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PUBLIC HEALTH ASSESSMENT MCRD PARRIS ISLAND SC
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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

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Public Health Assessment for

USMC MARINE CORPS RECRUIT DEPOT
(a/k/a PARRIS ISLAND MARINE CORPS RECRUIT DEPOT)
PARRIS ISLAND, BEAUFORT COUNTY, SOUTH CAROLINA
CERCLIS NO. SC6170022762
SEPTEMBER 12, 1996

U S DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTRO FOR TOXICOLOGICAL SERVICES
Agency for Toxic Substances and Hazardous Waste



PUBLIC HEALTH ASSESSMENT

**USMC MARINE CORPS RECRUIT DEPOT
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**Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Federal Facilities Assessment Branch
Atlanta, Georgia**

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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Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It 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. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at 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 then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its 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.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

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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SUMMARY

As a result of environmental contamination, Marine Corps Recruit Depot, (MCRD) Parris Island was proposed for listing on U.S. Environmental Protection Agency's National Priorities List in August 1994. The listing was based on surface water and human food chain contamination. MCRD is located on a barrier island off the Atlantic Ocean. It operates as a Marine Corps training depot for marine recruits. Parris Island was first used by the military in 1885 as a naval shipyard. The Depot's long history of disposal of hazardous materials has lead to environmental contamination.

ATSDR evaluated the environmental information and site conditions at 59 areas to determine if people could be coming in contact with hazardous chemical contaminants at levels of health concern. ATSDR does not evaluate biological contamination. All conclusions and recommendations are based on hazardous chemical contamination. Our findings are as follows.

NO APPARENT PUBLIC HEALTH HAZARD

We identified two areas where chemical contaminants in soil entered the surface water wetland areas and bioaccumulated in edible fish and shellfish species: 1) contaminated fish and shellfish at the Causeway Landfill (Site 3) and 2) contaminated shellfish near the Rifle Range. These exposure situations pose no apparent public health hazard due to the low levels of contaminants detected in fish and shellfish. However, because the landfill has no impermeable cap nor leachate collection system, it is not known whether contaminants in fish and shellfish will increase over time. Therefore, ATSDR recommends monitoring contaminant levels in fish and shellfish every 5 years to ensure that edible fish and shellfish species remain safe to eat for recreational harvesters.

NO PUBLIC HEALTH HAZARD

The remaining 57 contaminated areas pose no public health hazard because people are not coming in contact with contaminants. Most contaminated areas on Parris Island are either buried below ground, in remote unaccessible areas, or have been removed. However, if land use changes, the likelihood of human exposure should be re-evaluated by MCRD, SCDHEC, EPA or ATSDR.

BACKGROUND

Marine Corps Recruit Depot (MCRD) Parris Island is an active installation located on a barrier island 1 mile south of the city of Port Royal and about 3 miles south of Beaufort, South Carolina. It is in Beaufort County, South Carolina approximately 50 miles south of Charleston, South Carolina and 40 miles northeast of Savannah, Georgia (Figure 1) on the Atlantic Ocean (1). The only land access to Parris Island is via a guarded entry to the causeway road. Visitors must check in with Military Police who request information about the visitor's destination on the island before providing a pass. MCRD consists of 8,047 acres. Approximately 3,274 acres are dry land, 4,344 acres are salt marsh, and 429 acres are saltwater creeks and ponds (2).

Parris Island is sparsely populated, with only 2,151 active duty military personnel, 3,564 dependents, 2,997 military retirees, and 4,028 retiree family members (1). On-base housing is provided for all enlisted personnel and some officers. Other military personnel must find housing off-base. There is frequent turnover of personnel at MCRD. Recruits and drill instructors train for 11-12 weeks. Approximately 20,000 recruits graduating each year. The average tour of duty for officers and staff is about 2 years, with medical and dental staff staying for 3 to 4 years (3).

Construction of the naval shipyard began on Parris Island in 1885. A wooden dry dock was built in 1893 and used for ship maintenance. In 1915, the entire island was transferred to the Marine Corps for use as a recruit depot. A small air field was built (Page Field) in 1932 for training Marine Corps and Navy pilots. Presently, the depot provides training for Marine Corps recruits (male recruits east of the Mississippi and all female recruits) (4).

Prior to the current established environmental regulations, previously accepted hazardous material handling and disposal led to environmental contamination at several areas on the depot. Chemicals used or disposed of include fuels, metals, pesticides, explosives, volatile organic compounds, semi-volatile organic compounds, and polychlorinated biphenyls. Based on contamination of surface water and human food chain (seafood) contamination, MCRD was proposed for listing on the U.S. Environmental Protection Agency's National Priorities List in August 1994 (5). Environmental investigations have been on going since 1985 when the Navy conducted the Initial Assessment Study (6). Currently, environmental investigations continue under the Installation Restoration Program. A total of 49 potentially contaminated sites have been identified by past environmental assessments and investigations. Ten additional sites have been identified and are being evaluated to determine if further environmental investigations are warranted (4).

EVALUATION OF CONTAMINATION AND EXPOSURE SITUATIONS

ATSDR conducted a site visit of the depot on June 19-21, 1995. The purpose of the visit was to collect information necessary for developing a public health assessment. Our focus is to determine if people could come in contact with site contaminants at levels posing health hazards and, if needed, to recommend actions to stop or prevent such exposures from occurring. People can be exposed to contaminants if they breathe, eat, drink or have skin (dermal) contact with substances containing chemical contaminants. ATSDR does not evaluate biological contamination.

ATSDR staff inspected site conditions at the MCRD, considering the nature and extent of environmental contamination at each site. We looked at the site's proximity to populated areas and the types of human activities that could lead to exposures (exposure pathways). *We concluded that there is little opportunity for human contact with site contaminants.* However, we were concerned that chemicals could enter the wetland areas and bioaccumulate in edible fish and shellfish species. Two areas that posed the greatest likelihood for concern are the Causeway Landfill (Site 3) and the Rifle Range berm and impact areas because people harvest and consume seafood from these chemically contaminated areas (Figure 2).

Additionally, we looked at groundwater for possible exposures. However, groundwater contamination is not a health concern because the water is not used for domestic purposes. Drinking water is supplied to MCRD by the Beaufort/Jasper Sewer and Water Authority (4). Therefore, no one is exposed to contaminants found in groundwater.

I. NO APPARENT PUBLIC HEALTH HAZARDS

ATSDR concluded that two exposure situations present no apparent public health hazard: 1) fish and shellfish contamination near the Causeway Landfill (Site 3) and 2) shellfish contamination near the Rifle Range. We discussed our concern of contaminated shellfish with Marine Corps personnel and representatives from federal and state agencies. Several studies addressing the concern had already been undertaken by the Department of Defense (DoD) in cooperation with the South Carolina Department of Health and Environmental Control (SCDHEC) and U.S. Environmental Protection Agency. Sufficient data were collected to determine what, if any, health threat exists for people who eat fish and shellfish harvested from the estuaries bordering the MCRD.

All contaminants detected were initially screened using ATSDR Health Comparison Values. Media concentrations less than ATSDR's comparison values are unlikely to pose a health threat. Those chemicals with concentrations greater than the

comparison values were evaluated further. Only PCBs in fish/shellfish at the Causeway Landfill and lead in oysters at the Rifle Range areas were above comparison values thus, requiring further evaluation to determine the likelihood of public health hazard. However, none of the contaminants detected in fish or shellfish from these areas were at levels of health concern. Therefore, based on chemical contaminant levels, consumption of fish or shellfish from the areas near the Causeway Landfill and the Rifle Range are safe for recreational consumers. We present details of our finding below.

A. Fish and Shellfish Contamination at Causeway Landfill (Site 3)

Based on the 1993 chemical analysis of fin fish and shellfish collected from both the impoundment and the tidal marsh at the Causeway Landfill, ATSDR determined that consumption of seafood by recreational harvesters is safe.

The 0.8 mile long Causeway Landfill (Site 3) contains a two-lane gravel road that connects Parris Island and Horse Island. It was constructed in 1960 of solid waste and fill dirt deposited across the tidal march of the Broad River and Ribbon Creek (Figure 2). It was the primary MCRD solid waste disposal area from 1960 to 1972 (except for an inactive period from 1966 to 1968). Domestic trash was the bulk of the waste disposed in the 10 acre site. Lesser amounts of construction debris, solid paint waste, empty pesticide containers, and mercury amalgam were also discarded along with some solvent and beryllium wastes, and PCB-contaminated oil (8). During the construction of the Causeway, uncovered waste were burned nightly. In the mid-1970s the Causeway was renovated to improve the culverts connecting the partial impounded saltwater pond with the tidal marsh thus ensuring some tidal flow and water interaction (8).

ATSDR reviewed results from MCRD's analysis of crabs, clams, oysters, mullet, and flounder as presented in the Extended Site Inspection Report Causeway Landfill, August 1993. This thorough report details the Causeway Landfill site history, sampling activities and analytical results. Samples were collected from both sides of the Causeway Landfill, the impoundment and the tidal marsh (Figure 3). Sufficient data are included to assess possible health threats to people who eat seafood harvested from these areas bordering the landfill. ATSDR concludes these species are safe to eat by recreational harvesters. It is estimated that 25 people would be fishing at this location. (See Appendix for Assumptions and Methodology).

Because the landfill has no impermeable cap nor leachate collection system, it is not known whether contaminant levels in fish and shellfish will increase over time. Therefore, ATSDR recommends MCRD monitor contaminant levels in fish and shellfish to ensure that edible fish and shellfish species remain safe to eat by recreational harvesters. We suggest that monitoring occur at least every five years based on the estimated longest tour of duty. Because retirees and military personnel are known to fish and crab in the impoundment area recreational fishing assumptions were used. It is unlikely that anyone subsistence fishes on the depot.

B. Shellfish Contamination near Rifle Range

Based on the 1995 chemical analysis of oysters collected from Ribbon, Edding, and Archers Creeks, and the berm impact areas of the Rifle Range, ATSDR determined that consumption of oysters by all harvesters is safe.

The Rifle Ranges are located in the eastern portion of MCRD. Trainees use rifles and small arms to shoot at targets into the berm impact area which abuts marshes along Archer, Edding, and Ribbon Creeks. Fishing and shellfish harvesting are allowed during times when the Rifle Ranges are not in use. The creeks are accessible to fisherman every afternoon, portions of Saturday and all day Sunday. Not much oyster harvesting occurs in the marsh behind the range because the area is too muddy (9). Recreational harvesting is the most likely form of harvesting, however, lead levels are low enough to be safe for subsistence consumption as well. It is estimated that 20 people would be fishing at this location. Most of the shellfishing (oysters and clams) in the vicinity of the depot is done off the southeastern end of Parris Island which is not likely affected by depot contaminants (10).

To address possible leaching of contaminants into the marsh from the Rifle Range, the Department of Defense (DoD) and the South Carolina Department of Health and Environmental Control (SCDHEC) sampled sediment and surface water. Further, shellfish were collected from estuarine creeks (Figure 4) and analyzed for chemical contamination. Oysters, being relatively non-mobile, are a good indicator of shellfish contamination in this area. There was concern that heavy metal contamination from projectiles may have impacted the tidal areas. Because projectiles are currently copper jacketed to prevent them from leaching lead, contaminants from the Rifle Range are not expected to dramatically increase over time based on the current land use and past history of use.

MCRD, in conjunction with SCDHEC, collected and split samples for analysis. The laboratory detection limits of the SCDHEC analysis were not low enough (based on public health standards), for us to ensure safety. However, MCRD's detection limits of the same samples were sufficient for us to make a public health determination. ATSDR concludes that based on chemical contaminant levels, oysters from Ribbon, Edding, and Archers Creek are safe to eat by all consumers. (See Appendix for Assumptions and Methodology).

II. NO PUBLIC HEALTH HAZARDS

ATSDR concluded that the following identified potentially contaminated sites do not present a public hazard under current conditions because no one is coming in contact with contaminants. However, if land use changes, the likelihood of human exposures will need to be re-evaluated.

ATSDR evaluated the following sites based on visual inspection, review of site history, and sampling data. Currently, there is little opportunity for people to be exposed to site contaminants at MCRD. Most sites are not in areas where people commonly go. Many sites are fenced, or are otherwise inaccessible because they are in remote parts of the island that are thickly vegetated, making contact with residual contamination in soils unlikely. Other sites have been cleaned by removal of contaminated media (soil) and therefore, would not pose a current or future health hazard.

There are a few sites with localized contamination that are in light industrial or shop areas. Although workers could enter these areas, their normal activities would not result in frequent contact with significant quantities of residual contamination to pose a health hazard. These sites do not present a current public health hazard. However, if human activities increase or the use of the land changes (i.e., from industrial to residential) the risk to human health changes. Proposals for such changes need to include evaluation of human exposure by MCRD, SCDHEC, EPA, or ATSDR to ensure human safety. At the present time, institutional controls are in place to ensure that safety measures are implemented when contaminated areas are disturbed either for clean up or for alternative use. If however, the MCRD or parcels on MCRD are turned over to private control, then the chance for human exposure must be re-evaluated for each specific land use scenario.

Sites with No Public Health Hazard

Potentially Contaminated Areas	Potentially Contaminated Areas
1 Incinerator Landfill (Site 1)	33 Outdoor Motor Pool SAA
2 Borrow Pit Landfill (Site 2)	34 Motor Pool Waste Oil Tank
4 Dredge Soils Area Fire Training Pit (Site 4)	35 Defense Reutilization and Marketing Office (DRMO) Salvage Yard
5 Former Paint Shop Disposal Area (Site 5)	36 Hazardous Waste Storage Building
6 Former Automotive Hobby Shop Spill Area (Site 6)	37 Overflow Storage Yard
7 Page Field Fire Training Pit (Site 7)	38 Underground Waste Oil Tank
8 Paint Waste Storage Area (Site 9)	39 Electrolyte Basin
9 MCX Service Station Spill Area (Site 11)	40 Sanitary Wastewater Treatment Plant
10 Jericho Island Disposal Area (Site 10)	41 Former Incinerator
11 Inert Disposal Area A (Site 13)	42 Sanitary Sewer System
12 Inert Disposal Area B (Site 13)	43 Motor Pool Underground Waste Oil Tank
13 Inert Disposal Area C (Site 13)	44 Dumpsters
14 Storm Sewer Outfalls (Site 14)	45 Dry Cleaning Facility Spill Area
15 Dirt Roads (Site 15)	
16 Pesticide Rinsate Disposal Area (Site 16)	A PCB Spill Area A (Site 8)
17 Page Field Tanks (AS-16) (Site 17)	B PCB Spill Area B (Site 80)
18 Page Field Tanks (AS-18) (Site 18)	C Gasoline Spill Area (Site 10)
19 Diesel Shop Vehicle Washing Pad	D MCX Service Station (Site 19)
20 Power Station Oil/Water Separator	
21 Weapons Plant Oil/Water Separator	<u>Sites Being Considered for Preliminary Assessment</u>
22 Motor Transport Car Wash	Septic Tanks
23 Indoor Dental Lab Satellite Accumulation Area (SAA)	Old Dry Cleaning Facility
24 Dental Lab SAA	Transformer Staging Area
25 Paint Shop SAA	Hobby Shop
26 Pesticide SAA	Old Photo Shop
27 Equipment Parage Deck SAA	Existing Photo Shop
28 Power Station SAA	DRMO
29 Indoor Motor Pool SAA	Daylight Infiltration Course
30 Empty Drum Storage Area	Old Weapons Cleaning Area
31 Weapons Power Plant SAA	
32 Laundry SAA	

COMMUNITY HEALTH CONCERNS/HEALTH OUTCOME DATA

No community health concerns regarding environmental contamination at the MCRD were identified. We met with base public affairs staffers who reported no community inquiries about inclusion of the MCRD on the NPL or other concerns about possible chemical contaminants at the installation. However, if people have health concerns related to possible exposure at MCRD, they can direct them to PERIS Branch RE: MCRD Parris Island, ATSDR, Division of Health Assessment and Consultation, 1600 Clifton Road, NE (E56), Atlanta, Georgia 30333.

During the public comment period, draft versions of this document were provided to the Parris Island, EPA, state regulatory agencies and also public repositories. No comments or suggested revisions were received.

We did not evaluate health outcome databases because people are not coming in contact with site contaminants at levels that might cause illnesses.

Table 1 - No Apparent Public Health Hazard Situations

PATHWAY NAME	LIMITING CONTAMINANT ¹	COMPLETED EXPOSURE PATHWAYS ELEMENTS					TIME	COMMENTS
		SOURCE	ENVIRONMENTAL MEDIA	POINT OF EXPOSURE	ROUTE OF EXPOSURE	POTENTIALLY EXPOSED POPULATION		
Fish and Shellfish Contamination at Causeway Landfill	PCBs (Aroclor 1254)	Causeway Landfill leachate into pond and marsh	Fish and Shellfish	Eating Fish and Shellfish	Ingestion	Recreational harvesters who eat contaminated seafood	Past Present Future	No apparent public health hazard for harvesters who consume fish and shellfish ² . Contaminant levels were low.
Shellfish Contamination near Rifle Range	Lead	Rifle Range	Shellfish	Eating Shellfish	Ingestion	People who eat contaminated seafood		

1 - Those chemicals with concentrations greater than the comparison values. Only PCBs (Causeway Landfill) and lead (Rifle Range) had concentrations above comparison values thus, requiring further evaluation for public health hazard.

2 - See Appendix for Assumptions and Methodology.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions:

1. ATSDR concluded that based on chemical contaminant levels, fish and shellfish from both the impoundment and the tidal marsh area near the Causeway Landfill are safe to eat by recreational harvesters.
2. Oysters collected from Ribbon, Edding, and Archers Creeks and impact areas near the Rifle Range do not contain heavy metal contaminants at levels of health concerns and are therefore, safe to eat by all consumers (recreational and subsistence) even though subsistence fishing in this area is unlikely.
3. All other identified areas of contamination do not currently pose a public health hazard because people are not coming in contact with contaminants.

Completed and Planned Actions:

1. MCRD has analyzed surface water, sediment, and fish and shellfish tissue from various areas near the Causeway Landfill. MCRD continues to conduct environmental investigations at this site including alternatives for source containment or remediation.
2. MCRD continues to evaluate site conditions and conduct contaminant removal actions on the depot.

Recommended Actions:

1. Because contaminants may continue to leach from the Causeway Landfill (Site 3), ATSDR recommends that MCRD conduct monitoring of fish and shellfish tissue every five years (based on the longest tour of duty) to ensure that fish and shellfish tissue remain safe to eat based on chemical contaminant levels.

The Navy reviewed the above recommendation and has agreed to analyzed fish and shellfish tissue at the Causeway Landfill at least every five years to ensure that fish and shellfish tissue remain safe to eat based on chemical contaminant levels.

2. Additionally, as land use changes, ATSDR recommends that MCRD evaluate all contaminated sites for likelihood of human exposure to contaminants to ensure that no one comes in contact with contaminants.

Mechanisms are currently in place to ensure that any changes in land are evaluated for human exposure potential. Additionally, in the future, should Parris Island revert to civilian control, alternative land use scenarios will be evaluated for public health impact.

APPENDIX

ATSDR Assumptions and Methodology

ATSDR reviewed the fish and shellfish data as presented in the Extended Site Inspection Report Causeway Landfill, August 1993. We calculated a safe seafood consumption rate using the following assumptions. Although the calculations below imply a certain amount of precision, they are estimates using a range of values that include several safety factors. In other words, when there is uncertainty, they over-estimate rather than under-estimate risk by a factor of 10 to 1,000. Thus, the consumption rates we calculated are highly protective of the public's health. Therefore, based on the low level of chemical contamination, we believe that seafood can be consumed at these rates without any adverse health effects.

- We used a standard child body weight of 16 kg (35 pounds).
- We used a standard adult body weight of 70 kg (154 pounds).
- We used the average concentration levels of contaminants in our calculation which would be representative of what people would actually be consuming over time.
- We used a 4 ounce ingestion rate for children and adults (0.114 kg) (7).

A. Causeway Landfill Areas

We evaluated the level of chemical contaminants detected in fish and shellfish at the Causeway Landfill (pond and tidal marsh) and determined that PCBs represented the greatest human health concern. However, for recreational consumers, the level of PCBs in fish and shellfish were not a health hazard. We used the following methodology.

- We calculated an average concentration of detected PCBs combined for all species (flounder, mullet, oyster, clam and crab) of 0.044 mg/kg (8). We assumed that people's meals consist of a combination of fish and shellfish rather than meals of just one species.
- We estimated the likelihood for non-cancerous and cancerous health effects from PCBs. For non-cancerous effects, we used the EPA reference dose of 2×10^{-5} for Aroclor 1254 (the predominant PCB congener detected). For cancerous health effects, we used 4.95 as the cancer slope factor as recommended by USEPA, FDA and Consumer Products Safety Commission as outlined in the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory, 1993 (11).
- For cancerous effects, we estimated that exposure duration of recreational harvesters to be 6 years (1 year greater than the maximum tour of duty).

The following formulas were used to calculate our maximum recommended consumption frequency.

For Non-cancerous Effects:

$$\begin{array}{l} \text{ATSDR's} \\ \text{Maximum Recommended} \\ \text{Consumption Frequency} \\ \text{(days/year)} \end{array} = \frac{\text{Body weight (kg)} \times \text{Reference Dose (mg/kg/day)} \times 365 \text{ (days/year)}}{\text{Mean Chemical Concentration (mg/kg)} \times \text{Ingestion Rate (kg/day)}}$$

For Cancerous Effects:

We derived dose that gives cancer risk goal.

$$\begin{array}{l} \text{Dose} \\ \text{(mg/kg/day)} \end{array} = \frac{1 \times 10^{-5}}{\text{Cancer Slope Factor (mg/kg/day)}^{-1} \times \text{Exposure Duration} / 70 \text{ year lifetime}}$$

$$\begin{array}{l} \text{ATSDR's} \\ \text{Maximum Recommended} \\ \text{Consumption Frequency} \\ \text{(days/year)} \end{array} = \frac{\text{Body weight (kg)} \times \text{Dose (mg/kg/day)} \times 365 \text{ (days/year)}}{\text{Mean Chemical Concentration (mg/kg)} \times \text{Ingestion Rate (kg/day)}}$$

RESULTS:

Recreational harvesters (adults, including pregnant women) could eat as much as two - 4 ounce meals per week as often as 50 weeks per year. [Calculated value = 102 meals per year.] Children could eat as much as one - 4 ounce meal once every two weeks per year. [Calculated value = 23 meals per year.]

B. Rifle Range Areas

We evaluated the level of chemical contaminants detected in oysters from Ribbon, Edding, and Archers Creeks and near the impact berm area of the Rifle Range and determined that lead represented the greatest human health concern. However, the level of lead in oysters were not a health hazard for children, pregnant women or other adults. We used the following methodology.

- We used 0.046 mg/kg (the detection limit) from the MCRD as the lead concentration. The SCDHEC laboratory detection limit was 1.0 mg/kg which would not be protective of public health (12).
- We derived a tolerable dose for lead by using FDA’s provisional tolerable total intake level of lead and various research studies which relate blood lead levels and dietary lead intake to derive a tolerable dose for lead in children and pregnant women (the people most sensitive to the effects of lead).

For children, we used FDA’s estimated dietary effect level of 0.0625 mg/day divided by 16 kg to give an estimated dose for a corresponding blood lead level of 10 ug/dL. Then divided by 10 which provides a safety factor.

For pregnant adults, we used FDA’s estimated dietary effect level of 0.250 mg/day divided by 70 kg to give an estimated dose for a corresponding blood lead level of 10 ug/dL. Then divided by 10 which provides a safety factor and also to account for transference of maternal blood lead to the fetus. For other adults, FDA’s estimated dietary effect level is 0.750 mg/day (13).

$$\frac{0.062 \text{ mg/day}}{16 \text{ kg}} \text{ } \therefore \text{ } 10 = 0.00039 \text{ mg/kg/day (Tolerable Dose for lead for children)}$$

$$\frac{0.250 \text{ mg/day}}{70 \text{ kg}} \text{ } \therefore \text{ } 10 = 0.00035 \text{ mg/kg/day (Tolerable Dose for lead for pregnant adults)}$$

The following formula was used to calculate our maximum recommended consumption frequency.

$$\text{ATSDR's Maximum Recommended Consumption Frequency (days/year)} = \frac{\text{Body weight (kg)} \times \text{Tolerable Dose (mg/kg/day)} \times 365 \text{ (days/year)}}{\text{Chemical Concentration (mg/kg)} \times \text{Ingestion Rate (kg/day)}}$$

RESULTS:

Based on chemical contaminant levels, oysters are safe to eat by all consumers. The calculated values are as follows. Children can eat as much as 435 - 4 ounce meals per year. Pregnant women, 1,705 - 4 ounce meals per year. Other adults, 5,213 - 4 ounce meals per year.

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1. Marine Corps Recruit Depot, Parris Island, Community Relations Profile, 1995.
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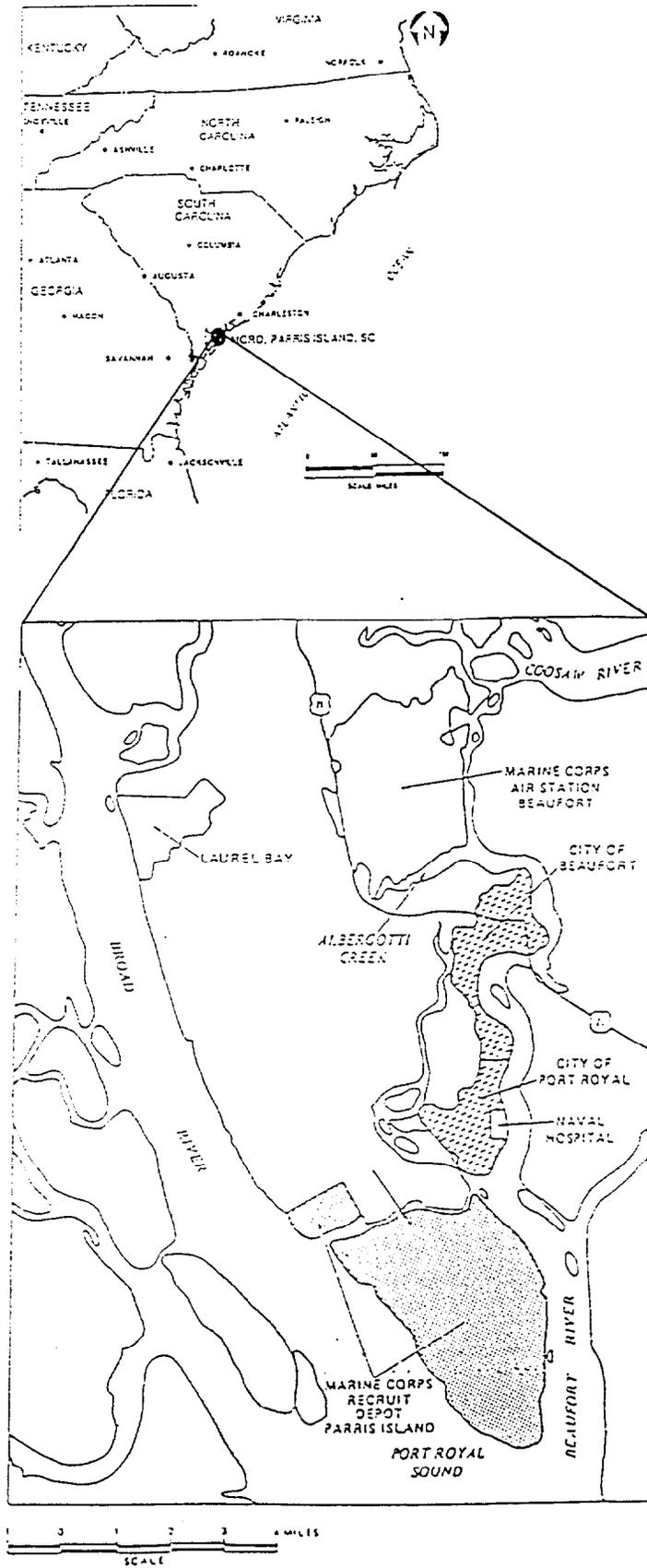


FIGURE 1. Marine Corps Recruit Depot, Parris Island, South Carolina

Adapted from:
 Extended Site Inspection Causeway Landfill August 1993. Dames & Moore, Initial Assessment Study September 1996.

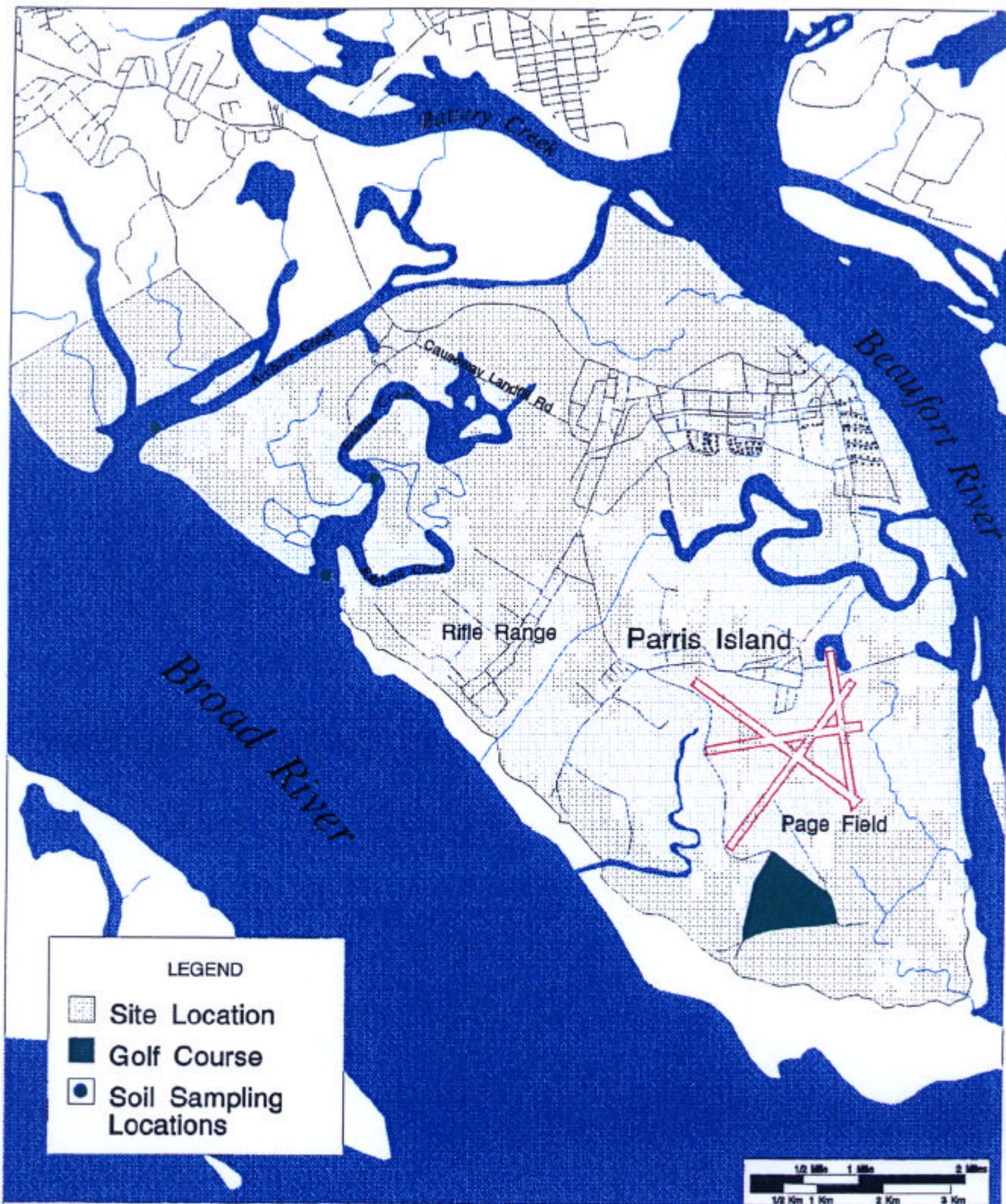


FIGURE 2. Marine Corps Recruit Depot, Parris Island, South Carolina

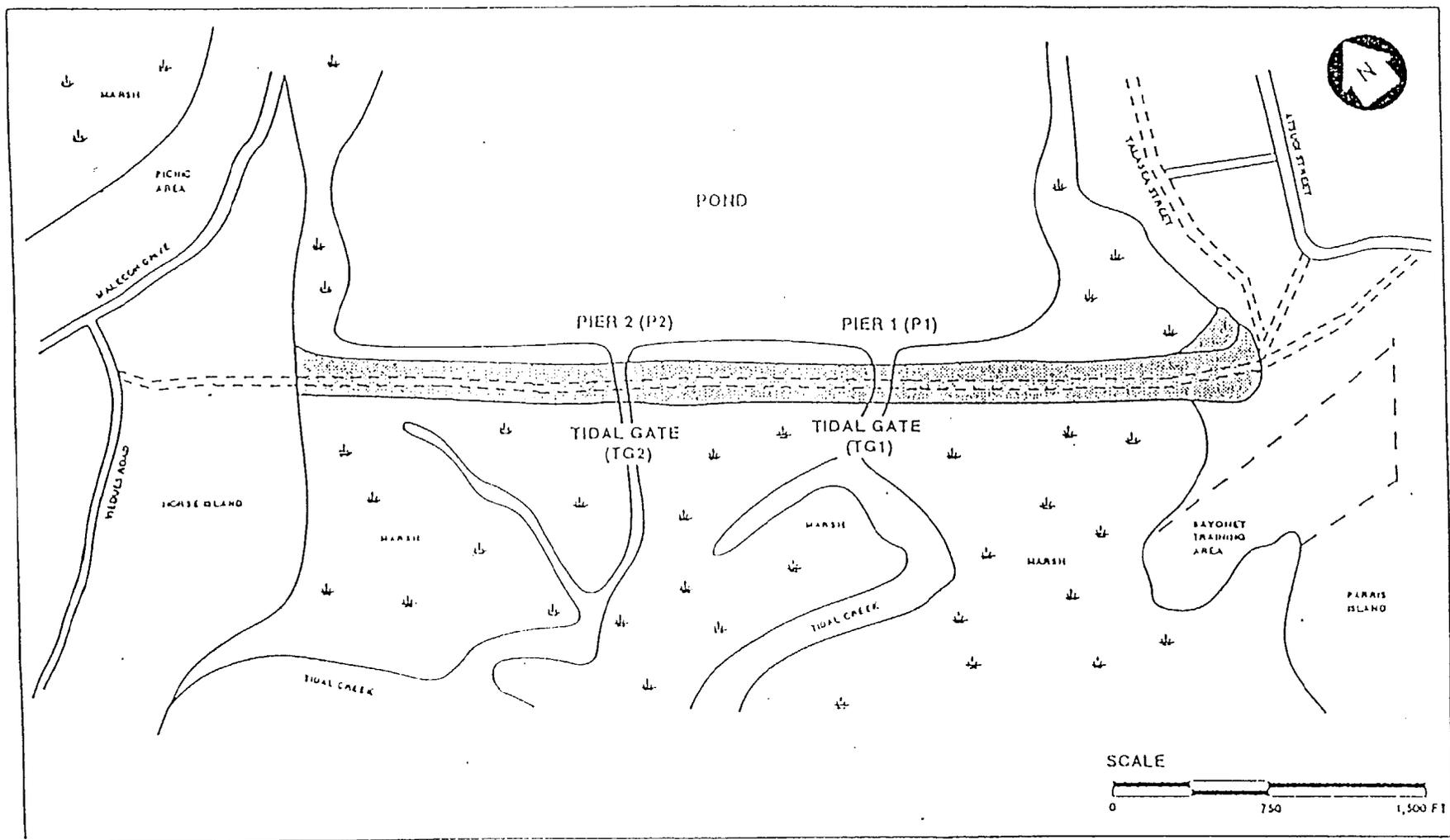


Figure 3. Sampling Locations at Causeway Landfill (Site 3) MCRD, Parris Island