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Medical Officer, DFAS, FPB, DHAC

Health Consultation: South Patrick Shores, Satellite Beach  
Florida (BREVARD Co)

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#### BACKGROUND AND STATEMENT OF ISSUES

Representative Jim Bacchus has petitioned ATSDR to conduct a health assessment on the South Patrick Shores neighborhood (1). The petition arose from a citizen's concern regarding an apparent increase in the number of cases of Hodgkin's Disease occurring in the neighborhood. Some individuals in the neighborhood believe the increase was a result of contamination from Patrick Air Force Base. One person with Hodgkin's Disease felt that exposures had occurred from swimming in the Survival Canal on the base. Some in the neighborhood believe that South Patrick Shores was built over an old military dump.

At the request of the U.S. Representative, ATSDR held public availability sessions and participated in a public meeting in the area. These meetings took place on August 7 and 8, 1991. Representatives from the Florida Department of Health and Rehabilitative Services (HRS), the Environmental Protection Agency (EPA), the Army Corps of Engineers, and Patrick Air Force Base participated in the public meeting.

At these meetings, the community expressed additional health concerns. These concerns include questions on the rates of all cancers in the area, the rate of Amyotrophic Lateral Sclerosis in the area, the rates of psychiatric illness in the area, the potential connection between the presence of the radar cluster at the base and the occurrence of Hodgkin's Disease, and the possible effects on health from the testing of DDT in the area during World War II (2).

## South Patrick Shores

The South Patrick Shores area is a subdivision of single family homes in Satellite Beach. The area is located on a barrier island bounded by the Atlantic Ocean on the east and the Banana River on the west. Patrick Air Force Base borders the subdivision to the north. Other residential areas are south of the subdivision. Highway A1A forms the eastern boundary and South Patrick Drive forms the western boundary. Commercial development is present along Highway A1A. Appendix I contains a map of the area.

A review of the title search performed for the developer of the project showed that a succession of private owners and corporations from 1895 to 1940 owned the land in question. A review of the judgment rendered in the government's petition on taking, granted the northern half of Lot 1, Section 23 to the United States. The southern half of Lot 1 remained in private hands. The corporation that developed South Patrick Shores later purchased this southern half. The boundary of the property does not appear to have been moved. There is no indication that the portion of the land in South Patrick Shores ever belonged to either the Navy or the Air Force (3).

Construction in the area began in the 1950s. Verbal reports suggest that an unidentified party used a small area in the northern part of South Patrick Shores as a dump. Workers excavating for homes in the 1950s discovered the dump. ATSDR was present at an interview conducted by Florida HRS with an individual who had worked on this initial construction. This individual reported debris consisting of vehicular batteries and barrels (several crushed barrels and two reportedly filled with oil). Workers had this debris removed prior to the construction. The first house in the subdivision was completed in 1956. Several individuals in the neighborhood reported discovering airplane debris in the area. There are no reports of the discovery of hazardous wastes in the area. In 1958, the homes were connected to the municipal water system of Melbourne located on the mainland. Homes in the subdivision have wells in the shallow aquifer that are used for lawn irrigation. Appendix I contains more complete discussion of the hydrogeology of the area.

The population in South Patrick Shores is predominantly white (95%). There was a substantial increase in the percentage of the population over age sixty-five from 1980 to 1990 suggesting the movement of retirees into the area. Less than 8.5% of the population were under the age of ten in 1990 (4,5). There is an elementary school in the southern portion of the neighborhood. There are no day care facilities, hospitals, or nursing homes in the neighborhood. A full discussion of the demographics of the area is in Appendix II.

The potable water supply for the South Patrick Shores area is

from the city of Melbourne and the city of Cocoa Beach municipal well fields. These well fields are upgradient in Orange County and obtain water from the Floridan Aquifer. Most residents in the South Patrick Shores area have drilled wells that they use for lawn irrigation and/or air conditioning. Three aquifers compose the hydrologic system in the South Patrick Shores area. These aquifers are a shallow, unconfined, water table aquifer, an intermediate aquifer, and the confined upper Floridan Aquifer. Water in the shallow aquifer follows the local topography and flows from areas of higher elevation to areas of lower elevation. Island topography and water flow slopes from east to west with discharge occurring in the Banana River and contiguous canals and creeks. There is an upward pressure gradient in both of the deeper aquifer systems. A full discussion of the hydrogeology of the area is in Appendix III.

Florida HRS conducted sampling of the shallow groundwater in the South Patrick Shores area in August of 1991 (8). The results of this sampling indicated a pattern consistent with local use and not with a contaminant plume.

The EPA conducted soil and groundwater sampling in November of 1991. Soil samples were collected within two feet of the surface. Groundwater samples were collected from both private (PW) and temporary wells (TW). The samples were analyzed for metals, organics, and pesticides/PCBs. The surface soil evaluation for organics had one sampling point with detectable levels that were significantly different than the other sampling points. The level of PAHs at this one point was 12-25 ppm. The groundwater sampling did not show any evidence of a contaminant plume. Lead was detected at 30 ppb and aluminum at 620 ppm in well TW-12. Lead was not detected in the other wells sampled. Aluminum was detected in the range of 170-270 in other wells. Well TW-12 has elevated levels for several of the parameters analyzed when compared to the other wells sampled. Aluminum levels are 2000-3000 times greater than levels detected in all other well sampled. TW-12 was the only well with detectable levels of lead. Unless that well is unique in regard to water source or location, data from the well may be questionable.

#### Patrick Air Force Base

Patrick AFB is an Air Force Command installation occupying approximately 1,800 acres. The base is 4.1 miles from north to south and its width varies from 800 feet at the north to 7,200 feet at the southern end.

The base was activated in October 1940 as the Banana River Naval Air Station. During World War II, it served as a primary

air defense unit and training base. The Navy transferred the base to the Air Force in 1948. In 1949, the Banana River Naval Air Station was redesignated the Joint Long Range Proving Ground. In 1950, it was redesignated Patrick AFB. The primary mission as Patrick AFB has been to provide support and facilities for various missile testing and training squadrons (6).

Construction on the base has significantly altered the landform on the base. A series of three maps was located: one from 1947, one from a report dated 1956, and one from the period after the construction of the Capehart housing (undated). The map of 1947 showed little development of the south part of the base. Between 1947 and 1956, the runway was extended and canals were filled to accommodate the longer runway. In addition, buildings were constructed south of the older structures and closer to the South Patrick Shores area. It appears that landfilling occurred only on base property, and base personnel have already identified these sites.

As a part of the Air Force Installation Restoration Program, Patrick AFB has had a remedial investigation/feasibility study (RI/FS) conducted. The sites included former landfill areas, fuel and chemical storage areas, and fire fighter training areas. Appendix IV contains summaries of these sites from the Phase II RI/FS.

Landfill No. 5 is the site adjacent to the Survival Canal. The two portions of this landfill received office refuse, cafeteria refuse, and some industrial wastes. The industrial wastes include waste motor oil, paint shop residues, transformer fluid filters, unrinsed pesticide containers, and asbestos. Dredged spoil (principally sand) from the Banana River and other water courses covers the area. The area is currently used as a small-arms range and recreational area. Groundwater sampling detected low levels of arsenic, chromium, copper, silver, zinc, and chlorobenzene. The levels of these substances did not exceed the Safe Drinking Water Act Maximum Contaminant Levels (MCL) or the EPA's Drinking Water Health Advisories. The MCLs are enforceable drinking water regulations that are protective of public health to the "extent feasible." National primary drinking water standards apply to all public water systems including community water systems and transient and nontransient noncommunity water systems. The EPA health advisories provide the level of a contaminant in drinking water at which adverse noncarcinogenic health effects would not be anticipated with a margin of safety. The pesticides aldrin, chlordane, and DDE were above these EPA levels for drinking water (7). Appendix IV includes a map of Landfill No. 5.

Patrick Air Force Base and the Federal Aviation Administration (9) provided information on the radar installation at the base. The radar is 165 feet within the perimeter of the Air Force Base. The radar is a long range radar used for air traffic

control. There are two antennas: one search antenna and one secondary antenna. The antennas are 35-40 feet in diameter and are located inside protective domes. It is a 1.2 gigahertz system with a maximum range of 250 nautical miles. A routine triennial maintenance inspection of the radar facility is due to be performed in December 1991. The entire facility will be shut down in 18-24 months and relocated approximately 13 miles away in western Brevard county. The new site will allow a 2,000 foot clearance buffer zone as required by FAA regulations for optimal functioning of equipment.

#### COMMUNITY HEALTH CONCERNS

**Hodgkin's Disease:** The Florida State Epidemiologist has conducted an epidemiological investigation into Hodgkin's Disease in South Patrick Shores. This investigation identified two clusters of Hodgkin's in the area: one in the late 1960s and one in the early 1980s. No cases have been reported since 1984 in the study area (10).

**Overall Cancer:** The data from the Florida Cancer Registry for the years 1981-1987 were requested (11). ATSDR reviewed information from the Holmes Regional Medical Center Tumor Registry. In addition, staff requested information from the Shands Medical Center (12). These two centers are the primary facilities where oncology patients in the area receive care. Drs. Lee and Lewis reviewed the records of the Patrick AFB Tumor Registry cases of Hodgkin's Disease.

**Amyotrophic Lateral Sclerosis (ALS):** Staff held discussions with the ALS Society (13), individuals in the community, and the Mayo Clinic (14). A fact sheet on ALS is in Appendix V.

**Psychiatric Illness:** There are no statistics for these illnesses that are adequate to determine an accurate rate for the area (26). It is therefore not possible to comment on whether the rates are higher than expected. A fact sheet on these illnesses is in Appendix V.

**Effects of Low Level Electromagnetic Fields from the Radar Facility on Health:** Because the radar beam at the Patrick Air Force Base radar facility is 35 feet above ground, with a three degree positive elevation, directed out over the sea, and is at some distance from the neighborhood. The facility is within the OSHA guidelines for electromagnetic field exposure. Appendix V contains a fact sheet on the effects of low level electromagnetic fields on human and animal physiology and a fact sheet on radiofrequency and microwaves.

Effects of Low Level Exposure to DDT: During the period around World War II, DDT was used extensively in the area around South Patrick Shores. The community expressed a concern regarding the potential effects of this low-level, long-term exposure.

## DISCUSSION

The sampling done in the South Patrick Shores area do not indicate extensive contamination with hazardous substances. Limited groundwater sampling done by the state of Florida found three wells with levels of atrazine below 10 ug/L, two wells with heptachlor epoxide, and two wells with dieldrin. The levels of heptachlor epoxide and dieldrin were below the standards for drinking water. The level of atrazine in one well was above the EPA safe level for lifetime exposure through drinking water. Residents do not use these wells for drinking water. There should be no problems at these levels in the use of the wells for irrigation and swimming pools.

The EPA groundwater sampling did not indicate any evidence of a contamination plume. TW-12 had an aluminum level of 620 ppm. The range of aluminum in the other wells was 170-270 ppb. Aluminum in the drinking water of the United States is generally below 100 ppb. Lead was detected in one well (TW-12) at 30 ppb. The EPA regulations limit lead in drinking water to 15 ppb. The wells sampled (including TW-12) are not a potable water source; therefore, adverse health effects would not be expected to occur from other potential exposure to water from those wells.

The soil sampling conducted by the EPA did not indicate significant contamination in the area. There was one sampling point (SS-12, SB-12) with higher levels of PAHs than the other soil sampling points. The level of PAHs at that one point is consistent with the levels seen in urban areas (27). Exposure through the ingestion of soils with those levels should not result in adverse health effects.

The Hodgkin's Disease cases in the area were excessive at two different periods of time: the late 1960s and the early 1980s. Spatial and temporal clustering of Hodgkin's Disease cases have been described in the literature. Authors have generally attributed that clustering to the possible role of an infectious process in the etiology of the disease. Review of the medical literature did not indicate a link between Hodgkin's Disease and exposure to toxic compounds in the environment. Results of this review are in Appendix V. Currently there is no information to link the cases of Hodgkin's with an exposure to some compound in the environment.

ATSDR received information on the cancer cases in the Satellite

Beach zip code area and a comparison of the information with the Florida state averages. Review of this data indicate that overall fewer cases of cancer were identified in Satellite Beach than would be expected. This was true for all categories except breast and cervical cancer in females. A full breakdown of this information is in Appendix V.

Breast cancer in females is a common disease with one in ten women at risk for developing breast cancer over a lifetime. Various factors have been associated with an increased risk of breast cancer. The highest increase in risk is in women with a history of breast cancer or a family history of breast cancer. Other endocrine factors that are important include early menarche, late menopause, late first pregnancy, and no pregnancy. Environmental factors such as alcohol use, radiation of the breast, and a high fat diet have also been suggested, although the information on the alcohol and dietary fat is inconclusive. Chemicals in the environment have not been consistently linked to the development of breast cancer (17).

Most women with carcinoma in situ of the cervix are under the age of 35. The peak age incidence of invasive carcinoma of the cervix is between 48 and 55 years. Evidence suggests that cervical cancer is a sexually transmitted disease (STD). Women at high risk for other sexually transmitted diseases are also at higher risk for cervical cancer. The characteristics that increase a woman's risk for cervical cancer include early age at first sexual intercourse, low socioeconomic status, early age at first pregnancy, multiple male sexual partners, and history of any other STD. Increasing evidence indicates that the human papillomavirus (HPV) plays an important etiologic role in the pathogenesis of squamous cell cancer of the cervix. Chemical irritants have not been shown to increase the incidence of cervical cancer in women (18).

The cancer summary report from Holmes Regional Medical Center for the years 1987-1990 did not show any unusual pattern of cancers. The most common cancers seen all four years were lung, breast, prostate, and colon. These four cancers are the most common in the United States, particularly in the ages above 55 years (19). The demographics section of this consultation noted that the population in South Patrick Shores above the age of 65 years increased to 22.7% in 1990.

Discussions with the Mayo Clinic and the ALS Society indicate an estimated annual incidence rate of 2/100,000 for ALS. It does not appear that there is an elevation in the number of ALS cases in the area.

Electromagnetic fields are out of the purview of ATSDR. ATSDR staff contacted the National Center for Environmental Health and Injury Control (CEHIC) regarding the issue of radar and electromagnetic fields. CEHIC reported that they had no

information that would be useful in the evaluation of the radar. ATSDR has contacted the IEEE Committee on Man and Radiation for consultation regarding that issue.

DDT was first produced in 1944. The peak production in the United States was 200,000-250,000 tons in 1964. In 1969, some states began to restrict the use of DDT. DDT use was banned in 1972 because of concern over its persistence in the environment, the possibility of long-term effects, and the increasing resistance of insects to its effects (16). The use of DDT was so widespread during the 1950s and 1960s that the general population has detectable levels in the blood and fat tissue. In studies of the population, between 90 and 100% of the population had measurable levels of DDT in the blood (20,21,22,23,24). DDT exhibits effects similar to those of estrogen. Single high doses have resulted in headaches, nausea, tachycardia, and convulsions in humans (16). One study in human volunteers did not demonstrate any adverse health effects from long-term low dose exposure to DDT (25). It is not likely that the exposures that may have resulted from the spraying of DDT in the 1940s would have a significant impact on health.

Many experimental studies in animals and epidemiologic studies have suggested that increased incidence of leukemia or lymphoma may be associated with low level electromagnetic fields (15). Adequate data is available for the period of 1981 - 1987. These data show no significant differences from the average incidence rates for the state of Florida in incidence of leukemia, Hodgkin's Disease, and non-Hodgkin's Lymphoma.

#### CONCLUSIONS

Based on the available data, ATSDR considers this site to be of no apparent public health hazard. This conclusion is based on the following:

The data do not indicate that humans are being exposed to levels of contamination that would be expected to cause adverse health effects. The soil and groundwater sampling in the area did not indicate significant contamination.

The community-specific health outcome data do not indicate that outcomes that have been associated with chemical exposure are of concern.

There were two clusters of Hodgkin's Disease: one in the late 1960s and one in the early 1980s. That finding is not unusual for cases of Hodgkin's Disease.

The overall incidence of cancer in the community does not appear to be elevated. The two cancers with elevated rates are female breast and cervical cancer. Increased risk for these cancers has not been associated with chemical exposure in the literature.



The incidence of Amyotrophic Lateral Sclerosis does not appear to be elevated in the community.

There is not a database sufficient to evaluate the rate of psychiatric illness in the community.

The potential for exposure to electromagnetic fields from the radar unit and potential adverse health effects from exposure to electromagnetic fields is out of the purview of ATSDR.

#### RECOMMENDATIONS

ATSDR will refer the questions of the health effects of electromagnetic fields to IEEE Committee on Man and Radiation.

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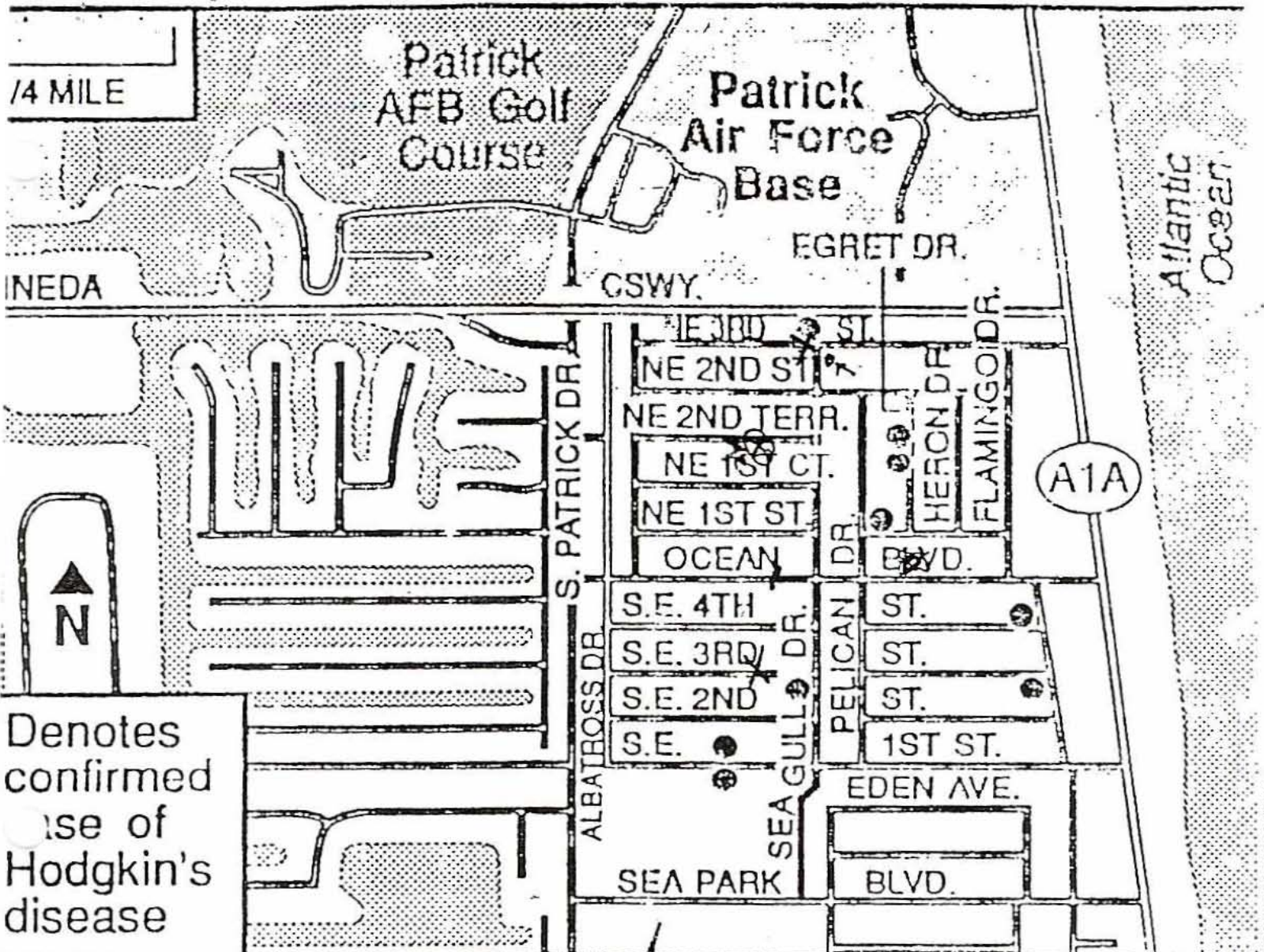
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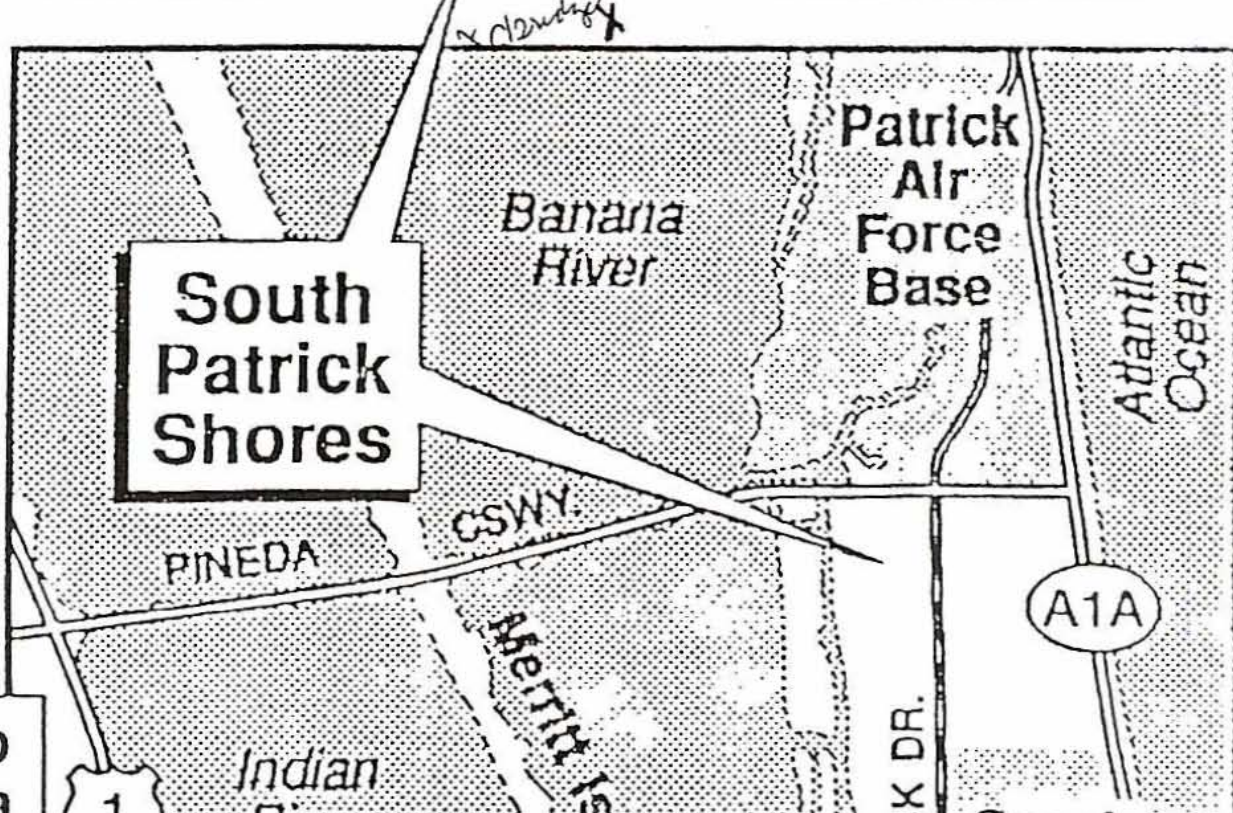
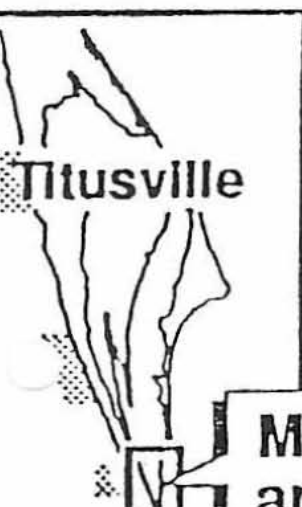
Appendix I: Maps

Appendix II: Hydrogeology



Denotes confirmed case of Hodgkin's disease

exact address of the confirmed Hodgkin's victim on Pelican Drive is unavailable.



**South Patrick Shores**

Map area

## SOUTH PATRICK SHORES/PATRICK AIR FORCE BASE

**HYDROGEOLOGY:** The hydrogeologic system in the South Patrick Shores area is composed of three, variably interconnected, aquifers: the shallow, unconfined, water table aquifer; the composite, laterally discontinuous, semi-confined, intermediate aquifer; and the confined upper, Florida aquifer. The information summarized in this study was obtained primarily from Installation Restoration Program Documents prepared for the Air Force by Environmental Science and Engineering (1) and communications with Douglas Munch (St. Johns Water Management District; 2) and Bud Timmons (Brevard County Office of Environmental Resource Management; 2).

The shallow water table aquifer occurs in sandy shelly deposits of Pleistocene and Holocene age and is always found within a few feet (0-8 feet) of the land surface. Recharge to the shallow aquifer is dominated by rainfall, although some upward leakage from underlying aquifers may occur (1). Discharge of the shallow aquifer occurs along all margins of the island which are at, or near, sea level. Local topography controls the direction of water flow and slopes westward from the primary dune along the Atlantic shore (15-20 feet MSL) to the Banana River (~0 feet MSL). Consequently, water in the shallow aquifer flows predominantly to the west and discharges into the Banana River. The shelly sands comprising the shallow aquifer have relatively high porosities and permeabilities and the rate of water flow is relatively rapid (360 feet/day; 1).

An intermediate aquifer occurs in thin, discontinuous sands and limestones at depths of 50 to 110 feet below sea level. The permeable units occur in several thin sands, shells or limestones that are separated from the overlying shallow aquifer by 30-40 feet of clayey sands and silts, and from the underlying Floridan Aquifer by similar thicknesses of clays and marls. There is no quantitative information on the direction or rate of water flow in this zone. Although this aquifer is semi-confined, recharge occurs as upward leakage from the underlying Floridan Aquifer and the potentiometric surface is 20-30 feet above MSL. (1).

The Floridan Aquifer occurs in Eocene and late Miocene limestones at depths greater than 150 feet (MSL). Recharge of the Floridan Aquifer occurs 150-200 km to the east in central Florida and the direction of flow in the South Patrick Shores area is north-northeast (1). The potentiometric surface of the Floridan Aquifer, which is the same as the overlying intermediate aquifer, is 20-30 feet above sea level. Consequently, discharge of the Floridan Aquifer is predominantly through upward leakage or at artesian irrigation wells.

Potable water supply for the South Patrick Shores area is from the City of Melbourne and the City of Cocoa municipal well



fields which are interconnected in this vicinity (2). These well fields are located upgradient in Orange County and obtain water from the Floridan Aquifer. Most residents in the South Patrick Shores area have wells drilled into the Floridan Aquifer that are used for lawn irrigation and/or air conditioning (heat exchangers; 1). These wells are all artesian (free flowing) due to the potentiometric surface above sea level.

Subsurface waste disposal activities at Patrick Air Force Base have little potential for contaminating groundwater in the South Patrick Shores area. Although numerous disposal areas have been identified on the Air Base, groundwater flow directions are away from the South Patrick Shores residential area. Water in the shallow aquifer follows the local topography and flows from areas of higher elevation, to areas of lower elevation. Island topography, and water flow, slopes from east to west with discharge occurring in the Banana River and contiguous canals and creeks. The surface of the shallow aquifer is always within a few feet of land surface and hydraulic conductivities are relatively high. Contaminants disposed in the shallow subsurface will be subject to rapid volatilization and/or leaching. Contaminants in the shallow aquifer have little potential for migrating into deeper confined and semi-confined aquifers due to the upward pressure gradient in both of the deeper aquifer systems.

#### REFERENCES

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Appendix II: Demographics

## PATRICK AFB DEMOGRAPHICS

Patrick Air Force Base is located on Florida's Atlantic coast in Brevard County. The base borders the Atlantic Ocean to the east and Cocoa Beach and Cape Canaveral to the north. The residential community of South Patrick Shores lies to the south of the site, along with the Capehart Housing area, which is a residential development for the base.

The total population living on the base declined by over 19 percent from 1980 to 1990. The base population consists of approximately 78 percent white, 15 percent black, and seven percent other races. The percent Hispanic origin increased from four percent to nearly ten percent from 1980 to 1990. Approximately 20 percent of the population were under age ten; over 54 percent were between the ages of 21 and 34 in 1990.

The total population of Capehart Housing was relatively static from 1980 to 1990, declining by 1.4 percent. Just under 80 percent of the population were white and 14 percent were black in 1990; over 7.4 percent were of Hispanic origin in 1990, up from four percent in 1980. There were 3.5 persons per household in 1990 as compared to 3.74 in 1980; these are relatively high percentages but are typical of military housing areas, which have a disproportionate number of young couples with children. Over 30 percent of the population were under age 10 in 1990.

The South Patrick Shores community experienced moderate population growth of 9.4 percent from 1980 to 1990. The percentage of those age 65 and over increased substantially, from 12.5 percent in 1980 to 22.7 percent by 1990; this trend suggests that a number of retirees are moving to the area. Less than 8.5 percent were under age ten in 1990. Over 95 percent were white. There were 2.38 persons per household in 1990. Over 80 percent of housing units were owner-occupied in 1990, indicating a non-transient population. Average household income was a relatively high \$24,617 in 1980, and only 4.7 percent of all persons were below poverty level in 1980 (figures are not yet available for 1990). Nearly one-half of owner-occupied houses were valued between \$60,000 and \$99,999 in 1990.

Tract 671 - Patrick AFB

Total population

1980: 2,843  
1990: 2,296

% Change from 1980-90: -19.2

% White

1980: 78  
1990: 78

% Black

1980: 15  
1990: 14

% Other races

1980: 7  
1990: 8

% Hispanic origin

1980: 4  
1990: 10

% Male

1980: 61  
1990: 59

% Female

1980: 39  
1990: 41

% < Age 10

1980: 20  
1990: 20

% Age 20-34

1980: 59  
1990: 59

No substantial % elderly

Tract 668 - Capehart Housing

Total population

1980: 4,020

1990: 3,965

% Change from 1980-90: -1.4

% White

1980: 83

1990: 80

% Black

1980: 12

1990: 14

% Other races

1980: 5

1990: 6

% Hispanic origin

1980: 4

1990: 7

% Male

1980: 50

1990: 50

% Female

1980: 50

1990: 50

% < Age 10

1980: 29

1990: 31

% Age 20-34

1980: 34

1990: 38

1-2% Age 65+ for 1980-90

87% of 1980 population lived outside the SMSA in 1975; indicative of highly transient population at military facilities. Median age for 1980 was only 23.4 (NA for 1990). About 7% of persons in 1980 were below poverty level; not too bad (NA for 1990).

Tract 669 - South Patrick Shores

Total population                   % Change from 1980-90: 9.4 (moderate)  
1980: 5,804  
1990: 6,350

% White	% Non-white
1980: 98	1980: 2
1990: 96	1990: 4

% Hispanic origin  
1980: 2  
1990: 3

% Male	% Female
1980: 49	1980: 51
1990: 50	1990: 50

% < Age 10	% Age 65+
1980: 6	1980: 12.5
1990: 8	1990: 22.7

High increase in 65+ suggests high inmigration of retirees, probably responsible for most of population growth in this tract. Over 80% of housing is owner-occupied, indicating non-transient population. Average income per household in 1980 was \$24,617, and only 4.7% of all persons were below poverty level in 1980 (figures NA for 1990). About half of owner-occupied houses were valued at \$60-99,999.