Public Health Assessment for

WHITING FIELD NAVAL AIR STATION
(ALIASES: NAVAL AIR STATION WHITING FIELD/
USN NAVAL AIR STATION WHITING FIELD SITE)
MILTON, SANTA ROSA, FLORIDA
CERCLIS NO. FL2170023244
SEPTEMBER 11, 2000

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

PUBLIC HEALTH ASSESSMENT

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Prepared by:

Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
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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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites 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. 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. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but 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 evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

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 warning 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 site 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 a site, 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 their comments. 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: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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LIST OF ABBREVIATIONS

ATSDR	Agency for Toxic Substances and Disease Registry
AVGAS	aviation gasoline
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
BQ	bachelors' quarters
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CREG	Cancer Risk Evaluation Guide
CV	comparison value
1,2-DCA	1,2-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
EMEG	Environmental Media Evaluation Guide
FDEP	Florida Department of Environmental Protection
FS	feasibility study
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
NAS	Naval Air Station
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PHA	public health assessment
PHAP	Public Health Action Plan
ppb	parts per billion
ppm	parts per million
PSC	potential source of concern
RfD	Reference Dose
RI	remedial investigation
RMEG	Reference Dose Media Guide
ROD	record of decision
SVOC	semi-volatile organic compound
TCE	trichloroethylene
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

SUMMARY

Naval Air Station (NAS) Whiting Field is a 2,560-acre installation devoted to training naval aviators. It is located in Santa Rosa County, in the northwest portion of the Florida panhandle, approximately 20 miles northeast of Pensacola and 8 miles north of Milton. Past handling and disposal of chemicals used at NAS Whiting Field, including solvents, paints, degreasers, oil, and fuels, resulted in releases to the environment, either due to accidental spills or leaks or to surface disposal or burial of these substances. Efforts to identify contamination at the installation began in 1985. Since then, 29 sites have been identified under the Department of Defense's Installation Restoration Program (IRP). An investigation of each has been completed, is underway, or is planned. An appropriate remedial alternative that is protective of human health will be selected for each IRP site. There are several plumes of trichloroethylene and its breakdown products, and of benzene, toluene, ethylbenzene, and xylenes (petroleum byproducts) within the installation. Contaminants are thought to be migrating off site in only one location, near the soutbeast corner of the installation.

In 1986, two of NAS Whiting Field's three water supply wells were closed because volatile organic compounds (VOCs) were detected in the wells at concentrations exceeding safe drinking water standards. Benzene concentrations exceeded the state drinking water standard in one well, and trichloroethylene concentrations exceeded the state and federal drinking water standards in the other. Each well reopened after a treatment system was installed to remove the contaminants. As a precautionary measure, a treatment system was also installed on the third water supply well. NAS Whiting Field was placed on the U.S. Environmental Protection Agency's National Priorities List on June 30, 1994, due to contamination detected at the installation, particularly groundwater contamination that had affected the on-site water supply.

The Agency for Toxic Substances and Disease Registry (ATSDR) visited the site in 1994 and 1999 to collect information about how people on and off site might be exposed to environmental contamination and to obtain environmental sampling results. During its review of available information, ATSDR identified the ways that people might be exposed to environmental contamination. Since groundwater is the source of drinking water both on and off site, the most widespread potential pathway for exposure is through drinking contaminated groundwater. Recreational users of Clear Creek and its floodplain may also come into contact with contaminated surface water, sediment, and fish. The exposure scenarios that ATSDR identified and evaluated are detailed below.

No Apparent Public Health Hazards

After evaluating available data, ATSDR concluded that *past exposure to water from the NAS Whiting Field water distribution system* poses no apparent public health hazard. No sampling data are available to assess the levels of contaminants, if any, in NAS Whiting Field drinking water prior to 1984. Limited sampling collected from the NAS Whiting Field distribution system in 1984

did not contain detectable concentrations of contaminants. However, levels of VOCs exceeding safe drinking water standards were detected during sampling of supply wells and the distribution system in 1985 and 1986. Use of the contaminated supply wells was suspended in 1986 until they were fitted with treatment systems. Because of the relatively low levels detected, and the short period of exposure, it is very unlikely that adverse health effects would result from exposure to the maximum levels of VOCs detected in the NAS Whiting Field drinking water. Levels of VOCs detected in more than one sample were several orders of magnitude lower (*i.e.*, 1,000 to 100,000 times lower) than the lowest doses found to cause adverse health effects in animal studies. Thus, ATSDR concludes that it is unlikely that levels of VOCs were high enough to cause adverse health effects to NAS Whiting Field employees and on-site residents.

Exposure to off-site groundwater presents no apparent public health hazard because no one has or is expected to consume drinking water containing site-related contaminants. Groundwater contamination has only been found migrating beyond NAS Whiting Field boundaries near the southeast corner of the installation. In a water well survey, the U.S. Navy determined the locations of private wells near NAS Whiting Field. From this survey, the Navy found one well located in an area downgradient of on-site groundwater contamination, which might be subject to contamination. However, no VOCs were detected in tap water collected from this well. In addition, at the request of homeowners, two other private wells have been sampled. These samples did not contain any VOCs. To ensure that no exposures of health concern occur, ATSDR recommends that the U.S. Navy continue to fully delineate the extent of off-site groundwater contamination and develop and implement a plan to monitor any private wells in the path of contaminant migration and address any detected contamination.

Exposure to surface water, sediment, and fish in the Clear Creek floodplain poses no apparent public health hazard. Clear Creek is difficult to access and thought to infrequently be used for recreation. Furthermore, signs have been posted by the U.S. Navy to warn people of contaminants in the floodplain. Surface water and sediment contaminant levels are too low to cause adverse health effects. No fish tissue data have been identified by ATSDR. However, contaminants that might accumulate in fish were detected in sediment samples only sporadically. This suggests that the contaminants are unlikely to accumulate in fish to levels that would cause adverse health effects to people occasionally consuming the fish. Since exposure to Clear Creek and its floodplain pose no apparent public health hazard, ATSDR recommends that use of this area not be curtailed. The U.S. Navy is planning to conduct further sampling of the creek and floodplain to more fully characterize the contaminants present in the area and to ensure the future safety of this area.

No Public Health Hazard

Current and future consumption of on-site drinking water poses no public health hazard because any VOC contamination is removed by a treatment system at each supply well, water is mixed prior to distribution, and drinking water is monitored regularly to ensure that it meets federal and

state safe drinking water standards. Thus, no exposure to contaminants at levels of health concern will occur. In addition, NAS Whiting Field is planning to remediate sources of groundwater contamination to the extent possible.

A summary of exposure scenarios identified at NAS Whiting Field is presented below.

Exposure Hazard Summary Table—Naval Air Station Whiting Field

Exposure Scenario	Time Frame	Exposure?	Public Health Hazard? *	Actions Taken/ Recommended
Consumption of contaminated on-site drinking water	past current future	yes no no	no apparent no no	• VOCs of concern were detected at concentrations unlikely to cause adverse health effects • In 1986, after VOC contamination was detected, supply wells were closed until activated carbon adsorption filtration systems were installed • Monitoring of water supply wells is ongoing • Remedial actions are underway or planned to address some of the sources of groundwater contamination
Consumption of contaminated drinking water from off-site wells	past current future	unlikely unlikely unlikely	no apparent no apparent no apparent	• A well survey was performed in 1995, and efforts to identify any other private wells in use are ongoing • Tap water at a house served by a private well near site-related contamination was sampled and did not contain VOCs • Two private wells were sampled at the request of homeowners, and no VOCs were detected • ATSDR recommends that the full extent of the contamination near installation boundaries be delineated • If it appears that any private wells might be affected by groundwater contamination migrating from NAS Whiting Field, ATSDR recommends that the U.S. Navy develop and implement a plan for monitoring these wells and addressing any detected contamination
Contact with contaminated surface water, sediment, and/or fish in Clear Creek	past current future	yes yes yes	no apparent no apparent no apparent	• Detected levels of contaminants are too low to pose a health hazard • Signs warning of contamination in the floodplain have been posted in the vicinity • Based on the results of site investigations, an appropriate remedial alternative will be implemented, if needed • ATSDR recommends that recreational use of the Clear Creek area not be curtailed

* Denotes ATSDR category describing level of potential public health hazard. Definitions are listed in Appendix B - Glossary.

BACKGROUND

Site Description and History

Naval Air Station (NAS) Whiting Field is located in the northwest portion of the Florida panhandle, in Santa Rosa County. It is approximately 20 miles northeast of Pensacola and roughly 8 miles from downtown Milton (see Figure 1). The mission of NAS Whiting Field is to train naval aviators in the use of basic instruments, in formation and tactical phases of fixed-wing, propeller-driven aircraft operation, and in the basic and advanced aspects of helicopter operation (ABB-ES 1998a; U.S. Navy 1995).

NAS Whiting Field currently encompasses approximately 2,560 acres and consists of two air fields separated by an industrial area. The air fields are known as North Field, which serves as the fixed-wing aircraft training base, and South Field, where helicopter training occurs. The industrial area contains facilities for industrial and administrative support, as well as military quarters (ABB-ES 1998a; U.S. Navy 1995). Land adjacent to the facility is primarily used for agriculture and forestry. However, within several miles of the facility (primarily to the southwest) are numerous residences and businesses associated with Milton (ABB-ES 1998a; NASWF 1999).

The facility was commissioned as Naval Auxiliary Air Station Whiting Field in 1943. During World War II, naval aviators were trained at the field. Subsequently, the facility was elevated to naval air station status and became the backbone of the Navy's flight training program. NAS Whiting Field has become known as the busiest naval air station in the world (U.S. Navy 1995).

The primary mission of the NAS Whiting Field has always been to train naval aviators, and various training squadrons have been stationed there over time. For example, the Navy's precision flying team, the Blue Angels, was stationed at NAS Whiting Field in 1949 and 1950. Helicopter squadrons have been active at the facility since 1974. Currently, NAS Whiting Field is home for the Training Air Wing Five, which includes fixed-wing squadrons VT-2, VT-3, and VT-6 and helicopter squadrons HT-8 and HT-18. Other groups are stationed at the field to provide support (ABB-ES 1998a; U.S. Navy 1995). There are 12 geographically separate installations associated with NAS Whiting Field. Known as Outlying Landing Fields, they range from 10 to 60 miles from the installation (Armed Forces. com, n.d).

The majority of contamination identified at NAS Whiting Field has resulted from the handling and disposal of products used at the facility over time, including solvents, paints, degreasers, oil, and fuels. Old landfills and disposal areas have also contributed to site-related contamination, as have accidental spills and leaks (U.S. Navy 1995).

Remedial and Regulatory History

In May 1985, an *Initial Assessment Study* of NAS Whiting Field was released. Available records, site reconnaissance, and interviews with long-standing and former employees indicated that most waste generated at the installation was disposed of on site until hazardous waste management programs and oil recycling programs were instituted in the 1970s. The report identified 16 areas (designated Site 1 through Site 16) where contaminants may have been used, stored, treated, or disposed of and concluded that further study of them was warranted (Envirodyne Engineers 1985; ABB-ES 1998a). In December 1985, two sites (termed Sites 17 and 18) were added to the list of areas warranting further study. Data regarding one site identified during the Initial Assessment Study, Site 5, were compiled in a 1985 report. This site, the Battery Acid Seepage Pit, had been the subject of a consent order issued by the Florida Department of Environmental Regulation, later renamed the Florida Department of Environmental Protection (FDEP) (ABB-ES 1998a). Soil and/or groundwater sampling at most of the remaining sites commenced in 1986 (Geraghty & Miller 1986).

On August 18, 1986, the state of Florida requested that one of the installation's water supply wells, known as South Well (Well W-S2), be shut down due the detection of benzene levels exceeding the state's drinking water standard of 1 part per billion (ppb). On September 25, 1986, the State requested that an additional well, known as West Well (Well W-W3), be shut down because the level of trichloroethylene in the water exceeded the state's drinking water standard of 3 ppb. Filtration systems were subsequently installed on the wells to reduce concentrations of volatile organic compounds (VOCs), including benzene and trichloroethylene, to levels below health concern (USEPA n.d.).

Because of the documented contamination of the installation and its water supply, the U. S. Environmental Protection Agency (USEPA) placed NAS Whiting Field on the National Priorities List, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), on June 30, 1994.

In 1990, under the Department of Defense's Installation Restoration Program (IRP), a remedial investigation (RI) at NAS Whiting Field commenced to characterize the nature and extent of contamination at the 18 identified sites. During Phase I of the RI, five additional sites requiring study were identified. These sites were designated Sites 29[1] through 33 and were to be investigated during Phase II of the RI. The six separate locations comprising site 31 were later assigned the designations 31A through 31F (ABB-ES 1995b). Three sites meriting investigation

[1] Site numbers 19 through 28 are not used at NAS Whiting Field because they identify sites under investigation at NAS Whiting Field's Outlying Landing Field Barin in Foley, Alabama. Investigations at that facility are being overseen by the Alabama Department of Environmental Management and the USEPA.

that had been identified in July 1993 were added to the IRP in 1995 (Sites 35[2], 36, and 37). Contamination in these areas was characterized in 1996 and 1997 (ABB-ES 1998b). Site 38 was added to the IRP in 1996.

In 1993, during Phase II RI activities, four drums were found in the Clear Creek floodplain and subsequently removed. Reportedly, this was an isolated incident (ATSDR-DHAC 1995; NASWF 1999). The floodplain was sampled in 1993 and 1997 and was added to the list of IRP sites in 1997 (as Site 39), as was facility-wide groundwater (Site 40). (See Appendix A, which summarizes available information about identified sites and Figure 2.) Pesticide Storage Building 1485C may be added to the list of IRP sites if planned soil and groundwater sampling reveal contamination. The building, which was used for storage of maintenance equipment and pesticides, caught fire in the late 1980s (Tetra Tech, 2000). As a potential site, the area is known as Potential Source of Concern (PSC) 1485C.

In September 1999, a record of decision (ROD) for surface and subsurface soil contamination at Site 1 was issued. The remedial action selected is land use controls, which prohibit residential use of the site and require periodic site inspections, among other things. Activities involving limited human exposure to the site, such as recreation, industrial or commercial uses, or limited agriculture, will be allowed on site (HLA 1999a). A September 1999 ROD for surface and subsurface soil at Site 2 also calls for the adoption of land use controls (HLA 1999b).

RIs and/or feasibility studies (FS) at IRP sites numbered 3 and higher are ongoing. A pilot study to remove petroleum products from soil at Site 4 is underway (Martin 2000). Nine petroleum-contaminated sites have been investigated by NAS Whiting Field's Underground Storage Tank (UST) program. At seven of the sites, sampling did not indicate related groundwater contamination. Appropriate remediation, such as the removal of contaminated soil, is planned at the other two sites, a JP-5 release from a pipeline at the intersection of Hornet and Saratoga Streets and a release of aviation gasoline (AVGAS) from Tanks 1438 and 1439 (Holland 2000b).

ATSDR Activities

In December 1994, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted an initial site visit and met with representatives of NAS Whiting Field, the Naval Environmental Health Center, and other interested governmental agencies, including FDEP (ATSDR-DHAC 1995). After the site visit, ATSDR recommended that a private well survey be performed and potentially-impacted wells be sampled. The U.S. Navy conducted a well survey of private well use within 4 miles of NAS Whiting Field in 1995. During the site visit, warning signs clearly marking most IRP sites were observed (NEHC n.d.).

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[2] Site 34 was initially assigned to the former facility laundry. After a record search and site history review, the site was removed from consideration. Thus, there is no longer a Site 34.

In June 1999, ATSDR conducted another site visit to gain an understanding of current site conditions and of the status of remedial actions, as well as to collect site-related documents and environmental data (NASWF 1999).

Demographics and Land Use

At the time of the 1990 U.S. Census, the total off-site population within one mile of the site was 1,371. Of these individuals, about 82% were white, 13% were black, and the others were of other racial origin. There were 166 children under the age of 6, 38 adults over the age of 65, and 334 females of reproductive age (15-44 years). (These numbers were calculated by ATSDR from 1990 U.S. Census data using an area-proportion spatial analysis technique.)

As of 1995, NAS Whiting Field employed approximately 3,800 military and civilian personnel. At that time, about 600 aviators were earning their wings at the facility each year (U.S. Navy 1995). The average tour of duty at NAS Whiting Field is 1 year, but aviators undergoing training at the installation may reside on site for up to 3 years (NASWF, 1999). An on-site housing facility known as the bachelors' quarters (BQ) typically houses from 100 to 300 military personnel on regular tours of duty (Brown & Root Environmental 1997). During the year ending in October 1999, the average daily residency of the BQ was 362 people (Durbin 2000). Just outside the main gate, there are 82 housing units available to NAS Whiting Field employees. This community, referred to as Magda Village, uses the installation's water supply (ATSDR-DHAC 1995). A larger housing development, called Whiting Pines, also served installation personnel and is located 7 miles south of the installation.

Milton is the largest incorporated municipality in Santa Rosa County. The site vicinity, in northern Santa Rosa County, is largely rural. Downtown Milton is approximately 6 miles southwest of NAS Whiting Field. Other nearby communities are East Milton (approximately five miles to the south), Point Baker (approximately 1.5 miles to the southwest), and Allentown (approximately 2 miles to the north). The 1990 U.S. Census reported 29,520 residents of Milton. According to the Navy, Santa Rosa County has experienced and is still experiencing significant population growth. The population of the county has grown from 55,988 in 1980 to over 90,259 (U.S Navy, 1995).

As of 1983, almost 65% of the county was forested, about 13% was used for agriculture, and only 4% was developed. The primary industries in the county as a whole are agriculture, U.S. Navy activities, manufacturing, forestry, oil, and tourism/recreation. Land to the northwest of NAS Whiting Field is primarily used for agriculture, land to the south and southwest is primarily residential or forested, and land surrounding the remaining borders of the facility is forested (Envirodyne Engineers 1985; U.S Navy, 1995).

Other military facilities in the vicinity are Pensacola NAS, located approximately 23 miles to the southwest, and Eglin Air Force Base, located approximately 10 miles to the southeast of NAS Whiting Field. Eglin Air Force Base is the largest military base in the nation and spans three

counties on the Florida panhandle, including 10% of Santa Rosa County. The Blackwater River State Forest, occupying about 60,000 acres of land, is approximately 10 miles northeast of NAS Whiting Field (Envirodyne Engineers 1985).

Access to NAS Whiting Field is restricted to military personnel, civilian employees, and authorized visitors. The installation is surrounded by a perimeter fence. Signs posted on the fence warn that trespassing is not permitted. People entering the facility must pass through staffed entrance gates. Within installation boundaries, certain contaminated sites are fenced (NASWF 1999).

There are no schools at NAS Whiting Field, although there is an on-site child development center that opened in 1988 (NASWF 1999). The installation also supports a community center, which opened subsequently (Holland 2000b).

Natural Resources

NAS Whiting Field is located on a plateau that slopes to the south. Elevations range from 150 feet to 190 feet above sea level. The land is well-drained; Clear Creek is to the west and south, and Big Coldwater Creek is to the east. The eastern floodplain of Clear Creek is within the boundaries of NAS Whiting Field, but outside of the fencing surrounding the installation (ATSDR-DHAC 1995; ABB-ES 1998a). Big Coldwater Creek is about 2 miles west of the installation boundary. Both creeks are tributaries to the Blackwater River, which feeds the Blackwater Bay, about 7 miles due south of NAS Whiting Field (U.S. Navy 1995). No drinking water intakes on Clear Creek, Big Coldwater Creek, or Blackwater Creek exist (ABB-ES 1998a).

Clear Creek and Big Coldwater Creek have been designated by FDEP as Class III surface waters, a designation applied to water bodies suitable for the propagation of fish and aquatic life and for recreational uses that involve body contact with the water. The Blackwater River is classified as an Outstanding Florida River, affording it recognition as a water body of exceptional recreational and ecological significance (ABB-ES 1998a).

When land was cleared for North and South Fields in the 1940s, concerns about the possibility of erosion led to the implementation of several soil conservation measures. Slope contouring and a system of concrete-lined drainage ditches were instituted to channel surface water runoff from runway, support, and industrial areas at NAS Whiting Field to either Clear Creek or Big Coldwater Creek. Five ditches run southwest from points on the west side of the facility to Clear Creek. From north to south, they are E Ditch, C Ditch, New A Ditch, New M Ditch, and New S Ditch. "New" ditches were reconstructed in the 1950s. Two ditches originating on the east side of the facility, P Ditch and Y Ditch, run east to a tributary of Big Coldwater Creek (ABB-ES 1998a; NASWF 1999).

Studies of hydrogeologic conditions at NAS Whiting Field indicate that some groundwater on the west side of the installation, flowing to the south or southwest, recharges Clear Creek. In addition, until April 1998, discharge of "secondary-treated" sewage effluent from the Sanitary Wastewater Treatment Plant at NAS Whiting Field, several hundred feet north of Site 31A, entered Clear Creek. Since April 1998, wastewater has been routed to the Milton wastewater treatment plant (ABB-ES 1993a; NASWF 1999).

Big Coldwater Creek, about 2 miles from the facility, is reportedly heavily used for recreation. However, this creek is not thought to be affected by NAS Whiting Field-related contamination. Clear Creek runs through the southwest corner of the installation. However, in this area, the creek is surrounded by dense vegetation, and few locations for public access exist. A small number of nearby residents are, however, thought to access the creek (NASWF 1999). Furthermore, there was a portion of NAS Whiting Field, at the southwest corner of the facility, that the Boy Scouts of America were permitted to use by the installation. Occasional Boy Scout use occurred from approximately 1987 to 1994. A fence separated the area used by the Boy Scouts from the remainder of the installation. Most Boy Scout activity is thought to have been restricted to a cleared area within a loop at the end of the access road to the camp. This area is about 1,000 feet from Clear Creek. The remainder of the 41-acre camp is forested (Gibson 2000).

Quality Assurance and Quality Control

In preparing this public health assessment (PHA), ATSDR reviewed and evaluated information provided in the referenced documents. Documents prepared for the CERCLA and Resource Conservation and Recovery Act programs must meet specific standards for adequate quality assurance and control measures for chain-of-custody procedures, laboratory procedures, and data reporting. The environmental data presented in this PHA are from U.S. Navy reports, including investigations of the IRP sites, as well as from information provided by FDEP and NAS Whiting Field on samples collected from the NAS Whiting Field drinking water supply system and from private wells. Based on our evaluation, ATSDR determined that the quality of environmental data available in site-related documents is adequate to make public health decisions.

EVALUATION OF ENVIRONMENTAL CONTAMINATION AND EXPOSURE SCENARIOS

Introduction

What is meant by exposure?

ATSDR's public health assessments are exposure, or contact, driven. Chemical contaminants disposed or released into the environment have the potential to cause adverse health effects. However, *a release does not always result in exposure*. People can only be exposed to a chemical if they come in contact with the chemical. Exposure may occur by breathing, eating, or drinking a substance containing the contaminant or by skin contact with a substance containing the contaminant. To acquaint readers with terminology used in this report, a glossary is included in Appendix B.

How does ATSDR determine which contaminants and exposure situations to evaluate?

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

If exposure was or is possible, ATSDR scientists then consider how often exposure occurs and whether contamination is present at levels that might affect public health. ATSDR selects contaminants for further evaluation by comparing them against health-based comparison values. Comparison values are developed by ATSDR from scientific literature available on exposure and health effects. These comparison values are derived for each of the different media and reflect the estimated contaminant concentration that is *not likely* to cause adverse health effects for a given chemical, assuming a standard daily contact rate (e.g., amount of water or soil consumed or 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), 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 are described in the glossary in Appendix B and include ATSDR's environmental media evaluation guides (EMEGs), reference dose media guides (RMEGs), cancer risk evaluation guides (CREGs), and USEPA's reference

doses (RfDs) and maximum contaminant levels (MCLs). MCLs are enforceable drinking water regulations, while CREGs, EMEGs, and RMEGs are non-enforceable, health-based comparison values developed by ATSDR for screening environmental contamination for further evaluation.

More information about the ATSDR evaluation process can be found in ATSDR's Public Health Assessment Guidance Manual at http://www.atsdr.cdc.gov/HAC/HAGM/ or by contacting ATSDR at 1-888-42ATSDR.

If someone is exposed, will they get sick?

Exposure does not always result in harmful health effects. The type and severity of health effects that occur in an individual from contact with a contaminant depend on the exposure concentration (how much), the frequency 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, life style, 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 as a result of exposure to a contaminant in the environment.

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 high-end, 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 to which people are actually exposed. If the exposure levels indicate that adverse health effects are possible, then a more detailed review of exposure combined with scientific information from the toxicological and epidemiologic literature about the health effects from exposure to hazardous substances is performed.

Figure 4 provides an overview of ATSDR's exposure evaluation process.

Potential Exposures of Concern at NAS Whiting Field

ATSDR identified the on-site and off-site groundwater and surface water, sediment, and fish exposure pathways for further evaluation. Soil exposures are not a public health hazard and are not discussed in detail in this document because there is no public exposure to on-site soil and exposure to authorized workers is sufficiently infrequent that the low contaminant levels detected would not cause adverse health effects. Table 1 provides a summary of ATSDR's evaluation of potential exposure pathways.

Concern: Exposure to On-site Groundwater

Levels of certain VOCs exceeding ATSDR comparison values were detected in NAS Whiting Field production wells in the mid-1980s. The contamination in these wells was subsequently addressed by remedial actions. Could past exposure to the on-site water supply have resulted in adverse health effects?

Conclusions

Based on the following evaluation, ATSDR has determined that past consumption of on-site drinking water poses no apparent public health hazard.

Prior to installing treatment systems at each well in 1986, elevated concentrations of VOCs were detected in samples from the NAS Whiting Field distribution system and from two of the supply wells. The detected concentrations are unlikely to cause adverse health effects. The samples analyzed in 1984 did not contain detectable concentrations of VOCs. The highest concentrations of contaminants detected more than once in 1985 and 1986 were several orders of magnitude (*i.e.*, 1,000 to 100,000 times) lower than the lowest levels known to cause adverse effects in animals. Water from the supply wells is routinely mixed, so that any contamination present would have been diluted by unaffected water. Also, because it is unlikely that VOCs reached levels high enough to cause adverse health effects, past consumption of on-site drinking water poses no apparent public health hazard.

Discussion

Hydrogeology

The surficial aquifer underlying NAS Whiting Field, known as the sand-and-gravel aquifer, is the major water-bearing unit in the area. This aquifer is believed to be 200 to 350 feet thick in the vicinity of the installation. In some areas, the aquifer is separated by layers of clay or clayey sand into an upper and a lower zone. These clay lenses, which may be as much as 60 feet thick, are considered leaky confining layers. All recharge to the aquifer comes from rainfall, and the upper zone is the primary source of recharge to the lower zone, which is more productive. Groundwater also may discharge to surface water bodies, such as creeks (ABB-ES 1998a).

Underlying the sand-and-gravel aquifer is an intermediate aquifer system, which is not a significant water-producing unit in Santa Rosa County. Other layers, most notably the Floridan aquifer system, are present under NAS Whiting Field, but have not been studied during IRP-related investigations of the facility (ABB-ES 1998a).

In the western half of NAS Whiting Field, groundwater generally flows to the south-southwest (toward Clear Creek), while it flows to the southeast (toward Big Coldwater Creek) in the eastern

half of the installation. In certain areas, especially in the central part of the installation, groundwater flows to the south. Wells drilled in connection with the RI have indicated the depth to the water table in certain parts of the facility. In the northwest corner of the installation, groundwater is first encountered between 65 and 115 feet below ground surface (bgs). In the southwest corner of the installation, groundwater is encountered at about 20 to 100 feet bgs (ABB-ES 1995a). Depending on the depth to groundwater in the upper zone of the aquifer, groundwater in the lower zone of the aquifer may be found from approximately 100 to 180 feet bgs or deeper (ABB-ES 1998a).

On-site Groundwater Use

Potable water is supplied to NAS Whiting Field from three wells in the industrial area, all screened in the sand-and-gravel aquifer. W-N4, known as North Well, is located at the southeast corner of the intersection of Wasp Street and Saratoga Street. It was installed in 1975 and draws water from approximately 220 feet bgs. W-W3, known as West Well, is located on the east side of Saratoga Street, between Yorktown Street and Langley Street. Installed in 1965, it draws water from 170 to 210 feet bgs. Finally, W-S2, known as South Well, was installed in 1951 and draws water from approximately 170 to 225 feet bgs. It is located east of Saratoga Street, about 750 feet south of Langley Street (ABB-ES 1998a). Figure 5 depicts the three installation supply wells. West Well and South Well were temporarily closed in late 1986 and subsequently reopened after activated carbon adsorption filtration systems were installed to address VOC contamination. As a precautionary measure, an activated carbon adsorption filtration system has also been installed on North Well.

After water is pumped through the filtration system at each well, it is pumped to the installation's water treatment plant. After treatment (e.g., flouridation), water is pumped to four on-site water towers. When the level of water in any of the towers begins to get low, the water system operator pumps water to it by turning on one or two wells, depending on need. Use of the three production wells is cycled (Auston 2000). The drinking water supply system is subject to state and federal safe drinking water requirements for water supply systems that serve more than 3,500 users (ATSDR-DHAC 1995). Since the water is fluoridated, fluoride levels are tested daily, and nitrate/nitrite is sampled annually. The state of Florida also requires that samples be analyzed for semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), metals, and radionuclides every 3 years. North Well is also sampled for 1,2-dibromoethane semi-annually. Because of past VOC detections in NAS Whiting Field water supply wells, the installation is required by regulators to analyze samples for VOCs from each well every 6 months. However, NAS Whiting Field analyzes samples for VOCs every month (Touart 2000).

Six other wells previously supplied potable water to NAS Whiting Field. Wells W-N1, W-S1, and W-W1 were installed in 1943, when the installation was built. Most information about the design of these wells is unavailable. These three wells were abandoned in 1951 and replaced by Wells W-N2, W-S2, and W-W2, drilled within 75 feet of the original wells. The new wells, designed to

draw water from over 170 feet bgs. Although records on the construction of these wells are not clear on the matter it is likely that they were installed to deliver increased yields. Because of unacceptably high levels of iron in the water they delivered, Well W-W2 was abandoned and replaced by Well W-W3 in 1965, and Well W-N2 was abandoned and replaced in 1975. Well W-N3, a test well, also produced water with unacceptably high levels of iron, and therefore the well known as Well W-N4 replaced Well W-N2. Well W-S1 was immediately adjacent to Well W-S2, Wells W-W1 and W-W2 were near the intersection of Ranger Street and Langley Street, and Wells W-N1, W-N2, and W-N3 were near the intersection of Hornet Street and Saratoga Street. (ABB-ES 1998a; Geraghty & Miller 1984, 1986)

Nature and Extent of Contamination

VOCs, SVOCs, metals, and pesticides have been detected in groundwater samples collected from various sites under investigation at NAS Whiting Field. Pesticides and metals do not tend to be transported significant distances by groundwater flow, as they adhere to soil particles. Pesticides have only been encountered at a few sites. Appendix A provides the locations and levels at which chemicals have been detected in on-site groundwater. The contaminants of greatest concern are two classes of VOCs, which originate from petroleum products and solvents, respectively.

Benzene, toluene, ethylbenzene, and xylenes (or BTEX compounds, which are petroleum byproducts) affect much of the groundwater underlying the installation. A primary source of these contaminants is thought to be Site 4, the North AVGAS Tank Sludge Disposal Area, also an UST site. There is an ongoing effort to remove petroleum products from the soil at the site, which is located near the North Field Maintenance Hangar (Site 32). Plumes of BTEX compounds in the upper and lower zones of the aquifer are located near the North Field Maintenance Hangar and South Field Maintenance Hangar (Site 30, located near the South AVGAS Tank Sludge Disposal Area and associated USTs, Site 7), as well as in groundwater at Site 5 (the Battery Acid Seepage Pit), not far from the Midfield Maintenance Hangar (Site 33). Levels of benzene thought to originate from Site 4 (as suggested by testing to "fingerprint" the contamination) have been detected in the lower zone of the aquifer at Sites 15 and 16, just northeast of Clear Creek (Martin 2000).

There are also thought to be plumes of the solvent trichloroethylene (TCE) and its breakdown products affecting groundwater underlying NAS Whiting Field. The source of this contamination is not known. Until 1985, however, TCE was used as a cleaner on site, particularly in the maintenance hangar areas (Martin 2000). TCE and its breakdown products are present in the upper and lower zones of the aquifer near the North Field and South Field Maintenance Hangars, in the upper zone near the Midfield Maintenance Hangar, and in the lower zone at Sites 15 and 16 (both disposal areas). The compounds have also been detected at low levels in several samples from the upper zone of the aquifer and one groundwater sample from the lower zone, near Sites 35 through 37 (facilities used for public works, auto repair, and painting) and in the upper zone groundwater at Sites 11 and 13 (both disposal areas).

The first sample analyzed from the installation's water distribution system (*i.e.*, the system and not an individual supply well) for which records are available was in February 1984 and did not contain detectable levels of VOCs, SVOCs, or pesticides (Geraghty & Miller 1984). Records from FDEP's Potable Water Section do not show a February 1984 sample, but do show a sample from the NAS Whiting Field water distribution system collected in March 1984 that did not contain any detectable levels of contaminants (Touart 2000). It is possible that the two reports of sampling in 1984 are actually referring to the same sample.

A sample collected from South Well, near Site 5, on November 1, 1985, contained 4 ppb of TCE. A sample from the installation's water distribution system was also collected that day and contained 7 ppb of TCE, exceeding the ATSDR comparison value (i.e. screening value) of 5 ppb (Geraghty & Miller 1985). According to state records, the next samples collected at the installation were from South Well, in which 4 ppb of benzene was detected on March 21, 1986, 2 ppb of benzene was detected on April 21, 1986, 49 ppb of vinyl chloride was detected on May 21, 1986, and 4 ppb of benzene was detected on July 21, 1986. These concentrations exceed ATSDR comparison values for benzene and vinyl chloride, respectively, as well as state drinking water standards. For this reason, South Well was shut down on August 18, 1986. Although the well was not in use at the time, samples from South Well collected from October 1986 through January 1987 contained levels of benzene reaching 17 ppb. Vinyl chloride was not detected in any samples from South Well other than the one analyzed in May 1986 (Touart 2000; Hendon Engineering Associates 1989).

NAS Whiting Field documents indicate that the first sample taken directly from West Well, on September 14, 1986, contained 7.9 ppb of TCE. West Well was closed 11 days later. The level of TCE measured in the well while it was closed reached 10.5 ppb, but after a filtration system was installed, only trace levels of TCE were detected, and the well reopened December 1, 1986. No contaminants were detected in North Well in the 1980s during six sampling events, other than a trace level of toluene in one sample (Hendon Engineering Associates 1989).

The first recorded sample taken from the distribution system subsequent to the November 1985 sample was collected in October 1986, at which time only North Well was operating. The sample did not contain detectable levels of any contaminants. A January 7, 1987, distribution system sample contained 7.8 ppb of benzene, which exceeds both the Florida drinking water standard and the ATSDR comparison value (Touart 2000; Hendon Engineering Associates 1989).

In the 1990s, VOCs were detected sporadically in treated water leaving one of the three supply wells. 1,1-Dichloroethene was detected in the West Well at 0.8 ppb in January 1996, 0.9 ppb in July 1996, 0.75 ppb in March 1997, and 0.7 ppb in April 1997. 1,2-Dichloroethane was detected at 0.51 ppb in a sample collected on August 5, 1994, (noted as "West Well and South") and at 0.52 ppb in a sample from North Well collected on August 12, 1994. 1,2-Dichloroethane was not detected in subsequent samples from any location at concentrations above the detection limit of 0.5 ppb (Touart 2000). In January 1999, 1.2 ppb of bromodichloromethane and 0.7 ppb of

dibromochloromethane were detected in treated water leaving North Well (Aqua Tech 1999a). However, they were not detected in July 1999 (Aqua Tech 1999b). While these VOCs have been detected at concentrations exceeding ATSDR's comparison values in the 1990s, they have not exceeded federal or state safe drinking water standards.

Radionuclides and VOCs were sampled in all three wells in January 1999, and SVOCs, pesticides and PCBs, and metals were sampled in August 1999. Only benzo(a)pyrene, detected at 0.03 ppb in North Well and West Well and 0.02 ppb in South Well, was detected above ATSDR's comparison values, but below federal and state safe drinking water standards. Due to these detections, samples from all three wells will be analyzed for benzo(a)pyrene quarterly for 1 year and then annually for 3 years. October 1999 sampling did not reveal measurable levels of the contaminant in any of the wells (Touart 2000).

Evaluation of Potential Public Health Hazards

In the mid-1980s, low levels of VOCs exceeding ATSDR comparison values were detected in individual production wells and, in two instances, in the water distribution system. Samples collected in 1984 from the distribution system did not contain any VOCs. Since vinyl chloride was only measured in South Well in one of five 1986 samples, and water from South Well was mixed with water from North and West Wells prior to distribution, it is unlikely that anyone was exposed to vinyl chloride at doses of health concern. Moreover, within 3 months of the vinyl chloride detection, South Well was temporarily deactivated. Other VOCs were not detected at levels of health concern, even for the worst-case scenario which assumes that an individual consumed (unmixed) water containing VOCs at the highest detected concentrations for a number of years.

The highest detected concentrations of these VOCs would result in doses several orders of magnitude (*i.e.*, 1,000 to 100,000 times) lower than the lowest doses at which they were found to cause health effects in available animal studies. It is unlikely that VOC concentrations would have been high enough to cause adverse health effects prior to the mid-1980s. Thus, past consumption of on-site drinking water poses no apparent public health hazard. Current and future consumption of on-site drinking water poses no public health hazard because levels of VOCs are monitored monthly to ensure that the water meets all state and federal safe drinking water standards. ATSDR is available to review the results of future sampling of installation supply wells.

Concern: Exposure to Off-site Drinking Water

Has contaminated groundwater from NAS Whiting Field moved off site, and does it impact any municipal or private wells in the vicinity?

Conclusions

Consumption of water from off-site wells poses no public health hazard because exposure to contaminated water has not occurred and is unlikely to occur in the future. The U.S. Navy has performed a survey of all private and municipal wells within 4 miles of NAS Whiting Field. In order to insure that no wells exist that have not been located by surveys to date the Navy continues to make efforts to ascertain the location of nearby private wells. In ongoing environmental investigations, The U.S. Navy is continuing to delineate groundwater contamination plumes originating at NAS Whiting Field. If it appears that any private wells might be in the path of contaminant migration, ATSDR recommends that the U.S. Navy develop and implement a plan for monitoring these wells and for addressing any detected contamination. At present, the only location in which groundwater contamination appears to be migrating off site is to the east of Site 13. A nearby home served by a private well did not contain any VOCs. To date, no VOCs have been detected in a monitoring well about 300 feet upgradient of the home. If future sampling and hydrogeological investigations indicate plume movement towards private wells, ATSDR recommends that the private wells be sampled.

Discussion

Off-site Groundwater Use

Milton's public water supply system relies on six wells screened in the sand-and-gravel aquifer. Wells 1, 2, and 3 supply potable water to areas east of NAS Whiting Field, including residential areas on East Gate Road and along Red Bug Road. Wells 4, 5, and 6 supply potable water to north Milton and suburban areas to the north and west of Milton. All of the Milton water supply wells are more than 2.5 miles southwest of NAS Whiting Field (ABB-ES 1998a).

Potable water is supplied to areas to the south and west of NAS Whiting Field by the Point Baker water supply system, which operates four wells. Point Baker Well 4 is northwest of the installation and serves the Allentown area. Since it is not downgradient of NAS Whiting Field, this well is not expected to be affected by site-related contamination. Point Baker Well 2 is dry. Point Baker Wells 1, 3, and 5 are connected to each other by pipelines and serve the population to the south and west of NAS Whiting Field (ABB-ES 1998a). Well 1 is about 2.5 miles due west of the installation, while Wells 3 and 5 are about 1 mile southwest and about 3 miles southwest of the facility, respectively. All wells are screened in the sand-and-gravel aquifer.

In 1995, a survey of wells within 4 miles of NAS Whiting Field identified 64 domestic wells, 5 agricultural wells, and 61 wells used for landscaping, as well as the nine public supply wells previously discussed. Four domestic wells and one well used for landscaping were identified within 0.5 miles of the installation. All of these wells are located due west of the industrial area, in the vicinity of the intersection of Route 87A and Route 87. One well used for agriculture was identified just under 1 mile southeast of NAS Whiting Field. An additional well, used for

landscaping, is located between 0.5 miles and 1 mile west of the boundary of the installation. In the area between 1 and 2 miles away, there are an additional 10 domestic wells, 8 landscape wells, and 1 agricultural well. Between 2 and 3 miles from the facility, there are 14 domestic wells and 13 landscape wells. Finally, there are 36 domestic wells, 38 landscape wells, and 3 agricultural wells located between 3 and 4 miles from NAS Whiting Field. (ABB-ES 1998a)

During the well survey, the Public Works Department of the city of Milton, the Point Baker water supply office, and the Northwest Florida Water Management District were contacted. Created in 1976, the District requires homeowners to obtain a permit before drilling a well. Prior to 1976, there was no requirement that private wells be permitted by or registered with any government agency. However, personnel overseeing remediation at NAS Whiting Field believe that all private wells that may be located near installation groundwater contamination have been identified, as visual inspections have been conducted of nearby private properties to look for private wells during groundwater sampling events near installation boundaries (Martin 2000). Two additional wells were identified this way, and they were sampled subsequent to the well survey. One is located just east of Site 13, off East Gate Road, and the other is west of Clear Creek (Durbin 2000).

Nature and Extent of Contamination

There is only one known area—east of Site 13—in which groundwater contamination originating at NAS Whiting Field is thought to be migrating off site. In 1997, 1,2-dichloroethene was detected in samples from an off-site monitoring well about 1,200 feet southeast of Site 13's southeastern corner, an estimated concentration of 3 ppb in June 1997, and an estimated 2 ppb in late October 1997. In April 1998, NAS Whiting Field sampled tap water from a home served by a private well on East Gate Road that is about 600 feet northeast (crossgradient) of the well in which the 1,2-dichloroethene was detected. No VOCs were detected in the tap water sample. In addition, no VOCs have been detected in a monitoring well about 300 feet northwest (upgradient) of the home and about 800 feet north of the well in which 1,2-dichloroethene was detected.

After VOC contamination was detected in two NAS Whiting Field supply wells in 1986, the Santa Rosa County Health Department sampled certain wells in the vicinity of the installation. Three wells about a mile or more from the installation were sampled on October 8, 1986, as were Milton Wells 1 through 5 and Pace Wells 3 through 5. The Milton and Pace supply wells are more than 4 miles southwest of the installation. No organic contaminants were detected in any of the wells, other than a trace of bromoform found in Milton Well 4 (Hendon Engineering Associates 1989).

The Santa Rosa County Public Health Unit has sampled, at the homeowner's request, a private well just under 0.5 miles west of the center of the installation, off Route 87. No VOCs or SVOCs were detected (Florida DHRS 1992). NAS Whiting Field has also sampled a private well downgradient of the installation, to the west of Clear Creek, in response to a request from a homeowner. No VOCs were detected in the May 1997 sample. ATSDR has not identified any

other sampling of off-site private wells. Municipal water distribution systems are sampled regularly, as required by the Safe Drinking Water Act.

Evaluation of Potential Public Health Hazards

NAS Whiting Field is planning to install and sample groundwater monitoring wells to continue to fully delineate the extent of all groundwater contamination plumes (Martin 2000). The installation has also performed a well survey and continues to make efforts to ascertain the location of nearby private wells. The only location in which groundwater contamination from NAS Whiting Field is thought to be migrating off site is southeast of Site 13. Tap water was collected and analyzed from one house (located near the off-site contamination) using a private well. The water did not contain any VOCs. Since no exposure to contaminants at levels of health concern has been found or is expected, ATSDR concludes that off-site groundwater contamination poses no apparent public health hazard. However, if any VOCs are detected in the future in the monitoring well east of Site 13 and about 300 feet northwest (upgradient) of the home, ATSDR recommends that the private well be resampled.

ATSDR recommends that the U.S. Navy fully delineate the extent of the groundwater plumes near installation boundaries to determine whether any private wells might be in the path of contaminants migrating from NAS Whiting Field. If it is appears that any private wells might be affected, the U.S. Navy should develop a plan to monitor these wells and address any detected contamination to ensure that no exposures occur to contaminant levels of health concern.

Concern: Exposure to Clear Creek Floodplain

Could exposure to potentially-contaminated surface water, sediment, and/or fish in the Clear Creek floodplain pose public health hazards? Should public recreational use of this area be restricted?

Conclusions

After reviewing available information about exposure to the Clear Creek floodplain and associated sampling data, ATSDR concluded that contaminants in surface water and sediment pose no apparent public health hazard. Since Clear Creek is difficult to access, recreational use is thought to be limited. While recreational users of the area might come into contact with selected contaminants at concentrations exceeding CVs, detected concentrations of contaminants are not high enough to cause adverse health effects to individuals who come into contact with them briefly and infrequently. Thus, ATSDR does not recommend that recreational use of Clear Creek or its floodplain be curtailed.

No fish tissue samples are available. However, contaminants that might accumulate in fish have only been detected in sediment samples sporadically and therefore are not expected to have

accumulated in fish to levels of health concern. According to information received by ATSDR, any fishing that may occur in Clear Creek is infrequent. Occasional consumption of fish from the creek, like exposure to surface water and sediment, is therefore not expected to result in adverse health effects.

Discussion

Nature and Extent of Contamination

Surface water samples from Clear Creek analyzed in 1990, 1992, and 1997 have revealed concentrations of benzene, bromodichloromethane, dibromochloromethane, arsenic, cadmium, manganese, and thallium at levels exceeding drinking water comparison values. Sediment samples from the Clear Creek floodplain have contained benzo(a)pyrene, bis(2-ethylhexyl)phthalate, dieldrin, Aroclor-1260, arsenic, cadmium, iron, and lead at concentrations exceeding soil comparison values. See Appendix A for the maximum detected concentrations of these contaminants. The floodplain may be affected by contaminants being transported down New "A" Ditch or New "M" Ditch, contaminants in groundwater that recharges the creek, and/or contaminants that were present in four drums that were removed from the creek bed in 1993. No fish sampling data are available.

Evaluation of Potential Public Health Hazards

To evaluate whether past, current, or future hazards might be associated with Clear Creek contamination, ATSDR evaluated contaminant levels present in surface water and sediment and the potential for exposure to these media. Based on this review, ATSDR concluded that past, current, and future use of the area pose no apparent public health hazard.

Signs are posted around Clear Creek within NAS Whiting Field property to warn people of contamination detected in the floodplain (Holland 2000a). Nonetheless, recreational users may come into contact with certain site-related contaminants at levels exceeding drinking water and/or surface soil comparison values on and off site. Detected concentrations have been compared to drinking water and soil comparison values because no surface water or sediment comparison values are available.

The available comparison values assume daily exposure to contaminants in water and soil. However, Clear Creek is not used as a drinking water source. Recreational exposures (via dermal contact or ingestion) to contaminants in Clear Creek and its floodplain are expected to be incidental, infrequent and of shorter duration than the long-term, frequent exposure scenarios assumed for deriving drinking water and soil comparison values. Exposures to the levels of contaminants detected in surface water and sediment are not expected to cause adverse health effects.

ATSDR has been advised that Clear Creek is difficult to access and is infrequently used for fishing, if used at all. Contaminants that might accumulate in fish (pesticides and PCBs, for example) have only been detected sporadically at concentrations above CVs. Based on the infrequency of their detection, it is not expected that these contaminants have accumulated in fish at levels that would be of health concern to people occasionally consuming the fish.

NAS Whiting Field is planning to conduct further surface water and sediment sampling in the Clear Creek floodplain, known as Site 39. ATSDR is available to review the findings of future evaluations and will revise its conclusions, if appropriate. After an RI/FS is completed, the installation will select a remedy to address contaminants that have affected the floodplain. This remedy is expected to prevent future exposure to contamination.

COMMUNITY HEALTH CONCERNS

During the site visits and in the conduct of the public health assessment, ATSDR met with Navy and NAS Whiting Field personnel, state and federal regulators and local government officials to discuss community concerns. No community health concerns associated with NAS Whiting Field have been brought to ATSDR's attention.

A community relations plan for NAS Whiting Field provides guidance for involving the community and other interested parties in the decision-making process for selecting remedial alternatives and keeping the community informed about site-related activities. Public meetings are held to inform citizens of ongoing remedial activities and to solicit their input. NAS Whiting Field officials have also given community presentations and are available to discuss any concerns that community members have. The public may review site-related documents, including RI reports and correspondence relating to cleanup activities, at a repository at the Milton Branch of the West Florida Regional Library (U.S. Navy 1995). A Restoration Advisory Board composed of community members and representatives of the U.S. Navy, U.S. EPA and FDEP meets regularly to discuss and review ongoing activities at NAS Whiting Field.

If, during the public health assessment process or after, concerns are raised, ATSDR will provide assistance in providing appropriate answers.

ATSDR CHILD HEALTH INITIATIVE

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 a result of a number of factors. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. Children are shorter than adults, which means they breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per 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 NAS Whiting Field as part of the ATSDR Child Health Initiative.

ATSDR has attempted to identify populations of children in the vicinity of NAS Whiting Field. Approximately 166 children under the age of 6 years (approximately 12 percent of the total population) live within 1 mile of the installation (as calculated by ATSDR from 1990 U.S. Census data using an area-proportion spatial analysis technique). An on-site childcare center, which opened in 1988, serves about 60 children (NASWF 1999). There are no schools within a mile of the installation.

Like other people living or working at or in the vicinity of NAS Whiting Field, children may contact contaminated site media. As discussed in the "Evaluation of Environmental Contamination and Exposure Scenarios" section of this PHA, past, current, and future exposures for children only include contact with surface water and sediment during recreational use of the Clear Creek floodplain.

In evaluating whether children may experience adverse health effects through past, current, or future exposures to site contaminants, ATSDR used very conservative assumptions that overestimate the levels of actual exposure. *ATSDR concluded that exposure to site contamination does not pose unique health hazards for children.* This conclusion is based on ATSDR's exposure evaluation and the fact that detection of chemicals above comparison values, which are only screening values, does not necessarily imply that harmful exposure occurred.

During recreational use of Clear Creek, children may be and may have been exposed to contaminants detected in surface water or sediment. However, children would only have the opportunity to come into contact with these media briefly and infrequently. No surface water and sediment comparison values are available; therefore, contaminant concentrations detected in these media were compared to drinking water and surface soil comparison values, respectively. These comparison values are derived using conservative assumptions about daily exposures. Recreational use of the creek would occur less frequently than assumed by the comparison values. Exposure to the maximum contaminant concentrations detected in surface water and sediment are not expected to result in adverse health effects.

Although no fish tissue data are available, contaminants that might accumulate in fish have only been detected in sediment samples sporadically. Therefore, fish are not expected to be contaminated at levels of health concern to children infrequently consuming them.

CONCLUSIONS

On the basis of its evaluation of available environmental information, ATSDR reached the following conclusions about potential exposures at NAS Whiting Field:

1. *No apparent public health hazard is associated with past consumption of drinking water from on-site wells at NAS Whiting Field.* VOCs were detected in installation supply wells in the mid-1980s, but the concentrations of contaminants that were either detected in single samples and not detected in repeated sampling, or were present in concentrations several orders of magnitude (*i.e.*, 1,000 to 100,000 times) lower than levels known to cause adverse health effects in animals. Thus, it is unlikely that VOCs reached levels of health concern prior to 1984, when sampling began. Contaminated wells were taken offline in 1986 and returned to service only after activated carbon adsorption filtration systems were installed to reduce levels of VOCs. Currently, the water supply system is monitored monthly for VOCs and regularly for other contaminants to assure that drinking water meets state and federal safe drinking water standards. *Therefore, no public health hazard is associated with current or future consumption of drinking water from on-site wells.*

2. *No apparent public health hazards are associated with past, current, or future consumption of water from off-site wells because no one is expected to be exposed to contaminated drinking water.* The U.S. Navy has made efforts to locate the private wells surrounding NAS Whiting Field. It is also in the process of establishing the extent of all groundwater contaminant plumes originating from the site. Only one well that may be in the path of contaminant migration has been identified. The well was sampled and no contaminants were detected.

3. *No apparent public health hazards are associated with exposures to surface water, sediment, or fish in the Clear Creek floodplain.* Recreational use of the creek is expected to be infrequent because it is difficult to access. Furthermore, warning signs have been posted. While surface water and sediment samples have contained contaminant concentrations exceeding comparison values, levels are too low to result in adverse health effects from recreational exposures. While no fish tissue samples are available, contaminants that would accumulate in fish have only been detected in sediment samples sporadically and are unlikely to accumulate in fish at levels of health concern to individuals occasionally consuming the fish.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for NAS Whiting Field contains a description of actions taken, planned, and recommended to be taken by ATSDR, the U.S. Navy, and USEPA 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 also 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, and recommended are listed below.

Completed Actions:

1. The U.S. Navy identified possible sources of contamination during several investigations.

2. In 1986, two supply wells in which VOCs had been detected were closed until activated carbon adsorption filtration systems could be installed. A similar system was also installed on the third NAS Whiting Field supply well.

3. The U.S. Navy conducted a survey of off-site private and municipal wells and looked for private wells near installation boundaries.

4. Private well sampling was conducted at three residences. Two homeowners requested the sampling, and the tap water at the third residence was sampled because the private well serving the residence was near a well in which low levels of a VOC had been detected.

5. The U.S. Navy investigated contamination at Sites 1 and 2, and RODs for the two sites have been signed.

6. Remedial investigations have been completed for Sites 3, 4, 6, 9, 10, 12, 13, 14, 15, 30, 32, and 33. Investigations have also been completed at three petroleum-contaminated sites under the UST program.

7. Interim remedial actions were conducted at Sites 9, 10, 17, 18 over which two feet of clean fill have been placed. At Site 31C , soil contamination exceeding residential standards was excavated and replaced with clean fill. Contaminated soil was removed from two UST sites.

8. Warning signs were placed around many of the sites under investigation, including Site 39, the Clear Creek floodplain.

Ongoing or Planned Actions:

1. Each NAS Whiting Field water supply well is regularly sampled for contaminants, including VOCs, for which samples are analyzed monthly.

2. Remedial investigations, including the analysis of further soil, groundwater, surface water, and/or sediment samples, are underway at all IRP sites where they are not yet complete. After investigations are complete, an appropriate remedial alternative will be selected for each site. Investigations and/or remediation are also underway or planned at four UST sites. Sampling at PSC 1485C is also planned.

3. A pilot study to remove petroleum products from soil at Site 4 is underway.

4. ATSDR will review additional groundwater and Clear Creek floodplain data.

Recommended Actions:

1. ATSDR recommends that the U.S. Navy continue the work to delineate the groundwater plumes near installation boundaries.

2. If any private wells are located that appear to be in the path of contaminants migrating from NAS Whiting Field, the U.S. Navy should develop and implement a plan for monitoring these wells and for addressing any contamination that may be detected.

3. ATSDR agrees that recreational use of Clear Creek and its floodplain does not need to be curtailed.

REFERENCES

ABB-ES. 1992. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study, Phase I: Technical Memorandum No. 4: Surface Water and Sediment Assessment. May 1992.

ABB-ES. 1993a. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study, Phase IIA: Technical Memorandum No. 1: Surface Water and Sediment Assessment. July 1993.

ABB-ES. 1993b. Asea Brown Boveri Environmental Services, Inc. Clear Creek Floodplain Investigation Report, Naval Air Station Whiting Field. July 1993.

ABB-ES. 1995a. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study, Phase IIA: Technical Memorandum No. 4: Hydrogeologic Assessment. January 1995.

ABB-ES. 1995b. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study, Phase IIA: Technical Memorandum No. 3: Soil Assessment. Volume I: Chapters 1 through 5 and Appendices A through D. May 1995.

ABB-ES. 1995c. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study, Phase IIA: Technical Memorandum No. 5: Groundwater Assessment. November 1995.

ABB-ES. 1996. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Baseline Risk Assessment Workplan, Operable Units 3, 4, 5, and 6. May 1996.

ABB-ES. 1997a. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study: Phase II-C Work Plan for Sites 3, 4, 30, 32, and 33. August 1997.

ABB-ES. 1997b. Asea Brown Boveri Environmental Services, Inc. Memorandum from Gerry Walker, ABB-ES to NAS Whiting Field Partnering Team Re: Preliminary Risk Screening For Site 39, Clear Creek Flood Plain. November 11, 1997.

ABB-ES. 1998a. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation and Feasibility Study: General Information Report. January 1998.

ABB-ES. 1998b. Letter from Asea Brown Boveri Environmental Services, Inc. to Linda Martin, Navy. Subject: Draft Report on the Investigations at Sites 35, 36, and 37 at Naval Air Station (NAS) Whiting Field in Milton Florida. January 28, 1998.

ABB-ES. 1999. Asea Brown Boveri Environmental Services, Inc. Naval Air Station Whiting Field Remedial Investigation Report: Site 9, Waste Fuel Disposal Pit and Site 10, Southeast Open Disposal Area (A). January 1999.

Aqua Tech Environmental Laboratories, Inc. 1999a. Lab Format for Reporting Drinking Water Analyses. January 12, 1999.

Aqua Tech Environmental Laboratories, Inc.1999b. Lab Format for Reporting Drinking Water Analyses. July 16, 1999.

ATSDR-DHAC. 1995. Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation. Naval Air Station Whiting Field, Milton, Florida, Site Summary. January 1995.

Auston, J. 2000. Personal communication with James Auston, Lead Operator, Naval Air Station Whiting Field Water Plant. February 16, 2000.

Brown & Root Environmental. 1997. Naval Air Station Whiting Field, Milton, Florida. Remedial Investigation and Feasibility Study Phase II-C Work Plan for Sites 3, 4, 30, 32, and 33. August 1997.

Durbin, P. 2000. Personal communication with Pat Durbin, Naval Air Station Whiting Field, February 24, 2000.

Envirodyne Engineers, Inc. 1985. Initial Assessment Study. Naval Air Station Whiting Field, Milton, Florida. May 1985.

Florida DHRS. 1992. Florida Department of Health and Rehabilitative Services, Office of Laboratory Services. Status Report - Sample Number: 92011153. February 4, 1992.

Geraghty & Miller, Inc. 1984. Hydrogeologic Assessment and Ground-water Monitoring Plan, U.S. Naval Air Station, Whiting Field, Florida. June 26, 1984.

Geraghty & Miller, Inc. 1985. Detection and Monitoring Program, Battery Shop Site, NAS Whiting Field, Florida. November 14, 1985

Geraghty & Miller, Inc. 1986. Verification Study: Assessment of Potential Ground-water Pollution at Naval Air Station Whiting Field. December 1986.

Gibson, M. 2000. Personal communication with Mark Gibson, Natural Resources Manager, NAS Pensacola. March 1, 2000.

HLA. 1999a. Harding Lawson Associates. Record of Decision: Site 1, Northwest Disposal Area, Naval Air Station Whiting Field, Milton, Florida. September 1999.

HLA. 1999b. Harding Lawson Associates. Record of Decision: Site 2, Northwest Open Disposal Area, Naval Air Station Whiting Field, Milton, Florida. September 1999.

Hendon Engineering Associates, Inc. 1989. Treatment of Water Supply Wells: Phase II - Long Term Solution, NAS, Whiting Field, Milton, Florida. January 1989.

Holland, J. 2000a. Personal communication with James Holland, Naval Air Station Whiting Field. February 24, 2000.

Holland, J. 2000b. Written communication from James Holland, Naval Air Station Whiting Field. February 24, 2000.

Martin, L. 2000. Personal communication with Linda Martin, Southern Division, Naval Facilities Engineering Command. March 3, 2000.

NASWF. 1999. Naval Air Station Whiting Field. Site Visit conducted by ATSDR. June 22 to 24, 1999.

NEHC. n.d. Naval Environmental Health Center. Trip report, NAS Whiting Field, 5-8 December 1994.

Tetra Tech NUS, Inc. 1999. NAS Whiting Field Environmental Geographic Information System. Release 1.0. October 1999.

Tetra Tech NUS, Inc. 2000. Remedial Investigation and Feasibility Study Work Plan for Sites 5, 7, 29, 35, 38, 39, 40, and PSC 1485C. Naval Air Station Whiting Field. January 2000.

Touart, T. 2000. Personal communication with Toni Touart, Potable Water Section, FDEP. February 16, 2000.

USEPA. n.d. United States Environmental Protection Agency, Superfund Program. NPL Site Narrative for Whiting Field Naval Air Station. http://www.epa.gov/oerrpage/superfund/sites/npl/nar1423.htm.

U.S. Navy. 1995. United States Department of the Navy, Installation Restoration Program. Naval Air Station Whiting Field Community Relations Plan. Final Draft. 1995 Update. December 1995.

TABLES

Table 1: Evaluation of Potential Exposure Pathways at Naval Air Station Whiting Field

Concern	Exposure Pathway Elements					Time of Exposure	Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population		
On-site drinking water	Operations and waste management practices at NAS Whiting Field	Groundwater	On-site taps from NAS Whiting Field	Ingestion, inhalation, dermal contact	Installation employees, residents, and visitors	**Past:** In the mid-1980s, NAS Whiting Field employees and residents were exposed to concentrations of VOCs above CVs. **Current and Future:** Current and future monitoring and treatment of NAS Whiting Field production wells will ensure that water from the distribution system is safe to drink.	**Past:** Exposure to VOCs detected in the NAS Whiting Field water supply in the mid-1980s is not expected to result in adverse health effects. VOCs are unlikely to have reached levels of health concern prior to 1984, when sampling began. Therefore, past exposure to on-site drinking water poses no apparent public health hazard. **Current and Future:** Concentrations of VOCs in installation supply wells are unlikely to reach levels of health concern because the wells are monitored regularly and a treatment system is in place. Thus, on-site drinking water poses no current or future public health hazard.
Off-site drinking water	Operations and waste management practices at NAS Whiting Field	Groundwater	Off-site taps from municipal or private wells	Ingestion, inhalation, dermal contact	Recipients of municipal water drawn from wells near the installation and users of off-site private wells	**Past, Current, and Future:** There are no municipal supply wells within a mile of NAS Whiting Field. The U.S. Navy has made a concerted effort to ascertain the locations of any nearby off-site private wells. No VOCs were detected in the only known private well in the vicinity of groundwater contamination.	**Past, Current, and Future:** Currently-available information indicates that there is no exposure to contamination in either off-site municipal or private wells. Thus, consumption of off-site drinking water presents no apparent public health hazard. ATSDR recommends that the U.S. Navy fully delineate all groundwater contamination near NAS Whiting Field boundaries and develop a plan for monitoring any private wells in the path of contaminant migration and for addressing any private well contamination that may be found.

Table 1: Evaluation of Potential Exposure Pathways at Naval Air Station Whiting Field (continued)

Concern	Exposure Pathway Elements					Time of Exposure	Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population		
Clear Creek floodplain	Surface water and sediment contaminated from operations and waste management practices at NAS Whiting Field	Surface water, sediment, and fish	Surface water bodies on site and off site; consumption of fish	Ingestion, dermal contact	Recreational users of Clear Creek and its floodplain	**Past, Current, and Future:** Recreational users of the Clear Creek floodplain may come into contact with contaminants in surface water and sediment at levels exceeding CVs. Contamination in the creek may also have affected fish, which may occasionally be consumed.	**Past, Current, and Future:** Infrequent exposure to the detected levels of contaminants in surface water and sediment during recreational use of the area is unlikely to cause adverse health effects. Remedial activities will prevent future exposures to site contaminants. Fishing in Clear Creek is thought to occur only occasionally, if at all. Sporadic detections of low levels of contaminants in sediment suggest that fish are unlikely to contain site-related contaminants at significant enough levels to cause adverse health effects to anyone occasionally consuming the fish.

ATSDR Agency for Toxic Substances and Disease Registry
CV comparison value
NAS Naval Air Station
VOC volatile organic compound

FIGURES

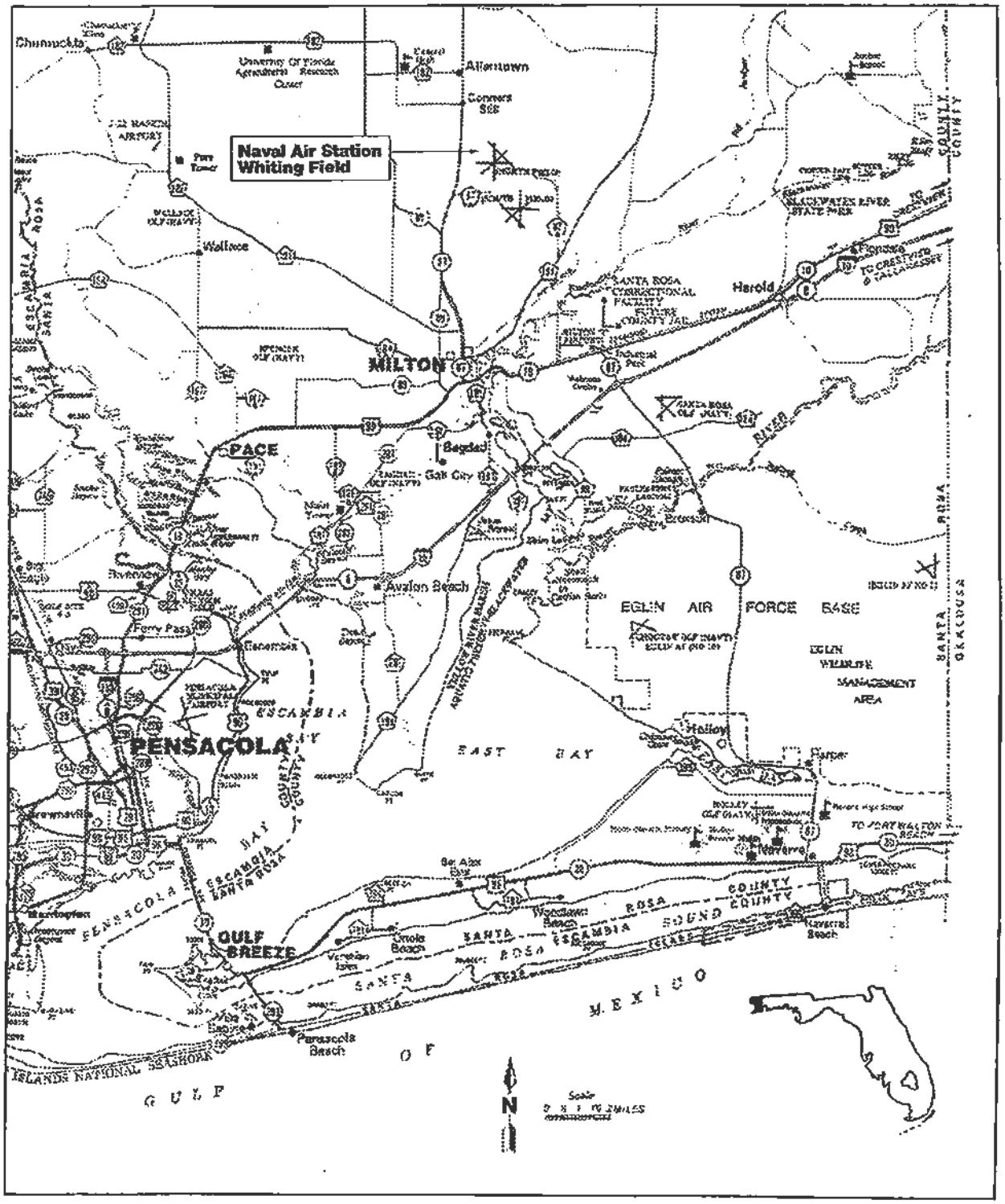


Figure 1: Location of NAS Whiting Field (Source: Dolph, 1996)

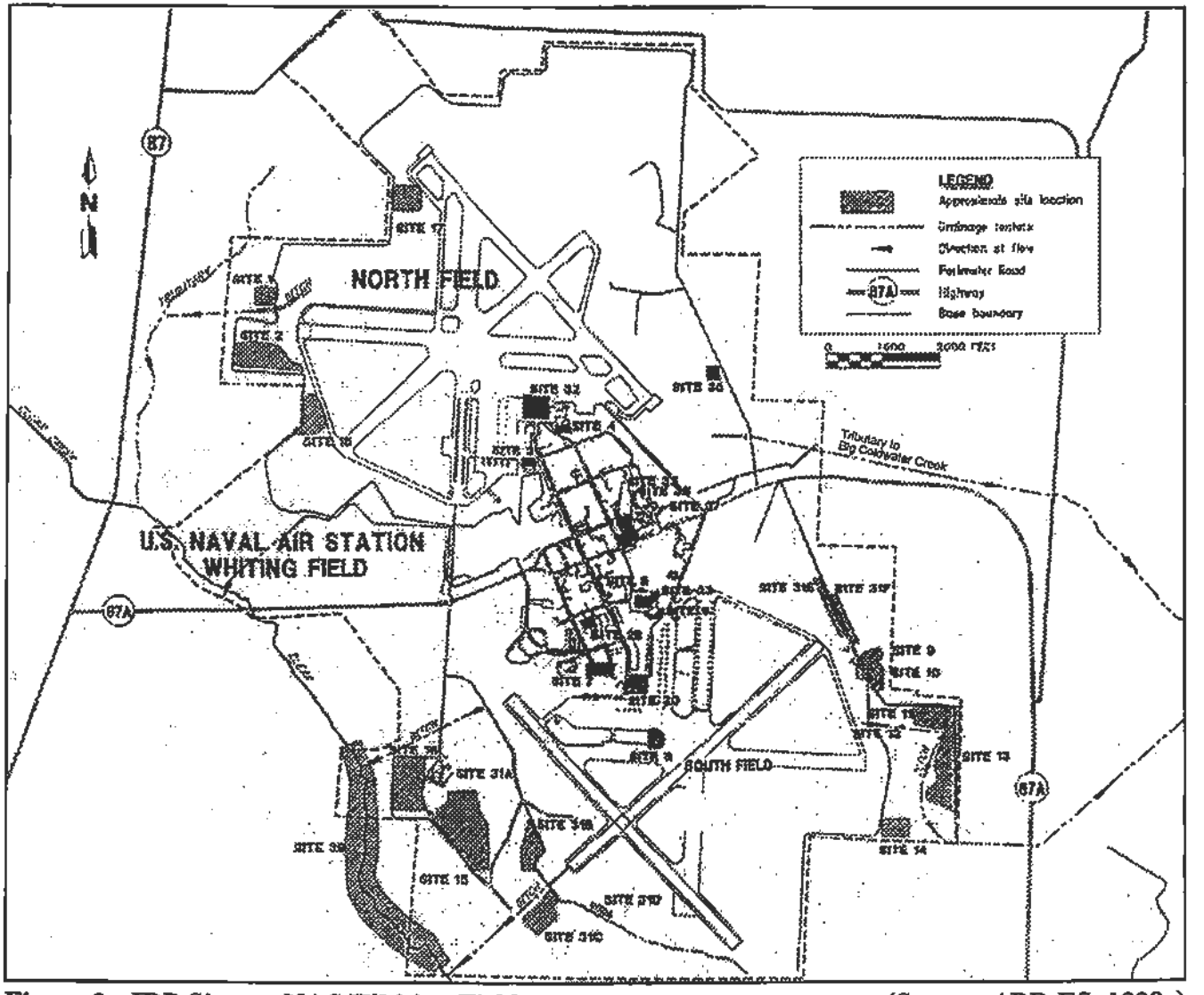


Figure 2: IRP Sites at NAS Whiting Field (Source: ABB-ES, 1998a)

Figure 3: ATSDR's Exposure Evaluation Process

REMEMBER: For a public health threat to exist, the following three conditions must all be met:

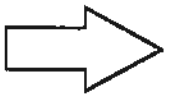
- People must come into contact with areas that have potential contamination
- Contaminants must exist in the environment
- The amount of contamination must be sufficient to affect people's health

Are People Exposed To Areas With Potentially Contaminated Media?

For exposure to occur, contaminants must be in locations where people can contact them.

People may contact contaminants by any of the following three exposure routes:

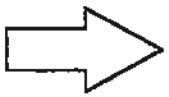
Inhalation
Ingestion
Dermal absorption



Are the Environmental Media Contaminated?

ATSDR considers:

Soil
Ground water
Surface water and sediment
Air
Food sources

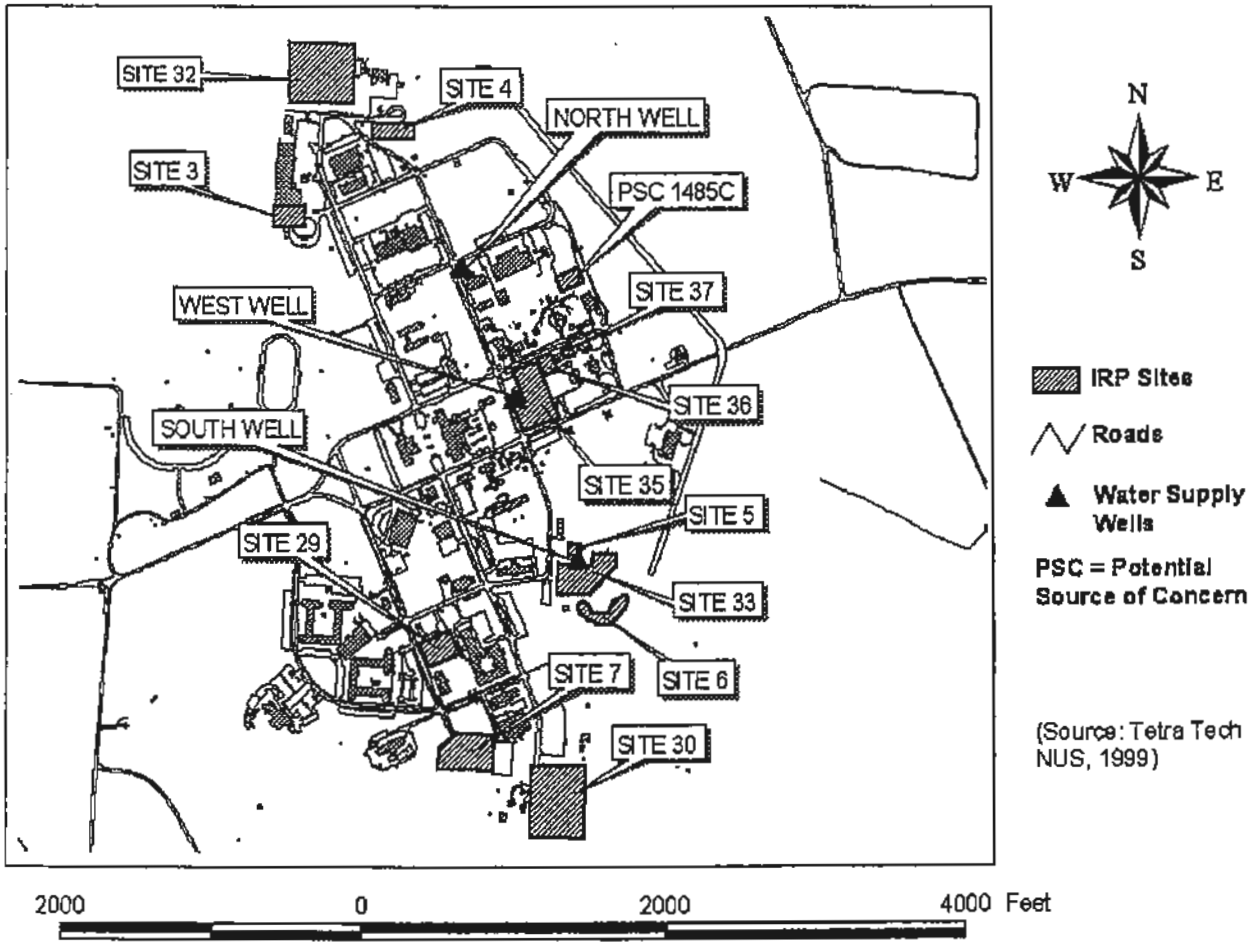


For Each Completed Exposure Pathway, Will the Contamination Affect Public Health?

ATSDR will evaluate existing data on contaminant concentration and exposure duration and frequency.

ATSDR will also consider individual characteristics (such as age, gender, and lifestyle) of the exposed population that may influence the public health effects of contamination.

Figure 4: Water Supply Wells and IRP Sites in the Industrial Area, NAS Whiting Field



APPENDICES

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Landfills and Open Disposal Areas				
Site 1: Northwest Disposal Area	This one-acre area was, from 1943 through 1965, a secondary disposal site for waste generated at Naval Air Station (NAS) Whiting Field. In addition to refuse, it received materials related to the operation and maintenance of aircraft, such as waste paint, paint thinner, solvents, waste oil, and hydraulic fluids. The site is now covered with pine trees.	**Soil:** In three surface soil samples analyzed in 1992 and five samples analyzed in 1995, no contaminants were detected at levels exceeding Agency for Toxic Substances and Disease Registry (ATSDR) comparison values (CVs) except arsenic, found at a maximum concentration of 4.2 parts per million (ppm). **Groundwater:** One sample was analyzed in 1986, and samples from four wells were analyzed in 1993 and 1996. The 1993 samples contained levels of beta-BHC (0.025 parts per billion [ppb]), aluminum (61,700 ppb), chromium (1,150 ppb), iron (318,000 ppb), nickel (210 ppb), and vanadium (1,360 ppb) at levels exceeding CVs.	A record of decision (ROD) for soil contamination at the site, which calls for the implementation of land use controls, was finalized in September 1999. Site-related groundwater contamination will be addressed as part of Site 40.	Soil poses no public health hazard. No contaminants have been detected at concentrations exceeding CVs other than arsenic. There is no public access to the installation, and the levels of arsenic detected would not cause adverse health effects to anyone exposed to them infrequently and incidentally. For a discussion of groundwater, see Site 40.
Site 2: Northwest Open Disposal Area	This site, formerly a borrow pit, was used from 1976 until 1984. It is also known as the Wood Dump. Construction and demolition waste, as well as wood, tires, furniture, and similar bulky debris were disposed of on site, as they were not suitable for disposal in the installation's primary landfill. The site covers about 12 acres and currently is vegetated.	**Soil:** Five 1995 surface soil samples contained only arsenic (4.2 ppm) at concentrations exceeding its CV. **Groundwater:** One sample collected in 1993 contained concentrations of bis(2-ethylhexyl)phthalate (BEHP, a possible laboratory contaminant) (7 ppb), chromium (163 ppb), iron (74,200 ppb), and vanadium (169 ppb) above CVs. Three 1996 samples did not contain any contaminants at levels exceeding CVs.	A ROD for soil contamination at the site, which calls for the implementation of land use controls, was finalized in September 1999. Site-related groundwater contamination will be addressed as part of Site 40.	No one is likely to be exposed to arsenic in the soil at sufficient doses to cause adverse health effects. No other contaminants were detected at concentrations exceeding CVs. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 10: Southeast Open Disposal Area A	This 4-acre site received mostly waste not suitable for landfill disposal, such as construction debris, trees, and metal cans from 1965 to 1973. Reportedly, waste also included empty cans of pesticides and herbicides and possibly PCB-containing transformer oil. Once within the installation, access to the site is unrestricted. It is currently covered with shrubs and planted pine trees, and several piles of construction debris remain.	**Soil:** Arsenic, iron, and polycyclic aromatic hydrocarbons (PAHs) were detected at concentrations exceeding CVs in samples from 1992, 1995, and 1996 (arsenic: 8.8 ppm, iron: 23,800 ppm, benzo[a]anthracene: 1.4 ppm, benzo[a]pyrene: 2.5 ppm, benzo[b]flouranthene: 2.5 ppm, dibenzo[a,h]anthracene: 1.0 ppm, and ideno[1,2,3-cd]pyrene: 3.2 ppm). **Groundwater:** No contaminants were detected at levels exceeding CVs in one 1986 sample or 1993 and 1996 samples from two monitoring wells.	Contaminated soil at the site was covered with 2 feet of clean fill, which is stabilized by vegetation. In 1999, a remedial investigation (RI) report for this site was released. It recommends a feasibility study (FS) for surface soil and no further action for subsurface soil. In the future, groundwater contamination will be addressed as part of work on Site 40.	The public is not allowed on site. Incidental, occasional, and brief exposures to the levels of contaminants detected in soil would not cause adverse effects. Thus, exposure to soil poses no public health hazard. Contaminants were not detected in groundwater at concentrations above CVs; therefore, it poses no public health hazard.
Site 11: Southeast Open Disposal Area B	This 3-acre site was an open disposal area, with no access restrictions, from 1943 through 1970. Refuse, construction debris, and furniture were left on site. Other possible waste includes liquids related to the operation and maintenance of aircraft (including paint, solvents, oils, and hydraulic fluid) and transformer oil. There is a field used for crops to the east of the site.	**Soil:** In 1992, five surface soil samples revealed benzo(a)anthracene (1.8 ppm), benzo(a)pyrene (910 ppm), arsenic (3.8 ppm), and lead (2,230 ppm) at concentrations exceeding CVs. 1996 surface soil samples contained only arsenic (2.7 ppm) at levels above its CV. **Groundwater:** 1993 and 1996 samples from four locations, as well as one 1986 sample, contained benzene (2 ppb), vinyl chloride (2 ppb), BEHP (23 ppb), arsenic (3.3 ppb), aluminum (24,000 ppb), chromium (55.2 ppb), iron (37,800 ppb), lead (21.9 ppb), thallium (0.7 ppb), and vanadium (61.8 ppb) at concentrations exceeding CVs.	In the early 1970s, a final soil covering was placed over the site. Pine trees were also reportedly planted at that time. Soil and groundwater sampling have been proposed to occur during the ongoing RI/FS at the site.	No one is expected to regularly access this site. Levels of contaminants in soil are sufficiently low that they would not cause adverse health effects. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 13: Sanitary Landfill	This site, the installation's last operating landfill, may have received waste solvents and residue from paint stripping during its first year of use, 1979. From 1980 to 1988, the landfill did not receive any hazardous waste; it received only refuse, along with asbestos wrapped in plastic.	**Soil:** In five surface soil samples analyzed in 1992 and five samples analyzed in 1995, only arsenic (6.9 ppm) and iron (23,500 ppm) were detected at concentrations above CVs. **Groundwater:** One sample did not contain contaminants at concentrations above CVs in 1986. 1993 and 1996 samples from three locations contained trichloroethylene (TCE) (7 ppb), tetrachloroethylene (PCE) (1 ppb), BEHP (10 ppb), arsenic (2.3 ppb), cadmium (12.6 ppb), iron (39,600 ppb), and manganese (753 ppb) at concentrations exceeding CVs.	An RI for soil at this site was completed in 1999, and an FS to address soil contamination is planned. Site-related groundwater contamination will be addressed as part of Site 40.	Limited exposure to the arsenic and iron levels detected in the soil would not cause adverse health effects. No other contaminants were detected at concentrations exceeding CVs. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.
Site 14: Short-Term Sanitary Landfill	This site served as a landfill for 6 to 9 months beginning in 1978. In 1979, operations were transferred to Site 13 because of drainage problems caused by clayey soil. Most waste received at this site was non-hazardous, but waste solvents and residue from paint stripping might have been disposed of on site. The area is currently vegetated.	**Soil:** Analyses of three surface soil samples in 1992 and another three in 1995 indicated that no contaminants were present at levels exceeding CVs except arsenic (4.3 ppm). **Groundwater:** One 1986 sample did not contain contaminants above CVs. In 1993 and 1996 samples from two locations, only BEHP (18 ppb) and arsenic (0.5 ppb in one sample) were detected at levels exceeding CVs.	An RI for this site was completed in 1999, and an FS to address soil contamination is planned. Site-related groundwater contamination will be addressed as part of Site 40.	Soil poses no public health hazard. No contaminants have been detected at concentrations exceeding CVs other than arsenic. There is no public access to the installation, and the levels of arsenic detected would not cause adverse health effects to anyone exposed to them infrequently and incidentally. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 15: Southwest Landfill	From 1965 to 1979, this 15-acre site was the primary installation landfill, accepting refuse and waste associated with aircraft operation and maintenance. Bagged asbestos and dielectric fluid containing polychlorinated biphenyls (PCBs) were also reportedly recieved. Waste was covered with soil daily. Currently, much of the site harbors pine trees, but some tracts are bare. In these areas, berms are in place to reduce erosion. Clear Creek is about 1,200 feet to the west.	**Soil:** Three 1991 samples, five 1992 samples, and twenty-five 1995 samples did not contain any contaminants at levels exceeding CVs except arsenic (which reached 6.8 ppm). **Sediment:** Three sediment samples from Y Ditch analyzed in 1991 contained only arsenic at levels above CVs (3.2 ppm). **Groundwater:** One 1986 sample, eleven 1993 samples, and 1996 and 1997 samples from eight locations contained benzene (130 ppb) 1,1-dichloroethene (1,1-DCE) (11 ppb), TCE (350 ppb), BEHP (118 ppb), aluminum (76,400 ppb), arsenic (2.3 ppb), cadmium (23.3 ppb), chromium (71.5 ppb), iron (94,500 ppb), manganese (1,270 ppb), thallium (1 ppb), and vanadium (136 ppb) at concentrations exceeding CVs.	An RI for this site was completed in 1999, and an FS is planned.	Only arsenic, at very low concentrations, has been detected in soil at this site and nearby sediment samples. Regular exposure to these media is not expected. However, limited exposure to detected levels would not cause adverse health effects. Thns, soil and sediment pose no public health hazard. For a discussion of groundwater, see Site 40.
Site 16: Open Disposal and Burning Area	From 1943 to 1965, this 10-acre site was the primary destination for waste generated on site, including refuse, paint, oil, solvents, hydraulic fluids, and possibly PCB-contaminated transformer oil. Spent diesel fuel was used to burn most of the waste to decrease its volume. Currently, the site is covered with pine trees. Clear Creek is located approximately 200 feet from the site.	**Soil:** Three 1991 samples, three 1992 samples, and sixteen samples analyzed in 1996 contained dieldrin (0.13 ppm), benzo(a)anthracene (2.3 ppm), benzo(b)flouranthene (3.6 ppm), dibenzo(a,h)anthracene (0.7 ppm), benzo(a)pyrene (3.1 ppm), indeno(1,2,3-cd)pyrene (1.9 ppm), arsenic (12.1 ppm), iron (48,900 ppm), and lead (759 ppm) levels exceeding CVs. **Groundwater:** One 1986 sample, twelve 1993 samples, and 1996 and 1997 samples from seven locations contained benzene (1,400 ppb), 1,2-dichloroethane (1,2-DCA) (32 ppb), TCE (7 ppb), BEHP (53 ppb), DDT (0.15 ppb), arsenic (4.5 ppb), antimony (124 ppb), cadmium (56.5 ppb), chromium (225 ppb), iron (313,000 ppb), lead (69.1 ppb), manganese (1,370 ppb), and vanadium (987 ppb) at levels exceeding CVs.	An RI for this site was completed in late 1999, and an FS is planned.	The public is not allowed on site. Infrequent exposure to the levels of contaminants found at this site would not result in adverse health effects. Therefore, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Fuel Disposal Areas				
Site 4: North AVGAS Tank Sludge Disposal Area (and associated Underground Storage Tank [UST] Site 1467)	At this site, there were formerly nine USTs, eight of which held aviation gasoline (AVGAS). Sludge from the bottom of the tanks was disposed of approximately every 4 years in shallow holes near the tanks from 1943 through 1968. North Well is located approximately 1,100 feet southeast of the site.	**Soil:** A 1986 composite soil sample did not contain any contaminants at concentrations exceeding CVs. Eleven 1998 borings contained benzo(a)anthracene (1.9 ppm), benzo(a)pyrene (1.2 ppm), benzo(b)flouranthene (1.2 ppm), dibenzo(a,h)anthracene (0.23 ppm), dieldrin (0.085 ppm), and arsenic (6.4 ppm) at levels above CVs. **Groundwater:** One 1986 sample, eighteen 1993 samples, and one 1998 sample contained chloroform (25 ppb), 1,2-dichloroethene (1,2-DCE) (80 ppb), TCE (510 ppb), benzene (5,500 ppb), toluene (24,000 ppb), ethylbenzene (2,000 ppb), xylenes, bis(2-chloroethyl)ether (18 ppb), carbazole (4 ppb), BEHP (32 ppb), antimony (12.5 ppb), arsenic (17.2 ppb), cadmium (17.2 ppb), chromium (84 ppb), iron (78,300 ppb), lead (481 ppb), manganese (605 ppb), and vanadium (196 ppb) at levels exceeding CVs. At the associated UST site, maximum levels of contaminants exceeding CVs in groundwater samples were: benzene, 5,360 ppb; ethylbenzene, 1,700 ppb; toluene, 18,970 ppb; xylenes, 4,100 ppb; chlorobenzene, 1,420 ppb; 1,1-DCE, 2 ppb; 1,2-DCE, 192 ppb; TCE, 390 ppb; PCE, 2 ppb; bis(2-chloroethyl)ether, 1 ppb; BEHP, 14 ppb; benzo(a)pyrene, 0.2 ppb; carbazole, 6 ppb; dibenzo(a,h)anthracene, 1 ppb; indeno(1,2,3-cd)pyrene, 1 ppb; arsenic, 19.6 ppb; chromium, 75.3 ppb; iron, 70,300 ppb; lead, 145 ppb; manganese, 799 ppb; and vanadium, 31.8 ppb.	A pilot study to remove petroleum products from soil at the site is underway. An RI for this site was completed in 1999, and an FS is planned.	The public is not allowed to access the installation. Others would come into contact with soil at this site only occasionally and incidentally. Detected levels of contaminants would not cause adverse health effects under such circumstances. Therefore, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 7: South AVGAS Tank Sludge Disposal Area (and associated UST Site 1466)	Eight USTs held AVGAS and two USTs held aviation lube oil on this site from 1943 to the late 1970s. Sludge from the bottom of the tanks was buried in shallow holes near tanks.	**Soil:** Two composite samples were analyzed for lead in 1986. The lead level (575 ppm) in one exceeded the CV. Samples from one boring analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, PCBs, and metals in 1997 did not contain any contaminants at concentrations exceeding CVs. **Groundwater:** One 1986 sample, twelve 1993 samples, one 1996 sample, and one 1997 sample contained vinyl chloride (190 ppb), 1,1-DCE (5 ppb), 1,2-DCE (170 ppb), carbon tetrachloride (1 ppb), TCE (1,400 ppb), benzene (14,000 ppb), toluene (47,000 ppb), ethylbenzene (2,400 ppb), xylenes (12,000 ppb), 1,2-dibromoethane (23.56 ppb), 4-methylphenol (390 ppb), carbazole (10 ppb), antimony (27.9 ppb), arsenic (29.3 ppb), cadmium (32 ppb), chromium (26.5 ppb), iron (42,500 ppb), lead (1,290 ppb), manganese (725 ppb), and vanadium (36.4 ppb) were detected at levels above CVs. At the associated UST site, maximum levels of contaminants exceeding CVs in groundwater samples were: benzene, 2,800 ppb; ethylbenzene, 2,400 ppb; toluene, 23,000 ppb; xylenes, 5,100 ppb; 1,1-DCE, 6 ppb; TCE, 390 ppb; antimony, 19.8 ppb; arsenic, 8.4 ppb; iron, 40,800 ppb; lead, 282 ppb; and thallium, 6.3 ppb.	Further soil sampling is planned, according to a January 2000 RI/FS work plan.	Soil sampling suggests that little, if any, soil contamination is present at this site. Since any exposures would be infrequent, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 8: AVGAS Fuel Spill Area (and associated UST Site 3054)	In the summer of 1972, about 25,000 gallons of high octane aviation fuel was spilled and covered an area of about 2 acres.	**Soil:** In 1986, twelve composite soil samples were analyzed for lead, which was not detected at levels above the CV. **Groundwater:** One 1986 sample contained benzene (2 ppb) at a level exceeding the CV, but a 1995 sample analyzed for VOCs and a 1996 sample analyzed for the full range of parameters did not contain at contaminants at levels exceeding CVs.	An RI/FS is planned.	The public is not allowed on-site, and other personnel would not come into contact with on site soil with any regularity. Therefore, no public health hazard is expected. For a discussion of groundwater, see Site 40.
Site 9: Waste Fuel Disposal Area	In the 1950s and 1960s, waste fuel, including AVGAS, was disposed of in a clay borrow bit at this site. Apparently, tanker trucks transported the waste fuel, carrying 200 to 300 gallons of fuel per trip. The pit was later covered with soil. There is a ponded area in the northeastern portion of the site, which is currently covered with shrubs and planted pine trees.	**Soil:** In 1986, twelve composite soil samples were analyzed for lead, 1,2-dibromoethane, benzene, toluene, and xylene, which were not detected at levels exceeding CVs. Five 1995 samples analyzed for VOCs, SVOCs, pesticides, PCBs, and metals contained only arsenic (10.1 ppm) and iron (29,800 ppm) at concentrations exceeding CVs. **Surface Water:** A 1996 sample from the ponded area contained only arsenic (0.6 ppb) at a level above the CV. **Groundwater:** One 1986 sample analyzed for the same parameters as the 1986 soil sample did not contain levels of contaminants above CVs. Seven groundwater samples collected in 1993 and 1996 contained levels of arsenic (3.6 ppb), chromium (67.8 ppb), and vanadium (32.7 ppb) exceeding CVs.	Contaminated soil at the site has been covered with 2 feet of clean fill and vegetation has been planted. A 1999 RI report for this site recommends a FS for surface soil and no further action for subsurface soil and surface water. Groundwater contamination will be addressed in the future as part of work on Site 40, Facility-wide Groundwater.	The low levels of arsenic and iron detected in soil and surface water would not cause adverse health effects to individuals with infrequent, incidental exposure. Thus, neither soil nor surface water poses a public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 12: Tetraethyl Lead Disposal Area	On May 1, 1968, the North and South Aqua Fuel System storage tanks and fuel filters were cleaned. The sludge from the bottoms of the tanks was left in six mounds on this site. Each mound is estimated to contain 200 to 400 gallons of sludge. The mounds are currently approximately 2 to 4 feet high and surrounded by dense shrubbery. There are signs posted around the site, indicating the possible hazard contained. Y Ditch is adjacent to the southern boundary of the site.	**Soil:** 1986, 1991, 1993, and 1996 samples collected from the surface of the mounds, as well as their centers, have not contained any contaminants at concentrations above CVs except arsenic (which reached 3.6 ppm). **Sediment:** The only contaminant detected at concentrations exceeding CVs in three 1991 sediment samples from Y Ditch was arsenic (1.8 ppm). **Groundwater:** One sample was analyzed in 1986 and 1993, and two samples were analyzed in 1996. Cadmium (22.3 ppb) exceeded its CV in 1993, and thallium (0.7 ppb) exceeded its CV in 1996.	An RI for soil at this site was completed in 1999, and an FS to address soil contamination is planned. Site-related groundwater contamination will be addressed as part of Site 40.	No one is expected to regularly access this site. Levels of contaminants in soil and sediment are sufficiently low that they would not cause adverse health effects. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.
Other Liquid Disposal Areas				
Site 3: Underground Waste Solvent Storage	From 1980 to 1984, two USTs at this site received waste generated by paint stripping operations. One of the tanks was punctured while being removed, and 120 gallons of liquid spilled from it. Some of this liquid was immediately pumped for proper disposal, and some of the contaminated soil was removed. Additional holes were discovered in both tanks after they were removed.	**Soil:** A 1986 soil sample did not contain any contaminants at levels above CVs. Thirty-three 1993 subsurface soil samples and four 1998 soil borings contained dieldrin (0.044 ppm), arsenic (16 ppm), and iron (32,600 ppm) at concentrations exceeding CVs. **Groundwater:** 1993, 1995, and 1998 samples from thirteen wells, as well as two 1986 samples, contained the following contaminants at levels exceeding CVs: 1,1-DCE (2 ppb), 1,2-DCE (240 ppb), PCE (1 ppb), 1,1,2-trichloroethane (111 ppb), TCE (250 ppb), benzene (4,500 ppb), toluene (15,000 ppb), ethylbenzene (2,800 ppb), xylenes (5,300 ppb), BEHP (490 ppb), heptachlor epoxide (0.26 ppb), arsenic (25.9 ppb), cadmium (34.4 ppb), chromium (82.4 ppb), iron (57,300 ppb), lead (221 ppb), mercury (19.8 ppb), and vanadium (36.4 ppb).	An RI for this site was completed in 1999, and an FS is planned.	The public is not allowed on site. Occasional exposure of facility personnel to the concentrations of contaminants found at this site would not result in adverse health effects. Therefore, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 5: Battery Acid Seepage Pit	From 1967 through 1984, waste electrolyte solution containing heavy metals and waste battery acid were poured down the drain of the battery shop, which drained to a dry well west of the building. The pit is located 110 feet from South Well.	**Soil:** In 1985, samples were collected from four borings and analyzed for five metals. Of those metals, only arsenic (1.27 ppm) was detected at concentrations exceeding CVs. **Groundwater:** Four August 1985 samples contained benzene (26 ppb), aldrin (0.13 ppb), heptachlor (0.04 ppb), arsenic (2 ppb), antimony (170 ppb), cadmium (3 ppb), lead (37 ppb), thallium (100 ppb) at levels above CVs. November 1985 samples from the same wells contained only benzene (14 ppb) and mercury (10 ppb) at levels exceeding CVs. 1993, 1995, 1996, and 1997 samples from eight locations revealed concentrations of benzene (32 ppb), PCE (3 ppb), TCE (154 ppb), BEHP (36 ppb), aluminum (29,500 ppb), antimony (23 ppb), arsenic (3.6 ppb), cadmium (32.6 ppb), chromium (123 ppb), iron (34,800 ppb), lead (30.5 ppb), and vanadium (117 ppb) exceeding CVs.	The site was first investigated in 1985, at which time sampling of South Well commenced. Further soil sampling is planned, according to a January 2000 RI/FS work plan.	Although soil sampling has not been completed at this site, soil is not expected to pose a public health hazard because authorized personnel would be exposed to soil at the site only infrequently and incidentally. For a discussion of groundwater, see Site 40.
Site 6: South Transformer Oil Disposal Area	From the 1940s through 1964, PCB-contaminated dielectric fluid was disposed of in a ditch known as 0-2 Ditch. The ditch, which has since been paved, drains to O Ditch, which in turn drains to P Ditch.	**Soil:** Ten soil samples from the ditch analyzed for PCBs in 1986 did not contain detectable concentrations of PCBs (over 0.2 ppm). Twelve surface soil samples were analyzed in 1991 for PCBs. While Aroclor-1260 was detected in some samples, all detected concentrations were below CVs. **Groundwater:** In samples from three locations analyzed in 1993, 1995, 1996, and 1997, levels of 1,1-DCE (18 ppb), 1,2-DCE (23 ppb), TCE (520 ppb), BEHP (12 ppb), dieldrin (0.47 ppb), cadmium (13.1 ppb), chromium (61.2 ppb), iron (21,000 ppb), lead (24 ppb), and vanadium (75.5 ppb) were detected at concentrations exceeding CVs.	An RI for this site was completed in 1999, and an FS is planned.	There is no evidence of soil contamination at levels of health concern at this site. Furthermore, exposure to the soil would be very limited. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Crash Crew Training Areas				
Site 17: Crash Crew Training Area	From 1951 to 1991, crash crew training occurred at this site. Typically, about 100 gallons of fuel (JP-4, JP-5, or AVGAS mixed with waste oil) were poured into a shallow pit, the fuel was ignited, then the fire was extinguished with a non-toxic foam agent. It is estimated that in 1984, about 6,200 gallons of fuel were used in crash crew training at two sites. At Site 17, there are seven burn pits of varying sizes. There are oil stains on surface soil in drainage swales leading from the burn pits.	**Soil:** 1992 analyses of 32 surface soil samples detected cadmium levels (reaching 30.6 ppm) in several samples and an iron level (23,800 ppm) in one sample exceeding CVs. **Groundwater:** One 1986 and four 1993 samples contained levels of BEHP (18 ppb), chromium (201 ppb), iron (146,000 ppb), and vanadium (508 ppb) exceeding CVs. 1996 samples from the same four monitoring wells did not contain any contaminants at levels above CVs.	In August 1994, metal tanks and abandoned aircraft fuselage were removed from the site. Mounds of soil mixed with burnt debris were dispersed across the site area. Also, 2 feet of clean fill were placed over this site and stabilized by vegetation. Additional soil and groundwater sampling have been proposed to occur during the ongoing RI/FS at the site.	Detected levels of metals in soil samples only slightly exceed CVs and would not cause adverse health effects to anyone exposed to them occasionally. More frequent exposure is not expected. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.
Site 18: Crash Crew Training Area	There are five shallow burn pits on this site. There are oil stains on surface soil in drainage swales leading from the burn pits. For a further description of site history, see Site 17.	**Soil:** In 1992, 47 surface soil samples from this site were analyzed. Results revealed arsenic (3.1 ppm), cadmium (38.8 ppm), iron (51,700 ppm), benzo(a)anthracene (1.3 ppm), and benzo(a)pyrene (1.2 ppm) at levels exceeding CVs. Two SVOCs without available CVs were also detected: phenanthrene (2.2 ppm) and bis(2-chloroethoxy)methane (0.44 ppm). **Groundwater:** One 1986 and three 1993 samples contained BEHP (32 ppb), arsenic (2.1 ppb), chromium (70.8 ppb), iron (61,800 ppb), lead (23 ppb), and vanadium (133 ppb) at concentrations exceeding CVs, but no contaminants exceeded CVs in 1996.	In 1993, four rusted metals drums that were partially buried in soil were removed from this site. In August 1994, two abandoned, charred aircraft fuselages were also removed. In addition, a mound of soil containing burnt debris was dispersed over the site. Two feet of clean fill have been placed on the site and vegetation has been planted. Further soil and groundwater sampling are proposed to occur during the ongoing RI/FS at the site.	The public cannot access this site. Sporadic, incidental, and brief soil exposures are not expected to cause adverse health effects to authorized personnel. Therefore, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Maintenance Hangars				
Site 30: South Field Maintenance Hangar	Aircraft maintenance activities were conducted in this paved area beginning in the mid-1940s. Waste generated on site included stripping compounds, solvents, paints, alkaline cleaners, detergents, oil, and hydraulic fluid. There were formerly underground waste oil tanks (abandoned in the 1980s) and a washrack used to clean aircraft on site.	**Soil:** Twenty-three 1993 subsurface soil samples, six 1996 borings, and six 1998 borings contained only arsenic (11.5 ppm) and iron (24,500 ppm) at concentrations exceeding CVs. **Groundwater:** Four samples from 1993 and three samples from 1996 contained levels of 1,1-DCE (27 ppb), 1,2-DCE (4 ppb), TCE (620 ppb), benzene (140 ppb), bromodichloromethane (2 ppb), dibromochloromethane (2 ppb), arsenic (13 ppb), cadmium (31.4 ppb), chromium (40.8 ppb), iron (40,100 ppb), lead (18.4 ppb), manganese (799 ppb), thallium (3.2 ppb), and vanadium (45.2 ppb) exceeding CVs.	An RI for this site was completed in 1999, and an FS is planned.	The public is not allowed to access maintenance hangars or any other parts of the installation. Employee exposure to soil at the site is not frequent enough for health effects to be expected. Therefore, on-site soil poses no public health hazard. For a discussion of groundwater, see Site 40.
Site 32: North Field Maintenance Hangar	This hangar was used to support aircraft maintenance activities beginning in the mid-1940s. Waste generated on site included stripping compounds, solvents, paints, alkaline cleaners, detergents, oil, and hydraulic fluid. There were formerly underground waste oil tanks (abandoned in the 1980s) and a washrack used to clean aircraft on site.	**Soil:** Fifty-three 1993 subsurface soil samples and eleven 1998 borings contained only arsenic (2.8 ppm) at concentrations exceeding CVs. **Groundwater:** Monitoring wells from twelve locations sampled in 1993, 1995, and 1998 contained benzene (1,900 ppb), bromodichloromethane (1 ppb), dibromochloromethane (1 ppb), 1,1-DCE (3 ppb), 1,2-DCE (1,000 ppb), 1,2-DCA (7 ppb), PCE (1.9 ppb), TCE (21,750 ppb), toluene (15,000 ppb), ethylbenzene (2,790), xylenes (6,400 ppb), BEHP (46 ppb), benzo(b)flouranthene (1 ppb), heptachlor (0.028 ppb), heptachlor epoxide (0.062 ppb), aluminum (53,900 ppb), antimony (21.9 ppb), arsenic (5ppb), cadmium (12.5 ppb), chromium (212 ppb), iron (110,000 ppb), lead (265 ppb), manganese (3,220 ppb), and vanadium (515 ppb) at concentrations exceeding CVs.	An RI for this site was completed in 1999, and an FS is plauned.	Levels of arsenic in soil similar to the ones detected at this site would not cause adverse health effects at low doses. Since exposure would only be incidental, soil does not pose a public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 33: Midfield Maintenance Hangar	This hangar was constructed in the mid-1940s as an area within which engine maintenance, corrosion control, and aircraft cleaning activities, among others, could be performed. Waste solvents, oil, antifreeze, and other fluids were poured into bowsers or an underground tank, abandoned in the 1980s.	**Soil:** Twenty-two 1993 subsurface soil samples, three 1996 borings, and seven 1998 borings contained only arsenic (11.5 ppm) at concentrations exceeding CVs. **Groundwater:** 1993, 1995, 1996, and 1997 samples from five locations contained levels of 1,1-DCE (10 ppb), 1,2-DCA (1 ppb), TCE (470 ppb), heptachlor epoxide (0.035 ppb), aluminum (45,700 ppb), antimony (3.5 ppb), cadmium (20.4 ppb), chromium (61.9 ppb), iron (28,300 ppb), thallium (6 ppb), and vanadium (72.1 ppb) exceeding CVs.	An RI for this site was completed in 1999, and an FS is planned.	No one is likely to be exposed to arsenic in the soil at sufficient doses to cause adverse health effects. No other contaminants were detected at concentrations exceeding CVs. Thus, soil poses no public health hazard. For a discussion of groundwater, see Site 40.
Miscellaneous Maintenance Facilities				
Site 29: Auto Hobby Shop	A tank at this site used to store waste motor oil and potentially solvents and paints from the 1940s through 1986, when it was abandoned. It was removed in 1998, as was an UST that held heating oil. Auto repair, maintenance, and painting materials may also have contaminated the site.	**Soil:** Three 1998 subsurface soil samples collected when the USTs were removed did not contain any contaminants at concentrations exceeding CVs. **Groundwater:** Five 1993 samples contained aluminum (49,400 ppb), antimony (13.9 ppb), arsenic (5.6 ppb), cadmium (8.1 ppb), chromium (173 ppb), iron (104,000 ppb), lead (32.4 ppb), and vanadium (130 ppb) at concentrations exceeding CVs, but not exceeding CVs in 1996 samples from the same wells.	The two USTs at the site were removed in 1998, at which time subsurface soil sampling was conducted. Surface and subsurface soil sampling is planned, according to a January 2000 RI/FS work plan.	No soil contamination has been detected. Public access to the installation is prohibited; therefore, soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 35: Public Works Maintenance Facility	Uses of the building at this site, built in 1943, included maintenance of vehicles and equipment, power generation, and metals and woodworking repair. There was a service station with three USTs (one diesel and two gasoline), abandoned in 1984. Five USTs, four holding fuel and the other holding diesel, remain.	**Soil:** Twenty 1996 subsurface soil samples were analyzed for VOCs, but none were detected at levels exceeding CVs. **Groundwater:** In six 1997 samples, 1,1-DCE (7 ppb) and BEHP (9 ppb), a possible laboratory contaminant, were detected once at levels over CVs.	According to a January 2000 RI/FS work plan, soil sampling is planned at this site.	While soil sampling at this site is incomplete, exposure to soil would be limited to occasional contact by authorized personnel, which would not be expected to result in adverse health effects. Thus, soil poses no apparent public health hazard. For a discussion of groundwater, see Site 40.
Site 36: Auto Repair Booth	This site was used until the early 1980s as an auto repair booth. An aboveground storage tank holding waste oil is on site. Fuel pumps and a buried fuel tank may also have been present.	**Soil:** Fourteen subsurface soil samples did not contain any VOCs at concentrations exceeding CVs in 1996. **Groundwater:** In 1997, two samples contained carbon tetrachloride (1 ppb), 1,1-DCE (2 ppb), and TCE (17 ppb) at levels exceeding CVs.	An RI/FS is underway.	The only expected exposure to on-site soil would be to installation personnel on an incidental and irregular basis. This type of exposure is not expected to result in adverse health effects, so soil is not expected to pose a public health hazard. For a discussion of groundwater, see Site 40.
Site 37: Paint Spray Booth	A paint spray booth and a furniture shop were present in a building on site, built in 1944. Fumes from painting were captured and combined with water, then discharged to the sanitary sewer.	**Soil:** Eleven 1997 subsurface soil samples did not contain any VOCs at concentrations exceeding CVs. **Groundwater:** In one of two 1997 samples, 1,1-DCE (7 ppb) and benzene (3 ppb) were detected at levels exceeding CVs.	An RI/FS is underway. It is possible that no further action will occur.	Soil contamination has not yet been fully investigated, but is unlikely to result in adverse health effects under infrequent exposure scenarios. Therefore, soil poses no apparent public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 38: Golf Course Maintenance Building	Until 1983, pesticides were stored and mixed in this building, which has since been demolished. Also, until the mid-1970s, batteries were reconditioned in the building. Any chemicals poured into the sinks in the building would have drained into an open tank and then a gravel-lined area on the ground.	**Soil:** In March 1996, a composite surface soil sample was analyzed. No organics were detected.	Planned soil sampling and groundwater well installation and sampling are outlined in a January 2000 RI/FS work plan.	Public access to NAS Whiting Field is prohibited, and others would only be exposed to soil on an infrequent basis. Soil contamination is unlikely to result in adverse health effects in these instances. Thus, soil poses no apparent public health hazard. There has not yet been groundwater sampling at this site; for a discussion of groundwater, see Site 40.
Other Sites				
Site 31: Sludge Drying Beds and Disposal Area	Sludge from the wastewater treatment plant was disposed of in several locations at the installation from 1943 through 1990. Site 31A is approximately one-fifth of an acre and contains four sludge drying beds covered with sand and gravel and surrounded by containment walls. The sludge was periodically trucked off and disposed of at Sites 31B, 31C, and 31D after it dried. Sites 31B, 31C, and 31D received both liquid waste and sludge materials. The three sites are on sloped terrain, where there are berms to reduce soil erosion from surface water runoff. Sites 31E and 31F are locations along the perimeter road where liquid sludge was formerly sprayed on grass. It is estimated that the two sites together comprise almost 7 acres.	**Soil:** In 1992, 24 surface soil samples were analyzed. Contaminants present at levels exceeding CVs included dieldrin (0.12 ppm), Aroclor-1260 (1.4 ppm), cadmium (26.8 ppm), chromium (295 ppm), and lead (1,890 ppm). The highest levels of these contaminants were detected at Site 31C. In eight borings and nineteen surface soil samples analyzed for all parameters in 1996, ouly arsenic (2.9 ppm) was detected at levels above its CV. **Groundwater:** 1996 and 1997 samples from six wells did not contain any contaminants at concentrations above CVs.	Contaminated soil has been removed from Site 31C, and sampling was conducted afterwards to verify that all contaminated soil had been removed. Then Site 31C was covered with clean fill to replicate the original grade. Further soil and groundwater sampling at Site 31 have been proposed to occur during the ongoing RI/FS at the site.	The public is not allowed on site. Incidental, infrequent, and brief exposures to installation persounel to the levels of contaminants detected in soil would not cause adverse effects. Thus, exposure to soil poses no public health hazard. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 39: Clear Creek Floodplain	The floodplain is primarily densely vegetated. Much of the surface water in the area comes from a concrete drainage ditch in the northeast portion of the site which originates at the west end of South Field runway No. 13. Groundwater is also thought to contribute to surface water flow. Potential sources of floodplain contamination are Site 16 and four drums that were removed from the creek bed in 1993.	**Groundwater:** Five 1997 groundwater samples did not contain any contaminants at concentrations exceeding CVs. **Surface Water/Sediment:** Forty-nine surface water samples analyzed in 1986, 1990, 1992, and 1997 contained benzene (5 ppb), bromodichloromethane (3 ppb), dibromochloromethane (1 ppb), arsenic (1 ppb), cadmium (4 ppb), manganese (1,420 ppb), and thallium (1.4 ppb) at levels exceeding CVs. The forty-one sediment samples collected in 1990, 1992, 1993, and 1997 contained benzo(a)pyrene (0.16 ppm), BEHP (9,300 ppm), Aroclor-1260 (0.45 ppm), dieldrin (0.29 ppm), arsenic (20 ppm), cadmium (20 ppm), iron (54,800 ppm), and lead (981 ppm) at concentrations exceeding CVs.	In 1993, four drums, some of them rusted and containing only creek water, were removed from the floodplain. Additional sampling described in a RI/FS work plan includes the collection of an additional 20 surface water samples. At each sampling location, a sample will be collected at the groundwater/surface water interface. Sediment samples from ten of the sampling locations will also be analyzed.	Recreational use of Clear Creek is limited. Incidental and occasional contact by recreational users with the detected levels of contaminants in surface water and sediment does not pose a public health hazard. The U.S. Navy is conducting additional sampling and will select an appropriate remedial alternative. For a discussion of groundwater, see Site 40.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Public Health Evaluation
Site 40: Facility-wide Groundwater	In 1997, facility-wide groundwater was designated a separate site to address the plumes of different contaminants in the groundwater underlying the installation.	To date, all groundwater sampling has been associated with individual sites. See entries for the sites for information about available groundwater data.	According to a January 2000 RI/FS work plan, there will be further sampling of 24 existing monitoring wells and the collection of samples from 35 new monitoring wells. Soil sampling at twelve sites (Sites 3, 4, 6, 10, 11, 13, 14, 15, 16, 18, 30, and 32) will also be conducted to evaluate the potential of soil contamination leaching into groundwater.	There are three water supply wells in the Industrial Area that provide potable water to the installation. VOCs were detected in two wells and in the installation distribution system in the mid-1980s. The two wells were closed in 1986 until they were fitted with treatment systems to address the VOCs. A treatment system was also installed on the third supply well, as a precautionary measure. Levels of VOCs in water leaving all three treatment systems is sampled monthly, ensuring that the base drinking water system poses no current or future public health hazard. Since it is unknown for how long and at what concentrations the installation distribution system was contaminated prior to 1986, consumption of the water until that time poses an indeterminate public health hazard. There are six domestic wells, two wells used for landscaping, and one well used for agriculture within one mile of the installation. All the domestic wells are west of the installation except one, which is just east of Site 13. Groundwater sampling to ascertain the extent of all contaminant plumes is ongoing. The only known location in which groundwater contamination is migrating off site is east of Site 13. Tap water from a residence in the vicinity has been sampled, as have two wells west of the installation. No VOCs were detected in any of the samples. If future investigations suggest that any private wells might be in the path of contaminant migration, ATSDR recommends that the U.S. Navy develop and implement a plan for monitoring these wells and for addressing any contamination that may be detected. Since no exposure to contaminants at levels of health concern in off-site wells is expected, consumption of water from these wells poses no apparent public health hazard.

Sources: ABB-ES 1992, 1993a, b, 1995c, 1996, 1997a, b, 1998a, b, 1999; Geraghty & Miller 1984, 1985, 1986; Hendon Engineering Associates 1989; HLA 1999a, 1999b; NASWF 1999; Tetra Tech NUS 1999, 2000; and Touart 2000.

Appendix A: Evaluation of Potential Public Health Hazards at Naval Air Station Whiting Field (continued)

Notes:

- Sites 19 through 28 are not included in this table, as they are located at Outlying Landing Field Barin in Foley, Alabama.
- Site 34 was initially assigned to the former facility laundry. However, based on a record search and site history review, the site was removed from the IR program. Thus, there is no longer a Site 34.

Abbreviations:

ATSDR	Agency for Toxic Substances and Disease Registry
AVGAS	aviation gasoline
BEHP	bis(2-ethylhexyl)phthalate
CV	comparison value
1,2-DCA	1,2-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
FS	feasibility study
NAS	Naval Air Station
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethylene
ppb	parts per billion
ppm	parts per million
RI	remedial investigation
ROD	record of decision
SVOC	semi-volatile organic compound
TCE	trichloroethylene
UST	underground storage tank
VOC	volatile organic compound

Appendix B: Glossary

Absorption: How a chemical enters a person's blood after the chemical has been swallowed, has come into contact with the skin, or has been breathed in.

Acute Exposure: Contact with a chemical that happens once or only for a limited period of time. ATSDR defines acute exposures as those that might last up to 14 days.

Adverse Health Effect: A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR: The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substances and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Level: An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Cancer: A group of diseases which occur when cells in the body become abnormal and grow, or multiply, out of control.

Cancer Risk Evaluation Guides (CREG): An estimated contaminant concentration in water, soil, or air that would be expected to cause no more than one excess cancer in a million persons exposed over a 70-year lifetime according to EPA estimates. As ATSDR's most conservative comparison value, the CREG merits special attention. Note that this does *not* mean that exposures equivalent to the CREG are actually expected to *cause* one excess cancer in a million persons exposed over a lifetime. Nor does it mean that every person in an exposed population of one million has a 1-in-a-million chance of developing cancer from the specified exposure. Although ATSDR CREGs continue to be useful devices for screening cancer-causing substances at a site, they cannot be used to predict cancer incidence rates at a site. Furthermore, the exposure assumptions on which EPA's cancer risk estimates and ATSDR's CREGs are based (i.e., essentially lifetime exposure) seldom apply at contaminated sites.

Chronic Exposure: A contact with a substance or chemical that happens over a long period of time. ATSDR considers exposures of more than one year to be *chronic*.

Completed Exposure Pathway: See **Exposure Pathway**.

Comparison Value (CV): Concentrations or the amount of substances in air, water, food, and soil that are unlikely, upon exposure, to cause adverse health effects. Comparison values are used by health assessors to select which substances and environmental media (air, water, food and soil) need additional evaluation while health concerns or effects are investigated.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): **CERCLA** was put into place in 1980. It is also known as **Superfund**. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the public health issues related to hazardous waste sites.

Concern: A belief or worry that chemicals in the environment might cause harm to people.

Concentration: How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant: See **Environmental Contaminant**.

Dermal Contact: A chemical getting onto your skin. (see **Route of Exposure**).

Dose: The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as "amount of substance(s) per body weight per day."

Duration: The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant: A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in **Background Level**, or what would be expected.

Environmental Media: Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. **Environmental Media** is the second part of an **Exposure Pathway**.

Environmental Media Evaluation Guides (EMEG): A concentration of a contaminant in water, soil, or air that is unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. EMEGs are derived from ATSDR Minimal Risk Levels by factoring in default body weights and ingestion rates. Separate EMEGs are computed for acute (14 days), intermediate (15-364 days), and chronic (365 days) exposures.

U.S. Environmental Protection Agency (USEPA): The federal agency that develops and enforces environmental laws to protect the environment and the public's health.

Epidemiology: The study of the different factors that determine how often, in how many people, and in which people disease will occur.

Exposure: Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see **Route of Exposure**.)

Exposure Pathway: A description of the way that a chemical moves from its source (where it began) to where and how people can come into contact with (or get exposed to) the chemical.

ATSDR defines an exposure pathway as having five parts:

1. Source of Contamination,
2. Environmental Media and Transport Mechanism,
3. Point of Exposure,
4. Route of Exposure, and
5. Receptor Population.

When all five parts of an exposure pathway are present, it is called a **Completed Exposure Pathway**. Each of these five terms is defined in this glossary.

Frequency: How often a person is exposed to a chemical over time; for example, every day, once a week, twice a month.

Hazardous Waste: Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Health Effect: ATSDR deals only with **Adverse Health Effects** (see definition in this glossary).

Indeterminate Public Health Hazard: The category is used in public health assessments for sites where important information is lacking (missing or has not yet been gathered) about site-related chemical exposures.

Ingestion: Swallowing something, as in eating or drinking. It is a way a chemical can enter your body (See **Route of Exposure**).

Inhalation: Breathing. It is a way a chemical can enter your body (See **Route of Exposure**).

Maximum Contaminant Level (MCL): A contaminant concentration in drinking water that U.S. Environmental Protection Agency (USEPA) deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of 2 liters of water per day.

Minimal Risk Level (MRL): An estimate of daily human exposure -- by a specified route and length of time -- to a dose of chemical that is likely to be without a measurable risk of adverse, noncancerous effects. An MRL should not be used as a predictor of adverse health effects.

National Priories List: Part of **Superfund**, a list kept by USEPA of the most serious, uncontrolled, or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

No Apparent Public Health Hazard: The category is used in ATSDR's public health assessments for sites where exposure to site-related chemicals may have occurred in the past or is still occurring but the exposures are not at levels expected to cause adverse health effects.

No Public Health Hazard: The category is used in ATSDR's public health assessments for sites where there is evidence of an absence of exposure to site-related chemicals.

Plume: A line or column of air or water containing chemicals moving from the source to areas further away. A plume can be a column or clouds of smoke from a chimney or contaminated underground water sources or contaminated surface water (such as lakes, ponds and streams).

Point of Exposure: The place where someone can come into contact with a contaminated environmental medium (air, water, food, or soil). For example: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population: A group of people living in a certain area; or the number of people in a certain area.

Public Health Assessment (PHA): A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Public Health Hazard: The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Category: PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each are defined in the glossary. The categories are:

1. Urgent Public Health Hazard
2. Public Health Hazard

3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Receptor Population: People who live or work in the path of one or more chemicals, and who could come into contact with them (See **Exposure Pathway**).

Reference Dose (RfD): An estimate, with safety factors (see **safety factor**) built in, of the daily, life-time exposure of human populations to a possible hazard that is not likely to cause harm to the person.

Reference Dose Media Evaluation Guide (RMEG): The concentration of a contaminant in air, water or soil that corresponds to USEPA's RfD for that contaminant when default values for body weight and intake rates are taken into account.

Route of Exposure: The way a chemical can get into a person's body. There are three exposure routes:
- breathing (also called inhalation),
- eating or drinking (also called ingestion), and
- getting something on the skin (also called dermal contact).

Safety Factor: Also called **Uncertainty Factor**. When scientists don't have enough information to decide if an exposure will cause harm to people, they use "safety factors" and formulas in place of the information that is not known. These factors and formulas can help determine the amount of a chemical that is not likely to cause harm to people.

Source (of Contamination): The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an **Exposure Pathway**.

Survey: A way to collect information or data from a group of people (**population**). Surveys can be done by phone, mail, or in person. ATSDR cannot do surveys of more than nine people without approval from the U.S. Department of Health and Human Services.

Toxic:	Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.
Toxicology:	The study of the harmful effects of chemicals on humans or animals.
Tumor:	Abnormal growth of tissue or cells that have formed a lump or mass.
Uncertainty Factor:	See **Safety Factor**.
Urgent Public Health Hazard:	This category is used in ATSDR's public health assessments for sites that have certain physical features or evidence of short-term (less than 1 year), site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.