Health Consultation

Fish in Gregg Enterprises Ponds Northwest of the Coronet Site

BORDEN FEED PHOSPHATE COMPLEX

PLANT CITY, HILLSBOROUGH COUNTY, FLORIDA

EPA FACILITY ID: FLD001704741

JULY 12, 2004

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

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Prepared by:

Florida Department of Health
Bureau of Community Environmental Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Table of Contents

Summary and Statement of Issues

In January 2003, a resident living near the Coronet site petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) for a public health assessment of the Gregg Enterprises' property. The petitioner expressed concerns about former landfills, storm water runoff from these landfills, and cancer in the petitioner's neighborhood.

During meetings with the Florida Department of Health (DOH) in March and April 2003, the petitioner reported that people were selling and eating the fish from ponds on Gregg Enterprises property. The petitioner also reported that some people became ill from eating the fish.

In response to petitioner concerns, staff from Florida DOH and the Florida Fish and Wildlife Conservation Commission (FFWCC) collected 88 fish (largemouth bass and blue tilapia) from four ponds on Gregg Enterprises property in February 2004. Fillet samples were analyzed for mercury and organochlorine pesticides. In addition, fish from Pond #4 were analyzed for dioxins and furans because they were the largest, oldest and most abundant specimens collected.

Using the highest mercury level (0.174 parts per million or ppm) found in our samples, conservative estimates of exposure to mercury in fillets were below minimal risk levels and pose no apparent public health hazard to adults or children. Following DOH advisory guidance of one 8-ounce meal per week for women of child bearing age and one 4-ounce meal for young children will help keep mercury exposures below levels of concern. Because Florida DOH is in the process of lowering mercury advisory levels, the fish advisory may be more stringent in the future.

Using the highest dioxin/furan toxicity equivalent concentration (0.2 parts per trillion or ppt) found in our samples, conservative exposure estimates were below comparison values used to assess potential health impacts. Eating largemouth bass and blue tilapia from Gregg Enterprises ponds poses no apparent public health hazard. Dioxin/furan levels were below the Florida advisory guideline level (7 ppt) and no specific advisory for dioxin is warranted at this time. Following the mercury consumption guidance will limit the amount of fish consumed and ultimately help keep dioxin exposures below levels of health concern.

Conservative exposure estimated indicated that the levels of organochlorine pesticides found in fish from ponds at the Gregg Enterprises site pose no apparent public health hazard.

Levels of dioxins/furans, mercury and organochlorine pesticides found in fish at Gregg Properties Enterprises property near the Coronet site do not warrant testing of people who eat these fish.

In separate reports, Florida DOH assessed the public health threat from drinking water from 143 area residents' wells near the Coronet Industries site and potential surface soil exposures from the Gregg Enterprises property.

Florida DOH tested urine of residents living near the Coronet Industries Site. Boron, cadmium, fluoride, lead and uranium were not detected in the residents' urine samples at levels associated with adverse health effects.

The conclusions and recommendations of this health consultation report apply only to people who eat fish caught from the Gregg Enterprises ponds northwest of the Coronet site.

Financial support for this consultation was provided entirely by the Agency for Toxic Substances and Disease Registry (ATSDR). The Hillsborough County Environmental Protection Commission paid for the mercury and organochlorine pesticide analyses and ATSDR/Florida DOH paid for analysis of dioxins and furans.

Purpose

This health consultation report addresses the petitioner's concerns about people eating fish taken from ponds on Gregg Enterprises property.

Site Background and History for Fish Testing

The Gregg Enterprises property occupies about 1400 acres between U.S. Highway 92, Park Road, Coronet Road and Wiggins Road in Plant City, in Hillsborough County, Florida. Gregg Enterprises is vacant, undeveloped land. International Paper Company, 84 Lumber and Starr Distributors are directly north of this property and south of U.S. Highway 92 (Figures 1-3).

Two contiguous former landfills are on this property immediately east of Park Drive, just across from the Lincoln Park community where the petitioner and other concerned residents live. Plant City and Hillsborough County operated these landfills in the late 50s and early 60s. The land is currently vacant, but is being considered for a large residential development.

According to Gregg Enterprises, they have never owned Coronet Industries. Another entity owned by Mr. Gregg owned Coronet and sold it to a Japanese corporation about 10 years ago.

The Gregg Enterprises site has five former borrow pits (now ponds) where residents report fishing (Figure 3). In 2003, a Florida DOH employee observed a man going onto the property with fishing gear and later returning with a heavy bucket. The petitioner reported that people both eat and sell the fish they catch there. The community reported that some people have become ill after eating fish from these ponds.

Several hundred people live in the Lincoln Park community just west of the ponds on the Gregg Enterprises site. Lincoln Park (Community #1 in Florida DOH records) was likely built in the 1950s. The Springhead Community (Community #2) surrounds the Coronet site on the north, east, and south and is zoned residential/agricultural. Some homes are along the Coronet property line. Most homes in Springhead appear to have been built from 1940-1960.

Both communities reported to the Florida Department of Environmental Protection (DEP) that Coronet improperly dumped waste into their ponds and ditches. Both communities have reported high rates of cancer, which they believe are associated with the Coronet site.

General Coronet Industries Site Background

Coronet Industries, Inc., in Plant City, Florida, manufactured an animal feed supplement utilizing phosphate rock. While the historic use of the site included phosphate mining, the facility also imported phosphate rock. The Coronet Junction area includes the Coronet Industries animal feed preparation plant, plus several closed landfills. The plant started operating in 1906 and has had several owners. Coronet's primary product was feed-grade tricalcium phosphate made from phosphate rock. The facility was regulated for air, water and waste by the Hillsborough County Environmental Protection Commission (EPC) and the Florida Department of Environmental Protection (DEP). Coronet Industries ceased operations on March 31, 2004, reportedly due to high operating costs.

Florida DOH activities

Since 2003, Florida DOH has been actively involved in assessing the public health threat to communities near the Coronet Industries and the Gregg Enterprises property sites. In January 2003, a resident living near the Coronet site petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) for a public health assessment of the Gregg Enterprises property. The petitioner expressed concerns about former landfills, storm water run off from the landfills, and cancer in the petitioner's neighborhood.

Florida DOH visited the site and surrounding neighborhoods in March and April 2003 to gather environmental and health concerns, meet with the petitioner from the Lincoln Park Community (Community #1) and meet with other nearby community members. In June 2003, Florida DOH wrote a brief scoping report including background information about the site, health concerns, demographics and contacts of all parties involved (FDOH 2003).

In August 2003, the petitioner wrote ATSDR to request an emergency intervention and investigation of Coronet and Gregg Enterprises property. The petitioner listed sources of contamination for investigation including landfills, the city's sewer system and drinking water.

In August 2003, 106 residents (78 adults and 28 children, aged 3 to 17 years old) agreed to have their urine tested for arsenic, cadmium, fluoride, lead and uranium. Because boron was also found in some of the residents' drinking water, Florida DOH asked these same 106 residents if they also wanted their urine tested for boron. Of the 106 residents, 101 requested that their urine also be tested for boron.

In December 2003, ATSDR mailed urine test results to 43 families (106 individuals). On December 5, 2003 ATSDR/Florida DOH released an exposure investigation concluding that boron, cadmium, fluoride, lead and uranium were not detected in the residents' urine samples at

levels associated with adverse health effects (ATSDR 2003). Therefore, the measured exposures to these chemicals were considered to pose no apparent public health hazard.

Also in December 2003, Florida DOH mailed background information to 70 Plant City area physicians. In January 2004, Florida DOH mailed a newsletter to 800 area residents informing them of recent activities

In March 2004, ATSDR/Florida DOH completed a report about cancers in the neighborhoods near Coronet (FDOH 2004). The Florida DOH concluded that the cancers analyzed during the time period studied were not statistically elevated relative to the expected number of cases in Hillsborough and Polk counties and in Florida overall.

In March 2004, Florida DOH completed an evaluation of test results for 143 private drinking water wells in the area (ATSDR 2004a). Florida DOH concluded that groundwater east and south of the Coronet plant poses no apparent public health hazard for current drinking water exposures. Contaminant levels were below levels expected to cause illness in the community.

On March 15, 2004, ATSDR/Florida DOH released an exposure investigation report which concluded that urinary arsenic concentrations in samples collected from residents were below levels associated with adverse health outcomes (ATSDR 2004b).

On March 16 and 17, 2004, Florida DOH and the Hillsborough County Health Department (CHD) held four open house meetings to discuss the well test results and fish results.

In June 2004, ATSDR/Florida DOH completed an evaluation of about 40 surface soil (0-6 inches below land surface) samples obtained from around the Coronet site. All samples were analyzed for metals (arsenic, boron, lead, mercury, and cadmium) and 18 samples were also tested for pesticides, herbicides, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs) and gross alpha radiation (ATSDR 2004c). Contaminants found in surface soil were not at levels expected to cause illness from daily exposures over 30 years. There are no previous surface soil sampling data. Current contaminant levels in surface soils may not be representative of past concentrations due to time, weather and other conditions.

The Florida DEP has also been actively involved with this site and has recently provided 41 households with bottled water. The Florida DEP continues to coordinate with federal, state, and local agencies for Coronet activities.

At Florida DEP's request, Coronet is installing reverse osmosis technology to improve the quality of water discharged by the facility. In November and December 2003, the DEP and the U.S Environmental Protection Agency conducted three unannounced compliance inspections at the facility for waste, water and air. At the time this consultation was completed, the findings of these inspections were not yet available.

Demographics

Two communities are near the Coronet site: Lincoln Park (Community #1) is northeast of Coronet (west of Gregg Enterprises property ponds) and Springhead (Community #2) is north, east, and south of the site. Demographic information for these communities is summarized below:

Demographics	Lincoln Park	Springhead
Population	About 500	About 200
Black	80%	15 %
Hispanic	15%	15%
White	5%	70 %
Household income	$15,000-$25,000	$20,000-45,000

Discussion

Attachments B and C contain general information concerning chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans, and mercury.

Fish Evaluation

Florida DOH coordinated fish collection from these ponds with the FFWCC. The Gregg Enterprises' property ponds are in a former mine area. The petitioner and other community residents expressed concern about nearby residents eating fish from these ponds. Community residents reported that people fish in these ponds regardless of the fence placed around the property and the signs posted stating:

WARNING PRIVATE PROPERTY.
TO AVOID PROSECUTION,
DO NOT FISH, HUNT OR TRESPASS

Fish Collection and Shipment

In February 2004, ATSDR approved Florida DOH's proposal to collect and analyze fish from Gregg Enterprises' ponds. On February 2004, DOH, FFWCC and the Gregg Enterprises agent signed the access agreement to collect fish from the Gregg Enterprises property ponds.

On February 23, 2004, FFWCC and Florida DOH personnel collected largemouth bass and blue tilapia (Attachment A) from four ponds at Gregg Enterprises (Figure 3) using electrofishing equipment. While fishing, Florida DOH noted fish spawning in one of the ponds.

Table I lists the fish length and weight ranges of the two fish species collected from each pond. Fish collection and sampling time from these four ponds was adequate. While in the field, it was

noted that Pond #1 had the poorest water quality visually, Pond #2 had the smallest fish, and Pond #4 had the most abundant and largest/oldest fish.

Largemouth bass and blue tilapia were the most numerous fish species collected. Florida DOH selected the largest and oldest of these two species (42 largemouth bass and 46 blue tilapia) for this investigation.

FFWCC personnel weighed and measured the fish; Florida DOH personnel recorded these data (Table I). Each fish was wrapped individually in butcher paper and heavy-duty aluminum foil, and placed in a labeled Ziploc bag to prevent cross-contamination. Samples were frozen overnight and prepared for shipment on February 24, 2004. Fish were shipped on dry ice in large plastic coolers. The shipment included proper transportation labels and forms, chain of custody forms, and laboratory forms. FFWCC personnel shipped the samples from Lakeland, Florida to College Station, Texas (Texas A&M laboratory) via an overnight delivery service. All samples were analyzed for mercury and organochlorine pesticides. Samples from Pond 4 were also analyzed for chlorinated dibenzodioxins (CDDs, or dioxin), chlorinated dibenzofurans (furans).

The largemouth bass (*Micropterus salmoides floridanus*) is a predator game fish species that lives in the water column. It can be a good indicator of persistent pollutants that biomagnify up the food chain. The diet of largemouth bass changes with its size. Young fish feed on microscopic animals (zooplankton) and small crustaceans such as grass shrimp and crayfish. Fingerling bass feed on insects, crayfish, and smaller fishes. Adult bass will eat whatever is available including: fish, crayfish, crabs, frogs, salamanders, snakes, mice, turtles and birds.

The blue tilapia (*Oreochromis aureus*) is a bottom feeder species that eats primarily plankton and small organisms living in or on the bottom of debris. These fish grow rapidly for the first few months, then slow somewhat, but ultimately reach 5-6 pounds by 3-5 years of age. It is common for these fish to weigh 2-4 pounds (FFWCC 2004). See Attachment A for photos and detailed descriptions of these fish.

Fish Laboratory Methods and Analyses

The laboratory filleted all 88 fish, removing the skins. Using standard operating procedures, the Texas A&M laboratory composited the fish by species and analyzed eight separate composite samples. In March 2004, they filleted, composited, homogenized and analyzed all eight composited fish samples (Table I) for mercury and organochlorine pesticides. In April 2004, the lab analyzed two of the eight composite samples from Pond #4 (composites #5 and #6) for dioxins/furans. For these tests, Florida DOH selected fish from pond #4 which represented the largest, oldest and most abundant of all fish collected. The analyses included preparation (resection and filleting), homogenizing, compositing, and three quality assurance (QA) samples (one procedure blank, one duplicate and one matrix spike). The Hillsborough County Environmental Protection Commission paid for the mercury and organochlorine pesticide analysis and ATSDR/Florida DOH paid for the dioxins/furans analysis.

Interpretation of Fish Results

In April 2004, Florida DOH received results from the Texas A&M laboratory. Table II – Table IV summarizes the analytical results for dioxins/furans, mercury and organochlorine pesticides.

Dioxins/Furans

Table II summarizes the TEQs of dioxin/furans in fish from the Gregg Enterprises' property ponds northwest of the Coronet Industries site. The highest TEQ in our fish samples was 0.2 parts per trillion. A TEQ is the mean concentration of the total dioxin/furan toxic equivalents. We conservatively assumed that on average, adults eat 30 grams of fish per day and children eat 15 grams per day. These rates may overestimate average fish consumption, but any error will be on the side of protecting human health.

Estimated child and adult exposure doses for dioxins/furans in blue tilapia or largemouth bass from Gregg Enterprises ponds were below comparison values published by ATSDR (Table ll). Comparison values include minimal risk levels (MRLs) and cancer effect levels (CELs). MRLs are conservative estimates of daily human exposures to specific chemicals at which noncancer illnesses are considered not likely to occur. CELs reflect levels of lifetime exposures associated with carcinogenic effects. Estimated exposure doses for dioxins and furans ranged from 10-2,000 times less than MRL values and about 10,000 times less than the ATSDR's CEL. Levels of dioxins/furans in fish from the Gregg Enterprises ponds pose no apparent public health hazard.

Florida DOH's current guideline for fish consumption advisories (7 ppt) is adopted from USEPA 1990 dioxin guidelines. Dioxin and furan toxicity equivalent (TEQ) levels in the largemouth bass and blue tilapia from pond #4 were well below this guideline. Florida DOH has not recommended additional fish sampling and will not issue a fish consumption advisory for the five ponds on Gregg Enterprises property.

Florida DOH is re-evaluating the dioxin/furan criteria and is scheduled to complete this by June 2005. Data from Gregg Enterprises will be re-assessed when the new criteria is finalized

Attachment B contains general information about dioxins/furans (chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans).

Mercury

The highest mercury level, 0.174 parts per million (ppm), was found in fillets of largemouth bass from Pond #1. Conservative estimates for adults and children indicated that exposures to mercury in fish fillets are below the minimal risk level for methyl mercury. Because mercury levels in fillets are below 0.5 ppm, Florida DOH defaults to the EPA consumption advisory of one 8-ounce meal per week for women of child bearing age and one 4-ounce meal for young children. Following these fish consumption recommendations would help keep mercury exposures below the minimal risk level.

For total mercury levels from 0.5 – 1.5 ppm, Florida DOH recommends limiting consumption of fish to one 8-ounce meal per month for women of child-bearing age and young children, and one 8-ounce meal per week for all others. For mercury levels greater than 1.5 ppm, Florida DOH recommends no fish consumption. Because Florida DOH is currently lowering mercury advisory levels, the fish advisory may be more stringent in the future. After final approval of the revised mercury advisory levels, we will review the Coronet data to see if any changes in conclusions, recommendations or public health actions are needed.

Please see Attachment C for general information concerning mercury.

Organochlorine Pesticides

All organochlorine pesticide levels in blue tilapia and largemouth bass were below ATSDR Minimal Risk Levels (MRLs), Cancer Effect Levels (CELs), No-observed-adverse-effect-levels (NOAELs) or Lowest-observed-adverse-effect-levels (LOAELs) for acute, intermediate and chronic exposures (Table IV). The levels of organochlorine pesticides in these fish are therefore not likely to cause illness. For three of these pesticides (pentachloroanisole, pentachlorobenzene and tetrachlorobenzene), literature is not available listing MRLs, CELs, NOAELs or LOAELs for acute, intermediate and/or chronic exposures.

Other Health-Based Standards

Mercury

The FDA action level for mercury in fish is 1.0 ppm methyl mercury in the edible portion (DHHS 1998). The highest levels of mercury found in the blue tilapia and largemouth bass from Gregg Enterprises' property ponds are less than USFDA's action level (Table III).

Dioxins

There are currently no FDA action levels for dioxins or furans in human food (DHHS 1998). Because dioxin analysis is costly and time-consuming, available data on background levels in most foods are limited. FDA is expanding its monitoring program to obtain more comprehensive data on background levels. The FDA is also working to identify opportunities to reduce human exposure to dioxins (USFDA 2002).

Organochlorine Pesticides

The FDA has action levels for aldrin/dieldrin, chlordane, DDT, DDE and lindane. All of these pesticide levels detected in the Gregg Enterprises pond fish were well below their respective FDA action levels (Table III).

Consideration of Biological Testing

Florida DOH considered biological testing (urine or blood) for people eating fish from Gregg Enterprises' property ponds. Using current guidelines, the levels of dioxins/furans, organochlorine pesticides and mercury found in these fish do not warrant biological testing.

Child Health Considerations

This health consultation considers that children could eat fish from the Gregg Enterprises ponds near Coronet Industries. Pregnant women, nursing mothers and children can be affected by dioxins, furans, mercury and organochlorine pesticides in fish. It is important to remember children are not small adults. Children can be more sensitive to the effects of dioxins, furans and mercury than adults. Few studies have looked at how dioxins or furans can affect a child's health. In one such study, children were exposed to higher-than-current background levels of 2,3,7,8-TCDD; the children appeared more sensitive than adults. Florida DOH has no information showing differences between children and adults in terms of how much dioxin enters one's body, where dioxins can be found in one's body, and how fast dioxins leave one's body (ATSDR 1998).

Children can be exposed to various forms of mercury and organochlorine pesticides in a variety of ways, including by eating fish and wildlife. A child's mercury and dioxin exposures can differ substantially from an adult's exposure because children drink more fluids, eat more food, and breathe more air per kilogram of body weight than do adults. Children's diets, behaviors and lifestyles can also influence exposure (ATSDR 1999). Florida DOH reviewed the results of our fish samples aware that sensitive populations such as pregnant women, nursing mothers and children are a particular concern. Given this, we conclude that the dioxin/furans, mercury and organochlorine pesticides found in largemouth bass and blue tilapia from the Gregg Enterprises property ponds near Coronet Industries are not likely to cause illness in either adults or in children.

Conclusions

1. Using the highest mercury level (0.174 ppm), conservative estimates indicated that exposure to mercury in fish fillets from ponds at the Gregg Enterprises site pose **no apparent public health hazard to adults or children**. Following DOH advisory guidance of one 8-ounce meal per week for women of child bearing age and one 4-ounce meal for young children will help keep mercury exposures below levels of concern. Because Florida DOH is in the process of lowering mercury advisory levels, the fish advisory may be more stringent in the future.

2. Using the highest dioxin/furan TEQ (0.2 ppt), conservative estimates indicated that eating largemouth bass and blue tilapia from Gregg Enterprises ponds poses **no apparent public health hazard**. Dioxin/furan levels were below the Florida advisory guideline level (7 ppt). No advisory for dioxin is warranted at this time. Following the mercury consumption guidance will reduce the amount of fish consumed and ultimately help keep dioxin exposures below levels of health concern.

3. The levels of organochlorine pesticides found in fish from ponds at the Gregg Enterprises site pose **no apparent public health hazard**.

4. The concentrations of dioxins/furans, mercury and organochlorine pesticides in fish from the Gregg Properties Enterprises property near the Coronet site do not warrant testing of people who eat these fish.

Recommendations

Women of child-bearing age should follow the consumption guidance for mercury in fish adopted by Florida DOH (one 8-ounce serving of fish per week) to help keep their exposures below levels of concern.

Children should follow the consumption guidance for mercury in fish adopted by Florida DOH (one 4-ounce serving of fish per week) to help keep their exposures below levels of concern.

Gregg Enterprises property owners should maintain the property fence and no trespassing signs posted to reduce physical hazards (e.g., drowning or snake bites).

Public Health Action Plan

Based on the highest mercury level found in Gregg Enterprises ponds fish, people following the EPA advisory for fish meals (fillets) are not likely to be exposed to methyl mercury at levels of concern.

Florida DOH is lowering advisory guidelines for mercury in fish and will re-evaluate data from the Gregg Enterprises site when this is completed.

Florida DOH is re-evaluating criteria used for assessing the potential for adverse human health effects from exposure to dioxin-like compounds. This evaluation is scheduled to be completed by June 2005. Upon completion, the risks of human health effects will be re-examined.

By late summer/early fall of 2004, Florida DOH will finish its comprehensive public health assessment report evaluating soil, water and air data from the Coronet site.

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Author
Susan Bland
Biological Scientist IV
Florida Department of Health
Bureau of Community Environmental Health

ATSDR Technical Project Officer
Lisa Hayes
Division of Health Assessment and Consultation
Superfund and Program Assessment Branch
Agency for Toxic Substances and Disease Registry

Florida DOH Designated Reviewer
Randy Merchant
Program Administrator
Florida Department of Health
Bureau of Community Environmental Health

ATSDR Technical Reviewer
W. Allen Robison, Ph.D.
Toxicologist
Division of Health Assessment and Consultation

CERTIFICATION

The Florida DOH, Bureau of Community Environmental Health, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) prepared this Fish in Gregg Enterprises Property Ponds near the Coronet Industries Site Health Consultation. It was prepared in accordance with approved methodology and procedures existing at the time.

Allen Robison, for
Lisa Hayes
Technical Project Officer, Superfund and Program Assessment Branch
Division of Health Assessment and Consultation

The Division of Health Assessment and Consultation has reviewed this health consultation and concurs with its findings.

Bobbi Erlwein
Team Leader, Cooperative Agreement Team
Superfund and Program Assessment Branch
Division of Health Assessment and Consultation
ATSDR

Map of Florida

SOURCE: FLORIDA DOH FILES

FIGURE 1
COUNTY MAP
Hillsborough County
Coronet Industries & Greg Enterprises' Property

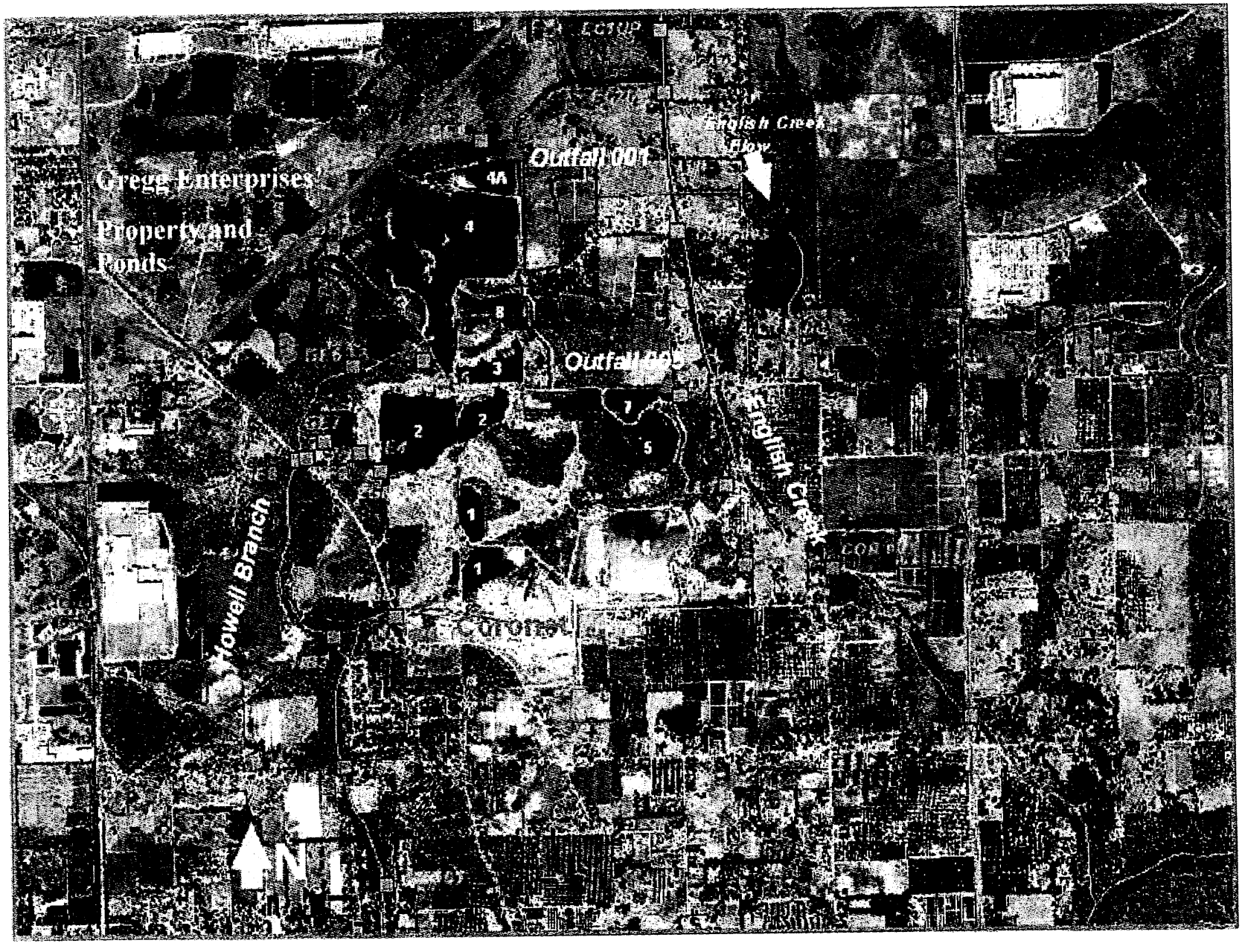


Figure 2

Map of Gregg Enterprises' Property and Ponds

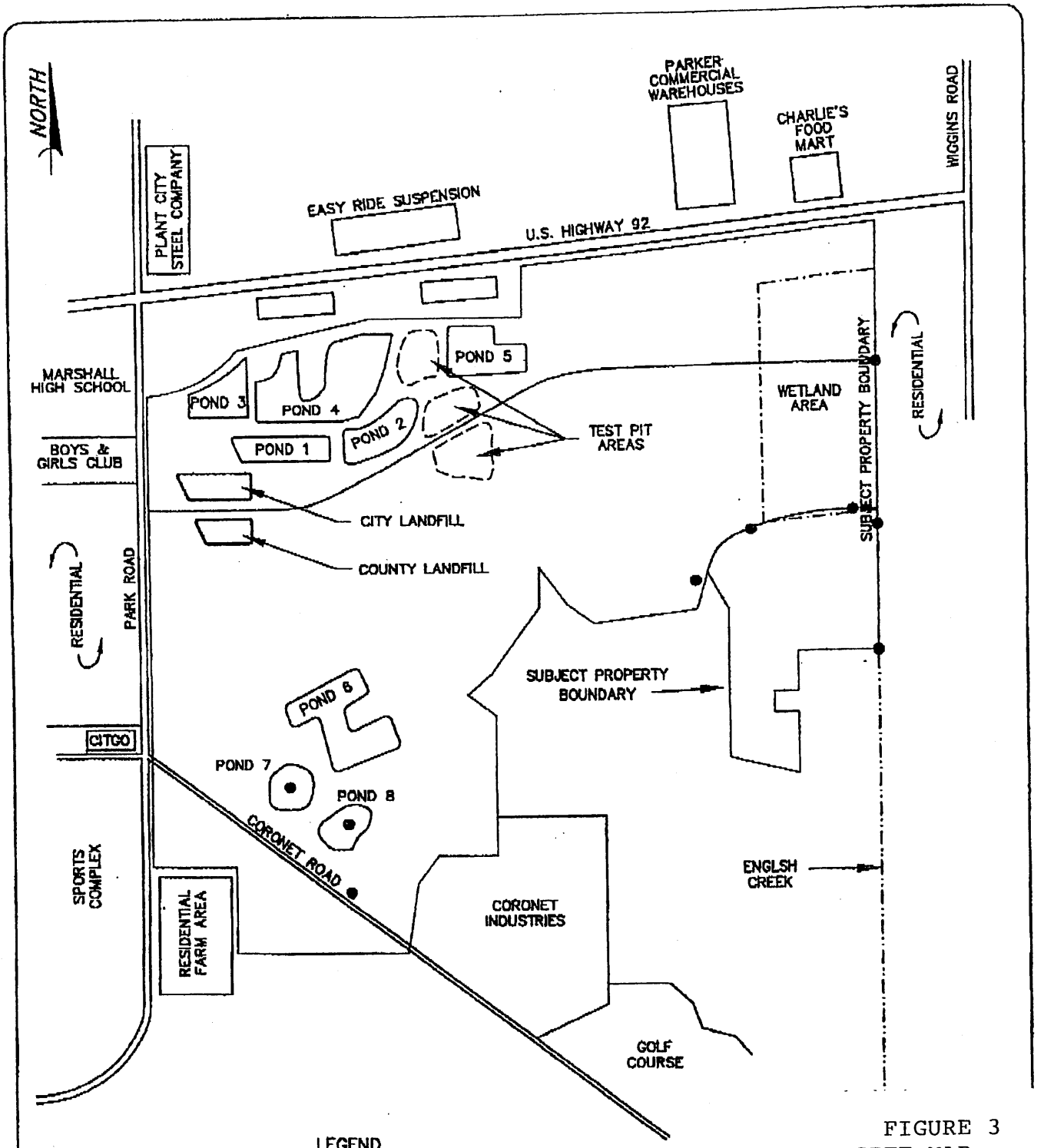


FIGURE 3
SITE MAP
Coronet Industries & Greg Enterprises' Property

PSI Information To Build On
Engineering • Consulting • Testing

SITE MAP
GREGG ENTERPRISES
S.E. OF INTERSECTION OF US HIGHWAY 92 AND PARK ROAD
PLANT CITY, HILLSBOROUGH COUNTY, FLORIDA

CHKD. BY:	DRAWN BY: SBW	DATE: 6/18/03	SCALE: N.T.S.	REVISION:	PROJECT NO.: 883-2G042	FIGURE NO.: 1

3530m02712

TABLE I

Length and Weight Ranges for Fish Collected from Gregg Enterprises Northwest of Coronet Industries

Pond - Fish Collected	# of Fish Composited	Weights (grams)	Lengths (millimeters)
Pond 1 - LMB	8	495-1869*	326-452
Pond 2 - LMB	12	57-165	175-246
Pond 4 - LMB	11	691-1541	355-451
Pond 5 - LMB	11	793-1529	382-458
Pond 1 - Blue Tilapia	11	700-1275	305-370
Pond 2 - Blue Tilapia	12	350-750	255-330
Pond 4 - Blue Tilapia	11	1500-2200	385-444
Pond 5 - Blue Tilapia	12	650-1050	316-369

*Note - more variable range as less fish available in this pond
LMB = Largemouth Bass
Pond #3 was not sampled

TABLE II

Dioxins/Furans Results (ppt, wet weight) for Fish Samples from Ponds at Gregg Enterprises Northwest of Coronet Industries

Fish/Pond	Dioxins/Furans TEQ	MRLs (ng/kg/d)			CEL	DOH guidance
	(ppt)	acute	intermediate	chronic		(ppt)
*LMB/Pond #4	0.2	0.2	0.02	0.001	1.0	7.0
**Tilapia/Pond #4	0.00008	0.2	0.02	0.001	1.0	7.0

TEQ = Total Equivalency Factor
MRLs = Minimal Risk Levels (nanograms per kilogram per day)
MRL is for 2,3,7,8-TCDD (most toxic of all dioxin/furan congeners)
*Composite sample of 11 Largemouth Bass
**Composite sample of 11 Tilapia
There are no FDA action levels for dioxins/furans

TABLE III

Highest Mercury Levels Found in Largemouth Bass and Blue Tilapia (ppm, wet weight)*

Fish/Pond	# of Fish Composited	Highest Level Detected	DOH guidance	FDA Action Level
LMB/Pond #1	8	0.174 ppm	0.5 -1.5 ppm	1 ppm methyl mercury
				(edible portion)
Blue Tilapia/Pond #4	11	0.014 ppm	0.5 - 1.5 ppm	1 ppm methyl mercury
				(edible portion)

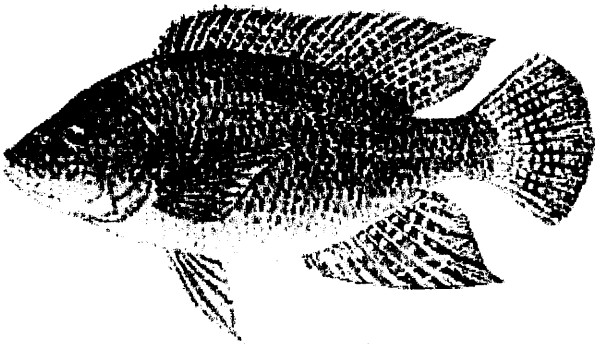
*Mercury levels ranged from 0.005 to 0.174 ppm.

TABLE IV.

Organochlorine Pesticide Results for Fish Samples from Ponds on Gregg Enterprises Northwest of Coronet Industries*

Pesticide	Fish/Pond	# of Fish	*Highest Level	FDA Action Levels	Calculated Dose†	acute MRL	intermed MRL	chronic MRL
		Composited	Detected (ug/g)	ppm (ug/g)	(child & adult)	mg/kg/day	mg/kg/day	mg/kg/day
Aldrin	LMB/Pond #1	8	0.00003	0.3 (edible portion)	0.000000013	0.002	0.9‡	0.00003
Chlordane (alpha+gamma+oxy+nonachlors)	LMB/Pond #4	11	0.0024	0.3 (edible portion)	0.000001000	0.003	0.0013	0.0006
Dieldrin	LMB/Pond #4	11	0.00006	0.3 (edible portion)	0.000000026	0.08‡	0.0001	0.00005
Endrin	LMB/Pond #4	11	0.00007	none available	0.000000030	0.3§	0.002	0.0003
DDD, DDE &DDT (total 2,4' & 4,4')	LMB/Pond #5	11	0.00705	5.0 (edible portion)	0.000003000	0.0005	0.0005	0.4 CEL
Chlorphyrifos	LMB/Pond #5	11	0.00005	none available	0.000000021	0.006	0.006	0.001
Endosulfan II	LMB/Pond #1	8	0.00008	none available	0.000000034	0.9‡	0.005	0.002
beta - HCH	LMB/Pond #1 & Tilapia/Pond #1	8 & 11	0.00006	none available	0.000000026	0.2	0.0006	14 CEL
gamma - HCH (lindane)	LMB/Tilapia Pond #1 & Tilapia/Pond #2	8 &12	0.00001	none available	0.000000004	0.003	0.00001	6.0 § in animals
alpha - HCH	LMB Pond #1 & Tilapia Pond #1	8 &11	0.00005	none available	0.000000021	none available	3 CEL	0.008
delta - HCH	Tilapia/Pond #4 & LMB/Pond #5	11 & 12	0.00001	none available	0.000000004	none available	100	none available
Hexachlorobenzene	Tilapia/Pond #5	12	0.00001	none available	0.000000004	0.008	0.0001	0.00005
Mirex	LMB/Pond #1	8	0.00005	0.1 (edible portion)	0.000000021	0.1‡	0.07‡	0.0008
Pentachloroanisole	LMB/Pond #4 & Tilapia/Pond #4	11 & 11	0.00106	none available	0.000000400	none available	none available	none available
Pentachlorobenzene	LMB/Pond #5	11	0.00019	none available	0.000000081	none available	none available	none available
Tetrachlorobenzene (total 1,2,3,4 -& 1,2,4,5-)	LMB/Pond # 4	11	0.00121	none available	0.000000500	none available	none available	none available
* Only the highest level of each pesticide detected in all fish collected are listed								
Heptachlor, heptachlor epoxide, beta-HCH and toxaphene were also analyzed but were not detected in all 8 fish samples								
LMB = Largemouth Bass								
HCH = hexachlorocyclohexanes								
All above pesticide levels are MRLs unless denoted ‡ = lowest-observed-adverse-effect-level (LOAEL) or § = no-observed-adverse-effect-level (NOAEL)								
FDA=Food and Drug Administration								
FDA's action levels for DDT and DDE are for residues of these pesticides individually or in combination								
†Calculated Dose in milligrams pesticide per kilogram body weight per day (mg/kg/day)								
ug/g = micrograms of pesticide per gram of fish or parts per million (ppm)								
CEL = Cancer Effect Level								

Attachment A: Fish Photos and Descriptions



BLUE TILAPIA (*Oreochromis aureus*)

COMMON NAME - Blue tilapia (sometimes erroneously referred to as Nile perch)

DESCRIPTION - Young nondescript gray with a black spot at rear of dorsal fin; adults generally blue-gray shading to white on the belly; borders of dorsal and caudal fins with red to pink borders; broken lateral line and the spiny dorsal fin is joined to the soft dorsal fin. In central Florida, anglers can assume every tilapia they observe in fresh water is a blue, and any tilapia over 3 pounds is also likely a blue tilapia.

Similar Species - Female Mozambique tilapia (*O. mossambicus*) nearly identical, but doesn't grow as large and currently only occurs in coastal areas south of Titusville; possible hybridization between blue and Mozambique tilapias further complicates identification; male Mozambique tilapia easily distinguished by large mouth and black coloration when breeding. Photo to right is of a spawning male and female Mozambique tilapia.

RANGE - Blue tilapia were imported in 1961 and have become established throughout central and southern Florida with isolated populations further north. Native to northern Africa and Middle East. It is thought to be the fish referred to in the Bible to feed the multitudes.

HABITAT – Widespread and abundant in Florida; found in fertile lakes, ponds, rivers, streams, and canals. It is tolerant of saltwater and found in some near shore marine habitats, such as Tampa Bay.

SPAWNING HABITS - Spawning occurs when the water temperature exceeds 68°F. Males dig large circular nests with their mouths in shallow water over a sandy bottom. The male swims out to a passing female and leads her to the nest where courtship occurs; female lays eggs and immediately takes into mouth after male fertilizes, after which she swims off, possibly to mate with another male. The males continue to guard nests and may spawn again with another female. Eggs hatch in female's mouth, and fry occasionally released to feed, but whenever threatened they return to the female's mouth until they are about three weeks old. This type of parental care is called mouth-brooding.

FEEDING HABITS - Feed primarily on plankton and small organisms living in or on bottom detritus; three most common foods consumed in Lake Alice and Lake George were diatoms, green algae, and detritus; dominant food items in stomachs of fish from Six-Mile Creek near Tampa were detritus, algae, diatoms, and plant material.

AGE AND GROWTH - Grow rapidly for first few months, then slow somewhat but ultimately reach 5-6 pounds by age 3-5 yrs; fish weighing 2-4 pounds common; largest caught in Florida weighed 10 pounds and measured over 21 inches in length; Lake Lena fish yielded a maximum age of 6 years, and indicated that males were larger at each age than females.

SPORTING QUALITY - Not normally known for their angling quality. The exception being some urban anglers catch these in ponds using small pieces of hot dogs, bread balls, dog food, or live worms; no bag or size limits. They are rarely caught on artificial lures. There is also a group of avid bow anglers that target this species.

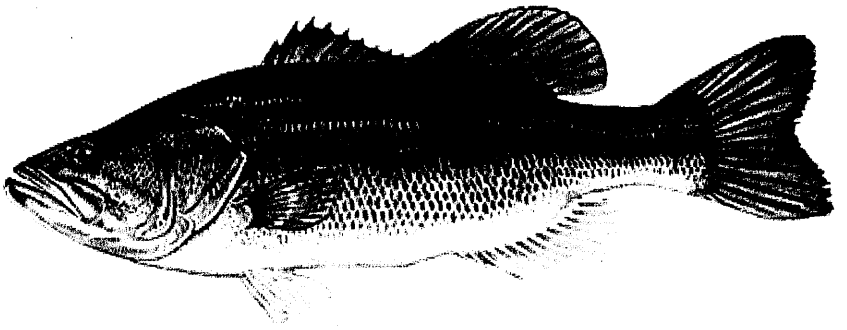
EDIBILITY – White flaky meat with a mild flavor; considered excellent eating, and farm-raised fish often sold in grocery stores.

STATE AND WORLD RECORDS - State record is open; qualifying weight is 10 pounds. The big catch program recognizes blue tilapia longer than 18 inches or heavier than 5 pounds (see state records for updates).

SPECIAL NOTE – Possession and transport of live tilapia in Florida is illegal without a special permit (except blue tilapia). They can only be possessed if dead, so anglers who catch and want to eat a tilapia, other than blue tilapia, should immediately place them on ice.

INFORMATION OBTAINED FROM

http://www.floridafisheries.com/fishes/non-native.html#tilapia



FLORIDA
LARGEMOUTH BASS

(Micropterus salmoides floridanus)

Common Names - black bass, Florida bass, Florida (or southern) largemouth, green bass, bigmouth, bucketmouth, linesides, Oswego bass and green trout.

Description - The largemouth is the largest member of the sunfish family. It generally has light greenish to brownish sides with a dark lateral line which tends to break into blotches towards the tail. Often confused with smallmouth and spotted bass, it is easily distinguishable because the upper jaw extends beyond the rear edge of the eye. Also, its first and second dorsal fins are almost separated by an obvious deep dip, and there are no scales on the soft-rayed second dorsal fin or on the anal fin.

Subspecies - Two are recognized: the northern largemouth (*M. s. salmoides*) and the Florida largemouth (*M. s. floridanus*). The two look much the same, but the Florida largemouth has 69-73 scales along the lateral line compared to the northern largemouth's 59-65 scales. Florida bass grow to trophy size more readily than northern largemouth in warm waters.

Range - Originally, the Florida largemouth was found only in peninsular Florida, but they have been stocked in several other states including Texas and California. Pure northern largemouth bass are not found in Florida. Genetic intergrades between the subspecies, however, occur throughout north Florida.

Habitat - Prefers clear, nonflowing waters with aquatic vegetation where food and cover are available. They occupy brackish to freshwater habitats, including upper estuaries, rivers, lakes, reservoirs and ponds. Also, they can tolerate a wide range of water clarities and bottom types, prefer water temperatures from 65 to 85 degrees, and are usually found at depths less than 20 feet.

Spawning Habits - Spawning occurs from December through May, but usually begins in February and March in most of Florida when water temperatures reach 58 to 65 degrees and continues as temperatures rise into the 70s. The male builds saucer-shaped nests 20 to 30 inches in diameter by placing its lower jaw near the bottom and rotating around this central location.

Bass prefer to build nests in hard-bottom areas along shallow shorelines or in protected areas such as canals and coves. Depending on her size, the female can lay up to 100,000 eggs, which are fertilized as they settle into the nest. After spawning is completed, usually five to 10 days, the male guards the nest and eggs and later the young (sometimes called fry) attacking anything that approaches the nest. The female bass stays near the nest or may swim a short distance and remain listless for up to a day. After hatching, the fry swim in tight schools, disbanding when the small fish reach a length of about one inch.

Feeding Habits - The diet of bass changes with its size. Young fish feed on microscopic animals (zooplankton) and small crustaceans such as grass shrimp and crayfish. Fingerling bass feed on insects, crayfish, and small fishes. Adult bass will eat whatever is available, including fish, crayfish, crabs, frogs, salamanders, snakes, mice, turtles and even birds.

Age and Growth - Growth rates are highly variable with differences attributed mainly to their food supply and length of growing season. Female bass live longer than males and are much more likely to reach trophy size. By age two or three, females grow much faster than male bass. Males seldom exceed 16 inches, while females frequently surpass 22 inches. At five years of age females may be twice the weight of males. One-year old bass average about seven inches in length and grow to an adult size of 10 inches in about 1-1/2 to 2-1/2 years. The oldest bass from Florida whose age has been determined by fisheries biologists was 16 year of age. Generally, trophy bass (10 pounds and larger) are about 10 years old. The formula used by Florida scientists to estimate weight based on length and girth is: log (weight, in grams) = -4.83 + 1.923 x log (total length, in mm) + 1.157 x log (girth, in mm). Click here for an automated formula, and here to determine how to properly measure your fish.

Sporting Qualities - The largemouth bass is Florida's most popular freshwater game fish. Much of its popularity is due to its aggressive attitude and willingness to strike a lure or bait with explosive force. They will strike almost any kind of artificial lure or live bait, but most are taken on plastic worms, surface plugs, spinner baits, crank baits, bass bugs and shiner minnows. The value of the largemouth as a sport fish has prompted a movement toward catch-and-release fishing. As a sport fish, specific bag and size limit regulations apply, and you can register a qualifying catch as part of the Florida Fish and Wildlife Conservation Commission's "Big Catch" program. Black bass are the most popular sportfish in North America and their value to Florida is immense (see: Florida Bass Values for more details). Florida's top ten bass destinations are updated annually on our fishing sites/forecast page.

Eating Quality - The meat is white, flaky and low in oil content. The flavor depends upon the way the fish are cleaned and prepared. The strong weedy taste of bass caught in some waters may be eliminated by skinning the fish and salting and peppering the fillets before battering. Fillets usually are fried, while larger ones may be baked.

World Record - 22 pounds, 4 ounces, caught in Montgomery Lake, Georgia in 1932. See the Big Bass Record Club (BBRC) for a history of this historic fish. BBRC offers a discount membership, fishing DVD and free hat to Florida fishing license holders.

Certified State Record - 17 pounds, 4-1/4 ounces, caught in an unnamed lake in Polk County in 1986. (Please check link for updates)

Uncertified State Record - 20 pounds, 2 ounces, caught in Big Fish Lake (private pond) in Pasco County in 1923.

Information obtained from - http://www.floridafisheries.com/fishes/bass.html#largemouth

Attachment B: Dioxins/Furans Information

Chlorinated Dibenzo-p-Dioxins: General Information

Chlorinated dibenzo-p-dioxins (CDDs) are a family of 75 different compounds with varying harmful effects. CDDs are divided into eight groups of chemicals based on the number of chlorine atoms in the compound. A few examples are di-chlorinated dioxin (DCDD), tri-chlorinated dioxin (TrCDD) and tetra-chlorinated dioxin (TCDD). 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) has four chlorine atoms, one each in the 2, 3, 7, and 8 positions. 2,3,7,8-TCDD is odorless. Whether the other CDDs are also odorless is unknown. CDDs occur naturally; but human activities also produce them. They occur naturally from the incomplete combustion of organic material, such as from forest fires or volcanic activity. Industry does not purposefully manufacture CDDs, except in small amounts for research purposes. However, they are unintentionally produced by industrial, municipal, and domestic incineration and combustion processes (ATSDR 1998).

Many factors determine whether harm will occur or not to someone exposed to CDDs. These factors include the dose (how much), the duration (how long) and how the exposure occurred. Additional factors include whether or not a person was exposed to other chemicals, as well as that person's age, sex, diet, family traits, lifestyle and state of health (ATSDR 1998).

CDDs are found everywhere in the environment, albeit at generally low levels. Most people are exposed to very small background levels of CDDs when they breathe air, consume food or milk, or have skin contact with materials contaminated with CDDs (ATSDR 1998). CDDs enter the environment as mixtures containing a variety of individual components and impurities. They tend to be associated with ash, soil, or any surface with a high organic content, such as plant leaves. CDDs adhere strongly to soils and sediments. Estimates of the half-life of 2,3,7,8-TCDD on the soil surface range from 9 to 15 years, whereas the half-life in subsurface soil might range from 25 to 100 years (Paustenback et al. 1992). Sunlight and atmospheric chemicals break down only a small portion of the CDDs.

Of the 126 waste sites on the EPA National Priorities List that contain CDDs, 91 include sites where 2,3,7,8-TCDD was detected.(ATSDR 1998). People living around these sites could be exposed to above-background levels of 2,3,7,8-TCDD and other CDDs. CDDs can enter the body when one breathes contaminated air, eats contaminated food, or has skin contact with contaminated soil or other materials. The most common way CDDs can enter the body is by eating food contaminated with CDDs.

Chlorinated Dibenzofurans: General Information

Chlorinated dibenzofurans (CDFs) are a family of chemicals containing 1 to 8 chlorine atoms attached to the carbon atoms of the parent chemical, dibenzofuran. The CDF family contains 135 individual compounds (known as congeners) with varying harmful health and environmental effects. Of the 135 compounds, those that contain chlorine atoms at the 2,3,7,8 positions are especially harmful. Other than for research and development purposes, industry does not

deliberately produce these chemicals. Industry produces small amounts of CDFs as unwanted impurities of certain products, and during processes utilizing chlorinated compounds. Only a few of the 135 CDF compounds have been produced in large enough quantities that their properties, such as color, smell, taste, and toxicity could be studied. Those few CDF compounds are colorless solids. They do not dissolve in water easily. There is no known use for these chemicals. Most commonly, CDFs enter the body when one eats food contaminated with CDFs—in particular, fish and fish products, meat and meat products, and milk and milk products. Exposure to CDFs from drinking water is less than that from food (ATSDR 1994).

Like the CDDs, many factors determine whether harm will occur to a person exposed to CDFs. These factors include the dose (how much), the duration (how long) and how a person is exposed to the chemicals. Other factors include exposures to other chemicals, their age, sex, diet, family traits, lifestyle and state of health (ATSDR 1994).

Chlorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans

Chlorinated dibenzodioxins (CDDs) occur in the environment together with structurally related chlorinated dibenzofurans (CDFs). 2,3,7,8-TCDD is one of the most toxic and extensively studied of the CDDs and serves as a prototype for the toxicologically relevant or "dioxin-like" CDDs and CDFs. Based on results from animal studies, scientists have learned they can express the toxicity of dioxin-like CDDs and CDFs as a fraction of the toxicity attributed to 2,3,7,8-TCDD. For example, the toxicity of dioxin-like CDDs and CDFs can be ½ or $^{1}/_{10}$ or any fraction of 2,3,7,8-TCDD. Scientists call that fraction a Toxicity Equivalent Factor (TEF). Toxicity Equivalency Factors (TEFs) usually report CDD and CDF exposures. CDDs and CDFs are highly persistent compounds—they have been detected in air, water, soil, sediments, animals and foods. (ATSDR 1998).

The concentration of chlorinated dibenzo dioxins (CDDs) in samples of air, water, or soil is often reported as parts per trillion. One part per trillion (ppt) is one part CDD per trillion parts of air, water, or soil. For the general population, more than 90% of the daily intake of CDDs, chlorinated dibenzofurans (CDFs), and other dioxin-like compounds comes from food—primarily meat, dairy products, and fish. That said, however, the actual intake of CDDs from food for any one person would depend on the amount and type of food consumed and the level of contamination.

As stated, CDDs remain in the environment for a long time. Because CDDs do not dissolve easily in water, most will attach strongly to small particles of soil sediment or organic matter and eventually settle to the bottom. CDDs might also attach to microscopic plants and animals (plankton). In turn, larger animals eat these plants and animals, and then yet even larger animals eat them. We call this process a "food chain." Concentrations of chemicals such as the most toxic, 2,3,7,8-chlorine-substituted CDDs, which are difficult for the animals to break down, usually increase at each step in the food chain. This process, referred to as "biomagnification," is the reason why undetectable levels of CDDs in water can result in measurable concentrations in aquatic animals. The food chain is the main route by which CDD concentrations build up in

larger fish, although some fish can accumulate CDDs by eating particle-containing CDDs directly off the bottom (ATSDR 1998). Concentrations of dioxins in aquatic organisms can be hundreds to thousands of times higher than the concentrations found in the surrounding waters or sediments (EPA 1999). Bioaccumulation factors vary among the congeners and generally increase with chlorine content up through the tetracongeners and then generally decrease with higher chlorine content (EPA 1999).

Elevated levels of CDDs have been reported in fish, shellfish, birds, and mammals collected in areas surrounding chemical production facilities, hazardous waste sites, and pulp and paper mills using the chlorine bleaching process. Sometimes these findings have resulted in closure of these areas to both commercial and recreational fishing. People who eat food from these contaminated areas are at risk of increased exposure to CDDs (ATSDR 1998).

Individuals who could be exposed to higher than average levels of dioxins include those who ingest food containing higher concentrations of dioxins than are found in the commercial food supply. These groups specifically include recreational and subsistence fishers who routinely consume large amount of locally caught fish (EPA 1999).

Lipophilic (fat-loving) chemicals—such as dioxins—accumulate mainly in fatty tissues of fish (e.g., belly, flap, lateral line, subcutaneous and dorsal fat, dark muscle, gills, eye, brain and internal organs). Therefore, removal of fish internal organs and skin and trimming the fat before cooking will decrease exposure.

References

[ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Toxicological profile for chlorinated dibenzo-p-dioxins. Atlanta: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1994. Toxicological profile for chlorodibenzofurans. Atlanta: US Department of Health and Human Services.

[EPA] Environmental Protection Agency. 1999. Fact sheet on polychlorinated dibenzo-p-dioxins and related compounds update: Impact on fish advisories. Washington, DC: Office of Water.

Paustenbach DJ, Wenning RJ, Lau V, et al. 1992. Recent developments on the hazards posed by 2,3,7,8-tetrachlorodibenzo-p-dioxin in soil: Implications for setting risk-based cleanup levels at residential and industrial sites. J Toxiol Environ Health 36(2): 103-150.

Attachment C: Mercury Information

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals.

Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants. It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.

Methylmercury may be formed in water and soil by small organisms called bacteria. Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

People can be exposed to mercury by:

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused

kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk. However, the benefits of breast-feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

Reference

[ATSDR] Agency for Toxic Substances and Disease Registry. 1999. Toxicological profile for mercury. Atlanta: US Department of Health and Human Services.

Attachment D: ATSDR Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. The mission of ATSDR is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. Unlike the U.S. Environmental Protection Agency (EPA), ATSDR is not a regulatory agency. EPA is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute-occurring over a short time [compare with **chronic**].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with **antagonistic effect** and **synergistic effect]**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Aerobic-requiring oxygen [compare with **anaerobic**].

Ambient-surrounding (for example, *ambient* air).

Anaerobic-requiring the absence of oxygen [compare with **aerobic**].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with **additive effect** and **synergistic effect**].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) **biomedical testing** or (b) the measurement of a substance [an **analyte**], its **metabolite**, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see **exposure investigation**].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP
See **Community Assistance Panel**.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk of for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen- a substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic-occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people, from a community and from health and environmental agencies, who work with ATSDR to resolve issues and problems related to hazardous substances in the community.

CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or injury that happens as a result of exposures that might have occurred in the past.

Dermal-referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact-contact with (touching) the skin [see **route of exposure**].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention-measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD-United States Department of Defense.

DOE-United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA-United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.
Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching), and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry
A system of ongoing follow-up of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Half-life ($t_{½}$)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard-a source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education
Programs designed with a community to help it know about health risks and how to reduce them.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with **in vivo**].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with **in vitro**].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite-Any product of **metabolism**.

mg/kg-milligram per kilogram.

mg/cm^2-milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration-moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality-death; usually the cause (a specific disease, condition, or injury) is stated.

Mutagen-a substance that causes **mutations** (genetic damage).

Mutation-a change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites**]

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb-parts per billion.

ppm-parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action-a list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by past, present, or future conditions at a site. One or more hazard categories could apply to a site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting-a public forum with community members for communication about a site.

Radioisotope
Unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide-any radioactive isotope (form) of any element.

RCRA [See **Resource Conservation and Recovery Act (1976, 1984)**]

Receptor population
People who could come into contact with hazardous substances [see **exposure pathway**].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

Remedial Investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD-see **reference dose**.

Risk-the probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication-exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor**]

SARA [see **Superfund Amendments and Reauthorization Act**]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size-the number of units chosen from a population or environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance-a chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Surveillance [see **epidemiologic surveillance**]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see **prevalence survey**].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see **additive effect** and **antagonistic effect**].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents which, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology-the study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and

for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency http://www.epa.gov/OCEPAterms/
National Center for Environmental Health (CDC)
http://www.cdc.gov/nceh/dls/report/glossary.htm
National Library of Medicine http://www.nlm.nih.gov/medlineplus/dictionaries.html