ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA
EPA FACILITY ID: FL9170024567
MARCH 14, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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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PUBLIC HEALTH ASSESSMENT

NAVAL AIR STATION PENSACOLA

PENSACOLA, FLORIDA

EPA FACILITY ID: FL9170024567

Prepared by:

Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

Foreword

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. Congress established this agency in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund law. This law set up a fund to identify and clean up our country's hazardous waste areas. The U.S. Environmental Protection Agency (EPA) and the individual states regulate the investigation and clean up of the areas.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the areas on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at an area, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data. Instead, it reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic, and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and occasionally scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by an area. In its public health action plan, the report recommends ways to stop or reduce exposure. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory to warn people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies, or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the area and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near an area, including residents of the area, civic leaders, health professionals, and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for comment. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us. Letters should be addressed as follows:

Attention: Aaron Borrelli
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List of Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
BEQ	benzo(a)pyrene equivalent
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDC	Centers for Disease Control and Prevention
CEL	cancer effect level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CREG	cancer risk evaluation guide (ATSDR)
CSF	cancer slope factor
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DHHS	U.S. Department of Health and Human Services
EMEG	environmental media evaluation guide (ATSDR)
EPA	U.S. Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FS	Feasibility Study
HAZMART	Hazardous Material Control Center
IARC	International Agency for Research on Cancer
IRP	Installation Restoration Program
IWTP	Industrial Wastewater Treatment Plant
kg	kilogram
LOAEL	lowest-observed-adverse-effect level
MCL	maximum contaminant level (EPA)
mg/L	milligrams per liter (same as ppm)
mg/kg	milligrams per kilogram (same as ppm)
mg/kg/day	milligrams per kilogram per day
MRL	minimal risk level (ATSDR)
NAAQS	National Ambient Air Quality Standards
NASP	Naval Air Station Pensacola
NEESA	Naval Energy and Environmental Support Activity
NFA	no further action
NOAA	National Oceanic Atmospheric Administration
NOAEL	no-observed-adverse-effects level
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
ppb	parts per billion
ppm	parts per million
POL	petroleum, oil, and lubricant
RBC	risk-based concentration (EPA)
RCRA	Resource Conservation and Recovery Act

List of Abbreviations

RfD	reference dose (EPA)
RI	Remedial Investigation
RMEG	reference media evaluation guide (ATSDR)
ROD	Record of Decision
SI	Screening Investigation
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Units
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	trichloroethylene
TEF	toxic equivalency factor
TEQ	toxic equivalent
UST	underground storage tank
VOC	volatile organic compound

Summary

Naval Air Station Pensacola (NASP) is located approximately 5 miles southwest of the city of Pensacola on a peninsula in the Florida panhandle. Naval operations began on Pensacola Bay in 1825, and expanded between 1828 and 1835. However, after several natural disasters in the early 1900s, the Navy Yard was forced into maintenance status for a three-year period. In 1914, the first U.S. Naval Air Station was established and became the primary training base for naval aviators. NASP is known as the "Cradle of Naval Aviation" because it is where every Naval Aviator, Naval Flight Officer, and enlisted air crewman begins flight training. It is also the Navy's premier location for enlisted aviation technical training.

ATSDR is required by law to conduct a public health assessment at each of the sites on the National Priorities List. U.S. Environmental Protection Agency (EPA) placed NASP on the National Priorities List in November 1989. Through the Installation Restoration Program, the Navy identified 46 sites as potential sources of contamination at NASP. ATSDR evaluated the potential for exposure to occur at each of these sites, and identified the following potential exposure situations for further discussion:

- *Surface water in Pensacola Bay and Bayou Grande*. The concentrations of environmental contaminants that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting surface water. Therefore, incidental exposure to surface water is not expected to result in harmful health effects.

- *Sediments in Pensacola Bay and Bayou Grande*. The concentrations that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting or contacting sediment. Therefore, incidental exposure to sediment is not expected to result in harmful health effects.

- *Fish in Bayou Grande*. The concentrations in game fish were too low to be of health concern for anyone eating up to 3.5 meals of fish a month. However, because the sampling is limited, it would be a prudent public health practice for people, particularly children and pregnant women, to follow the Florida Fish Consumption Advisories.

- *Blue crabs in Pensacola Bay and Bayou Grande*. The concentrations detected in edible blue crab samples were too low to be of health concern for anyone eating up to 3.5 meals of blue crab a month. Therefore, eating blue crab from Pensacola Bay and Bayou Grande is not expected to result in harmful health effects.

  However, because the blue crab hepatopancreas, or "mustard," samples contained higher concentrations of several chemicals and some of the estimated exposures approach levels of health concern, it would be a prudent public health practice to limit consumption of crab hepatopancreas to two meals per month. If you eat 3.5 meals of blue crab per month, you should not eat any additional meals of crab hepatopancreas.

- *Oysters in Bayou Grande*. The oyster sampling near NASP is limited—only one sample was collected in Bayou Grande. The results of that one sample do not indicate that eating oysters

would be a health concern. The concentrations present in oysters collected from 22 additional locations throughout the Pensacola Bay area were also too low to be of health concern for anyone eating up to 3.5 meals of oyster a month. Therefore, eating oysters is not expected to result in harmful health effects.

With the exception of East Bay and Escambia Bay, the Pensacola Bay system, including Bayou Grande, is not classified for shellfish propagating and harvesting (EnSafe 1998a; FDACS 2005; FDEP 2004).

Background

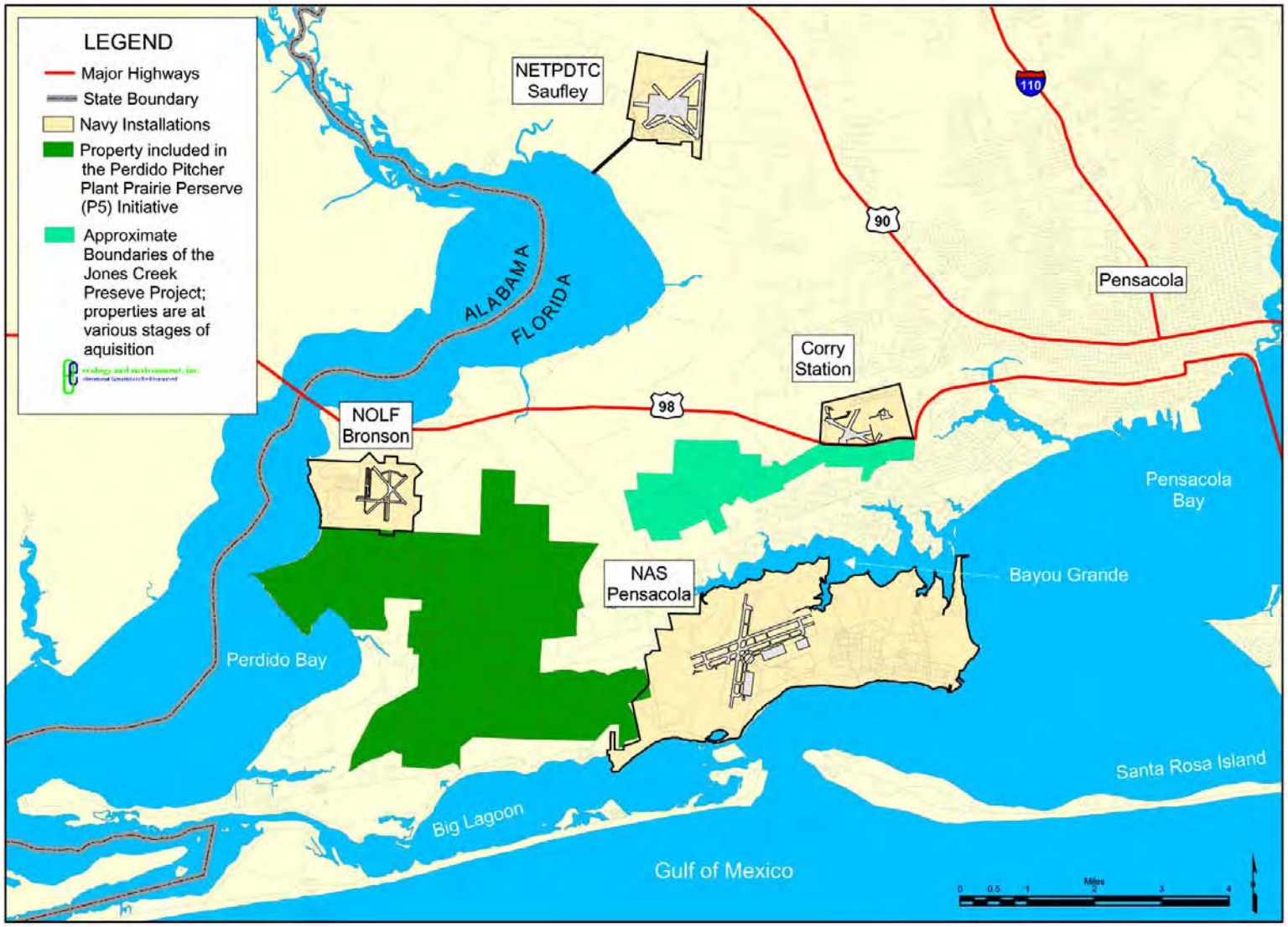
Site Description and Operational History

Naval Air Station Pensacola (NASP) is located on 5,800 acres on a peninsula in the Florida panhandle. The site is approximately 5 miles southwest of the city of Pensacola in southern Escambia County. NASP is surrounded by water on three sides—Bayou Grande to the north, Pensacola Bay to the east, and Big Lagoon and Pensacola Bay to the south (see Figure 1) (NASP 2001; Tetra Tech 2003).

Naval operations began on Pensacola Bay in 1825, when President John Quincy Adams and Secretary of the Navy, Samuel Southard, established "one of the best equipped naval stations in the country" (NASP 2001). As operations expanded between 1828 and 1835, the Navy acquired approximately 2,300 acres. After several natural disasters in the early 1900s, the Navy Yard was forced into maintenance status for a three-year period. In 1914, the first U.S. Naval Air Station (NAS) was established and became the primary training base for naval aviators (Tetra Tech 2003). NASP is known as the "Cradle of Naval Aviation" because it is where every Naval Aviator, Naval Flight Officer, and enlisted air crewman begins flight training. It is also the Navy's premier location for enlisted aviation technical training. About 40,000 students are trained at NASP each year, with about 9,000 students located at the station at a time (P. Nichols, NASP Public Affairs Department, personal communication, February 2006).

The Pensacola Naval Complex is comprised of NASP, the Naval Technical Training Center Corry Station, Outlying Landing Field Saufley, Outlying Landing Field Bronson, and Naval Air Station Whiting Field. Of these, NASP and Naval Air Station Whiting Field are listed on the U.S. Environmental Protection Agency's (EPA) National Priorities List. This public health assessment addresses potential human exposure to environmental contamination at NASP. The Agency for Toxic Substances and Disease Registry (ATSDR) completed a public health assessment for Naval Air Station Whiting Field in September 2000, which is available at: http://www.atsdr.cdc.gov/HAC/PHA/whiting/whi_toc.html.

Figure 1. Location of Naval Air Station Pensacola



Source: NASP 2001

Remedial and Regulatory History

Since Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980, the Navy has actively investigated potential contamination that may have resulted from former practices at their installations (Tetra Tech 2003). EPA placed NASP on the National Priorities List in November 1989 (EPA 2005a). To identify and control environmental contamination, the Navy established the Navy Assessment and Control of Installation Pollutants, which later became part of the Navy's Installation Restoration Program (IRP). Through these programs, 46 sites at NASP were identified as potential sources of contamination (see Figure 2 and Appendix B for additional information about each site) (Navy 2004a).

- Records of Decision were submitted for 14 sites.

- Site Characterization Reports were submitted for 12 sites.

- Sixteen (16) sites have obtained "no further action" status, and six (6) additional sites are recommended for or are pending no further action.

- Nineteen (19) sites are being investigated and remediated under the State of Florida Petroleum Program. Seven of these sites originated in the IRP, but were transferred when only petroleum-related contamination was found.

The 46 sites were divided into two categories—22 sites requiring Remedial Investigations/ Feasibility Studies and 24 sites requiring screening reports. The 22 sites requiring Remedial Investigations/Feasibility Studies were grouped into 14 Operable Units (Navy 2004a).

In addition to the IRP, NASP also initiated the following Resource Conservation and Recovery Act (RCRA) and environmental programs (Tetra Tech 2003):

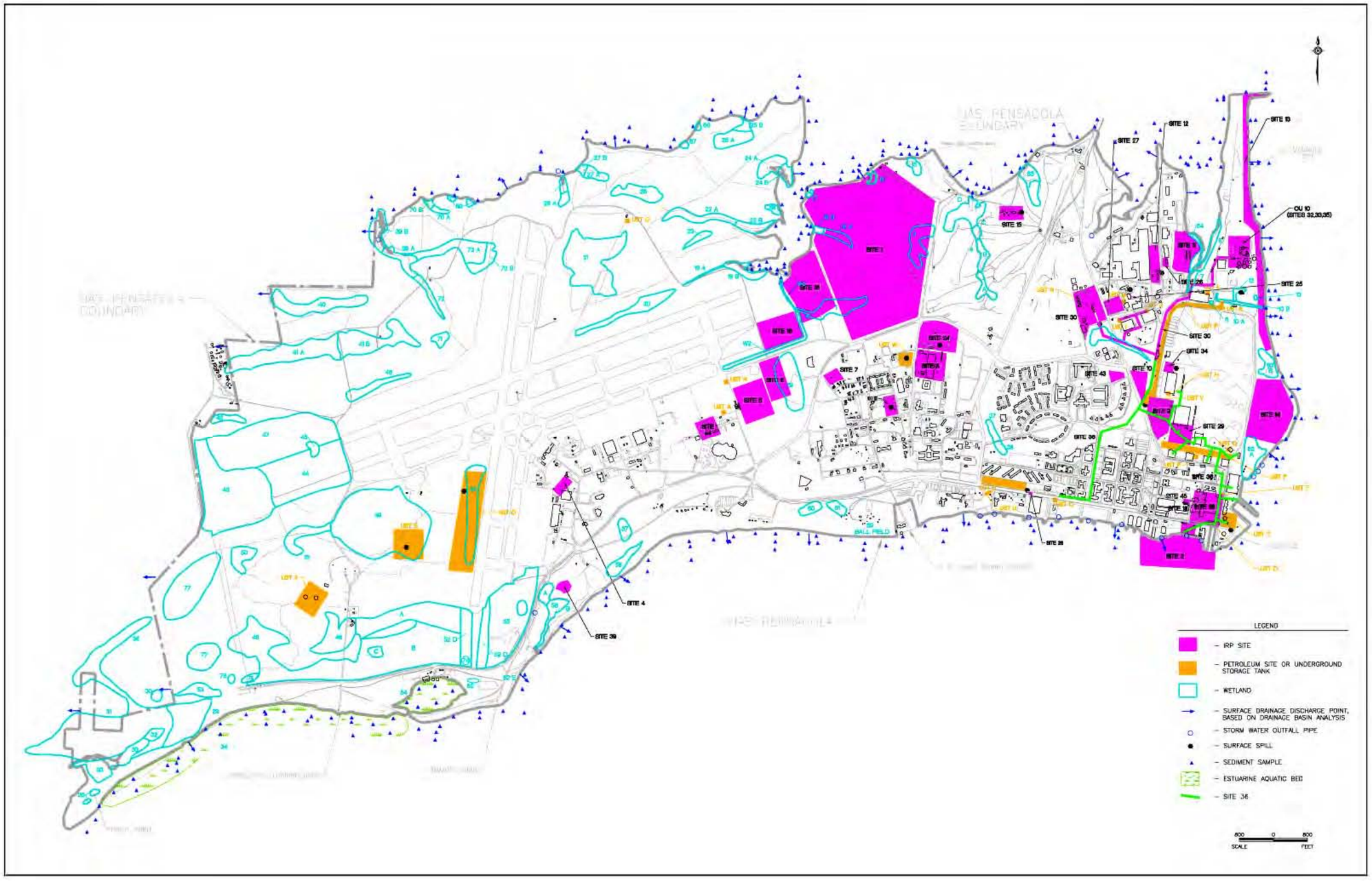
- *Groundwater Recovery System*. A groundwater recovery system was installed in 1991, to replace the use of industrial wastewater treatment surface holding ponds. This system was permanently shutdown in 2003, because of suspected interference with natural attenuation processes.

- *Hazardous Waste Storage*. NASP constructed an area for safe, controlled storage of hazardous waste material (e.g., used oils, industrial cleaners, and paints).

- *Hazardous Waste Minimization Program*. This program was initiated to reduce the amount of hazardous waste generated at the base by streamlining operations and increasing the efficient use of resources.

- *Hazardous Material Control Center (HAZMART)*. HAZMART established procedures for purchasing, receiving, issuing, monitoring, and retrieving hazardous material—in a manner that is protective of both the environment and personnel.

Figure 2. Installation Restoration Program Sites at Naval Air Station Pensacola



Source: EnSafe 1999a

- *Natural Resources Conservation Program*. This program includes forestry, land, and fish and wildlife management programs. The goal of the program is to stabilize and beautify the natural environment and provide outdoor recreation opportunities for base personnel.

- *Petroleum Program*. This program was developed to comply with the State of Florida petroleum regulations. Under this program, NASP removed or replaced 219 underground storage tanks. The four remaining underground storage tanks were installed in 1991, in accordance with secondary containment standards.

ATSDR Involvement

ATSDR is required by law to conduct a public health assessment at each of the sites on the National Priorities List. As part of the public health assessment process, ATSDR conducted an initial site visit to NASP in February 1991. The visit's purpose was to collect information necessary to rank the site according to the potential public health hazard it represented and to identify public health issues related to environmental contamination. During the visit, ATSDR staff met base representatives, toured the installation and surrounding areas, and collected community health concerns. At that time, ATSDR identified past, current, and future exposure pathways and determined that no immediate or long-term public health hazards existed.

In January 2005, ATSDR revisited NASP to obtain updated information about ongoing environmental activities. Again, ATSDR met with base personnel and toured the site. Discussions, the site visit, and data reviews once again led ATSDR to conclude that there was little opportunity for public contact with site contaminants and no immediate threats to public health. ATSDR did, however, identify three potential exposure pathways for additional evaluation in this public health assessment:

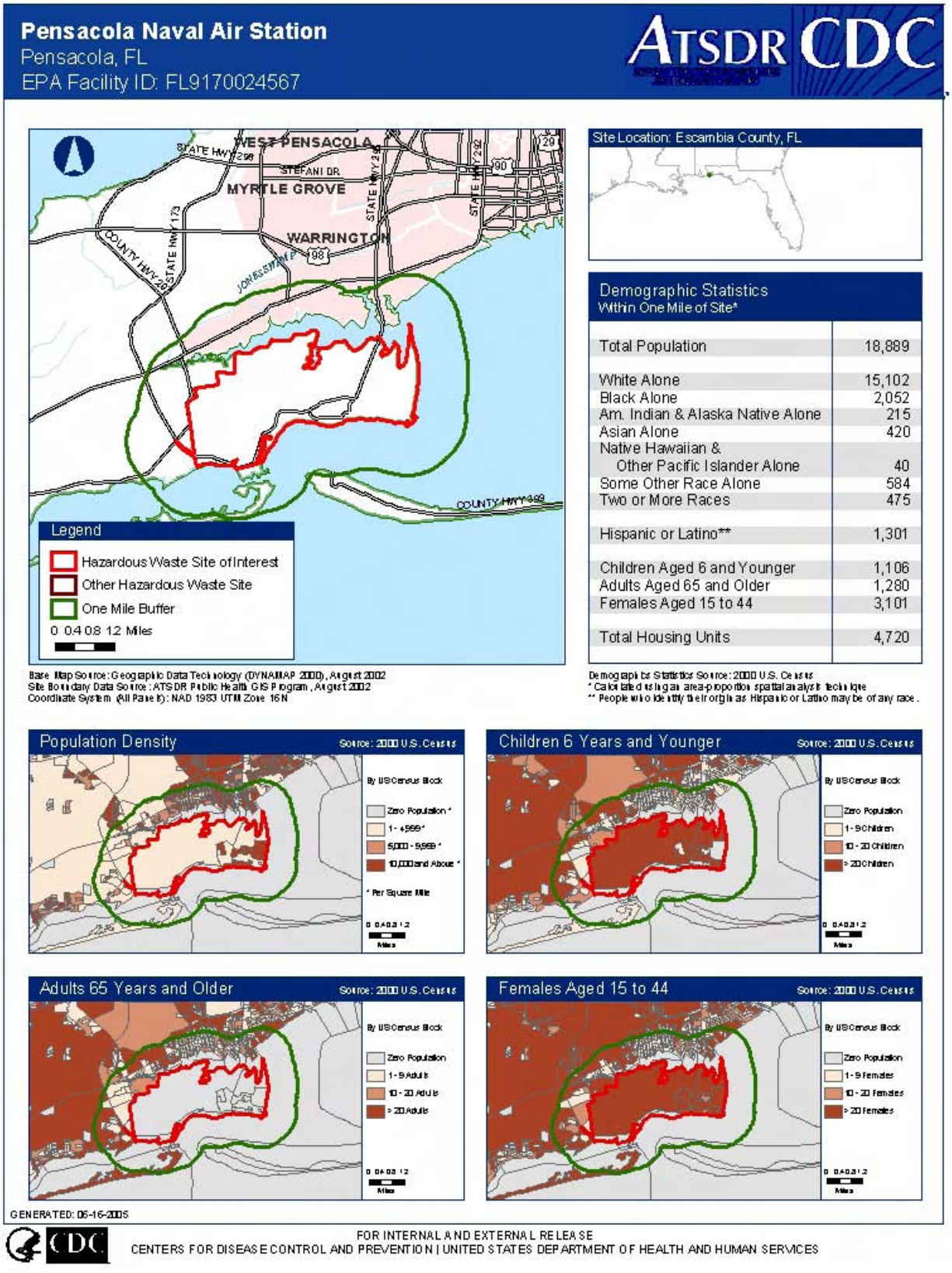
- Exposure to site-related contaminants in Pensacola Bay and Bayou Grande surface water.
- Contact with site-related contaminants in Pensacola Bay and Bayou Grande sediment.
- Exposure from eating fish and shellfish caught in Pensacola Bay and Bayou Grande.

Demographics and Land Use

ATSDR examines demographic and land use data to identify sensitive populations, such as young children, the elderly, and women of childbearing age, and to determine whether these sensitive populations are exposed to any potential health risks. Demographics also provide details on population mobility and residential history in a particular area. This information helps ATSDR evaluate how long residents might have been exposed to contaminants.

NASP is located in southern Escambia County, which occupies about 661 square miles and has a population of about 294,000 (Bureau of the Census 2000). Pensacola is the county seat and the largest city in the county. According to the 2000 census, Pensacola is home to approximately 56,000 people—5.7 percent of whom are under the age of 5 years, 40 percent are women of childbearing age, and 17.2 percent are over 65 years. Figure 3 shows the demographics within one mile of NASP.

Figure 3. Demographics Within 1 Mile of Naval Air Station Pensacola



Approximately 23,000 military and civilian personnel live and/or work at NASP and contribute more than $1 billion annually to the local economy (Tetra Tech 2003). The Housing Department estimates that about 1,400 people currently live in the 577 housing units located at NASP. The average length of residence is two years, with a maximum of three years for enlisted employees (G. Wooten, NASP Housing Department, personal communication, January 2005). More than 25,000 military retirees and families live near NASP and contribute almost $500 million annually to the local economy. The local economy is comprised of large and small industry, agriculture, retail, and tourism (Tetra Tech 2003).

Various housing, training, and support facilities are located on NASP. Forrest Sherman Field occupies a large portion of the western end of the peninsula. Most industrial operations occurred on the eastern end (EnSafe 1995c; Tetra Tech 2003). Housing is located on the southern portion of the eastern end of NASP, in areas independent from the contaminated IRP sites. The Consolidated Training School was built along the bay on the eastern end of the peninsula.

Climate

The climate at NASP is mild, subtropical with an average annual temperature ranging from 50.5° Fahrenheit in the winter to 82° Fahrenheit in the summer. The average rainfall is approximately 60-63 inches per year, with the highest amount of rain falling in July and August. Moderate winds tend to prevail from the north during the winter and from the south during the summer (EnSafe 1999a; NASP 2001).

Even though Santa Rosa Island and Perdido Key protect NASP from direct hurricane hits, flooding and high wind velocities can cause severe damage during hurricanes (NASP 2001). In September 2004, Hurricane Ivan made landfall as a Category III hurricane about 30 miles west of NASP, and inflicted heavy damage to the station. Much of the destruction to the natural topography and buildings was still apparent when ATSDR visited the site in January 2005.

Quality Assurance and Quality Control

In preparing this public health assessment, ATSDR reviewed and evaluated information provided in the referenced documents. Documents prepared for the CERCLA program must meet standards for quality assurance and control measures for chain-of-custody, laboratory procedures, and data reporting. The environmental data presented in this public health assessment come from site characterization and remedial investigation reports prepared by NASP and its contractors under CERCLA and RCRA. ATSDR has found that the quality of environmental data available for NASP is adequate for making public health decisions.

Evaluation of Environmental Contamination and Potential Exposure Situations

Introduction

What is meant by exposure?

ATSDR's public health assessments are driven by exposure to, or contact with, environmental contaminants. Contaminants released into the environment have the potential to cause harmful health effects. Nevertheless, *a release does not always result in exposure.* People can only be exposed to a contaminant if they come into contact with that contaminant—if they breathe, eat, drink, or come into skin contact with a substance containing the contaminant. If no one comes into contact with a contaminant, then no exposure occurs, and thus no health effects could occur. Often the general public does not have access to the source area of contamination or areas where contaminants are moving through the environment. This lack of access to these areas becomes important in determining whether people could come into contact with the contaminants.

An exposure pathway has five elements: (1) a source of contamination, (2) an environmental media, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. The source is the place where the chemical or radioactive material was released. The environmental media (such as groundwater, soil, surface water, or air) transport the contaminants. The point of exposure is the place where people come into contact with the contaminated media. The route of exposure (for example, ingestion, inhalation, or dermal contact) is the way the contaminant enters the body. The people actually exposed are the receptor population.

The route of a contaminant's movement is the pathway. ATSDR identifies and evaluates exposure pathways by considering how people might come into contact with a contaminant. An exposure pathway could involve air, surface water, groundwater, soil, dust, or even plants and animals. Exposure can occur by breathing, eating, drinking, or by skin contact with a substance containing the chemical contaminant.

How does ATSDR determine which exposure situations to evaluate?

ATSDR scientists evaluate site conditions to determine if people could have been, are, or could be exposed (i.e., exposed in a past scenario, a current scenario, or a future scenario) to site-related contaminants. When evaluating exposure pathways, ATSDR identifies whether exposure to contaminated media (soil, sediment, water, air, or biota) has occurred, is occurring, or will occur through ingestion, dermal (skin) contact, or inhalation.

If exposure was, is, or could be possible, ATSDR scientists consider whether contamination is present at levels that might affect public health. ATSDR scientists select contaminants for further evaluation by comparing them to health-based comparison values. These are developed by ATSDR from available scientific literature related to exposure and health effects. Comparison values are derived for each of the different media and reflect an estimated contaminant concentration that is *not likely* to cause adverse health effects for a given chemical, assuming a standard daily contact rate (e.g., an amount of water or soil consumed or an amount of air breathed) and body weight.

Comparison values are not thresholds for adverse health effects. ATSDR comparison values establish contaminant concentrations many times lower than levels at which no effects were observed in experimental animals or human epidemiologic studies. If contaminant concentrations are above comparison values, ATSDR further analyzes exposure variables (for example, duration and frequency of exposure), the toxicology of the contaminant, other epidemiology studies, and the weight of evidence for health effects.

Some of the comparison values used by ATSDR scientists include ATSDR's environmental media evaluation guides (EMEGs), reference dose media evaluation guides (RMEGs), and cancer risk evaluation guides (CREGs) and EPA's maximum contaminant levels (MCLs). EMEGs, RMEGs, and CREGs are non-enforceable, health-based comparison values developed by ATSDR for screening environmental contamination for further evaluation. MCLs are enforceable drinking water regulations developed to protect public health.

You can find out more about the ATSDR evaluation process by consulting Appendix C, contacting ATSDR at 1-888-42ATSDR, or reading ATSDR's Public Health Assessment Guidance Manual at http://www.atsdr.cdc.gov/HAC/PHAManual/.

If someone is exposed, will they get sick?

Exposure does not always result in harmful health effects. The type and severity of health effects a person can experience because of contact with a contaminant depend on the exposure concentration (how much), the frequency (how often) and/or duration of exposure (how long), the route or pathway of exposure (breathing, eating, drinking, or skin contact), and the multiplicity of exposure (combination of contaminants). Once exposure occurs, characteristics such as age, sex, nutritional status, genetics, lifestyle, and health status of the exposed individual influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. Together, these factors and characteristics determine the health effects that may occur.

In almost any situation, there is considerable uncertainty about the true level of exposure to environmental contamination. To account for this uncertainty and to be protective of public health, ATSDR scientists typically use worst-case exposure level estimates as the basis for determining whether adverse health effects are possible. These estimated exposure levels usually are much higher than the levels that people are really exposed to. If the exposure levels indicate that adverse health effects are possible, ATSDR performs a more detailed review of exposure and consult the toxicologic and epidemiologic literature for scientific information about the health effects from exposure to hazardous substances.

What potential exposure situations were evaluated for NASP?

Access to natural resource management areas at NASP for recreational purposes is limited to active duty and reserve military personnel, their dependents and guests; federal civilian employees, their dependents and guests; and military retirees. However, the general public is allowed access to several designated natural and cultural resource areas, such as National Park Service areas, the Pensacola Lighthouse, and the Bayou Grande Nature Trail.

Pensacola Bay and Bayou Grande are classified as Class II and Class III waters, meaning they are designated to support shellfish propagation and recreational and wildlife use (NASP 2001). Because of the warm climate and easy access to Pensacola Bay and Bayou Grande, outdoor recreational activities such as fishing, canoeing, sailing, and boating occur year-round (NASP 2001). However, due to the seasonal water temperatures, swimming is generally limited to May through September (EnSafe 1999a). Sherman Cove Marina offers many motorized and non-motorized boating opportunities. In addition, freshwater fishing is popular in Lake Frederic, a small 1.2-acre pond near Sherman Cove Marina that is stocked with catfish, sunshine bass, and bluegill (NPS 1999). Fishing in Lake Frederic was not considered a completed exposure pathway because no sources of contamination are near the small pond.

ATSDR identified the following three potential exposure situations for further evaluation:

1. Exposure to site-related contaminants in Pensacola Bay and Bayou Grande surface water.
2. Contact with site-related contaminants in Pensacola Bay and Bayou Grande sediment.
3. Exposure from eating fish and shellfish caught in Pensacola Bay and Bayou Grande.

Table 1 provides a summary of potential exposure situations evaluated in this public health assessment.

Table 1. Potential Exposure Pathways Evaluated at Naval Air Station Pensacola

Pathway	*Exposure Pathway Elements*					*Comments*
	Potential Sources of Contamination	***Environmental Media***	***Point of Exposure***	***Route of Exposure***	***Exposed Population***	
Surface Water	Pensacola Bay IRP sites 2, 3, 4, 13, 14, 17, 18, 28, 32, 33, 35, 36, 38, and 39 Bayou Grande IRP sites 1, 3, 9, 10, 11, 12, 15, 16, 29, 30, 32, 33, 35, 34, 36, and 38	▪ Surface Water	▪ Mustin Beach ▪ Bayou Grande Family Picnic Area ▪ Sailing Facility	▪ Incidental Ingestion	Recreational adults and children	Recreational exposures to Pensacola Bay and Bayou Grande surface water and sediment are not expected to cause harmful health effects.
Sediment		▪ Sediment		▪ Incidental Ingestion ▪ Dermal Contact	Recreational adults and children	
Fish and Shellfish		▪ Fish ▪ Blue crab ▪ Oysters	▪ Throughout Pensacola Bay and Bayou Grande	▪ Ingestion	Recreational fishers	People should follow the Florida Department of Health's Fish Consumption Advisories, and also limit consumption of crab hepatopancreas.

Sources: EnSafe 1995c, 1997b, 1998a

Site Description and Use

Pensacola Bay

Pensacola Bay is a 54-square mile estuarine water body with a mean depth of 19.5 feet (NASP 2001). About 10 miles of the bay border NASP property where the mean water depth is 10 feet (EnSafe 1998a). Near the station, it is considered a "lower estuarine environment" with regular tidal flushing though the Pensacola Pass into the Intercoastal Waterway (EnSafe 1997b). Pensacola Bay is protected from the Gulf of Mexico by two barrier islands, Santa Rosa Island and Perdido Key. The U.S. Army Corps of Engineers periodically dredges Pensacola Bay to maintain a navigable channel for naval and commercial shipping (EnSafe 1995c).

Both the Navy and the Coast Guard monitor activity and boat traffic in Pensacola Bay. Fishing and crabbing occur on a daily basis in portions of the Pensacola Bay system—East Bay and Escambia Bay are conditionally classified for shellfish propagating and harvesting (EnSafe 1998a; FDACS 2005; FDEP 2004). Swimming near NASP is only allowed at Mustin Beach, which is west of the Coast Guard Station, and the swift currents of the shipping channel limit swimming in the bay. The only other swim activity occurs when students at the Rescue Training School participate in one activity in the bay during a single class (EnSafe 1997b, 1998a). Even though trespassing at NASP is possible, the occasional trespasser would likely be arrested (EnSafe 1998a).

Since September 11, 2001, NASP and the Coast Guard enforce a 500-foot restricted area along the shoreline adjacent to NASP, which prohibits fishing in this area (EnSafe 2003). The area is marked with permanently stationed buoys that warn unauthorized boats to stay out of the "waterborne security zone" (EnSafe 2005b).

Bayou Grande

Bayou Grande is a 1.7-square mile estuarine water body with a mean water depth of 6 feet (EnSafe 1999a; NASP 2001). It has approximately 20 miles of coastline, with about 8.5 miles bordering NASP property. The majority of the land along the shore is residential property.

Neither commercial nor subsistence fishing occurs in Bayou Grande, and the area is not classified for shellfish harvesting (FDACS 2005; FDEP 2004). The Florida Marine Patrol Office reports that approximately 10 boats per day fish in the bayou from April through September and only one or two boats per day fish in the bayou from October through March (EnSafe 1999a, 2003). Most boats are reported to catch only one redfish or one trout per day. The general public can only access Bayou Grande by boat because NASP restricts access to the south, and private residents own the land on the west and north sides. Swimming is allowed at the Bayou Grande Family Picnic Area and at the Sailing Facility (EnSafe 1999a).

Environmental Sampling and Results

Pensacola Bay

The Pensacola Bay watershed has been impacted by both non-point source pollution (e.g., urban stormwater runoff and agricultural runoff) and point source pollution (e.g., wastewater treatments plants and industrial plants) (NASP 2001). Fourteen IRP sites (2, 3, 4, 13, 14, 17, 18, 28, 32, 33, 35, 36, 38, and 39) have been identified as potentially discharging or having previously discharged contaminants in Pensacola Bay (EnSafe 1995c). Three general areas of contaminant discharge are the southwest sewer discharge area, the eastern shore of Magazine Point and Chevalier Field, and Sherman Inlet and Sherman Cove (EnSafe 1995c).

In 1993, surface water samples were collected from five locations near Site 2 in Pensacola Bay. The samples were analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), and organic compounds. Four metals and 12 semi-volatile organic compounds (SVOCs) were detected in the surface water. No pesticides, PCBs, or volatile organic compounds (VOCs) were detected in any of the surface water samples (EnSafe 1996e). In 1993, sediment samples were collected from 52 locations near Site 2 in Pensacola Bay. The samples were analyzed for metals, pesticides, PCBs, and organic compounds. Nine metals, two pesticides, two PCBs, and eight SVOCs were detected in the sediment. VOCs were not detected in the sediment samples (EnSafe 1996e). In 1994, 12–14 blue crabs were collected from each of six locations—five near Site 2 and one near the Coast Guard Station. The edible portion was analyzed for metals, pesticides, and organic compounds. Nine metals and seven pesticides were detected in the crab samples. No SVOCs or VOCs were detected in any of the samples (EnSafe 1996e).

The Navy sampled sediment from 141 locations along NASP property from October 1995 to January 1996 (see Figure 2) (EnSafe 1997b). Because surface water was not considered a significant route of exposure and seawater chemistry does not encourage the solution of contaminants, no surface water samples were collected (EnSafe 1998a). The sediment samples were analyzed for metals, pesticides, PCBs, and organic compounds. Twenty-three metals, 18 pesticides, 3 PCBs, 23 SVOCs, and 9 VOCs were detected in the sediment samples (EnSafe 1998a). The marine environment encourages the assimilation of these contaminants into sediment, which is transported by currents and deposited in areas unaffected by currents (EnSafe 1998a). Areas with the greatest level of contamination are the barge loading dock, Coast Guard Station, concrete seawall and quay, and the Industrial Wastewater Treatment Plant (EnSafe 1997b, 1998a). The sediment samples collected from Mustin Beach were lower in concentration than other areas, due to the strong surf and tidal currents in the area (EnSafe 1997b).

Bayou Grande

NASP is the primary industrial influence in Bayou Grande. Sixteen IRP sites (1, 3, 9, 10, 11, 12, 15, 16, 29, 30, 32, 33, 34, 35, 36, and 38) have been identified as potentially contributing or having contributed to contamination in Bayou Grande (EnSafe 1995c). Contaminants migrate to the bayou primarily through sediment migration and redistribution within the bayou, surface water drainage, and groundwater discharge (EnSafe 1999a). Two general areas of contaminant

discharge are the yacht basin west of Magazine Point and the southcentral portion of Bayou Grande (EnSafe 1995c).

The Navy sampled sediment, surface water, and fish from Bayou Grande from 1995 to 1997 (see Figure 2) (EnSafe 1999a). Sediment was sampled from 143 locations along the NASP coastline. Only submerged sediment samples were collected because shoreline sediments "do not represent an environment conducive to deposition" (EnSafe 1999a). The shoreline sediments are chemically inert due to the grain size and are continually winnowed by wind and water. Surface water was collected from three locations. Two composite samples of prey fish (minnows) were collected from one location. The Navy then estimated concentrations of contaminants in game fish (e.g., red drum) from the concentrations detected in the prey fish samples (EnSafe 2003). Sediment, surface water, and fish tissue samples were analyzed for metals, pesticides, PCBs, and organic compounds (EnSafe 1999a). Twenty-three metals, 19 pesticides, three PCBs, 31 SVOCs, and five VOCs were detected in the sediment samples (EnSafe 1999a). One VOC, two pesticides, and 14 metals were detected in the surface water samples. No SVOCs or PCBs were detected in surface water (EnSafe 1999a). One metal, six pesticides, and 1 PCB were detected in the prey fish samples (EnSafe 1999a, 2003). Because mercury was not analyzed in the prey fish due to a sampling error, the Navy used a model to predict mercury concentrations in red drum from the mercury levels detected in the sediment in Bayou Grande (EnSafe 2003).

In 2003 and 2004, as part of an environmental health study of northwest Florida, the University of West Florida collected blue crabs and oysters from the bays and bayous in the Pensacola area, including locations in Bayou Grande (Karouna-Renier et al. 2005). One composite oyster sample comprised of at least 10 oysters was collected and two blue crab samples composited from at least seven crabs were collected from Bayou Grande. Oysters were collected from 22 additional locations throughout the Pensacola Bay area. The tissues were analyzed for metals, dioxin-like PCBs, and dioxins/furan compounds, which were all detected in the samples. The University of West Florida also recently sampled mullet fillets from Bayou Grande (N. Karouna-Renier, University of West Florida, personal communication, May 2005). Arsenic, mercury, PCBs, and dioxin/furan compounds were detected in the fillet samples.

Public Health Implications

Introduction

ATSDR evaluated recreational exposures to surface water and sediment in Pensacola Bay and Bayou Grande. In addition, ATSDR determined whether the fish and shellfish from the bay and bayou are safe to eat. To do so, ATSDR evaluated available data to determine whether contaminants were above ATSDR's comparison values. Comparison values are derived for each environmental media (water, soil, fish) and reflect an estimated contaminant concentration that is not expected to cause harmful health effects, assuming a standard daily contact rate (for example, the amount of water or soil consumed) and representative body weight. For chemicals above comparison values, ATSDR derived exposure doses (see text box for definition) and compared them against health-based guidelines. Health guidelines are estimates of daily human exposure to substances that are not expected to result in health effects over a specified duration. They have built in "uncertainty" or "safety" factors that make them much lower than levels at which health effects have been observed. ATSDR also reviewed relevant toxicologic data to obtain information about the toxicity of the chemicals of interest.

An exposure dose is the amount of chemical a person is exposed to over time.

Issue 1. Exposure to site-related contaminants in Pensacola Bay and Bayou Grande surface water

ATSDR evaluated whether incidentally ingesting surface water while engaged in recreational activities, such as swimming, in Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting surface water. Therefore, incidental exposure to surface water is <u>not</u> expected to result in harmful health effects.

Of the 16 metals, 12 SVOCs, one VOC, and two pesticides detected in Pensacola Bay and Bayou Grande surface water, only three metals and one SVOC had maximum concentrations higher than comparison values (see Table 2). However, one of the metals (arsenic) and the one SVOC (pentachlorophenol) were only detected in one of 24 samples. ATSDR further evaluated the potential exposure to the chemicals frequently detected above comparison values by calculating exposure doses and comparing the doses to protective health guideline values. ATSDR assumed that adults and children swam at the designated swimming areas in the bay and bayou 150 days of the year (May through September; EnSafe 1999a). All adult and child exposure doses were below health effect levels reported in the scientific literature. Therefore, ATSDR does not expect that incidentally ingesting surface water while engaging in recreational activities in Pensacola Bay or Bayou Grande would cause harmful health effects. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects.

Table 2. Chemicals with Maximum Concentrations Exceeding Comparison Values in Pensacola Bay and Bayou Grande Surface Water

Chemical	*Number of Detections*	*Range of Detected Concentrations (ppb)*	*Comparison Value (ppb)*	*Comparison Value Type*
Metals				
Antimony	20/24	95.8–180	4	RMEG
Silver	18/24	6.3–144	50	RMEG

Sources: EnSafe 1996e, 1999a

ppb = parts per billion
RMEG = reference media evaluation guide

Issue 2. Contact with site-related contaminants in Pensacola Bay and Bayou Grande sediment

ATSDR evaluated whether incidentally ingesting or dermally contacting sediments while engaged in recreational activities in Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting or dermally contacting sediment. Therefore, incidental exposure to sediment is not expected to result in harmful health effects.

Of the 23 metals, 20 pesticides, three PCBs, 32 SVOCs, and nine VOCs detected in Pensacola Bay and Bayou Grande sediment, only four metals, five SVOCs, and one pesticide had maximum concentrations higher than comparison values (see Table 3). ATSDR further evaluated the potential exposure for these chemicals by calculating exposure doses and comparing the doses to protective health guideline values. ATSDR assumed that adults and children engage in recreational activities in the bay and bayou 150 days of the year (May through September; EnSafe 1999a). ATSDR also qualitatively evaluated the potential for dermal exposures to result in adverse health effects. All adult and child exposure doses were below health effect levels reported in the scientific literature. Therefore, ATSDR does not expect that incidentally ingesting or dermally contacting sediment while engaging in recreational activities in Pensacola Bay or Bayou Grande would cause harmful health effects. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects.

Table 3. Chemicals with Maximum Concentrations Exceeding Comparison Values in Pensacola Bay and Bayou Grande Sediment

Chemical	*Number of Detections*	*Range of Detected Concentrations (ppm)*	*Comparison Value (ppm)*	*Comparison Value Type*
Metals				
Arsenic	250/336	0.12–22.3	0.5	CREG
Cadmium	68/336	0.2–24	10	Chronic EMEG
Chromium	256/336	0.39–238	200	RMEG (CrVI)
Iron	332/336	19.3–38,000	23,000	Residential RBC
Semi-volatile Organic Compounds				
Benzo(a)anthracene	77/336	0.021–44	0.87	Residential RBC
Benzo(a)pyrene	73/336	0.021–21	0.1	CREG
Benzo(b)fluoranthene	107/336	0.022–19	0.87	Residential RBC
Benzo(k)fluoranthene	62/336	0.021–16	8.7	Residential RBC
Indeno(1,2,3-cd)pyrene	46/336	0.021–7.5	0.87	Residential RBC
Pesticide				
Dieldrin	37/333	0.00011–0.099	0.04	CREG

Sources: EnSafe 1996e, 1997b, 1998a, 1999a

CrVI = hexavalent chromium
CREG = cancer risk evaluation guide
EMEG = environmental media evaluation guide
ppm = parts per million
RBC = risk-based concentration
RMEG = reference media evaluation guide

Issue 3. Exposure from eating fish and shellfish caught in Pensacola Bay and Bayou Grande

ATSDR evaluated whether eating fish caught in Bayou Grande could result in harmful health effects. The concentrations that were detected and estimated in game fish were too low to be of health concern for anyone eating up to 3.5 meals of fish a month. Therefore, eating fish from Bayou Grande is <u>not</u> expected to result in harmful health effects. However, because the sampling results were limited, it would be a prudent public health practice for people, particularly children and pregnant women, to follow the Florida Department of Health Fish Consumption Advisories.

ATSDR also evaluated whether eating blue crabs and oysters from Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations detected in edible blue crab samples were too low to be of health concern for anyone eating up to 3.5 meals of blue crab a month. Therefore, eating blue crab from Pensacola Bay and Bayou Grande is <u>not</u> expected to result in harmful health effects. Because the blue crab hepatopancreas, or "mustard," samples contained higher concentrations of several chemicals and some of the estimated exposures

approach levels of health concern, it would be a prudent public health practice to limit consumption of crab hepatopancreas to two meals per month. The oyster sampling near NASP is limited; however, the concentrations found in oysters throughout the Pensacola Bay area do not indicate that eating oysters would be a health concern.

The available fish data is very limited. Only two composite samples of prey fish and one mullet sample were collected from Bayou Grande. No fish samples were collected from Pensacola Bay. Using the levels detected in the prey fish, the Navy estimated concentrations in game fish. The Navy also estimated the level of mercury in game fish using detected sediment concentrations. Eight of the detected contaminants (two metals, three pesticides, two PCBs, and dioxins) were found at concentrations higher or were estimated to be at concentrations higher than comparison values (see Table 4). ATSDR further evaluated the potential exposure for these chemicals by calculating exposure doses and comparing the doses to protective health guideline values. Based on the recreational patterns observed by the Florida Marine Patrol Office (EnSafe 1999a, 2003), ATSDR assumed that people ate about 3.5 meals of fish each month (a meal was defined as 8 ounces for adults and 4 ounces for children). All adult and child exposure doses were below health effect levels reported in the scientific literature. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects. Based on the available data, ATSDR does not expect that eating fish from Bayou Grande would cause harmful health effects. However, given that the fish sampling is limited, it would be a prudent public health practice for people to follow the Florida Department of Health Fish Consumption Advisories, which can be found at http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/ and are provided in Appendix D. Pregnant women and children should be particularly cautious because fetuses and young children are more sensitive to certain contaminants.

Table 4. Chemicals with Maximum Concentrations Exceeding Comparison Values in Fish Caught in Bayou Grande

Chemical	*Maximum Concentration in Prey Fish (ppm)*	*Maximum Concentration in Game Fish (ppm)*	*Comparison Value (ppm)*	*Comparison Value Type*
Metals				
Arsenic	Not sampled	0.61 (measured)	0.0021	RBC
Mercury	Not sampled	0.26 (estimated)	0.14	RBC (MeHg)
Pesticides				
Aldrin	0.00066	0.00066 (estimated)	0.00019	RBC
DDE	0.012	0.043 (estimated)	0.0093	RBC
Dieldrin	0.0013	0.0014 (estimated)	0.0002	RBC
PCBs				
Aroclor-1260	0.1	0.37 (estimated)	0.0016	RBC
Total PCBs	Not sampled	0.0147 (measured)	0.0016	RBC
Dioxins				
Total dioxin TEQ	Not sampled	0.000001 (measured)	0.000000021	RBC

Sources: EnSafe 1999a, 2003; N. Karouna-Renier, University of West Florida, personal communication, May 2005

DDE = dichlorodiphenyldichloroethylene
MeHg = methylmercury
PCB = polychlorinated biphenyl
ppm = parts per million
RBC = risk-based concentration
TEQ = toxic equivalency quotient

Blue crabs were collected from six locations in Pensacola Bay and two locations in Bayou Grande. Seven of the detected contaminants were higher than comparison values (see Table 5). Oysters were collected from one location in Bayou Grande and 22 additional locations throughout the Pensacola Bay area. Four of the detected contaminants were higher than comparison values (see Table 5). ATSDR further evaluated the potential exposure for these chemicals by calculating exposure doses and comparing the doses to protective health guideline values. Based on the recreational patterns observed by the Florida Marine Patrol Office (EnSafe 1999a, 2003), ATSDR assumed that people ate about 3.5 meals of crab or oyster each month (a meal was defined as 8 ounces for adults and 4 ounces for children). All adult and child exposure doses were below health effect levels reported in the scientific literature. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects. Based on the available data, ATSDR does not expect that eating the muscle/tissue portions of crab and oysters from Pensacola Bay and Bayou Grande[1] would cause harmful health effects.

[1] Bayou Grande is not classified for shellfish propagating and harvesting (FDACS 2005; FDEP 2004).

Blue crab hepatopancreas from Bayou Grande were also analyzed. They contained higher concentrations of arsenic, cadmium, copper, and dioxins than the muscle/tissue samples (see Table 5). When assuming the same consumption rate (3.5 meals of crab hepatopancreas a month), some of the exposure doses approach levels of concern. Because contaminants tend to deposit in the hepatopancreas, it would be a prudent public health practice to limit consumption of crab hepatopancreas to two meals per month. If you eat 3.5 meals of blue crab per month, you should not eat any additional meals of crab hepatopancreas.

Table 5. Chemicals with Maximum Concentrations Exceeding Comparison Values in Shellfish Caught in Pensacola Bay and Bayou Grande

Chemical	*Maximum Concentration in Edible Portion of Crab* (ppm)*	*Maximum Concentration in Crab Hepatopancreas (ppm)*	*Maximum Concentration in Oyster Tissue[§] (ppm)*	*Comparison Value (ppm)*	*Comparison Value Type*
Metals					
Arsenic	1.85	3.8	1.8	0.0021	RBC
Inorganic arsenic	0.024	0.076	0.018	0.0021	RBC
Cadmium	0.76	4.6	0.61	1.4	RBC
Copper	15.25	58	56	54	RBC
Mercury	0.21	0.14	0.017	0.14	RBC (MeHg)
Pesticides					
Aldrin	0.00093	Not sampled	Not sampled	0.00019	RBC
DDT	0.0096	Not sampled	Not sampled	0.0093	RBC
Heptachlor epoxide	0.0025	Not sampled	Not sampled	0.00035	RBC
Dioxins					
Total dioxin TEQ	0.0000047	0.000028	0.0000042	0.000000021	RBC

Sources: EnSafe 1996e; Karouna-Renier et al. 2005

*Edible portion of crab includes either the crab muscle alone or crab muscle with a portion of the hepatopancreas (calculated as 15% of the total edible mass; Karouna-Renier et al. 2005).
[§]Collected from the one location in Bayou Grande near NASP.
Bold text indicates that the maximum concentration exceeded the comparison value for that chemical.
DDT = dichlorodiphenyltrichloroethane
MeHg = methylmercury
ppm = parts per million
RBC = risk-based concentration
TEQ = toxic equivalency quotient

Community Health Concerns

The Navy has kept the community informed about activities at NASP throughout the site's history (EnSafe 1998a). A Technical Review Committee with representatives from the Navy, EPA, the Florida Department of Environmental Protection (FDEP), and the community was established in 1989, to review recommendations for, and monitor progress of, the investigation and remedial activities at NASP. In 1995, a Restoration Advisory Board was formed to establish a forum for communication between the decision makers and the community (EnSafe 1998a). In addition, the NASP Public Affairs office established and maintained a mailing list of interested community members and organizations.

In 1990, the Navy conducted a series of interviews with "a variety of individuals representing diverse personal and institutional concerns and interests" (Tetra Tech 2003). Individuals interviewed included elected and appointed officials; local, county, and state representatives; businesspeople; people historically affiliated with the station; and local residents. The key concerns raised during the interviews were:

- Drinking water supplies
- Wetland protection
- Hazardous waste minimization
- Scout camping near an inactive landfill (Site 1)
- Air quality
- Health of Bayou Grande and Pensacola Bay

Drinking Water Supplies

NASP receives its potable water from wells at Corry Station, which is located about 1.5 miles west of Pensacola and 2.5 miles north of NASP. Potable groundwater in the Pensacola area is generally drawn from the sand-and-gravel aquifer (NASP 2001). The sand-and-gravel aquifer occurs from the ground surface to about 220 to 330 feet below ground surface, and is informally subdivided into the surficial zone, the low permeability zone, and the main producing zone (NFWMD 1995). The low permeability zone acts as a semiconfining layer that restricts the vertical flow of groundwater between the surficial zone and the main producing zone. The main producing zone is the main source of groundwater throughout the area (NFWMD 1995).

The current drinking water supply is safe. According to the 2003 Annual Drinking Water Quality Report, the drinking water meets all federal and state requirements. NASP routinely monitors for contaminants to supply a "safe and dependable supply of drinking water" (NASP 2003). Water from the wells at Corry Station is treated with chlorine for disinfection, sodium hydroxide for pH stabilization, aeration for carbon dioxide removal, zinc orthophosphate for corrosion control, granular activated carbon units for dieldrin removal, and fluoride for dental health purposes.

There were some issues with groundwater contamination affecting the Corry Station potable water wells in the past. In 1993, the Northwest Florida Water Management District conducted a

site investigation to characterize the extent of the contamination and identify the source. Pesticides (dieldrin, chlordane, and heptachlor epoxide) and VOCs (mainly benzene, toluene, ethylbenzene, and xylenes [BTEX] and tetrachloroethylene [PCE]) were detected in the Corry Station wells (NFWMD 1995). ATSDR evaluated the contaminant concentrations detected during this investigation, and determined that exposure to the low levels found would not have resulted in harmful health effects for people drinking water from the Corry Station wells. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects.

Wetland Protection

Formal wetland delineations were performed in 1997. A large portion—about 250 acres—of NASP consists of wetlands (NASP 2001). Including all freshwater and brackish ponds and drainage ditches, 81 wetland areas were identified (Tetra Tech 2003). Two-thirds are located on the west side of the base where few IRP sites are located. About one-third of the wetlands are located east of Sherman Field, where most of the IRP sites are located. Ten drainage ditches and 12 wetlands are associated with IRP sites. Elevated levels of metals, pesticides, and polynuclear aromatic hydrocarbons (PAHs) have been detected in sediment; and elevated levels of metals have been detected in surface water. In 2005, the Navy finalized a Remedial Investigation for the site wetlands and concluded that only four needed further action (see EnSafe 2005b).

NASP has an "aggressive resource conservation program that includes protection of the wetlands as a major goal" (Tetra Tech 2003). In 2001, NASP established an Integrated Natural Resources Management Plan. One of the primary objectives is to: "Continue existing, and establish new programs and procedures to monitor, maintain, and enhance wetlands and water quality" (NASP 2001).

The Navy has a policy of "no net loss" of wetlands. Part of the long-term management plan is to develop vegetative buffers around wetland areas, discourage pedestrian and pet access, plant vegetated filter strips to intercept the flow of runoff, and manage the use of pesticides and herbicides (NASP 2001).

Hazardous Waste Minimization

NASP established a Hazardous Waste Minimization Program to reduce the amount of hazardous waste generated at the base by streamlining operations and increasing the efficient use of resources. Some examples include:

- Modified the Industrial Wastewater Treatment Plant from industrial wastewater to domestic wastewater in January 1996.
- Established hazardous waste training programs.
- Established a pollution prevention program.

According to the Navy, the program has "significantly reduced the amount of hazardous materials" generated at NASP (Tetra Tech 2003).

Scout Camping Near an Inactive Landfill (Site 1)

A primitive camping area used by visiting Boy and Girl Scout troops is located near an inactive landfill that was used from the early 1950s until 1976, for disposal of solid and industrial wastes (Tetra Tech 2003). Access to the landfill is restricted to authorized personnel; however, the site is not fenced to prevent trespassing (EnSafe 1998b).

The Navy performed a human health risk assessment for a potential child trespasser scenario. The risks and/or hazards were within EPA and FDEP's generally acceptable ranges. Therefore, they concluded that there was little risk posed from contact with the surface soil (EnSafe 1998b). ATSDR reviewed the Navy's risk assessment and performed our own health evaluation. ATSDR concurs that the contaminant levels found in the landfill surface soil are too low to be of health concern for scouts camping near the landfill. Please see Appendix C for more details on the methods and assumptions ATSDR used to estimate human exposure doses and determine health effects. NASP is monitoring the conditions at the landfill and will notify area scout leaders if the adjacent area becomes unsuitable for camping (Tetra Tech 2003).

Air Quality

Air pollutant emissions at NASP are generated from surface coating, fuel storage and handling, fire-fighting training facilities, miscellaneous small stationary combustion sources, aircraft, motor vehicles, and ground support equipment (NASP 2001). Military aircraft operations are the largest source of air emissions at NASP. Prescribed burning can also contribute to high levels of particulate matter in the air. However, to avoid potential impacts on the regional air quality, NASP coordinates with Florida's Division of Forestry to stay within the guidelines for conducting prescribed burns (NASP 2001).

The Clean Air Act established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants—respirable particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, lead, and ozone. The state of Florida adopted these standards into its air quality regulations to protect public health and welfare. EPA classifies the area around NASP as "in attainment" for all six NAAQS criteria pollutants (NASP 2001). None of the counties near NASP have air pollution levels that persistently exceed national air quality standards established by the Clean Air Act (EPA 2005b).

Health of Pensacola Bay and Bayou Grande

ATSDR evaluated whether incidentally ingesting the surface water or contacting the sediment while engaged in recreational activities, such as swimming, in Pensacola Bay and Bayou Grande would result in harmful health effects. The concentrations that were present throughout the bay and the bayou were too low to be of health concern. ATSDR also evaluated whether eating fish, crabs, and oysters from Pensacola Bay and Bayou Grande would be expected to result in harmful health effects. The concentrations found in the fish, crab muscle/tissue, and the oyster samples were too low to be of health concern for anyone eating up to 3.5 meals a month (a recreational fishing scenario). However, because the sampling is limited, it would be a prudent public health practice to follow the Florida Department of Health Fish Consumption Advisories. In addition,

the crab hepatopancreas samples contained higher concentrations of several chemicals and some of the estimated exposures approach levels of health concern, therefore, it would also be a prudent public health practice to limit consumption of crab hepatopancreas.

ATSDR does not evaluate ecological health. However, the Navy's ecological assessment is described below.

The Navy performed baseline risk assessments for Pensacola Bay and Bayou Grande to evaluate the potential health hazard and/or cancer risk to people and the environment from contamination at NASP (see EnSafe 1997b, 1999a). The objectives of the baseline risk assessment were to:

- Characterize the source media and determine chemicals of potential concern.
- Identify potential ecological and human receptors and quantify potential exposures.
- Evaluate the adverse effects associated with site-specific contaminants of potential concern.

The Navy determined that, in general, there is limited, low risk to ecological receptors in Pensacola Bay. However, the sediment sampled near the barge loading dock and Coast Guard Station presents a moderate risk to ecological receptors (EnSafe 1997b). No ecological risk was determined for Bayou Grande (EnSafe 1999a). There were some differences in benthic species diversity; however, the toxicity tests showed no effects from exposure to Bayou Grande sediment. Further, species indicative of a healthy environment were found. Surface water concentrations did not indicate that there would be impacts to the fish, and the fish concentrations were not at levels predicted to pose a risk to fish-eating birds. However, a model predicted that there could be a risk to upper trophic level fish.

The Navy concluded that no measurable risk could be attributed to eating crab from Pensacola Bay, the only complete exposure pathway identified (EnSafe 1997b). A human health risk was determined for subsistence fishers in Bayou Grande (EnSafe 1999a). However, this is an unrealistic exposure scenario. Neither commercial nor subsistence fishing occurs in Bayou Grande. The Florida Marine Patrol Office reported that prior to September 11, 2001, approximately 10 boats per day fished in the bayou from April through September and only one or two boats per day fished in the bayou from October through March. Most boats caught only one redfish or one trout per day (EnSafe 1999a, 2003). Since September 11, 2001, NASP and the Coast Guard enforce a 500-foot restricted area along the shoreline adjacent to NASP, which prohibits fishing in this area (EnSafe 2003).

Child Health Considerations

ATSDR recognizes that infants and children may be more sensitive to exposures than adults in communities with contamination in water, soil, air, or food. This sensitivity is the result of a number of factors. Children are more likely to be exposed because they play outdoors and they often bring food outside. Children are shorter than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, potentially resulting in higher doses of chemical exposure per unit body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care. Therefore, ATSDR is committed to evaluating their special interests at sites such as NASP as part of the ATSDR Child Health Initiative.

According to the 2000 census, Pensacola is home to approximately 14,000 children (up to 19 years old), 6,700 who are under the age of 10 years (Bureau of the Census 2000). In addition, families with children live in on-site quarters at NASP. The maximum length of residency is three years (G. Wooten, NASP Housing Department, personal communication, January 2005). Housing is located on the southern portion of the eastern end of NASP, and many areas have playgrounds. A youth center and child care center are located near Duncan and Moffett Roads adjacent to the Cabaniss Crescent officer quarters and Area H townhouse enlisted quarters. None of these areas are co-located with contaminated IRP sites. Children who live on NASP attend school off base.

> In 1993, NASP initiated a blood lead monitoring program as part of the wellness physical. The majority of the pediatric blood lead levels were below the Centers for Disease Control and Prevention's (CDC) effects level of 10 micrograms per deciliter (μg/dl). Because a few of the exposures were above 10 μg/dl, NASP completely abated lead from housing units in 1998.
>
> (S. Forester, Industrial Hygiene Department, personal communication, January 2005)

Children could be exposed to site contamination while participating in recreational activities in Pensacola Bay or Bayou Grande. To evaluate whether children may experience adverse health effects from this exposure, ATSDR estimated potential doses specifically for children. To estimate these doses, ATSDR used protective assumptions that overestimate the levels of actual exposure. *ATSDR concluded that exposure to site contamination at NASP does not pose unique health hazards for children.* The level of contamination found in surface water and sediment collected from Pensacola Bay and Bayou Grande was too low to be of health concern for children exposed through recreational activities. Based on the available data, ATSDR does not expect that eating fish, the edible portion of crab, and oysters from Pensacola Bay and Bayou Grande would cause harmful health effects for children. However, given that the fish sampling is limited, it would be a prudent public health practice for children and pregnant women to be particularly cautious and follow the Florida Department of Health Fish Consumption Advisories, which can be found at http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/ and are provided in Appendix D. Due to the higher concentrations of contaminants found in the crab hepatopancreas, it would also be a prudent public health practice for children and pregnant women to avoid eating that portion of the crab.

Conclusions

On the basis of its evaluation of available environmental information, ATSDR has categorized exposures to contamination at NASP as *no apparent public health hazard*. This means that people may be exposed to environmental contamination, but not at levels which are expected to cause harmful health effects.

- ATSDR evaluated whether incidentally ingesting surface water while engaged in recreational activities in Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting surface water. Therefore, incidental exposure to surface water is not expected to result in harmful health effects.

- ATSDR evaluated whether incidentally ingesting or contacting sediments while engaged in recreational activities in Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations that were present throughout the bay and the bayou were too low to be of health concern for anyone incidentally ingesting or contacting sediment. Therefore, incidental exposure to sediment is not expected to result in harmful health effects.

- ATSDR evaluated whether eating fish caught in Bayou Grande could result in harmful health effects. The concentrations in game fish were too low to be of health concern for anyone eating up to 3.5 meals of fish a month. However, because the sampling is limited, it would be a prudent public health practice for people, particularly children and pregnant women, to follow the Florida Department of Health Fish Consumption Advisories.

  ATSDR also evaluated whether eating blue crabs from Pensacola Bay and Bayou Grande could result in harmful health effects. The concentrations detected in edible blue crab samples were too low to be of health concern for anyone eating up to 3.5 meals of blue crab a month. Therefore, eating blue crab from Pensacola Bay and Bayou Grande is not expected to result in harmful health effects. However, because the blue crab hepatopancreas, or "mustard," samples contained higher concentrations of several chemicals and some of the estimated exposures approach levels of health concern, it would be a prudent public health practice to limit consumption of crab hepatopancreas to two meals per month. If you eat 3.5 meals of blue crab per month, you should not eat any additional meals of crab hepatopancreas.

  ATSDR evaluated whether eating oysters from Bayou Grande could result in harmful health effects. The oyster sampling near NASP is limited—only one sample was collected. The results of that one sample do not indicate that eating oysters would be a health concern. The concentrations present in oysters collected from 22 additional locations throughout the Pensacola area were also too low to be of health concern for anyone eating up to 3.5 meals of oysters a month. Therefore, eating oysters is not expected to result in harmful health effects.

Recommendations

Because the fish sampling is limited, it would be a prudent public health practice for people, particularly children and pregnant women, to follow the Florida Fish Consumption Advisories (available at http://www.doh.state.fl.us/environment/community/fishconsumptionadvisories/ and provided in Appendix D). In addition, due to the higher concentrations of contaminants found in the crab hepatopancreas, it would be a prudent public health practice for children and pregnant women to avoid eating that portion of the crab.

Public Health Action Plan

The Public Health Action Plan (PHAP) for NASP contains a description of actions taken and to be taken by ATSDR and the Navy subsequent to the completion of this public health assessment. The purpose of the PHAP is to ensure that this public health assessment not only identifies potential and ongoing public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions that are completed, ongoing, or planned are listed below.

Completed Actions

- The Navy established the IRP and identified 46 sites at NASP as potential sources of contamination. Records of Decision were submitted for 14 sites. Site Characterization Reports were submitted for 12 sites. Sixteen sites have obtained "no further action" status, and six additional sites are recommended for or are pending no further action. Nineteen sites are being investigated and remediated under the State of Florida Petroleum Program. Seven of these sites originated in the IRP, but were transferred when only petroleum-related contamination was found.

- The Navy also initiated the following RCRA and environmental programs: Groundwater Recovery System, Hazardous Waste Storage, Hazardous Waste Minimization, HAZMART, Natural Resources Conservation, and the Petroleum Program.

- The Navy has kept the community informed about activities at NASP throughout the site's history. In 1989, a Technical Review Committee was established, and in 1995, a Restoration Advisory Board was formed. In addition, the NASP Public Affairs office established and maintained a mailing list of interested community members and organizations.

- In February 1991, ATSDR conducted an initial site visit to NASP. In January 2005, ATSDR revisited NASP to obtain updated information about ongoing environmental activities.

Ongoing Actions

- The Navy is continuing to conduct IRP activities (such as collecting additional environmental sampling data and monitoring) at sites that have not obtained "no further action" status.

- A Remedial Investigation is ongoing at Site 2.

- The Navy is finalizing an Optimization Study Report for Site 1 and a Remedial Investigation Addendum for Operable Unit 2.

Planned Actions

- The Navy plans to conduct site investigations for IRP Sites 44, 45, and 46.

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