise on hearing.

A further consideration is the physical setting in which the exposure takes place. Although there are no data to justify the assumption, it is judged here that, whereas a small amount of speech interference in most outdoor places is not detrimental to public health and welfare, the same is not true for most indoor environments. Based on this reasoning, adequate protection of the public against involuntary exposure to environmental noise requires special consideration of physical setting and the communication needs associated with each.

In the next subsection, the above rationale is applied to identify the maximum noise level consistent with an adequate margin of safety for the general classes of sound found most often in the environment. Certain special classes of sound, such as infrasound, ultrasound, and impulsive sounds are discussed in the final subsection.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

IDENTIFICATION OF MAXIMUM EXPOSURE LEVELS TO AVOID SIGNIFICANT ADVERSE EFFECTS

Hearing

Basic Considerations

The following considerations have been applied in identifying the environmental noise levels requisite to protect the hearing of the general population. For detailed derivation, justification and references, (see Appendix C).

1. The human ear, when damaged by noise, is typically affected at the 4000 Hz frequency first, and, therefore, this frequency can be considered the most noise-sensitive frequency. The averaged frequencies of 500 Hz, 1000 Hz and 2000 Hz have traditionally been employed in hearing conservation criteria because of their importance to the hearing of speech sounds. Since there is considerable evidence that frequencies above 2000 Hz are critical to the understanding of speech in lifelike situations, and since 4000 Hz is considered the most sensitive frequency, 4000 Hz has been selected as the most important frequency to be protected in this document.
2. Changes in hearing level of less than 5 dB are generally not considered noticeable or significant.
3. As individuals approach the high end of the distribution and their hearing levels are decreased, they become less affected by noise exposure. In other words, there comes a point where one cannot be damaged by sounds, which one cannot hear.
4. The noise level chosen protects against hearing loss up to and including the 96th percentile of the population, ranked according to decreasing ability to hear at 4000 Hz. Since the percentiles beyond that point are also protected (see consideration number 3), virtually the entire population is protected against incurring more than a 5 dB noise-induced permanent threshold shift (NIPTS).

Explanation of Identified Level for Hearing Loss

Taking into account the assumptions and considerations mentioned above, the 8-hour exposure level, which protects virtually the entire population from greater than 5 dB NIPTS is 73 dB, (see Figure 3). Before this value of 73 dB for 8-hour exposures can be applied to the environmental situation, however, certain correction or conversion factors must be considered. These correction factors are:

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

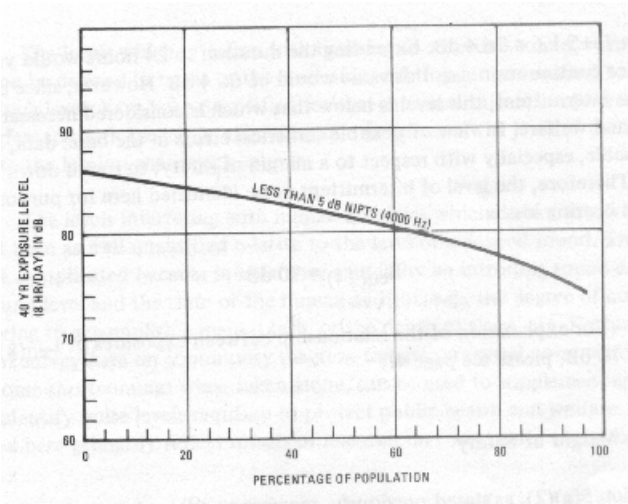

Figure 3. Percentage of Exposed Population That Will Incur No More Than 5 dB NIPTS Shown as a Function of Exposure Level. Population Ranked by Decreasing Ability to Hear at 4000 Hz. (See Appendix C for Rationale).

1. Intermittency: allows the exposure level to be 5 dB higher. This correction factor is required because most environmental noise is intermittent (not at a steady level, but below 65 dBA more than 10% of any one-hour period) and intermittent noise has been shown less damaging than continuous noise of the same L_{eq}. This correction should normally be applied except in situations that do not meet this criterion for intermittency.

2. Correction to yearly dose (250 to 365 days): requires reduction of the exposure level by 1.6 dB. All data used as the basis of Figure 3 come from occupational exposures which are only 250 days per year, whereas, this document must consider all 365 days in a year.

3. Correction to twenty-four hour day: the identified level of 73 dB is based on 8-hour daily exposures. Conversion to a 24-hour period using the equal-energy rule requires reduction of this level by 5 dB. This means that continuous sounds of a 24-hour duration must be 5 dB less intense than higher level sounds of only 8 hours duration, with the remaining 16 hours considered quiet.

Using the above corrections and conversions implies that the average 8-hour daily dose (based on a yearly average and assuming intermittent noise) should be no greater

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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than $L_{eq(8)}$ = 73+5-1.6 = 76.4 dB. Extending the duration to 24 hours would yield a value of 71.4 dB. For continuous noise, this value would be 66.4 dB. However, since environmental noise is intermittent, this level is below that which is considered necessary to protect public health and welfare. In view of possible statistical errors in the basic data, it is considered reasonable, especially with respect to a margin of safety, to round down from 71.4 dB to 70 dB. Therefore, the level of intermittent noise identified here for purposes of protection against hearing loss is:

$$L_{eq(24)} = 70 \text{ dB}$$

(For explanation of the relationship between exposures of $L_{eq(8)}$ = 75 dB and $L_{eq(24)}$ = 70 dB, please see page 4.)

Adequate Margin of Safety

Section 5(a)(2), as stated previously, requires an adequate margin of safety. The level identified to protect against hearing loss, is based on three margins of safety considerations

1. The level protects at the frequency where the ear is most sensitive (4,000 Hz).

2. It protects virtually the whole population from exceeding 5 dB NIPTS.

3. It rounds off in the direction of hearing conservation (downward) to provide in part for uncertainties in analyzing the data.

Activity Interference/Annoyance

Basic Considerations

The levels of environmental noise which interfere with human activity (see Appendix D for detailed dicussion) depend upon the activity and its contextual frame of reference; I.e., they depend upon "defined areas under various conditions". The effect of activity interference is often described in terms of annoyance. However, various non-level related factors, such as attitude towards the noise source and local conditions, may influence an individual's reaction to activity interferences.

The levels which interfere with listening to a desired sound, such as speech or music, can be defined in terms of the level of interfering sound required to mask the desired sound. Such levels have been quantified for speech communication by directly measuring the interference with speech intelligibility as a function of the level of the intruding sound, relative to the level of the speech sounds.

The levels interfering with human activities which do not involve active listening have not been as well quantified relative to the level of a desired sound. These relationships are more complicated because interference caused by an intruding sound depends upon the background level and the state of the human auditor; e.g., the degree of concentration when endeavoring to accomplish a mental task, or the depth of sleep, etc. Fortunately, there is a wealth of survey data on community reaction to environmental noise which, although subject to some shortcomings when taken alone, can be used to supplement activity interference data to identify noise levels requisite to protect public health and welfare. Thus, the levels identified here primarily reflect results of research on community reaction and speech masking.

Identified Levels for Interference

The level identified for the protection of speech communication is an L_{eq} of 45 dB within the home in order to provide for 100% intelligibility of speech sounds. Allowing for the 15 dB reduction in sound level between outdoors and indoors (which is an average amount of sound attenuation that assumes partly-open windows), this level becomes an outdoor L_{eq} of 60 dB for residential areas. For outdoor voice communication, the outdoor L_{eq} of 60 dB allows normal conversation at distances up to 2 meters with 95% sentence intelligibility.

Although speech-interference has been identified as the primary interference of noise with human activities and is one of the primary reasons for adverse community reactions to noise and long-term annoyance, the 10 dB nighttime weighting (and, hence, the term L_{dn}) is applied to give adequate weight to all of the other adverse effects on activity interference. For the same reason, a 5 dB margin of safety/ is applied to the identified outdoor level. Therefore, the outdoor L_{dn} identified for residential areas is 5 5 dB. (See Appendix E for relationship of L_{eq} to L_{dn}.)

The associated interior day-night sound level within a typical home which results from outdoors is 15 dB less, or 40 dB due to the attenuation of the structure. The expected indoor daytime level for a typical neighborhood which has an outdoor L_{dn} of 55 dB is approximately 40 dB, whereas the nighttime level is approximately 32 dB (see Figure A-7). This latter value is consistent with the limited available sleep criteria [D-5]. Additionally,

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

these indoor levels of 40 dB during the day and approximately 32 dB at night are consistent with the background levels inside the home which have been recommended by acoustical consultants as acceptable for many years, (see Table D-10).

The effects associated with an outdoor day-night sound level of 55 dB are summarized in Table 3. The summary shows that satisfactory outdoor average sentence intelligibility may be expected for normal voice conversations over distances of up to 3.5 meters; that depending on attitude and other non-level related factors, the average expected community reaction is none, although 1% may complain and 17% indicate "highly annoyed" when responding to social survey questions; and that noise is the least important factor governing attitude towards the area.

Identification of a level which is 5 dB higher than the 55 dB identified above would significantly increase the severity of the average community reaction, as well as the expected percentage of complaints and annoyance. Conversely, identification of a level 5 dB lower than the 55 dB identified above would reduce the indoor levels resulting from outdoor noise well below the typical background indoors (see Table 3) and probably make little change in annoyance since at levels below the identified level, individual attitude and life style, as well as local conditions, seem to be more important factors in controlling the resulting magnitude of annoyance or community reaction than is the absolute magnitude of the level of the intruding noise.

Accordingly, L_{dn} of 45 dB indoors and of 55 dB outdoors in residential areas are identified as the maximum levels below which no effects on public health and welfare occur due to interference with speech or other activity. These levels would also protect the vast majority of the population under most conditions against annoyance, in the absence of intrusive noises with particularly aversive content.

Adequate Margin of Safety

The outdoor environmental noise level identified in Table 3 provides a 5 dB margin of safety with respect to protecting speech communication. This is considered desirable for the indoor situation to provide for homes with less than average noise reduction or for persons speaking with less than average voice level. A higher margin of safety would be ineffective most of the time due to normal indoor activity background levels.

The 5 dB margin of safety is particularly desirable to protect the population against long-term annoyance with a higher probability than would be provided by the levels protecting indoor and outdoor speech communication capability alone. The 5 dB margin clearly shifts community response as well as subjective annoyance rating into the next lower

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table 3

SUMMARY OF HUMAN EFFECTS IN TERMS OF SPEECH COMMUNICATION, COMMUNITY REACTIONS, ANNOYANCE AND ATTITUDE TOWARD AREA ASSOCIATED WITH AN OUTDOOR DAY/NIGHT SOUND LEVEL OF 55 dB re 20 MICROPASCALS

TYPE OF EFFECT	MAGNITUDE OF EFFECT
Speech - Indoors	100% sentence intelligibility (average) with a 5 dB margin of safety
	100% sentence intelligibility (average) at 0.35 meters

Speech - Outdoors	99% sentence intelligibility (average) at 1.0 meters
	95% sentence intelligibility (average) at 3.5 meters
Average Community Reaction	None evident; 7 dB below level of significant "complaints and threats of legal action" and at least 16 dB below "vigorous action" (attitudes and other non-level related factors may affect this result)
Complaints	1% dependent on attitude and other non-level related factors
Annoyance	1% dependent on attitude and other non-level related factors
Attitudes Towards Area	Noise essentially the least important of various factors

(Derived from Appendix D)

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

response category than would be observed for the maximum level identified with respect to speech communication alone. According to present data, this margin of safety protects the vast majority of the population against long-term annoyance by noise. It would reduce environmental noise to a level where it is least important among environmental factors that influence the population's attitude toward the environment. To define an environment that eliminates any potential annoyance by noise occasionally to some part of the population appears not possible at the present state of knowledge.

MAXIMUM EXPOSURES TO SPECIAL NOISES

Inaudible Sounds

The following sounds may occur occasionally but are rarely found at levels high enough to warrant consideration in most environments, which the public occupies. For a more detailed discussion, see Appendix G.

Infrasound

Frequencies below 16 Hz are referred to as infrasonic frequencies and are not audible. Complaints associated with extremely high levels of infrasound can resemble a mild stress reaction and bizarre auditory sensations, such as pulsating and fluttering. Exposure to high levels of infrasound is rare for most individuals. Nevertheless, on the basis of existing data[2,7], the threshold of these effects is approximately 120 dB SPL (I -16 Hz). Since little information exists with respect to duration of exposure and its effects, and also since many of the data are derived from research in which audible frequencies were present in some amount, these results should be interpreted with caution.

Ultrasound

Ultrasonic frequencies are those above 20,000 Hz and are also generally inaudible. The effects of exposure to high intensity ultrasound is reported by some to be a general stress response. Exposure to high levels of ultrasound does not occur frequently. The threshold of any effects for ultrasound is 105 dB SPL[2]. Again, many of these data may include frequencies within the audible range, and results are, therefore, to be interpreted cautiously.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Impulse Noise

It is difficult to identify a single-number limit requisite to protect against adverse effects from impulse noise because it is essential to take into account the circumstances of exposure, the type of impulse, the effective duration, and the number of daily exposures, (see Appendix G),

Hearing

Review of temporary threshold shift data leads to the conclusion that the impulse noise limit requisite to prevent more than a 5 dB permanent hearing loss at 4000 Hz after 10 years of daily exposure is a peak sound pressure level (SPL) of 145 dB. This level applies in the case of isolated events, irrespective of the type, duration, or incidence at the ear. However, for duration of 25 microseconds or less, a peak level of 167 dB SPL would produce the same effect, (see Figure 4).

1. Duration Correction: When the duration of the impulse is less than 25

micro-seconds, no correction for duration is necessary. For durations exceeding 25 microseconds, the level should be reduced in accordance with the "modified CHABA limit" shown in Figure 4 and Figure G-I of Appendix G.

2. Correction for Number of Impulses:

(More detailed information is provided in Figure 4.)

Furthermore, if the average interval between repeated impulses is between 1 and 10 seconds, a third correction factor of -5 dB is applied. Thus, to prevent hearing loss due to impulse noise, the identified level is 145 dB SPL, or 167 dB peak SPL for impulses less than 25 microseconds, for one impulse daily. For longer durations or more frequent exposures, the equivalent levels are as shown in Figure 4.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

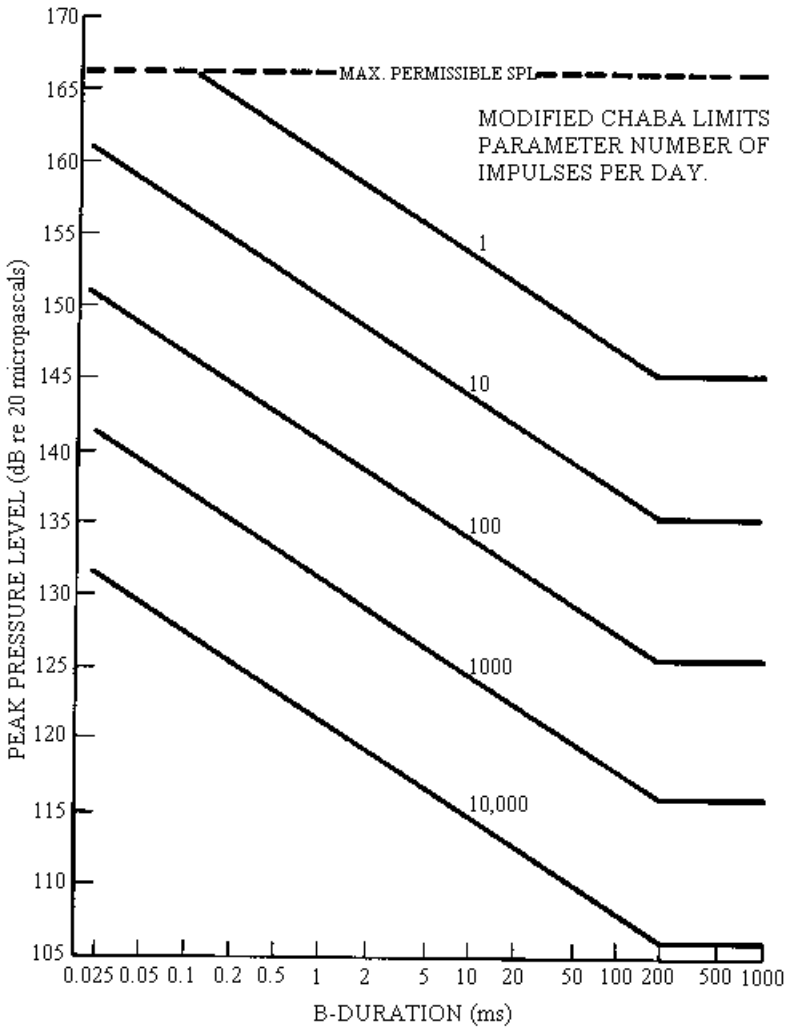

Figure 4. Set of Modified CHABA Limits for Daily Exposure to Impulse Noises Having B-Duration in the Range 25Microseconds to 1 Second. (Parameter: number (N) of impulses per daily exposure. Criterion: NIPTS not to exceed 5 dB at 4 kHz in more than 10% people.)

(Derived from Appendix G)

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Non-Auditory Effects of Impulsive Sound

Impulses exceeding the background noise by more than about 10 dB are potentially startling or sleep-disturbing- If repeated, impulsive noises can be disturbing to some individuals if heard at all (they Tray be at levels below the average noise levels). However, no threshold level can be identified at this time ; nor is there any clear evidence or documentation of any permanent effect on public health and welfare.

Sonic Booms

Little or no public annoyance is expected to result from one sonic boom during the daytime below the level of 35.91 pascals (0.75 pounds per square foot) as measured on the ground (see Appendix G). The same low probability of annoyance is expected to occur for more than one boom per day if the peak level of each boom is no greater than :

$$\text{Peak Level} = \frac{35.91}{\sqrt{N}} \text{ pascals}$$

Where N is the number of booms. This value is in agreement with the equal energy concept.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Section 4

IDENTIFIED LEVELS OF ENVIRONMENTAL NOISE IN DEFINED AREAS

IDENTIFIED LEVELS

Table 4 identifies the levels requisite to protect public health and welfare with an adequate margin of safety for both activity interference and hearing loss. The table classifies the vyrious areas according to the primary activities that are most likely to occur in each. The following is a brief description of each classification and a discussion of the basis for the identified levels in Table 4. For a more detailed discussion of hearing loss and activity interference, see Appendices C and D.

1.Residential areas are areas where human beings live, including apartments, seasonal residences, and mobile homes, as well as year-round residences. A quiet environment is necessary in both urban and rural residential areas in order to prevent activity interference and annoyance, and to permit the hearing mechanism to recuperate if it is exposed to higher levels of noise during other periods of the day.

An indoor L_{dn} of 45 dB will permit speech communication in the home, while an outdoor L_{dn} not exceeding 55 dB will permit normal speech communication at approximately three meters. Maintenance of this identified outdoor level will provide an indoor L_{dn} of approximately 40 dB with windows partly open for ventilation. The nighttime portion of this L_{dn} will be approximately 32 dB, which should in most cases, protect against sleep interference. An $L_{eq(24)}$ of 70 dB is identified as protecting against damage to hearing.

Although there is a separate category for commercial areas, commercial living accommodations such as hotels, motels, cottages, and inns should be included in the residential category since these are places where people sleep and sometimes spend extended periods of time.

2. Commercial areas include retail and financial service facilities, offices, and miscellaneous commercial services. They do not include warehouses, manufacturing plants, and other industrial facilities, which are included in the industrial classification. Although a level for activity interference has not been identified here (see footnote a), suggestions for such levels will be found in Table D-10 of Appendix D. On the other hand, a level of $L_{eq(24)}$ of 70 dB has been identified to protect against hearing loss.

Table of Contents
NPC Online Library
NPC Law Library

Table 4

YEARLY AVERAGE* EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

	Measure	Indoor			Outdoor		
		Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)	Activity Interference	Hearing Loss Consideration	To Protect Against Both Effects (b)
Residential with Outside Space and Farm Residences	L_{dn}	45	-	45	55	-	55
	$L_{eq(24)}$	-	70	-	-	70	-
Residential with No Outside Space	L_{dn}	45	-	45	-	-	-
	$L_{eq(24)}$	-	70	-	-	-	-
Commercial	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq(24)}$	(a)	70	(a)	-	-	-
Industrial	$L_{eq(24)(d)}$	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55	-	55
	$L_{eq(24)}$	-	70	-	-	70	
Educational	$L_{eq(24)}$	45	-	45	55	-	55
	$L_{eq(24)(d)}$	-	70	-	-	70	
Recreational Areas	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Unpopulated Land	$L_{eq(24)}$	-	-	-	(a)	70	70(c)

Code:

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (See Figure D-2 for noise levels as a function of distance which allow satisfactory communication.)

b. Based on lowest level.

c. Based only on hearing loss.

d. An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

Note: Explanation of identified level for hearing loss: The exposure period which results in hearing loss at the identified level is a period of 40 years.

*Refers to energy rather than arithmetic averages.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

3. Transportation facilities are included so as to protect individuals using public and private transportation. Included within this classification are commercial and private transportation vehicles. Identification of a level to protect against hearing loss is the only criterion used at this time, although levels lower than a L_{eq} of 70 dB are often desirable for effective speech communication. However, because of the great variety of conditions inside transportation vehicles, and because of the desirability of speech privacy in certain situations, a level based on activity interference cannot be identified for all modes of transportation at this time.

4. Industrial areas include such facilities as manufacturing plants, warehouses, storage areas, distribution facilities, and mining operations. Only a level for hearing loss is identified due to the lack of data with respect to annoyance and activity interference. Where the noise exposure is intermittent, a $L_{eq(24)}$ of 70 dB is identified as the maximum level for protection of hearing from industrial exposure to intermittent noise. For 8-hour exposures, an $L_{eq(8)}$ of 75 dB is considered appropriate so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average.

5. Hospital areas include the immediate neighborhood of the hospital as well as its interior. A quiet environment is required in hospital areas because of the importance of sleep and adequate rest to the recovery of patients. The maintenance of a noise level not exceeding a L_{dn} of 45 dB in the indoor hospital environment is deemed adequate to prevent activity interference and annoyance. An outdoor L_{dn} of 55 dB should be adequate to protect patients who spend some time outside, as well as insuring an adequately protective indoor level. A $L_{eq(24)}$ of 70 dB is identified to prevent hearing loss.

6. Educational areas include classrooms, auditoriums, and schools in general, and those grounds not used for athletics. The principal consideration in the education environment is the prevention of interference with activities, particularly speech communication. An indoor noise level not exceeding $L_{eq(24)}$ of 45 dB is identified as adequate to facilitate thought and communication. Since teaching is occasionally conducted outside the classroom, an outdoor $L_{eq(24)}$ of 55 dB is identified as the maximum level to prevent activity interference. To protect against hearing loss a $L_{eq(24)}$ of 70 dB is identified for both indoor and outdoor environments. As in the industrial situation, eight hours is generally the amount of time spent in educational facilities. Therefore an $L_{eq(8)}$ of 75 dB is considered appropriate to protect against hearing loss, so long as the exposure over the remaining 16 hours is low enough to result in a negligible contribution to the 24-hour average.

7. Recreational areas include facilities where noise exposure is voluntary. Included within this classification are nightclubs, theaters, stadiums, racetracks, beaches, amusement parks, and athletic fields. Since sound exposure in such areas is usually voluntary, there is seldom any interference with the desired activity. Consequently, the chief consideration is

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

the protection of hearing. An $L_{eq(24)}$ of 70 dB is therefore identified for intermittent noise in order to prevent hearing damage.

8. Farm and general unpopulated land primarily includes agricultural property used for the production of crops or livestock. For such areas, the primary considerations are the protection of human hearing and the prevention of adverse effects on domestic and wild animals. Protection of hearing requires that an individual's exposure to intermittent noise does not exceed $L_{eq(24)}$ of 70 dB. A separate level for the exposure of animals is not identified due to the lack of data indicating that hearing damage risk for animals is substantially different from that of humans. The unpopulated areas include wilderness areas, parks, game refuges, and other areas that are set aside to provide enjoyment of the outdoors. Although quiet is not always of paramount importance in such areas, many individuals enjoy the special qualities of serenity and tranquility found in natural areas. At this time it is not possible to identify an appropriate level to prevent activity interference and annoyance. However, when it becomes possible to set such a level, a clear distinction should be made between natural and man-

made noise.

USE OF IDENTIFIED ENVIRONMENTAL NOISE LEVELS

One of the purposes of this document is to provide a basis for judgment by states and local governments as a basis for setting standards. In doing so the information contained in this document must be utilized along with other relevant factors. These factors include the balance between costs and benefits associated with setting standards at particular noise levels, the nature of the existing or projected noise problems in any particular area, the local aspirations and the means available to control environmental noise.

In order to bring these factors together, states, local governments and the public will need to evaluate in a systematic manner the following:

1. The magnitude of existing or projected noise environments in defined areas as compared with the various levels identified in this document.

2. The community expectations for noise abatement with respect to existing or projected conditions.

3. The affected elements of the public and the degree of impact of present or projected environmental noise levels.

4. The noise sources not controlled by Federal regulations that cause local noise problems.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

5. Methods available to attack environmental noise problems (use limitations, source control through noise emission standards, compatible land use planning, etc.).

6. The costs inherent in reducing noise to certain levels and benefits achieved by doing so.

7. The availability of technology to achieve the desired noise reduction.

The levels of environmental noise identified in this report provide the basis for assessing the effectiveness of any noise abatement program. These noise levels are identified irrespective of the nature of any individual noise source. One of the primary purposes of identifying environmental noise levels is to provide a basis by which noise source emission regulations, human exposure standards, land use planning, zoning, and building codes may be assessed, as to the degree with which they protect the public health and welfare with respect to noise. Such regulatory action must consider technical feasibility and economic reasonableness, the scale of time over which results can be expected, and the specific problems of enforcement. In the process of balancing these conflicting elements, the public health and welfare consequence of any specific decision can be determined by comparing the resultant noise environment against the environmental noise levels identified in this report.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

GLOSSARY

AUDIBLE RANGE (OF FREQUENCY) (AUDIO-FREQUENCY RANGE). The frequency range 16 Hz to 20,000 Hz (20 kHz). Note.- This is conventionally taken to be the normal frequency range of human hearing.

AUDIOMETER. An instrument for measuring the threshold or sensitivity of hearing.

AUDIOMETRY. The measurement of hearing.

BROAD-BAND NOISE. Noise whose energy is distributed over a broad range of frequency (generally speaking, more than one octave).

CONTINUOUS NOISE. On-going noise whose intensity remains at a measurable level (which may vary) without interruption over an indefinite period or a specified period of time.

DEAFNESS. 100 percent impairment of hearing associated with an organic condition.

Note: This is defined for medical and cognate purposes as the hearing threshold level for speech or the average hearing threshold level for pure tones of 500, 1000 and 2000 Hz in excess of 92 dB.

EQUIVALENT SOUND LEVEL. The level of a constant sound which, in a given situation and time period, has the same sound energy as does a time-varying sound. Technically, equivalent sound level is the level of the time-weighted, mean square, A-weighted sound pressure. The time interval over which the measurement is taken should always be specified.

ENVIRONMENTAL NOISE. By Sec 3(11) of the Noise Control Act of 1972, the term "environmental noise" means the intensity, duration, and character of sounds from all sources.

HEARING LEVEL. The difference in sound pressure level between the threshold sound for a person (or the median value or the average for a group) and the reference sound pressure level defining the ASA standard audiometric threshold (ASA: 1951).

Note: The term is now commonly used to mean hearing threshold level (qv). Units: decibels.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

HEARING LOSS. Impairment of auditory sensitivity: an elevation of a hearing threshold level. 1

HEARING THRESHOLD LEVEL. The amount by which the threshold of hearing for an ear (or the average for a group) exceeds the standard audiometric reference zero (ISO, 1964; ANSI, 1969). Units: decibels.

IMPULSE NOISE (IMPULSIVE NOISE). Noise of short duration (typically, less than one second) especially of high intensity, abrupt onset and rapid decay, and often rapidly changing spectral composition. Note.- Impulse noise is characteristically associated with such sources as explosions, impacts, the discharge of firearms, the passage of super-sonic aircraft (sonic boom) and many industrial processes.

INFRASONIC. Having a frequency below the audible range for man (customarily deemed to cut off at 16 Hz).

INTERMITTENT NOISE. Fluctuating noise whose level falls once or more times to low or unmeasurable values during an exposure. In this document intermittent noise will mean noise that is below 65 dBA at least 10% of any I hour period.

NOISE EXPOSURE. The cumulative acoustic stimulation reaching the ear of the person over a specified period of time (e.g., a work shift, a day, a working life, or a lifetime).

NOISE HAZARD (HAZARDOUS NOISE). Acoustic stimulation of the ear which is likely to produce noise-induced permanent threshold shift in some of a population.

NOISE-INDUCED PERMANENT THRESHOLD SHIFT (NIPTS). Permanent threshold shift caused by noise exposure, corrected for the effect of aging (presbyacusis).

NOISE-INDUCED TEMPORARY THRESHOLD SHIFT (NITTS). Temporary threshold shift caused by noise exposure.

NON-VOLUNTARY EXPOSURE TO ENVIRONMENTAL NOISE. The exposure of an individual to sound which (1) the individual cannot avoid or (2) the sound serves no useful purpose (e.g., the exposure to traffic noise or exposure to noise from a lawn mower).

OCCUPATIONAL EXPOSURE TO ENVIRONMENTAL NOISE. The noise exposure of an individual defined under Pi. 91-596, Occupational Safety and Health Act of 1970.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

OTOLOGICALLY NORMAL. Enjoying normal health and freedom from all clinical manifestations and' history of ear disease or injury; and having a patent (wax-free) external auditory meatus.

PEAK SOUND PRESSURE. The absolute maximum value (magnitude) of the instantaneous sound pressure occurring in a specified period of time. PRESBYACUSIS (PRESBYCUSIS). Hearing loss, chiefly involving the higher audiometric frequencies above 3000 Hz, ascribed to advancing age. RISK. That percentage of a population whose hearing level, as a result of a given influence, exceeds the specified value, minus that percentage whose hearing level would have exceeded the specified value in the absence of that influence, other factors remaining the same. Note.- The influence may be noise, age, disease, or a combination of factors.

SOUND LEVEL. The quantity in decibels measured by a sound level meter satisfying the requirements of American National Standards Specification for Sound Level Meters Sl.4-1971. Sound level is the frequency-weighted sound pressure level obtained with the standardized dynamic characteristic "fast" or "slow" and weighting A, B, or C; unless indicated otherwise, the A-weighting is understood. The unit of any sound level is the decibel, having the unit symbol dB.

SOUND EXPOSURE LEVEL. The level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of one second.

SOUND PRESSURE LEVEL. In decibels, 20 times the logarithm to the base ten of the ratio of a sound pressure to the reference sound pressure of 20 micropascals (20 micronewtons per square meter). In the absence of any modifier, the level is understood to be that of a mean-square pressure.

SPEECH DISCRIMINATION. The ability to distinguish and understand speech signals.

TEMPORARY THRESHOLD SHIFT (TTS). That component of threshold shift which shows a progressive reduction with the passage of time after the apparent cause has been

removed.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

THRESHOLD OF HEARING (AUDIBILITY). The minimum effective sound pressure level of an acoustic signal capable of exciting the sensation of hearing in a specified proportion of trials in prescribed conditions of listening. ULTRASONIC. Having a frequency above the audible range for man (conventionally deemed to cut off at 20,000 Hz).

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

APPENDIX A

EQUIVALENT SOUND LEVEL AND ITS RELATIONSHIP TO OTHER NOISE MEASURES

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Appendix A

EQUIVALENT SOUND LEVEL AND ITS RELATIONSHIP TO OTHER NOISE MEASURES

DEVELOPMENT OF EQUIVALENT SOUND LEVEL

The accumulated evidence of research on human response to sound indicates clearly that the magnitude of sound as a function of frequency and time are basic indicators of human response to sound. These factors are reviewed here, and it is concluded that it is not necessary to invent a new concept for the purpose of identifying levels of environmental noise.

Magnitude

Sound is a pressure fluctuation in the air; the magnitude of the sound describes the physical sound in the air; (loudness, on the other hand, refers to how people judge the sound when they hear it). Magnitude is stated in terms of the amplitude of the pressure fluctuation. The range of magnitude between the faintest audible sound and the loudest sound the ear can withstand is so enormous (a ratio of about 1,000,000 to I) that it would be very awkward to express sound pressure fluctuations directly in pressure units. Instead, this range is "compressed" by expressing the sound pressure on a logarithmic scale. Thus, sound is described in terms of the sound pressure level (SPL), which is ten times the common logarithm of the ratio of the square of the sound pressure in question to the square of a (stated or understood) reference sound pressure, almost always 20 micropascals. * Or, in mathematical terms, sound pressure level L expressed in decibels is:

$$L = 10 \log \left(\frac{p^2}{p_o^2} \right)$$

where p is the pressure fluctuation and p_o is the reference pressure.

*One pascal = one newton per square meter.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Frequency Characteristics of Noise

The response of human beings to sound depends strongly on the frequency of sound. In general, people are less sensitive to sounds of low frequency, such as 100 hertz (Hz)*, than to sounds at 1000 Hz; also at high frequencies such as 8000 Hz, sensitivity decreases. Two basic approaches to compensate for this difference in response to different frequencies are (1) to segment the sound pressure spectrum into a series of contiguous frequency bands by electrical filters so as to display the distribution of sound energy over the frequency range; or (2) to apply a weighting to the overall spectrum in such a way that the sounds at various frequencies are weighted in much the same way as the human ear hears them.

In the first approach a sound is segmented into sound pressure levels in 24 different frequency bands, which may be used to calculate an estimate of the "loudness" or "noisiness" sensation which the sound may be expected to cause. This form of analysis into bands is usually employed when detailed engineering studies of noise sources are required. It is much too complicated for monitoring noise exposure.

To perform such analysis, especially for time-varying sounds, requires a very complex set of equipment. Fortunately, much of this complication can be avoided by using approach 2, i.e., by the use of a special electrical weighting network in the measurement system. This network weights the contributions of sounds of different frequency so that the response of the average human ear is simulated. Each frequency of the noise then contributes to the total reading by an amount approximately proportional to the subjective response associated with that frequency. Measurement of the overall noise with a sound level meter incorporating such a weighting network yields a single number, such as the A-weighted Sound Level, or simply A-level, in decibels. For zoning and monitoring purposes, this marks an enormous simplification. For this reason, the A-level has been adopted in large-scale surveys of city noise coming from a variety of sources. It is widely accepted as an adequate way to deal with the ear's differing sensitivity to sounds of different frequency, including assessment of noise with respect to its potential for causing hearing loss. Despite the fact that more detailed analysis is frequently required for engineering noise control, the results of such noise control are adequately described by the simple measure of sound level.

One difficulty in the use of a weighted sound level is that psychoacoustic judgment data indicate that effects of tonal components are sometimes not adequately accounted for by a simple sound level. Some current ratings attempt to correct for tonal components;

*Hertz is the international standard unit of frequency, until recently called cycles per second; it refers to the number of pressure fluctuations per second in the sound wave.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

for example, in the present aircraft noise certification procedures, "Noise Standards: Aircraft Type Certification," FAR Part 36, the presence of tones is identified by a complex frequency analysis procedure. If the tones protrude above the adjacent random noise spectrum, a penalty is applied beyond the direct calculation of perceived noise level alone. However, the complexities involved in accounting for tones exceed practicable limits for monitoring noise in the community or other defined areas. Consequently, EPA concludes that,

where appropriate, standards for new products will address the problem of tones in such a way that manufacturers will be encouraged to minimize them and, thus, ultimately they will not be a significant factor in environmental noise.

With respect to both simplicity and adequacy for characterizing human response, a frequency-weighted sound level should be used for the evaluation of environmental noise. Several frequency weightings have been proposed for general use in the assessment of response to noise, differing primarily in the way sounds at frequencies between 1000 and 4000 Hz are evaluated. The A-weighting, standardized in current sound level meter specifications, has been widely used for transportation and community noise description. [A-1] For many noises the A-weighted sound level has been found to correlate as well with human response as more complex measures, such as the calculated perceived noise level or the loudness level derived from spectral analysis. [A-2] However, psychoacoustic research indicates that, at least for some noise signals, a different frequency weighting which increases the sensitivity to the 1000-4000 Hz region is more reliable. [A-3] various forms of this alternative weighting function have been proposed; they will be referred to here as the type "D-weightings". None of these alternative weightings has progressed in acceptance to the point where a standard has been approved for commercially available instrumentation.

It is concluded that a frequency-weighted sound pressure level is the most reasonable choice for describing the magnitude of environmental noise. In order to use available standardized instrumentation for direct measurement, the A frequency weighting is the only suitable choice at this time. * The indication that a type D-weighting might ultimately be more suitable than the A-weighting for evaluating the integrated effects of noise on people suggests that at such time as a type D-weighting becomes standardized and available in commercial instrumentation, its value as the weighting for environmental noise should be considered to determine if a change from the A-weighting is warranted.

Time Characteristics Of Noise

The dominant characteristic of environmental noise is that it is not steady-at any particular location the noise usually fluctuates considerably, from quiet at one instant to loud *All sound levels in this report are A-weighted sound pressure levels in decibels with reference to 20 micropascals.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

the next. Thus, one cannot simply say that the noise level at a given location or that experienced by a person at that location is "so many decibels" unless a suitable method is used to average the time-varying levels. To describe the noise completely requires a statistical approach. Consequently, one should consider the noise *exposure*, which is received by an individual moving through different noisy spaces. This exposure is related to the whole time-varying pattern of sound levels. Such a noise exposure can be described by the cumulative distribution of sound levels, showing exactly what percent of the whole observation period each level was exceeded.

A complete description of the noise exposure would distinguish between daytime, evening and nighttime, and between weekday and weekend noise level distributions. It would also give distributions to show the difference between winter and summer, fair weather and foul.

The practical difficulty with the statistical methodology is that it yields a large number of statistical parameters for each measuring location; and even if these were averaged over more or less homogeneous neighborhoods, it still would require a large set of numbers to characterize the noise exposure in that neighborhood. It is literally impossible for any such array of numbers to be effectively used either in an enforcement context or to map existing noise exposure baselines.

It is essential, therefore, to look further for a suitable single-number measure of noise exposure. Note that the ultimate goal is to characterize with reasonable accuracy the noise exposure of whole neighborhoods (within which there may actually exist a fairly wide range of noise levels), so as to prevent extremes of noise exposure at any given time, and to detect unfavorable trends in the future noise climate. For these purposes, pinpoint accuracy and masses of data for each location are not required, and may even be a hindrance, since one could fail to see the forest for the trees.

A number of methodologies for combining the noise from both individual events and quasi-steady state sources into measures of cumulative noise exposure have been developed in this country and in other developed nations, e.g., Noise Exposure Forecast, Composite Noise Rating, Community Noise Equivalent Level, Noise and Number Index, and Noise Pollution Level. Many of these methodologies, while differing in technical detail (primarily in the unit of measure for individual noise events), are conceptually similar and correlate fairly well with each other. Further, using any one of these methodologies, the relationships between cumulative noise exposure and community annoyance[A-4,A-5] also correlate fairly well. It is therefore unnecessary to invent a new concept for the purpose of identifying levels of environmental noise. Rather, it is possible to select a consistent measure that is based on existing scientific and practical experience and methodology and which meets the criteria presented in Section 2 of the body of this document. Accordingly, the Environmental Protection

Agency has selected the Equivalent Sound Level (L_{eq}) for the purpose of identifying levels of environmental noise.

A-4

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Equivalent Sound Level is formulated in terms of the equivalent *steady* noise level which in a stated period of time would contain the same noise energy as the time-varying noise during the same time period.

The mathematical definition of L_{eq} for an interval defined as occupying the period between two points in time t_1 and t_2 is:

$$L_{eq} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p^2(t)}{p_o^2} \, dt \right]$$

where p(t) is the time varying sound pressure and p_o is a reference pressure taken as 20 micropascals.

The concept of Equivalent Sound Level was developed in both the United States and Germany over a period of years. Equivalent level was used in the 1957 original Air Force Planning Guide for noise from aircraft operations, [A-6] as well as in the 1955 report [A-7] on criteria for short-time exposure of personnel to high intensity jet aircraft noise, which was the forerunner of the 1956 Air Force Regulation [A-8] on "Hazardous Noise Exposure". A more recent application is the development of CNEL (Community Noise Equivalent Level) measure for describing the noise environment of airports. This measure, contained in the Noise Standards, Title 4, Subchapter 6, of the California Administrative Code (1970) is based upon a summation of L_{eq} over a 24-hour period with weightings for exposure during evening and night periods

The Equivalent Noise Level was introduced in 1965 in Germany as a rating specifically to evaluate the impact of aircraft noise upon the neighbors of airports. [A-9] It was almost immediately recognized in Austria as appropriate for evaluating the impact of street traffic noise in dwellings [A-10] and in schoolrooms. [A-11] It has been embodied in the National Test Standards of both East Germany [A-12] and West Germany [A-13] for rating the subjective effects of fluctuating noises of all kinds, such as from street and road traffic, rail traffic, canal and river ship traffic, aircraft, industrial operations (including the noise from individual machines), sports stadiums, playgrounds, etc. It is the rating used in both the East German [A-14] and West German [A-15] standard guidelines for city planning. It was the rating that proved to correlate best with subjective response in the large Swedish traffic noise survey of 1966-67. It has come into such general use in Sweden for rating noise exposure that commercial instrumentation is currently available for measuring L_{eq} directly; the lightweight unit is small enough to be held in one hand and can be operated either from batteries or an electrical outlet. [A-16]

A-5

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

The concept of representing a fluctuating noise level in terms of a steady noise having the same energy content is widespread in recent research, as shown in the EPA report on Public Health and Welfare Criteria for Noise (1973). There is evidence that it accurately describes the onset and progress of permanent noise-induced hearing loss, [A-17] and substantial evidence to show that it applies to annoyance in various circumstances. [A-18] The concept is borne out by Pearsons' experiments [A-19] on the trade-off of level and duration of a noisy event and by numerous investigations of the trade-off between number of events and noise level in aircraft flyovers. [A-20] Indeed, the Composite Noise Rating [A-21] is a formulation of L_{eq}, modified

by corrections for day vs. night operations. The concept is embodied in several recommendations of the International Standards Organization, for assessing the noise from aircraft,[A-22] industrial noise as it affects residences,[A-23] and hearing conservation in factories.[A-24]

COMPUTATION OF EQUIVALENT SOUND LEVEL

In many applications, it is useful to have analytic expressions for the equivalent sound level L_{eq} in terms of simple parameters of the time-varying noise signal so that the integral does not have to be computed. It is often sufficiently accurate to approximate a complicated time-varying noise level with simple time patterns. For example, industrial noise can often be considered in terms of a specified noise level that is either on or off as a function of time. Similarly, individual aircraft or motor vehicle noise events can be considered to exhibit triangular time patterns that occur intermittently during a period of observation. (Assuming an aircraft flyover time pattern to be triangular in shape instead of shaped like a "normal distribution function" introduces an error of, at worst, 0.8 dB). Other noise histories can often be approximated with trapezoidal time pattern shapes.

The following sections provide explicit analytic expressions for estimating the equivalent sound level in terms of such time patterns, and graphic design charts are presented for easy application to practical problems. Most of the design charts are expressed in terms of the amount that the level (L) of the new noise source exceeds an existing background noise level, L_b. This background noise may be considered as the equivalent sound level that existed before the introduction of the new noise, provided that its fluctuation is small relative to the maximum value of the new noise level.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Constant Level Noise - Steady or Intermittent

The L_{eq} for a continuous noise having a constant value of L_{max} is

$L_{eq} = L_{max}$, which is derived from

$$L_{eq} = 10 \log \frac{1}{T} \int_0^T 10^{\left(\frac{L_{max}}{10}\right)} dt = L_{max} \quad \text{(dB)} \qquad \text{(Eq. A-3)}$$

When L_{max} is intermittently on during the period T for a fraction x of the total time, with a background noise level L_b present for the time fraction (1-x), L_{eq} is given by:

$$L_{eq} = L_b + 10 \log \left[(1-x) + x \left(10^{\frac{\Delta L}{10}}\right) \right] \quad \text{(dB)} \qquad \text{(Eq. A-4)}$$

Where $\Delta L = L_{max} - L_b$. This pattern is illustrated and the expression is plotted in Figure A-1 for various values of L and x. For values of L_{max} that are 10dB or more higher than L_b, L_{eq} is approximated quite accurately by:

$L_{eq} = L_{max} + 10 \log x$ (dB) (Eq. A-5)

Except in extreme cases as noted on the graph. An hourly equivalent sound level (L_h) can be computed from the last equation with the integration time (T) equal to 3600 seconds (1 hour). An example of the relationship between L_h and L_{max} as a function of pulse duration t for L_{max} - L_b greater than 10 is given in Figure A-2. These results may be described by:

$L_h = L_{max} + 10 \log t - 35.6$ (dB) (Eq. A-6)

for $(L_{max} - L_b) > 10$

Triangular Time Patterns

The equivalent sound level for a single triangular time pattern having a maximum value of L_{max} and rising from a background level of L_b is given by:

$$L_{eq} = L_b + 10 \log \left[\frac{10}{2.3\Delta L} \left(10^{\frac{\Delta L}{10}} - 1\right) \right] \quad \text{(dB)} \qquad \text{(Eq. A-7)}$$

A-7

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

where again $\Delta L = L_{max} - L_b$. When ΔL is greater than 10 dB, the following approximation for L_{eq} is quite accurate:

$$L_{eq} = L_{max} - 10 \log \frac{2.3\Delta L}{10} \quad \text{(dB)} \qquad \text{(Eq. A-8)}$$

Except in extreme cases as noted on the graph. The value of L_{eq} for a series on n identical triangular time patterns having maximum levels of L_{max} is given by:

$$L_{eq} = L_b + 10 \log \left[1 + \frac{n\tau}{T} \left(\frac{10^{\frac{\Delta L}{10}} - 1}{2.3} - \frac{\Delta L}{10} \right) \right] \quad \text{(dB)} \qquad \text{(Eq. A-9)}$$

Where the duration between (L_{max} - 10 dB) points* is τ seconds, the background level is L_b, and the total time period is T. (See Figure A-3). A design chart for determining L_{eq} for different values of (DELTA)L as a function of N*t* per hour is provided in Figure A-3.

*The duration for which the noise level is within 10 dB of L_{max}; also called the "10 dB down" duration.

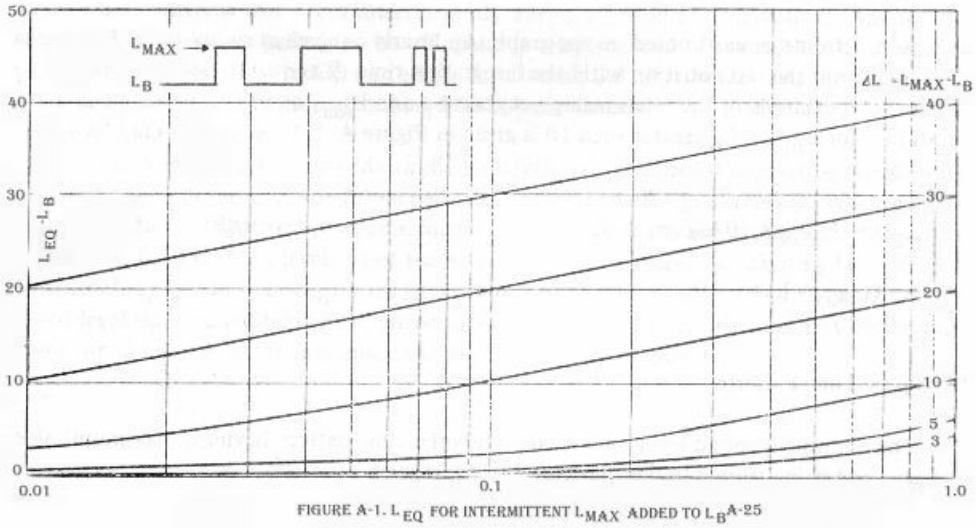

Figure A-1. L_{eq} for Intermittent L_{max} Added to L_b[A-25]

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Figure A-2. Hourly Equivalent Sound Level as a Function of Pulse Duration and Maximum Sou

nd Level for One Pulse per Hour of a Succession of n Shorter Pulses Having a Total of the Indicated Duration During One Hour. (Background sound level less than 30 dB). (Derived from Equation A-5).

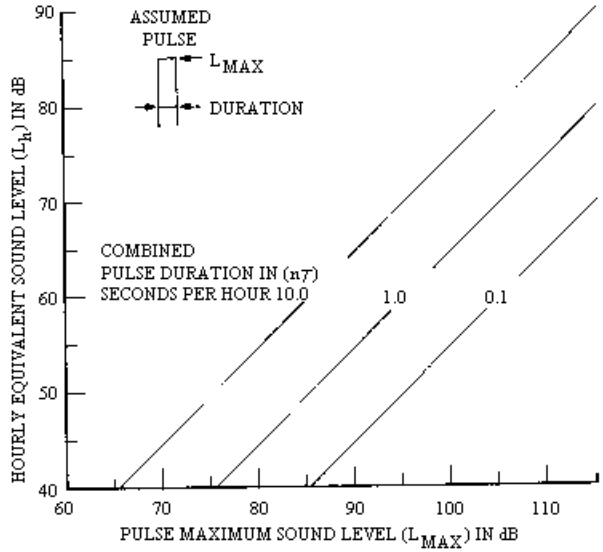

Figure A-3. L_{eq} for a Repeated Series of n Triangular Signals Overlaid on a Background Level of L_b, dB and τ= Duration at (L_{max}-10) dB in Seconds.[A-25] (See Equation A-9).

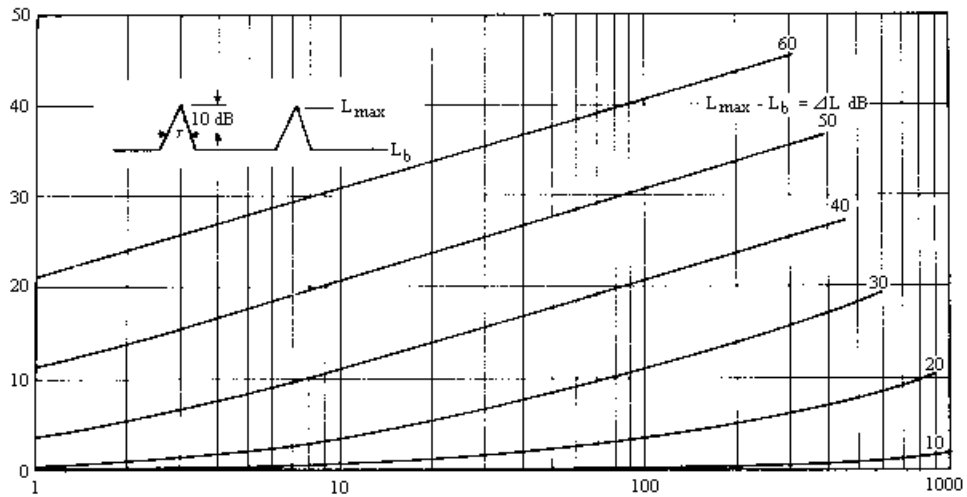

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

An approximation to equation (A-9) for cases where L is greater than 10 dB is given by:

$$L_{eq} = L_{max} + 10 \log \frac{n\tau}{2.3T}$$

This equation yields fairly good results except in extreme cases as can be seen in the graph.

Trapezoidal Time Patterns

The equivalent sound level, Leq, for a trapezoidal time pattern having maximum level of L_{max}, background level L_b, duration between (L_{max} -10 dB) points of τ and duration at L_{max} of § is given by

$$L_{eq} = 10 \log \left(\frac{1}{\frac{(\tau - \xi)\,\Delta L}{10} + \frac{\xi}{2}} \right) \left[10^{\frac{L_b}{10}} \left(\frac{(\tau - \xi)}{2.3} \right) \left(10^{\frac{\Delta L}{10}} - 1 \right) + 10^{\frac{L_{max}}{10}} \left(\frac{\xi}{2} \right) \right] \quad \text{(dB)} \qquad \text{(Eq. A-11)}$$

The approximation to L_{eq} when (DELTA)L is greater than 10 dB, for § small compared to τ, is:

$$L_{eq} = L_{max} - \frac{2.3\ \Delta L}{10} + 10 \log \xi \quad \text{(dB)} \qquad \text{(Eq. A-12)}$$

This equation yields adequate results except in extreme cases as noted on the graph. Noting the similarity between equations (A-5) (A-8), and (A-12), one can approximate L_{eq} for a series of trapezoidal pulses by suitably combining design data from Figure A-1 and A-3. That is, the approximate L_{eq} for a series of n trapezoidal pulses is obtained by the Leq value for triangular pulses plus an additional term equal to 10 log n, e.g.,

$$L_{eq} = L_{max} + 10 \log \frac{n\tau}{2.3T} + 10 \log n\xi \quad \text{(dB)} \qquad \text{(Eq. A-13)}$$

Time Patterns of Noise Having a Normal Statistical Distribution

Many cases of noise exposures in communities have a noise level distribution that may be closely approximated by a normal statistical distribution. The equivalent sound level for the distribution can be described simply in terms of its mean value, which for a normal

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

distributions is L_{50}, and the standard deviation (s) of the noise level distribution:

$L_{eq} = L_{50} + 0.115\ s^2$ (dB) (Eq. A-14)

A design chart showing the difference between L_{eq} and L_{50} as a function of the standard deviation is provided in Figure A-4.

It is often of interest to know which percentile level of a normal distribution is equal in magnitude to the Leq value for the distribution. A chart providing this relationship as a function of the standard deviation of the distribution is provided in Figure A-5.

Various noise criteria in use for highway noise are expressed in terms of the L_{10} value. For a normal distribution, the L_{10} value is specified in terms of the median and the standard deviation by the expression $L_{10} = L_{50} + 1.28\ s$. The difference between L_{10} and L_{eq} is given by L_{10}-$L_{eq} = 1.28\ s - 0.115\ s.^2$ This expression is plotted as a function of s in Figure A-6.

It should be noted that traffic noise does not always yield a normal distribution of noise levels, so caution should be used in determining exact differences between L_{eq} and L_{10}.

RELATIONSHIPS BETWEEN DAYTIME AND NIGHTTIME EQUIVALENT SOUND LEVELS

The day-night sound level (L_{dn}) was defined as the equivalent A-weighted sound level during a 24-hour time period with a 10 decibel weighting applied to the equivalent sound level during the nighttime hours of 10 p.m. to 7 a.m. This may be expressed by the equation:

$$L_{dn} = 10 \log \frac{1}{24} \left[\left[15(10^{L_d/10}) + 9(10^{\frac{L_n+10}{10}}) \right] \right] \quad \text{(dB)} \qquad \text{(Eq. A-15)}$$

where

$L_d = L_{eq}$ for the daytime (0700-2200 hours)

and

$L_n = L_{eq}$ for the nighttime (2200-0700 hours).

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

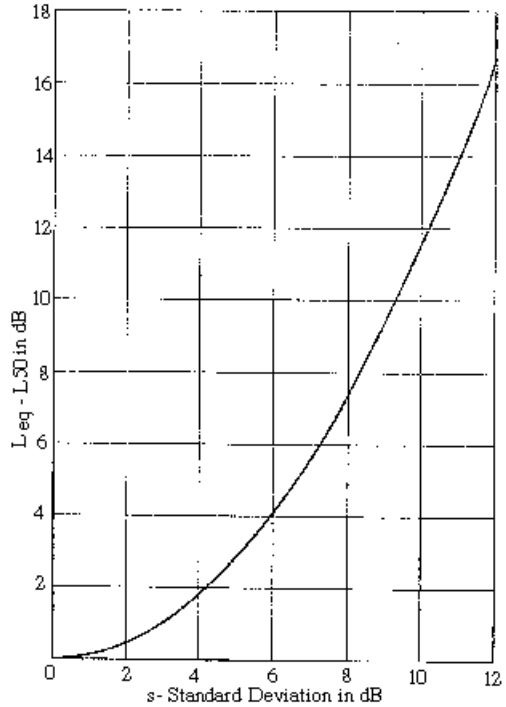

Figure A-4. Difference Between L_{eq} and L_{50} for a Normal Distributions Having Standard Deviation of s.[A-25] (See Equation A-14).

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

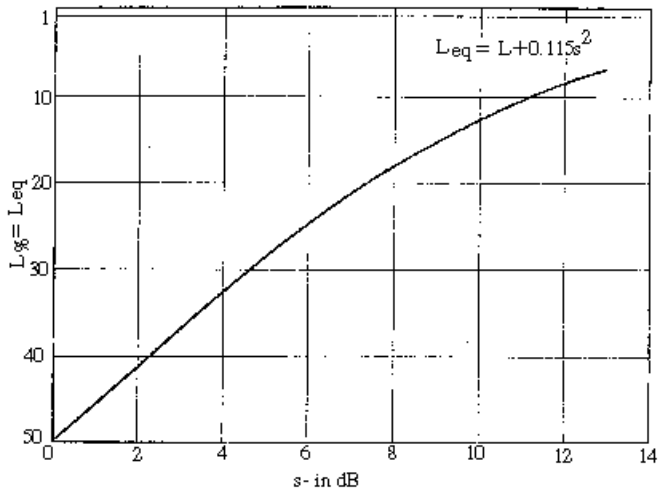

Figure A-5. Percentile of a Normal Distribution that is Equal to L_{eq}[A-25] (See Equation A-14 and Probability Function).

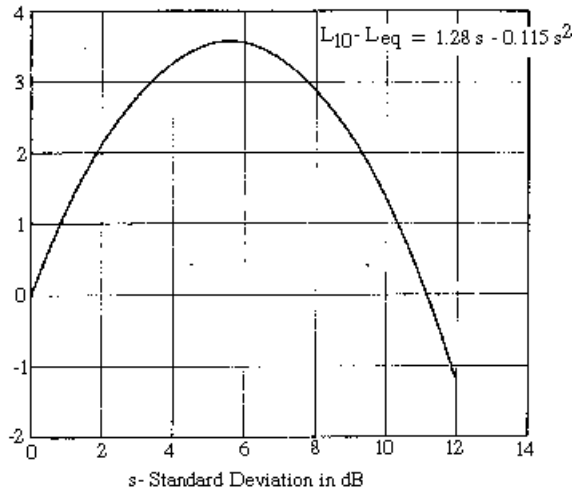

Figure A-6. Difference Between L_{10} and L_{eq} for a Normal Distribution[A-25]

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

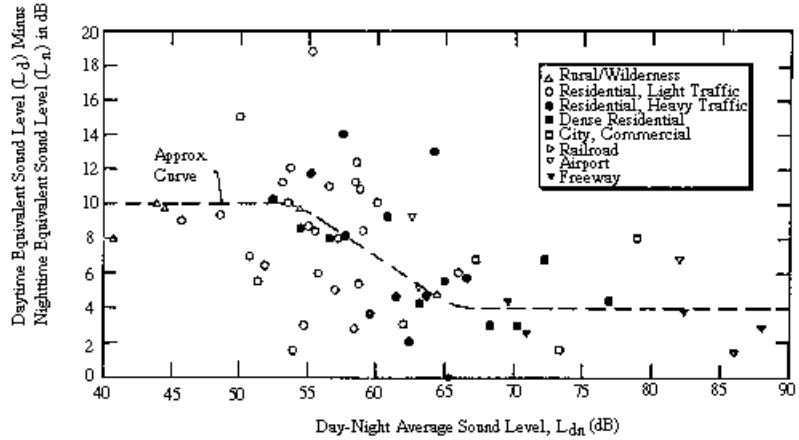

Figure A-7. Comparison of the Difference Between Day and Night Values of the Equivalent Sound Level with the Day-Night Average Sound Level, L_{dn} [A-25]

The effect of the weighting may perhaps be more clearly visualized if it is thought of as a method that makes all levels measured at night 10 dB higher than they actually are. Thus, as an example, if the noise level is a constant 70 dB all day and a constant 60 dB all night, L_{dn} would be 70 dB.

Methods for accounting for the differences in interference or annoyance between daytime/nighttime exposures have been employed in a number of different noise assessment methods around the world. [A-5] The weightings applied to the nondaytime periods differ slightly among the different countries but most of them weight night activities on the order of 10 dB; [A-24] the evening weighting if used is 5 dB. The choice of 10 dB for the nighttime weighting made in Section 2 was predicated on its extensive prior usage, together with an examination of the diurnal variation in environmental noise. This variation is best illustrated by comparing the difference between L_d and L_n as a function of L_{dn} over the range of environmental noise situations.

Data from 63 sets of measurements were available in sufficient detail that such a comparison could be made. These data are plotted in Figure A-7. The data span noise environments ranging from the quiet of a wilderness area to the noisiest of airport and highway environments. It can be seen that, at the lowest levels (L_{dn} around 40-55 dB),

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

L_d is the controlling element in determining L_{dn}, because the nighttime noise level is so much lower than that in the daytime. At higher L_{dn} levels (65-90 dB), the values of L_n are not much lower than those for L_d; thus, because of the 10 dB nighttime weighting, L_n will control the value of L_{dn}.

The choice of the 10 dB nighttime weighting in the computation of L_{dn} has the following effect: In low noise level environments below L_{dn} of approximately 55 dB, the natural drop in L_n values is approximately 10 dB, so that L_d and L_n contribute about equally to L_{dn}. However, in high noise environments, the night noise levels drop relatively little from their daytime values. In these environments, the nighttime weighting applies pressure towards a round-the-clock reduction in noise levels if the noise criteria are to be met.

The effect of a nighttime weighting can also be studied indirectly by examining the correlation between noise measure and observed community response in the 55 community reaction cases presented in the EPA report to Congress of 1971.A-1 The data have a standard deviation of 3.3 dB when a 10 dB nighttime penalty is applied, but the correlation worsens (std, dev. = 4.0 dB) when no nighttime penalty is applied. However, little difference was observed among values of the weighting ranging between 8 and 12 dB. Consequently, the community reaction data support a weighting of the order of 10 dB but they cannot be utilized for determining a finer gradation. Neither do the data support "three-period" in preference to "two-period" days in assigning nondaytime noise penalties.

COMPARISON OF DAY-NIGHT SOUND LEVEL WITH OTHER MEASURES OF NOISE USED BY FEDERAL AGENCIES

The following subsections compare the day-night sound level with three measures utilized for airport noise, CNR, NEF, and CNEL, the HUD Guideline Interim Standards and the Federal Highway Administration standards:

Comparison of L_{dn} with Composite Noise Rating (CNR), Noise Exposure Forecast (NEF), and Community Noise Equivalent Level (CNEL)

CNR, NEF, and CNEL are all currently used expressions for weighted, accumulated noise exposure. Each is intended to sum a series of noise while weighting the sound pressure level for frequency and then adding appropriate nighttime weightings. The older ratings, CNR and NEF, are expressed in terms of maximum Perceived Noise Level and Effective Perceived Noise Level, respectively; each considers a day-night period identical to L_{dn}.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

The measure CNEL itself is essentially the same as L_{dn} except for the method of treating nighttime noises. In CNEL, the 24-hour period is broken into three periods: day (0700-1900), evening (1900-2200), and night (2200-0700). Weightings of 5 dB are applied to the evening period and 10 dB to the night period. For most time distributions of aircraft noise around airports, the numerical difference between a two-period and three-period day are not significant, being of the order of several tenths of a decibel at most.

One additional difference between these four similar measures is the method of applying the nighttime weighting and the magnitude of the weighting. The original CNR concept, carried forward in the NEF, weighted the nighttime exposure by 10 dB. Because of the difference in total duration of the day and night periods, 15 and 9 hours respectively, a specific noise level at night receives a weighting of 10 + 10 log (15/9), or approximately 12 dB in a reckoning of total exposure. Given the choice of weighting either exposure or level, it is simpler to weight level directly, particularly when actual noise monitoring is eventually considered.

The following paragraphs describe the method utilized to calculate CNR, NEF, and CNEL, as applied principally to aircraft sounds, together with the analogous method for calculating L_{dn}:

Composite Noise Rating Method (CNR)

The original method for evaluating land use around civil airports is the composite noise rating (CNR). It is still in wide use by the Federal Aviation Administration and the Department of Defense for evaluating land use around airfields (Civil Engineering Planning and Programming, "Land Use Planning with Respect to Aircraft Noise," AFM 86-5, TM 5-365, NAVDOCKS P-98, October 1, 1964). This noise exposure scale may be expressed as follows:

$$CNR = \overline{PNL}_{max} + 10 \log N_f - 12$$

(Eq. A-16)

The single event noise level is expressed (without a duration or tone correction) as simply the maximum perceived noise level (PNL_{max}) in PNdB.

The noise exposure in a community is specified in terms of the composite noise rating (CNR), which can be expressed approximately as follows:

$\overline{PNL}$

= approximate energy mean maximum perceived noise level (PNL) at a given point

A-16

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

$N_f = (N_d + 16.7\ N_n)$, where N_d and N_f the numbers of daytime and nighttime events, respectively.

The constant (-12) is an arbitrary constant, and the factor 16.7 is used to weight the nighttime exposure in the 9-hour night period on a 10 to 1 basis with the daytime exposure in the 15-hour daytime period.

Noise Exposure Forecast (NEF)

This method, currently in wide use, for making noise exposure forecasts utilizes a perceived noise level scale with additional corrections for the presence of pure tones. Two time periods are used to weight the number of flights (Galloway, W.J. and Bishop, D.E., "Noise Exposure Forecasts: Evolution Evaluation, Extensions and Land Use Interpretations," FAA-NO-70-9, August 1970.

The single event noise level is defined in terms of effective perceived noise level (EPNL) which can be specified approximately by:

$$EPNL = PNL_{max} + \log \frac{\Delta t_{10}}{20} + F, \text{(EPNdB)}$$

(Eq. A-17)

where

PNL_{max} = maximum perceived noise level during flyover, in PNdB,

Δt_{10}

= "10 dB down" duration of the perceived noise level time history, in seconds,

and

F = pure tone correction. Typically, F = 0 to + 3 dB

Community noise exposure is then specified by the Noise Exposure Forecast (NEF). For a given runway and one or two dominant aircraft types, the total NEF for both daytime and nighttime operations can be expressed approximately as:

$$NEF = \overline{EPNL} + 10 \log N_f - 88.0$$

(Eq. A-18)

where

$\overline{EPNL}$ = energy mean value of EPNL for each single event at the point in question

N_f = same as defined for CNR

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Community Noise Equivalent Level (CNEL)

The following simplified expressions are derived from the exact definitions in the report, "Supporting Information for the Adopted Noise Regulations for California Airports." They can be used to estimate values of CNEL where one type of aircraft and one flight path dominate the noise exposure level.

Single event noise is specified by the single event noise exposure level (SENEL) in dB and can be closely approximated by:

$SENEL = NL_{max} + 10 \log_{10} \tau/2$ (dB) (Eq. A-19)

where

NL_{max} = maximum noise level as observed on the A scale of a standard sound level meter

and

τ = duration measured between the points of (L_{max} - 10) in seconds. The effective duration is equal to the "energy" of the integrated noise level (NL), divided by the maximum noise level, NL_{max}, when both are expressed in terms of antilogs. It is approximately 1/2 of the 10 dB down duration.

A measure of the average integrated noise level over one hour is also utilized in the proposed standard. This is the hourly noise level (in dB), defined as:

$$HNL = \overline{SENEL} + 10 \log n - 35.6$$

= (dB) Eq. A-20)

where

SENEL = energy mean value of SENEL for each single event,

and

n = number of flights per hour

The total noise exposure for a day is specified by the community noise equivalent level (CNEL) in dB, and may be expressed as:

$$CNEL = \overline{SENEL} + 10 \log N_c - 49.4$$

= (dB) (Eq. A-21)

---

where

$Nc = (N_d + 3N_e + 10\ N_n)$

or

$$= (12\bar{n}_d + 9\bar{n}_e + 90\bar{n}_n)$$

$N_d, \bar{n}_d$ = total number and average number per hour, respectively, of flights during the period 0700 to 1900

$N_e, \bar{n}_e$ = total number and average number per hour, respectively, of flights during the period 1900 to 2200

and

$N_n, \bar{n}_n$ = total number and average number per hour, respectively, of flights during the period 2200 to 0700

Day-Night Sound Level (L_{dn})

The following simplified expressions are useful for estimating the value of L_{dn} for a series of single event noises which are of sufficient magnitude relative to the background noise that they control L_{dn}:

Single event noise is specified by the sound exposure level (L_{ex}) measured during a single event. It can be closely approximated by:

$$L_{ex} \cong L_{max} + 10 \log_{10} \tau/2$$

(dB) (Eq. A-22)

Where

L_{max} = maximum sound level as observed on the A scale of a standard sound level meter on the slow time characteristic

and

τ = duration measured between the points of (L_{max} - 10) in seconds

The day-night sound level may be estimated by:

$$L_{dn} = \overline{L_{ex}} + 10 \log N - 49.4$$

(dB) (Eq. A-23)

where

$\overline{L_{ex}}$ = the energy mean value of the single event L_{ex} values

$N = (N_d + 10N_n)$

A-19

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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or

N_d = total number of events during the period 0700 to 2200

and

Nn = total number of events during the period 2200 to 0700

There is no fixed relationship between L_{dn} or CNEL and CNR or NEF because of the differences between the A-level and PNL frequency weightings and the allowance for duration, as well as the minor differences in approach to day-night considerations. Nevertheless, one may translate from one measure to another by the following approximate relationship:

(Eq. A-24)

$$L_{dn} \doteq CNEL \doteq NEF + 35 \doteq CNR - 35$$

For most circumstances involving aircraft flyover noise, these relationships are valid within about a ± 3 dB tolerance.

Comparison of Leq with HUD Guideline Interim Standards (1390.2 Chg. 1)

The interim HUD standards for outdoor noise are specified for all noise sources, other than aircraft, in terms of A-weighted sound level not to be exceeded more than a certain fraction of the day. Aircraft noise criteria are stated in terms of NEF or CNR.

The HUD exposure criteria for residences near airports are "normally acceptable" if NEF 30 or CNR 100 is not exceeded. A "discretionary acceptable" category permits exposures up to NEF 40 or CNR 115.

For all other noise sources, the HUD criteria specify a series of acceptable, discretionary, and unacceptable exposures. Since these specifications are similar to points on a cumulative statistical description of noise levels, it is of interest to compare the HUD criteria with L_{eq} for different situations. For discussion purposes, consider the boundary between the categories "discretionary-normally acceptable" and "unacceptable."

The first criterion defining this boundary allows A-weighted noise levels to exceed 65 dB up to 8 hours per 24 hours, while the second criterion states that noise levels exceeding 80 dB

should not exceed 60 minutes per 24 hours. These two values may be used to specify two limit points on a cumulative distribution function, L33.3 = 65 dB and L4.2 = 80 dB. The relationship between Leq and the HUD criteria may then be examined for different types of distribution functions, restricting the shape of the distribution only so that it does not exceed these two limit points.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

First consider two cases of a normal distribution of noise levels, comparable to vehicle traffic noise. For the first case, assume a distribution with quite narrow variance so placed on the graph that the 65 dB point is not exceeded (see Figure A-8). For this curve, to the nearest decibel, L_{50} = 64 dB, and the corresponding standard deviation (arbitrarily chosen small) is 2.3 dB. The resulting L_{eq} is equal to 64.6 dB.

Now consider a normal distribution with the widest permissible variance (the curve marked Maximum Variance in Figure A-8); if the variance were any greater, the distribution would violate HUD's requirement that the level not exceed 80 dB for more than 60 minutes per 24 hours. This distribution, to the nearest decibel, has L_{50} = 60 dB, L_{10} = 74 dB and a standard deviation of approximately 11 dB. The resultant L_{eq} = 74 dB, is almost 10 dB higher than for the previous case. Both curves meet HUD's interim standards.

Next, consider a series of intermittent high level noises, superposed on a typical urban/ suburban background noise level, such that 80 dB is not exceeded more than 60 minutes per 24 hours, say 4%. Choosing a series of repeated triangular-shaped time signals of 90 dB maximum sound level will produce an L_{eq} value of 72.4 dB without exceeding an L_4 value of 80 dB.

However, one can allow the maximum level to increase indefinitely provided L_4 remains at 80 dB or less. The limiting case is that of a square-shaped time pattern, switched on and off. In this instance, if the total "on-time" is 4% or less, the value of L_{eq} is equal to L_{max} - 14 dB, and both L_{max} and L_{eq} can increase without limit and still remain acceptable within the HUD interim standards. Maximum A-levels for an aircraft can be as high as 110 dB, which would permit L_{eq} values of 96 to be obtained without exceeding the L_4 limit of 80 dB.

It is clear that no unique relationship can be specified between the HUD non-airport standards and L_{eq}. Values of L_{eq} ranging up to 95 dB can be found in compliance with the HUD outdoor noise standard depending on the time distribution of noise levels considered. Even if the nighttime penalty were applied to L_{eq} to yield L_{dn} there would still be no unique relation with the HUD standards.

Comparison of L^{eq} with Federal Highway Administration Noise Standards, PPM 90-2, February 8, 1973

The primary criteria of PPM 90-2 are that L_{10} for noise levels inside people-occupied spaces shall not exceed 55 dB, or for sensitive outdoor spaces "-in which serenity and quiet are of extraordinary significance-," 60 dB.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

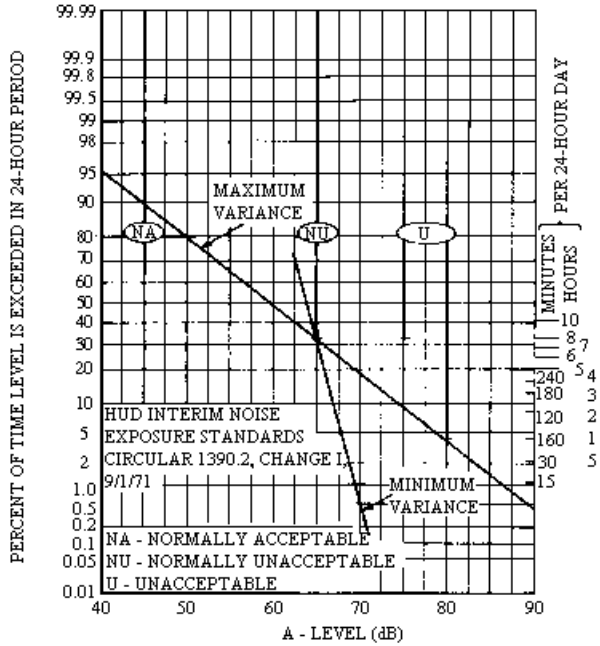

Figure A-8. Permissible Normal Distribution of L_{eq} Under HUD Standards[A-25]

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Highway noise often has a random distribution of noise level, the distribution function being approximately normal in many instances. In this case, the relationship between L_{eq} and L_{10} is given by the expression:

Where s is the standard deviation of the noise level distribution. The difference between L_{10} and L_{eq} for normal distribution of sound level is plotted in Figure A-6. It can be noted that Leq = L_{10} -2 dB within +2 dB, for s ranging from 0 to 11 dB. Highway noise rarely has a standard deviation of 11 dB; 2 to 5 dB is more typical.

Thus, setting L_{10} at 60 dB for highway noise impacting a sensitive outdoor space, we find that a L_{eq} value of 60 -2 = 58 +2 dB would meet the most sensitive FHWA criterion.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
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NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

APPENDIX B

LEVELS OF ENVIRONMENTAL NOISE IN THE U.S. AND TYPICAL EXPOSURE PATTERNS OF INDIVIDUALS

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

APPENDIX B

LEVELS OF ENVIRONMENTAL NOISE IN THE U.S. AND TYPICAL EXPOSURE PATTERNS OF INDIVIDUALS

Levels of environmental noise for various defined areas are provided for both the outdoor and indoor situation. Examples are then used to illustrate how an individual's daily dose accumulates from the exposure to such noise levels.

LEVELS OF ENVIRONMENTAL NOISE

Outdoor Sound Levels

The range of day-night sound levels (L_{dn}) in the United States is very large, extending from the region of 20-30 dB estimated for a quiet* wilderness area to the region of 80-90 dB in the most noisy urban areas, and to still higher values within the property boundaries of some governmental, industrial and commercial areas which are not accessible to the general public. The measured range of values of day-night sound levels outside dwelling units extends from 44 dB on a farm to 88.8 dB outside an apartment located adjacent to a freeway. Some examples of these data are summarized in Figure B-1.

The dominant sources for outdoor noise in urban residential areas are motor vehicles, aircraft and voices. This conclusion has been found in several studies, including a recent survey [B-1] of 1200 people which is summarized in Table B-1.

The cumulative number of people estimated to reside in areas where the day-night sound level exceeds various values is given in Table B-2. In the areas where the L_{dn} exceeds 60 dB, the proportion between the number of people residing in areas where the outdoor noise environment is dominated by aircraft and those residing in areas where motor vehicles dominate

is approximately one to four. This proportion is almost identical to the proportion found in the survey, previously summarized in Table B-1 where people were asked to judge the principle contributing sources of neighborhood noise. The estimates in Table B-2 of the

*Measurement approximately 25 feet from a mountain waterfall on a small canyon stream in Wyoming gave an L_{dn} of approximately 85 dB.[B-2]

B-1

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

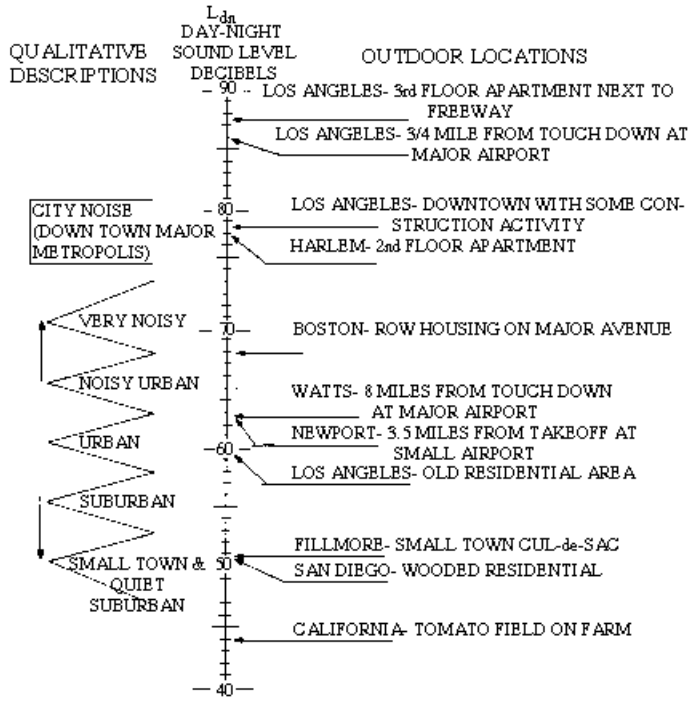


Figure B-1. Examples of Outdoor Day-Night Sound Level in dB (re 20 micropascals) Measured at Various Locations[B-4]

B-2

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table B-1

PERCENT CONTRIBUTION OF EACH SOURCE IDENTIFIED BY RESPONDENTS CLASSIFYING THEIR NEIGHBORHOOD AS NOISY (72% OF 1200 RESPONDENTS)[B-3]

Source	Percentage
Motor Vehicles	55
Aircraft	15
Voices	12
Radio and TV Sets	2
Home Maintenance Equipment	2
Construction	1
Industrial	1
Other Noises	6
Not Ascertained	

Table B-2

ESTIMATED CUMULATIVE NUMBER OF PEOPLE IN MILLIONS INUNITED STATES RESIDING IN URBAN AREAS WHICH ARE EXPOSED TO VARIOUS LEVELS OF OUTDOOR DAY/NIGHT AVERAGE SOUND LEVEL,[B-4, B-5]

Outdoor L_{dn} Exceeds	Urban Traffic	Freeway Traffic	Aircraft Operations	Total
60	59.0	3.1	16.0	78.1
65	24.3	2.5	7.5	34.3
70	6.9	1.9	3.4	12.2
75	1.3	0.9	1.5	3.7
80	0.1	0.3	0.2	0.6

B-3

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

number of people living in areas which are exposed to freeway and aircraft noise are taken from the EPA airport/aircraft noise report.[B-4] They were based on calculated noise contours and associated populations for a few selected situations which formed the basis for extrapolation to national values. The estimates for the number of people living in areas in which the noise environment is dominated by urban traffic were developed from a survey[B-5] conducted in Summer 1973 for EPA. The survey measured the outdoor 24-hour noise environment at 100 sites located in 14 cities, including at least one city in each of the ten EPA regions. These data, supplemented with that from previous measurements at 30 additional sites, were correlated with census tract population density to obtain a general relationship between L_{dn} and population density. This relationship was then utilized, together with census data giving population in urban areas as a function of population density, to derive the national estimate given in Table B-2.

These data on urban noise enable an estimate of the percentage urban population in terms of both noise levels and the qualitative descriptions of urban residential areas which were utilized in the Title IV EPA report to Congress in 1971.[B-6]

These estimates, summarized in Table B-3, show that the majority of the 134 million people residing in urban areas have outdoor L values ranging from 43 dB to 72 dB with a median

value of 59 dB. The majority of the remainder of the population residing in rural or other non-urban areas is estimated to have outdoor L_{dn} values ranging between 35 and 50 dB.

Indoor Sound Levels

The majority of the existing data regarding levels of environmental noise in residential areas has been obtained outdoors. Such data are useful in characterizing the neighborhood noise environment evaluating the noise of identifiable sources and relating the measured values with those calculated for planning purposes. For these purposes, the outdoor noise levels have proved more useful than indoor noise levels because the indoor noise levels contain the additional variability of individual building sound level reduction. This variability among dwelling units results from type of construction, interior furnishings, orientation of rooms relative to the noise, and the manner in which the dwelling unit is ventilated.

Data on the reduction of aircraft noise afforded by a range of residential structures are available.[B-7] These data indicate that houses can be approximately categorized into "warm climate" and "cold climate" types. Additionally, data are available for typical open-window and closed-window conditions. These data indicate that the sound level reduction provided by buildings within a given community has a wide range due to differences in the use of materials, building techniques, and individual building plans. Nevertheless, for

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table B-3

ESTIMATED PERCENTAGE OF URBAN POPULATION (134 MILLION) RESIDING IN AREAS WITH VARIOUS DAY-NIGHT NOISE LEVELS TOGETHER WITH CUSTOMARY QUALITATIVE DESCRIPTION OF THE AREA [B-3,B-4]

Description	Typical Range L_{dn} in dB	Average L_{dn} in dB	Estimated Percentage of Urban Population	Average Census Tract Population Density, Number of People Per Square Mile
Quiet Suburban Residential	48-52	50	12	630
Normal Suburban Residential	53-57	55	21	2,000
Urban Residential	58-62	60	28	6,300
Noisy Urban Residential	63-67	65	19	20,000
Very Noisy Urban Residential	68-72	70	7	63,000

planning purposes, the typical reduction in sound level from outside to inside a house can be summarized as follows in Table B-4. The approximate national average "window open" condition corresponds to an opening of 2 square feet and a room absorption of 300 sabins (typical average of bedrooms and living rooms). This window open condition has been assumed throughout this report in estimating conservative values of the sound levels inside dwelling units which results from outdoor noise.

The sound levels inside dwelling units result from the noise from the outside environment plus the noise generated internally. The internally generated noise results from people activity, appliances and heating and ventilating equipment. Twenty-four hour continuous measurements were made in 12 living rooms (living, family or dining room) in 12 houses during the 100-site EPA survey[B-5] of urban noise, excluding areas where the noise resulted from freeways and aircraft. The results, summarized below in Table B-5, show that the inside day-night sound level in these homes was the result of internally generated noise. In fact, the internal L_{dn} and L_d values were slightly higher than those measured outdoors, despite the fact that the average house sound level reduction appeared to exceed 18 dB. The pattern for the indoor sound levels varies significantly among the homes, as portrayed by the data in Figure B-2. The hourly equivalent sound levels have an average minimum of approximately

Table of Contents
NPC Online Library

Table B-4

SOUND LEVEL REDUCTION DUE TO HOUSES * IN WARM AND COLD CLIMATES, WITH WINDOWS OPEN AND CLOSED[B-7]

	Windows *Open*	Windows *Closed*
Warm Climate	12 dB	24 dB
Cold Climate	17 dB	27 dB
Approximate national average	15 dB	25 dB

*(Attenuation of outdoor noise by exterior shell of the house)

Table B-5

COMPARISON OF INTERNAL AND OUTDOOR SOUND LEVELS IN LIVING AREAS AT 12 HOMES[B-7]

	Daytime Sound Level (L_d) in dB	Nighttime Sound Level (L_n) in dB	Day-Night Sound Level L_{dn} in dB
Outdoors:			
Average	57.7	49.8	58.8
Standard Deviation	3.1	4.6	3.6
Indoors:			
Average	59.4	46.9	60.4
Standard Deviation	5.6	8.7	5.9
Difference:			
Outdoors Minus Indoors	1.7	2.9	-1.6

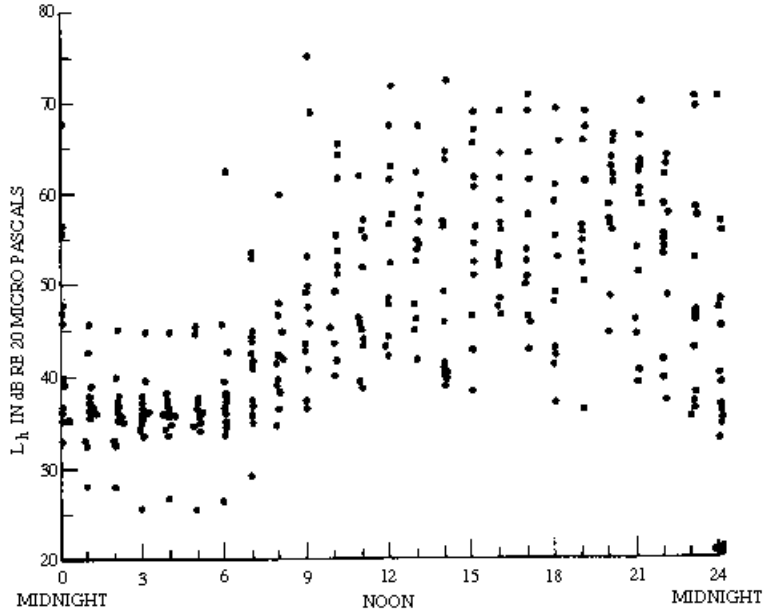


Figure B-2. Noise Inside Living Areas of 12 Homes - Values of Hourly Equivalent Sound Level as a Function of Hour of Day[B-5]

36 dB during the hours between 1 a.m. and 6 a.m. This minimum level is probably governed by outdoor noise in the majority of the situations. However, when people are active in the daytime, the hourly equivalent sound levels have a range of over 30 dB, depending on the type of activity. Thus, during the waking hours, the outdoor noise sets a lower bound of indoor noise. For the outdoor L_{dn} range of 52-65 dB this lower bound is significantly below the average level of the internally generated noise.

EXAMPLES OF INDIVIDUAL NOISE EXPOSURES

The noise exposures received by individuals are very much a function of the individual's life style. The variation in these exposures can be illustrated by examining several typical daily activity patterns. While these patterns are realistic, they should not be construed as applying to all individuals following the particular life style depicted.

The total daily exposure, $L_{eq(24)}$ is considered the sum of the sound energy from all daily exposure, including occupational exposures. Mathematically this can be interpreted as:

$$L_{eq}(24\ hr) = 10 \log \left[\sum_{i=1}^{n} t_i \times 10^{L(t_i)/10} \right] - 49.4$$

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

where $L(t_i)$ is the L_{eq} value for the appropriate time periods, (t_i) and the summation of all the t_i's must equal a total of 24 hours (i.e., $\sum_{i=1}^{n} t_i = 24$ hours (86400 sec.))

Five different exposure patterns for a 24-hour day are depicted in figures B-3 to B-7. The patterns are representative of the exposures that might be incurred by:

Factory worker	-	Figure B-3
Office worker	-	Figure B-4
Housewife	-	Figure B-5
School child	-	Figure B-6
Pre-school child	-	Figure B-7

Five different exposure patterns for a 24-hour day are depicted in Figures B-3 to B-7. The patterns are representative of the exposures that might be incurred by :

Certain assumptions were made in determining the levels shown in Figure B-3 to B-7. First, it was assumed that the suburban environment was equal to an L_{dn} of 50 ($L_d = 50$, $L_n = 40$). For the urban environment, the L_{dn} value was 75 ($L_d = 72$, $L_n = 68$). The levels for the various activities were determined from previous EPA reports on appliance noise, transportation noise, as well as information contained in the EPA Task Group No. 3 Report relating to aircraft noise.[B-4]

Values for the Equivalent Sound level ($L_{eq(24)}$) experienced by the individual are computed from the basic formulation of L_{eq}. For each of these life-styles, the $L_{eq(24)}$ value and the Ldn values are equivalent as the controlling noise dose normally does not occur at night. This emphasizes that for most practical situations, the average individual L_{dn} dose or $L_{eq(24)}$ individual dose are interchangeable.

Noise levels for other life-styles could also be generated. However, it is important to remember that $L_{eq(24)}$ values are, in most cases, controlled by the 2- to 3-hour exposures to relatively high level noise. For example, assume a motorcycle rider rode his vehicle for 2 hours a day at an exposure of 100 dB producing an $L_{eq(24)}$ of 89; if this were the case, then other noise producing activities during the day would have little effect on the L_{dn} if they were at a level of at least 15 dB below the level of the motorcycle.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

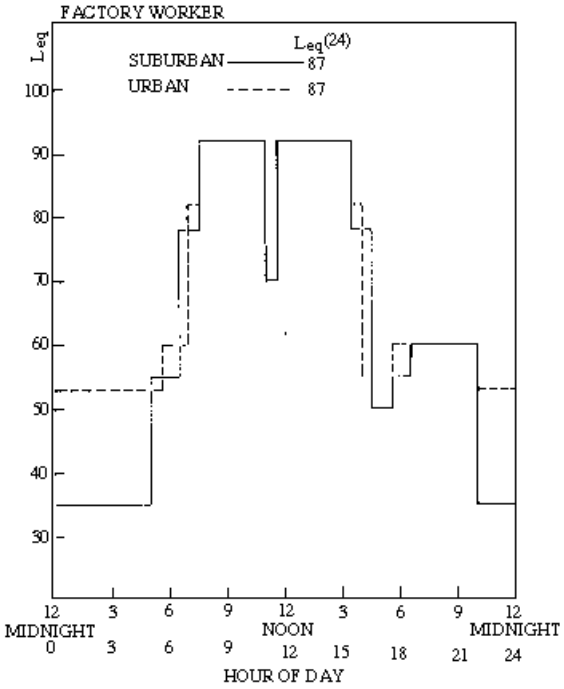


Figure B-3. Typical Noise Exposure Pattern of a Factory Worker[B-1, B-4, B-8, B-9]

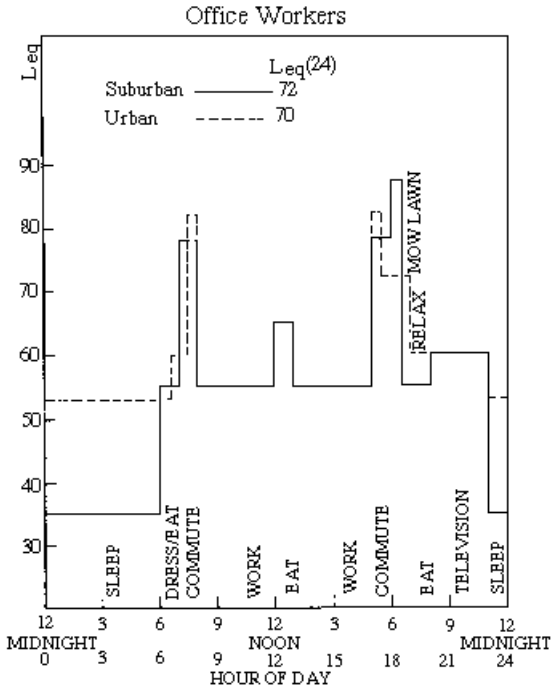


Figure B-4. Typical Noise Exposure Pattern of an Office Worker[B-1, B-4, B-8, B-9]

B-9

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

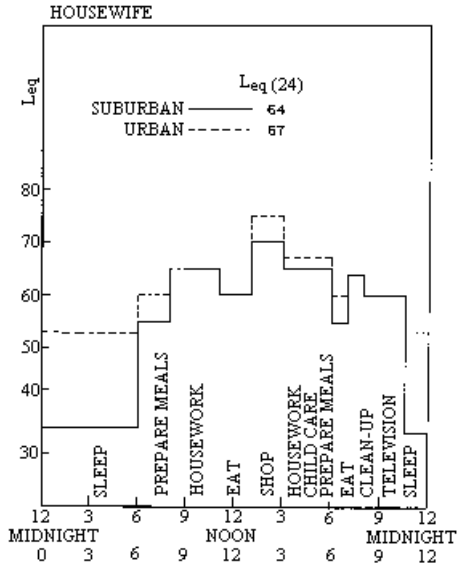
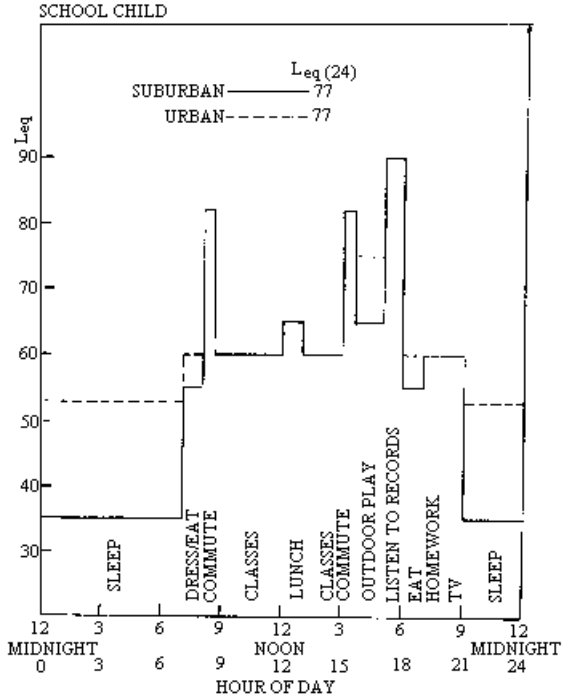


Figure B-5. Typical Noise Exposure Pattern of a Housewife[B-1, B-4, B-8, B-9]



FigureB-6. Typical Noise Exposure Pattern of a School Child[B-1, B-4, B-8, B-9]

B-10

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

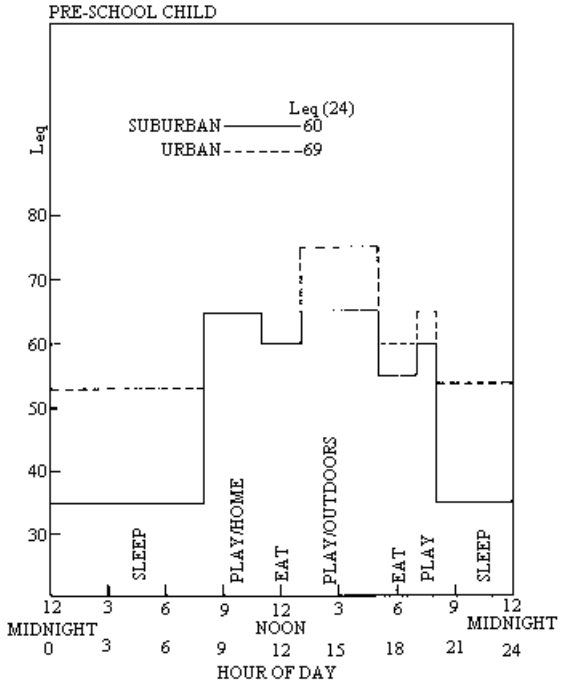


Figure B-7. Typical Noise Exposure Pattern of a Pre-School Child[B-1, B-4, B-8, B-9]

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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B-8 "Transportation Noise and Noise from Equipment Powered by Internal Combustion Engines," Environmental Protection Agency NTID 300,13, December 1971.

B-9 "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances," Environmental Protection Agency NTID 300.1, December 1971.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

APPENDIX C

NOISE-INDUCED HEARING LOSS

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

APPPENDIX C

NOISE-INDUCED HEARING LOSS

INTRODUCTION

A considerable amount of hearing loss data have been collected and analyzed. These data include measurements of hearing loss in people with known histories of noise exposure. Much of the analysis consists of grouping these measurements into populations of the same age with the same history of noise exposure and determining the percentile distribution of hearing loss for populations with the same noise exposure. Thus, the evidence for noiseinduced permanent threshold shift can be clearly seen by comparing the distribution of a noise-exposed population with that of a relatively non-noise-exposed population.

Most of these data are drawn from cross-sectional research rather than longitudinal studies. That is, individuals or populations have been tested at only one point in time. Because complete noise-exposure histories do not exist, many conclusions are limited by the need to make certain hypotheses about the onset and progression of noise-induced hearing loss. Different hypotheses about the time history will lead to different conclusions even from the same data base, although the range of such conclusions is limited. Thus, in reaching conclusions about hearing loss, reliance is made on assumptions, hypotheses, and extrapolations which are not all universally accepted by the scientific community. However, attempts have been made to consider differing opinions and to insure that the methodology and conclusions in this section are in the mainstream of current scientific thought.

BASIC ASSUMPTIONS AND CONSIDERATIONS

In order to proceed further, it is necessary to make the following well-based assumptions:

1. Hearing shifts in the "non-noise-exposed" populations are attributable to aging and other causes rather than to noise exposure.

2. As individuals approach the high end of the distribution and their hearing becomes worse, they become less affected by noise exposure. In other words, there comes a point where one cannot be damaged by sounds that one cannot hear.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

In addition, there are some important considerations necessary for the identification of a level to protect against hearing loss.

Preservation of High Frequency Hearing

The levels identified in this document for hearing conservation purposes are those which have been shown to provide protection from any measurable degradation of hearing acuity. This protection is prodded even for those portions of the hearing mechanism which respond to the audiometric frequency at which noise-induced hearing impairment first occurs, namely 4000 Hz. The definition of hearing handicap originated by the American Academy of Opthalmology and Otolaryngology (AA00), and currently incorporated in many hearing damage-risk criteria, is somewhat different from the definition used in this document. Hearing handicap, (and later, hearing impairment) was defined by a formula which used the average hearing level at 500 Hz, 1000 Hz and 2000 Hz.

Although hearing loss for frequencies above 2000 Hz is not treated as significant by most of the existing occupational hearing damage-risk criteria, the ability to hear frequencies above 2000 Hz is important for understanding speech and other signals. Despite the traditional use of the term "speech frequencies" to apply to 500, 1000 and 2000 Hz, useful energy in speech sound ranges from about 200 to 6100 Hz.[C-1] It has been known for many years that the equal discriminability point in the speech spectrum is at about 1600 Hz. That is, frequencies above 1600 Hz are equal in importance to those below 1600 Hz for understanding speech. C-l However, there are other reasons for preserving the frequencies above 2000 Hz. Higher frequencies are important for the localization and identification of faint, high-pitched sounds in a variety of occupational and social situations. Detection of soft, relatively highfrequency sounds can be especially important in dgflance tasks, such as those which may occur in the military. In addition, good hearing for the higher frequencies is important to hear everyday occurrences such as sounds indicative of deterioration in mechanical equipment, crickets on a summer evening, bird song, and certain musical sounds. In fact, highfidelity sound reproducing equipment is often promoted on the basis of its fidelity up to 15,000 Hz, or even 30,000 Hz.

Any measurable hearing loss at any frequency is unacceptable if the goal is protection of health and welfare with an adequate margin of safety. For most environmental noise, protection at 4000 Hz will insure that all other frequencies are protected.[C-2] Thus, the 4000 Hz frequency has been selected as the most sensitive indicator of the auditory effects of environmental noise.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Significant Changes in Hearing

In this section an attempt will be made to determine the relation between exposure level and noise-induced permanent threshold shift (NIPTS). Before this is accomplished, however, the significance of various amounts of NIPTS needs to be addressed.

For the purposes of identifying the levels in this document, it was necessary to adopt a criterion for an allowable amount of NIPTS. Whereas a NIPTS of 0 dB would be ideal, it is not appropriate for the following reasons:

1. Most audiometric equipment does not have the capability to measure hearing levels in less than 5 dB steps.

2. There is no known evidence that NIPTS of less than 5 dB are perceptible or have any practical significance for the individual.

3. Individual hearing thresholds are subject to minor fluctuations due to transitory psychological or physiological phenomena.

NIPTS of cunsiderably larger amounts have been permitted in various damage-risk criteria in the past. For instance, shifts of 10 dB to 20 dB have been considered reasonable.[C-3] However, the requirement for an adequate margin of safety necessitates a highly conservative approach. This approach dictates the prevention of any effect on hearing, which is defined here as an essentially insignificant and unmeasurable NIPTS, i.e., a NIPTS of less than 5 dB.The available evidence consists of statistical distributions of hearing levels for populations at various exposure levels. The evidence of NIPTS, then, is the shift in the statistical distribution of hearing levels for a noise-exposed population in comparison to that of a non-exposed population.

PREDICTION OF NOISE-INDUCED PERMANENT THRESHOLD SHIFT

Status of Hearing at 4000 Hz in the United States

Figure C-1 summarizes hearing levels of the general U.S. population at 4000 Hz. The data are from the Public Health Survey, (PHS) conducted in 1960-62 in the United States.C-4 Robinson's[C-5] non-noise-exposed and otologically screened population is shown for comparison. Several points should be noted.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

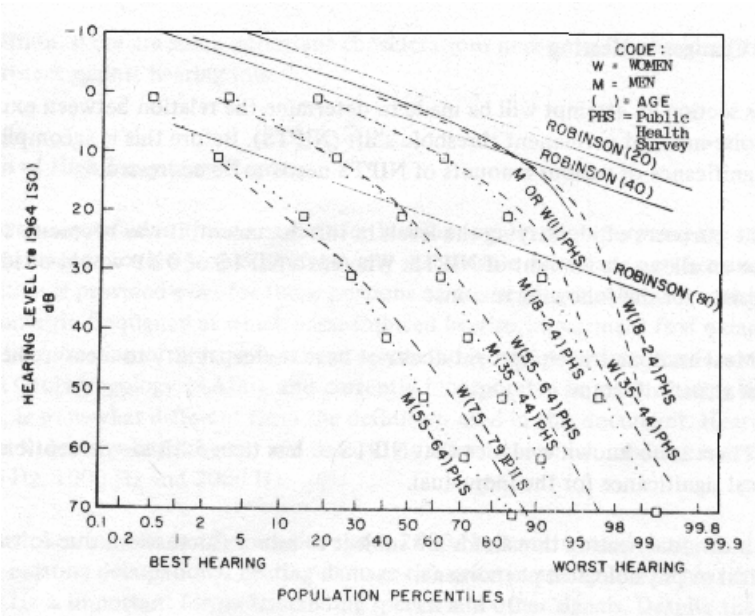

Figure C-1. Population Hearing Levels at 4000 Hz[C-4, C-5, C-6]

1. The hearing of a selected percentile of the population can be determined for various age groups. As displayed here, the higher the percentile point, the worse the hearing.
2. At age 11, there is no hearing difference due to sex,[C-6] but for the 18-24 age group, a definite difference is evident, with men's hearing considerably worse.
3. Considering that there is no evidence for any sex-inherent differences in susceptibility to hearing impairment, it is most likely that the differences displayed are due to noise exposure.

The Effect of Noise on Hearing

Table C-1 summarizes the hearing changes expected for daily exposures to various values of steady noise, for an eight-hour day, over 10- and 40-year periods.[C-7]

Four different measurement parameters are considered in Table C-1 :

1. Max NIPTS: The permanent change in hearing threshold attributable to noise. NIPTS increases with exposure duration. Max NIPTS is the maximum value during a 40-year

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table C-1

SUMMARY OF THE PERMANENT HEARING DAMAGE EFFECTS EXPECTED FOR CONTINUOUS NOISE EXPOSURE AT VARIOUS VALUES OF THE A-WEIGHTED AVERAGE SOUND LEVEL [C-7]

		75 dB for 8 hrs	
	av.0.5,1,2 kHz	av.0.5,1,2,4 kHz	4 kHz
Max NIPTS 90th percentile	1 dB	2 dB	6 dB
NIPTS at 10 yrs. 90th percentile	0	1	5
Average NIPTS	0	0	5
Max NIPTS 10th percentile	0	0	0
		80 dB for 8 hrs	
	av.0.5,1,2 kHz	av.0.5,1,2,4 kHz	4 kHz
Max NIPTS 90th percentile	1 dB	4 dB	11 dB
NIPTS at 10 yrs. 90th percentile	1	3	9
Average NIPTS	0	1	4
Max NIPTS 10th percentile	0	0	2
		85 dB for 8 hrs	
	av.0.5,1,2 kHz	av.0.5,1,2,4 kHz	4 kHz
Max NIPTS 90th percentile	4 dB	7 dB	19 dB
NIPTS at 10 yrs. 90th percentile	2	6	16
Average NIPTS	1	3	9
Max NIPTS 10th percentile	1	2	5
		90 dB for 8 hrs	
	av.0.5,1,2 kHz	av.0.5,1,2,4 kHz	4 kHz
Max NIPTS 90th percentile	7 dB	12 dB	28 dB
NIPTS at 10 yrs. 90th percentile	4	9	24
Average NIPTS	3	6	15
Max NIPTS 10th percentile	2	4	11

Example: For an exposure of 85 dB during an 8-hour working day, the following effects are expected:

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table C-1 (continued)

For the 90th percentile point, the Max NIPTS occurring typically during a 40-year work lifetime, averaged over the four frequencies of 0.5, 1, 2 and 4 kHz, is 7 dB; averaged over the three frequencies of 0.5, 1, and 2 kHz is 4 dB and 19 dB at 4 kHz. For this same 90th percentile point of the population, the expected NIPTS after only 10 years of exposure would be 6 dB averaged over the four frequencies, 2 dB averaged over three frequencies, and 15 dB at 4 kHz.

exposure that starts at age 20. Data from the 90th percentile point of the population will be used to extrapolate to higher percentiles.

2. NIPTS at 10 years: The entries on this row also apply to the 90th percentile point of the population for 10 years of exposure.

3. Average NIPTS: The value of NIPTS is averaged over all the percentiles for all age groups. (This figure differs by only a couple of decibels from the median NIPTS after 20 years of exposure for the entire population.)

The values in Table C-1 are arithmetic averages of data found in the reports of PasschierVermeer,[C-8] Robinson,[C-5] and Baughn.[C-9]

DERIVATION OF EXPOSURE LEVELS

Selection of the Percentile and Related Exposure Level

The estimation of NIPTS for a given percentile has been accomplished by subtracting the hearing level of that percentile of the non-noise-exposed group from the hearing level of the respective percentile of the noise-exposed group. People above the 90th percentile are those whose hearing is worse than that of 90 percent of the population. Thus, for example, if the group at the 90th percentile shows a shift of 10 dB because of noise exposure, then it is considered that the group has a NIPTS of 10 dB. Extrapolations above the 90th percentile can be made from existing data, as done in Figure C-2. These extrapolations require cautious interpretation. First, the data for the 75 dB exposure levels in Table C-1 are themselves derived from extrapolations. The last firm data are at 78 dB. Second, for many of the studies that serve as the basis for the Passchier-Vermeer work, the 90th percentile is already extrapolated from the 75th percentile.

As stated earlier, the assumption has been made that if a person's hearing loss is severe enough, noise exposure will not make it worse. To be more precise, a person will not incur a hearing loss from a noise that he cannot hear (so long as it is within the audible frequency range). Granting this assumption, it follows that at some percentile, the amount of NIPTS

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

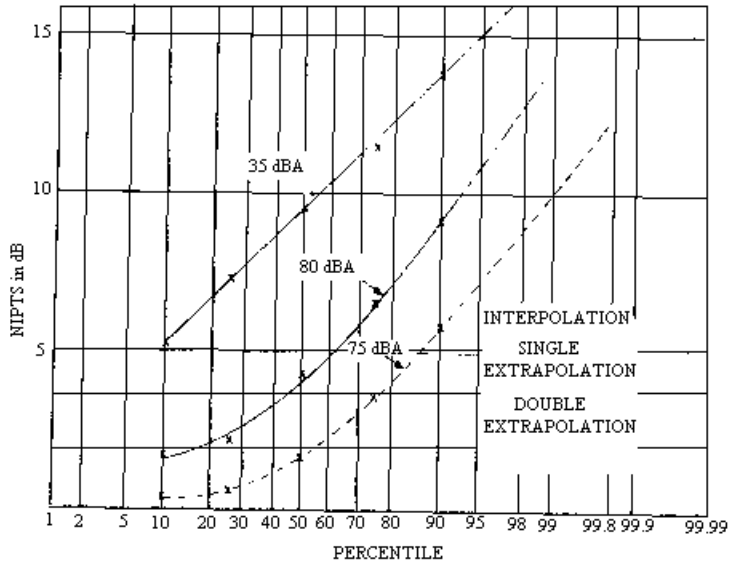

Figure C-2. NIPTS at 4000 Hz across Percentiles for Various 40-yr Exposure Levels [C-2]

for a given exposure level will approach an asymptote. In order for further hearing loss to be incurred above this critical percentile point, greater exposure levels must occur. In the extreme, a person who is totally deaf cannot suffer noise-induced hearing loss.

A study of the data provides a basis for a reasonable estimate of this critical percentile. Baughn's data gives an indication that the population with a hearing level greater than 60 dB after a 40-year exposure begins to become less affected by noise (Figures 9, 10, and 11 of ref. C-2). For example, if a person has a hearing loss greater than 75 dB, it is not reasonable to expect that an A-weighted noise of 75 dB (which normally means that only a level of 65 dB would be present at the octave band centered at 4000 Hz) will cause a further increase of the 75 dB loss. Next, it is necessary to determine the distribution of hearing levels of the non-noise-exposed population at age 60. The best data available are the hearing levels of 60 year-old women of the 1960-62 Public Health Survey,[C-4] While certainly some of the women in the sample may be noise exposed, the noise exposure of that population sample can be considered minor as compared to the apparent noise exposure of men. The data from the Public Health Survey predict the percentage of the population with hearing levels above 70, 75, and 80 dB.

Figure C-3 shows the exposure levels at which no more than 5 dB NIPTS at 4000 Hz will occur for various percentiles on the lowermost curve. The curve labeled PHS-4000 Hz

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

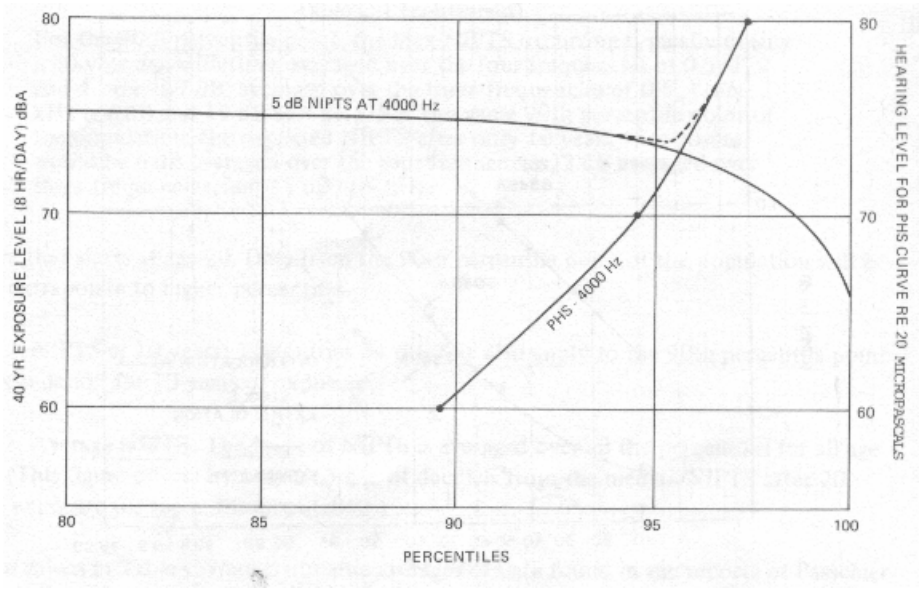

Figure C-3. Exposure Level and Hearing Level as a Function of Population Percentile, Showing the 5 dB NIPTS Curve

Merging with the PHS 4000 Hz Curve represents hearing levels by percentiles of the non-noise exposed population. If a noise level that cannot be heard by an individual is assumed not to change his hearing level, then the extrapolated 5 dB NIPTS curve of Figure C-3 cannot cross the curve labeled PHS. In fact, the 5 dB NIPTS curve must turn upward and merge with the PHS curve, shown in Figure C-3 by the dotted line. The point of merging is seen to be at approximately the 96th percentile and the exposure level required to protect this percentile from a shift of more than 5 dB is an $L^{eq(8)}$ of 72 to 74 dB, or approximately 73 dB. It may be concluded therefore, that a 40-year noise exposure below an $L_{eq(8)}$ of 73 is satisfactory to prevent the entire statistical distribution of hearing levels from shifting at any point by more than 5 dB. Generalizing from these conclusions, the entire population exposed to $L_{eq(8)}$ of 73 is protected against a NIPTS of more than 5 dB.

A similar analysis can be made for 5 dB and 10 dB NIPTS at the mid frequencies (Figure C-4). The upper PHS curve represents the better ear data for the average of 500, 1000 and 2000 Hz of both men and women from the Public Health Survey.[C-4] Both men and women are used since there is little difference due to sex and hearing levels for these frequencies. Considering that the curves will merge in the same manner as the 5 dB at 4000 Hz NIPTS and PHS curves, one can conclude that:

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

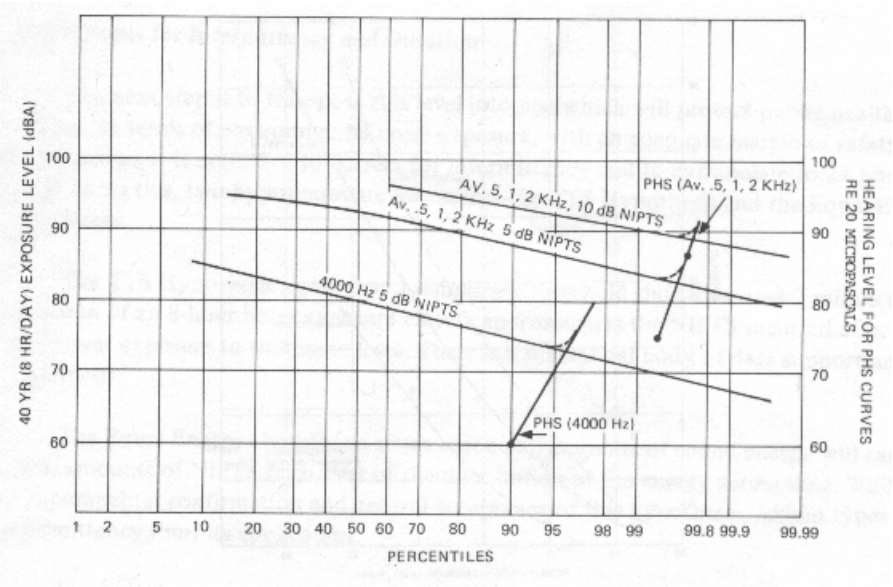

Figure C-4. Exposure Level and Hearing Level as a Function of Population Percent Showing Merging of Different NIPTS Curves with PHS Curves

1. $L_{eq\ (8)}$ of 84 dB will cause no more than a 5 dB shift at the critical percentile for the averaged frequencies 500, 1000 and 2000 Hz.

2. $L_{eq(8)}$ dB will cause no more than a 10 dB shift at the most critical percentile for the averaged)requencies 500, 1000 and 2000 Hz.

Although the data base used here is quite large, we cannot be absolutely certain that it is representative of the whole population. Any argument such as that presented above does not, in fact, provide 100% protection of the entire population. Obviously, there are a few individuals who might incur more than 5 dB NIPTS for an exposure level of 73 dB. There is the possibility that individuals might shift from lower to higher percentiles with a change in exposure level. In other words, there may be individuals who experience greater shifts in hearing level than those predicted here over periods of time much less than 40 years.

At this point, it may be useful to examine the same data in a slightly different way, without utilizing the concept of the critical percentile. Assuming that the NIPTS of the exposed population are distributed normally, the exposure levels which produce various amounts of NIPTS at the 50th and 90th percentiles may be extrapolated to levels which produce NIPTS at the 99th percentile. Using this extrapolation, Figure C-5 shows NIPTS as

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

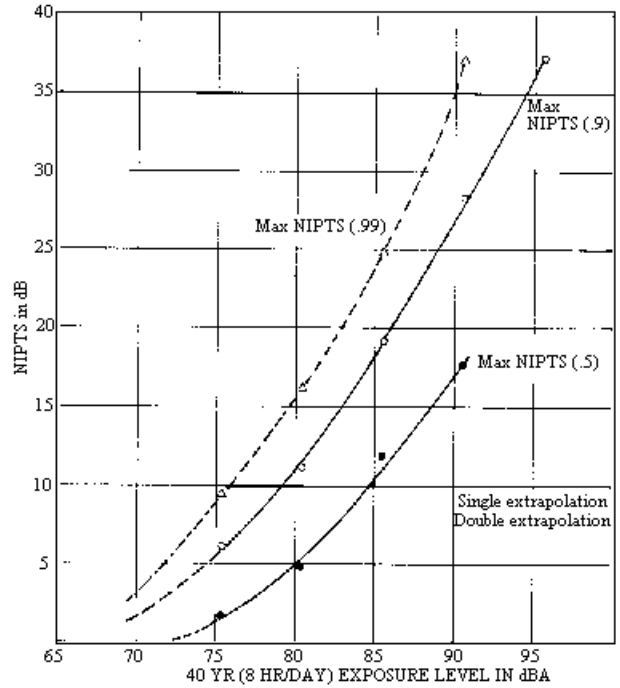

Figure C-5. NIPTS as a Function of Exposure Level for the 50th, 90th and 99th Percentiles

a function of exposure level for the 50th, 90th and 99th percentiles. The 99th percentile curve intersects the 5 dB NIPTS point at 71.5 dB (which is only 1.5 dB below the level previously identified). Thus, if one wishes to protect up to the 99th percentile without employing the concept of the critical percentile, the exposure level necessary to prevent more than 5 dB NIPTS is an $L_{eq(8)}$ of 71.5 dB.

The preceeding analysis utilizing the concept of the critical percentile, concludes that an 8-hour per day exposure to a 73 dB steady noise for 40 years will result in a noise-induced permanent threshold shift of no more than 5 dB at 4000 Hz. This conclusion was reached through the use of assumptions and considerations pointed out earlier in this appendix. Similar analysis of the same and similar data may be made using other assumptions and considerations. Some analyses lead to essentially the same conclusion while others do not. However, no such analysis has identified a level of much less than 65 dB or much greater than 80 dB for the same conditions (i.e., 5 dB NIPTS at 4000 Hz for 40 years of exposure). While the discussion of these levels and their derivations are a subject of great interest and activity in the scientific community, the Administrator of the Environmental Protection Agency is required to identify the level which, in his judgment, is requisite to protect public health and welfare. For that purpose, the level of 73 dB appears to be the most reasonable choice for the conservation of hearing based on the present state of scientific knowledge.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Adjustments for Intermittency and Duration

The next step is to transpose this level into one which will protect public health and welfare, in terms of environmental noise exposure, with an adequate margin of safety. For this purpose, it is necessary to correct for intermittency and to extrapolate to 24 hours. In order to do this, two hypotheses are necessary-the TTS Hypothesis and the Equal Energy Hypothesis.

The TTS Hypothesis states that a temporary threshold shift measured 2 minutes after cessation of an 8-hour noise exposure closely approximates the NIPTS incurred after a 10- to 20-year exposure to that same level. There is a substantial body of data supporting this hypothesis.

The Equal Energy Hypothesis states that equal amounts of sound energy will cause equal amounts of NIPTS regardless of the distribution of the energy across time. While there is experimental confirmation and general acceptance of this hypothesis, certain types of intermittency limit its application.

Intermittency

The equal energy concept is considered by some to be a conservative approach for short exposure periods. An alternative approach may be necessary because there is little direct evidence to show the effect of short exposure periods or intermittency on the development of NIPTS. This approach implies the use of temporary threshold shift as a predictor of NIPTS.

Even for a continuous noise, TTS is not predictable for all possible durations using the equal energy rule. The equal energy rule predicts, with reasonable accuracy, the TTS at 4000 Hz for durations of 8 hours down to about 30 minutes. Effects from durations shorter than this, however, are better predicted by a slight deviation from the equal energy rule. While equal energy provides for a 3 dB increase in exposure level for each halving of exposure duration, TTS for durations of less than 30 minutes are better predicted by greater intensities for each halving of time. For instance, TTS for durations of less than 15 minutes are better predicted by a 6 dB rather than a 3 dB increase. For an exposure of two minutes duration, the level required to produce an expected TTS at 4000 Hz would be approximately 10 dB greater than the level predicted by the equal energy concept.

Investigations of environmental noise patterns reported in the EPA document "Community Noise" [C-10] indicate that in most environments, noise fluctuates or is intermittent. Moreover, intermittent noise for a given Leq having peak levels of 5 to 15 dB higher than the background level, may produce less hearing damage than a continuous noise

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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with the same energy. C-11 Also, noise levels which are below 65 dB for 10 percent of the time tend to be less dangerous than continuous noise. [C-12] Therefore, intermittent noise as used in this document will be defined as noise which is below 65 dB for about 10 percent of each hour (i.e., L_{90} of less than 65 dB), with peak levels of 5 to 15 dB higher than the background. From the examples cited in "Community Noise", it is clear that most environmental noise meets these criteria. For this reason, the L_{eq} measured in many situations can be expected to produce less harmful effects on hearing than those depicted in Table C-1. Some correction factor is thus indicated for L_{eq} values describing noise expected in a typical environmental situation in which the exposure is relatively intense but intermittent in nature.

In order to determine an appropriate correction factor, Figure C-6 has been drawn. Using an exposure of 73 dB for 8 hours as a baseline, the sound pressure levels producing equal TTS_2 to be expected at 4000 Hz are plotted for durations of continuous noise as short as 1-1/2 minutes. [C-3] Plotted also (curve a), is the maximum intermittency correction suggested by "Second Intersociety Committee" [C-13] and discussed in the NIOSH criteria document. [C-11] This correction is for the mid frequencies. Recent work has indicated that for 4000 Hz the best intermittency correction to produce equal TTS_2 is represented by curve b. [C-14] The crosshatched area between the curves "a" and "c" signifies the area of uncertainty.

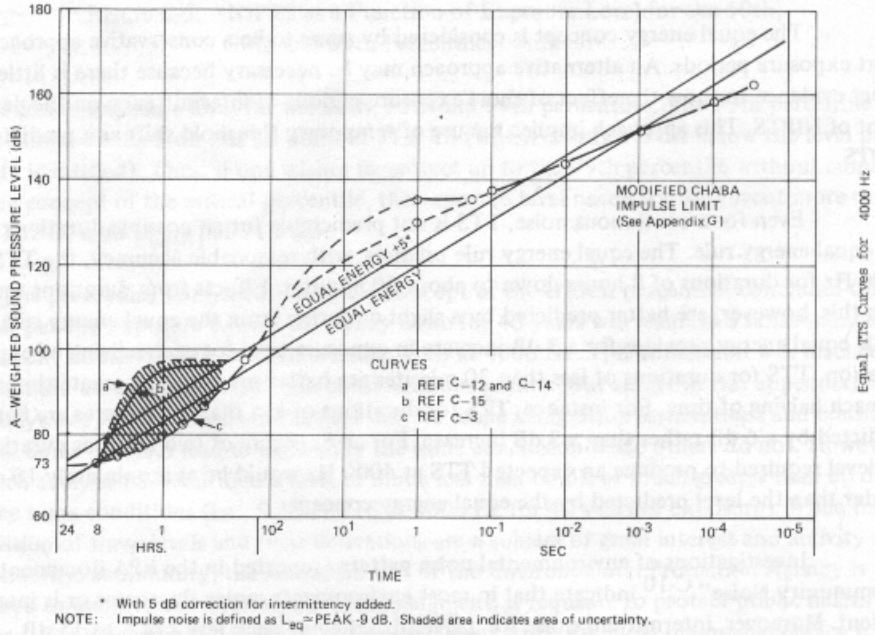

Figure C-6. Equal TTS Curves for 4000 Hz

C-12

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

In addition, TTS curves for impulse noise are included in Figure C-6. Appendix G contains the details of the modified CHABA limit and the conversion necessary to derive from the peak sound pressure level of a decaying impulse the continuous A-weighted noise of the same duration. The impulse noise data show that the equal energy concept is still a reasonable approximation for very short durations. While certainly it may be overly protective for some noise pattems, in general it predicts the effects of noise on hearing reasonably well. Prediction is improved, however, with a 5 dB allowance for intermittency.

The average correction for intermittency suggested by Figure C-6 is 5 dB (i.e., placing the origin of the equal energy line at 78 dB for 8 hours). This correction should be used only if the noise level between events is less than 65 dBA for at least 10 percent of the time (L_{90} < 65 dBA). Since most environmental noise exposures will meet this requirement during any 8-hour period, it is further suggested that environmental noise should be considered intermittent unless shown otherwise. Using the 5 dB correction factor, the area of uncertainty (crosshatched) of Figure C-6 is approximately bisected. Further support for such a 5 dB correction factor is found in a recent Swedish study where exposure to continuous noise of L_{eq} 85 to 90 caused a hearing loss which corresponded to an intermittent noise of L_{eq} 90 to 95. The authors conclude that a 5 dB correction factor is appropriate. [C-15]

For certain noise situations, a larger intermittency correction might be justified. However, the use of large corrections when only part of the total noise exposure pattern is known entails a considerably higher chance of error. Therefore, the use of correction factors higher than 5 dB for intermittency are not considered consistent with the concept of an adequate margin of safety.

Conversion of 8-Hour to 24-Hour Exposure Levels

The TTS after 24 hours of exposure generally exceeds that after 8 hours of exposure by about 5 dB.[C-2] Thus the use of a 5 dB correction factor is suggested to extrapolate from the 8-

hour exposure data to 24-hour exposure.[C-2] For example, the predicted effects of an exposure to 75 dB steady-state noise for a 24-hour duration are equivalent to the effects estimated from industrial studies for an 8-hour exposure to a continuous noise with a level of

80 dB. This 5 dB correction is consistent with the equal-energy trade-Jff between exposure duration and noise level. That is, the equal-energy rule in this case also dictates a correction of 5 dB for 24 hours.

It appears that exposures over a period longer than 24 hours need not be considered in this case. Various studies of TTS [C-16,C-17, C-18] have shown that, for an exposure to a specific noise level, TTS will not exceed a limiting valud regardless of exposure duration. This limit is reached at approximately 24 hours of exposure. However, this concept applies only to exposure levels less than 85 dB.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Conversion of Occupational Dose to a Full Year (250 to 365 Days)

The applicability of occupational data to non-occupational exposure is questional in several ways. One concern is the use of the occupational exposure data to predict the general effects on populations composed of people who, for a variety of reasons, do not work. However, there are no data from which to derive approximate correction factors. Another concern is the fact that the occupational data are based on a 250-day working year. When predicting the effect of a known noise exposure over the 365-day year, certainly some correction is in order. The equal energy concept would predict at least a 1.6 dB lowering of the exposure level, and such a correction should be used when the concept of an annual exposure dose is used.

To summarize the adjustments, the following exposures over 40 years will result in the same effect:

- L_{eq} of 73 dB continuous noise during the 8-hour working day with relative quiet for the remaining 16 hours, 5 days per week. (See discussion of quiet requirements below).
- L_{eq} of 78 dB intermittent noise during the 8-hour working day with relative quiet for the remaining 16 hours, 5 days per week. 73 + 5 = 78
- L_{eq} of 76.4 dB intermittent noise for 8 hours a day, with relative quiet for the remaining 16 hours, for the 365-day year. 78 - 1.6 = 76.4
- L_{eq} of 71.4 dB intermittent noise for 24 hours a day, 365 days a year. 76.4 - 5 = 71.4

In view of possible uncertainties in the analysis of the data, it is considered reasonable to round down from 71.4 dB to 70 dB. These uncertainties will be discussed in the next section.

CONSIDERATIONS FOR PRACTICAL APPLICATION

The Data Base

In viewing the data in this appendix and elsewhere in the hearing impairment literature, a number of fundamental considerations must be noted :

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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1. Few, if any, of the various "classic studies" (e.g., those of Robinson, Baughn, and Passchier-Vermeer) are on comparable populations. In addition, some of the data are derived from populations for which noise exposure histories are sketchy, if not absent (e.g., the 1960-62 U.S. Public Health Survey data).
2. There are major questions regarding the comparability of the audiometric techniques used in the various surveys.

3. There are a great number of unanswered questions and areas of uncertainty with regard to the relationship of hearing thresholds to individual physiological and metabolic state. The role of the adequacy of the blood supply to the ear (and the possible influence of changes in that blood supply resulting from cardio-vascular respiratory disease or the process of aging), as well as the fundamentals of cellular physiology involved in adverse effects within the organ of Corti, simply cannot be stated with any degree of reliability at this time. There is some evidence that these non-noise related influences may be of major significance. Moreover, part of the adverse effect of noise on hearing may be attributable indirectly to these influences.
4. There are no large-scale longitudinal studies on hearing loss in selected and carefully followed populations, whose physical state and noise exposure has also been carefully detailed.

Accuracy of Estimated Effects

There is imperfect agreement among various studies as to the exact relationship between sound exposure level and noise-induced hearing loss. The range of error involved is on the order of 5 dB [C-2] when examining the difference between the values in any single study and the values presented in Table C-1. Furthermore, the intermittency correction of 5 dB is only an approximation. It has been proposed that a correction as high as 15 dB could be used in some cases. Thus, the true intermittency correction for a particular noise exposure situation could be from 0-15 dB.

The selection of alternative population percentiles to be protected would cause relatively small changes. For instance, there is only a 7 dB difference in protecting the 50th percentile against incurring a 5 dB hearing loss instead of the 96th percentile.

Using the assumption that the noise is of broadband character can lead to errors of 5 to 10 dB by which the risk of the sound exposure is underestimated. This could lead to greater possible errors if a substantial portion of the exposure is to noise with intense pure tone components. These conditions, however, are rare in the environmental situation.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

There are apt to be errors in extrapolating beyond the 90th percentile in order to predict effects at higher percentiles. Likewise, there might be errors in extrapolating from known exposure data at 90 and 80 dB to estimated effects at 73 dB for an 8-hour exposure to continuous noise. One final potential source of error inherent in using the occupational data is the need to compare a population that has received an occupational noise exposure to a population that has not received an occupational noise exposure. However, this latter population may have been exposed to levels of environmental noise (other than occupational). As a consequence in comparing the two groups, occupational exposures may very well show negligible effects below a certain level because other environmental noises predominate. The direction of the possible error is not unequivocally clear, as certainly the adverse effect of many industrial exposures may very well have been due to an unfortunate combination with non-occupational exposures. At this time, it is impossible to properly analyze the possible bias that the nonoccupational noise exposure introduces into the data of Table C-1. At present it is assumed to be negligible. This assumption will require ultimate verification by experimentally relating the annual exposure dose of individuals to their hearing level. Only such studies will show how much of what we now tend to contribute to the physiological aging process of the hearing mechanism could be reduced by further reducing what we consider today as "normal" or "quiet" environmental noise levels associated with present-day living in our society.

Quiet Requirements

It has been shown that the quiet intervals between high intensity noise-bursts must be below 60 dB SPL for the octave band centered at 4000 Hz if recovery from temporary threshold shift at 4000 Hz is to be independent of the resting sound pressure level.[C-20] In this document, sound pressure level of 50 dB in the 4000 Hz octave band is suggested as a goal for "effective quiet". For typical spectra of community noise, 50 dB SPL in the 4000 Hz octave band translates to an A-weighted sound level of approximately 60 dB. Thus, for purposes of hearing conservation, the noise level where an individual sleeps should not be above an L_{eq} of 60 dB, based on the following considerations:

1. Total TTS recovery is required to prevent TTS from becoming NIPTS.
2. For some individuals, an 8-hour nighttime period is the only available recovery period.
3. In order to be consistent with the identified level of $L_{eq(24)} = 70$, an 8-hour exposure of 75 dB would require an exposure of 60 dB or less for the remaining 16 hours.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

It should be noted that this level would be too high to protect against other effects. (See Appendix D).

Contribution of Outdoor Noise to the Total Exposure in Residential Areas

A person's 24-hour exposure to outdoor noise will typically include both outdoor and indoor exposures. Since a building reduces the level of most intruding outdoor environmental noises by 15 dB or more (windows partially open), an outdoor L_{eq} will not adequately predict hearing effects, because the corresponding NIPTS estimates will be too high. Consider a situation where the average sound level is 70 dB outdoors and 55 dB indoors. The effective noise exposures for some of the possible exposure situations are:

24-hour L_{eq} in dB (assuming the noise is generated outdoors)

Indoor Time (55 dB)	Outdoor Time (70 dB)	Combined Indoor and Outdoor	Outdoor Only
24 hrs	0 hrs	55.0	
23	1	58.6	56.2
22	2	60.5	59.2
21	3	61.8	61.0
20	4	62.9	62.2
16	8	65.5	65.2
8	16	68.3	68.2
0	24	70	70

The 24-hour value of the combined Leq is essentially unchanged from the outdoor value (less than one dB) by the indoor noise exposure, so long as the outdoor exposure exceeds 3 hours. Thus, as long as the criterion is established with respect to outdoor noise exposure exceeding 3 hours per day, the contribution of the indoor level of intruding outdoor noise may be neglected in computing the 24 hour L_{eq}. This conclusion does not depend greatly on the actual noise attenuation provided by the house so long as the attenuation is greater than 10 dB.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Relation of L_{dn} to L_{eq} in Residential Areas

Although in residential areas, or in areas where individuals may be expected to be present for prolonged periods of time, it would appear desirable for practical considerations to use only one measure of noise, such as L_{dn}, it may be misleading to do so. The difficulty arises from the fact that to relate hearing loss to noise exposure, the basic element to consider is the actual energy (not weighted) entering the ear during a twenty-four hour period. L_{eq} measures the actual energy entering the ear whereas L_{dn} includes a 10 dB weighting for the nighttime period. Thus, L_{dn} values corresponding to actual L_{eq} values are dependent upon the distribution in noise levels occurring during the total twenty-four hour period and could be misleading. For example, the L_{dn} values corresponding to $L_{eq(8)}$ are between 0 to 6 dB greater than the L_{eq} values. The lower value corresponds to a situation where the average sound

level during the night is 10 dB lower than that occurring during the day, whereas the higher value corresponds to the situation when the average sound level during the night equals that occurring during the day. In residential areas, the difference in L_{eq} values for the daytime and nighttime period often is approximately 4 dB based on community noise measurements.[C-20] In this particular case, this difference in L_{eq} values leads to an L_{dn} value which is three decibels above the L_{eq} value for the daytime period.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Appendix D

NOISE INTERFERENCE WITH HUMAN ACTIVITIES AND RESULTING OVERALL ANNOYANCE/HEALTH EFFECTS

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Appendix D

NOISE INTERFERENCE WITH HUMAN ACTIVITIES AND RESULTING OVERALL ANNOYANCE/HEALTH EFFECTS

Environmental noise may interfere with a broad range of human activities in a way which degrades public health and welfare. Such activities include:

1. Speech Communication in Conversation and Teaching.
2. Telephone Communication.
3. Listening to TV and Radio Broadcasts.
4. Listening to Music.
5. Concentration During Mental Activities.
6. Relaxation.
7. Sleep.

Interference with listening situations (items 1-4) can be directly quantified in terms of the absolute level of the environmental noise and its characteristics. The amount of interference in non-listening situations (e.g.,) is often dependent upon factors other than the physical characteristics of the noise. These may include attitude towards the source of an identifiable noise, familiarity with the noise, characteristics of the exposed individual, and the intrusiveness of the noise.

The combination of the various interference effects results in an overall degradation of total well-being. Maximum noise levels that do not affect human well-being must be derived from the body of information on human behavioral response to various noise environments.

SPEECH INTERFERENCE

Speech communication has long been recognized as an important requirement of any human society. It is one of the chief distinctions between humans and other species. Interference with speech communication disturbs normal domestic or educational activities, creates an undesirable living environment, and can sometimes be a source of extreme annoyance. Continued long-term annoyance is considered to affect individual as well as public health and welfare in a variety of ways.

Noise can disturb speech communication in situations encountered at work, in vehicles, at home, and in other settings. Of chief concern for the purposes of this report, is the effect

of noise on face-to-face conversation indoors and outdoors, telephone use, and radio or television enjoyment.

The extent to which environmental noise affects speech communication depends on the location (whether indoors or outdoors), the amount of noise attenuation provided by the exterior walls when indoors (including windows and doors), and the vocal effort of the talkers. Certainly, it is possible to maintain communication in the face of intruding noise if the voice level is raised, but in an ideal environment, one should not have to increase the voice level above that which is comfortable in order to communicate easily.

Research since the late 1920's has made great progress in quantitatively characterizing the effects of noise on speech perception. A review of that work is contained in references D-1 and D-2, and it is summarized here as the basis for the maximum environmental noise levels compatible with public health and welfare identified in Section 4 of this report.

The chief effect of intruding noise on speech is to mask the speech sounds and thus reduce intelligibility. The important contributants to intelligibility in speech sounds cover a range in frequency from about 200 to 6000 Hz, and at each frequency a dynamic level range of about 30 dB. The intelligibility of speech will be nearly perfect if *all* these and contributions are available to a listener for his understanding. To the extent that intruding noise masks out or covers some of these contributions, the intelligibility deteriorates more rapidly the higher the noise level, particularly if the noise frequencies coincide with the important speech frequencies.

It is no accident, from an evolutionary point of view, that the hearing of humans is most sensitive in the frequency range most important for the understanding of speech. Therefore, it is not mere coincidence that the A-weighting, designed to reflect the frequency sensitivity of the human ear, should also be useful as a measure of the speech interference potential of intruding noise. A-weighting gives greatest weight to those components of the noise that lie in the frequency range where most of the speech information resides, and, thus, yields higher readings (A-weighted levels) for noises in most of the 200 to 6000 Hz range than does the overall sound pressure level. A-weighted sound levels will be used throughout this appendix unless otherwise noted.

The principal results of relevant speech research can be utilized for practical application to provide the levels of noise that will produce varying degrees of masking as a function of average noise level and the distance between talkers and listeners. Other factors such as the talker's enunciation, the familiarity of the listener with the talker's language, the listener's motivation and, of course, the normality of the listener's hearing also influence intelligibility. This value is consistent with the upper end of the range of levels of steady state sound recommended by prior authors in Table D-10 (to be discussed later) as

"acceptable" for design purposes for homes, hotels, motels, small offices, and similar spaces where speech communication is an expected and important human activity.

Indoor Speech Interference Due to Steady Noise

The effects of masking normally-voiced speech indoors are summarized in Figure D-1, which assumes the existence of a reverberant field in the room. This reverberant field is the result of reflections from the walls and other boundaries of the room. These reflections enhance speech sounds so that the decrease of speech level with distance found outdoors occurs only for spaces close to the talker indoors. At distances greater than 1.1 meters from the talker, the level of the speech is more or less constant throughout the room. The distance from the talker at which the level of the speech decreases to a constant level in the reverberant part of the room is a function of the acoustic absorption in the room. The greater the absorption, the greater the distance over which the speech will decrease and the lower the level in the reverberant field for a given vocal effort. The absorption in a home

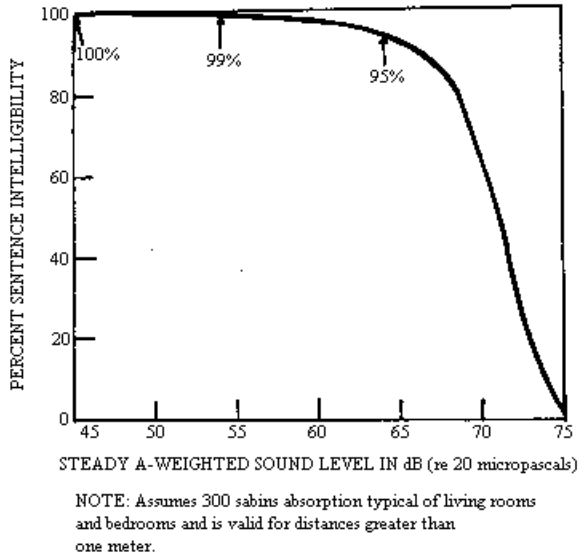

Figure D-1. Normal Voice Sentence Intelligibility as a Function of the Steady Background Sound Level in an Indoor SituationD-1, D-2 & D-4

D-3

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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will vary with the type and amount of furnishings, carpets, drapes and other absorbent materials. It is generally least in bathrooms and kitchens and greatest in living rooms, with typical values ranging between 150 and 450 sabins. A typical value for living rooms and bedrooms is 300 sabins. For this value of absorption, the distance to the reverberant field from the talker is slightly greater than one meter, as stated above.

As shown in Figure D-1, the maximum sound level that will permit relaxed conversation with 100% sentence intelligibility throughout the room (talker-listener separation greater than approximately 1.1 meter) is 45 dB.

Outdoor Speech Interference Due to Steady Noise

The sound level of speech outdoors generally continues to decrease with increasing distance between talker and listener with the absence of reflecting walls which provide the reverberance found indoors. Figure D-2 presents the distances between talker and listener for satisfactory outdoor conversations, in different steady background noise levels (A-weighted), for three degrees of vocal effort. This presentation depends on the fact that the voice level at the listener's ear (outdoors) decreases at a predictable rate as the distance between talker and listener is increased. In a steady background noise there comes a point, as the talker and listener increase their separation, where the decreasing speech signal is masked by the noise.

The levels for normal and raised-voice "satisfactory conversation" plotted in the figure do not permit perfect sentence intelligibility at the indicated distances; instead, the sentence intelligibility at each distance is 95 percent, meaning that 95 percent of the key words in a group of sentences would be correctly understood. Ninety-five percent sentence intelligibility usually permits reliable communication because of the redundancy in normal conversation. That is, in normal conversation, some unheard words can be inferred if they occur in particular, familiar contexts. Moreover, the vocabulary is often restricted, which also helps understanding. Therefore, 95 percent intelligibility is satisfactory for most situations.

The levels given in Figure D-2 for relaxed conversation permit 100% speech intelligibility when communicating in a normal voice. This situation represents an ideal environment for speech communication and is considered necessary for acceptable conversation in the indoor environment. However, it does not define the situation outdoors where 95% intelligibility is

adequate, and communication outdoors generally takes place between people who are walking or standing relatively close together, about 1 or 2 meters. Moreover, these levels appear to be consistent with the need for speech privacy.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

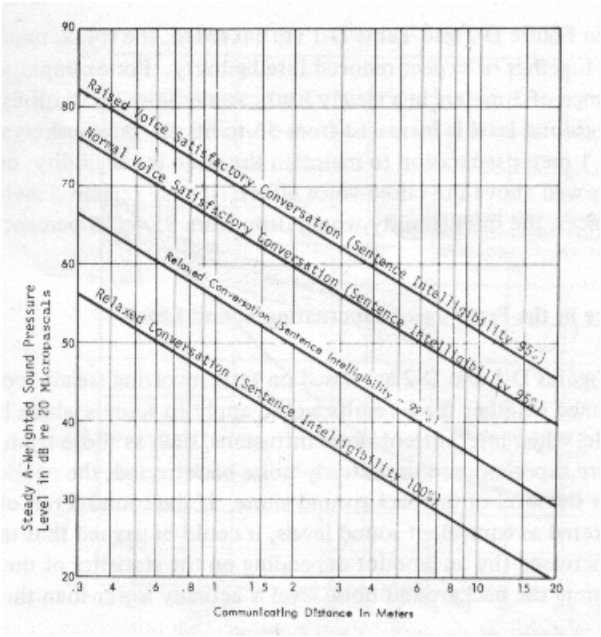

Figure D-2. Maximum Distances Outdoors Over Which Conversation is Considered to be Satisfactorily Intelligible in Steady Noise.[D-1, D-2]

The data for normal and raised voice of Figure D-2 are tabulated for convenience below:

Table D-1

STEADY A-WEIGHTED NOISE LEVELS THAT ALLOW COMMUNICATION WITH 95 PERCENT SENTENCE INTELLIGIBILITY OVER VARIOUS DISTANCES OUTDOORS FOR DIFFERENT VOICE LEVELS[D-2]

VOICE LEVEL	COMMUNICATION DISTANCE (meters)					
	0.5	1	2	3	4	5
Normal Voice (dB)	72	66	60	56	54	52
Raised Voice (dB)	78	72	66	62	60	58

Table of Contents

If the noise levels in Figure D-2 and Table D-1 are exceeded, the speaker and listener must either move closer together or expect reduced intelligibility. For example, consider a conversation at a distance of 3 meters in a steady background noise of 56 dB using normal voice levels. If this background level is increased from 56 to 66 dB, the speakers will either need to move from 3 to 1 meter separation to maintain the same intelligibility, or alternatively, to raise their voices well above the raised-voice effort, if they remain 3 meters apart without raising their voices, the intelligibility would drop from 95 to 65 percent.

Speech Interference in the Presence of Fluctuating Sound Levels

The data in Figures D-1 and D-2 are based on tests involving steady, continuous sound.

It might be questioned whether these results would apply to sounds which have fluctuating levels. For example, when intermittent noise intrusions, such as those from aircraft flyovers or truck passbys, are superimposed on a steady noise background, the equivalent sound

level is greater than the level of the background alone, if the sound levels of Figure D-1 and D-2 are interpreted as equivalent sound levels, it could be argued that these values could be slightly increased (by an amount depending on the statistics of the noise), because most of the time the background noise level is actually lower than the equivalent sound level.

The amount of this difference has been calculated for the cases of urban noise and aircraft noise statistics shown in Figure D-3. The data in this figure[D-3] include a wide range of urban sites with different noise levels and an example of aircraft noise at a site near a major airport. in each case the speech intelligibility was calculated from the standard sentence intelligibility curve[D-4] for various values of L_{eq}, first with steady noise and then with the two specific fluctuating noises of Figure D-3. The calculation consisted of determining the incremental contribution to sentence intelligibility for each level (at approximately 2 dB increments) and its associated percentage of time occurrence. The incremental contributions were then summed to obtain the total value of intelligibility in each case.

The results, shown in Table D-2, demonstrate that, for 95 percent sentence intelligibility, normal vocal effort, and 2 meter separation between talker and listener outdoors, the maximum L_{eq} value associated with continuous noise is less than the maximum value for an environmental noise whose magnitude varies with time. It is therefore concluded that almost all time-varying environmental noises with the same L_{eq} would lead, averaged over long time periods, to better intelligibility than the intelligibility for the same L_{eq} values of continuous noise.

Alternatively, for a fixed L_{eq} value, the percentage of interference with speech (defined as 100 minus the percentage sentence intelligibility) is greater for steady noise than

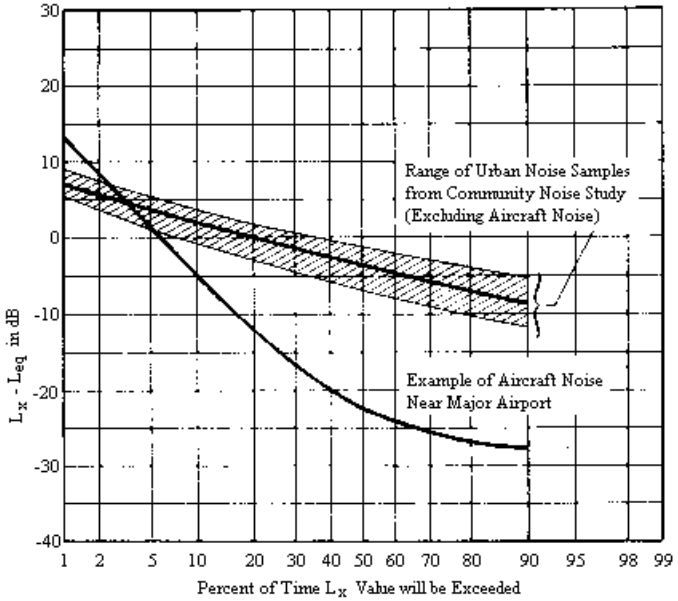

Figure D-3. Cumulative Distribution of Typical Community Noises During the Daytime Relative to the Equivalent Sound Level.[D-39]

Table D-2

MAXIMUM EQUIVALENT SOUND LEVELS THAT ALLOW 95 PERCENT SENTENCE INTELLIGIBILITY AT A DISTANCE OF 2 METERS USING NORMAL VOICE EFFORT OUTDOORS

(From Figures D-2 and D-3)

Noise Type	L_{eq} in decibels
Steady	60
Urban Community Noise	60+
Aircraft Noise	65

D-7

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

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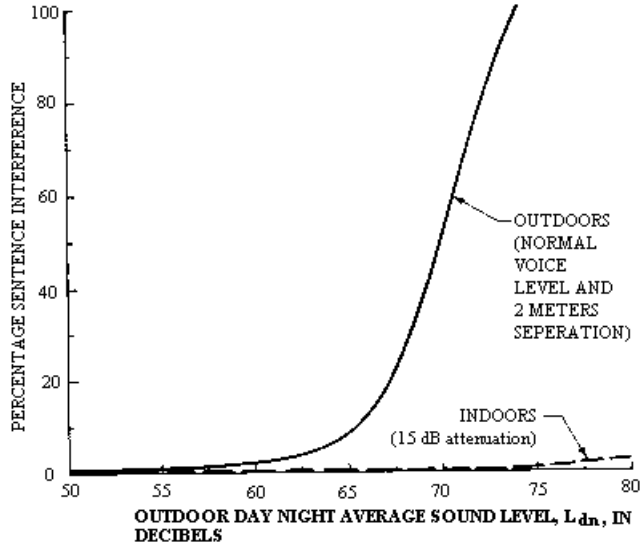
for almost all types of environmental noise whose magnitude varies with time. The relationship between L_{dn} and the *maximum* percentage sentence interference (i.e., for continous noise) is given in Figure D-4.



(re 20 micropascals)

NOTE: Percentage interference equals 100 minus percentage intelligibility, and L_{dn} is based on $L_d + 3$.[D-39]

Figure D-4. Maximum Percentage Interference with Sentences as a Function of the Day-Night Average Noise Level.

The extreme example of a fluctuating noise is a series of noise pulses of constant level that are of sufficient magnitude relative to the background to control the equivalent sound level. For example, there could be a case where the background noise during the off-cycle is assumed negligible, so that when the noise pulses are not present, the speech intelligibility is 100 percent. Table D-3 shows how the percentage interference with sentence intelligibility varies as a function of the level and on-time for a cycled steady noise whose level and duration are always adjusted to yield a fixed value for the equivalent sound level. Two situations are envisaged: indoors, relaxed conversation, L_{eq} = 45 dB, leading to 100 percent sentence intelligibility in the steady, continuous noise; and outdoors, normal voice effort at 2 meters separation, L_{eq} = 60 dB, leading to 95 percent sentence intelligibility in the steady, continuous noise.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-3

PERCENTAGE INTERFERENCE WITH SENTENCE INTELLIGIBILITY IN THE PRESENCE OF A STEADY INTRUDING NOISE CYCLED ON AND OFF PERIODICALLY IN SUCH A WAY AS TO MAINTAIN CONSTANT EQUIVALENT SOUND LEVEL, AS A FUNCTION OF THE MAXIMUM NOISE LEVEL AND DURATION[D-39]
(Assumes 100% intelligibility during the off-cycle)

Situation	A-Weighted level of intruding noise during "on-cycle," decibels	Duration of intruding noise as percent of total time	Percent interference if intruding noise were continuous	Average percent interference in cycled noise

INDOORS Relaxed conversation, background L_{eq}=45dB, 100% intelligibility if background noise were continuous at 45 dB	45 50 55 60 65 70 75 80	100 32 10 3 1 0.3 0.1 0.03	0 0.5 1 2 6 40 100 100	0 0.16 0.1 0.06 0.06 0.12 0.1 0.03
OUTDOORS Normal voice at 2 meters, background L_{eq}=60dB, 95% intelligibility if background noise were continuous at 60 dB	60 65 70 75 80	100 32 10 3 1	5 7.7 53 100 100	5.0 2.5 5.3 3.0 1.0

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

The combination of level in the first column and duration in the second column are such as to maintain constant L_{eq} for each situation, 45 dB indoors and 60 dB outdoors. The third column gives the percent interference with sentence intelligibility that would apply if the noise were steady and continuous with the level indicated in column 1. The fourth column gives the percent interference for the cycled noise in each case.

The results for this extreme case indicate that no matter how extreme the noise fluctuation for the indoor case, on the average there is negligible speech interference for L_{eq} = 45 dB. On the other hand, with L_{eq} = 60 dB outdoors, the average speech interference tends to decrease as the fluctuations of the noise become more extreme. However, it should be recognized that if the duration of the intruding noise were to take place in one continuous period, and if its percentage interference (column 3) were equal to 100, then it would blot out all communication for the duration of its "on-cycle".

The following sections relating to activity interference, annoyance, and community reaction utilize equivalent sound level with a nighttime weighting (L_{dn}) which is discussed more fully in Appendix A. However, for the speech interference effects of noise, a similar measure without the nighttime weighting (L_{eq}) has been employed. To allow comparison between the various effects stated above, some relationships are necessary to allow at least approximate conversion from L_{eq} to L_{dn}. For indoor levels such as those described in Appendix A for various lifestyles, levels during the day are at least 10 dB higher than those during the night. Thus L_{eq} is virtually the same as L_{dn} for normal indoor situations.

For an outdoor L_{dn} of 55 dB or less, day time levels (L_d) are generally 8 dB higher than the nighttime levels (L_n). For this situation, L_{dn} is still quite close to L_{eq} during the day. The correction is less than one dB. For levels greater than L_{dn} 65 dB, the nighttime levels are generally only 4 dB less than during the day time. For these cases, L_{dn} is 3 dB higher than L_{eq} during the day.

For values of L_{dn} between 55 and 65, further interpolation is necessary using Figure A-7.

ACTIVITY INTERFERENCE

Activity interference due to noise is not new. The recent EPA document concerning public health and welfare criteria for noise[D-5] mentions an ordinance enacted 2500 years ago by the ancient Greek community of Sybaris, banning metal works and the keeping of

Table of Contents

roosters within the city to protect against noise that interfered with speech and might disturb sleep. History contains other examples indicating speech and sleep interference due to various types of noises, ranging from wagon noise to the noise of blacksmiths.

More recently, surveys have been conducted which further demonstrate that noise does interfere with various types of activity. For example, Figures D-5 and D-6, based on research done in England, give activity interference reported by the people who were disturbed by aircraft noise for various types of activities as a function of the approximate L_{dn} associated with noise from aircraft flyovers[D-14] (for explanation of the term L_{dn} see Appendix A). Thus, for an outside L_{dn} of approximately 55 dB, over 50% of the people who were disturbed reported some interference with TV sound, and 45% reported some interference with conversation. At the same level, about 45% reported that noise occasionally woke them up, while 30% claimed it sometimes disturbed their relaxation. The figures also indicate that at higher noise levels, greater percentages of people who were disturbed have reported activity interference.

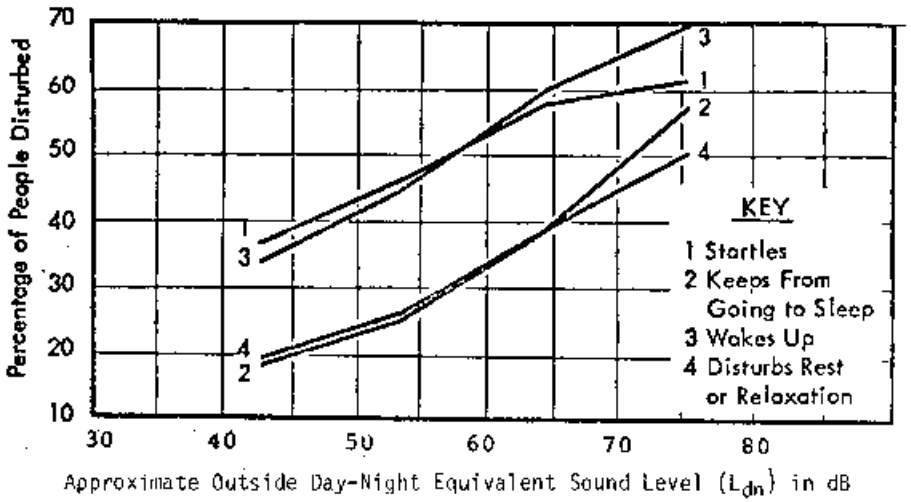


Figure D-5. Percentage of People Disturbed by Aircraft Noise for Various Types of Reasons Concerned With Rest And Sleep[D-6]

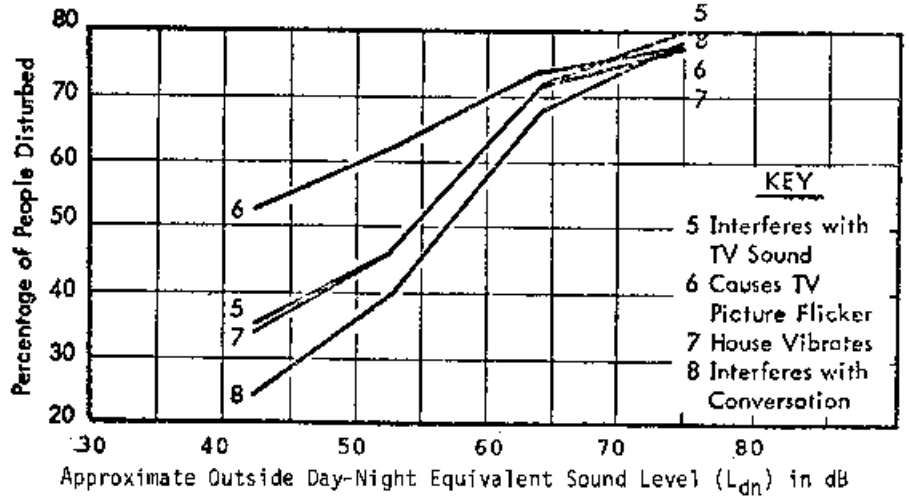


Figure D-6. Percentage of People Disturbed by Aircraft Noise for Various Types of Reasons Concerned with Domestic Factors [D-6]

Later research in the USA[D-7] provides the information on activity interference shown in Table D-4. This table gives the activity disturbance percentages of those who reported that they were *extremely dtsturbed* by the noise, which accounts in part for the low percentage values. It was reported that the daily activities of 98. 6% of those questioned (about 4000 people) were disrupted one or more times by aircraft noise. More activities are mentioned in Table D-4 than in the previous tables. For example, telephone use, reading, listening to tapes and records, and eating were reported to have been disturbed by noise.

A study performed in the Netherlands[D-8] gives further evidence that activity interference is associated with noise (see Table D-5). The data were taken in the urban/suburban areas in the vicinity of the Amsterdam Airport where the L_{dn} ranged from 45 to 85 dB. Activity interference is shown by percentage of people interviewed who have been frequently or sometimes disrupted in various activities. Also reported are the estimated tolerance limits for various portions of the exposed population. Thus, in an area where

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-4

PERCENT OF THOSE PEOPLE WHO WERE EXTREMELY DISTURBED BY AIRCRAFT NOISE*, BY ACTIVITY DISTURBED[D-7]

Activity	Percent
TV/Radio reception	20.6
Conversation	14.5
Telephone	13.8
Relaxing outside	12.5
Relaxing inside	10.7
Listening to records/tapes	9.1

Sleep	7.7
Reading	6.3
Eating	3.5

*Percent scoring 4 or 5 on a 1-5 scale

noise produces "predominantly moderate nuisance," the "tolerance limit" is reached for one third of the population. Thirty-one percent report being sometimes disturbed by noise during conversation, and 21% report being sometimes disturbed by noise during sleep; occupational disturbance was reported by 12%. (The judgment of "admissibility" with respect to well-being in Table D-5 is the result of the referenced study and not a conclusion of this report.)

A recent study[D-9] in the USA found that 46% of the 1200 respondents were annoyed by surface vehicle noise at some time. Activities which were reported disturbed are indicated by percentages shown in Table D-6. Here we see that sleeping is the activity most disturbed by surface vehicle noise, followed in order by listening to TV, radio orrecordings; mental activity, such as reading, writing or thinking; driving; conversing; resting and walking.

From the studies reported here, it is clear that noise does indeed interfere with various activities in our everyday lives. Unfortunately, most of the studies do not provide activity interference as a function of noise exposure. However, the activity which is most sensitive to noise in most of the studies is speech communication (including listening to TV), which can be directly related to the level of the intruding noise.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-5

PERCENTAGE OF PERSONS INTERROGATED WHO FEEL THAT THEY HAVE FREQUENTLY, (F) OR SOMETIMES (S) BEEN DISTURBED IN CONVERSATION, RADIO LISTENING, TELEVISION, OCCUPATIONS, SLEEP; FEEL AFRAID, AND OF PERSONS IN WHOSE EXPERIENCE ON THESE OCCASIONS THE HOUSE VIBRATES. AT MEAN VALUE OF THE NUISANCE SCORES.[D-8]

	Disturbance of Conversation		Disturbance of Radio Listening		Disturbance of Occupations		Disturbance of Television		Afraid
Mean Nuisance Score	F*	S*	F	S	F	S	F	S	YES
0	0	0	0	0	0	0	0	0	0
1	7	12	2	4	6	10	1	3	25
2	16	24	5	8	12	18	3	7	48
3	27	31	10	15	20	23	7	12	66
4	39	35	18	22	31	25	11	19	78
5	56	37	27	30	42	23	19	28	91
6	67	31	38	36	57	23	34	39	94
7	83	17	56	44	72	28	55	45	100

*F denotes "frequently" S denotes "sometimes"

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-5 (Continued)

House Vibrates	Disturbance of Sleep		Nuisance Felt Subjectively	Admissibility from point of view of physical, mental and social well being, in regard to which the stress is laid on disturbance of sleep, disturbance of conversation and feeling afraid
YES	F	S		
0	0	0	No nuisance	--------
21	3	7	Slight nuisance	Admissable
41	6	14	Slight to moderate nuisance	Admissable; the tolerance limit is reached for about one-third of the population.
56	12	21	Predominantly moderate nuisance	Limit of admissability; tolerance limit is reached in about one-third of the population.
72	20	28	predominantly serious nuisance	Inadmissable; the tolerance limit is exceeded for about half of the population.
83	31	33	Serious nuisance	Inadmissable; the tolerance limit is exceeded for about two-thirds of the population.
92	44	42	Intolerable	Absolutely inadmissable
100	72	28	Intolerable	Absolutely inadmissable

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-6 ACTIVITIES OF RESPONDENTS DISTURBED BY SURFACE VEHICLE NOISE

(All Situations: Respondent's Usual Activity)[D-9]

Category	No. of Situations	Percentage of Total Situations
Driving	47	7
Walking	16	2

Talking with people present	42	6
Working at home	12	2
Reading, writing, thinking	80	12
Sleeping	155	22
Other	13	2
Not relevant	179	26
Listening to TV, radio, records	92	13
Resting (awake)	35	5
Not ascertained	22	3
Total	693	100

COMMUNITY REACTION TO ENVIRONMENTAL NOISE

There are two methods of indirectly assessing the cumulative effects of environmental noise on people. These are examining the reactions of individuals or groups of individuals to specific intruding noises, either (a) with respect to actions taken (complaints, suits, etc.), or (b) in terms of responses made to social survey questionnaires. The first category, involving overt action by individuals or groups, is summarized in this section, and key data regarding the second category, involving responses indicating annoyance, is summarized in the next section.

In the last 25 years, many new types of noise sources have been introduced into suburban and urban residential communities. These sources, such a jet aircraft, urban

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

freeways, new industrial plants, and homeowner equipment, have created numerous community problems with environmental noise. These problems have provided significant data and insight relating to community reaction and annoyance and stimulated the development of several indices for measurement of the magnitude of intruding noises.

Various U.S. Governmental agencies began to investigate the relationships between aircraft noise and its effect on people in communities in the early 1950's. This early research resulted in the proposal of a model by Bolt, Rosenblith and Stevens[D-10] for relating aircraft noise intrusion and the probable community reaction. This model, first published by the Air Force, accounted for the following seven factors:

1. Magnitude of the noise with a frequency weighting relating to human response.
2. Duration of the intruding noise.
3. Time of year (windows open or closed).
4. Time of day noise occurs.
5. Outdoor noise level in community when the intruding noise is not present.
6. History of prior exposure to the noise source and attitude toward its owner.
7. Existence of pure-tone or impulsive character in the noise.

Correction for these factors were initially made in 5 dB intervals since the magnitudes of many of the corrections were based solely on the intuition of the authors, and it was considered difficult to assess the response to any greater degree of accuracy. [D-11-13] This model was incorporated in the first Air Force Land Use Planning Guide[D-14] in 1957 and was later simplified for ease of application by the Air Force and the Federal Aviation Administration.

Recently the day-night sound level has been derived for a series of 55 community noise problems [D-3] to relate the normalized measured L_{dn} with the observed community reaction. The

normalization procedure followed the Bolt, Rosenblith and Stevens method with a few minor modifications. The correction factors which were added to the measured L_{dn} to obtain the normalized L_{dn} are given in Table D-7. The distribution of the cases among the various noise sources having impact on the community are listed in Table D-8. The results are summarized in Figure D-7.

The "no reaction" response in Figure D-7 corresponds to a normalized outdoor day-night sound level which ranges between 50 and 61 dB with a mean of 55 dB. This mean value is 5 dB below the value that was utilized for categorizing the day-night sound level for a "residential urban community," which is the baseline category for the data in the figure. Consequently, from these results, it appears that no community reaction to an intruding noise is expected, on the average, when the normalized day-night sound level of an identifiable intruding noise is approximately 5 dB less than the day-night sound level

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-7

CORRECTIONS TO BE ADDED TO THE MEASURED DAY-NIGHT SOUND LEVEL (L_{dn}) OF INTRUDING NOISE TO OBTAIN NORMALIZED L_{dn}[D-3]

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
	Very noisy urban residential community	-10
Correction for Previous Exposure & Community	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous	

Attitudes	exposure to the intruding noise and the noise maker's relations with the community are good	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tine or impulsive character Pure tone or impulsive character present	0 +5

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-8

NUMBER OF COMMUNITY NOISE REACTION CASES AS A FUNCTION OF NOISE SOURCE TYPE AND REACTION CATEGORY

Type of Source	Community Reaction Categories			Total Cases
	Vigorous Threats of Legal Action	Wide Spread Complaints	No Reaction or Sporadic Complaints	
Transportation vehicles, including:				
Aircraft operations	6	2	4	12
Local traffic			3	3
Freeway	1			1
Rail		1		1
Auto race track	2			2
Total Transportation	9	3	7	19
Other single-event or intermittent operations, including circuit breaker testing, target shooting, rocket testing and body shop	5			
Steady state neighborhood sources, including transformer substations, residential air conditioning	1	4	2	7
Steady state industrial operations, including blowers, general manufacturing, chemical, oil refineries, et cetera	7	7	10	24
Total Cases	22	14	19	55

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

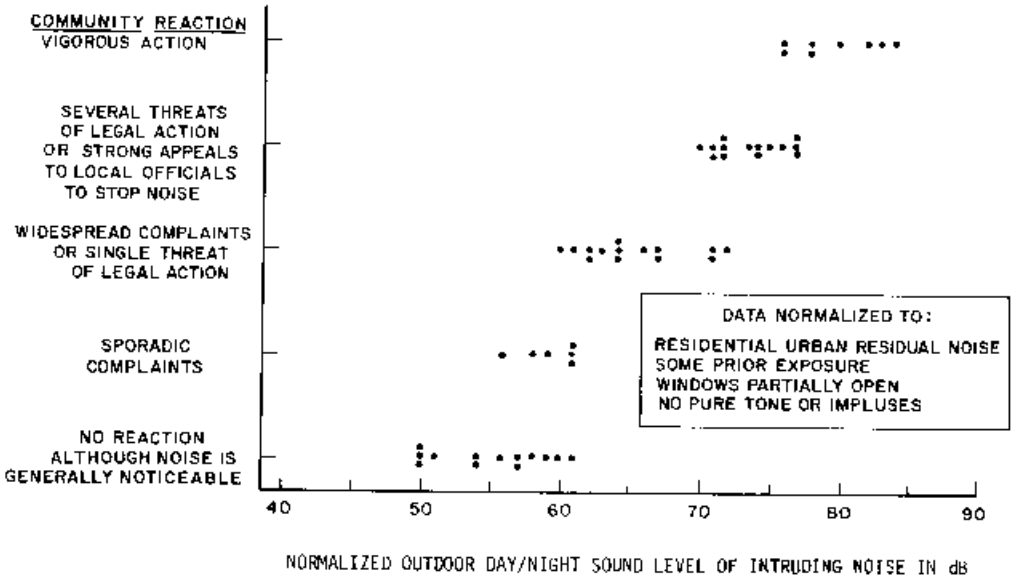


Figure D-7. Community Reaction to Intensive Noises of Many Types as a Function of the Normalized Outdoor Day Night Sound Level of the Intruding Noise[D-3]

that exists in the absence of the identifiable intruding noise. This conclusion is not surprising; it simply suggests that people tend to judge the magnitude of an intrusion with reference to the noise environment that exists without the presence of the intruding noise source.

The data in Figure D-7 indicate that widespread complaints may be expected when the normalized value of the outdoor day-night sound level of the intruding noise exceeds that existing without the intruding noise by approximately 5 dB, and vigorous community reaction may be expected when the excess approaches 20 dB. The standard deviation of these data is 3.3 dB about their means and an envelope of +5 dB encloses approximately 90 percent of the cases. Hence, this relationship between the normalized outdoor day-night sound level and community reaction appears to be a reasonably accurate and useful tool in assessing the probable reaction of a community to an intruding noise and in obtaining one type of measure of the impact of an intruding noise on a community.

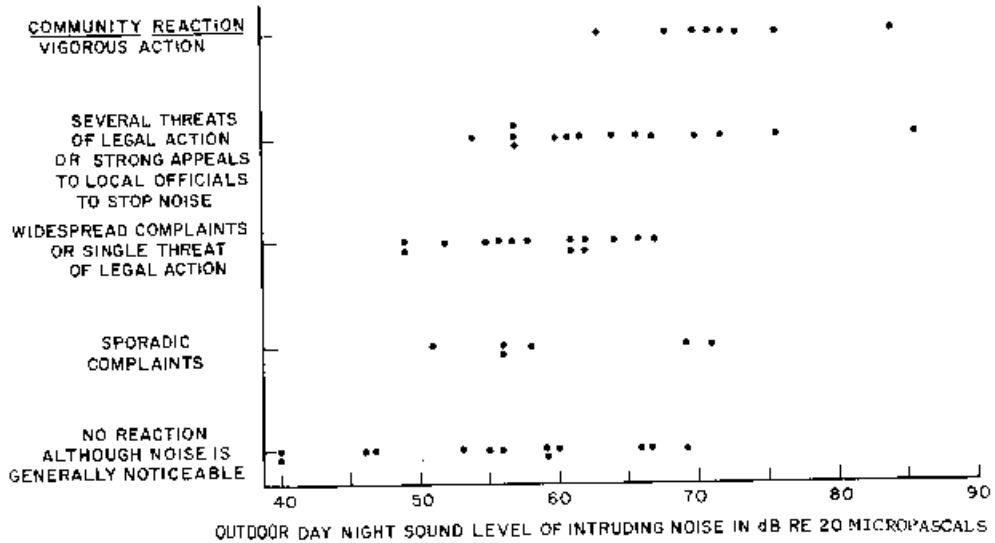
The methodology applied to arrive at the correlation between normalized L_{dn} and community complaint behavior illustrated in Figure D-7 is probably the best available at

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

present to predict the most likely community reaction in the U.S. Unfortunately, readiness to complain and to take action is not necessarily an early indicator of interference with activities and annoyance that the noise creates. The fact that correction for the normal background noise level without intruding noise results in better correlation of the data points might

be interpreted to mean that urban communities have adapted to somewhat higher residual noise levels that are not perceived as interfering or annoying. On the other hand, it is more likely that the higher threshold for complaining is caused by the feeling that higher residual noise is unavoidable in an urban community and that complaining about "normal" noise would be useless. For the present analysis, it might therefore be more useful to look at the same data without any corrections for background noise, attitude, and other subjective attributes of the intruding noise. Figure D-8 gives these data for the same 55 cases,

The increase in spread of the data is apparent in comparing Figures D-7 and D-8, and the standard deviation of the data about the mean value for each reaction is increased from 3.3 dB for the normalized data to 7.9 dB. The mean value of the outdoor day-night sound level associated with "no reaction" is 55 dB; with vigorous reaction, 72 dB; and, for the three intermediate degrees of reaction, 62 dB.



D-21

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

There is no evidence in these 55 cases of even sporadic complaints if the L_{dn} is less than 50 dB.

ANNOYANCE

Annoyance discussed in this report is limited to the long-term integrated adverse responses of people to environmental noise. Studies of annoyance in this context are largely based on the results of sociological surveys. Such surveys have been conducted among residents of a number of countries including the United States.[D-6, D-7, D-15, D-16]

The short-term annoyance reaction to individual noise events, which can be studied in the field as well as in the laboratory, is not explicitly considered, since only the accumulating effects of repeated annoyance by environmental stimuli can lead to environmental effects on public health and welfare. Although it is known that the long-term annoyance reaction to a certain environment can be influenced to some extent by the experience of recent individual annoying events, the sociological surveys are designed to reflect, as much as possible, the integrated response to living in a certain environment and not the response to isolated events.

The results of sociological surveys are generally stated in terms of the percentage of respondents expressing differing degrees of disturbance or dissatisfaction due to the noisiness of their environments. Some of the surveys go into a complex procedure to construct a scale of annoyance. Others report responses to the direct question of "how annoying is the noise?" Each social survey is related to some kind of measurement of the noise levels (mostly from aircraft operations) to which the survey respondents are exposed, enabling correlation

between annoyance and outdoor noise levels in residential areas.

The results of social surveys show that individual responses vary widely for the same noise level. Borsky[D-17] has shown that these variances are reduced substantially when groups of individuals having similar attitudes about "fear" of aircraft crashes and "misfeasance" of authorities are considered. Moreover, by averaging responses over entire surveys, almost identical functional relationships between human response and noise levels are obtained for the whole surveyed population as are obtained for the groups of individuals having neutral attitudinal responses. Therefore, in deriving a generalized relationship between reported annoyance and day-night sound level, it seems reasonable to use the average overall group responses, recognizing that individuals may vary considerably from the average, both positively and negatively depending upon their particular attitudinal biases. In most cases, the average group response can also be interpreted as the average individual's response during his life period. That is to say, each individual changes his attitudinal biases according to various factors and personal experiences not necessarily connected to the noise or

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

even to the environment in general, which lead to fluctuations of each individual's attitude. The average group response does, to some extent, express the individual's response averaged over longer periods of his life. Therefore, this response reflects the effects most likely to affect his health over a longer time period. A comparison of the results of three of the most prominent social surveys around airports are presented in the following paragraphs. These are the first and second surveys around London's Heathrow Airport, [D-6, D-15] and the Tracor study [D-7] around eight major airports in the United States. The noise level data reported for each survey were converted to outdoor day-night sound levels for the purpose of this analysis. In addition, data are presented from a survey of response to motor vehicles in U.S. urban areas.[D-18]

First London-Heathrow Survey

The first survey of about 2,000 residents in the vicinity of Heathrow airport was conducted in 1961 and reported in 1963.[D-6] The survey was conducted to obtain responses of residents exposed to a wide range of aircraft flyover noise. A number of questions were used in the interviews to derive measures of degrees of reported annoyance. Two results of this survey are considered here.

A general summary of the data, aggregating all responses on a category scale of annoyance ranging from "not at all" to "very much annoying," is plotted as a function of approximate L_{dn} in Figure D-9. This figure presents a relationship between word descriptors and day-night sound level.

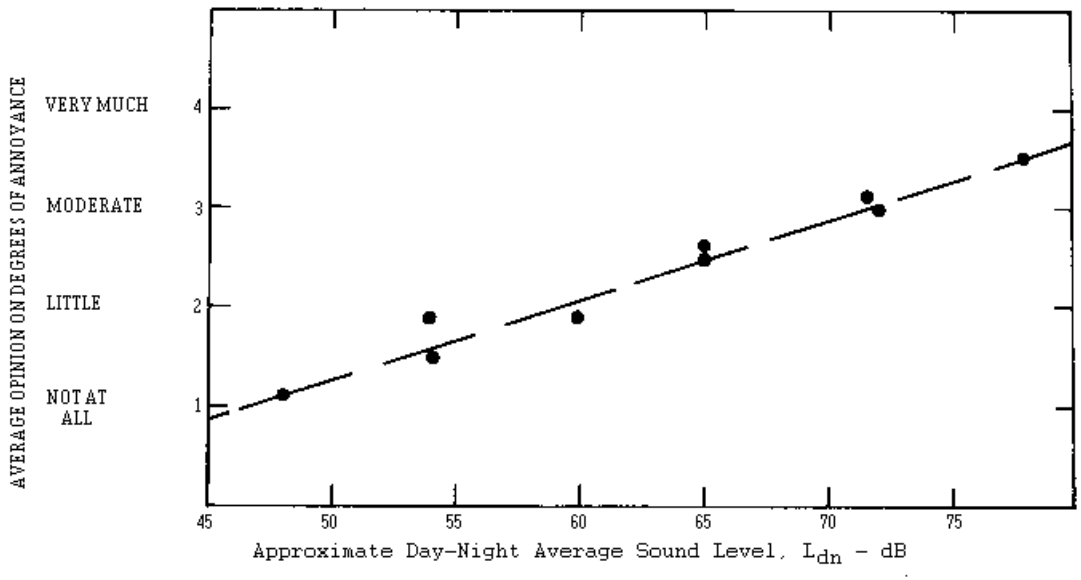
Among the respondents in every noise level category, a certain percentage were classified in the "highly annoyed" category. This percentage of each group is plotted as a function of approximate L_{dn} on Figure D-10.

Comparison of the data on the two figures reveals that, while the average over the population would fit a word classification of "little annoyed" at an L_{dn} value of approximately 60 dB, more than 20% of the population would still be highly annoyed at this L^{dn} value.

In addition to the derivation of overall annoyance scales, this study examined the attitude of the people towards their area and their desire to move as a function of both noise level and several other factors. The results are summarized in Figs. D-11 and D-12. They indicate that when the approximate L_{dn} exceeded 66-68 dB, aircraft noise became the reason most often cited by those who either "liked their area less now than in the past" or "wanted to move". Further, the data indicate that aircraft noise was of little importance,

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Figure D-9. Average Degree of Annoyance as a Function of the Approximate Day-Night Noise



Level - Results of First London Heathrow Survey[D-39 from D-6]

compared to other environmental factors, when the approximate L_{dn} was below 53 dB and was of average importance as a factor when the approximate L_{dn} was 60 dB.

Results of Second London Survey and Tracor Surveys

In 1967, a second survey[D-15] was taken around Heathrow Airport in the same general area as the first survey. While refinements were attempted over the first survey, the results were generally the same. In 1971, the results of an intensive three year program under NASA sponsorship which studies eight air carrier airports in the United States were reported by Tracor.[D-7] Since each of these efforts is discussed in detail in the references, only an analysis of their combined results is considered here. Borsky[D-17] used the data from these studies to correlate annoyance with noise exposure level for people having different attitudinal characteristics and different degrees of annoyance.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

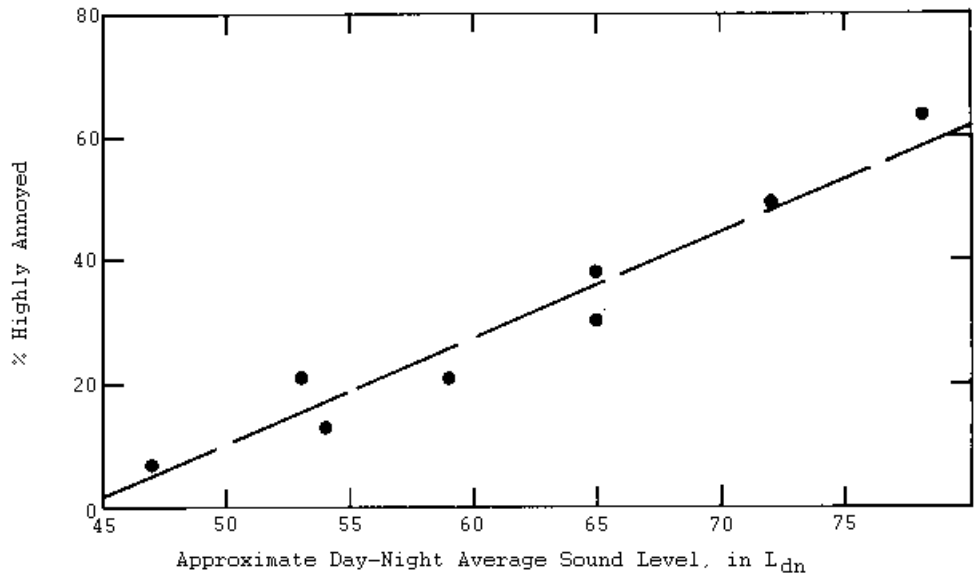


Figure D-10. Percentage Highly Annoyed as Function of Approximate Day-Night Noise Level - Results of First London Heathrow Survey[D-39 from D-6]

Utilizing Borsky's data for "moderate" responses to the attitudes of "fear" and "misfeasance", the relationship between percent highly annoyed and noise exposure level is plotted on Figure D-13. Again, noise levels have been converted to approximate L_{dn} values. It is worth noting that more than 7500 respondents are included in the data sets from which the computations were derived.

The comparison between the results shown on Figures D-10 and D-13 is striking in the near identity of the two regression lines-indistinguishable at any reasonable level of statistical confidence. The importance of these two sets of data lies in the stability of the results even though the data were acquired 6 to 9 years apart, at nine different airports in two different countries. This complete agreement led to the proposal of an average curve for the nominal relationship between sound level and percentage of people annoyed, which has been coordinated among and used by various U.S. Government agencies, [D-19] applied in the studies of ICAO'S coordinating committee on aircraft noise; and verified by a recent analysis of British, French and Dutch survey results conducted by the Organization for Economic Cooperation and Development (OECD). [D-20] According to the OECD work,

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

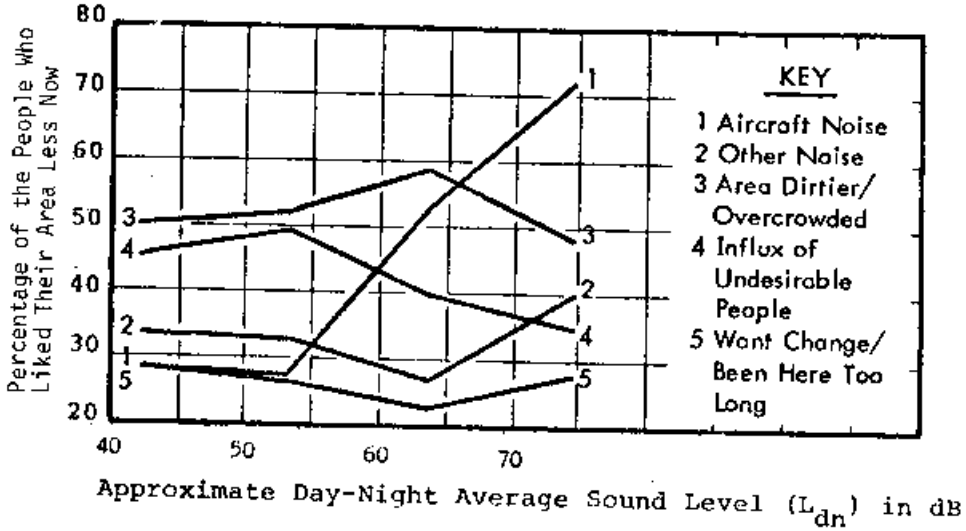


Figure D-11. Percentage of People Liking Their Area Less Now than in the Past for Various Reasons[D-6]

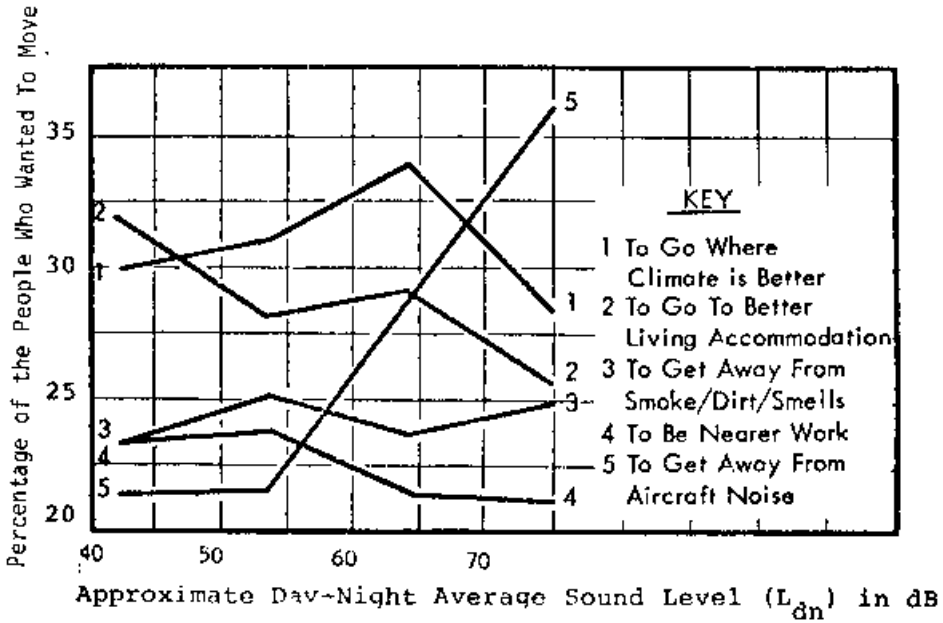


Figure D-12. Percentage of People Giving Particular Reasons for Wanting to Move[D-6]

Table of Contents
NPC Online Library
NPC Law Library

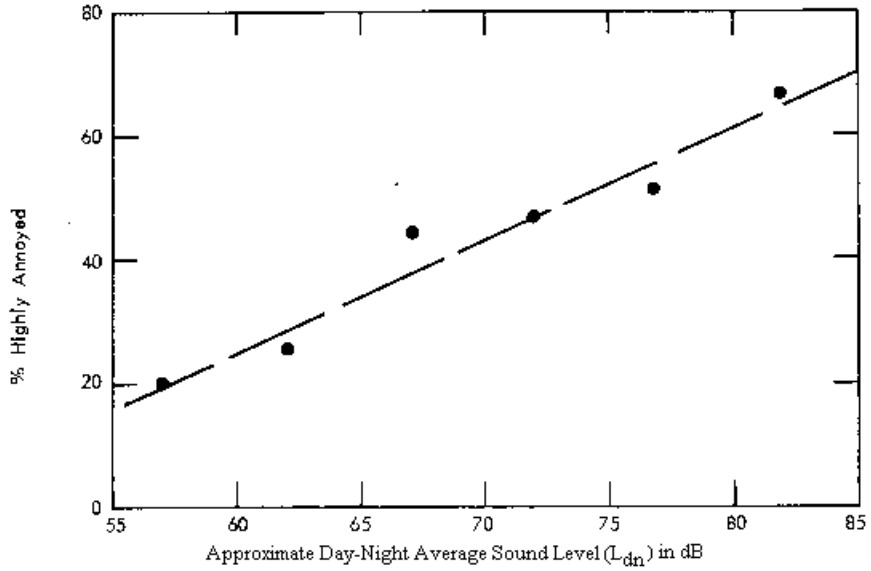


Figure D-13. Combined Results-British and U.S. Surveys [D-17]

the percentage of annoyed people can be predicted as follows: Percentage of annoyed people = 2 (L_{dn} - 50).

The results of the Tracor Study [D-7] also give a relationship between the number of people who indicate in a social survey that they are highly annoyed and the number of people who indicate that they have ever complained about the noise to any one in authority. The results, presented in Figure D-14, indicate that when 1% of the people complain, 17% report being highly annoyed; and when 10% of the people complain, 43 are highly annoyed.

Judgement of Noisiness at Urban Residential Sites

In 1972, a study of urban noise was conducted primarily to evaluate motor vehicle noise for the Automobile Manufacturers Association. [D-9] As part of this survey, 20 different urban-suburban residential locations *not in the vicinity of airports* were studied in Boston, Detroit, and Los Angeles. Noise measurements were acquired and a social survey of 1200

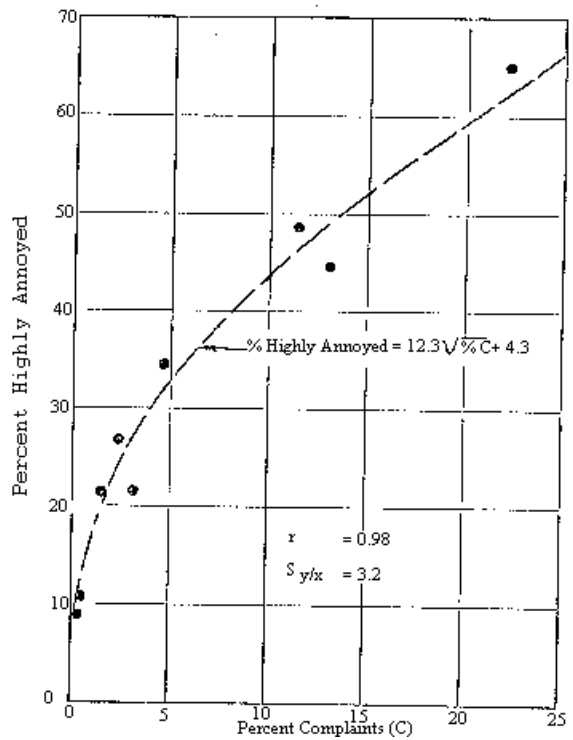


Figure D-14. Percentage of Highly Annoyed As A Function of Percent of ComplaintsD-7

D-28

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

respondents was conducted. Part of the survey was directed towards obtaining the respondents' judgement, on a category scale, of the exterior noisiness at their places of residence.

The averaged judged noisiness values per site are plotted on Figure D-15 as a function of measured L_{dn} values. The significance of these "non-aircraft" data is the comparison they permit with other survey data acquired exclusively around airports. Intercomparison of these data with previous data indicate that for an L_{dn} value of 60 dB, the site would be judged "quite" noisy. The average annoyance for a group would be classified as "little," but about 25% of the people would still claim to be highly annoyed.

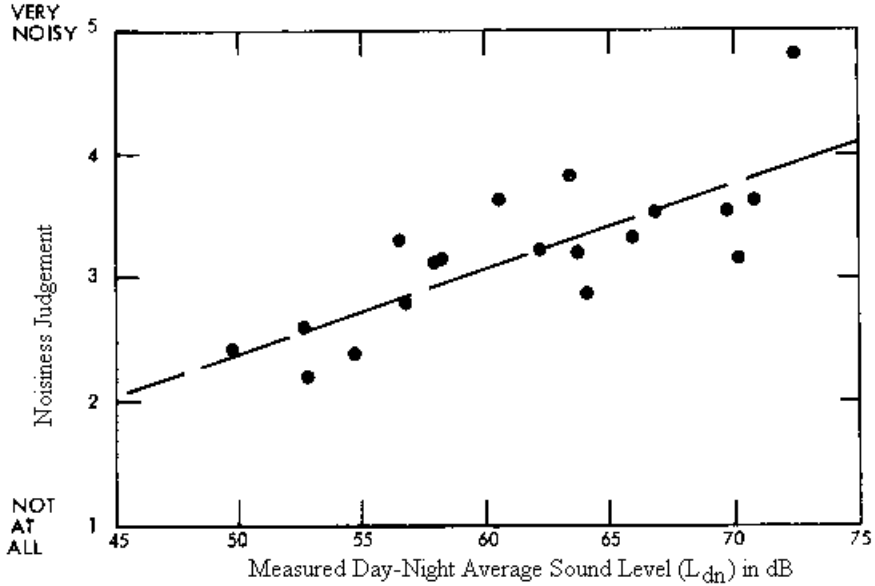


Figure D-15. Judged Noisiness at Automobile Manufacturers Association Survey SitesD-9

When all respondents, irrespective of exposure site, were asked whether they were annoyed by motor vehicle noise, 53% were not annoyed, while 46% were, with an average intensity of annoyance of 4.2 on a scale where 3 stood for "quite annoying," 4 for "definitely annoying" and 5 "strongly annoying." Of the 46% of respondents who stated they were annoyed by motor vehicle noise, 77% experienced annoying noises while in their homes, 12% while in transit, and only 5% at work.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

This indication, that the principle annoyance with environmental noise occurs in the residential situation is further confirmed in the results of the London City Noise Survey [D-18] summarized in Table D-9.

Summary of Annoyance Survey Results

The relationships among percent complainants and percent highly annoyed (Figure D-14) together with the combined results of the two Heathrow surveys and the Tracor survey (Figures D-10 and D-13) have been combined in Figure D-16 to produce a general summary relationship between day-night sound level, percent complainants and percent highly annoyed. Also included in the figure is a scale of the relative importance of aircraft noise as a factor in disliking an area or wanting to move (Figures D-11 and D-12) and the average values of the three main community noise reaction categories (Figure D-7).

The results indicate that below an outdoor day-night sound level of 55 dB, less than 1% of the households would be expected to complain, although 17% of the people may respond as highly annoyed when questioned in a social survey. "No reaction" would be expected in the average community, and noise would be the least important factor in attitude towards neighborhood. When the outdoor L_{dn} is 60 dB, approximately 2% of the households might be expected to complain, although 23% of the people may respond as highly annoyed when questioned, and some reaction would be expected from an average community. If the levels increase over 65 dB, more than 5% may be expected to complain, and over 33% would respond as highly annoyed. Increasingly, vigorous community reaction could be expected, and noise becomes the dominant factor in disliking an area.

Table D-9

PERCENTAGE OF PEOPLE WHO WERE EVER DISTURBED BY NOISE AT HOME, OUTDOORS AND AT WORK IN LONDON CITY SURVEY[D-18]

	At Home	Outside	At Work
Disturbed from time to time	56	27	20
Notice but not disturbed	41	64	70
Do not notice	3	9	10

D-30

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

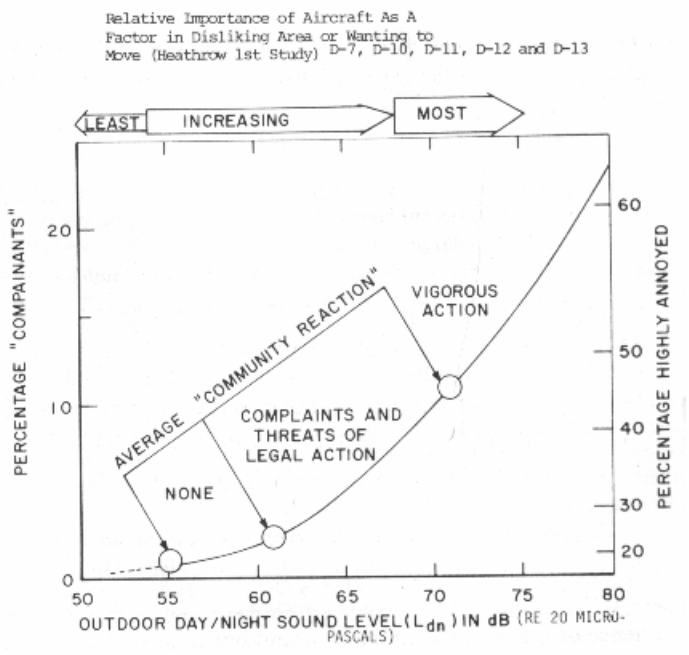


Figure D-16. Summary of Annoyance Survey and Community Reaction Results

It is important to keep in mind that the annoyance/tolerance limits obtained from the social survey results have been found to be based on relatively well defined health and welfare criteria: the disturbance of essential daily activities. [D-19]

VARIOUS PRIOR RECOMMENDATIONS FOR ACCEPTABLE SOUND LEVELS

Recommended values for acceptable sound levels in various types of spaces have been suggested by a number of authors over the past two decades. These recommendations generally have taken into consideration such factors as speech intelligibility and subjective judgements by space occupants. However, the final values recommended were largely the result of judgements on the part of the authors, which in the case of acoustical consultants, have been motivated by the need for design values which will be on the "safe" side. One of the earliest

publications providing recommended values in modern terminology was that

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

---

of Knudsen and Harris [D-21] in 1950. It is of interest to quote from the text to understand the reasoning used to develop the recommended levels:

> **Acceptable Noise Levels in Buildings**
>
> The highest level of noise within a building that neither disturbs its occupants nor impairs its acoustics is called the acceptable noise level. It depends, to a large extent, on the nature of the noise and on the type and customary use of the building. The time fluctuation of the noise is one of the most important factors in determining its tolerability. For example, a bedroom with an average noise level of 35 dB, with no instantaneous peak levels substantially higher, would be much more conducive to sleep than would be a room with an average noise level of only 25 dB but in which the stillness is pierced by an occasional shriek. Furthermore, levels that are annoying to one person are unnoticed by another. It is therefore impossible to specify precise values within which the noise levels should fall in order to be acceptable. It is useful, however, to know the range of average noise levels that are acceptable under average conditions. A compilation of such levels for various types of rooms in which noise conditions are likely to be a significant problem is given in [Table D-10.*] The recommended acceptable noise levels in this table are empirical values based on the experience of the authors and others they have consulted. Local conditions or cost considerations may make it impractical to meet the high standards inherent in these relatively low noise levels. In more than 80 percent of the rooms of some of the types listed, the prevalent average noise levels exceed the recommended acceptable levels. However, it should be understood that the acceptance of higher noise levels incurs a risk of impaired acoustics or of the comfort of the individuals in the room.

Since 1950 recommendations by a number of authors, as well as national standards, have been presented. Eighteen of these recommendations are tabulated in Table D-10. [D-21 through D-38] It is encouraging to note the consistency displayed, although many of the later recommendations may be based on the recommendations of the earlier authors.

SUMMARY OF NOISE INTERFERENCE WITH HUMAN ACTIVITIES AND RESULTING HEALTH/WELFARE EFFECTS

The primary effect of noise on human health and welfare due to interference with activity comes from its effect on speech communication.

*These values are given in the first column of Table D-10.

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

Table D-10

PRIOR RECOMMENDATIONS OF SOUND LEVELS IN VARIOUS SPACES[D-21 through D-38]

B&M

August 10, 1973

RECOMMENDED ACCEPTABLE NOISE LEVELS

	Knudsen-Harris 1950 1 dB(A)	Beranek 1953 2 db(A)[c]	Beranek 1957 3 dB(A)	Lawrence 1962 4 dB(A)	Kosten-Van Os 1962 5 dB(A)[c]	Ashrae 1967 6 dB(A)*	Denisov 1970 7 dB(A)	Kryter 1970 8 dB(A)	Tokyo 1971 9 dB(A)	USSR 1971 10 db(A)	Beranek 1971 11 dB(A)	Doelle 1972 12 dB(A)[c]	Wood 1972 13 dB(A)[c]	Rettinger 1973 14 dB(A)	Sweden (p-9) 15 dB(A)	Switzerland 1970 (p-4) 16 dB(A)	Czechoslovakia 1967 (p-10-11) 17 dB(A)	West Germany 1968 (p-12) 18 L_{eq}M-D
RESIDENT																		
Home																		
Bedroom	35-45	35	35-45	25	30	25-35	-	40	-	35	34-47	35-45	35	34-42	25	35-45	40	-
Living Room	35-45	35	-	40	35	30-40	-	40	-	35	38-47	-	40	-	25	35-45	40	-
Apartment	35-45	-	35-40	30	-	35-45	-	18	-	-	34-47	-	-	38-42	-	35-50	40	-
Hotel	35-45	-	35-40	35-40	-	35-45	-	38	-	35	34-47	35-54	30-40	42	-	35-50	40	-
COMMERCIAL																		
Restaurant	50-55	55	55	40-60	50	40-55	-	55	-	55	42-52	45-60	45-50	50	-	40-50	55	-
Private Office	40-45	50	30-45	35-45	30-45	25-45	40-45	35	-	-	38-47	30-45	40-45	46	40	-	-	-
General Office	45-55	-	40-55	40-60	60	35-65	50-60	35-40	-	50	42-52	45-55	45-55	50	-	-	-	-
Transport.	-	-	-	-	-	35-55	-	-	-	60	-	-	-	-	-	-	-	-
INDUSTRIAL																		
Workshop																		
Light	-	50	-	40-60	-	-	-	-	-	-	52-61	-	55-65	-	-	45-55	-	-
Heavy	-	75	-	60-90	70	-	85	-	-	-	66-80	-	60-75	70	-	50-60	-	-
EDUCATION																		
Classroom	35-40	35	35	30-40	30	35-45	-	35	-	40	38-47	35	35-45	38	35	35-45	-	-
Laboratory	-	-	-	40-50	-	40-50	40-50	-	-	-	47-46	-	45-50	42	-	-	-	-
Library	40-45	40	42-45	35-45	35	35-45	-	40	-	-	38-47	40-45	40-45	42	-	-	40	-
HEALTH Hospital	35-40	40	42	20-35	35	30-45	-	40	-	25	34-47	40	40-45	38	25-35	25-35	35-40	-
RECREATION																		
Swimpool	-	-	-	-	-	45-60	-	-	-	-	-	-	50-60	50	-	-	-	-
Sports (ampl.)	-	60	30	-	-	35-45	-	-	-	60	-	60	-	46	-	-	60	-
Gymnasium	-	-	-	-	55	40-50	-	-	-	-	-	55-60	45-55	46	-	-	-	-
AUDITORIUM																		
Assembly Hall	35-40	35	35-40	40-45	-	30-40	-	38	-	-	30-42	35-45	35-45	-	-	-	-	-
Church	35-40	40	40	35-40	35	25-35	-	40	-	35	30-42	35-40	35-40	38-42	-	-	-	-
Concert Hall	30-35	30-35	25-35	25-35	30	25-35	-	28-35	-	-	21-30	25-35	30-35	34	-	-	35	-

Court Room	40-45	40	40-45	40-45	35	-	-	40	-	-	42	35-40	35-40	-	-	-	-	-
Record Studio	25-30	30	25-30	20-30	20	25-35	-	28	-	-	21-34	25-30	30	30	-	-	-	-
TV Studio	25-30	30	30	25-35	30	25-35	-	28	-	-	21-34	30-35	35	34-38	-	-	-	-
Mot. Pict. Studio	25-30	30	25-30	-	25-35	-	-	28	-	-	21-34	35	25	-	-	-	-	-
Mot. Pict. Theater	35-40	40	40	-	35	35-45	-	40	-	40	-	40	35-40	38	-	-	-	-
Lec. Theater	30-35	35	30-35	-	25	30-40	-	33	-	-	30-34	30-35	-	34	-	-	35	-
OUTSIDE																		
Rural	-	-	-	-	-	-	-	-	35-45	35	-	-	-	-	-	-	-	35-45
Suburb	-	-	-	-	-	-	-	-	40-50	45	-	-	-	-	-	-	-	35-50
Urban	-	-	-	-	-	-	-	-	50-60	-	-	-	-	-	-	-	-	40-55
Industrial	-	-	-	-	-	-	-	-	50-60	-	-	-	-	-	-	-	-	50-65
Res Areas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-	-
Near Schools	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hospitals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: db(A)^c = MC = 10
*6 dB greater than ASHRAE'S cited MC

D-33

Table of Contents
NPC Online Library
NPC Law Library
NPC Noise News
NPC Home

The levels that interfere with human activities which do not involve active listening cannot be quantified relative to the level of a desired sound. Rather, the level of an intruding sound that will cause an interference depends upon its relation to the level of the other background sounds in the environment and the state of the human auditor, e.g., the degree of concentration when endeavoring to accomplish a mental task, or the depth of sleep, etc.

The levels of environmental noise that are associated with annoyance depend upon local conditions and attitudes. They cannot be clearly identified in terms of the national public health and welfare. The only levels which can be so identified are the levels which are required to assure that speech communication in the home and outdoors is adequate in terms of public health and welfare. Lower levels may be desirable and appropriate for specific local situations.

The level identified for the protection of speech communication is 45 dB within the home. Allowing for the 15 dB reduction in sound level between outdoors and indoors, this level becomes an outdoor day-night sound level of 60 dB (re 20 micropascals) for residential areas. For outdoor voice communication, the outdoor day-night level of 60 dB allows normal conversation at distances up to 2 meters with 95 sentence intelligibility.

Although speech interference has been identified as the primary interference of noise with human activities, and as one of the primary reasons for adverse community reactions to noise and long-term annoyance, a margin of safety of 5 dB is applied to the maximum outdoor level to give adequate weight to all of these other adverse effects.

Therefore, the outdoor day-night sound level identified for residential areas is a daynight sound level of 55 dB.

The associated interior day-night sound level within a typical home which results from outdoors is 15 dB less, or 40 dB. The expected indoor daytime level for a typical neighborhood which has an outdoor day-night sound level of 55 dB is approximately 40 dB, whereas the nighttime level is approximately 32 dB (see Figure A-7). This latter value is consistent with the limited available sleep criteria. [D-5] Additionally, these resulting indoor levels are consistent with the background levels inside the home and which have been recommended by acoustical consultants as "acceptable" for many years (Table D-10).

The effects associated with an outdoor day-night sound level of 55 dB are summarized in Table D-11. The summary shows:

1. Satisfactory outdoor average sentence intelligibility may be expected for normal voice conversations over distances of up to 3.5 meters;

Table D-11

SUMMARY OF HUMAN EFFECTS IN TERMS OF SPEECH COMMUNICATION, COMMUNITY REACTION, COMPLAINTS, ANNOYANCE AND ATTITUDE TOWARDS AREA ASSOCIATED WITH AN OUTDOOR DAY/NIGHT SOUND LEVEL OF 55 dB re 20 MICROPASCALS

Type of Effect	Magnitude of Effect
Speech - Indoors	100% sentence intelligibility (average) with a 5 dB margin of safety
- Outdoors	100% sentence intelligibility (average) at 0.35 meters
	99% sentence intelligibility (average) at 1.0 meters
	95% sentence intelligibility (average) at 3.5 meters
Average Community Reaction	None, 7 dB below level of significant "complaints and threats of legal action" and at least 16 dB below "vigorous action" (attitudes and other non-level related factors may affect this result)
Complaints	1% dependent on attitude and other non-level related factors
Annoyance	17% dependent on attitude and other non-acoustical factors
Attitudes Toward Area	Noise essentially least important of various factors

2. Depending on attitude and other non-acoustical factors, the average expected community reaction is "none" although 1% may complain and 17% indicate "highly annoyed" when responding to social survey questions; and

3. Noise is the least important factor governing attitude towards the area.

Identification of a level which is 5 dB higher than the 55 dB identified above would significantly increase the severity of the average community reaction, as well as the expected percentage of complaints and annoyance. Conversely, identification of a level 5 dB lower than the 55 dB identified above would reduce the indoor levels resulting from outdoor noise well below the normal background indoors. It would decrease speech privacy outdoors to marginal distance. Little change in annoyance would be made since at levels below the identified level, individual attitude and life style, as well as local conditions, are more important factors in controlling the resulting magnitude of the level of the intruding noise.

In conclusion, a L_{dn} level of 55 dB is identified as outdoor level in residential areas compatible with the protection of public health and welfare. The level of 55 dB is identified as maximum level compatible with adequate speech communication indoors and outdoors. With respect to complaints and long term annoyance this level is clearly a maximum satisfying the large majority of the population (see Table D-11). However, specific local situations, attitudes, and conditions may make lower levels desirable for some locations. A noise environment not annoying some percentage of the population cannot be identified at the present time by specifying noise level alone.

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Appendix E

GENERAL EFFECTS OF NOISE NOT DIRECTLY USED IN IDENTIFYING LEVELS OF NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE

Appendix E

GENERAL EFFECTS OF NOISE NOT DIRECTLY USED IN IDENTIFYING LEVELS OF NOISE REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE

There are a multitude of adverse effects that can be caused by noise which may, both directly or indirectly, affect public health and welfare. However, there are only three categories of adverse relationships in which the cause/effect relationships are adequately known and can be justifiably used to identify levels of environmental noise for protection of public health and welfare. These are: (1) the effect of noise on hearing, (2) the effect of noise on the general mental state as evidenced by annoyance, and (3) the interference of noise with specific activities. These three categories of effects, discussed in detail in Appendices C and D, will serve as the main basis for identifying the levels in Section 3 of this document.

Since a causal link between community noise and extra-auditory disease has not been established, this document proceeds on the assumption that protection against noise-induced hearing loss is sufficient for protection against extra-auditory effects. However, the generation of most stress-related disorders is somewhat longer than that required for noise-induced hearing loss, and this time interval may have clouded a causal association. Noise of lesser amplitude than that traditionally identified for the protection of hearing causes regular and dependable physiological responses in humans. Similar noise-induced physiological changes in sensitive animals regularly leads to the development of stress-related disease. The implications of generalizing from these animal studies to humans is not clear. With the availability of new information concerning the role of noise as a stressor in the pathogenesis of stress-related disease, the levels identified in this document may require further review.

In the meantime, the question that is invariably asked is, "What is the significance of omitting all other physiological effects?"

In answer to this question, most experts agree that, at present, there is insufficient knowledge of the effect of noise on health except for noise-induced hearing loss, (defining health in the more restricted sense, as the absence of disease). In a recent review of this subject E-1 it was concluded that: "if noise control sufficient to protect persons from ear damage and hearing loss were instituted, then it is highly *unlikely* that the noises of lower level and duration resulting from this effort could directly induce non-auditory disease." Therefore, in this document, hearing loss will be considered the controlling effect.

This is not to say that there are no indications to arouse concern in the area of nonauditory effects, but substantial further research on these effects of noise on health would be required to alter the above statements. Such research should be fostered, and the results should be carefully monitored for any evidence indicating that the maximum sound levels identified herein are excessive.

Although noise can affect people indirectly by disturbing the general environment in which they live, the noise levels required to produce significant non-auditory physiological effects are normally much higher than the levels required to protect the public health and welfare from adverse effects on hearing or interference with activities.

However, for special conditions, certain effects which have not been directly utilized in identifying the levels in this document, should be examined. For this purpose, certain of the summary paragraphs of the EPA criteria document "Public Health and Welfare Criteria for Noise"[E-2] are included in this appendix. Caution must be exercised when using such information since, in many cases, there is no way to relate the exact exposure level to the effect in question.

EFFECTS OF NOISE ON HUMANS

Performance and Work Efficiency

Continuous noise levels above 90 dBA appear to have potentially detrimental effects on human performance, especially on what have been described as noise-sensitive tasks such as vigilance tasks, information-gathering and analytical processes. Effects of noise on routine-type tasks appear to be much less important, although cumulative degrading effects have been demonstrated by researchers. Noise levels of less than 90 dBA can be disruptive, especially if they have predominantly high frequency components, are intermittent, unexpected, or uncontrollable. The amount of disruption is highly dependent on:

- The type of task.
- The state of the human organism.
- The state of morale and motivation.

Noise does not usually influence the overall rate of work, but high levels of noise may increase the variability of the work rate. There may be "noise pauses" or gaps in response, sometimes followed by compensating increases in work rate. Noise is more likely to reduce the accuracy of work than to reduce the total quantity of work. Complex or demanding tasks are more likely to be adversely affected than are simple tasks. Since laboratory studies represent idealized situations, there is a pressing need for field studies in real-life conditions.

Although these possibly adverse effects were not used in identifying the noise levels in this document, employers or educational authorities should consider their influence since it might provide additional motivation to achieve the values seen in Table D-10 of Appendix D.

Effects of Noise on the Autonomic Nervous System and Other Non-Auditory Physiological Effects

Noise can elicit many different physiological responses. However, no clear evidence exists to indicate that the continued activation of these responses leads to irreversible changes and permanent health problems. Sound of sufficient intensity can cause pain to the auditory system, however, such intense exposures are rarely encountered in the nonoccupational environment. Noise can also affect one's equilibrium, but the scarce data available indicates that the intensities required to do so must be quite high, similar to the intensities that produce pain.

Noise-induced orienting reflexes serve to locate the source of a sudden sound and, in combination with the startle reflex, prepare the individual to take appropriate action in the event of danger. Apart from possibly increasing the chance of an accident in some situations, there are no clear indications that the effects are harmful since these effects are of short duration and do not cause long-term physiological changes.

Noise can definitely interfere with sleep, however, relating noise-exposure level to the quality of sleep is difficult. Even noise of moderate levels can change the pattern of sleep, but the significance of these changes is still an open question.

Noise exposure may cause fatigue, irritability, or insomnia in some individuals, but the quantitative evidence in this regard is also unclear. No firm relationships between noise and these factors can be established at this time.

Interaction of Noise and Other Conditions or Influences

Determination of how various agents or conditions interact with noise in producing a given effect requires three separate determinations: the effect produced by the noise alone, the effect produced by the other agent alone, and the effect produced by the combined action of the agent and the noise. These results indicate whether the combined effect is indifferent, additive, synergistic, or ameliorative.

Chemical agents may have a harmful effect when combined with noise. Ototoxic drugs that are known to be damaging to the hearing mechanism can be assumed to produce at least an additive effect on hearing when combined with noise exposure. There are instances in which individuals using medication temporarily suffer a hearing loss when exposed to noise, but there is no definitive data on the interaction of ototoxic drugs and noise on humans. Evidence linking hearing loss with the combination of noise and industrial chemicals is also inconclusive.

The possibility of a synergistic effect exists when noise and vibration occur together. Vibration is usually more potent than noise in affecting physiological parameters. There appears to be consensus that vibration increases the effect of noise on hearing, but such increases are probably quite small.

Health disorders may interact with noise to produce a hearing loss. Mineral and vitamin deficiencies are one example but little research has been done on the effect of such deficiencies on susceptibility to noise. A reasonable hypothesis is that illness increases an individual's susceptibility to the adverse effects of noise. However, as with the other hypotheses, conclusive evidence is lacking.

Noise exposure can be presumed to cause general stress by itself or in conjunction with other stressors. Neither the relationship between noise exposure and stress nor the noise level or duration at which stress may appear have been resolved. .

Exposure to moderate intensities of noise that are likely to be found in the environment may affect the cardiovascular system in various ways, but no definite permanent effects on the circulatory system have been demonstrated. Noise of moderate intensity has been found to cause vasoconstriction of the peripheral blood vessels and pupillary dilation. There is no evidence that these reactions to noisy environments can lead to harmful consequences over prolonged periods of noise exposure. However, speculation that noise might be a contributing factor to circulatory difficulties and heat disease is not yet supported by scientific data.

EFFECTS OF NOISE ON WILDLIFE AND OTHER ANIMALS

Noise produces the same general types of effects on animals as it does on humans, namely: hearing loss, masking of communications, behavioral, and non-auditory physiological effects.

The most observable effects of noise on farm and wild animals seem to be behavioral. Clearly, noise of sufficient intensity or noise of aversive character can disrupt normal

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patterns of animal existence. Exploratory behavior can be curtailed, avoidance behavior can limit access to food and shelter, and breeding habits can be disrupted. Hearing loss and the masking of auditory signals can further complicate an animal's efforts to recognize its young, detect and locate prey, and evade predators. Competition for food and space in an "ecological niche" results in complex interrelationships and, hence, a complex balance.

Many laboratory studies have indicated temporary and permanent noise-induced threshold shifts. However, damage-risk criteria for various species have not yet been developed. Masking of auditory signals has been demonstrated by commercial jamming signals, which are amplitude and frequency modulated.

Physiological effects of noise exposure, such as changes in blood pressure and chemistry, hormonal balance and reproductivity have been demonstrated in laboratory animals and, to some extent, in farm animals. But these effects are understandably difficult to assess in wildlife. Also, the amount of physiological and behavioral adaptation that occurs in response to noise stimuli is as yet unknown.

Considerable research needs to be accomplished before more definitive criteria can be developed. The basic needs are:

- More thorough investigations to determine the point at which various species incur hearing loss.
- Studies to determine the effects on animals on low-level, chronic noise exposures.
- Comprehensive studies on the effects on animals in their natural habitats. Such variables as the extent of aversive reactions, physiological changes, and predator-prey relationships should be examined.

Until more information exists, judgments of environmental impact must be based on the existing information, however incomplete. The most simple approach is to assume that animals will be at least partially protected by application of maximum levels identified for human exposure.

EFFECT OF NOISE ON STRUCTURES

Airborne sound normally encountered in real life does not usually carry sufficient energy to cause damage to most structures. The major exceptions to this are sonic booms produced by supersonic aircraft, low frequency sound produced by rocket engines and some construction equipment, and sonic fatigue.

From an environmental point of view, the most significant effects are those caused by sonic booms on the secondary components of structures. These effects include the breaking of windows and cracking of plaster. Effects such as these have led to the speculation that historical monuments and archeological structures may age more rapidly when exposed to repeated sonic booms. However, the levels identified in Appendix G to protect against adverse effects on public health and welfare are low enough to protect against damage to structures.

REFERENCES FOR APPENDIX E

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Appendix F

EPA's RESPONSIBILITY TO IDENTIFY SAFE LEVELS FOR OCCUPATIONAL NOISE EXPOSURE

Appendix F

EPA's RESPONSIBILITY TO IDENTIFY SAFE LEVELS FOR OCCUPATIONAL NOISE EXPOSURE

Although the workplace is a vital component of the human environment, the Environmental Protection Agency does not have jurisdiction over most occupational health and safety matters. These matters have traditionally been the responsibility of the Departments of Labor and Health, Education and Welfare. Section 6(b)(5) of the Occupational Safety and Health Act of 1972 specifies that the Secretary of Labor, ". . . in promulgating standards dealing with toxic materials or harmful physical agents . . . shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life . . . In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws."

In contrast, section 5(a)(2) of the Noise Control Act of 1972 directs EPA's Adminisrator to "publish information on the levels of environmental noise, the attainment and maintenance of which in defined areas under various conditions are requisite to protecting the public health and welfare with an adequate margin of safety."

The words "public health and welfare" appear in a number of places in the Noise Control Act, and have a broader reference than those defining jurisdiction in the Occupational Safety and Health Act, namely, the entire American public at all times rather than the American worker during his workday. In addition, the requirement of an "adequate margin of safety" does not appear in the Occupational Safety and Health Act, which instead uses the phrase, "no employee will suffer material impairment of health or functional capacity." These distinctions indicate that EPA's duty to identify levels for exposure to noise is broader in scope and more stringent that OSHA'S duty to protect in the occupational area. Furthermore, the intent of this document is to identify safe levels for a variety of settings, whereas the responsibility of HEW is to develop occupational exposure criteria and that of the Department of Labor is to promulgate and enforce standards. In the writing of such standards, the Labor Department must take feasibility into account, a consideration omitted in the writing of this document.

EPA's responsibility to identify levels of exposure to noise "in defined areas under various conditions" necessarily includes an identification of exposure levels in the workplace

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in order to satisfy the intent of the law to consider total human exposure to noise. Working hours are an inseparable part of the individual's 24-hour day, and they must be considered in order to evaluate the contributions of nonoccupational exposure to his daily and lifetime dose. For this reason, it is of utmost importance that the levels specified for occupational and non-occupational noise be compatible.

Appendix G

IMPULSE NOISE AND SOME OTHER SPECIAL NOISES

Appendix G

IMPULSE NOISE AND SOME OTHER SPECIAL NOISES

IMPULSE NOISE

Impulse noise is defined in various ways [G-1, G-2, G-11] but generally means a discrete noise (or a series of such noises) of short duration (less than a second), in which the sound pressure level rises very rapidly (less than 500 ms, sometimes less than 1 ms) to a high peak level before decaying below the level of background noise. The decay is frequently oscillatory, because of sound reflections and reverberation (ringing) in which case the spectrum of the oscillation may also be important in determining the hazard to hearing. Some authors distinguish reverberant impulse noise as "impact" noise (typically produced by metal to metal impact as in industrial forging), to distinguish it from simple oligophasic impulses (typified by a gunshot in the open air). [G-3]

The peak sound pressure level (SPL) is an important but not the sole parameter determining hazard. Some typical values for disturbing or hazardous impulse noises are given in Table G-1.

NOTE: Peak SPL for impulses cannot be properly measured with a standard sound level meter, which is a time-averaging device. Oscillographic techniques must be used.

Table G-1

SOME TYPICAL VALUES OF PEAK SPL FOR IMPULSE NOISE

(in dB re 20 micropascals)

SPL	EXAMPLE
190+	Within blast zone of exploding bomb
160-180	Within crew area of heavy artillery piece or naval gun when shooting
140-170	At shooter's ear when firing hand gun
125-160	At child's ear when detonating toy cap or firecracker
120-140	Metal to metal impacts in many industrial processes (e.g., drop-forging; metal-beating)
110-130	On construction site during pile-driving

G-1

Effects of Impulse Noise on People

Cochlear Damage and Hearing Loss

Impulse noise can produce temporary (TTS) and permanent threshold shift (PTS). The pattern essentially resembles that produced by a continuous noise but may involve somewhat higher frequency losses (maximal at 4 to 6 kHz) and recovery from impulse-NIPTS can be more variable.[G-9] A blow to the head can have a similar effect. TSS (and, by inference, PTS) in man depends on many factors, the more important of which are reviewed in more detail later. Impulse noise (like continuous noise) can also be shown to produce pathological changes in the inner ear (cochlea) of mammals, notably destruction and degeneration of the haircells of the hearing organ, and atrophic changes in related structures. A quantitative relationship between the amount of visible damage to the cochlea and the amount of NIPTS has not yet been clearly established. [G-2, G-4, G-5]

Other Pathological Effects

Exposure to blast or to sustained or repeated impulsive airborne over-pressures in the range of 140 to 150 dB (239 to 718 pascals) or higher can cause generalized disturbance or damage to the body apart from the ear. This is normally a problem for military personnel at war (e.g., artillerymen firing field guns), and need not be considered further here. Transient over-pressures of considerable magnitude can be experienced due to sonic boom but are unlikely to be hazardous to the ear.

Startle and Awakening

Impulsive noises which are novel, unheralded, or unexpectedly loud can startle people and animals. Even very mild impulsive noises can awaken sleepers. In some circumstances (e.g., when a person is handling delicate or dangerous objects or materials), startle can be hazardous. Because startle and alerting responses depend very largely upon individual circumstances and psychological factors unrelated to the intensity of the sound, it is difficult to make any generalization about acceptable values of SPL in this connection. A high degree of behavioral habituation, even to intense impulse noises such as gunfire, is normally seen in animals and humans when the exposure is repeated, provided that the character of the stimulus is not changed.

Parameters of Impulse Noise Exposure

Impulse noise is characterized completely by the waveform and spectrum. Various summary parameters are also useful in characterizing an impulsive noise, these include:

1. Peak SPL (in dB re 20 micropascals)

2. Effective duration (in milliseconds or microseconds)

3. Rise time

In addition, the following are important for predicting the effects of the impulse on people:

4. Number of repeated impulses in a daily or other cumulative exposure

5. Intervals or average interval between repeated impulses (or rate of impulse occurrence)

6. Individual susceptibility to inner ear damage

7. Orientation of the ear with respect to the noise

8. Preceding or simultaneous exposure to continuous noise at TTS-producing levels

9. Action of acoustic reflex, if elicited

10. Audiometric frequency

Impulse Noise Exposure Criteria and Limits

Hearing Damage and Criteria for Impulse Noise

It is obvious from the above lists that limiting impulse noise exposure for hearing conservation is not an easy matter. Existing guidance in this matter in some spheres is seriously inadequate or misleading.[G-3] For instance, the Occupational Safety and Health Act prescribes a limiting level of 140 dB SPL for industrial impulse noise, with no allowance for any other parameter.

In 1968, Working Group 57 of CHABA prepared a damage risk criterion for gunfire noise, based essentially on the work of Coles *et. al.,* [G-6] which included procedures to allow for repetition of impulses and some of the other parameters listed above.[G-1] Some modification has recently been proposed by Coles and Rice. [G-7] The CHABA proposal was intended to protect 95% of the exposed population.

Guidelines for Evaluating Hazard from Impulse Noise Exposure

Peak Level

The growth of TTS at 4 kHz with increase in peak level above 130 dB SPL of impulses (clicks) presented at a steady rate has been demonstrated by Ward *et. al.* [G-8] Based on TTS data from rifle shooters, Kryter and Garinther[G-18] estimated permanent hearing levels expected to result from daily exposure to a nominal 100 rounds of rifle shooting noise in selected percentiles. Their data are reproduced in Table G-2 below, showing the increasing hazard with increasing peak level and with increasing audiometric frequency up to 6000 Hz.

CHABA'S 1968 Damage-Risk Criteria (DRC) [G-1] recommended limits to peak level as a function of impulse duration for a nominal exposure of l00 impulses per day at normal incidence (discussed below and shown in Figure G-1). These limits were intended to protect 95% of the people according to an implied criterion of NIPTS not exceeding 20 dB at 3 kHz or above, after 20 yrs. If 90% of the people were to be protected to a criterion of NIPTS not exceeding 5 dB at 4 kHz, it would be necessary to lower the CHABA limits by 12 dB (15 dB reduction to meet the more stringent criterion, assuming an approximately decible to decibel relationship in the range of interest [see Table G-2], less 3 dB elevation to apply the limit to the 90th percentile). This modified CHABA limit is shown in Figure G-1 by hatched lines.

Duration of Impulse

Hazard increases with the effective duration of impulses. [G-10] Impulse duration is defined according to the type of impulse (A, simple peak, or B, oscillatory decay) ; [G-1, G-6] and CHABA has recommended separate limits for A- and B-durations (Figure G-1). For effective durations much above 1 ms, a more stringent limit should be applied to reverberant oscillations (e.g., metallic impacts in industry or gunshots in a reverberant indoor range) than to simple A-type impulses (e,g., gunshots in the open). When the type of impulse cannot be determined, it is conservative to assume the B-duration.

Table G-2

ESTIMATED EXPECTED PERMANENT HEARING LEVEL (IN DB RE ASA:1951) IN SELECTED PERCENTILES OF THE MOST SENSITIVE EARS FOLLOWING NOMINAL DAILY EXPOSURE TO RIFLE NOISE (DURING TYPICAL MILITARY SERVICE), NAMELY, 100 ROUNDS AT ABOUT 5 SECOND INTERVALS[G-18]

Peak SPL* (dB)	Percentile Exceeding HL	Audiometric Test Frequency (Hz)				
		1000	2000	3000	4000	6000
170	10	25	35	70	85	90
	25	15	25	55	65	70
	50	0	10	35	45	50
165	10	16	20	62	60	67
	25	9	10	32	45	52
	50	0	0	12	25	47
160	10	15	16	25	45	60
	25	7	8	18	35	45
	50	0	0	0	15	25
150	10	10	15	15	35	50
	25	3	4	8	25	40
	50	0	0	0	10	20
140	10	0	5	10	30	45
	25	0	2	2	18	30
	50	0	0	0	5	10

*At the ear, grazing incidence.

Figure G-1. The 1968 CHABA [G-1] Damage-Risk Criterion for Impulse Noise Exposure (solid lines) and a Proposed Modification (hatched lines). Peak Sound Pressure Level is Expressed as a Function of A- or B-Duration in the Range 25 Microseconds to 1 Second. [G-1]

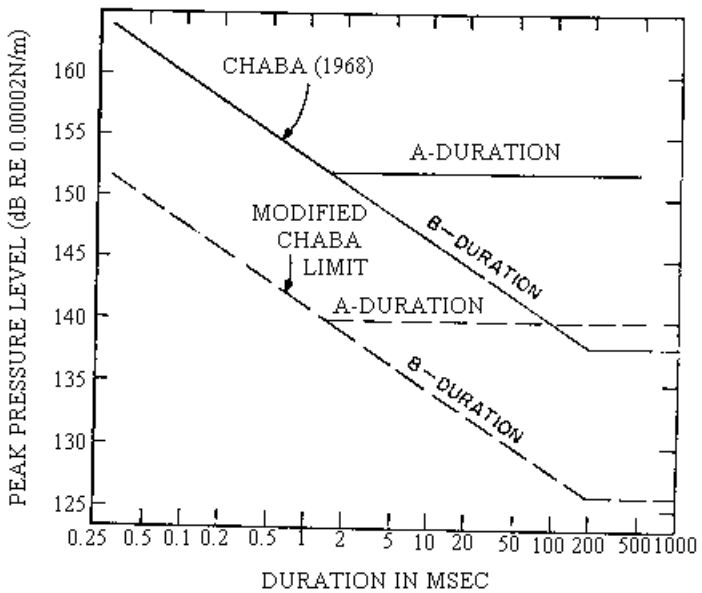

Figure G-1. The 1968 CHABA[G-1] Damage-Risk Criterion for Impulse Noise Exposure (solid lines) and a Proposed Modification (hatched lines). Peak Sound Pressure Level is Expressed as a Function of A- or B-Duration in the Range 25 Microseconds to 1 second.[G-1]

Rise Time

This parameter is usually correlated closely with peak pressure. Present evidence as to its effect on hearing risk is insufficient for allowance to be made for it in damage risk criteria.

Spectrum (Or Waveform)

Impulses with largely high frequency spectral components (e.g., reverberant gunshots) are generally more hazardous to the hearing mechanism than predominantly low-frequency impulses (e.g., distance-degraded blast waves; sonic booms) of the same peak SPL. However, comparative data are as yet too scanty to serve as the basis of differential damage risk criteria.

Number of Repeated Impulses

TTS (and, by inference, NIPTS) grows linearly with the number of impulses in a series, or linearly with time when the rate of impulses is constant. [G-8] CHABA [G-1] recommended an allowance of -5 dB for every tenfold increase in number of impulses in a daily exposure (Figure G-2). Recently, Coles and Rice [G-7] have contended that this rule is underprotective for large numbers (N) of impulses and have recommended a modification (see Figure G-2). In 1973, McRobert and Ward [G-3] questioned this modification, maintaining that it is probably grossly overprotective for N>1000, and commented also on the CHABA rule in the light of recent experiments. Figure G-2 reproduces a comparison by McRobert and Ward of the CHABA rule with Coles and Rice [G-7] and an "equal-energy" rule (10 dB weighting for each tenfold increase in N) originating at N = 100.

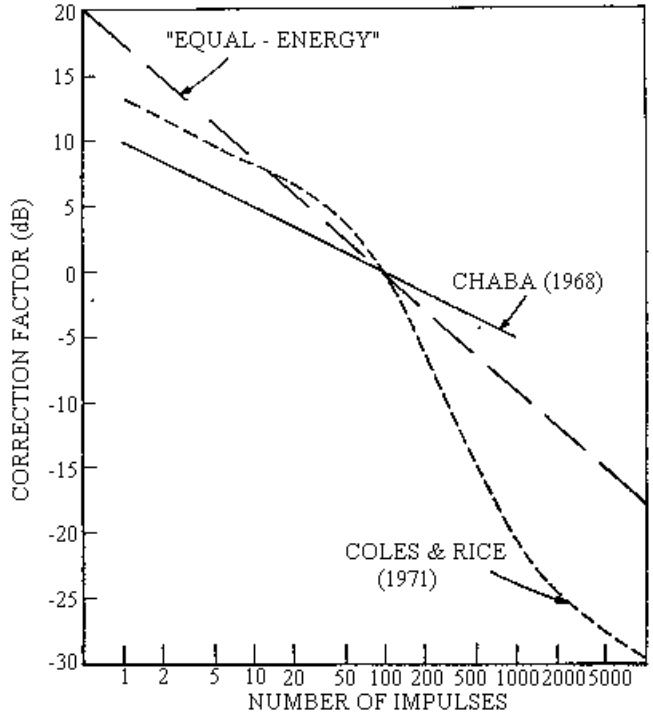

Figure G-2. Comparison of CHABA Weighting (Re: Zero at N=100 Impulses per Day) for Number (N) of Impulses in Daily Exposure[G-1] with the Proposed Modification by Coles and Rice[G-7] and an "Equal-Energy" Rule. After McRoberts and Ward.[G-3]

G-7

All in all, an "equal-energy" rule appears to fit the existing data tolerably well and is easy to apply in practice, but it may underestimate the hazard for values of N substantially less than 100 (isolated impulses).

Interval Between or Rate of Occurrence of Impulses

Ward, *et. al* G-8 showed that, when equal impulses occur at more than 1/s, TTS development is slower than when the average interval is in the range 1 to 9 s, presumably because the acoustic reflex is maintained. When the interval is long (range 9 - 30 seconds), TTS again develops more slowly, probably because the interval allows some recovery. A conservative rule would be to apply a 5 dB penalty when the average impulse interval lies between 1 and 10 seconds; such an interval may be typical of such activities as range shooting in groups, heavy hammering in industry, or pile-driving.

Individual Susceptibility to Inner Ear Damage

The distribution of individual susceptibility to NITTS and NIPTS in the population is believed to have the same pattern for impulse as for continuous noise. Similar rules may therefore be applied when predicting risk of impulse-NIPTS. The CHABA [G-1] DRC was intended to protect 95% of the population; a relaxation of 3 dB may be applied to obtain limits for the 90th percentile.

Orientation of the Ear

Based on Hodge & McCommons[G-12] and other data, CHABA[G-1] has recommended, in the case of gun noise, a penalty of 5 dB to apply when the noise strikes the eardrum at normal rather than grazing incidence. If uncertain, it is conservative to assume normal incidence.

Combinations of Impulse and Continuous Noise

Certain combinations of impulsive and continuous noise, such as occur in industry may be antagonistic-that is, one may provide some protection from the other-probably because of acoustic reflex activation. Other studies, however, show that the effects of combined impulse and steady noise are additive.[G-2, G-16] ISO, in its Recommendation R/1999,[G-17] proposed a flat weighting of 10 dB for "impulsiveness" in distributed noise, but the validity of this rule is questionable. On present evidence, it is probably safest to

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evaluate simultaneous impulsive and continuous noise separately, each according to its own criterion.

Action of the Acoustic Reflex

This protective mechanism is valueless in the case of brief single or isolated impulses because it has a latency of at least 10 ms and takes up to 200 ms before being fully effective. Rapidly repeated impulses, [G-7] however, or simultaneous continuous noise,[G-15] may activate it sufficiently to provide up to 10 dB of protection : but this is too variable and uncertain to be allowed for in damage risk criteria.

Audiometric Frequency

Generally speaking, impulse noise affects the hearing in much the same way as does continuous noise, with TTS and PTS beginning and growing most rapidly at 4 to 6 kHz. It is possible, however, that impulse noise may have relatively more effect on high-frequency hearing or affect hearing at higher frequencies.[G-13,G-14]

Use of Equivalent Continuous Sound Level (L_{eq}) In Evaluation of Impulse Noise

Support for the extension of the equal-energy (equivalent A-weighted sound energy) concept of hearing hazard from continuous noise exposure to include impulse noise expo- sure has recently been gaining ground. [G-19] At the 1970 Teddington Conference on "Occupational Hearing Loss", it was suggested that a unifying rule based on this concept might be drawn up to link continuous and impulse noise exposure limits in a single continuum relating A-weighted sound level to effective daily exposure duration. [G-20] An empirical formula enabling the A-weighted L_{eq} to be calculated from the peak sound pressure (p_h) repetition rate in impulses per second (N) and the decay constant of the impulse envelope (k) in inverse seconds, was introduced as follows: [G-21]

where p_h is absolute pressure in pascals; not sound pressure level in dB. For one impulse of the B-type, this formulation simplifies such that the L_{eq} of an A-weighted continuous pulse of duration T is equal to the peak sound pressure level (in dB) of an impulse which decays by 20 dB in time T minus 9 dB. The use of this formula assumes the impulse is composed of broad-band noise that exponentially decays. This relationship, at the present time, should not be used to evaluate impulse data until it is further justified by more experimental research. However, it does provide further support of the equal energy concept outlined in Appendix C.

Summary and Conclusions

Hearing Conservation

The following rules may be recommended if it is desired to protect 90% of the people from significant impulse-NIPTS, that is, from impulse-NIPTS exceeding 5 dB at 4 kHz after 10 years of repeated exposures:

1. Measure or predict the peak level (SPL) and A- or B-type duration of the impulse, using proper oscillographic technique (NOTE: if the noise is sufficiently rapidly repetitive to fit Coles and Rice's [G-7] category "C", it may be treated and measured as continuous noise and evaluated accordingly in dBA. This usually means a repetition rate exceeding 10/s).

2. Use the "modified CHABA limit" in Figure G-1 to determine the maximum permissible peak SPL. If in doubt as to impulse type, assume B-duration.

3. If the number of similar impulses (N) experienced per day exceeds 100, reduce the permissible level by 10 dB for every tenfold increase in N (e.g., 10 dB when N = 1000, 20 dB when N = 10,000).

4. If N is less than 100, a higher peak level may be allowed in accordance with the same rule (e.g., 10 dB more when N = 10), provided that an absolute maximum value of 167 dB for durations less than 25 microseconds, grazing incidence (or 162 dB normal incidence) is not exceeded.

5. If the average repetition rate of impulses falls in the range 0.1 to 1 per second (i.e., the average interval between impulses is 1 to 10 seconds), reduce the permissible peak level by 5 dB.

6. If the impulses are known to reach human ears in the vicinity at grazing incidence, the permissible peak level may be raised by 5 dB. NOTE: This allowance should be used with caution and must not be applied if the surroundings are reverberant. If in doubt, assume normal incidence.

Effects Other Than on Hearing

See Section 3 in main document.

SPECIAL NOISES

Infrasound [G-26]

Frequencies below 16 Hz are referred to as infrasonic frequencies. Sources of infrasonic frequencies include earthquakes, winds, thunder, and jet aircraft. Man-made infrasound occurs at higher intensity levels than those found in nature. Complaints associated with high levels of infrasound resemble mild stress reactions and bizarre auditory sensations, such as pulsating and fluttering. It does not appear, however, that exposure to infrasound, at intensitities below 130 dB SPL, present a serious health hazard. For the octave band centered at 16 Hz, the A-weighted equivalent to 130 dB SPL is 76 dB(A).

Ultrasound[G-26]

Ultrasonic frequencies are those above 20,000 Hz. They are produced by a variety of industrial equipment and jet engines. The effects of exposure to high intensity ultrasound (above 105 dB SPL) are also the effects observed during stress. However, there are experimental difficulties in assessing the effects of ultrasound since:

1. Ultrasonic waves are highly absorbed by air

2. Ultrasonic waves are often accompanied by broad-band noise and by sub-harmonics.

At levels below 105 dB SPL, however, there have been no observed adverse effects.

SONIC BOOMS

Present day knowledge regarding the acceptability of sonic booms by man is based on observations from both experimental field and laboratory studies and observations of community response to actual sonic boom exposures. Individual human response to sonic boom is very complex and involves not only the physical stimulus, but various characteristics of the environment as well as the experiences, attitudes and opinions of the population exposed. [G-22] One of the most comprehensive studies to date on sonic boom exposure of a large community over a relatively long period of time was the Oklahoma City study conducted in 1964. [G-23, G-24] Eight sonic booms per day at a median outdoor peak overpressure level of 57.46 pascals (or 1.2 psf)* were experienced by this community over a

* 1 psf = 47.88 pascals

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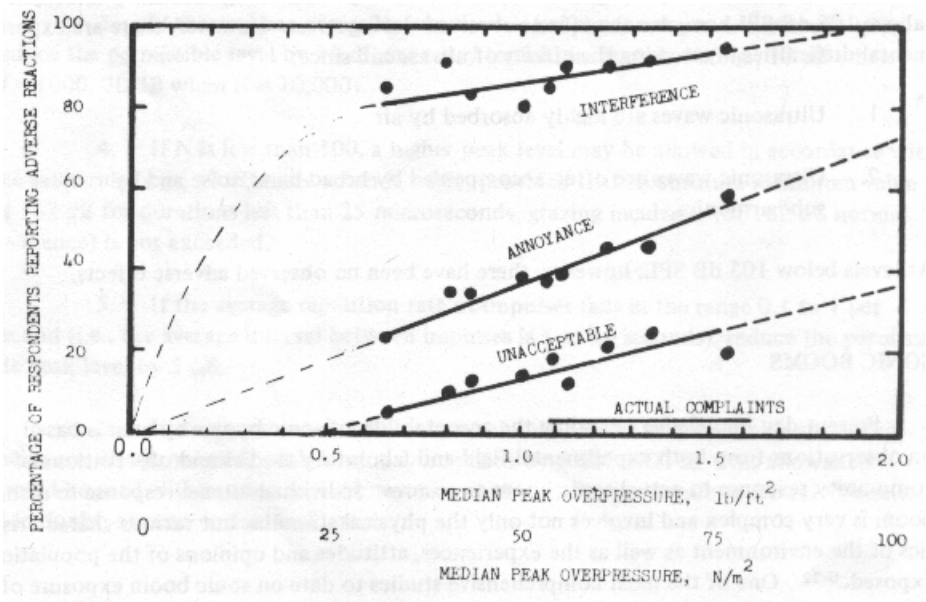
6 month period. Some results of this study are summarized in Figure G-3. For eight sonic booms/day, there is clear evidence that the median peak overpressure must be well below 47.88 pascals (or 1 psf) if no annoyance is reported. When interviewed, part of the population considered eight sonic booms/day to be unacceptable. By extrapolation, the level at which eight sonic booms per day should be acceptable for the population is slightly less than 23.94 pascals (or 0.5 psf). But even at 23.94 pascals, approximately 20% of the population consider themselves annoyed by an exposure of eight sonic booms/day. Linear extrapolation of the annoyance data of Figure G-3 indicates that annoyance will disappear in the total population only when the 8 sonic booms per day are less than 4.79 pascals. A linear extrapolation is probably not entirely justified, however, as certainly for sonic booms much less than

4.79 to 9.58 pascals, a large percentage of the population is not even expected to sense the boom. The fact that the extrapolation must curve is best illustrated by the interference curve of Figure G-3. Unless the extrapolation is curved as shown, interference would be predicted for about 70% of the population even when the peak overpressure is zero, i .e., no boom at all.



NOTE: Data compiled from Oklahoma City Study. Dashed lines are extrapolations. All data for 8 sonic boom/day.[G-22]

Figure G-3. Percentage of Respondents Reporting Adverse Reactions to Sonic Booms

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So far the discussion has been about eight sonic boom exposures per day on a daily recurring basis. The more difficult question is how to interpret the effect on public health and welfare of sonic booms that are more infrequent than eight times per day. Kryter [G-25] provides a relationship which indicates that a sonic boom of 90.97 pascals once a day would be equal to 110 PNdB or a CNR of 98 dB. It further suggests that the level (which is proportional to P^2) should be reduced by one half (3 dB) for each doubling of number of occurrences. From Appendix A, L_{dn} is approximately related to CNR by L_{dn} = CNR -35 dB. Thus, a CNR of 98 equals an L_{dn} of 63 dB. If the sonic boom is made equivalent to an L_{dn} = 55 dB, so as to be consistent with the levels identified in the interference/ annoyance section of this document, the level of one daytime sonic boom per day must be less than 35.91 pascals. For more than eight sonic booms/day, the level should be less than 12.45 pascals or pascals. This result is slightly lower than the data from Figure G-3. However, extrapolating the annoyance line in the figure suggests that the 12.45 pascals level of 8 booms would annoy only 8% of the people and more would find it unacceptable. Therefore, the relationship proposed is: daytime peak over-pressure per day = pascals where N = number of sonic booms/day. Thus, the peak over-pressure of a sonic boom that occurs during the day should be no more than 35.91 pascals if the population is not to be annoyed or the general health and welfare adversely affected.

The standard sound level meter, which is a time-averaging device, will not properly measure the peak sound pressure level of sonic booms.

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Global Greenhouse Gas Data

Atmospheric concentrations of greenhouse gases are affected by the total amount of greenhouse gases emitted to and removed from the atmosphere around the world over time. Figure 1 shows a breakdown of global anthropogenic greenhouse gas emissions by each gas measured on a CO_2-equivalent basis.

Related Links

Carbon Dioxide Information Analysis Center

DOE/EIA State Energy Data

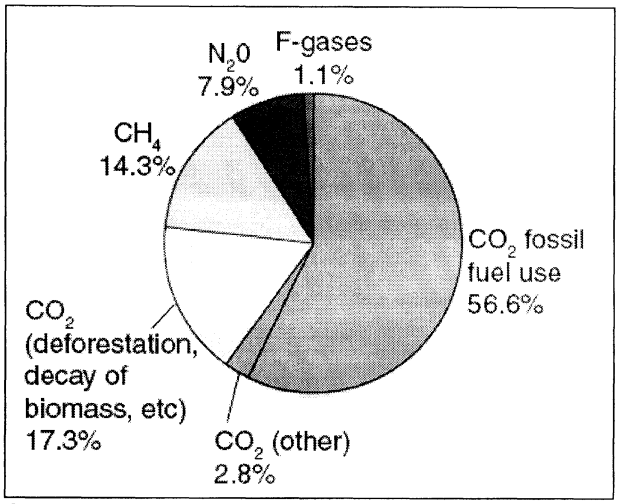
EPA Non-CO2 Gases Site

Gapminder EXIT Disclaimer

National Inventory Submissions EXIT Disclaimer

World Development Indicators EXIT Disclaimer

Figure 1: Global Anthropogenic Greenhouse Gas Emissions in 2004

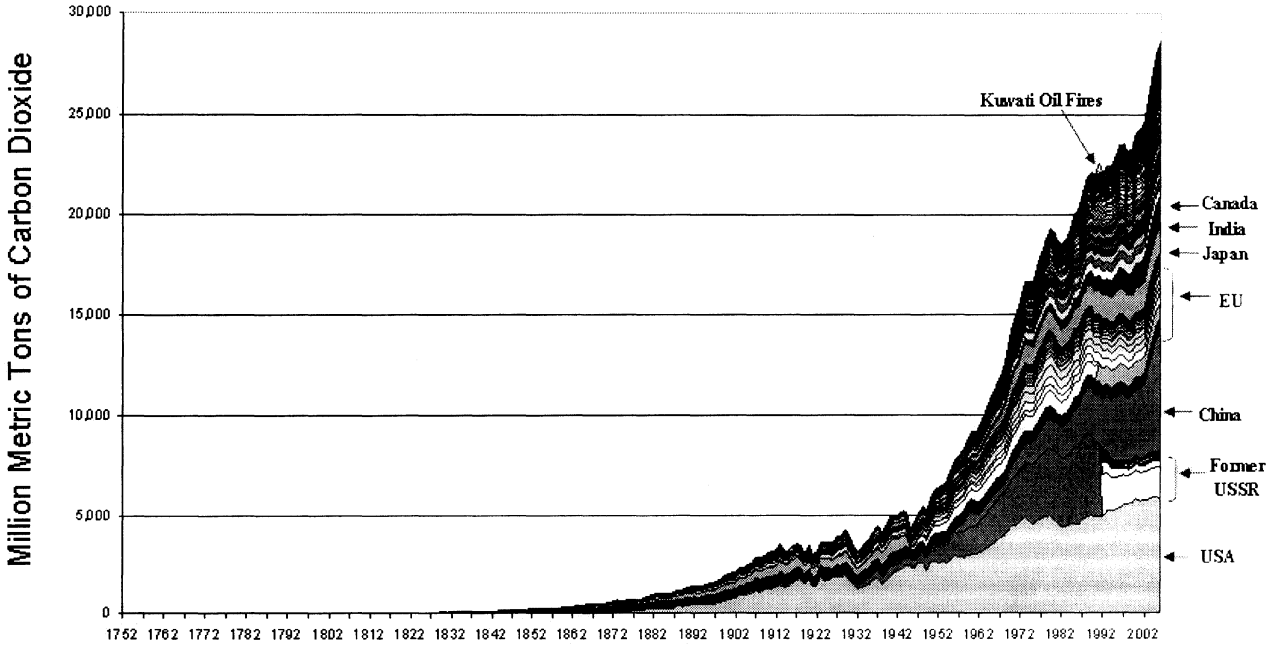


Reference: IPCC 4th Assessment Report:Climate Change 2007: Synthesis Report EXIT Disclaimer

Note: Other CO_2 includes cement production and natural gas flaring.

Figure 2 presents data on the major global sources of carbon dioxide (CO2) emissions by country, from the beginning of the Industrial Revolution to the present.

Figure 2: Global CO_2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1752-2006

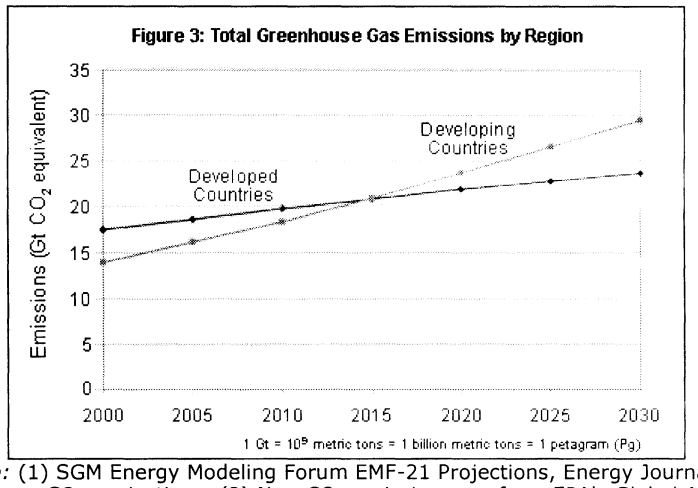


Reference: Carbon Dioxide Information Analysis Center

Subscribers to the World Resources Institute's Climate Analysis Indicators Tool (CAIT) EXIT Disclaimer can draw on existing

greenhouse gas data to generate breakdowns of global emissions by year, country, source and greenhouse gas. In addition, the Intergovernmental Panel on Climate Change synthesizes existing scientific data on global fluxes of greenhouse gas emissions and removals in its assessment reports Exit Disclaimer. These reports provide global data by gas and by type of emission pathway (e.g., general type of source or sink), and include both human and natural emissions.

Figure 3 provides a projection of future greenhouse gas emissions of developed and developing countries. Total emissions from the developing world are expected to exceed those from the developed world by 2015.



Reference: (1) SGM Energy Modeling Forum EMF-21 Projections, Energy Journal Special Issue, in press, reference case CO2 projections. (2) Non-CO2 emissions are from EPA's Global Anthropogenic Emissions of Non-CO2 Greenhouse Gases 1990-2020.