Health Consultation

Exposure Investigation

EVALUATION OF FISH FROM ST. JOE BAY

PORT ST. JOE, GULF COUNTY, FLORIDA

EPA FACILITY ID: FLD004056602

MAY 15, 2007

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

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 Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Summary and Statement of Issues

To protect the health of area seafood consumers, the Florida Department of Health (DOH) coordinated testing of St. Joe Bay redfish, black drum, gulf flounder and bay scallops for dioxins/furans and polychlorinated biphenyls (PCBs). These species are eaten by nearby residents and visitors or harvested commercially. Based on a review of environmental data in 2003 and community concerns, the Florida DOH tested fish and scallops to see if dioxins/furans and PCBs accumulated in these fish from St. Joe Bay sediments. Previous tests of St. Joe Bay fish were inadequate to determine the health risk to consumers.

Due to seasonal variations and availability, the Florida DOH coordinated two collections of fish and scallops from St. Joe Bay. In March 2006, the Florida Fish and Wildlife Conservation Commission (FFWCC) collected redfish and black drum. In August 2006, a private charter fisherman and crew helped the Florida DOH collect gulf flounder and bay scallops from St. Joe Bay.

Dioxins/furans levels in fish tested were well below Florida's advisory guideline level and ATSDR's minimal risk levels. These levels are a "no apparent public health hazard" to adults or children. PCB levels in fish tested were below ATSDR's minimal risk levels and are also a ."no apparent public health hazard." Therefore, for children and adults eating redfish, black drum, flounder or bay scallops from St. Joe Bay near the marina and Gulf County Canal Millville site, there is no apparent public health hazard.

Purpose

This health consultation report addresses health concerns about people eating fish and scallops from St. Joe Bay.

To protect the health of area seafood consumers, the Florida Department of Health (DOH) coordinated testing of redfish, black drum, gulf flounder and bay scallops for dioxins and PCBs. The Florida DOH tested fish and scallops to see if these contaminants from St. Joe Bay sediments accumulated in the seafood.

The conclusions and recommendations of this health consultation report apply only to people who eat redfish, black drum, gulf flounder and scallops caught from the St. Joe Bay within two miles of the Millville site.

Financial support for this consultation was provided entirely by ATSDR.

Site Background

The St. Joe Paper Company and Florida Coast Paper operated a paper mill on St. Joe Bay between 1938 and 1998[1](Figure 1). From 1938 to 1974, the paper mill discharged 25–30 million gallons of wastewater per day [1] into an unlined surface impoundment on the northern part of the site. Dioxins and PCBs are byproducts of pulp and paper manufacturing. Throughout this document, the term “dioxins” will refer to all dioxin and furan based compounds that have a common mechanism of action on biological systems. "Dioxins" is used to represent all or any combinations of dioxin or furans. Dioxins and PCBs were found in impoundment sludge that had settled from mill wastewater [(2)]. Although the impoundment was designed as an infiltration basin, the mill periodically emptied wastewater overflow via a ditch into St. Joe Bay. This resulted in a visible area of discharge. By 1960, an 11-foot-thick layer of soft plant wastes and organic material existed along the bottom of St. Joe Bay near the paper mill [(3)]. After 1974, the City of Port St. Joe treated paper mill waste at their wastewater treatment plant before discharging into a canal leading to St. Joe Bay.

Dioxins are byproducts of pulp and paper manufacturing [(2, 4, and 5)]. A 1988 study of five paper mills (including St. Joe Paper) found that bleaching pulp with chlorine and hypochlorite produced dioxins and furans[(6)]. From 1966 to 1974, the St. Joe paper mill plant bleached up to 23% of their daily pulp production [(1)].

In the 1950s and 1960s, the St. Joe Paper Mill used PCBs to manufacture carbonless copy paper [(7, 8)]. When the paper mill was dismantled, PCB contaminated soil from six locations was discovered and removed; leaks from PCB-containing transformers are likely sources. Storm water runoff likely carried PCB contaminated soil into the St. Joe Bay.

The previous owner of the former mill site was Smurfit-Stone. St. Joe Company now owns both sites (the former mill site and the former waste water impoundment) and intends to develop the sites according to Florida Brownfields stipulations. For the mill site, engineering controls are in place preventing exposure to any contaminated soil left in place. The Florida DEP is in the process of negotiating a restrictive covenant which will prevent groundwater use at the site.

Florida DOH activities

On October 31, 2001 Florida DOH/ATSDR published a health consultation evaluating June 2001 DEP soil testing of 32 soil samples for arsenic, cadmium, lead, mercury and nickel in the nearby Millview subdivision. The Florida DOH found these metals were unlikely to cause illness. However, Florida DOH categorized this site as an indeterminate public health hazard since exposure to other paper mill wastes had not been determined. On February 16, 2002, the Florida DOH held a public open house meeting for residents to discuss DOH findings on soil and water results and gather community health concerns. In separate reports, Florida DOH assessed the public health threat from soil and ground water near the Millville site. These reports can be accessed online at http://www.myfloridaeh.com/community/SUPERFUND/pha.htm.

In June 2005, the Florida DOH distributed a newsletter to Millview residents announcing the results of the soil and ground water tests.

Demographics

In 2000, about 341 people lived within a 1/2-mile radius of the center of the western part of the Mill View site. Approximately 95% were black or African American, 5% percent were white, and one person (less than 1% of the total) was American Indian or Alaskan native. Within a 1.5-mile radius, the total population was about 2,867. About 61% were white, 37% were black or African American, about 1 % were two or more races, about 1% were Hispanic or Latino, and less than 1% were American Indian, and Alaskan Native [(9)].

Target Population

The target population includes recreational and commercial fishermen from Gulf County as well as surrounding counties including Franklin, Bay, Liberty, Wakulla, Leon and Escambia. Also included in this population are out-of-state fishermen.

Recreational Fishermen
There are many recreational fishermen in this area of the state. There is a mixture of offshore and inshore fishing. Some fish from charter boats; some use inshore fishing guides. Others fish from the shore and piers or bring their boats. Overall, out-of-state fishermen are a majority (2/3) of the charter and guide fishing anglers. Out-of-state anglers particularly from Georgia and Alabama also fish from shore and recreational boats in the Florida Panhandle. This is also true during scallop season.

Commercial Fishermen

Local and out-of-state fishermen land fish from St. Joe Bay and sell them throughout the Florida panhandle. At this time, there are no fish advisories specifically for this bay. There is however a statewide fish advisory for mercury in certain marine fish (including gulf flounder, red drum (aka redfish) and black drum) for all water bodies in Florida. Please go to http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/Fish_consumption_guide.pdf for information on these mercury fish consumption advisories.

Discussion

Background for Fish and Scallop Testing

Accumulation of Dioxins and PCBs in St. Joe Bay Sediments

The Florida DOH selected contaminants to test in fish and shellfish based on their persistence in the environment, their toxicity, and their ability to bioaccumulate in fish and shellfish.

Dioxins and PCBs are persistent organic pollutants. Persistant organic pollutants are chemicals that resist biological and chemical degradation [10] and accumulate in sediments. U.S. Fish and Wildlife Service (FWS) staff have measured dioxins and PCBs in St. Joe Bay sediments [11, 19]. They analyzed sediment samples in water 20 feet deep. Levels of dioxins and furans (TEQs) in St. Joe Bay sediments ranged from 2.9 to 10.9 parts per trillion (average 8 ppt). The US FWS estimates dioxin contamination in approximately 20,000 acres of St. Joe Bay bottom sediments.

Dioxins accumulate in aquatic sediments[12] and may have a half-life of over 50 years[13]. This means it may take 50 years for dioxins in sediments to fall to half their original concentration.

PCB mixtures can persist in the environment for many years [12, 14]. A particular kind of PCB with high chlorine content—Arochlor-1260 (60% chlorine)—was identified in the former wastewater impoundment sediments. High-chlorine PCBs are extremely resistant to biodegradation and degradation by oxidation and hydrolysis [12]. High-chlorine PCBs accumulate and persist in sediments, especially sediments with high organic content [12]. Generally, the more chlorine atoms PCBs contain, the more slowly they break down.

Bioaccumulation of Dioxins and PCBs in Fish and Scallops

Because dioxins and PCBs persist in the environment and are highly fat soluble, they tend to bioaccumulate at high concentrations in animals [10, 18].

PCBs bioaccumulate in aquatic organisms [12]. Bioaccumulation through the food chain tends to concentrate higher chlorine content PCBs, resulting in PCB mixtures considerably different and more toxic than the original ingested PCB mixture [14]. As a result, the PCB mixture in fish and people may not resemble the original PCB mixture [14]. People who rely on PCB-contaminated fish for a significant portion of their diet are at increased risk of PCB exposure [14].

Previous Testing Inadequate

The Florida DOH reviewed previous St. Joe Bay fish data and found these data inadequate. DOH could not determine whether there were elevated levels of contaminants resulting in health risk to consumers for the following reasons: a particular species was not collected, too few individual fish were collected, or the laboratory analysis did not meet current standards. Previously, bay scallops were not collected at all.

- Only limited information on the levels of dioxins and furans in St. Joe Bay fish is available. Fish testing for dioxins and furans in the early and mid 1990 did not meet current standards. Dioxin testing did not include all of the dioxins necessary to compare to standards adopted by EPA in 2002. Fish have not been tested at all for PCBs [1, 2 3, and 19].

- Of two previous studies of St. Joe Bay fish, one analyzed only the fish muscle without the skin [11] and the other did not specify the preparation method[3]. Dioxins and PCBs accumulate in fish skin fat. Many people, however, prepare and eat fish with the skin on.

- Scallops have not been collected previously or tested for dioxins or PCBs.

Fish Eaten Locally from St. Joe Bay

St. Joe Bay near the Gulf County Canal and the Port St. Joe Marina are popular fishing spots [15, 16 and 17]. Nearby residents and visitors catch and eat sheepshead, redfish, spotted sea trout, hardhead catfish, and flounder (http://www.floridasportsman.com/features/panhandle_highway_98/).

Bay Scallops Harvested

Bay scallops occur in discrete populations scattered along the coast of Florida. In prehistoric times, scallops could be found from West Palm Beach to Pensacola, but in recent decades, that range has contracted considerably. Now, dense aggregations of bay scallops are found only in the area between Tarpon Springs and Port St. Joe [20].

The results of ongoing scallop population monitoring reveal three characteristics of a healthy scallop population: 1) density > 25 scallops per 600-m^2 survey transect, 2) a broad distribution of scallops within the survey area, and 3) a rapid rebuilding of the population following a collapse. Applying those criteria, only two sites in Florida, Steinhatchee and St. Joe Bay, supported healthy scallop populations through 1999 [20].

Each June, before scallop season opens, the Florida Fish and Wildlife Research Institute (FWRI) staff members conduct annual adult-population surveys of bay scallop populations in Pine Island Sound, Anclote estuary, Hernando, Homosassa, Cedar Keys, Steinhatchee, St. Joe Bay, and St. Andrew Bay. Each September, after the season has closed adult-population surveys are conducted in Anclote, Homosassa, Steinhatchee, and St Joe Bay [21].

Results of the surveys showed that scallop abundance in St. Joe Bay was very low during 2000 and again during 2001, but it is still increasing relative to past levels and is within the 5–25 animals/600 m^2 abundance index. The survey also showed that scallops are extremely rare west of St. Joe Bay, and since that area remains open to fishing, those few available scallops are subject to intense harvest pressure. [21]

Bay scallops feed continuously by “vacuuming”or filtering small particles of algae and organic matter from the water. Because of this they are likely to accumulate PCBs and dioxins.

Fish Collection and Shipment

On March 15 and 16, 2006, the Florida DOH and the FFWCC concentrated on collecting fish from St. Joe Bay first near the Gulf County Canal and the Port St. Joe Marina and then within 2 miles of these locations (Figure 2). After hours of unsuccessful fishing with hook and line, FFWCC used a 600 foot seine net and collected redfish and black drum. The fish were collected near the Highland View boat ramp. The fish were kept on ice. Redfish are predators and black drum are bottom feeders.

Sheepshead were collected as well but were not large enough or a consistent size for analyses. The goal was to collect at least 12 of the largest and oldest fish or scallops for one composite sample. It is important that each individual fish or scallop in the composite sample be uniform in size for a representative sample. Ten fish were only accepted if 12 fish are not caught after a full day of fishing. Detailed information about the fish collected are shown in Attachment A. FFWCC followed DOH's March 2006 protocol (Attachment B).

FFWCC weighed and measured the redfish and black drum. Fish were measured from nose to tip of tail. For each fish composite, the Florida DOH divided the minimum length by the maximum length to calculate a percentage. Percentages were calculations similarly for the weights. The calculations for these composites must be 75% or higher. Some of the smallest fish were discarded to meet these criteria. This ensures that a representative composite sample is sent to the laboratory for analyses. Based on these calculations, 13 redfish and 10 black drum were selected for analyses. Each fish was rinsed with distilled water, wrapped individually in butcher paper and heavy-duty aluminum foil, and placed in a labeled Ziploc bag to prevent cross-contamination. Fish were shipped on regular ice in large plastic coolers. The shipment included proper transportation labels and forms, chain of custody forms, and laboratory forms. The fish were shipped overnight to Severn Trent Laboratories (STL) in Tennessee.

Since only a few of the proposed fish species were caught in March due to cooler water temperatures, the Florida DOH decided to wait until the summer to collect flounder and sheepshead. At the same time, they could collect scallops.

On August 2 and 3, 2006 Florida DOH, the Gulf County Health Department and a chartered crew collected gulf flounder and bay scallops from within approximately 2 miles of the Gulf County Canal and the Port St. Joe Marina (Figure 2 and Attachment A). Other fish were also collected, but were not a sufficient amount to send to the lab. The bay scallops were found further out in the bay near sandbars rather than closer to the marina or canal. Three composite adult scallops were collected from three separate sandbars about 2 miles from the marina. The scallops were kept on ice. The Florida DOH recorded GPS coordinates for each location. Because two scallop composites were collected in close proximity and scallops travel due to the currents, one composite was discarded and only two composites were analyzed for this investigation (composite #1 and #2)(Table I).

The Florida DOH weighed, measured and prepared the gulf flounder in the same manner as in March. Based on the minimum and maximum length and weight calculations, 12 gulf flounder were selected for analyses (Table I and Attachment C). The Florida DOH measured each scallop from the indentation on one side of the base to the indentation on the other side of the base. The scallops harvested from each location (composite) were all adults and consistent in size (composite #1 - 14 scallops, composite #2 - 15 scallops).

The scallops were rinsed with distilled water and placed in a Ziploc bag with shells intact. The gulf flounder and scallop composite samples were frozen overnight and shipped express mail the following day to STL in Tennessee.

See Attachment A and C for photos and detailed descriptions of these fish and scallops.

Fish Laboratory Methods and Analyses

In March 2006, STL filleted the two fish composites (13 redfish and 10 black drum), leaving skins intact. In August 2006, STL filleted one fish composite (12 gulf flounder) leaving fish skins intact and shucked two scallop composites (14 scallops and 15 scallops). Using EPA Methods and guidelines, STL homogenized each fish and scallop composite (5 composites total) and analyzed all composite samples (Table I and II) for dioxins/furans and PCBs. The analyses included preparation (resection and filleting), compositing (keeping the same fish species together) homogenizing (blending), and quality assurance (QA) samples (1 method blank per composite sample). All samples had sufficient QA .

Interpretation of Fish/Scallop Results

The Florida DOH reviewed STL's April and August 2006 fish and scallop dioxin and PCB results. The Florida DOH used the World Health Organization's (WHO) 2005 Total Equivalency Factors (TEFs) to calculate dioxin Toxicity Equivalents (TEQs) to compare with DOH's dioxin guidance (Tables II, III and IV). A TEQ is the mean concentration of the total dioxin/furan toxic equivalents. The protocol in Attachment B lists previous 1998 WHO TEFs. The Florida DOH also calculated ingestion doses for dioxins and PCBs to compare with ATSDR's MRLs (Table V and Attachment D).

<u>Dioxins/Furans</u>

Table IV summarizes the TEQs of dioxin/furans in fish and bay scallops from St. Joe Bay. Florida DOH calculated a TEQ for each fish and scallop composite tested for dioxins. The highest TEQ was 0.212 parts per trillion (ppt) in composite scallop #1. Dioxin and furan toxicity equivalent (TEQ) levels in the redfish (0.0541 ppt), black drum (0.0003 ppt), gulf flounder (0.0018 ppt) and bay scallops (0.204 ppt) were well below Florida DOH's current guideline for fish consumption advisories (7 ppt)(Table IV).

Levels of dioxins in redfish, black drum, gulf flounder and bay scallops from St. Joe Bay pose no apparent public health hazard. To calculate an ingestion dose, the Florida DOH assumed that on average, adults eat 30 grams of fish or bay scallops per day and children eat 15 grams per day. DOH used the highest level of dioxins in scallops (0.212 ppt) and the highest level of PCBs (0.2279) to calculate these doses (Attachment D). Estimated child and adult exposure doses for dioxins/furans in redfish, black drum, flounder and bay scallops from St. Joe Bay were below comparison values published by ATSDR (Table V). 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 [22]. Estimated exposure doses for dioxins and furans for acute (1-14 days), intermediate (15-364 days) and chronic ($\geq$ 365 days) exposure ranged from 2,500 to 13 times less than MRL values respectively and about 13,000 times less than ATSDR's CEL for chronic exposure.

Please see Attachment E for general information concerning dioxins/furans (chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans).

Polychlorinated Biphenyls (PCBs)

Table IV summarizes the PCBs in fish from St. Joe Bay. The highest PCB level for the 12 dioxin-like PCBs was 0.2279 ppt in the redfish. We assumed that on average, adults eat 30 grams of fish or bay scallops per day and children eat 15 grams per day.

Estimated child and adult exposure doses for PCBs in redfish, black drum, flounder and scallops from St. Joe Bay were below comparison values published by ATSDR (Table II and Attachment D). This was true for both scenarios (using the highest PCB level from the 209 congeners or just the 12 dioxin-like PCBs). 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. There is no PCB MRL for acute (1-14 day) exposure [23]. Using the highest level for the 12 dioxin-like PCBs, estimated exposure doses for dioxins and furans for intermediate (15-364 days) and chronic ($\geq$ 365 days) exposure ranged from 300,000 to 200,000 times less than MRL values respectively for monkey studies and about 10 billion times less than the ATSDR's CEL for rat studies for chronic exposure. Therefore, levels of PCBs in redfish, black drum, gulf flounder and bay scallops from St. Joe Bay pose no apparent public health hazard.

Also, DOH is working to develop a guideline for PCBs in fish by the end of 2007. The concentrations of PCBs found in the St. Joe Bay are well below the standards for PCBs used by other southeastern or Atlantic Coast states.

Please see Attachment F for general information concerning PCBs.

Other Health-Based Standards

Dioxins/Furans

There are currently no Food and Drug Administration (FDA) action levels for dioxins or furans in food [24]. 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 [25].

PCBs

There are currently no FDA action levels for PCBs in food [24].

Biological Testing

The levels of dioxins and PCBs found in the fish and scallops do not warrant biological testing in blood or urine for people eating fish or bay scallops from St. Joe Bay.

Clam Testing

Florida DOH and ATSDR decided that clam testing from St. Joe Bay was not warranted. Clam harvesting from St. Joe Bay is prohibited near the Gulf County canal and marina (Figure 2).

Child Health Considerations

This health consultation considers that children could eat fish or scallops from St. Joe Bay. Pregnant women, nursing mothers and children can be affected by dioxins and PCBs in fish. It is important to remember children are not small adults. Children can be more sensitive to the effects of dioxins and PCBs 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. There is little 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 [22]. Also, humans are less sensitive to dioxins than animals.

Children can be exposed to PCBs by eating fish and wildlife. A child's PCB 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 [22 and 23]. 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. We conclude however that the dioxin and PCBs found in redfish, black drum, flounder and scallops from St. Joe Bay within two miles of the marina and Gulf County canal are not likely to cause illness in either adults or in children.

Conclusions

Dioxins/furans levels in fish tested were well below Florida’s advisory guideline level and ATSDR’s minimal risk levels These levels are a “no apparent public health hazard” to adults or children. PCB levels in fish tested were below ATSDR’s minimal risk levels and are also a “no apparent public health hazard” Therefore, for children and adults eating redfish, black drum, flounder or bay scallops from St. Joe Bay near the marina and Gulf County Canal Millville site, there is no apparent public health hazard.

Recommendations

The Florida DOH does not recommend a fish consumption advisory or additional fish or bay scallop testing for St. Joe Bay.

Public Health Action Plan

Past action items:

On October 31, 2001 Florida DOH/ATSDR published a health consultation evaluating June 2001 DEP soil testing of 32 soil samples for arsenic, cadmium, lead, mercury and nickel in the Millview subdivision. The Florida DOH found these metals were unlikely to cause illness. However, Florida DOH categorized this site as an indeterminate public health hazard since exposure to other paper mill wastes had not been determined.

On February 16, 2002, the Florida DOH held a public open house meeting for Millview residents to discuss DOH findings on soil and water results and gather community health concerns.

May 22, 2003, the Florida DOH determined they were unable to evaluate possible health effects for workers and Millview community members from airborne and/or work exposures because of the lack of worker exposure or air quality data. The western Millview fill area was determined to be an indeterminate public health hazard because DOH cannot rule out PCBs in surface soil at levels that should be avoided in gardening exposures. The Bay Street fill area is a no apparent public health hazard.

In June 2005, the Florida DOH distributed a newsletter to Millview nearby residents announcing the results of the soil and ground water tests.

Future action items:

Florida DOH will review St. Joe Bay fish and scallop test results based on EPA's final dioxin criteria expected at the beginning of 2008.

Florida DOH is working to develop a guideline for PCBs in fish by the end of 2007.

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Other Documents Reviewed

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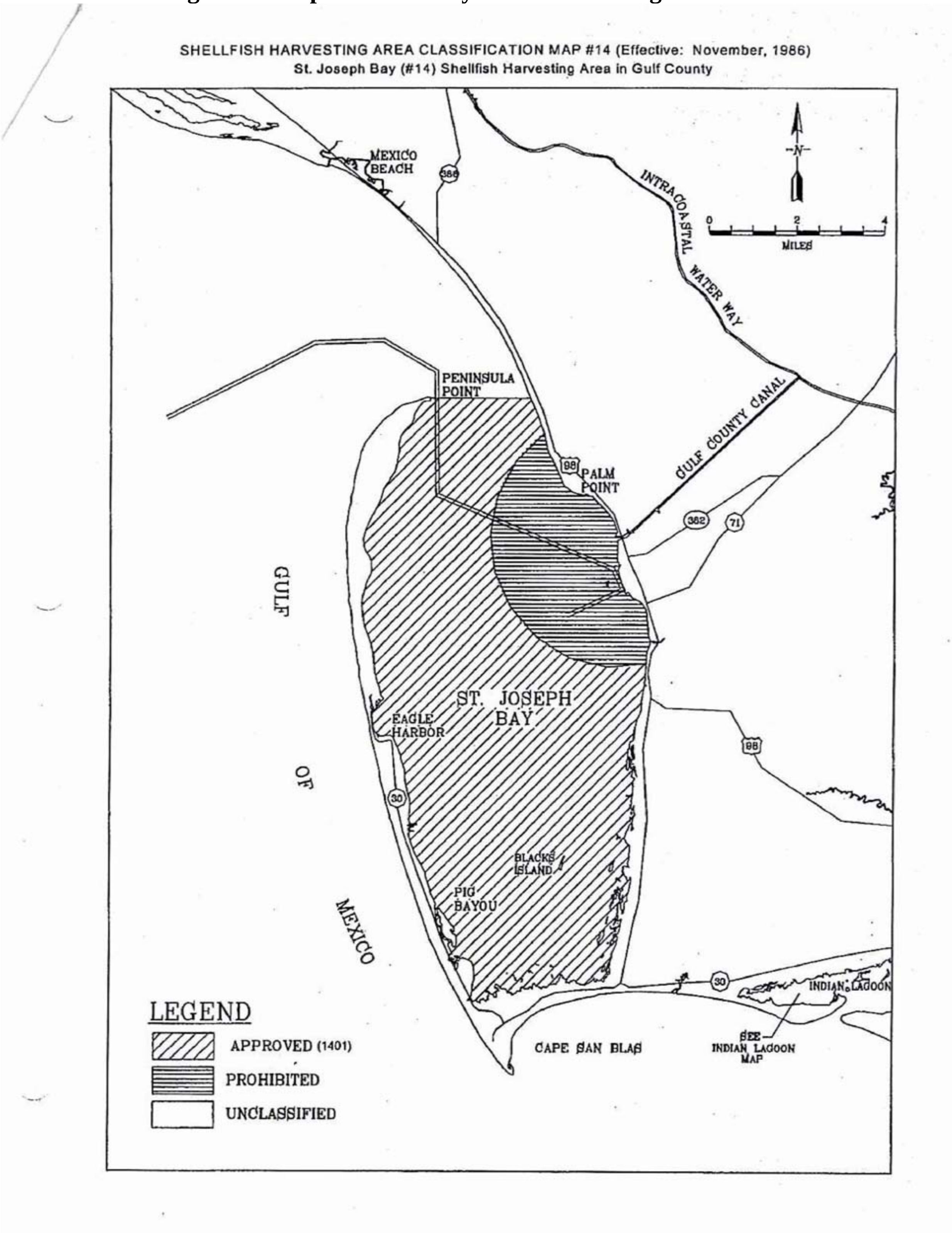
Figures and Tables

Figure 1: Millville Site and County Map

Figure 2: Map of St. Joe Bay and Surrounding Area



TABLES I-V

Table I

Length and Weight Ranges for Fish and Scallops from St. Joe Bay Collected March 2006* and July 2006**

Fish/Scallops Collected	# Composited	Individual Weights (grams)	Individual Lengths (millimeters)
		Range	Range
Red Fish*	13	1781-2371	558-624
Black Drum*	10	624-878	358-399
Gulf Flounder**	12	907-1247	325-445
Scallops Composite #1**	14	n/a	55-60
Scallops Composite #2**	15	n/a	53-64

n/a = not available

Table II
Dioxin Congeners and Relevant Toxicity Equivalency Factors (TEF)

Congener	TEF	Congener	TEF
2,3,7,8-TCDD	1.0	2,3,7,8-TCDF	0.10
1,2,3,7,8-PeCDD	1.0	1,2,3,7,8-PeCDF	0.03
		2,3,4,7,8-PeCDF	0.30
1,2,3,4,7,8-HxCDD	0.10	1,2,3,4,7,8-HxCDF	0.10
1,2,3,7,8,9-HxCDD	0.10	1,2,3,7,8,9-HxCDF	0.10
1,2,3,6,7,8-HxCDD	0.10	1,2,3,6,7,8-HxCDF	0.10
		2,3,4,6,7,8-HxCDF	0.10
1,2,3,4,6,7,8-HpCDD	0.01	1,2,3,4,6,7,8-HpCDF	0.01
		1,2,3,4,7,8,9-HpCDF	0.01
OCDD	0.0003	OCDF	0.0003

Source:Van den Berg et al. The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

Table III
PCB Congeners and Relevant Toxicity Equivalency Factors (TEF)

Congener	TEF	Congener	TEF
PCB77	0.0001	PCB169	0.03
PCB81	0.0003	PCB189	0.00003
PCB105	0.00003		
PCB114	0.00003		
PCB118	0.00003		
PCB123	0.00003		
PCB126	0.1		
PCB156	0.00003		
PCB157	0.00003		
PCB167	0.00003		

Source:Van den Berg et al. The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

Table IV
Calculated TEQs Using Fish/Scallop Dioxin and PCB Results (parts per trillion) and TEFs

	Red Fish	Black Drum	Gulf Flounder	Scallop #1	Scallop #2	Florida DOH Guidance
Dioxins (TEQ)	0.0541	0.0003	0.0018	0.212	0.204	7.0
Total of 12 dioxin-like PCBs	0.2279	0.0047	0.154	0.0018	0.0011	none

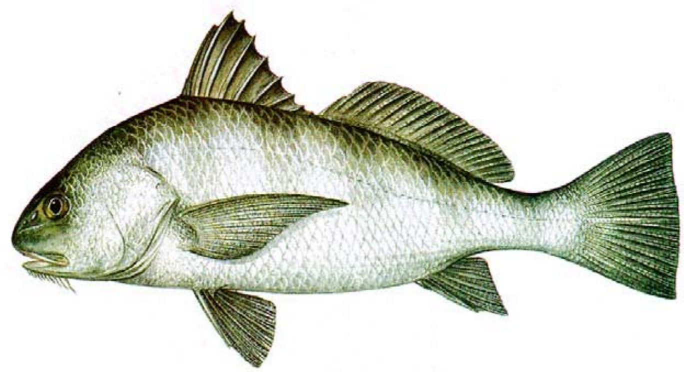
All above results are in parts per trillion (ppt) unless otherwise noted in mg/kg/day
TEQ=Toxicity Equivalents
A TEQ is the mean concentration of the total dioxin/furan or PCB toxic equivalents
TEF=Total Equivalency Factor

Table V
Calculated Ingestion Doses Compared with ATSDR MRLs and DOH Guidance

	Calculated Ingestion Dose For Adult and Child	ATSDR Guidance (MRL)
Dioxins	8.57×10^{-11} mg/kg/day	Acute - 2.0×10^{-7} mg/kg/day Inter - 2.0×10^{-8} mg/kg/day Chronic – 1.0×10^{-9} mg/kg/day CEL – 1.2×10^{-6} mg/kg/day
PCBs	9.86×10^{-11} mg/kg/day	Inter – 3.0×10^{-5} mg/kg/day Chronic - 2.0×10^{-5} mg/kg/day CEL – 1 mg/kg/day

Note: Ingestion doses were calculated using the highest level of dioxins and PCBs found in all fish and scallops samples tested (Dioxins – 0.212 ppt in scallops and PCBs **-** 0.2279 ppt for redfish). DOH assumed that on average, adults eat 30 grams of fish or bay scallops per day and children eat 15 grams per day.
MRL= minimal risk level
MRL is for 2,3,7,8-TCDD (most toxic of all dioxin/furan congeners)
CEL=cancer effect level

Attachment A: Fish/Scallop Photos and Descriptions



Black drum, *Pogonias cromis*

Black drum inhabit Florida estuaries as juveniles and occasionally move into near shelf waters as adults. The species occurs in nearshore waters from Nova Scotia south to Argentina. Gold and Richardson (1991) suggested that there was little differentiation into subpopulations in U.S. waters; although, Gold and Richardson (1998b) emphasized a significant degree of clinal variation among black drum mtDNA haplotypes along the U.S. Gulf of Mexico coast. Growth is fairly slow; 11”–14" at age 1, 15”–17" at age 2, and 19”–21" at age 3 (Table 1; Murphy and Taylor 1989; Murphy and Muller 1995a; Jones and Wells 1998). Black drum, the largest members of the family Sciaenidae, can reach over 46" and 120 pounds (Murphy *et al*. 1998; Jones and Wells 1998; Campana and Jones 1998). Long-lived fish, black drum can reach almost 60 years of age. Black drum spawn during the winter–early spring. Females mature at age 4–6 years and are prodigious, multiple spawners. An average-sized female (13.4 pounds) may spawn 32-million eggs each year (Fitzhugh *et al.* 1993).

Table 1. Von Bertalanffy growth parameters and length-weight relations for black drum

Inches FL = $L_\infty(1-e^{-K(age-t_0)})$	K	L_∞ (inches FL)	t_0 (years)	Source
Sexes combined, Chesapeake Bay	0.105	46.2	-2.3	Jones and Wells (1998)
Sexes combined, northeast Florida	0.124	46.1	-1.300	Murphy and Tayl (1989)
Sexes combined, west-central Florida	0.171	40.2	-1.164	Murphy and Mul (1995a)
Sexes combined, northern Gulf of Mexico	0.051	39.4	-13.07	Beckman *et al.* (1990)

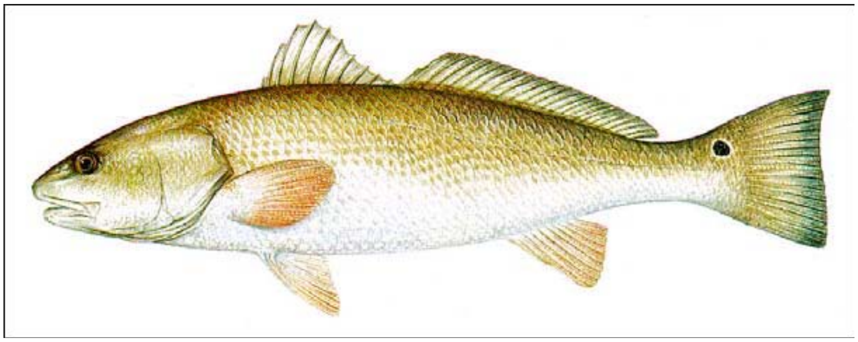
Weight in lbs = a (inches FL)^b	a	b	Source
Sexes combined, Chesapeake Bay	0.000404	3.11	Jones and Wells (199
Sexes combined, northeast Florida	0.000483	3.044	Murphy and Taylor (1989)
Sexes combined, west-central Florida	0.000046	3.696	Murphy and Muller (1995a)
Sexes combined, northern Gulf of Mexico	0.000484	3.05	Beckman *et al.* (1990

Black drum are primarily bottom feeders. Young black drum feed on small fish and invertebrates, such as copepods, annelids, and amphipods (Pearson 1929; Thomas 1971). Larger black drum in Texas estuaries eat mostly mollusks, crabs, and shrimps (Miles 1949). As juveniles, black drum are prey to a wide range of estuarine piscivores, e.g., spotted seatrout, crevalle jack. Larger drum are probably subject to predation by sharks (Murphy and Muller 1995a).

Total landings of black drum in Florida during 2003 were 757,867 pounds. These landings were made mostly on the Atlantic coast (72% of statewide total) and mostly by recreational fishers (98% of statewide landings by weight). Anglers in Duval County reported the highest county-specific commercial landings in 2001 (Fig. 1). Recreational landings in Florida were greatest along the Atlantic coast in Duval, St. Johns, Volusia and Martin counties (Fig. 2). The 2003 total landings were 14% lower than the average landings in the previous five years (1998–2002) and were 25% lower than the 1982–2003 historical average landings (Fig.3). Total landings slowly declined statewide between 1991 and 1997 then showed occasional large increases along the Atlantic coast (2000 and 2001) but varied without trend on the gulf coast. Fishing regulations, implemented in 1990, were probably partly responsible for the sharp decline in 1990 (Fig. 3).

Commercial catch rates increased between 1997 and 2001 on the Atlantic coast but have since declined. Gulf coast commercial catch rates dropped between 1995 and 1998 and have since been steady at about 10 pounds per trip since then (Figs. 4, 5). The total-catch rates for recreational anglers have fluctuated without long-term trends on both the Atlantic and gulf coasts during 1982–2003 (Figs. 6, 7).

An assessment of black drum in Florida indicated that under fishing mortalities estimated for the mid to late 1980s, their static spawning potential ratio was at least 26%–36% (Murphy and Muller 1995a). Murphy and Muller (1995a) concluded that the black drum stock in Florida could sustain the level of fishing occurring during the early 1990s. The Gulf States Marine Fisheries Commission developed a fishery management plan for black drum that recommended that states set size limits on the commercial fishery and bag limits on the recreational fishery (Leard *et al.* 1993). The plan did not recommend a gulf-wide size limit because of low interest in the fishery at that time. A 14-inch minimum size limit, a 24-inch maximum size limit, and 500 pound commercial trip limit was applied to Florida's black drum fishery in 1989 to prevent expansion of a developing purse-seine fishery.



Red drum, *Sciaenops ocellatus*

Red drum are found throughout Florida's nearshore waters. Gold and Richardson (1991) identified weakly differentiated subpopulations occurring in the northeast Gulf of Mexico, Mosquito Lagoon, and along the coasts of North and South Carolina. Seyoum *et al*. (2000) also found genetic evidence for separate populations on Florida's gulf and Atlantic coasts but found no evidence of a separate population in Mosquito Lagoon. Red drum along the Gulf of Mexico side of the Florida peninsula may be somewhat isolated from red drum in the northern and western gulf.

Newly hatched red drum spend about 20 days in the water column before becoming demersal (Rooker *et al.* 1999). Small juvenile red drum seek out and inhabit rivers, bays, canals, tidal creeks, boat basins, and passes within estuaries (Peters and McMichael 1987). Subadults are found in these habitats and in large aggregations on seagrass beds and over oyster bars, mud flats, or sand bottoms. Adult red drum are found mostly in nearshore shelf waters, except where they occur within the Mosquito-Indian River Lagoon complex on Florida's Atlantic coast. Growth is very rapid through ages 4–5 (Table 1). Maximum age is about 40 years in Florida (Murphy and Taylor 1990), but there are reports of red drum as old as 60 years in North Carolina waters (Ross *et al.* 1995). Males mature when 1–3 years old, and females mature when 3–6 years old. Red drum spawn during the late summer and early fall in inlets, within estuaries, or in nearshore shelf waters.

Table 1. Von Bertalanffy growth parameters and length-weight relations for red drum

Inches FL = $L_\infty(1-e^{-K(age-t_0)})$	K	L_∞ (inches FL)	t_o (years)	Source
Combined sexes, Atlantic coast of Florida	0.418	38.6	-0.149	Murphy and Taylor (1990)
Combined sexes, gulf coast of Florida	0.460	36.8	0.029	Murphy and Taylor (1990)

Weight in lbs = a (inches FL)^{b}	a	b	Source
Combined sexes, Atlantic coast of Florida	0.000371	3.0275	Murphy and Taylor (19
Combined sexes, gulf coast of Florida	0.000306	3.0984	Murphy and Taylor (19

Juvenile red drum feed primarily on copepods, mysid shrimp, and amphipods (Peters and McMichael 1987). Menhaden and anchovies were the most important prey for adult red drum in the winter and spring; crabs and shrimp were the most important prey in the summer and fall (Boothby and Avault 1971).

There is no commercial harvest of red drum because the Florida Administrative Code, chapter 68B-22.005(2), prohibits the sale of red drum. In 2003, recreational red drum landings totaled 2,302,211 pounds. Landings were greater on the gulf coast, where about 69% of the statewide landings were made. The 2003 recreational landings of red drum were greatest along the Big Bend south through the southwest Florida region (Fig. 1). Since 1989, when current regulations were enacted, landings have slowly increased on the Atlantic and remained somewhat stable on the gulf coasts (Fig. 2). The 2003 total landings of red drum were 17% higher than the average landings in the previous five years (1998–2002) and were 8% higher than the average historical average landings (1982–2003).

During the mid-1980s, high total-catch rates occurred when the red drum standing stock increased subsequent to several moratoria prohibiting red drum harvest. Until 1997, catch rates on the Atlantic remained higher than the total-catch rates experienced in the early 1980s; beginning in 1997, catch rates on the Atlantic dropped to levels similar to those in the 1980s (Fig. 3). Gulf coast total-catch rates during the late 1990s through 2003 were slightly below those experienced in the early 1980s (Fig. 4).
Young-of-the-year abundance indices of red drum on the Atlantic coast increased slightly in 2002 and 2003, while on the gulf coast indices have been slowly increasing following a sharp decrease in 1997 (Figs. 5, 6). Abundances of post-YOY red drum were highest from 2000-2002 on the Atlantic coast, while abundances on the gulf coast increased in 2003 (Figs. 7, 8). Few red drum were colleted exhibiting gross external abnormalities on the Atlantic coast, while the proportion of affected red drum on the gulf coast varied without trend (Figs. 9, 10). Tumors/cysts were the only gross abnormalities encountered on the Atlantic coast, while red/bloody areas were the most common affliction in red drum on the gulf coast (Figs. 11, 12).

Escapement rates and direct evidence from the age composition of adults in the gulf off Tampa Bay indicate that the adult stocks are rebuilding after the years of overfishing that occurred prior to the mid-1980s. Studies by FWC-FMRI indicate that the offshore stock of red drum (mostly fish older than age 5) is increasing in abundance as new recruits move into the population (Murphy and Crabtree 2001).

Coastwide assessments suggest that the Atlantic and gulf red drum stocks are still overfished but that both are recovering (Goodyear 1996a, Vaughan 1996, Vaughan and Carmichael 2000). Porch (2000), however, suggests that red drum stocks are not recovering. A gulfwide assessment found that fishing mortality rates on subadults, particularly age-2 fish, were still high enough in 1998 that the spawning potential ratio of the stock was not likely to achieve 20% (Porch 2000).

Murphy (2002) indicated that the average instantaneous fishing mortalities on both coasts of Florida peaked during the mid 1980s, declined during the late 1980s, and increased to relatively stable levels by the mid-1990s. Because there was no information at that time on the sizes of red drum that died subsequent to being released alive, a large portion of the harvest, the condition of the red drum stocks in Florida could not be precisely determined. Preliminary findings on the status of red drum in Florida indicate that year-class specific escapement rates were 30% on the Atlantic coast and 37% on the gulf coast in 2003 (Murphy 2005 In Review).

Figure 1. Geographic distribution of recreational landings of red drum landings during 2003
Figure 2. Total annual landings of red drum on the Atlantic and gulf coasts of Florida, 1982–2003
Figure 3. Annual standardized recreational total-catch rates (numbers) for red drum on the Atlantic coast of Florida, 1982–2003
Figure 4. Annual standardized recreational total-catch rates (numbers) for red drum on the gulf coast of Florida, 1982–2003

Figure 5. Percentage of Fishery Independent Monitoring sets on the Atlantic coast that captured young-of-the-year red drum, 1996-2003.

Figure 6. Percentage of Fishery Independent Monitoring sets on the gulf coast that captured young-of-the-year red drum, 1996-2003.

Figure 7. Percentage of Fishery Independent Monitoring sets on the Atlantic coast that captured post-young-of-the-year red drum, 1997-2003.

Figure 8. Percentage of Fishery Independent Monitoring sets on the gulf coast that captured post-young-of-the-year red drum, 1996-2003.

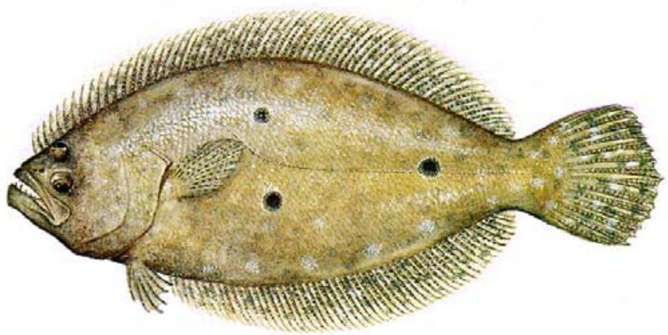
Figure 9. Proportion of red drum ≥ 75 mm collected in Fisheries-Independent Monitoring sets on the Atlantic coast that had gross external abnormalities, 1999-2003.

Figure 10. Proportion of red drum ≥ 75 mm collected in Fisheries-Independent Monitoring sets on the gulf coast that had gross external abnormalities, 1999-2003.

Figure 11. Proportions of different gross external abnormalities in red drum ≥ 75 mm collected in Fisheries-Independent Monitoring sets on the Atlantic coast, 1999-2003.

Figure 12. Proportions of different gross external abnormalities in red drum ≥ 75 mm collected in Fisheries-Independent Monitoring sets on the gulf coast, 1999-2003.

Reference:
http://research.myfwc.com/engine/download_redirection_process.asp?file=reddrum_1131.pdf&objid=5437&dltype=article



Flounders, *Paralichthys* spp.

Nearly all flounders landed by anglers in Florida are one of three species in the genus *Paralichthys*: gulf flounder *P. albigutta;* southern flounder, *P. lethostigma*; or summer flounder, *P. dentatus*. Gulf flounder are the only species to range along the entire Florida coast. Summer flounder are only a minor component of the flounder landings in northeast Florida; their center of distribution is off the U.S. Mid-Atlantic Bight. Southern flounder are generally only found north of the Loxahatchee River on the Atlantic coast and north of the Caloosahatchee River on the gulf coast. The distributions of gulf and southern flounder appear to be substrate-related. Southern flounder are found on silt and mud, and gulf flounder are found mostly on sand. Studies have shown that female southern flounder reach about 28" and 7 years of age while female gulf flounder reach only about 18" and 3 years of age (Table 1; Wenner *et al*. 1990; Stokes 1977). More recently, Fitzhugh *et al*. (1999) reported that gulf flounder attain older ages than previously thought: the oldest gulf flounder found in offshore waters off northwest Florida was age 11. While estuarine samples of southern flounder show maximum ages of about 4 years (Stunz *et al.* 2000; Fitzhugh *et al.* 1999), older fish probably occur in shelf waters. Males of both species do not get as large as females. Female southern flounder mature at age 3 or 4 (Wenner *et al.* 1990), and female gulf flounder mature at age 1 (Fitzhugh *et al*. 1999). Both species spawn in offshore waters during late fall–winter (65 ft–200 ft).

Table 1. Von Bertalanffy growth parameters and length-weight relations for flounders

Inches TL = $L_\infty(1-e^{-K(age-t_0)})$	K	L_∞ (inches TL)	t_0 (years)	Source
Male southern founder, South Carolina	0.25	20.4	-1.07	Wenner *et al.* (1990)
Female southern flounder, South Carolina	0.23	29.9	-0.57	Wenner *et al.* (1990)
Male gulf flounder, northwest Florida	0.60	13.6	-2.4	Fitzhugh *et al.* (1999)
Female gulf flounder, northwest Florida	0.40	19.4	-2.14	Fitzhugh *et al.* (1999)
Male southern flounder, northwest Florida	0.32	13.5	-5.2	Fitzhugh *et al.* (1999)
Female southern flounder, northwest	1.67	18.0	-0.75	Fitzhugh *et al.*

Florida			(1999)

Weight in lbs = a (inches TL)^b	a	b	Source
Male southern founder, South Carolina	0.000261	3.17	Wenner *et al.* (1990)
Female southern flounder, South Carolina	0.000275	3.15	Wenner *et al.* (1990)
Male gulf flounder, northwest Florida	0.000579	2.81	Fitzhugh *et al.* (1999)
Female gulf flounder, northwest Florida	0.000220	3.2183	Fitzhugh *et al.* (1999)
Male southern flounder, northwest Florida	0.000906	2.5723	Fitzhugh *et al.* (1999)
Female southern flounder, northwest Florida	0.000200	3.314	Fitzhugh *et al.* (1999)

Gulf flounders are benthic carnivores. Large juveniles feed primarily on small fish and crustaceans (shrimp and crabs). Adults feed on schooling fish such as menhaden, bay anchovy, pinfish, grunts, pigfish, Atlantic croaker, and mullets (Springer and Woodburn 1960; Topp and Hoff 1972; Benson 1982).

Total landings of flounders in Florida during 2003 were 893,553 pounds, the majority of which (71%) were landed by the recreational fishery. Landings were greater on the Atlantic coast, where about 59% of the statewide landings were made in 2003. In 2003, commercial landings on the Atlantic coast were highest in Volusia County (Fig. 1). On the gulf coast, commercial landings were greatest in Franklin county. Estimated recreational landings of flounders in Florida were highest in the waters between Volusia and Martin counties along the Atlantic coast (Fig. 2)

The 2003 total landings of flounders were 2% higher than the average landings in the previous five years (1998–2002) and were 14% lower than the historical average landings (1982–2003). In 1995, Atlantic coast recreational landings were almost exclusively southern flounder, while gulf coast recreational landings were mostly gulf flounder. Based on limited commercial sampling, the species composition of the commercial landings appears to be similar to that of the recreational landings (Murphy *et al.* 1994).

Annual standardized commercial catch rates for mixed flounder species have been steady since 1996 on the Atlantic coast and have increased since 1997 on the gulf coast (Figs. 4, 5). Recreational catch rates for gulf flounder are much lower on the Atlantic coast than on the gulf coast (Figs. 6, 7). There is a slow, long-term increase in catch rates since 1990 evident for gulf flounder on the Atlantic coast. Standardized recreational total-catch rates for southern flounder on the Atlantic coast were relatively stable between 1989 and 1994, increased through 1997, then exhibited a decline until 2001 (Fig. 8). Gulf coast catch rates for anglers fishing for southern flounder declined markedly between 1982 and 1989, but catch rates have remained relatively stable and low through 2003 (Fig. 9).
Indices of abundance for YOY gulf flounder were consistently low on the Atlantic coast but varied cyclically with peaks in 1998 and 2003 on the gulf coast (Figs. 10, 11).

Abundances of post-YOY gulf flounder on the Atlantic coast were high in 2003 and low in 1999, while on the gulf coast, post-YOY gulf flounder varied without trend except for highs in 1998/1999 (Figs. 12,13). On the Atlantic coast, no gulf flounder were collected with gross external abnormalities, while abnormalities in gulf flounder on the gulf coast were high in 2001 (Fig. 14). No one specific type of gross external abnormality was most frequent among gulf flounder on the gulf coast (Fig. 15).

Murphy *et al.* (1994) found that adequate information was not available to assess the condition of southern or gulf flounder stocks in Florida. A rough characterization of gulf flounder's population dynamics suggested it was unlikely that they were being fished at a maximum level of yield-per-recruit. Summer and southern flounder populations, which mature at a larger size and older age, are possibly more sensitive to fishing than gulf flounder. New life history information (Fitzhugh *et al.* 1999) needs to be considered in future assessments of gulf or southern flounder.

Assessments of the status of summer flounder in North Carolina northward found that the stock abundance in 1993–1994 was at the lowest average level since the 1960s. Although data indicated that 1993 year-class was very poor, some stock rebuilding had occurred due to good recruitment in 1991 and 1992. The Atlantic States Marine Fisheries Commission (1982) developed a Fishery Management Plan for summer flounder for the stock north of North Carolina.

Scallops—General Information

A secretive animal that spends most of its short life hiding in underwater grasses, the bay scallop is a prized dinner entrée for many Floridians and an important part of the marine ecosystem.

Nineteenth century coal miners took canaries into mines, relying on the birds' sensitive respiratory systems to warn of low oxygen levels and the presence of dangerous gases long before the air problems could harm humans. Like the miners' canaries, bay scallops are biomonitors, providing an early warning system for scientists who monitor the quality of Florida's coastal waters. Scallops are highly sensitive to changes in water quality; therefore, observing their health is a good way to measure the health of an ecosystem. A secretive animal that spends most of its short life hiding in underwater grasses, the bay scallop is a prized dinner entrée for many Floridians and an important part of the marine ecosystem. Historically, the bay scallop was a valuable seafood commodity; however, declining populations in many of Florida's coastal areas have prompted restrictions, which now allow only recreational harvests.

The bay scallop is a member of the shellfish family known as bivalves, named for its two valves, or shells. Its upper valve is a dark mottled color, occasionally bright yellow or orange, and its lower valve is typically white. Bay scallops may reach a shell height of two inches and live two years; although, in Florida their life span is generally only one year.

The bay scallop feeds continuously by "vacuuming" or filtering small particles of algae and organic matter from the water. It does this by funneling water over open pathways called gills. One of these pathways takes in water and skims off particles, while another expels the filtered water along with digestive wastes.

Scallops open their valves when feeding or breathing and close them when predators approach. The shell can also be slammed shut to avoid silt, which can clog the animal's delicate gills. Many tiny, blue eyes arrayed along the outer rim of the shell detect movement near the animal and serve as a warning system. When threatened, the scallop can swim backwards by clapping its valves and expelling water rapidly.

A bay scallop has the remarkable ability to develop both male and female sexual organs; consequently, the scallop produces both eggs and sperm. Scallops release their sperm and eggs at different times to reduce the chance of inbreeding. The amount of food available and the surrounding water temperature influence development of the reproductive organs. If too little food is present, the scallop will direct all its energy toward survival and will not reproduce.

A change in water temperature can trigger spawning. In Florida, spawning occurs in the fall when the temperature drops. Each scallop is capable of producing millions of eggs at once, but the mortality rate is extremely high. Only one egg out of 12 million may survive to adulthood.

It takes about 36 hours for fertilized eggs to become tiny larvae that float in the water for about 14 days before attaching to the base of seagrass blades. At this time, larvae transform into juvenile scallops, commonly called spat. The spat gradually move up the seagrass blades, out of the reach of bottom-dwelling predators such as crabs. Even then, survival is uncertain; as many as 90% of the spat will die within six weeks of latching on to seagrass. Those that do grow large enough to avoid consumption by predators will eventually drop off and fall to the bottom, where they remain the rest of their lives.

One creature, the pea crab, lives in harmony with the bay scallop. This crab finds protection within the scallop's shells. While the pea crab does steal some of the scallop's food, it doesn't take enough to jeopardize the health of its host.

Bay scallops are very sensitive to changes in temperature and salinity. They are also very vulnerable to changes in water quality. Water made cloudy by floating particles and sediments, referred to as turbidity, can clog the scallop's gills. The scallop can close its shell to protect its gills for a short period of time, but it is unable to shut out the dirty water for more than about two hours.

Although bay scallops were once plentiful throughout Florida's west coast, they have virtually disappeared in some areas. An extensive scallop fishery existed in Tampa Bay as recently as the 1960s, but scallops are rarely found there now. Charlotte Harbor also supported a commercial fishery some 30 years ago. Scientists believe poor water quality is responsible for these declines. Currently, the most extensive bay scallop populations are located north and west of the Suwannee River, particularly near the fishing hamlet of Steinhatchee and in St. Joseph Bay.

Once a population is depleted, it may not be able to recover on its own, even with improved water quality and restrictions on harvest. Scallops are broadcast spawners, sequentially releasing eggs and sperm to maximize fertilization by other scallops. If no other scallops are nearby, reproduction won't be successful. Consequently, a depleted scallop population may have to rely on neighboring populations to replenish its losses.

The decline of the bay scallop has prompted the Fish and Wildlife Commission (FWC) to team up with the University of South Florida (USF) in a program to restore Florida's natural bay scallop populations. In this three-year project, funded with a grant from the National Marine Fisheries Service through its Disaster Relief Fund, FWC and USF are placing young scallops in protective cages at several Florida locations with the hope that they will spawn and begin to repopulate areas that have few scallops left.

Through this program, scallops are being stocked at Anclote River, Homosassa River, and Tampa Bay. The scallops are spawned at USF, brought to FWC's stock enhancement facility (SERF) at Port Manatee, and raised in monitored ponds. Once large enough, the scallops are placed in protective cages at one of the planting sites. The cages allow the scallops to feed and spawn without the threat of predators. Scientists are hopeful that the scallops will spawn in the cages; then the larvae will float out of the cages and settle in seagrasses.

One group of scallops has been placed on a custom-built barge anchored off Crystal River. The barge has a hinged platform surface that opens to reveal the caged scallops underneath. This barge allows researchers to easily monitor the progress and growth of the scallops. Researchers intend to incorporate the barge into educational programs through USF.

Field assessments are conducted on the scallops every three weeks. Researchers monitor the scallops' growth, reproductive development, and survival rates, as well as conduct genetic testing and monitor the animals for disease. The success of the program will be determined when the scallops spawn and larvae are found in the restocking areas.

To date, about 35,000 scallops have been placed in the restocking sites. The process of gathering broodstock, raising them, and placing them in cages will be repeated every year for the duration of the program. The ultimate goal of this project is to both reestablish scallops for recreational harvesters and build populations that can support commercial harvest.

Harvest of bay scallops for commercial sale is illegal in Florida. Recreational harvest for personal consumption is allowed only north of the Suwannee River and only between July 1 and September 10 of each year. Each person is allowed 2 gallons of whole scallops, or the equivalent of 1 pint of shucked meat, per day. The limit for each boat is 10 gallons of whole scallops or ½ gallon of meat per day, but the individual limit applies when fewer than five people occupy the boat. A saltwater fishing license is required if using a mask and snorkel or if fishing from a boat. Scallop harvesting is very popular in the Steinhatchee vicinity, St. Joseph Bay, and areas around St. Marks and St. Andrews Bay.

To view current state of Florida regulations on harvesting bay scallops, visit the Florida Administrative Code (FAC) Web site, Chapter 68—FISH AND WILDLIFE CONSERVATION COMMISSION located at: http://fac.dos.state.fl.us/

Attachment B: Fish/Scallop Protocol

Exposure Investigation Protocol for
St. Joe Bay Fish and Bay Scallop Collection for PCB/Dioxin Testing
Gulf County, St. Joe, Florida
March 8, 2006

Prepared by

Susan Ann Skye, Florida DOH

Connie Garrett, Florida DOH

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I. PROJECT OVERVIEW

A. Summary

To protect the health of area seafood consumers, the Florida Department of Health (DOH) will coordinate testing of St. Joe Bay fish and bay scallops for persistent organic pollutants. Fish and bay scallops may have accumulated enough persistent organic pollutants from St. Joe Bay sediments to cause illness in consumers. Previous tests of St. Joe Bay fish were inadequate to determine the health risk to consumers: a particular species was not collected, too few individual fish were collected, or the laboratory analysis did not meet current standards.

The Florida DOH will coordinate fish and bay scallop collection with the Florida Fish and Wildlife Conservation Commission (FFWCC). They will collect sheepshead, redfish, spotted sea trout, hardhead catfish, flounder, and bay scallops from the eastern part of St. Joe Bay near the Bay County Canal and the Port St. Joe Marina. In order to collect the largest and oldest species, FFWCC will collect fish in March 2006 and bay scallops in June2006. These species are eaten by nearby residents, visitors, or harvested commercially. All fish and bay scallops will be analyzed for dioxin/furans toxicity equivalents (TEQs) and polychlorinated biphenyls (PCBs).

B. Investigators and collaborators

Susan Skye, Florida DOH – Exposure Investigator (EI) Coordinator for this project; oversees project from beginning until end; evaluate data; write EI evaluating results

Connie Garrett, Florida DOH – Public Health Assessor; technical assistance

Randy Merchant, Florida DOH – Principle Investigator (PI); proofing documents; technical assistance

Lu Grimm, Florida DOH – Community involvement (press release, newsletters, public meetings)

Joe Sekerke – Florida DOH – toxicologist; technical assistance

Joe OHop – FFWCC – Assisting Ms. Skye with overseeing fish and bay scallop collection and preparation from Dec 2005-June 2006

Fishing crew – A team of four staff members with the Fisheries Independent Monitoring (FIM) subsection of the (FFWCC) Fish and Wildlife Research Institute (FWRI) from the Apalachicola field lab will collect fish and bay scallops. One or two additional staff from St. Petersburg's FFWCC office may also assist.

FIM will provide staff, vehicles, vessels, fuel, fish measurements and weights. They will also help pack and ship samples to the lab for analysis.

II. INTRODUCTION

A. Background

St. Joe Bay Industries Produced/Discharged Persistent Organic Pollutants

Discharge from a paper mill and other industries have contributed to persistent organic pollutants in St. Joe Bay sediments. The St. Joe Paper Company and Florida Coast Paper operated a paper mill on St. Joe Bay between 1938 and 1998[(1)]. From 1938 to 1974, the paper mill discharged 25–30 million gallons of wastewater per day[(1)] into an unlined surface impoundment on the northern part of the site (Figure 1). Dioxins and PCBs can be byproducts of pulp and paper manufacturing. Dioxins and PCBs were all found in impoundment sludge that had settled from mill wastewater [(2)]. Although the impoundment was designed as an infiltration basin, the mill periodically emptied wastewater overflow via a ditch into St. Joe Bay. This resulted in a visible area of discharge (Figure 1). By 1960, an 11-foot-thick layer of soft plant wastes and organic material existed along the bottom of St. Joe Bay near the paper mill[(3)]. After 1974, the City of Port St. Joe treated paper mill waste at their wastewater treatment plant before discharging into a canal leading to St. Joe Bay.

Dioxins are byproducts of pulp and paper manufacturing[(2, 4, and 5)]. A 1988 study of five paper mills (including St. Joe Paper) found that bleaching pulp with chlorine and hypochlorite produced dioxins and furans[(6)]. From 1966 to 1974, the St. Joe paper mill plant bleached up to 23% of their daily pulp production[(1)].

In the 1950s and 1960s, the St. Joe Paper Mill used PCBs to manufacture carbonless copy paper[(7, 8)]. When the paper mill was dismantled, PCBs contaminated soil from six locations was discovered and removed; leaks from PCB-containing transformers are likely sources. Storm water runoff likely carried PCB contaminated soil into the St. Joe Bay.

Persistent Organic Pollutants Accumulated in St. Joe Bay Sediments

We selected contaminants to test in fish and shellfish based on their persistence in the environment, their toxicity, and their ability to bioaccumulate in fish and shellfish.

Dioxins and PCBs are persistent organic pollutants: chemicals that resist biological and chemical degradation [(9)] and accumulate in sediments. U.S. Fish and Wildlife Service (FWS) staff have measured dioxins and PCBs in St. Joe Bay sediments [(10, 18)]. They analyzed sediment samples in water 20 feet deep. Levels of dioxins and furans (TEQs) in St. Joe Bay sediments ranged from 2.9 to 10.9 parts per trillion (average 8 ppt). The US FWS estimates dioxin contamination in approximately 20,000 acres of St. Joe Bay bottom sediments.

Dioxins accumulate in aquatic sediments[11] and may have a half-life of over 50 years[12]. This means it may take 50 years for dioxins in sediments to fall to half their original concentration.

PCB mixtures can persist in the environment for many years[11, 13]. A particular kind of PCB with high chlorine content—Arochlor-1260‡ (60% chlorine)—was identified in the former wastewater impoundment sediments. High-chlorine PCBs are extremely resistant to biodegradation and degradation by oxidation and hydrolysis[11]. Although higher percentage-chlorinated congeners are susceptible to reductive dechlorination by anaerobic microorganisms, these processes occur very slowly[11]. High-chlorine PCBs accumulate and persist in sediments, especially sediments with high organic content[11].

<u>Persistent Organic Pollutants Bioaccumulate in Fish and Scallops</u>

Because dioxins and PCBs persist in the environment and are highly fat soluble, they tend to bioaccumulate at high concentrations in animals [9, 17].

PCBs bioaccumulate at significant levels in aquatic organisms[11]. Bioaccumulation through the food chain tends to concentrate higher chlorine content PCBs, resulting in PCB mixtures considerably different and more toxic than the original[13]. As a result, the PCB mixture in fish and people may not resemble the original PCB mixture[13]. People who rely on PCB-contaminated fish for a significant portion of their diet are at increased risk of PCB exposure[13].

<u>St. Joe Bay Fish Eaten Locally</u>

St. Joe Bay near the Bay County Canal and the Port St. Joe Marina are popular fishing spots [14, 15 and 16]. Nearby residents and visitors catch and eat sheepshead, redfish, spotted sea trout, hardhead catfish, and flounder. The following text and pictures are found at:

http://www.floridasportsman.com/features/panhandle_highway_98/

"Our virtual journey begins in the small town of Port St. Joe. Once largely dependant upon a local paper mill, this coastal village is beginning to re-invent itself as an eco-tourism economy.

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‡ Although environmental mixtures are often characterized in terms of Arochlors, this can be both imprecise and inappropriate. Qualitative and quantitative errors can arise from judgments in interpreting gas chromatography/mass spectrometry, which reveals a spectrum of peaks that are compared with characteristic patterns for different Arochlors. For environmentally altered mixtures, an absence of these characteristic patterns can suggest the absence of Arochlors, even though some congeners are present in high concentrations. Large differences have been found in results reported by laboratories analyzing the same sediment samples[13].

Claude Reeves shows off a pair of sea trout taken under the George G. Tapper Bridge over the Gulf County Canal in Port St. Joe.

The next stop is less than a mile to the north under the George G. Tapper Bridge over the Gulf County Canal. Follow the paved road under the north side of the bridge, and then turn onto a sandy road leading back under the bridge to the mouth of the canal. The canal connects St. Joe Bay to the Intracoastal Waterway five miles inland. During the colder months fish from the bay (mostly flounder, speckled trout and redfish) move into the deeper, warmer waters of the canal. During the summer the mouth of the canal is popular for sea trout, bluefish and Spanish mackerel. Live bait anglers typically fish in the deeper part of the canal, letting their bait drift slowly with the tidal current. The flats just north of the canal entrance are good for wading and casting plastic grubs or live shrimp."

"The Gulf County Canal connects St. Joe Bay to the Intracoastal Waterway.

The Low Docks in Port St. Joe

One popular local fishing hole is the Low Docks, located at the end of First Street in the middle of the small downtown district. Drive past the Port St. Joe Marina and the road will end on a small spit of land. This spot was once used for loading paper mill products, but is now only used for fishing. Almost year-round, the deep, clear water next to the long seawall holds a collection of sea bass, sheepshead, mangrove snapper and flounder."

Bay Scallops Harvested

Bay scallops occur in discrete populations scattered along the coast of Florida. In prehistoric times, scallops could be found from West Palm Beach to Pensacola, but in recent decades, that range has contracted considerably. Now, dense aggregations of bay scallops are found only in the area between Tarpon Springs and Port St. Joe [19].

The results of ongoing scallop population monitoring reveal three characteristics of a healthy scallop population: 1) density > 25 scallops per 600-m^2 survey transect, 2) a broad distribution of scallops within the survey area, and 3) a rapid rebuilding of the population following a collapse. Applying those criteria, only two sites in Florida, Steinhatchee and St. Joe Bay, supported healthy scallop populations through 1999 [19].

Each June, before scallop season opens, Florida Marine Research Institute (FMRI) staff members conduct annual adult-population surveys of bay scallop populations in Pine Island Sound, Anclote estuary, Hernando, Homosassa, Cedar Keys, Steinhatchee, St. Joe Bay, and St. Andrew Bay. Each September, after the season has closed adult-population surveys are conducted in Anclote, Homosassa, Steinhatchee, and St Joe Bay [20].

Results of the surveys showed that scallop abundance in St. Joe Bay was very low during 2000 and again during 2001, but it is still increasing relative to past levels and is within the 5–25 animals/600 m^2 abundance index. The survey also showed that scallops are extremely rare west of St. Joe Bay, and since that area remains open to fishing, those few available scallops are subject to intense harvest pressure [20].

Previous Testing Inadequate

Previous testing of St. Joe Bay fish was inadequate to determine whether there are elevated levels of contaminants that could result in health risk to consumers: a particular species was not collected, too few individual fish were collected, or the laboratory analysis did not meet current standards. Previously, bay scallops were not collected at all.

- Only limited information on the levels of dioxins and furans in St. Joe Bay fish is available. Fish testing for dioxins and furans in the early and mid 1990 did not meet current standards. Dioxin testing did not include all of the dioxins necessary to compare to standards adopted by EPA in 2002. Fish have not been tested at all for PCBs [1, 2 3, and 18].

- Of two previous studies of St. Joe Bay fish, one analyzed only the fish muscle without the skin[10] and the other did not specify the preparation method[3]. Dioxins and PCBs accumulate in fish skin fat. Many people, however, prepare and eat fish with the skin on.

- Scallops have not been collected previously or tested for dioxins or PCBs.

B. Justification for the exposure investigation

Nearby residents, visitors and commercial fishermen fish and eat fish/shellfish from St. Joe Bay. To protect the health of area seafood consumers, the Florida Department of Health (DOH) will coordinate testing of St. Joe Bay fish and bay scallops for persistent organic pollutants. Fish and bay scallops may have accumulated enough persistent organic pollutants from St. Joe Bay sediments to cause illness in consumers.

C. Objectives

- Collect fish and bay scallops from St. Joe Bay and determine if levels of dioxins or PCBs found in the samples warrant a fish or shellfish advisory.

- Issue a fish or shellfish consumption advisory and press release to notify nearby seafood consumers if necessary.

II. METHODS

A. Exposure investigation design

Details of the exposure investigation design are covered below under the sampling collection section.

B. Exposure investigation population

The target population includes recreational and commercial fishermen from Gulf County as well as surrounding counties including Franklin, Bay, Liberty, Wakulla, Leon and Escambia. Also included in this population are out-of-state fishermen.

Recreational Fishermen
There are many recreational fishermen in this area of the state. There is a mixture of offshore and inshore fishing. Some fish from charter boats, some use inshore fishing guides. Others fish from the shore and piers or bring their boats. Overall, out-of-state fishermen are a majority of the charter and guide fishing anglers. About 2/3 of the charter and guide fishing anglers FFWCC interviews are from out-of-state on the Gulf Coast of Florida). Typically, Florida residents comprise the majority of shore and private/rental boat anglers, but out-of-state anglers particularly from Georgia and Alabama also fish from shore and recreational boats in the Florida Panhandle. This is also true during scallop season.

Commercial Fishermen

Local and out-of-state fishermen land and sell fish in the Florida panhandle.

C. Fieldwork coordination

All fieldwork will be coordinated by Susan Skye, Florida DOH and Joe Ohop, FFWCC. Fieldwork will include four travel days to and from the bay, collection and shipment of samples.

D. Sampling location and species selection

1) Sampling Location

The target sampling area is St. Joe Bay, within one or two miles of the Bay County Canal and the Port St. Joe Marina.

2) Fish Species Selection

All sampled fish species will be representative of those caught for human consumption. Sheepshead, redfish, flounder, sand and spotted sea trout, and hardhead catfish are known to live year round in St. Joe Bay [21] and caught/eaten by nearby residents.

Table 1. Priority for Fish/Shellfish Species Collection

Predator	**Bottom-Feeders**
sheepshead (*Archosargus probatocephalus*)	hardhead catfish (*Ariopsis felis)*
redfish (*Sciaenops ocellata*)	flounder (*Paralichthys albigutta*)
spotted sea trout (*Cynoscion nebulosus)*	

Please go to http://floridafisheries.com/Fishes/index.html for detailed fish information and identification [22].

E. Sampling timeframe

Fish will be collect in mid-March and scallops will be collected in June.

Fish

FFWCC will assist the Florida DOH collecting fish over a 3 day period in mid-March. If flounder are not readily available during this time frame, FFWCC will plan a one day trip in the summer to collect this species. FFWCC will be compensated for hours worked during this time frame.

In the winter months, flounder, speckled trout, and redfish move from the Bay into the deeper and warmer Gulf County canal. Therefore, these fish should be collected from the canal in the winter and the Bay during the summer.

Scallops

FFWCC will assist the Florida DOH collecting scallops one day in June. Flounder may also be collected at this time if they are not readily available during the March sampling time frame. FFWCC will be compensated for hours worked during this time frame.

F. Sampling collection

Note: Field staff will check with Florida DOH before making any in-field changes to the fish and bay scallop collection plan.

Fish

FFWCC biologists will collect 12 individual fish of each of 5 species (sheepshead, spotted seatrout, red drum, hardhead catfish, gulf and/or southern flounder) from areas of St. Joe Bay within one or two miles of near the Gulf County Canal. The area closest to the canal is the most contaminated. If fish species are territorial and stay within one mile, they will be collected as close to the canal and marina as possible. For those fish that are more mobile, the collection distance may range out to 2 miles of the canal and marina. FFWCC will collect fish by deploying a 600' seine up to 4 times each day. Several hours of hook and line fishing each day by staff will also be used if needed. Fish collected will be of size legal for retention by recreational anglers. If FFWCC is unable to collect 12 fish of the same species, or too few of a species or individuals which are too small per sampling protocols, different species (e.g., sea bass or mangrove snapper) may be substituted. Both predator and bottom feeders will be collected. An additional sampling trip in June, in coordination with the DOH, may be needed to fulfill the sampling requirements to include all necessary fish.

Twelve oldest fish of the same size and species, that will allow a composite sample of 200 grams, should be collected from predator and bottom-feeding finfish. For each species, the fish should be the same size and length for a representative sample. Sample composites should include at least 12 fish of the same age (which usually correlates with length), same genus/species, and the largest legal-size fish available. Health Advisories issued by the Florida DOH usually require 12 fish from a single water body, for statistical validity [(23)].

Scallops

The bay scallop (Argopecten irradians) is a widely-exploited and mobile species associated with St. Joe Bay.

FFWCC staff will collect 3 separate composites of bay scallops from 3 different areas of the bay within the sampling area. FFWCC will collect the largest and oldest bay scallops for analysis. FFWCC biologists will collect the bay scallops (largest size available) from shallow grass flats in St. Joe Bay near the Gulf County Canal using dive gear (SCUBA and/or snorkel). FFWCC will follow FWRI dive protocols for coldwater (below 70º F) diving. Bay scallops have a relatively short life cycle (18 months or less) and are relatively fast-growing. The open season for bay scallops occurs from July 1-September 10 and will not be legal for retention by recreational divers during the sampling period. Therefore, the FFWCC will do a separate collection for scallops in June (before the season starts) when the scallops are larger and represent the size scallops people eat. If the bay scallops were collected during March at the same time of fish collection, they would be smaller than those typically collected by recreational divers during the open season.

If the quest for 12 fish or scallops initially has low yields, then a collection time of two 3-hour periods in a one day timeframe will be considered the maximum time to demonstrate diligence in that sampling effort. If this effort exhausts the possibility of collecting 12 fish of each species or three composites of 12 scallops, FFWCC will consult with DOH to document those efforts.

Susan Skye will be in the field with the FFWCC staff to supervise and confirm the correct amount and size of fish and scallops collected.

G. Preparation and shipment of samples

After collection, all fish and bay scallops will be individually weighed and measured. Total length will be measured from the anterior-most part of the fish across its mid-line to the tip of the caudal fin (tail) with the tail compressed to its maximum length waters. In addition, sheepshead and hardhead catfish will be measured in fork length. There is a 12" minimum size on sheepshead, and the regulations state that this species is "measured from the most forward point of the head to the rear center edge of the tail" (i.e., a fork length). There are currently no minimum size regulations on hardhead catfish.

This information will be logged on a field collection record, and each fish or bay scallop will be inventoried on a Chain-of-Custody record with unique sample identification, collection location including GPS, and collection date. Collection location, species measurements and Chain-of- Custody records will be included in the final report.

All fish and bay scallop composites should contain the same number of fish and bay scallops to allow numerically unbiased data comparisons, where possible. The composites will be divided by species, collected from the same area of the water body and represent the oldest (largest) subpopulation of a single species. The collected oldest fish in each composite should be approximately the same size and length. The results will be used to determine and verify previous results and assess the magnitude of tissue contamination. One composite sample for each target species will be analyzed. The analytical laboratory should maintain archived composites for reanalysis until DOH determines they are no longer needed.

Clean sampling methodologies are paramount to the collection process to insure that no contamination of samples occurs during collection, transport, and processing. All surfaces used to weigh fish and clams will be covered with new aluminum foil (shiny side out). Sample nets will be pre-cleaned and kept near the front of the boat away from the motor and any exhaust gases. Fish should be collected and wrapped whole in pre-cleaned aluminum foil (shiny side out), then butcher wrapping paper in an envelope format to prevent leakage, sealed in a waterproof plastic bag, placed on ice in pre-cleaned coolers, bound using duct or strapping tape, and shipped via overnight courier service using appropriate Chain-of-Custody forms.

For additional guidance, refer to EPA's, Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Volume 1, Fish Sampling and Analysis, Third Edition. EPA 823-B-00-007, November 2000.

H. Laboratory Processing and Analysis

1) Lab Sample Processing

Fish

Fish will be dissected and filleted with skins on for a representative sample of what people eat. Analytical samples should consist of a composite of edible tissue (fillets). Scales will be removed prior to filleting and skin left intact. After filleting, individual fish fillets will be homogenized into uniform subsamples. Approximately equal portions from each individual subsample should be used to make up the composite sample. The composite sample will then be homogenized to form a uniform composite sample of which twenty-five grams solvent extracted for analysis.

Scallops

To preserve the juices, scallop shells will be removed in the lab, not in the field. After shelling, individual scallop muscle should be homogenized into uniform subsamples. Approximately equal portions from each individual subsample should be used to make up the composite sample. The composite sample should then be homogenized to form a uniform composite sample of which twenty-five grams solvent extracted for analysis.

2) Lab Analysis

Dioxins

All fish and bay scallops collected from St. Joe Bay will be tested for 17 chloro-p-dibenzodioxins/furans. These dioxins are listed in Table 2. The toxic equivalency factors

(TEF) for these congeners represent the most recent toxicological information for this chemical. Dioxin analyses should be performed using EPA method 1613B. Results will be reported as wet weight in parts per trillion (ppt).

Table 2. Dioxin Congeners and Relevant Toxicity Equivalency Factors (TEF)

Congener	TEF	Congener	TEF
2,3,7,8-TCDD	1.0	2,3,7,8-TCDF	0.10
1,2,3,7,8-PeCDD	1.0	1,2,3,7,8-PeCDF	0.05
		2,3,4,7,8-PeCDF	0.50
1,2,3,4,7,8-HxCDD	0.10	1,2,3,4,7,8-HxCDF	0.10
1,2,3,7,8,9-HxCDD	0.10	1,2,3,7,8,9-HxCDF	0.10
1,2,3,6,7,8-HxCDD	0.10	1,2,3,6,7,8-HxCDF	0.10
		2,3,4,6,7,8-HxCDF	0.10
1,2,3,4,6,7,8-HpCDD	0.01	1,2,3,4,6,7,8-HpCDF	0.01
		1,2,3,4,7,8,9-HpCDF	0.01
1,2,3,4,6,7,8,9-OcDD	0.0001	1,2,3,4,6,7,8,9-OcDF	0.0001

Source: EPA, Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories: Vol. 1, Fish Sampling and Analysis, Third Edition. EPA 823-B-00-007, November 2000.

PCBs

A dozen PCBs are now considered by many toxicologists to be "dioxin-like" because of their toxicity and certain features of their structure which make them similar to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2378-TCDD). These 12 PCBS are the W.H.O. (World Health Organization) Coplanar PCBs: # 77, #81, #105, #114, #118, #123, #126, #156, #157, #167, #169 and #189 [(24)].

All fish and scallops collected from St. Joe Bay will be tested for all 209 PCB congeners (including the 12 World Health Organization coplanar PCBs) because the lab cost is the same for all 209 congeners as it is for just the twelve congeners. The lab will analyze for PCBs using EPA Method 1668A. Results will be reported as wet weight in parts per trillion (ppt). The TEFs for the WHO PCBs are included in Table 3.

In addition, DOH will request that the lab analyzing the fish and scallops for PCBs including arochlors using method SW8082. The lab will use the total area integration method when analyzing for arochlors.

Table 3. PCB Congeners and Relevant Toxicity Equivalency Factors (TEF)

Congener	TEF	Congener	TEF
PCB77	0.0001	PCB169	0.01
PCB81	0.0001	PCB189	0.0001
PCB105	0.0001		

PCB114	0.0005		
PCB118	0.0001		
PCB123	0.0001		
PCB126	0.1		
PCB156	0.0005		
PCB157	0.0005		
PCB167	0.00001		

http://www.epa.gov/toxteam/pcbid/tefs[(24)]

3) Lab Reports

The final report should include copies of all sample handling and processing data sheets including field data sheets, Chain-of-Custody receipts, and laboratory processing sheets. It should also include results of all analytical quality assurance results including analysis of duplicates, standard reference materials, matrix spike samples, and laboratory blanks. Any deviations from laboratory data quality objectives should be indicated.

I. Evaluation of Data

For dioxins and PCBs, DOH will use the TEFs in Tables 2 and 3 to calculate a Total Equivalent (TEQ) for each composite fish or scallop sample. For dioxins, TEQs will be compared to DOH's standard to determine if a fish/shellfish consumption advisory is necessary. DOH's dioxin standard is 7.0 parts per trillion (ppt). Because DOH currently does not have a state standard for PCBs, DOH will calculate a dose for both children and adults using the levels found in each species of fish and scallops and compare the oral MRL for Arochlor 1254 to the calculated dose. (See Appendix A - http://www.atsdr.cdc.gov/toxprofiles/tp17.html).

J. Quality assurance

The lab will perform one equipment blank and a matrix sample for each species. They will follow their approved QAPP.

IV. BENEFITS TO SURROUNDING COMMUNITIES & COMMERCIAL FISHERMEN

The EI Coordinator will review the fish and bay scallop data and determine if levels are above a health-based standard and a fish/shellfish consumption advisory is necessary. She will consult with DOH's toxicologist and ASTDR's toxicologist. Benefits of this investigation include community awareness of the presence or lack of contaminants in fish or bay scallops, increase of knowledge, and being informed to weigh the about potential health risks associated with eating fish or bay scallops from St. Joe Bay versus the health benefits of eating fish and bay scallops.

V. NOTIFYING COMMUNITY & COMMERCIAL FISHERMEN OF RESULTS

Within three weeks of reviewing and evaluating the fish/shellfish data the Florida DOH will inform the community, out-of-state fishermen and commercial fishermen of their findings. If warranted, the Florida DOH will issue a press release announcing a fish/scallop advisory or consumption limitations for certain fish/scallop. The Florida DOH may distribute a newsletter to nearby communities to expand this announcement or distribute a press release.

VI. OVERALL PROJECT ESTIMATED TIMEFRAME

March 2006 - FFWCC will collect fish from St. Joe Bay. If not enough flounder are collected, they will be collected during the June scallop sampling event.

March 2006 – DOH will compensate FFWCC for collection efforts via a purchase order.

May 2006 – DOH will receive the fish laboratory results.

June 2006 – DOH will review laboratory results and issue fish advisory if necessary. FFWCC will collect scallops from St. Joe Bay and flounder if none collected in March.

July 2006 – DOH will receive the scallop laboratory results and review the laboratory results within two weeks. DOH will issue a scallop advisory if warranted.

Late summer/fall 2006 – ATSDR will publish final EI report.

VII. PROJECTED BUDGET AND SOURCE OF FUNDING

For the fish analyses, the Florida DOH will use existing ATSDR cooperative agreement funds by March 31, 2006. For the scallop analyses (and possibly the flounder analyses) in June 2006, the Florida DOH will use existing ATSDR cooperative agreement funds from fiscal year 2006/2007.

Fieldwork

$4000 for 4 trips to St. Joe Bay ($1000 per trip – 3 trips for fish collection in March; 1 trip for scallop/possible flounder collection in June).

This cost includes a FFWCC four man crew for four consecutive days (for each trip, boat, 600’ seine, fuel costs and crew time are included).

Lab Analyses

Costs estimates are based on eleven composite samples (three composite scallop samples and five composite fish samples). The fish and bay scallops will be analyzed for dioxin/furans and PCBs.

Laboratory sample preparation	$150-$300/sample
Laboratory dioxin/furan analysis	$1,000-$1,500/sample
Laboratory PCB analysis	$250-$350/sample

Laboratory sample preparation: 8 composite samples X $150-$300/sample = $1,200-2,400
Dioxin & PCB analysis: 8 composite samples X $1,250-$1,850/sample = $10,000-14,800
Total laboratory preparation and analysis = $11,200-17,200

Note: QA costs for the equipment blank and matrix samples are usually included in the total lab costs. If not, the total may increase by $5000.

The following laboratories test for dioxins and PCBs in fish and bay scallops will be contacted for quotes for this project:

Battelle Laboratory
Karen Tracey (614-424-4028) - Columbus, Ohio
Eric Crecilius (360) 681-3604 – Sequim, WA
Texas A&M Laboratory - Terry Wade 979-862-2323 ext 134 - College Station, TX
DataChem Laboratory – Paul Pope – 1-800-356-9135 ext 381 - Salt Lake City, UT
Severn Trent Laboratory - Miami or Tallahassee
PBS&J Laboratory - Orlando

VIII. REFERENCES

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2. Professional Service Industries, Inc., 2004. Brownfield site assessment report for former wastewater impoundment, Port St. Joe paper mill, Port St. Joe, Gulf Co., FL, Brownfield site ID# BF230201001. Oakbrook Terrace, Illinois: Professional Service Industries, Inc.
3. Hamilton, S. 2001. Letter from Steve Hamilton to Jim McCarthy, Florida Department of Environmental Protection, regarding Stone Container Corp. production data, dioxin data, and groundwater information. Tucker, Georgia. February 16, 2001.
4. EPA Sector Notebook – Pulp and Paper Industry. September 1995. EPA Office of Compliance Sector Notebook. EPA/310-R-95-015. Page 128 lists the supporting documents for the integrated rulemaking: the 1987 EPA "**National Dioxin Study**" which unexpectedly found elevated levels of dioxin in fish tissues downstream from

57% of the pulp and paper mill sites sampled. Further investigations. The **"Five Mill Study"** and the **"104 Mill Study"** confirmed the presence of dioxin in wastewater, wastewater treatment sludge, and pulp from these mills. The **"National Study of Chemical Residues in Fish"** confirmed the pulp and paper mills were the dominant source of dioxins and furans in fish tissue.

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Attachment C: Field Fish/Scallop Photos

Scallops Composite #1 – August 2006

Scallops Composite #2 – August 2006

Gulf Flounder Collected (not all selected for analyses)

Some of the Fishing/Scallop Crew August 2006

St. Joe Bay

Attachment D: Dose Calculations

St. Joe Fish 2006 Dose Calculations

Dioxins

Highest dioxins found in fish/scallops collected – scallops – 0.212 ppt = 2.1×10^{-7} ppm (mg/kg)

Assuming an adult eating 30 grams of fish per day and a child eating 15 grams per day

Acute MRL - 2.0×10^{-7} mg/kg/day
Interm MRL - 2.0×10^{-8} mg/kg/day
Chronic MRL – 1.0×10^{-9} mg/kg/day
CEL – 1.2×10^{-6} mg/kg/day

Adult

$$\text{Dose (mg/kg/day)} = \frac{\text{(kg fish per day)(conc in fish)}}{\text{body weight}}$$

$$= \frac{\text{(0.03 kg fish/day)(0.0000002 mg/kg)}}{\text{70 kg}}$$

$$= 8.57 \times 10^{-11} \text{ mg/kg/day dioxins}$$

2500x less than acute MRL
250x less than inter MRL
12.5x less than chronic MRL

Child

$$\text{Dose (mg/kg/day)} = \frac{\text{(0.015 kg fish/day)(0.0000002 mg/kg)}}{\text{35 kg}}$$

$$= 8.57 \times 10^{-11} \text{ mg/kg/day dioxins}$$

PCBs

Total of 12 dioxin like PCBs (usual way to total dioxins) – highest was 0.2279 ppt in redfish
Assuming an adult eating 30 grams of fish per day and a child eating 15 grams per day:

Interm MRL – 3.0×10^{-5} mg/kg/day
Chronic MRL - 2.0×10^{-5} mg/kg/day
CEL – 1 mg/kg/day

Adult

$$\text{Dose (mg/kg/day)} = \frac{\text{(kg fish per day)(conc in fish)}}{\text{body weight}}$$

$$\text{PCBs} = \frac{\text{(0.03 kg fish per day)(2.3x10-7 mg/kg in fish)}}{\text{70 kg}} = 9.86 \times 10^{-11} \text{ mg/kg/day}$$

Child

$$\text{Dose (mg/kg/day) PCBs} = \frac{\text{(0.015 kg fish per day)(2.3x10-7 mg/kg in fish)}}{\text{35 kg}} = 9.86 \times 10^{-11} \text{ mg/kg/day}$$

Attachment E: 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.

Attachment F: PCB Information

PCBs: General Information

PCBs are a group of synthetic organic chemicals that can cause a number of different harmful effects. There are no known natural sources of PCBs in the environment. PCBs are either oily liquids or solids and are colorless to light yellow. Some PCBs are volatile and may exist as a vapor in air. They have no known smell or taste. PCBs enter the environment as mixtures containing a variety of individual chlorinated biphenyl components, known as congeners, as well as impurities. Because the health effects of environmental mixtures of PCBs are difficult to evaluate, most of the information in this toxicological profile is about seven types of PCB mixtures that were commercially produced. These seven kinds of PCB mixtures include 35% of all the PCBs commercially produced and 98% of PCBs sold in the United States since 1970. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor. For example, the name Aroclor 1254 means that the mixture contains approximately 54% chlorine by weight, as indicated by the second two digits in the name. Because they don't burn easily and are good insulating materials, PCBs were used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in August 1977 because there was evidence that PCBs build up in the environment and may cause harmful effects. Consumer products that may contain PCBs include old fluorescent lighting fixtures, electrical devices or appliances containing PCB capacitors made before PCB use was stopped, old microscope oil, and old hydraulic oil.

Before 1977, PCBs entered the air, water, and soil during their manufacture and use in the United States. Wastes that contained PCBs were generated at that time, and these wastes were often placed in landfills. PCBs also entered the environment from accidental spills and leaks during the transport of the chemicals, or from leaks or fires in transformers, capacitors, or other products containing PCBs. Today, PCBs can still be released into the environment from poorly maintained hazardous waste sites that contain PCBs; illegal or improper dumping of PCB wastes, such as old transformer fluids; leaks or releases from electrical transformers containing PCBs; and disposal of PCB-containing consumer products into municipal or other landfills not designed to handle hazardous waste. PCBs may be released into the environment by the burning of some wastes in municipal and industrial incinerators.

Once in the environment, PCBs do not readily break down and therefore may remain for very long periods of time. They can easily cycle between air, water, and soil. For example, PCBs can enter the air by evaporation from both soil and water. In air, PCBs can be carried long distances and have been found in snow and sea water in areas far away from where they were released into the environment, such as in the arctic. As a consequence, PCBs are found all over the world. In general, the lighter the type of PCBs, the further they may be transported from the source of contamination. PCBs are present as solid particles or as a vapor in the atmosphere. They will eventually return to land and water by settling as dust or in rain and snow. In water, PCBs may be transported by currents, attach to bottom sediment or particles in the water, and evaporate into air. Heavy kinds of PCBs are more likely to settle into sediments while lighter PCBs are more likely to evaporate to air. Sediments that contain PCBs can also release the PCBs into the surrounding water. PCBs stick strongly to soil and will not usually be carried deep into the soil with rainwater. They do not readily break down in soil and may stay in the soil for months or years; generally, the more chlorine atoms that the PCBs contain, the more slowly they break down. Evaporation appears to be an important way by which the lighter PCBs leave soil. As a gas, PCBs can accumulate in the leaves and above-ground parts of plants and food crops.

PCBs are taken up into the bodies of small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs especially accumulate in fish and marine mammals (such as seals and whales) reaching levels that may be many thousands of times higher than in water. PCB levels are highest in animals high up in the food chain.

Although PCBs are no longer made in the United States, people can still be exposed to them. Many older transformers and capacitors may still contain PCBs, and this equipment can be used for 30 years or more. Old fluorescent lighting fixtures and old electrical devices and appliances, such as television sets and refrigerators, therefore may contain PCBs if they were made before PCB use was stopped. When these electric devices get hot during operation, small amounts of PCBs may get into the air and raise the level of PCBs in indoor air. Because devices that contain PCBs can leak with age, they could also be a source of skin exposure to PCBs.

Small amounts of PCBs can be found in almost all outdoor and indoor air, soil, sediments, surface water, and animals. However, PCB levels have generally decreased since PCB production stopped in 1977. People are exposed to PCBs primarily from contaminated food and breathing contaminated air. The major dietary sources of PCBs are fish (especially sportfish that were caught in contaminated lakes or rivers), meat, and dairy products. Between 1978 and 1991, the estimated daily intake of PCBs in adults from dietary sources declined from about 1.9 nanograms (a nanogram is a billionth part of a gram) to less than 0.7 nanograms. PCB levels in sportfish are still high enough so that eating PCB-contaminated fish may be an important source of exposure for some people. Recent studies on fish indicate maximum concentrations of PCBs are a few parts of PCBs in a million parts (ppm) of fish, with higher levels found in bottom-feeders such as carp. Meat and dairy products are other important sources of PCBs in food, with PCB levels in meat and dairy products usually ranging from less than 1 part in a billion parts (ppb) of food to a few ppb.

Concentrations of PCBs in subsurface soil at a Superfund site have been as high as 750 ppm. People who live near hazardous waste sites may be exposed to PCBs by consuming PCB-contaminated sportfish and game animals, by breathing PCBs in air, or by drinking PCB-contaminated well water. Adults and children may come into contact with PCBs when swimming in contaminated water and by accidentally swallowing water during swimming. However, both of these exposures are far less serious than exposures from ingesting PCB-contaminated food (particularly sportfish and wildlife) or from breathing PCB-contaminated air.

Attachment G: ATSDR Glossary of Environmental Health Terms

This glossary defines words used by the Agency for Toxic Substances and Disease Registry (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,
1-888-422-8737.

Absorption
The process of taking in. For a person or an 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].

The Agency for Toxic Substances and Disease Registry (ATSDR)

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. ATSDR's mission 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.

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.

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

CAP [see Community Assistance Panel.]

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

Cancer risk
A theoretical risk 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.

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 [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. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

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 an 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.

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 [see Public health surveillance].

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.

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

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 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 evaluate the possible association between the occurrence and exposure to hazardous substances.

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].

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.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

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]

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.

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 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 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.

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 conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each 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 health 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.

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.

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

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
The 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 an environment.

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.

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.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (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 public health 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 that, 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, and methylene chloride.

CERTIFICATION

The Florida Department of Health, Bureau of Community Environmental Health prepared this Exposure Investigation under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It followed approved methodology and procedures existing at the time it began. The Cooperative Agreement Partner completed editorial review.

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

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