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BASEWIDE ECOLOGICAL RISK ASSESSMENT WITH TRANSMITTAL LETTER NAS KEY WEST FL
2/1/2000
TETRA TECH NUS

Basewide Ecological Risk Assessment

for

Naval Air Station
Key West, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888
Contract Task Order 0007

February 2000

Revision 1

7046-7.19.2

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AIK-00-0033

February 8, 2000

Project Number HK 7046 *via U.S. Mail*

Mr. Dudley Patrick - Code 1858
Southern Division
NAVFACENGCOM
P.O. Box 190010
North Charleston, South Carolina 29419-9010

Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0007

Subject: Basewide Ecological Risk Assessment, Rev. 1
Naval Air Station Key West, Florida

Dear Mr. Patrick:

At your request, Tetra Tech NUS, Inc. (TtNUS) is pleased to submit the enclosed final Basewide Ecological Risk Assessment. This report was prepared to address ecological risks on a basewide level, and is an assessment of cumulative impacts to ecological receptors from multiple sites. At your request, copies of this document are being distributed to members of the NAS Key West Partnering Team and Restoration Advisory Board (RAB).

Please call me at (803) 649-7963, extension 345 with any questions you may have regarding the enclosed document.

Sincerely,

C. M. Bryan
TtNUS Project Manager

Q A Record

CMB:

Enclosure

c: Ms. Debbie Wroblewski/DER (Cover Letter Only)
Mr. T. Ballard, EPA (2 copies)
Mr. J. Caspary, FDEP (2 copies)
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Ms. R. Haag, South Florida Water Management District
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File: 7046-7.19.2

AIK-00-0033
Rev. 1

BASEWIDE ECOLOGICAL RISK ASSESSMENT

FOR

NAVAL AIR STATION KEY WEST, FLORIDA

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0007

February 2000

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1.0 INTRODUCTION

This report provides an integrated assessment of ecological risks resulting from former waste management activities at Naval Air Station (NAS) Key West, Florida. Tetra Tech NUS, Inc. (formerly Brown & Root Environmental) has recently performed ecological and human health risk assessments for 12 sites at NAS Key West on behalf of the U.S. Navy, Naval Facilities Engineering Command, Southern Division (NAVFACENGCOM-Southern Division) as part of an ongoing Resource Conservation and Recovery Act (RCRA) Facility Investigation and Remedial Investigation (RFI/RI). The document entitled "Supplemental RCRA Facility Investigation and Remedial Investigation Report for Naval Air Station Key West High Priority Sites, Boca Chica Key, Florida" covered the investigation of Solid Waste Management Units (SWMUs) 1, 2, 3, and 9 (B&R Environmental, 1997). The document entitled "Supplemental RCRA Facility Investigation and Remedial Investigation Report for Eight Sites, Naval Air Station Key West, Florida" covered the investigation of SWMUs 4, 5, 7; Installation Restoration (IR) sites 1, 3, 7, 8; and Area of Concern (AOC) B (B&R Environmental, 1998).

The two previous RFI/RI reports were not intended to characterize potential ecological risks on a base-wide level. Instead, each of the 12 sites was assessed as an individual, discrete site. However, most of the 12 individual sites are relatively small and constitute only a small portion of the home ranges of many ecological receptors. Thus, assessments of individual sites might be insufficient to fully characterize potential risks to wide-ranging ecological receptors. The goal of this report is to assess cumulative impacts to ecological receptors from multiple sites at NAS Key West. This report is intended to be a working document that will be revised as new data are collected during the RFI/RI process.

The results of the recent ecological risk assessments for the 12 sites are summarized in Table 1-1. The reader is advised to refer to the two previous RFI/RI reports (B&R Environmental, 1997; 1998) for information regarding the history of the installation restoration program at NAS Key West, methods used in the investigations, and detailed results of the investigations.

TABLE 1-1

SUMMARY OF SITE-SPECIFIC ECOLOGICAL RISK ASSESSMENTS NAS KEY WEST

Site	Area	Source of Contamination	Potential Ecological Risks in Applicable Media	Notes/Recommendations
SWMU 1	5 acres	General refuse, construction debris, solvents	Surface soil: chromium, mercury, tin, DDT[1], and several PAH compounds.	Elevated lead in some minnow samples. Corrective Measures Study (CMS) report complete. Hazardous and Solid Waste Amendment (HSWA) permit has been modified. Land Use Controls are in effect.
SWMU 2	0.5 acre	Pesticides	Groundwater, surface water, sediment, surface soil: DDT	Moderate to high concentrations of DDT daughter products in fish tissue. CMS report complete. HSWA permit has been modified. Land Use Controls are in effect.
SWMU 3	1.5 acres	Petroleum products	None	Land Use Controls[2]
SWMU 4	0.5 acre	Solvents, oil mixtures	Surface soil: cyanide, chromium	Land Use Controls[2]
SWMU 5	0.5 acre	Sand blasting residue	Sediment: cadmium elevated in a few samples (but not elevated in large lagoon south of site)	CMS report is complete. HSWA permit modification to be included in permit renewal. Land Use Controls are in effect.
SWMU 7	1 acre	Transformer oils, PCBs	Sediment: cyanide, mercury, silver, DDT, chlordane. Surface soil: PAHs elevated east of site - areal extent uncertain	CMS report is complete. Area east of site to be incorporated into Underground Storage Tank program.
SWMU 9	1 acre	Petroleum, solvents	Surface soil: chromium Groundwater: organic compounds	Pilot-scale treatability study will determine potential for reducing VOCs in groundwater.
IR 1	7 acres	Household and construction debris, general refuse, solvents	Groundwater: endosulfan, dieldrin, lindane. Sediment: copper, lead, zinc, DDT, dieldrin, endrin, endosulfan, lindane, Aroclor 1260. Surface soil: copper, lead, zinc.	Public participation process set to occur in Spring of 2000. Land Use Controls and monitoring are proposed as the final remedy.
IR 3	0.25 acre	Pesticides	Ecological exposure pathway is absent.	Presumptive remedy (capping) to be presented to public in the Proposed Plan.
IR 7	30 acres	Household and construction debris, general refuse	DDT elevated in some soil samples.	Land Use Controls[2]
IR 8	45 acres	Household and construction debris, general refuse	Groundwater and sediment: copper, lead, zinc	Public participation process set to occur in Spring of 2000. Land Use Controls and monitoring are proposed as the final remedy.
AOC B	10 acres	Discarded motor vehicles	Groundwater: DDT, dieldrin. Surface water: copper, iron, manganese, mercury. Sediment: cadmium, copper, lead, nickel, zinc, lindane, DDT, dieldrin.	Land Use Controls[2]

1 DDT = As used in this table, DDT generally refers to 4,4'-DDT as well as its daughter products 4,4'-DDD and 4,4'-DDE.
2 Land use controls have been recommended based on potential human health risks; no further action is required based on ecological risks.

2.0 PROBLEM FORMULATION

The problem formulation step defines factors such as the environmental setting, contaminants known to exist at the sites, contaminant fate and transport mechanisms, exposure routes, assessment and measurement endpoints, and the conceptual model. These factors are addressed in the following subsections.

2.1 ENVIRONMENTAL SETTING AND CONTAMINANT SOURCES

A brief description of the physical setting and general habitat types at NAS Key West is presented below and is followed by a description of contaminant sources and ecological resources at each site.

2.1.1 Physical Setting

NAS Key West encompasses approximately 6,323 acres of land divided into twenty separate tracts in the lower Florida Keys. The 12 sites discussed herein are located on four islands within NAS Key West: Boca Chica Key, Big Coppitt Key, Fleming Key, and Key West (Figure 2-1). These 12 sites are roughly clustered into two groups. One group consists of two sites on Fleming Key (IRs 7 and 8) and two sites near the western end of Key West (IRs 1 and 3). The second group consists of seven sites on Boca Chica Key (SWMUs 1, 2, 3, 4, 5, 7, and 9), and one site on Big Coppitt Key (AOC B). The two groups are separated by a distance of approximately 7 miles. The distance between sites ranges from 1,100 ft (SWMU 1 - SWMU 3) to 12 miles (IR 1 - AOC B). The sites range in size from 0.25 acres (IR 3) to 45 acres (IR 8).

2.1.2 Habitat Types

Aquatic habitat exists at each site except IR 3. SWMU 9 and IRs 1, 7, and 8 and are adjacent to open marine water. The remaining sites with aquatic habitat (SWMUs 1, 2, 3, 4, 5, 7; and AOC B) are inland, with little or no surface water connection to the Gulf of Mexico or Atlantic Ocean, with the exception of SWMU 1 and AOC B, which occasionally receive some tidal flooding. The only surface freshwater body at any site consists of a roadside ditch adjacent to SWMU 4. All other surface water is marine or brackish.

Several terrestrial habitat types are found at the 12 sites, and all habitats have been disturbed to some extent by historical human activities. The most common habitats (in acreage) consist of turf grass, grassy or weedy unmowed areas, Australian pine forests, and mangrove swamps. Pavement, buildings, and road sides constitute significant portions of some sites. Detailed habitat descriptions are discussed in the

Supplemental RFI/RI reports (B&R Environmental, 1997; 1998). Brief descriptions of site-specific habitats, receptors, and contamination sources are provided below.

2.1.3 SWMU 1 – Boca Chica Open Disposal Area

The contaminant source at SWMU 1 consists of a former open disposal and burning area. The disposal area was operated from 1942 until the mid-1960s and covers an area of approximately 5 acres. An interim remedial action (IRA) conducted at the site in 1996 removed 6,275 cubic yards of lead-contaminated soil and sediment.

SWMU 1 is characterized by open, low lying areas with scattered patches of buttonwood (*Conocarpus erectus*) and other vegetation. The southern and eastern portions of the site consist of a mangrove swamp dominated by red mangrove (*Rhizophora mangle*) and black mangrove (*Avicennia germinans*). The mangrove swamp extends eastward to Geiger Creek, which is located approximately 1,000 feet east of the site. The area west of the site provides habitat for the Lower Keys marsh rabbit (*Sylvilagus palustris hefneri*), which is listed as endangered by the U.S. Fish and Wildlife Service and the Florida Game and Fresh Water Fish Commission. The site is relatively flat but slopes gradually toward the mangrove swamp. The site occasionally receives some tidal flooding from Geiger Creek. There are three small, shallow ponded areas in the eastern portion of the site within the mangrove swamp. These areas are approximately 15 feet wide and 2 to 3 feet deep, and range from approximately 40 feet to 80 feet in length. Raccoon (*Procyon lotor*) tracks are abundant throughout the site. Other ecological receptors at SWMU 1 include small fish, arboreal and wading birds, and presumably reptiles and amphibians.

2.1.4 SWMU 2 – Boca Chica DDT Mixing Area

The contaminant source at SWMU 2 is the former DDT mixing area. The site was used for DDT mixing operations from the mid-1940s to the early 1970s. An IRA conducted at the site in 1996 removed 1,943 cubic yards of DDT-contaminated soil and sediment.

The site is a sparsely vegetated area covering approximately ½ acre and is located on the northern edge of a manmade ditch that exits into a lagoon that has formed in a borrow pit. Red mangroves line the eastern portion of the ditch outside the area of soil remediation. Habitat south of the ditch consists of a flat grassy area dominated by cordgrass (*Spartina* sp.) and fringe rush (*Fimbristylis* sp.) with scattered buttonwood trees. The area south of the ditch provides habitat for the endangered Lower Keys marsh rabbit, which is known to occur there. Wading birds forage along the edges of the lagoon and ditch, and waterfowl are often observed in the lagoon. Ospreys (*Pandion haliaetus*) and bald eagles (*Haliaeetus* *leucocephalus*) probably use the lagoon (at least occasionally) for foraging, although none were observed during RFI/RI field efforts.

2.1.5 SWMU 3 – Firefighting Training Area

The contaminant source at SWMU 3 is the burn pits where firefighting training was formerly conducted. An IRA conducted at the site in 1995 removed 835 cubic yards of petroleum-contaminated soil.

Most of SWMU 3 is paved or covered with gravel, which precludes the existence of significant terrestrial habitat. Approximately 200 feet to the south and west of the former pits is a 16-acre shallow lagoon that is fringed by a strip of red and black mangroves. Water depth in the lagoon ranges from approximately 16 to 26 inches. The lagoon is landlocked and therefore is not connected by surface hydrology to open ocean water. The lagoon provides habitat for wading birds and a variety of small minnow-sized fish species.

2.1.6 SWMU 4 – AIMD Building A-980

The contaminant source at SWMU 4 consists of two former in-ground 55-gallon drums. The two drums and surrounding soil were removed in 1989.

SWMU 4 consists primarily of buildings and a large paved parking area. The site is bordered on the south by a lawn and drainage ditch adjacent to a paved road. A large shallow marsh and scattered areas of mangrove swamp exist north and west of the site. A narrow strip of vegetation dominated by buttonwood and Australian pine (*Casuarina equisetifolia*) separates the marsh from the paved parking area. The marsh provides habitat for minnow-sized fish, various reptiles and amphibians, raccoons, and piscivorous wading birds. In addition, scat deposited by the Lower Keys marsh rabbit has been observed at the edge of the marsh immediately north and northwest of SWMU 4. The shallow ditch south of the AIMD building provides negligible aquatic habitat.

2.1.7 SWMU 5 – AIMD Sand Blasting Building A-990

The contaminant source at SWMU 5 consists of a former sand blasting area. Sand blasting activities were discontinued at the site in 1995. The sand blasting area is approximately 65 feet by 90 feet and consists of buildings and concrete.

A concrete drainage ditch near the former sand blasting area directs storm water runoff to a small area of terrestrial vegetation and a shallow pond approximately 500 ft southwest of the site. The pond is connected to a large lagoon by a culvert under a paved road. Approximately 0.2 acres of unmowed grassy habitat exists at the downstream end of the concrete ditch. The nearby pond is approximately 0.1 acre in size and is 10 to 18 inches in depth. A narrow border of buttonwood and black mangrove occurs along the edges of the pond and the large lagoon to which the pond is connected. Due to the small areal extent of the upland area at the end of the concrete ditch and the close proximity of active aircraft maintenance operations in the adjacent buildings, use of the area by terrestrial receptors is probably minimal. However, occasional use by birds and small mammals is possible. The shallow pond provides habitat for minnow-sized fish and wading birds, while the large lagoon provides habitat for a variety of fish and wildlife.

2.1.8 SWMU 7 – Building A-824

The contaminant source at SWMU 7 consists primarily of transformer oils that were occasionally dumped on the ground immediately north of the Building A-824. An IRA was conducted in 1995 during which 26 cubic yards of PCB-contaminated soil was excavated from the area at the north end of the building. A second potential source of contamination is a roadside diesel fuel spill that may have occurred east of the road on the eastern side of Building A-824 (IT, 1994). This fuel spill site has been transferred to the Underground Storage Tank Program and is not considered in this basewide ecological risk assessment.

SWMU 7 consists primarily of an equipment storage building, grassy areas, and two small ponds. The larger pond is approximately 40 ft × 40 ft, and 3 to 4 ft deep. A ditch extends southward from the pond and is connected to the smaller pond south of the site. Surface water in the ditch and ponds is not connected by surface hydrology to any other surface water bodies. The ponds are surrounded by a narrow strip of black mangrove, buttonwood, and Australian pine. Other vegetation in the vicinity of the ponds consists of cordgrass, broom sedge (*Andropogon virginicus*), Muhly grass (*Muhlenbergia capillaris*), sea oxeye daisy (*Borrichia frutescens*), seashore dropseed (*Sporobolus virginicus* and *S. soartinae*), and other grasses and weeds.

Minnows are present in the ponds and ditch, but due to the small size of the ponds and ditch, the use of this habitat by other aquatic receptors is probably insignificant. Terrestrial receptors in the surrounding area probably include a variety of invertebrates as well as vertebrates such as raccoons, snakes, lizards, and birds. Scat of the endangered Lower Keys marsh rabbit was observed in the grassy area both to the west and east of the northern pond during RFI/RI sampling activities.

2.1.9 SWMU 9 – Jet Engine Test Cell Building A-969

The contaminant source at SWMU 9 is an area where approximately 700 gallons of JP-5 fuel was spilled during a system leak in 1989. Approximately 600 gallons of fuel was recovered from surface puddles during initial remediation activities. A groundwater pump and treat system was installed and operated for several months in 1996 to remove contaminants associated with jet fuel.

The entire area is paved or covered with turf grass, so it contains no significant terrestrial habitat. Off-site adjacent grassy areas provide habitat for terrestrial receptors such as small mammals. However, these grassy areas are occasionally mowed, reducing their value as terrestrial habitat. An inlet of Florida Bay is located approximately 200 feet north of the spill area. The inlet provides excellent habitat for a variety of aquatic receptors. Wading birds forage in the shallow portions of the inlet. Although not observed during RFI/RI site activities, ospreys and bald eagles presumably forage at least occasionally in the inlet.

2.1.10 IR 1 – Truman Annex Refuse Disposal Area

The contaminant source at IR 1 consists of buried debris in the former disposal area. The site was used for general refuse disposal and open burning from 1952 until the mid 1960s, and covers an area of approximately 7 acres. An IRA was conducted in 1995, during which 4,878 cubic yards of lead-contaminated soil was removed. Excavated areas were backfilled with clean fill.

Terrestrial habitat within the former disposal area consists largely of turf grass enclosed by a chain link fence and is essentially devoid of all native vegetation. Prior to landfall of Hurricane Georges on September 25, 1998, a 5 to 15-foot strip of weeds and a few Australian pines were present between the chain link fence and riprap along the shoreline. However, Hurricane Georges resulted in massive erosion of much of the area between the riprap and the chain link fence. Additional riprap, composed of boulders and concrete rubble, has subsequently been placed along the shoreline as a temporary method of restoration and erosion control. Due to the overall lack of vegetation (other than turf grass), the site is probably utilized by few terrestrial receptors. Birds, however, probably forage occasionally in grassy areas on the site.

A diverse assembly of marine life was observed within the near shore vicinity of IR 1 during RFI/RI sampling activities. Common plants included turtle grass (*Thalassia testudinum*), sea fan (*Gorgonia* spp.) sea plume (*Pseudopterogorgia* spp.), and sea whip (*Leptogorgia* spp.). Observed animal life included spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), hawkwing conch (*Strombus raninus*), Caribbean vase conch (*Vasum muricatum*), green moray eel (*Gymnothorax funebris*), hermit crabs, tarpon (*Megalops atlanticus*), barracuda (*Sphyraena barracuda*), and several other fish. A sandy beach approximately 200 ft northwest of IR 1 was used in 1991 for nesting by Atlantic loggerhead turtles (*Caretta caretta*), classified as threatened by the U.S. Fish and Wildlife Service and the Florida Game and Fresh Water Fish Commission (IT, 1994).

2.1.11 IR 3 – Truman Annex DDT Mixing Area

The contaminant source at IR 3 is contaminated soil from pesticide mixing activities that were conducted at the site from the 1940s to the early 1970s. The site covers an area of about 1/4 acre. An IRA conducted in 1996 removed 735 cubic yards of DDT-contaminated soil from the site.

The site consists of an open, flat, rectangular area near downtown Key West. The site is covered with turf grass and is surrounded by parking lots, paved streets, residential areas, and other developed areas. Vegetation in the areas surrounding IR 3 consists of turf grass and scattered ornamental trees along streets and in residential areas. No surface water is present at IR 3, and the nearest surface water is approximately 1,100 feet to the south. Thus, IR 3 and the adjacent areas provide only limited terrestrial habitat of marginal quality in an urban and suburban setting. Ecological receptors in the vicinity of IR 3 consist of those typically found in urban areas, such as terrestrial invertebrates, lizards, songbirds, and exotic rodents such as the Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), and house mouse (*Mus musculus*). Because of the absence of aquatic habitat and the limited terrestrial habitat on and near IR 3, and since a substantial amount of contaminated soil has been removed, exposure routes and potential risks to ecological receptors are negligible and were not evaluated in the RFI/RI (B&R Environmental, 1998). In addition, the entire surface area of IR 3 is in the process of being covered with an asphalt cap. For these reasons, a complete exposure pathway for ecological receptors does not exist at the site. The potential for ecological impacts does not exist at IR 3, so this site will not be considered in this assessment.

2.1.12 IR 7 – Fleming Key North Landfill

The contaminant source at IR 7 consists of buried debris in the former disposal area. The site was used as a landfill for NAS Key West and the city of Key West from 1952 to 1962 and covers an area of approximately 30 acres. An IRA was conducted in 1995 to prevent ponding of rainwater and minimize infiltration. Clean topsoil was imported to fill low areas and promote runoff, and a vegetative cover was established to prevent erosion.

The site consists of the U.S. Department of Agriculture Animal Import Center and surrounding grounds, a wooded area to the west of this facility, and shorelines along the east and west sides of Fleming Key. Terrestrial habitat over much of the site consists of turf grass and weedy areas. Wooded portions of the site are dominated by Australia pine and Brazilian pepper. A narrow strip of black mangrove is located along the west shoreline. The east shoreline is rocky, with turf grass extending down to the high tide line. Terrestrial receptors at IR 7 include various invertebrates, reptiles, birds, and mammals such as the raccoon, opossum

(*Didelphis virginianus*), and possibly cotton rat (*Sigmodon hispidus*), as well as exotic rodents such as the black rat and house mouse.

Aquatic habitat along both the east and west shorelines of IR 7 is dominated by vast expanses of turtle grass, with manatee grass (*Syringodium filiforme*) and shoal grass (*Halodule wrightii*) present in some areas. Numerous fish were observed near both shorelines during RFI/RI sampling activities. Other observed aquatic animal life included spiny lobster, queen conch, stone crab (*Menippe mercenaria*), spiny spider crab (*Mithrax spinosissimus*), and loggerhead sponge (*Spheciospongia vesparium*).

2.1.13 IR 8 – Fleming Key South Landfill

The contaminant source at IR 8 consists of the former landfill and covers an area of approximately 30 acres. Waste materials from Sigsbee Key were deposited at the site from 1948 to 1951. The site served as a landfill for NAS Key West and the city of Key West from 1956 to 1982. An IRA was conducted at the site in 1997 to reduce erosion and stabilize the shoreline. Red mangroves and sea purslane (*Sesuvium maritimum*) were planted along the shoreline of IR 8 during the IRA.

Most of the site consists of a closed canopy of Australian pines. Ground cover is sparse to absent beneath the Australian pines. In areas where more sunlight can reach the ground, vegetation consists of Brazilian pepper and weedy species such as sandbur (*Cenchrus tribuloides*) and *Cyperus* spp. Since most of the site is a monoculture of Australian pines, the site provides poor habitat for terrestrial species. Nevertheless, a few species of reptiles and arboreal birds utilize the site. Mammals such as raccoons, opossums, and cotton rats may occur there, as well as exotic rodents such as the black rat and house mouse.

Turtle grass is the dominant aquatic vegetation in nearshore waters of IR 8. Marine life observed here during RFI/RI sampling activities included queen conch, milk conch (*Strombus costatus*), stone crab, spiny spider crab, true tulip snails (*Fasciolaria tulipa*), spiny lobsters, and several species of fish.

2.1.14 AOC B – Big Coppitt Key Disposal Area

The contaminant source at AOC B consists of discarded automobiles and automobile parts. The Navy acquired the land at AOC B sometime during 1985 or 1986. The site covers an area of approximately 10 acres and was used by civilians as an automobile disposal area during an unknown period. An IRA was conducted in 1996, during which 993 cubic yards of debris and metal-contaminated soil was removed from the area.

A dense mangrove swamp surrounds the east, south, and west boundaries of the area cleared during the IRA. This swamp, consisting primarily of red and black mangroves, extends to the eastern end of Big Coppitt Key. A sparsely vegetated area occurs north of the remediated area between Old Boca Chica Road and a dead-end canal. This area contains scattered glasswort (*Salicornia* spp.), saltwort (*Batis maritima*), and sea oxeye daisy. The canal is bordered by a thin strip of black mangroves. Buttonwood and white mangrove are found in the slightly more elevated portions of the site.

The canal is approximately 65 ft wide and 12 ft deep and extends north approximately 450 yds to a filled area over which a road has been constructed. Presumably, the canal was once linked to nearby ocean waters, but presently the outlet appears to be totally blocked, preventing the passage to and from the site by ocean dwelling organisms. Various marine fish, crabs, and other aquatic species exist in the canal.

While much of the site is cleared of vegetation and probably provides poor terrestrial habitat, the extensive mangrove swamp adjacent to the site provides good habitat for a variety of terrestrial and semi-aquatic receptors such as invertebrates, reptiles, amphibians, small mammals, and arboreal birds. Several wading bird species were observed foraging either in the canal or in the remediated area during RFI/RI sampling activities.

2.2 CONTAMINANT RELEASE MECHANISMS AND MIGRATION PATHWAYS

Contaminant fate and transport mechanisms as well as migration pathways that exist at each site are discussed in detail in site-specific sections of the two recent RFI/RI reports (B&R Environmental, 1997; 1998), and are briefly described below.

Potential contaminant release pathways at the sites include volatilization, wind erosion, overland runoff, and infiltration of contaminants. Constituents in the soil could volatilize from surficial material or become airborne via resuspension. Contaminated fugitive dust could be generated during ground-disturbing activities such as construction or excavation. The contaminants could then be dispersed in the surrounding environment and transported to downwind locations where they could repartition to surface soil, surface water, or sediment through gravitational settling, precipitation, and deposition. Precipitation runoff can carry contaminants to nearby soils and to nearby surface water and sediment. Wave erosion at the shoreline sites can carry contaminants to surface waters and sediments. Infiltrating precipitation can cause the contamination of subsurface soil and groundwater. After reaching the water table, contaminants can be carried with the flow of groundwater to downgradient locations. Groundwater at NAS Key West is shallow and probably eventually connects to marine surface water at most sites. Contaminants can be deposited subsequently in sediment or surface water and can potentially accumulate in the tissues of aquatic organisms.

The extent to which these pathways are present varies from site to site. For example, at sites largely covered by concrete or turf grass or otherwise thickly vegetated, volatilization, wind erosion, and overland runoff are minimal.

2.3 EXPOSURE ROUTES

Terrestrial animals can be exposed to soil contaminants through the ingestion of contaminated food items. In addition, animals can incidentally ingest soil while grooming fur, preening feathers, digging, grazing close to the soil, or feeding on items that are covered with soil (such as roots and tubers). Terrestrial vegetation can be exposed to contaminants through direct aerial deposition and root translocation. Aerial deposition could have been a significant exposure route during historical excavation or landfill activities. However, aerial deposition is presently minimal because the contaminant sources are largely covered by vegetation. Terrestrial receptors can also come into contact with contaminants in surface water by using it for drinking, although this exposure route generally represents a negligible portion of total exposure for most receptors. In addition, the salt content of surface water at the sites precludes the use of the water for drinking, and no surface fresh water exists at any site (with the exception of a roadside ditch adjacent to SWMU 4 and ephemeral puddles after rain showers). Thus, the ingestion of surface water is not considered to be an applicable exposure route at the sites investigated in this ecological risk assessment (ERA).

Exposure to contaminants in the soil via dermal contact can occur but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons minimize the transfer of contaminants across dermal tissue. Volatile constituents could be present in some site soils, and soil-bound contaminant airborne suspension could occur at some sites. However, inhalation does not represent a significant exposure pathway because this investigation assumes that air contaminant concentrations are quite low, even for burrowing wildlife. In addition, inhalation ecotoxicity data for chronic exposure are lacking. Hence, the air pathway was not considered for ecological receptors.

Aquatic and semi-aquatic organisms utilizing the open water on or adjacent to the sites can be exposed to contaminants through direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic and semi-aquatic organisms can also be exposed to constituents in contaminated groundwater that discharges into surface water.

2.4 ECOTOXICITY AND POTENTIAL RECEPTORS

Mechanisms of ecotoxicity are discussed in the two previous RFI/RI reports (B&R Environmental, 1997; 1998) and are summarized in Appendices D and B-3, respectively, of those documents.

Mobile aquatic species such as fish, lobsters, and crabs could conceivably be exposed to contaminants from multiple sites. However, as discussed in Section 2.1.2, only four sites are adjacent to marine waters, and of these, only IR 7 and IR 8 are in close enough proximity to result in potential multi-site exposure for aquatic organisms.

Several species of reptiles and amphibians occur on the base, but most of these have small home ranges. A few snakes, however, have relatively large home ranges. The Eastern indigo snake (*Drymarchon corais couperi*), for example, is known to utilize areas of 250 acres or more (Moler, 1992). Thus, some reptiles could be exposed to contaminants from more than one site. Alligators and crocodiles are not present at NAS Key West. Sea turtles could conceivably be exposed to contaminants from the shoreline sites. However, their presence has been documented only near a single site (IR 1) and only during egg-laying activities. Nesting habitat for sea turtles does not exist at the other three shoreline sites.

Very few mammal species exist at NAS Key West and in the lower Florida Keys. The low species diversity of mammals is presumably due to the relatively harsh natural ecological conditions in the Keys (i.e., poor soils, scarcity of fresh water). Additionally, natural habitats have been extensively altered or destroyed by humans in the Keys, so that remaining suitable natural habitats are broken into small isolated patches. Native terrestrial mammals on the base appear to be limited to the raccoon, the endangered Lower Keys marsh rabbit, the opossum, and possibly the cotton rat (Frank, 1996; Schuetz, 1996). Raccoons are abundant and widespread on the base and could be exposed to contaminants from multiple sites. Opossums are uncommon (Schuetz, 1996; FNAI, 1994) but are wide-ranging and could be exposed to contaminants from multiple sites.

Birds are the most mobile terrestrial ecological receptors and are the only receptors that could conceivably be exposed to contaminants at all 12 sites. Wading birds such as herons and egrets are probably the most likely species to be exposed to contaminants from multiple sites. Piscivorous birds such as the osprey, brown pelican (*Pelecanus occidentalis),* and bald eagle, as well as various other birds including numerous *Passeriforme* species, could also be exposed to contaminants from multiple sites.

2.5 ASSESSMENT AND MEASUREMENT ENDPOINTS

As discussed by EPA (1997), assessment endpoints are any adverse effects on ecological receptors, where receptors are plant and animal populations, communities, habitats, and sensitive environments. For this ERA, the assessment endpoint is the protection of groups of semi-aquatic and terrestrial receptors from adverse effects of contaminants on their growth, survival, and reproduction. This is the same endpoint that was investigated in the two earlier RFI/RI reports (B&R Environmental, 1997; 1998), except that aquatic receptors are not directly included as assessment endpoints in this ERA. As discussed in Section 2.4, strictly aquatic receptors (fish, lobsters, crabs, etc.) are unlikely to be exposed to contaminants from multiple sites.

Three species were used in the establishment of measurement endpoints: the American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), and raccoon. The selection of these three species is discussed in Section 3.2. For the kestrel (representative terrestrial receptor), the measurement endpoint is the total contaminant dose (based on chemical concentrations in soil) associated with adverse effects on growth, survival, and reproduction. For the great blue heron (representative piscivorous receptor), the measurement endpoint is the total contaminant dose in prey items (based on chemical concentrations in minnows) associated with adverse effects on growth, survival, and reproduction. For the raccoon (representative semi-aquatic receptor), the measurement endpoint is the total contaminant dose in prey items and incidentally ingested soil and/or sediment (based on chemical concentrations in crabs, surface soil, and sediment) associated with adverse effects on growth, survival, and reproduction. Details regarding the estimation of doses are provided in Section 4.2.

2.6 CONCEPTUAL SITE MODEL

The conceptual model is designed to identify potentially exposed receptor populations and applicable exposure pathways, based on the physical nature of a site and the potential contaminant source areas. Actual or potential exposures of ecological receptors associated with the sites are determined by identifying the most likely pathways of contaminant release and transport. A complete exposure pathway has three components: a source of contaminants that can be released to the environment; a route of contaminant transport through an environmental medium; and an exposure or contact point for an ecological receptor. Figure 2-2 shows the conceptual model for the 12 sites as whole. However, some exposure pathways shown as "complete" in Figure 2-2 are not applicable when assessing cumulative impacts to ecological receptors from multiple sites (e.g., uptake of soil by plants). The exposure pathways that were assessed in this ERA consist of the ingestion by terrestrial and semi-aquatic receptors of prey items exposed to contaminants in surface water, sediment, and soil, as well as the incidental ingestion of sediment and soil.

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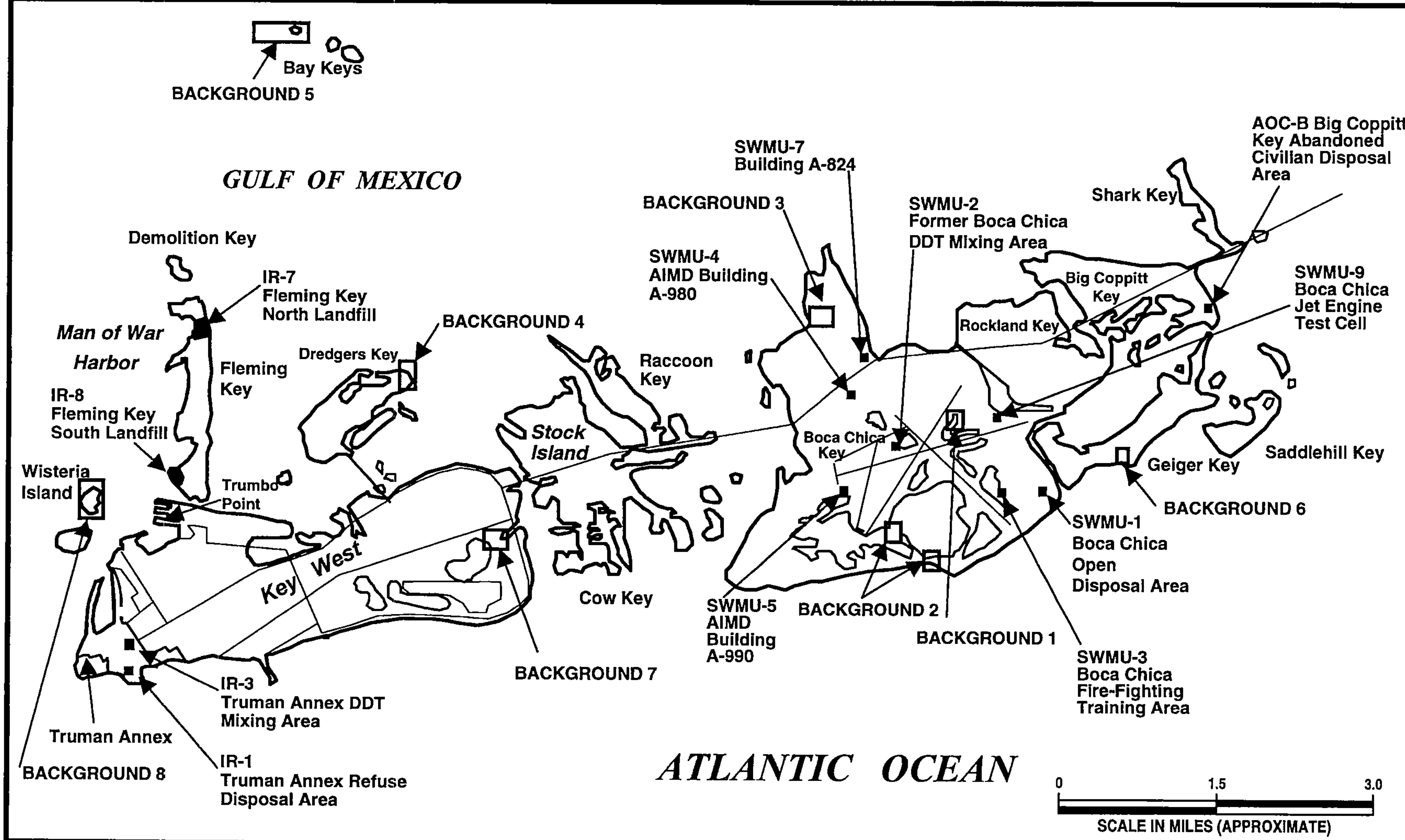

DRAWN BY RBP	DATE ----		BASEWIDE ECOLOGICAL RISK ASSESSMENT FIGURE 2-1 RFI/RI AND BACKGROUND SITES NAVY SOUTHERN DIVISION NAS KEY WEST, FLORIDA	CONTRACT NO. 7046
CHECKED BY	DATE			APPROVED BY / DATE
COST/SCHED-AREA				APPROVED BY / DATE
SCALE N.T.S.				DRAWING NO. F2-1 RFI-RI & BKGD SITES.PPT / REV. 0

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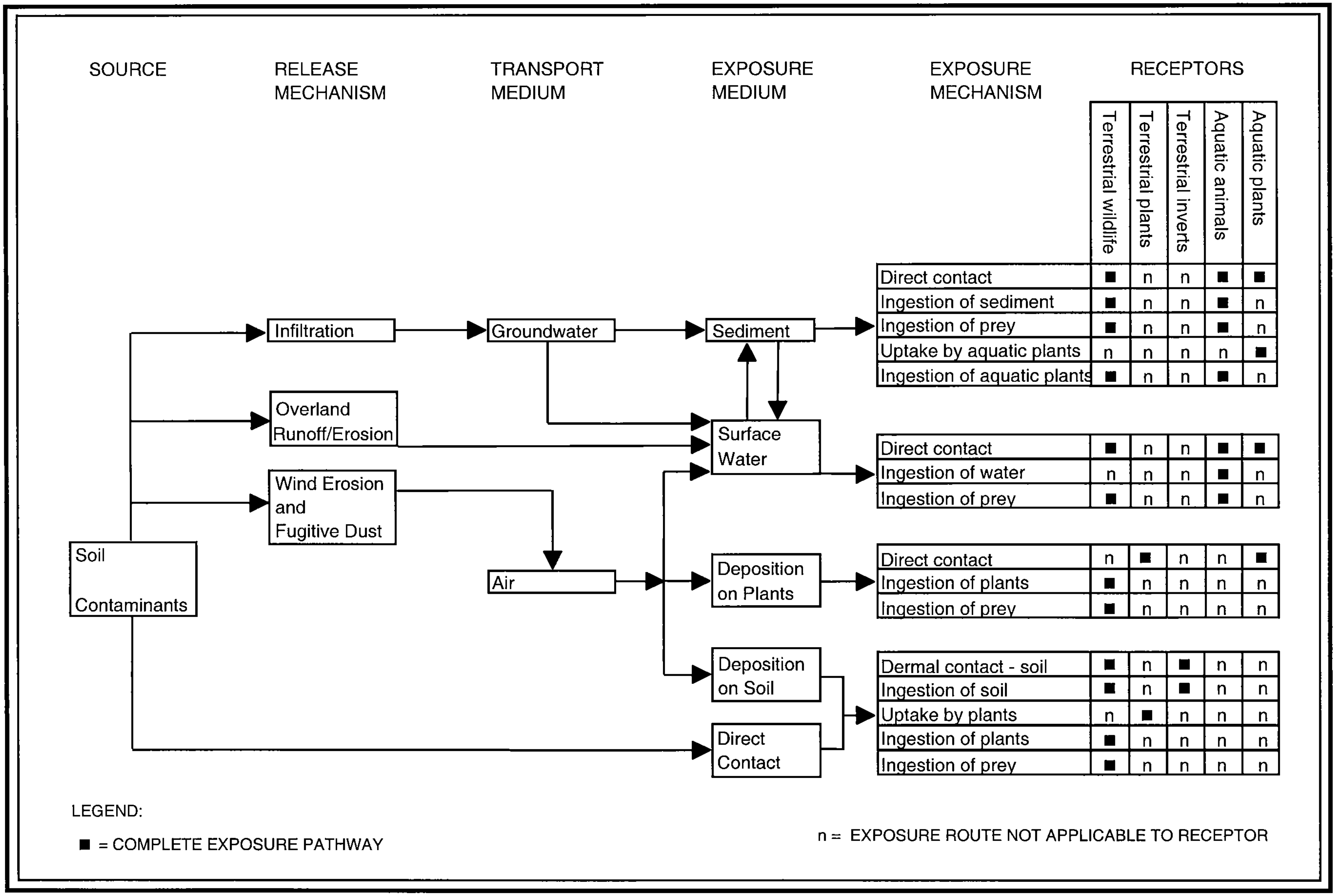

Key West/ERNA/Baseline ERA/Pubs Only/Graphix/F2-2.ppt

Figure 2-2. Conceptual Site Model, NAS Key West

3.0 ECOLOGICAL EFFECTS EVALUATION

Modeling of contaminant exposure via the food chain was performed to investigate potential risks to ecological receptors at NAS Key West. Species chosen to represent ecological receptors at NAS Key West, and for which contaminant intake doses were estimated, consisted of the raccoon, American kestrel, and great blue heron. Estimated doses for these representative receptors were compared to toxicity reference values (TRVs), which are doses above which potential risks may be present. TRVs that represent a threshold for sub-lethal effects were preferentially identified. Methods used for the derivation of TRVs and a discussion of the representative species chosen for this ERA are presented below.

3.1 TOXICITY REFERENCES VALUES (TRVS)

Since toxicity data for the specific receptors chosen were often not available, toxicity data from laboratory species were extrapolated to receptor species. Most of the TRVs were obtained from Oak Ridge National Laboratory (ORNL) wildlife toxicity data (Sample et al., 1996), but other sources were used when ORNL data were not available. No-observed-adverse-effects-levels (NOAELs) and lowest-observed-adverse-effects-levels (LOAELs) were used in the models. Following EPA Region 4 guidance, LOAELs were divided by a factor of 10 to obtain estimated NOAELs if NOAELs were not available for a contaminant, and NOAELs were multiplied by 10 to obtain estimated LOAELs if LOAELs were not available (Wellman, 2000). Tables 3-1 and 3-2 summarize the TRVs used in this ERA.

Following discussions with Region 4 EPA, VOCs were not included in food chain modeling. Analytes with log K_{ow} values less than 3.5 (VOCs) generally do not accumulate in animal tissue (Suter, 1993).

3.2 SELECTION OF REPRESENTATIVE RECEPTORS

Criteria considered in the selection of representative species used in the food chain model included the relationship of the representative species to species or guilds associated with NAS Key West, consistency of potential exposure pathways with the species being selected, the recreational or aesthetic value of the species, and the probability that these species might be maximally exposed to contaminants from multiple sites. As mentioned earlier, receptor species selected for food chain modeling consisted of the American kestrel, great blue heron, and raccoon. Table 3-3 presents exposure parameters for each receptor used in the model. A discussion of the representative receptors chosen for this ERA is presented below.

3.2.1 American Kestrel

Avian predators that feed primarily on terrestrial species are largely absent from the Keys. For example, red-tailed hawks are rare migrants during the winter and are absent during the breeding season, and red-shouldered hawks are uncommon in the Keys (FNAI, 1994). The American kestrel was chosen as a representative avian carnivorous receptor in the food chain modeling because it is the most common avian/terrestrial predator at NAS Key West. Although kestrels are not known to breed in the Keys, they are common from September through April and were frequently observed during RFI/RI sampling activities. Kestrels are found in a variety of habitats and are more likely to use habitats near human activities than are most other raptors. Kestrels prey on small animals including insects, amphibians, reptiles, mammals, and birds. In winter, small mammals and birds comprise most of their diet. Home ranges vary from less than 25 acres in productive areas to more than 1,400 acres in less productive areas (EPA, 1993).

3.2.2 Great Blue Heron

The great blue heron was selected as a representative avian piscivorous receptor. This heron inhabits a variety of freshwater and marine areas throughout North America and is found in the Florida Keys throughout the year. Great blue herons in the Florida Keys often consist of a white color morph and are known locally as the "great white heron" (Kale and Maehr, 1990). Fish are the preferred prey, and usually comprise about 90 to 98 percent of the diet (EPA, 1993). However, herons will occasionally eat insects, crustaceans, amphibians, reptiles, and small mammals. The distance between foraging areas and communal nesting/roosting areas ranges from 0 to 12 miles, but is usually less than 5 miles (EPA, 1993). While feeding, individual herons defend areas averaging 1.5 to 20 acres (EPA, 1993).

3.2.3 Raccoon

The only carnivorous mammals in the Key West area are non-native feral cats and the raccoon, which is omnivorous. Raccoons are found in virtually all habitats at NAS Key West. They are opportunistic feeders and will forage on a wide variety of animal and plant matter (EPA, 1993). Raccoons are highly adapted to urban environments and frequently feed on garbage and other refuse. However, in a conservative attempt to include all possible terrestrial guilds in the food chain modeling, the raccoon was chosen as a mammalian carnivore. Since all sites evaluated in this ERA contain aquatic habitats, and since raccoons often forage primarily on aquatic food items in shoreline environments (EPA, 1993) the raccoon was assumed to forage exclusively on aquatic organisms for this ERA. The size of a raccoon's home range depends on factors such as age, sex, habitat, food sources, and season. A literature review of several studies reported home ranges of up to 6,000 acres, although values of 200 to 600 acres were most common (U.S. EPA, 1993). Raccoon home ranges during a 1-year period on a Georgia coastal island were 161 acres for adult males and 96 acres for adult females (Lotze, 1979).

TABLE 3-1

DERIVATION OF TOXICITY REFERENCE VALUES FOR THE RACCOON
NAS KEY WEST, FLORIDA
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Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source	LOAEL Source
INORGANICS						
Aluminum	Mouse	Reproduction	1.93	19.3	Sample et al., 1996	Sample et al., 1996
Antimony	Mouse	Longevity	1.25	1.25	Sample et al., 1996	Sample et al., 1996
Arsenic	Mouse	Reproduction	1.26	1.26	Sample et al., 1996	Sample et al., 1996
Barium	Rat	Growth	5.1	19.8	Sample et al., 1996	Sample et al., 1996
Beryllium	Rat	Weight loss	0.66	6.6	Sample et al., 1996	NOAEL * 10
Cadmium	Rat	Reproduction	1.0	10	Sample et al., 1996	Sample et al., 1996
Chromium	Rat	Body weight	3.28	32.8	Sample et al., 1996	NOAEL * 10
Copper	Mink	Reproduction	11.7	15.14	Sample et al., 1996	Sample et al., 1996
Cyanide	Rat	Reproduction	68.7	687	Sample et al., 1996	NOAEL * 10
Iron	Rabbit	ERT[a]	50	500	ERT, 1997	NOAEL * 10
Lead	Rat	Reproduction	8.0	80	Sample et al., 1996	Sample et al., 1996
Manganese	Rat	Reproduction	88	284	Sample et al., 1996	Sample et al., 1996
Mercury	Rat	Reproduction	0.032	0.16	Sample et al., 1996	Sample et al., 1996
Nickel	Rat	Reproduction	40	80	Sample et al., 1996	Sample et al., 1996
Selenium	Rat	Reproduction	0.2	0.33	Sample et al., 1996	Sample et al., 1996
Silver	Mouse	Behavior	1.8	18	Rungby & Danscher, 1984	Rungby & Danscher, 1984
Thallium	Rat	Reproduction	0.0074	0.074	Sample et al., 1996	Sample et al., 1996
Tin	Mouse	Reproduction	23.4	35	Sample et al., 1996	Sample et al., 1996
Vanadium	Rat	Reproduction	0.21	2.1	Sample et al., 1996	Sample et al., 1996
Zinc	Rat	Reproduction	160	320	Sample et al., 1996	Sample et al., 1996
PESTICIDES/PCBS						
4,4'-DDD[b]	Rat	Reproduction	0.8	4	Sample et al., 1996	Sample et al., 1996
4,4'-DDE[b]	Rat	Reproduction	0.8	4	Sample et al., 1996	Sample et al., 1996
4,4'-DDT	Rat	Reproduction	0.8	4	Sample et al., 1996	Sample et al., 1996
Aroclor-1248	Monkey	Reproduction	0.01	0.1	Sample et al., 1996	Sample et al., 1996
Aroclor-1254	Mouse	Reproduction	0.068	0.68	Sample et al., 1996	Sample et al., 1996
Aroclor-1260[c]	Mouse	Reproduction	0.068	0.68	Sample et al., 1996	Sample et al., 1996
Alpha-BHC[d]	Mink	Reproduction	0.014	0.14	Sample et al., 1996	Sample et al., 1996
Beta-BHC	Rat	Reproduction	0.4	2	Sample et al., 1996	Sample et al., 1996
Gamma-BHC	Rat	Reproduction	8.0	80.0	Sample et al., 1996	Sample et al., 1996
Delta-BHC[d]	Mink	Reproduction	0.014	0.14	Sample et al., 1996	Sample et al., 1996
2,4-D	Rat	Blood/Liver	1.0	10.0	IRIS, 1995	NOAEL * 10
Dieldrin	Rat	Reproduction	0.02	0.2	Sample et al., 1996	Sample et al., 1996
Endosulfan I[e]	Rat	Reproduction	0.15	1.5	Sample et al., 1996	NOAEL * 10
Endosulfan II[e]	Rat	Reproduction	0.15	1.5	Sample et al., 1996	NOAEL * 10
Endosulfan Sulfate[e]	Rat	Reproduction	0.15	1.5	Sample et al., 1996	NOAEL * 10
Endrin	Mouse	Reproduction	0.092	0.92	Sample et al., 1996	Sample et al., 1996
Endrin Aldehyde[f]	Mouse	Reproduction	0.092	0.92	Sample et al., 1996	Sample et al., 1996
Gamma Chlordane[g]	Mouse	Reproduction	4.6	9.2	Sample et al., 1996	Sample et al., 1996
Heptachlor	Mink	Reproduction	0.1	1.0	Sample et al., 1996	Sample et al., 1996
Methyl parathion			NA	NA		
Toxaphene			NA	NA		
SEMIVOLATILE ORGANIC COMPOUNDS						
3-Methylcholanthene			NA	NA		
Acenaphthene[h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Acenaphthylene[h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Acetophenone			NA	NA		
Anthracene[h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Benzo(a)anthracene[h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Benzo(a)pyrene	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Benzo(b)fluoranthene[h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996

TABLE 3-1

DERIVATION OF TOXICITY REFERENCE VALUES FOR THE RACCOON
NAS KEY WEST, FLORIDA
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Benzo(g,h,i)perylene	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Benzo(k)fluoranthene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Bis(2-ethylhexyl)phthalate	Mouse	Reproduction	18.3	183	Sample et al., 1996	Sample et al., 1996
Chrysene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Dibenzo(a,h)anthracene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Fluoranthene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Fluorene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Hexachlorophene [h]			NA	NA		
Indeno(1,2-cd)pyrene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Naphthalene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Phenanthrene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996
Pyrene [h]	Mouse	Reproduction	1	10	Sample et al., 1996	Sample et al., 1996

a. Test end point not provided by ERT (1997).
b. 4,4'-DDT value used as a surrogate.
c. Aroclor-1254 value used as a surrogate.
d. BHC mixed isomers value used as a surrogate.
e. Endosulfan value used as a surrogate.
f. Endrin value used as a surrogate.
g. Chlordane value used as a surrogate.
h. Benzo(a)pyrene value used as a surrogate.
NA = Not Available.

TABLE 3-2

TOXICITY REFERENCE VALUES (TRVS) FOR THE AMERICAN KESTREL AND GREAT BLUE HERON NAS KEY WEST, FLORIDA PAGE 1 OF 2

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source	LOAEL Source
INORGANICS						
Aluminum	Dove	Reproduction	109.7	1097	Sample et al., 1996	NOAEL * 10
Antimony			NA	NA		
Arsenic	Cowbird	Reproduction	2.46	7.38	Sample et al., 1996	Sample et al., 1996
Barium	Chicken	Mortality	20.8	41.7	Sample et al., 1996	NOAEL * 10
Beryllium			NA	NA		
Cadmium	Mallard	Reproduction	1.45	20	Sample et al., 1996	Sample et al., 1996
Chromium	Black Duck	Reproduction	1	5	Sample et al., 1996	Sample et al., 1996
Copper	Chicken	Growth	47	61.7	Sample et al., 1996	Sample et al., 1996
Cyanide	Chicken	ERT[a]	4.5	45	ERT, 1997	NOAEL * 10
Iron	Chicken	ERT[a]	100	1000	ERT, 1997	NOAEL * 10
Lead	Japanese quail	Reproduction	1.13	11.3	Sample et al., 1996	Sample et al., 1996
Manganese	Japanese quail	Growth, behavior	977	9770	Sample et al., 1996	NOAEL * 10
Mercury	Japanese quail	Reproduction	0.0064	0.064	Sample et al., 1996	Sample et al., 1996
Nickel	Mallard	Growth, mortality	77.4	107	Sample et al., 1996	Sample et al., 1996
Selenium	Mallard	Reproduction	0.4	0.8	Sample et al., 1996	Sample et al., 1996
Silver			NA	NA		
Tin	Japanese quail	Reproduction	6.8	16.9	Sample et al., 1996	Sample et al., 1996
Vanadium	Mallard	Body weight	11.4	114	Sample et al., 1996	NOAEL * 10
Zinc	Chicken	Reproduction	14.5	131	Sample et al., 1996	Sample et al., 1996
PESTICIDES/PCBS						
2,4,5-T			NA	NA		
2,4,5-TP (Silvex)			NA	NA		
2,4-D			NA	NA		
4,4'-DDD[b]	Pelican	Reproduction	0.0028	0.028	Sample et al., 1996	Sample et al., 1996
4,4'-DDE[b]	Pelican	Reproduction	0.0028	0.028	Sample et al., 1996	Sample et al., 1996
4,4'-DDT	Pelican	Reproduction	0.0028	0.028	Sample et al., 1996	Sample et al., 1996
Aroclor-1260[c]	Pheasant	Reproduction	0.18	1.8	Sample et al., 1996	Sample et al., 1996
Alpha-BHC[d]	Japanese quail	Reproduction	0.56	2.25	Sample et al., 1996	Sample et al., 1996
Beta-BHC[d]	Japanese quail	Reproduction	0.56	2.25	Sample et al., 1996	Sample et al., 1996
Gamma-BHC	Mallard	Reproduction	2	20	Sample et al., 1996	Sample et al., 1996
Delta-BHC[d]	Japanese quail	Reproduction	0.56	2.25	Sample et al., 1996	Sample et al., 1996
Dieldrin	Barn owl	Reproduction	0.077	0.77	Sample et al., 1996	NOAEL * 10
Endosulfan I[e]	Partridge	Reproduction	10	100	Sample et al., 1996	NOAEL * 10
Endosulfan II[e]	Partridge	Reproduction	10	100	Sample et al., 1996	NOAEL * 10
Endosulfan sulfate[e]	Partridge	Reproduction	10	100	Sample et al., 1996	NOAEL * 10
Endrin	Screech owl	Reproduction	0.01	0.1	Sample et al., 1996	Sample et al., 1996
Endrin aldehyde[f]	Screech owl	Reproduction	0.01	0.1	Sample et al., 1996	Sample et al., 1996
Heptachlor			NA	NA		
Toxaphene			NA	NA		

TABLE 3-2

TOXICITY REFERENCE VALUES (TRVS) FOR THE AMERICAN KESTREL AND GREAT BLUE HERON NAS KEY WEST, FLORIDA PAGE 2 OF 2

Chemical	Test Species	Endpoint	NOAEL Derived TRV (mg/kg/day)	LOAEL Derived TRV (mg/kg/day)	NOAEL Source	LOAEL Source
SEMIVOLATILE ORGANIC COMPOUNDS						
Anthracene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Acetophenone			NA	NA		
Benzo(a)anthracene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Benzo(a)pyrene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Benzo(b)fluoranthene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Benzo(g,h,i)perylene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Benzo(k)fluoranthene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Bis(2-ethylhexyl)phthalate	Ringed dove	Reproduction	1.1	11	Sample et al., 1996	NOAEL * 10
Chrysene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Di-n-butyl phthalate	Ringed dove	Reproduction	0.11	1.1	Sample et al., 1996	Sample et al., 1996
Dibenzo(a,h)anthracene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Fluoranthene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Hexachlorophene			NA	NA		
Indeno(1,2-cd)pyrene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Naphthalene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Phenanthrene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994
Pyrene[h]	Starling	Immune dysfunction	10	100	Trust et al., 1994	Trust et al., 1994

a. Test end point not provided by ERT (1997).
b. 4,4'-DDT value used as a surrogate.
c. Aroclor-1254 value used as a surrogate.
d. BHC mixed isomers value used as a surrogate.
e. Endosulfan value used as a surrogate.
f. Endrin value used as a surrogate.
g. Chlordane value used as a surrogate.
h. 7,12-dimethylbenz(a)anthracene value used as a surrogate.
NA = Not Available.

TABLE 3-3

EXPOSURE PARAMETERS FOR ECOLOGICAL RECEPTORS NAS KEY WEST

Receptor	Guild	Parameter	Value	Reference
American kestrel (*Falco sparverius*)	Carnivore (Avian)	Body Weight	138 grams	Migratory kestrels wintering in Florida (EPA, 1993)
		Food Ingestion	40.0 grams/day	Based on 0.29 g/g body weight/day (EPA, 1993)
		Soil Ingestion	NA	Sample and Suter (1994)
		Home Range	24 to 1485 acres	EPA (1993)
Great blue heron (*Ardea herodias*)	Piscivore (Avian)	Body Weight	2,229 grams	EPA (1993)
		Food Ingestion	401 grams/day	Based on 0.18 g/g body weight/day (EPA, 1993)
		Soil Ingestion	NA	Sample and Suter (1994)
		Foraging Radius[1]	0.2 to 5 miles	EPA (1993)
Raccoon (*Procyon lotor*)	Carnivore (Mammalian)	Body Weight	3,990 grams	Mean of males and females in Alabama (EPA 1993)
		Food Ingestion	856 grams/day[2]	EPA (1993)
		Sediment/Soil Ingestion	9.4% of diet	EPA (1993)
		Home Range	96 to 6326 acres	Home range for a Georgia coastal island (EPA, 1993)

NA = Not applicable since soil ingestion by raptors and great blue heron is assumed to be negligible (Sample and Suter, 1994).
1 = Home range not available.
2 = Calculated using mammal equation developed by Nagy (1987) converted to wet weight assuming 75 percent water content in food items (aquatic organisms).

4.0 EXPOSURE ESTIMATE

The potential for impacts to ecological receptors from exposure to multiple sites at NAS Key West was investigated by first estimating the dose that representative ecological receptors might receive for each contaminant of potential concern (COPC). Doses were then compared to TRVs, which were discussed in Section 3.0. The elements of the exposure estimate are described below.

4.1 EXPOSURE POINT CONTAMINANT CONCENTRATIONS

Data used to obtain exposure point concentrations in this ERA were those used in the two previous RFI/RI reports (B&R Environmental, 1997; 1998). COPCs consisted of analytes in sediment and surface soil whose maximum detected concentrations exceeded respective ecological threshold values at one or more sites in the previous RFI/RI reports, except that inorganic analytes whose maximum detected concentration was less than twice the average background concentration were excluded as COPCs. Analytes for which no suitable ecological threshold were available were also considered to be COPCs. The comparisons of maximum concentrations to ecological threshold values and background values at each site, as well as the complete list of ecological threshold values, are provided in the two previous RFI/RI reports. Analytes not retained as COPCs were dropped from further consideration.

Groundwater as an exposure medium was not investigated in this basewide ERA. Ecological receptors are not directly exposed to groundwater, and thus, risks to wide-ranging ecological receptors from groundwater exposure are not applicable. The risks to ecological receptors from groundwater contamination were assessed on a site by site basis in the two previous RFI/RI reports.

Surface water as an exposure medium was also not directly investigated in this basewide ERA. Surface water provides three possible exposure mechanisms for ecological receptors: direct contact, ingestion of water, and ingestion of prey (Figure 2-2). As discussed in Section 2.3, the salinity of surface water at the sites precludes the use of surface water for drinking. Direct contact with surface water at multiple sites, and subsequent dermal exposure, is not assumed to be a major exposure mechanism for basewide receptors. Therefore, exposure point concentrations of surface water were not used in this risk assessment. Nevertheless, surface water as an exposure medium was indirectly examined by investigating the risks to the great blue heron from consumption of minnows, and by investigating the risks to the raccoon from consumption of crabs collected from surface water bodies at several sites.

Maximum detected contaminant concentrations were used as exposure point concentrations for site-specific assessments in the two previous RFI/RI reports (B&R Environmental, 1997; 1998). However, the current study is an attempt to assess risks on a basewide level. Specifically, the goal of this study is to assess cumulative impacts to wide-ranging ecological receptors from multiple sites at NAS Key West. Since wide-ranging receptors will not be exposed to the maximum concentration at a single site for the period of the exposure duration, alternate concentration terms are more applicable than maximum detected contaminant concentrations. Thus, multi-site exposure point contaminant concentrations within a given medium (e.g., surface soil) were calculated by two methods: (1) the mean concentration of each COPC, and (2) the mean of the maximum detected concentrations for each COPC. Potential ecological risks were assessed using both sets of exposure point concentrations.

Mean values were calculated using all data points from all sites within each exposure unit for a given medium. Exposure units are described in Sections 4.1.1 through 4.1.3. Means were calculated using values of one-half the instrument detection limit for samples where concentrations were less than the instrument detection limit. "Non-detects" were not used, however, when calculating means of the maximum detected concentrations. For example, the maximum detected concentration of Aroclor-1260 in surface soil at IR 1 was 85 μg/kg, but Aroclor-1260 was not detected in surface soil at the other two sites within the western data set (see Section 4.1.3 for a description of the western data set). In this example, 85 μg/kg was used as the mean of the maximum detected concentrations. As a second example, the mean of the maximum detected concentrations for a chemical detected at 2 of 11 sites would be calculated by deriving the mean of the maximum detected concentrations at those two sites only.

Information regarding data quality issues (e.g., data validation) is contained in Appendix G, Section 2.0 of B&R Environmental (1997) and Appendix C, Section 2.0 of B&R Environmental (1998).

A discussion of data used to estimate exposure point concentrations for the three representative ecological receptors used in this assessment is provided below.

4.1.1 American Kestrel

As discussed in Section 2.4, birds are the only receptors that could conceivably be exposed to contaminants at all NAS Key West RCRA/CERCLA sites. Therefore, the exposure unit for the kestrel was assumed to be the area encompassed by all sites, and the soil data set used to estimate the dose to the kestrel consisted of surface soil samples collected from all sites where complete exposure pathways exist (i.e., all sites except IR 3).

4.1.2 Great Blue Heron

The exposure unit for the great blue heron was assumed to be the area encompassed by all sites. Measured contaminant concentrations in minnows collected at SWMUs 1, 2, 3, 4, 5, and AOC B were used to estimate contaminant doses to the great blue heron. Minnow tissues were not collected from SWMUs 7 or 9, or from IRs 1, 7, or 8. However, the absence of minnow data from these sites does not significantly impact the results of this basewide risk assessment for the following reasons. Aquatic habitat is minimal at SWMU 7, and no wading birds were observed during several site visits. There were few COPCs in SWMU 9 surface water and sediment samples, and most concentrations of COPCs in surface water and sediment were within the range of those at sites from which minnow tissue data are available. IRs 1, 7, and 8 are located along the open ocean, where wave action and deep water reduce the opportunity for extensive foraging by wading birds.

4.1.3 Raccoon

Terrestrial mammals at NAS Key West could not be exposed to contaminants at all 11 sites, since the spatial orientation and the distance between sites would preclude this. As discussed in Section 2.1.1, the sites are roughly clustered into two groups. Therefore, risk to the raccoon was assessed by separating the analytical data into two data sets, designated as “western sites” and “eastern sites” (Figure 4-1).

The western data set consisted of samples collected from IRs 1, 7, and 8. Based on available mapping software, Fleming Key (location of IR 7 and IR 8) covers approximately 260 acres, and the westernmost portion of Key West (i.e., west of a line drawn from the peninsula at IR-1 to the southeastern tip of Fleming Key) covers approximately 520 acres. Thus, a raccoon that forages among IRs 1, 7, and 8 would have a home range of at least 780 acres. This home range size is within the range of values in the literature for the raccoon (Table 3-3), although the spatial orientation of IRs 1, 7, and 8 would reduce the likelihood that a raccoon would forage among all three sites. Nevertheless, it is conservatively assumed that a raccoon could forage at all three sites in the western data set, and the exposure unit was assumed to be this 780-acre area.

The eastern data set consisted of samples collected from SWMUs 1, 2, 3, 4, 5, 7, and 9. The area encompassed within a polygon formed by SWMUs 1, 4, 5, 7, and 9 is approximately 1020 acres (SWMUs 2 and 3 are within this polygon). This home range size is within the range of values in the literature for the raccoon (Table 3-3), although it is larger than most reported home range values. For this ERA, it is assumed that a raccoon could forage at all seven sites in the eastern data set, and the exposure unit was assumed to be this 1,020-acre area. AOC B data was not included in the eastern data set since it is located on Big Coppitt Key 2.5 to 4.2 miles from the sites on Boca Chica Key in the eastern data set. This distance is well beyond the distance that a raccoon would conceivably range. It is assumed that risks to the raccoon from AOC B contaminants were adequately addressed in the RFI/RI report for that site (B&R Environmental, 1998).

Potential risks to the raccoon were evaluated using contaminant concentrations in surface soil and sediment, and estimated or measured contaminant concentrations in crabs. Incidental ingestion of surface soil and sediment was assumed to account for 9.4 percent of the diet (EPA, 1993). Raccoons were assumed to forage exclusively on aquatic organisms (crustaceans) from the sites. Crustaceans are common forage items for raccoons in marine and estuarine environments while fish usually comprise less than 3 percent of the diet (EPA, 1993). Measured concentrations in crabs collected from the western sites (IRs 1, 7, and 8) were used to estimate doses to raccoons from prey items. Concentrations of contaminants not analyzed in crabs (SVOCs, cyanide, tin) were assumed to be equal to sediment concentrations. Crabs collected and analyzed at IRs 1, 7, and 8 included stone crabs, spiny spider crabs, and hermit crabs. No crab data or data from similar prey items were available for the eastern sites (SWMUs 1, 2, 3, 4, 5, 7, and 9). Therefore, contaminant concentrations in sediment-associated organisms (crabs) at those sites were assumed to be equal to contaminant concentrations in sediment.

4.2 DOSE CALCULATIONS

A simple model was used to predict dietary exposures for representative receptor species. The equations used to calculate the dose of contaminants ingested for each exposure route for the representative receptors used in this ERA are presented below.

Most of the input parameters (e.g., body weight, ingestion rate) for the representative receptors were obtained from EPA's *Wildlife Exposure Factors Handbook: Volumes I and II* (EPA, 1993) and were the same as those used in the recent Eight Site RFI/RI report (B&R Environmental, 1998). In general, the values used for the input parameters were those specific to species in Florida and were the most conservative (e.g., upper bound food ingestion rate) presented in the EPA publication.

For simplicity, bioaccumulation factors (BAFs) were set equal to 1.0. The uncertainties associated with using BAFs of 1.0 are discussed in the Section 5.2.4.

4.2.1 Incidental Ingestion of Sediment and Surface Soil

Daily intake of each contaminant as a result of ingestion of sediment and surface soil was determined using the following equation:

$$PD_{soil/\,sediment} = (C_{soil/sediment} * FI * SA * F)/WR$$

where: PD = predicted dose from ingestion of soil or sediment (mg/kg/day)

$C_{soil/sediment}$ = concentration in soil or sediment (mg/kg)

FI = fractional intake (% of home range that overlaps impacted areas; assumed to be 100%)

SA = percent of diet that equals soil or sediment

F = food consumed (kg/day)

WR = body weight of receptor (kg)

Whether an animal ingests soil or sediment (or both) depends on the habits of the species in question, and EPA (1993) uses the terms "soil ingestion" and "sediment ingestion" interchangeably. For example, sandpipers, which feed on mud-dwelling invertebrates, would be expected to ingest sediment, while desert tortoises would be expected to ingest soil. As discussed in Section 3.2.3, food items of the raccoon were assumed in this ERA to consist exclusively of aquatic organisms. Therefore, it might be assumed that the raccoon would incidentally ingest sediment rather than soil. Nevertheless, the raccoon is an opportunistic feeder, and could also incidentally ingest soil while foraging on terrestrial food items. Because the ratio of ingested soil to sediment is unknown, potential risks to the raccoon from incidental percent sediment, 75 percent sediment plus 25 percent soil, 50 percent sediment plus 50 percent soil, 25 percent sediment plus 75 percent soil, and 100 percent soil. This approach provides a range of risks given the uncertainty associated with soil versus sediment ingestion. Soil and sediment ingestion by the kestrel and great blue heron were assumed to be negligible (Sample and Suter, 1994).

4.2.2 Ingestion of Prey

The following equation was used to estimate contaminant intake from ingestion of contaminated prey:

$$PD_{prey} = (C_{prey} * F * FI)/WR$$

where: PD = predicted dose from ingestion of prey items (mg/kg/day)

C_{prey} = contaminant concentration in prey (mg/kg)

F = food consumed (kg/day)

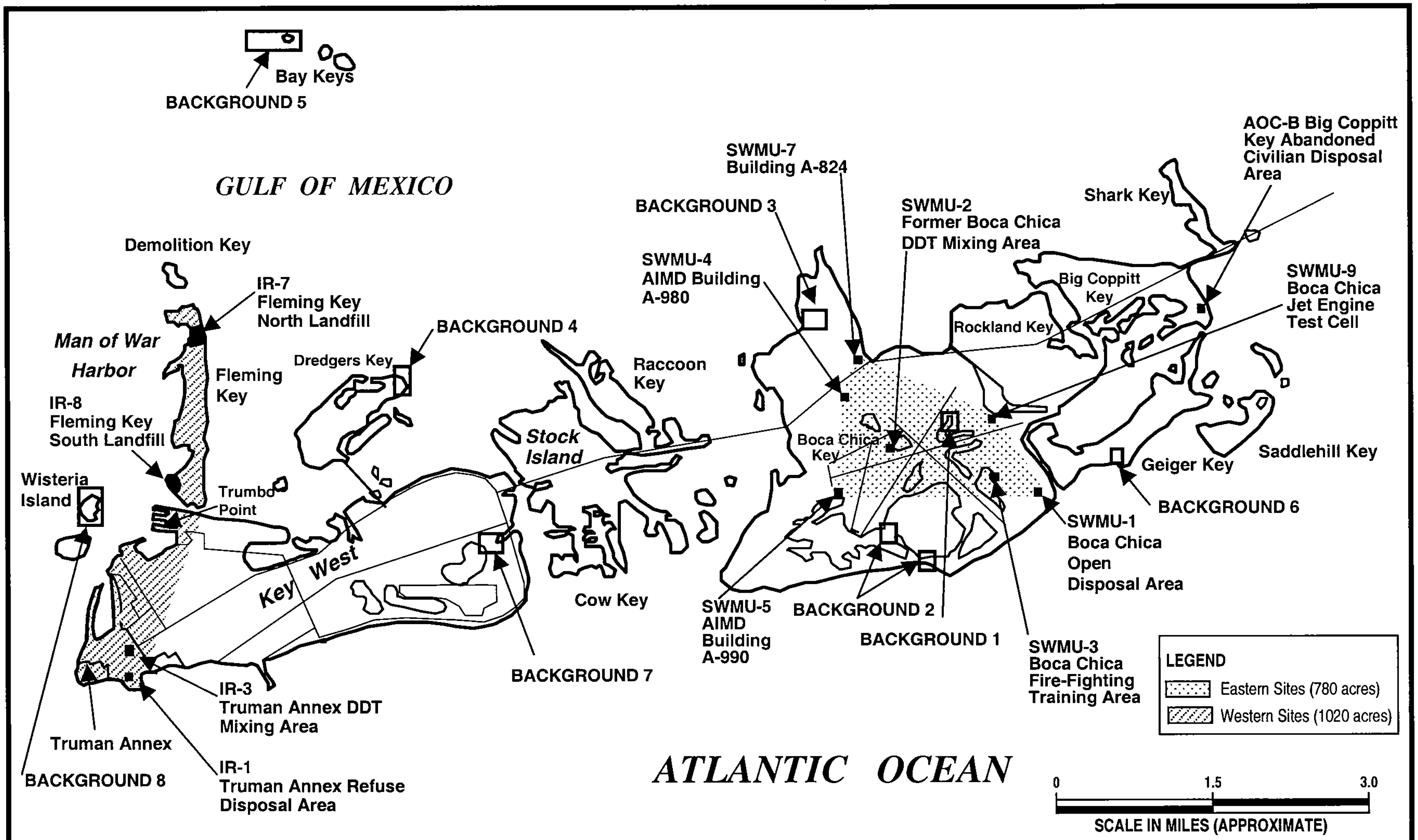
FI = fractional intake (% of home range that overlaps affected areas; assumed to be 100%)

WR = body weight of receptor (kg)

4.2.3 Ingestion of Water

There is no surface freshwater at any of the sites under investigation except at SWMU 4, where a small ditch adjacent to Midway Avenue contains freshwater. A source of freshwater is not critical to kestrels, as they obtain an adequate supply of water from prey items (FGFWFC, 1993). The great blue heron and raccoon are assumed to obtain their required water from sources other than the sites under investigation. Therefore, exposure to contaminants in surface water at the sites is assumed to be negligible, and the calculation of contaminant doses from the ingestion of water was not performed.

P:/KEY WEST/ERNA/BASEWIDE ERA/PUBS ONLY/GRFX/F4-1 RFI-RI SITES DIVIDED EAST-WEST.PPT



DRAWN BY RBP	DATE ----			CONTRACT NO. 7046
CHECKED BY	DATE			APPROVED BY / DATE
COST/SCHED-AREA				APPROVED BY / DATE
SCALE N.T.S.				DRAWING NO. F4-1 RFI-RI SITES DIVIDED EAST-WEST / REV. 0

BASEWIDE ECOLOGICAL RISK ASSESSMENT
FIGURE 4-1 RFI/RI SITES DIVIDED INTO EASTERN AND WESTERN SITES
NAVY SOUTHERN DIVISION
NAS KEY WEST, FLORIDA

FORM POWERPOINT-SD_AH.PPT-REV 0-3/98

5.0 RISK CALCULATION

The risk characterization step in the ERA process compares contaminant doses for representative receptors to doses associated with toxic effects. The ratio of the modeled dose to the toxic dose is called the hazard quotient (HQ), and is defined as follows:

$$HQ_i = ID_i/TRV_I$$

where: HQ_i = Hazard Quotient for analyte "i" (unitless)

ID_i = Intake Dose for analyte "i" (mg/kg/day)

TRV_I = Toxicity Reference Value for analyte "i" (mg/kg/day)

When the ratio of the intake dose to the TRV exceeded 1.0, adverse impacts are considered possible. The HQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an exposure point concentration exceeds or is less than a guideline. When HQ values exceed 1.0, it is an indication that ecological receptors are potentially at risk. Additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially since most toxicity data are conservative.

Some contaminants were present in some media for which no suitable TRVs were available. In these instances, the contaminants were qualitatively assessed.

5.1 SUMMARY OF ECOLOGICAL RISK ASSESSMENT APPROACH

Data collected during previous investigations of 12 separate sites at NAS Key West were used to assess cumulative impacts to ecological receptors from multiple sites at NAS Key West. For this assessment, analytes in surface soil and sediment were considered to be ecological chemicals of potential concern (COPCs) if the maximum concentration exceeded ecological screening values, or if no ecological screening values were available. Data for all COPCs in all samples collected from all sites (with the exception of IR 3, at which a complete exposure pathway does not exist) were combined into basewide data sets for each of the surface soil, minnow tissue, and crab tissue data sets. Sediment and surface soil data were each combined into two data sets: one for eastern sites, and one for western sites. Thus, seven data sets were generated. The mean concentration and the mean of the maximum detected concentration of each COPC in each of these seven data sets were used to estimate doses that ecological receptors might receive.

Representative ecological receptors consisted of the American kestrel, the great blue heron, and the raccoon. The basewide surface soil data were used to estimate doses to the kestrel. The basewide minnow data were utilized to estimate doses to the great blue heron. Doses to raccoons at the eastern sites were based on sediment and surface soil data, and doses to western raccoons were based on sediment, surface soil, and crab tissue data. Estimated doses were compared to TRVs, which are doses above which ecological risks may be present. Risks were considered to be possible when estimated doses exceeded the respective TRVs.

5.2 RESULTS AND DISCUSSION

Tables 5-1 through 5-5 summarize the data used in this basewide ERA for surface soil, sediment at eastern sites, sediment at western sites, minnows, and crabs, respectively. These tables provide the frequency of detection, average (i.e., mean) value, range of detected values, and average background value for each COPC. The means of maximum detected concentrations are provided in Appendix B. Ecological screening values are also provided for the surface soil and sediment COPCs (Tables 5-1, 5-2, and 5-3). As mentioned earlier, contaminant concentrations were compared to these screening values in the two earlier RFI/RI risk assessments. The ecological screening values are shown in the soil and sediment tables merely to provide the reader with a cursory comparison of detected values to ecological guidelines.

Tables 5-6 through 5-11 present the HQs for the receptors used in this ERA. The results of the food chain modeling are presented and discussed in the following three subsections, after which an assessment of uncertainties in this ERA are discussed. The final subsection presents the summary and conclusions.

5.2.1 Semivolatile Compounds (SVOCs)

Di-n-butyl phthalate was the only SVOC with an HQ value greater than 1.0 for representative avian receptors, with a NOAEL HQ of 2.4 for the kestrel based on the mean concentration of all samples (Table 5-6), and an HQ of less than 1.0 using the mean of maximum detected concentrations (Table 5-7). This apparent discrepancy is a consequence of using one-half the detection limit for non-detected surface soil samples, which resulted in an average concentration that was greater than the maximum detected concentration (Table 5-1). This occasionally occurs when detection limits in non-detected samples exceed the detected concentrations, and especially when the analyte is infrequently detected, as was the case for di-n-butyl phthalate in surface soil. As described earlier, potential risks to the kestrel were based on surface soil data. Di-n-butyl phthalate was detected in surface soils only at SWMU 1 and SWMU 3 (B&R Environmental, 1997), and it was detected in 6 of 38 basewide samples (Table 5-1).

SVOCs with HQ values greater than 1.0 using the raccoon as a representative receptor consisted of benzo(a)pyrene, chrysene, indeno(1,2,3-cd)pyrene, and pyrene. HQs for these four PAH compounds exceeded 1.0 only at the eastern sites and only using the means of maximum detected concentrations. HQs were relatively low, however, and the maximum hazard index (HI) calculated by summing the individual HQs was only 9.4 (Table 5-9). HQs for SVOCs using the raccoon as a representative receptor were based on the assumption that concentrations in prey items were equal to sediment concentrations. This assumption is probably overly conservative for PAH compounds, which generally do not biomagnify in food chains (Eisler, 1987), and accumulation of PAHs in aquatic organisms is not usually a major exposure source for predators of aquatic organisms (ATSDR, 1990). Potential risks due to PAHs in sediment within the eastern data set were due primarily to samples collected at SWMU 1 and SWMU 7, the only eastern sites where PAHs were COPCs in sediment (B&R Environmental, 1997; 1998).

The ratio of incidentally ingested sediment versus incidentally ingested surface soil had minimal effects on the subsequent SVOC HQs for the raccoon.

5.2.2 Pesticides and PCBs

Pesticides with HQ values greater than 1.0 for representative avian receptors consisted of 4,4'-DDT and its metabolites 4,4'-DDE, and 4,4'-DDD (hereinafter referred to as DDT, DDE, and DDD, respectively). The maximum NOAEL HQ for DDT (kestrel) was especially elevated, with an HQ of 165 (Table 5-7). Surface soil concentrations (with which kestrel HQs were calculated) of these three compounds tended to be highest at SWMU 1 and SWMU 2, where all three compounds were soil COPCs. DDE and DDT were also soil COPCs at IR 7, and DDT was a soil COPC at IR 8 (B&R Environmental, 1997; 1998). Based on means of maximum detected concentrations, HQ values using the heron as a representative receptor were 54.8 for DDD and 21.0 for DDE. Minnow concentrations of these compounds (with which heron HQs were calculated) were highest at SWMU 1 and SWMU 2. Most minnow tissue concentrations of DDT, DDD, and DDE from other sites were less than concentrations in background minnows (B&R Environmental, 1997). No other pesticides had HQs greater than 1.0 for representative avian receptors.

Aroclor-1260 was the only PCB compound with an avian HQ greater than 1.0. The NOAEL HQ for this compound was 9.39 (kestrel) using the mean of maximum soil concentrations, and was slightly less than 1.0 using the mean of all soil samples. Aroclor-1260 was detected in surface soils at SWMU 1, SWMU 7, and IR 1, at maximum concentrations of 900 μg/kg, 16,500 μg/kg, and 85 μg/kg, respectively (B&R Environmental, 1997; 1998).

Pesticides and PCBs with HQs greater than 1.0 using the raccoon as a representative receptor at the eastern sites consisted of DDT, DDD, delta-BHC, dieldrin, and Aroclor-1260 (Tables 5-8 and 5-9). The HQs for these five compounds were relatively low, however, with none exceeding 1.62.

HQs of all pesticides were less than 1.0 at the western sites using the raccoon as a representative receptor, and Aroclor-1260 was the only PCB compound with an HQ greater than 1.0. Potential risks from Aroclor-1260 at western sites were largely due to IR 1, where this compound was detected in 1 of 2 crab samples and sediment concentrations were elevated, with a maximum sediment concentration of 18,260 μg/kg. Aroclor-1260 was detected in most sediment samples from IR 1 but was detected in only one sediment sample from the other western sites, and was not detected in any of nine crabs collected from the other western sites (B&R Environmental, 1998). The NOAEL HQ based on the mean of maximum detected Aroclor-1260 concentrations was 3.47, assuming incidental ingestion of 100 percent sediment. The maximum detected concentration of Aroclor-1260 in surface soils at western sites was 85 μg/kg, compared to a maximum sediment concentration of 18,260 μg/kg, and thus, HQs for this compound decreased as the soil-to-sediment incidental ingestion ratio increased (Table 5-11).

5.2.3 Metals

Metals with HQ values greater than 1.0 using the kestrel as a representative receptor consisted of aluminum, chromium, copper, iron, lead, mercury, and zinc. Soil concentrations of each of these seven metals were highest at SWMU 1 and IR 1. NOAEL HQs were highest for lead and mercury, with values of 56.7 for lead and 83.1 for mercury based on means of maximum detected concentrations in soil (Table 5-7). Lead was frequently detected in surface soils, but was a COPC only at SWMU 1 and IR 1. With the exception of SWMU 1 and IR 1, maximum mercury concentrations in surface only barely exceeded screening levels at the sites where it was a soil COPC (B&R Environmental, 1997; 1998). Aluminum had a maximum HQ of 11.0, but aluminum concentrations in soils were similar to those in background soils (Table 5-1).

Mercury was the only metal with an HQ greater than 1.0 using the heron as a representative receptor, with a NOAEL HQ of 2.1 based on the mean of maximum detected concentrations. Metals with HQs greater than 1.0 using the raccoon as a representative receptor consisted of aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, thallium, and vanadium.

The raccoon NOAEL HQs for aluminum at the eastern sites were especially high, with values of 323 to 335 based on means of maximum detected concentrations (Table 5-9). However, aluminum concentrations in soils and sediments at the RFI/RI sites were similar to those in background soils and sediments (Tables 5-1 and 5-2). As described earlier, HQs for raccoons at the eastern sites were based on the assumption that concentrations in prey items were equal to sediment concentrations, an assumption that might be overly conservative, based on data from the western sites. Sediment concentrations of aluminum at western sites ranged from 72 to 17,400 mg/kg (mean = 1,044 mg/g), but aluminum was detected in only 1 of 11 crabs collected from the western sites. HQs for raccoons at the western sites were based on actual concentrations measured in crabs collected from those sites; and aluminum HQs were considerably lower.

The raccoon NOAEL HQ for arsenic, based on the mean of maximum detected concentrations, was 15.6 at the eastern sites and 36.1 at the western sites. Arsenic was a sediment COPC at most sites, but was not a COPC in surface soil at any site (B&R Environmental, 1997; 1998). Arsenic concentrations in crabs collected from the western sites were similar to those in crabs collected from background sites (Table 5-5).

The maximum raccoon NOAEL HQ for thallium was 22.6 at the western sites, but thallium was detected in only 2 of 69 sediment samples at the western sites (Table 5-3). Thallium was not detected in any crab sample and was not a COPC in soils.

The maximum raccoon NOAEL HQ for vanadium, based on the mean of maximum detected concentrations, was 17.5 at the eastern sites. Vanadium concentrations in sediment were highest at SWMU 1, SWMU 5, and IR 8, and tended to be similar to background sediment concentrations at other sites.

Raccoon HQs for other metals were relatively low. The ratio of incidentally ingested sediment versus incidentally ingested surface soil had minimal effects on the subsequent metal HQs for the raccoon.

5.2.4 Uncertainty Analysis

Uncertainty is associated with all aspects of the ERA process. This section provides a summary of the uncertainties involved in this ERA, with a discussion of how they may affect the final risk estimates and conclusions.

5.2.4.1 Uncertainty in the Problem Formulation

Since each of the sites investigated in this ERA has been subjected to several investigations, the contaminant sources, as well as the nature and extent of contamination at each site, have generally been well defined. For the same reason, the ecological receptors utilizing each site are fairly well known. Therefore, the uncertainties applicable to the Problem Formulation step are minimal.

5.2.4.2 Uncertainty in the Ecological Effects Evaluation

For TRV derivation, all available data were gathered for calculating doses for all COPCs to which the representative receptor species (raccoon, kestrel, great blue heron) may be exposed. However, toxicological data for these species are scarce. As a result, extrapolations were made using toxicity data from studies that used other small mammals and birds as test species. In addition, LOAELs were used in a few cases to estimate NOAELs. Thus, in some cases, risk estimates may be due more to a lack of species-specific toxicity data than to potential risks, and potential risks may be overestimated or underestimated.

Toxicity data are scarce for reptiles and amphibians, and thus, the modeling of potential risks to reptiles and amphibians was not conducted. As a result, direct conclusions about the potential risks to reptiles and amphibians cannot be made. However, since most of these organisms have small home ranges, the risks of exposure from multiple sites to reptiles and amphibians are probably low.

5.2.4.3 Uncertainty in the Exposure Estimate

Bioavailability of 100 percent, which tends to overestimate risks, was used for the dose calculations (i.e., 100 percent of the ingested contaminant was bioavailable and absorbed). Actual absorption fractions range widely among chemicals and among animal species (Bonaccorsi et al., 1984). Once ingested, the bioavailability of a contaminant depends upon a variety of factors, including physiochemical properties of the contaminant, the physiological characteristics of the organism, and other general factors such as age, sex, or disease state of the individual (Hrudey et al., 1996). Metals in soils at most hazardous waste sites are typically in poorly available forms (Efroymson et al., 1997). Data for oral exposures indicate that absorption of metals can be as low as 24 percent (arsenic; Freeman et al., 1993). Organic carbon in soils can bind metals and organics and reduce their bio-availability, and absorption of organics are often considerably less than 100 percent (Bonaccorsi et al., 1984). The TRVs used for this ERA are based also on partial absorption of ingested chemicals, because it is unlikely that all of the oral dose is absorbed in laboratory toxicity studies. However, the studies used to calculate TRVs are generally designed to maximize exposure and toxicity (e.g., the most bioavailable forms of the chemical are used in toxicity tests). Thus, the assumption of 100% bioavailability in the field, where chemical forms are generally associated with low bioavailability, is conservative and tends to overestimate risk.

The representative receptors were assumed to forage exclusively at the sites investigated herein. In reality, this would not occur, especially for the kestrel and heron, since portions of the sites contain little or marginal habitat.

Uncertainty is associated with the omission of literature-based BAFs from the food chain modeling. This can lead to both over-and underestimation of potential risks. For example, compounds such as mercury, organochlorine pesticides, and PCBs can significantly bioaccumulate. When BAFs of 1.0 are assumed for these compounds, potential risks may be underestimated. In contrast, some metals have BAFs much less than 1.0. In these instances, potential risks may be overestimated.

Uncertainty is also associated with the method used to obtain exposure point concentrations. As discussed in Section 4.1, exposure point concentrations within a given medium were calculated by two methods: (1) the mean concentration of all samples, and (2) the mean of the maximum detected concentrations. Potential ecological risks were subsequently assessed using both sets of exposure point concentrations. The assumption inherent in the two exposure estimates is that potential risks will be bounded by the risk value calculated with the maximum detected concentrations and that calculated with the means of all samples. However, the combined area of the sites investigated in the current study is 102 acres, which is only a small portion of the entire NAS Key West complex (6,323, acres). Assuming that the extent of contamination in habitats outside of the RFI/RI sites is less than that at the RFI/RI sites, then the actual contaminant concentrations to which wide-ranging ecological receptors are exposed could be less than the mean values used in this report. If so, the actual risks would be bounded by the risk values calculated with the maximum detected concentrations and the risk values that could be calculated with *background* concentrations. In summary, the most realistic estimate of actual exposure by wide-ranging receptors is uncertain.

Uncertainty associated with the method used to obtain exposure point concentrations also results from the use of "non-detects". Specifically, mean concentrations of COPCs were calculated using one-half the detection limit for non-detected samples. This resulted in average values that were greater than the maximum detected values for a few analytes (primarily SVOCs). This occurs when detection limits in non-detected samples exceed the detected concentrations, and especially when the analyte is infrequently detected. The use of non-detected samples could over- or underestimate risks, but the impact is minimal when detection limits are satisfactory, as was the case for most samples (B&R Environmental, 1997; 1998).

As discussed in Section 4.1, surface water as an exposure medium was not directly investigated in this basewide ERA. The salinity of surface water at the sites precludes the use of surface water for drinking. Direct contact with surface water at multiple sites, and subsequent dermal exposure, is not assumed to be a major exposure mechanism for basewide receptors. However, this does introduce some uncertainty in the risk assessment. Nevertheless, surface water as an exposure medium was indirectly examined by investigating the risks to the great blue heron from consumption of minnows, and by investigating the risks to the raccoon from consumption of crabs collected from surface water bodies at some sites.

Dermal exposure is usually limited by the outer coverings of most receptors. Nevertheless, certain portions of some receptors, such as foot pads, eyes, and the nose do not contain fur or feathers, for example, and may have a higher chance of exposure. However, these areas generally constitute a small portion of the total surface area of most receptors. Although some contaminants in surface soils and sediments are elevated, they do not appear to be elevated or widespread enough to warrant concern over dermal exposure.

Inhalation of contaminants is assumed to be negligible. Most portions of the sites are covered with vegetation, and inhalation of contaminants is assumed to be not applicable for aquatic species. As a result, toxicity due to inhalation is expected to be minimal. Burrowing wildlife could have a higher probability of inhalation exposure, but data regarding inhalation exposure and toxicity for wildlife were not available. In addition, few burrowing wildlife species exist in the lower Florida Keys. Overall, since dermal and inhalation exposures cannot be quantitatively assessed, only limited conclusions regarding their significance can be drawn and uncertainties remain.

5.2.4.4 Uncertainty in the Risk Calculation

Uncertainty in the risk characterization is affected by all aspects of the ERA process described above. Each component of the ERA contains some degree of uncertainty. Thus, uncertainties may be propagated when these components are combined. The weight of evidence approach is used to make risk decisions in an attempt to reduce the overall uncertainty in the risk assessment. This approach takes the results of all aspects of the assessment into account, including the uncertainties, to make determinations of potential risk.

5.2.5 Summary and Conclusions

Fifteen metals had HQ values greater than 1.0, indicating potential risks to ecological receptors. Surface soil samples at SWMU 1 and IR 1 were responsible for the greatest potential risk estimates. However, both of these sites are relatively small in areal extent, and consist of habitats that provide little opportunity for exposure to soil contaminants. Terrestrial habitat at IR 1 consists largely of turf grass, and the site is essentially devoid of all native vegetation. SWMU 1 consists primarily of mangrove swamp habitat. Thus, sediment rather than soil is the major exposure medium at SWMU 1, and exposure to soil contaminants by terrestrial receptors is relatively minimal. SWMU 1 is approximately 5 acres in size, and IR 1 is approximately 7 acres. Therefore, habitats at SWMU 1 and IR 1 provide little opportunity for potential risks from soil contaminants relative to the combined area of the other nine sites (90 aces). Because of this, and based on analyses of uncertainties and comparisons to background concentrations, the overall potential risks due to site-associated metal contaminants does not appear to be significant.

Potential risks from pesticides appear to be limited to DDT and its metabolites DDE and DDD in surface soil and minnow tissue. Risks from these pesticides in soils were primarily due to elevated concentrations in samples collected at SWMU 1 and SWMU 2. As discussed above, terrestrial habitats at these two sites are relatively small in areal extent. Concentrations of DDT and metabolites in minnows were generally less than or similar to concentrations in background minnows, except at SWMU 1 and SWMU 2. Subsequent to collection of minnow samples from these two sites for use in the RFI/RI risk assessment, IRAs removed 6,275 cubic yards of contaminated soil and sediment from SWMU 1 and 1,943 cubic yards of contaminated soil and sediment from SWMU 2. Long-term monitoring of fish tissues from SWMU 1 and SWMU 2 has been recommended in Corrective Measures Studies recently completed for these sites.

Potential risks from PCBs are limited to Aroclor-1260, which had especially high soil concentrations at SWMU 7. However this site is small in areal extent, and HQ values were relatively low.

Six semivolatile compounds (four PAHs and one phthalate) had HQ values greater than 1.0. Based on relatively low HQs and infrequent detections, basewide potential risks from semivolatile compounds appear to be low.

A consideration of the size of the RFI/RI sites relative to the foraging ranges of ecological receptors is important when assessing the cumulative impacts of exposure to multiple sites. The total combined area of the 11 sites investigated in this ERA is approximately 102 acres (Table 1-1). However, the entire NAS Key West complex encompasses approximately 6,323 acres. Large portions of NAS Key West, as well as extensive tracts of non-Navy properties in the lower Florida Keys, provide foraging habitats for ecological receptors. Thus, potential risks indicated by the elevated HQs generated in this ERA are somewhat mitigated by the fact that even wide-ranging ecological receptors would not forage exclusively at the 11 RFI/RI sites. The extent of contamination on Navy property exclusive of the RFI/RI sites is unknown, but is presumed to be less than at the sites investigated in this ERA. Similarly, the extent of contamination on non-Navy properties is presumably less than at the RFI/RI sites.

In summary, the overall potential risks to ecological receptors from exposure to multiple RFI/RI sites at NAS Key West do not appear to be significant. However, the pesticide DDT and its metabolites in minnows may pose risks to some receptors at some sites. This document will be revised to include new data as they become available during the RFI/RI process.

TABLE 5-1

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL
NAS KEY WEST
PAGE 1 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
INORGANICS (mg/kg)						
Aluminum	76/79	1,904.1	179	12,200	1,887.29	600
Antimony	59/98	7.4	0.2	203	0.39	NA
Beryllium	58/98	0.07	0.01	0.3	0.05	NA
Chromium	74/99	19.0	2	184	6.02	0.4
Copper	84/99	211.9	0.4	2,250	5.43	50
Cyanide	7/42	2.5	1.5	21	ND	0.005
Iron	77/77	4,593.1	31.9	45,200	1,167.44	200
Lead	201/214	157.7	0.3	740	15.66	500
Manganese	79/79	55.8	0.6	467	17.65	100
Mercury	64/98	0.6	0.02	9.3	0.03	0.1
Vanadium	80/99	4.4	0.43	20.2	3.97	20
Tin	12/29	3.2	0.7	11.8	1.94	0.89
Zinc	92/98	275.0	0.7	3,240	15.22	200
PESTICIDES/PCBS (µg/kg)						
4,4-DDD	38/77	231.7	2.7	1,400	22.46	100
4,4-DDE	54/78	142.0	1.0	1,730	63.23	100
4,4-DDT	54/78	216.4	2.1	4,700	46.78	100
2,4,5-T	3/16	22.3	6.7	7.2	ND	NA
2,4,5-TP (silvex)	2/16	21.7	4	4.0	ND	NA
2,4-D	2/16	22.4	7.4	7.4	ND	NA
Aroclor-1260	8/59	616.3	15.6	16,500	ND	NA
Toxaphene	2/77	689.1	91	343	ND	NA
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)						
Acetophenone	1/32	1,033.3	120	120	ND	NA
Anthracene	2/59	705.9	280	280	414.89	100
Benzo(a)anthracene	9/59	794.0	160	3,420	ND	100
Benzo(a)pyrene	8/59	773.1	200	2,185	ND	100
Benzo(b)fluoranthene	9/59	957.7	240	6,830	414.89	100
Benzo(g,h,i)perylene	8/59	746.1	140	1,940	ND	100
Benzo(k)fluoranthene	5/59	682.0	160	410	ND	100
Bis(2-Ethylhexyl)phthalate	9/39	886.7	120	2,200	470.55	NA
Chrysene	10/59	873.9	210	5,435	407.04	100

TABLE 5-1

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SURFACE SOIL
NAS KEY WEST
PAGE 2 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
Di-n-butyl phthalate	6/38	910.3	80	230	ND	NA
Dibenzo(a,h)anthracene	6/59	698.9	79	604	ND	100
Fluoranthene	10/59	956.0	250	3020	434.18	100
Hexachlorophene	4/14	10,303.6	340	890	525.50	NA
Indeno(1,2,3-cd)pyrene	8/59	738.3	150	1,590	ND	100
Phenanthrene	8/59	760.0	106	2,755	ND	100
Pyrene	10/59	929.1	300	6,290	420.61	100

1 = See Table C.3-21 of Appendix C (B&R Environmental, 1998) for sources of ecological screening values.
ND = Not detected in any background surface soil sample.
NA = Ecological screening value not available.

TABLE 5-2

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT-EASTERN SITES
NAS KEY WEST
PAGE 1 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
INORGANICS (mg/kg)						
Aluminum	39/39	2,068.8	669	4,330	1,331.89	NA
Arsenic	46/58	4.3	0.7	17.8	2.63	7.24
Barium	34/58	17.4	5.3	250	9.27	40
Beryllium	13/58	0.2	0.9	2.6	0.06	NA
Cadmium	31/58	4.0	0.3	120	0.22	0.676
Chromium	57/59	35.7	3	428	5.01	52.3
Copper	59/59	37.5	3.3	430	8.88	18.7
Cyanide	5/42	2.3	1.8	14	ND	0.1
Iron	39/39	1,891.5	608	4,270	1,199	20,000
Lead	63/63	77.5	2.5	966	17.97	30.2
Manganese	38/38	17.0	4.1	36.5	15.39	460
Mercury	23/59	0.2	0.03	1.9	0.05	0.13
Nickel	42/58	4.7	1.2	26.6	2.15	15.9
Selenium	7/58	1.1	0.4	7.3	0.68	NA
Silver	14/58	1.6	0.2	29.1	0.27	0.733
Tin	14/26	20.2	1.6	200	2.85	NA
Vanadium	53/58	9.3	1.9	34.2	5.08	NA
Zinc	56/59	180.2	6.7	1,260	25.74	124
PESTICIDES PCBs (µg/kg)						
4,4-DDD	23/33	1,546.8	7.5	17,200	13.03	1.22
4,4-DDE	27/33	763.5	4.3	4,640	19.85	2.07
4,4-DDT	19/33	1,388.5	4.8	14,800	13.02	1.19
Aroclor-1260	6/35	334.5	56.4	510	70.57	5
beta-BHC	1/32	81.5	99	99	ND	5
delta-BHC	8/33	75.1	2	231	7.35	3
gamma-BHC (lindane)	2/32	76.1	1	11.6	6.72	0.32
gamma-chlordane	1/14	177.2	51	51	ND	0.5
Dieldrin	4/33	151.1	6	23.3	ND	0.715
Endosulfan I	6/32	94.5	2	359	6.70	2.9
Endosulfan II	3/32	172.2	86	200	ND	14
Endrin	5/32	152.9	6.6	244	12.89	3.3
Endrin Aldehyde	1/17	110.0	37	37	ND	3.3

TABLE 5-2

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT-EASTERN SITES
NAS KEY WEST
PAGE 2 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
Heptachlor	1/32	80.1	60	60	6.51	4.9
Methyl parathion	3/20	45	14.8	38.8	ND	NA
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)						
3-Methylcholanthrene	1/39	2,532.5	690	690	ND	NA
Acetophenone	1/39	1,240.0	790	790	ND	NA
Benzo(a)anthracene	1/53	1,064.6	1,910	1,910	ND	74.8
Benzo(a)pyrene	2/53	1,156.9	780	11,000	ND	88.8
Benzo(b)fluoranthene	2/53	1,084.0	380	3,500	966.92	655
Benzo(g,h,i)perylene	5/53	1,030.9	490	7,000	ND	655
Bis(2-Ethylhexyl)phthalate	10/39	1,050.7	459	2,500	1,992.17	182
Chrysene	5/53	1,218.7	37	14,000	961.38	108
Dibenzo(a,h)anthracene	1/53	1,014.4	610	610	ND	6.22
Fluoranthene	4/53	1,745.0	70	4,000	982.38	113
Hexachlorophene	4/13	11,173.1	1,200	8,100	ND	NA
Indeno(1,2,3-cd)pyrene	2/53	1,070.0	710	5,900	ND	655
Phenanthrene	3/53	1,196.6	60	10,000	ND	86.7
Pyrene	6/53	1,355.2	82	18,000	968.46	153

1 = See Table C.3-20 of Appendix C (B&R Environmental, 1998) for sources of ecological screening values.
ND = Not detected in any background sediment sample.
NA = Ecological screening value not available.

TABLE 5-3

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT-WESTERN SITES
NAS KEY WEST
PAGE 1 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
INORGANICS (mg/kg)						
Aluminum	50/50	1,044.2	72.4	17,400	1,331.89	NA
Antimony	6/69	2.7	5	20.7	ND	12
Arsenic	65/70	4.8	0.7	43.5	2.63	7.24
Barium	59/70	14.0	3.3	304	9.27	40
Beryllium	6/69	0.07	0.1	0.2	0.06	NA
Cadmium	9/69	0.6	0.2	11.4	0.22	0.676
Chromium	58/70	7.9	2.3	70.7	5.01	52.3
Copper	69/70	55.9	1.5	1,100	8.88	18.7
Cyanide	2/36	2.5	13	23	ND	0.1
Iron	37/49	4,590.1	17.4	32,600	1,199	20,000
Lead	69/70	78.8	4.6	1,680	17.97	30.2
Manganese	50/50	65.6	2.5	546	15.39	460
Mercury	52/70	0.08	0.02	1.6	0.05	0.13
Nickel	40/70	8.0	1	248	2.15	15.9
Selenium	1/69	0.4	4.8	4.8	0.68	NA
Silver	7/69	0.9	0.3	17.7	0.27	0.733
Thallium	2/69	4.1	46.7	168	ND	NA
Tin	8/26	9.9	9.3	64.1	2.85	NA
Vanadium	51/70	4.7	0.7	25.7	5.08	NA
Zinc	57/70	141.0	1.1	2,180	25.74	124
PESTICIDES/PCBS (µg/mg)						
4,4-DDD	13/63	25.6	1.6	100	13.03	1.22
4,4-DDE	27/63	29.5	1.6	296	19.85	2.07
4,4-DDT	24/63	45.9	4.6	711	13.02	1.19
2,4-D	8/33	8.0	11	58.8	39.15	NA
Aroclor-1248	1/55	78.0	120	120	ND	30
Aroclor-1254	4/55	121.5	26.1	669	ND	60
Aroclor-1260	17/55	1,392.7	24.1	18,260	70.57	5
alpha-BHC	3/63	10.0	0.9	30	7.11	6
beta-BHC	3/63	13.1	20	170	ND	5
delta-BHC	4/63	10.7	1	48	7.35	3
gamma-BHC (lindane)	10/63	9.9	0.8	3.3	6.72	0.32
Dieldrin	5/63	21.5	2.4	20.8	ND	0.715

TABLE 5-3

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN SEDIMENT-WESTERN SITES
NAS KEY WEST
PAGE 2 OF 2

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration	Ecological Screening Value[1]
			Min	Max		
Endosulfan I	13/63	18.2	1.3	375	6.70	2.9
Endosulfan II	1/63	22.6	83	83	ND	14
Endosulfan Sulfate	4/63	27.7	0.8	341	ND	5.4
Endrin	10/63	82.2	1.2	1,462	12.89	3.3
Endrin Aldehyde	4/45	40.8	0.6	380.5	ND	3.3
Heptachlor	7/63	10.1	0.6	18.9	6.51	4.9
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)						
Acenaphthene	1/43	357.1	300	300	ND	6.71
Acenaphthylene	1/43	354.0	75	75	ND	5.87
Anthracene	2/43	352.0	20	140	ND	46.9
Benzo(a)anthracene	9/43	325.2	15	640	ND	74.8
Benzo(a)pyrene	8/43	340.6	41	540	ND	88.8
Benzo(k)fluoranthene	9/43	324.3	9.8	610	ND	655
Bis(2-Ethylhexyl)phthalate	13/18	781.4	260	1,100	1,992.17	182
Chrysene	9/43	339.1	16	950	961.38	108
Dibenzo(a,h)anthracene	1/43	354.2	190	190	ND	6.22
Fluoranthene	12/43	375.6	26	1,900	982.38	113
Fluorene	6/43	379.9	110	320	ND	21.2
Naphthalene	6/43	359.2	45	120	ND	34.6
Phenanthrene	13/43	371	24	2,100	ND	86.7
Pyrene	14/43	373.2	28	1,700	968.46	153

1 = See Table C.3-20 of Appendix C (B&R Environmental, 1998) for sources of ecological screening values.
ND = Not detected in any background sediment sample.
NA = Ecological screening value not available.

TABLE 5-4

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN MINNOWS
NAS KEY WEST

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration
			Min	Max	
INORGANICS (mg/kg)					
Aluminum	4/70	9.2	27.6	318	8.84
Arsenic	17/106	0.6	0.2	4.3	2.13
Barium	69/106	2.3	0.6	9.4	2.43
Chromium	10/106	0.5	0.9	1.9	0.41
Copper	48/106	5.2	0.8	51.6	4.63
Iron	39/70	27.3	12.1	84.5	16.95
Lead	75/106	1.4	0.1	8.6	1.50
Manganese	56/70	3.5	0.7	7.6	1.38
Mercury	2/106	0.01	0.05	0.1	0.02
Selenium	16/106	0.4	0.3	1.0	0.44
Silver	3/106	0.2	0.6	4.6	0.18
Zinc	106/106	56.6	5.6	535	41.38
PESTICIDES/PCBS (µg/kg)					
4,4-DDD	57/105	70.6	0.1	4,200	3.95
4,4-DDE	97/105	51.6	0.5	1,730	28.75
4,4-DDT	56/105	5.1	1.0	76.7	1.02
Aroclor-1260	32/105	58.4	35.5	357	47.47
alpha-BHC	9/105	1.0	0.5	4.7	ND
beta-BHC	41/105	1.3	0.1	6.0	0.95
delta-BHC	26/105	1.0	0.07	7.6	0.58
gamma-BHC (lindane)	23/105	0.8	0.1	2.8	ND
Dieldrin	52/105	1.2	0.2	4.2	1.13
Endosulfan I	48/105	1.2	0.1	12	0.73
Endosulfan II	50/105	1.0	0.1	4	1.02
Endosulfan Sulfate	49/105	5.3	0.6	76	1.30
Endrin	17/105	1.4	0.3	1.7	0.98
Endrin Aldehyde	68/105	4.8	0.7	26	1.15
Heptachlor	40/105	1.1	0.05	8.1	ND
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)					
Pyrene	1/58	775.3	430	430	ND

ND = Not detected in any background minnow sample.

TABLE 5-5

ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN IN CRABS
NAS KEY WEST

Chemical of Potential Concern	Frequency of Detection	Average Concentration	Range of Detected Values		Average Background Concentration
			Min	Max	
INORGANICS (mg/kg)					
Aluminum	1/11	3.4	6.2	6.2	ND
Arsenic	11/11	11.2	4.1	22.7	15.14
Barium	6/11	1.8	1.6	5	1.13
Cadmium	5/11	0.5	0.5	1.6	0.77
Chromium	1/11	0.8	5.1	5.1	ND
Copper	10/11	23.8	7.7	69.8	20.38
Iron	9/11	79.6	18.5	290	23.48
Lead	4/11	0.5	0.5	1.7	0.27
Manganese	9/11	2.3	1.6	3.5	1.30
Mercury	4/11	0.04	0.02	0.1	0.06
Nickel	2/11	0.4	0.3	0.3	ND
Selenium	2/11	0.8	2.2	2.2	ND
Silver	1/11	0.2	0.3	0.3	0.27
Vanadium	5/11	0.6	0.7	1.1	0.36
Zinc	11/11	30.6	7.1	93.8	33.87
PESTICIDES/PCBS (µg/kg)					
4,4-DDD	4/11	1.4	0.2	1.7	1.14
4,4-DDE	4/11	2.9	1.0	17	1.37
4,4-DDT	6/11	1.6	0.2	3.3	1.37
Aroclor-1260	1/11	38.5	260	260	34.07
alpha-BHC	1/11	0.9	1.6	1.6	ND
delta-BHC	4/11	0.7	0.07	1.1	0.78
gamma-BHC (lindane)	2/11	0.8	0.2	0.8	1.07
Dieldrin	5/11	1.2	0.2	1.2	1.24
Endosulfan I	2/11	0.9	0.9	1.2	0.82
Endosulfan II	5/11	3.3	0.1	13	1.29
Endosulfan Sulfate	2/11	1.6	1	1.4	1.61
Endrin	5/11	1.2	0.09	1	1.07
Endrin Aldehyde	8/11	2.4	0.5	6.4	1.68
Heptachlor	1/11	0.8	0.7	0.7	0.66

ND = Not detected in any background crab sample.

TABLE 5-6

HAZARD QUOTIENTS FOR AVIAN RECEPTORS - MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
Page 1 of 2

Ecological Chemical of Potential Concern *	Kestrel		Heron	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds (SVOCs)				
Anthracene	2.05E-02	2.05E-03	ND	ND
Acetophenone	NA	NA	ND	ND
Benzo(a)anthracene	2.30E-02	2.30E-03	ND	ND
Benzo(a)pyrene	2.24E-02	2.24E-03	ND	ND
Benzo(b)fluoranthene	2.78E-02	2.78E-03	ND	ND
Benzo(g,h,i)perylene	2.16E-02	2.16E-03	ND	ND
Benzo(k)fluoranthene	1.98E-02	1.98E-03	ND	ND
Bis(2-Ethylhexyl)phthalate	2.34E-01	2.34E-02	ND	ND
Chrysene	2.53E-02	2.53E-03	ND	ND
Di-n-butyl phthalate	**2.40E+00**	2.40E-01	ND	ND
Dibenzo(a,h)anthracene	2.03E-02	2.03E-03	ND	ND
Fluoranthene	2.77E-02	2.77E-03	ND	ND
Hexachlorophene	NA	NA	ND	ND
Indeno(1,2,3-cd)pyrene	2.14E-02	2.14E-03	ND	ND
Phenanthrene	2.20E-02	2.20E-03	ND	ND
Pyrene	2.69E-02	2.69E-03	1.39E-02	1.39E-03
SVOC Hazard Index	**2.91E+00**	2.91E-01	1.39E-02	1.39E-03
Pesticides and PCBs				
4,4'-DDD	**2.40E+01**	**2.40E+00**	**4.53E+00**	4.53E-01
4,4'-DDE	**1.47E+01**	**1.47E+00**	**3.31E+00**	3.31E-01
4,4'-DDT	**2.24E+01**	**2.24E+00**	3.27E-01	3.27E-02
2,4,5-T	NA	NA	ND	ND
2,4,5-TP (Silvex)	NA	NA	ND	ND
2,4-D	NA	NA	ND	ND
Aroclor-1260	9.92E-01	9.92E-02	5.83E-02	5.83E-03
alpha-BHC	ND	ND	3.09E-04	7.68E-05
beta-BHC	ND	ND	4.17E-04	1.04E-04
gamma-BHC (lindane)	ND	ND	7.35E-05	7.35E-06
delta-BHC	ND	ND	3.07E-04	7.63E-05
Dieldrin	ND	ND	2.76E-03	2.76E-04
Endosulfan I	ND	ND	2.09E-05	2.09E-06
Endosulfan II	ND	ND	1.76E-05	1.76E-06
Endosulfan Sulfate	ND	ND	9.45E-05	9.45E-06
Endrin	ND	ND	2.56E-02	2.56E-03
Endrin Aldehyde	ND	ND	8.57E-02	8.57E-03
Heptachlor	ND	ND	NA	NA
Toxaphene	NA	NA	ND	ND
Pest/PCB Hazard Index	**6.21E+01**	**6.21E+00**	**8.35E+00**	8.35E-01

TABLE 5-6

HAZARD QUOTIENTS FOR AVIAN RECEPTORS - MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Ecological Chemical of Potential Concern *	Kestrel		Heron	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Inorganics				
Aluminum	**5.03E+00**	5.03E-01	1.50E-02	1.50E-03
Antimony	NA	NA	ND	ND
Arsenic	ND	ND	4.19E-02	1.40E-02
Barium	ND	ND	1.98E-02	9.86E-03
Beryllium	NA	NA	ND	ND
Chromium	**5.50E+00**	**1.10E+00**	9.14E-02	1.83E-02
Copper	**1.31E+00**	9.96E-01	1.99E-02	1.52E-02
Cyanide	1.61E-01	1.61E-02	ND	ND
Iron	**1.33E+01**	**1.33E+00**	4.92E-02	4.92E-03
Lead	**4.05E+01**	**4.05E+00**	2.17E-01	2.17E-02
Manganese	1.65E-02	1.65E-03	6.43E-04	6.43E-05
Mercury	**2.69E+01**	**2.69E+00**	4.11E-01	4.11E-02
Selenium	ND	ND	1.85E-01	9.23E-02
Silver	ND	ND	NA	NA
Tin	1.35E-01	5.42E-02	ND	ND
Vanadium	1.12E-01	1.12E-02	ND	ND
Zinc	**5.50E+00**	6.08E-01	7.02E-01	7.77E-02
Inorganics Hazard Index	**9.85E+01**	**1.14E+01**	**1.75E+00**	2.97E-01

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the RFI/RI ecological risk assessments (B&R Environmental, 1997; 1998).

NA = Toxicity reference value not available.

ND = Analyte was either not detected in soil (kestrel) or minnows (heron) or its maximum detected concentration was less than ecological screening levels in the RFI/RI ecological risk assessments (B&R Environmental, 1997; 1998).

Bolded items indicate HQ or HI > 1.

TABLE 5-7

HAZARD QUOTIENTS FOR AVIAN RECEPTORS
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
Page 1 of 2

Ecological Chemical of Potential Concern *	Kestrel		Heron	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds (SVOCs)				
Anthracene	8.12E-03	8.12E-04	ND	ND
Acetophenone	NA	NA	ND	ND
Benzo(a)anthracene	7.33E-02	7.33E-03	ND	ND
Benzo(a)pyrene	6.12E-02	6.12E-03	ND	ND
Benzo(b)fluoranthene	1.47E-01	1.47E-02	ND	ND
Benzo(g,h,i)perylene	4.93E-02	4.93E-03	ND	ND
Benzo(k)fluoranthene	1.04E-02	1.04E-03	ND	ND
Bis(2-Ethylhexyl)phthalate	1.95E-01	1.95E-02	ND	ND
Chrysene	1.07E-01	1.07E-02	ND	ND
Di-n-butyl phthalate	6.06E-01	6.06E-02	ND	ND
Dibenzo(a,h)anthracene	1.75E-02	ND	ND	ND
Fluoranthene	1.47E-01	1.47E-02	ND	ND
Hexachlorophene	NA	NA	ND	ND
Indeno(1,2,3-cd)pyrene	4.44E-02	4.44E-03	ND	ND
Phenanthrene	4.15E-02	4.15E-03	ND	ND
Pyrene	1.26E-01	1.26E-02	7.74E-03	7.74E-04
SVOC Hazard Index	**1.63E+00**	1.62E-01	7.74E-03	7.74E-04
Pesticides and PCBs				
4,4'-DDD	**4.08E+01**	**4.08E+00**	**5.48E+01**	**5.48E+00**
4,4'-DDE	**4.52E+01**	**4.52E+00**	**2.10E+01**	**2.10E+00**
4,4'-DDT	**1.65E+02**	**1.65E+01**	**1.67E+00**	1.67E-01
2,4,5-T	NA	NA	ND	ND
2,4,5-TP (Silvex)	NA	NA	ND	ND
2,4-D	NA	NA	ND	ND
Aroclor-1260	**9.39E+00**	9.39E-01	2.15E-01	2.15E-02
alpha-BHC	ND	ND	6.93E-04	1.72E-04
beta-BHC	ND	ND	1.41E-03	3.52E-04
gamma-BHC (lindane)	ND	ND	1.93E-04	1.93E-05
delta-BHC	ND	ND	8.58E-04	2.13E-04
Dieldrin	ND	ND	8.41E-03	8.41E-04
Endosulfan I	ND	ND	1.04E-04	1.04E-05
Endosulfan II	ND	ND	4.44E-05	4.44E-06
Endosulfan Sulfate	ND	ND	6.90E-04	6.90E-05
Endrin	ND	ND	2.52E-02	2.52E-03
Endrin Aldehyde	ND	ND	3.60E-01	3.60E-02
Heptachlor	ND	ND	NA	NA

TABLE 5-7

HAZARD QUOTIENTS FOR AVIAN RECEPTORS
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
Page 2 of 2

Ecological Chemical of Potential Concern *	Kestrel		Heron	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Toxaphene	NA	NA	ND	ND
Pest/PCB Hazard Index	**2.61E+02**	**2.61E+01**	**7.81E+01**	**7.81E+00**
Inorganics				
Aluminum	**1.10E+01**	**1.10E+00**	2.98E-01	2.98E-02
Antimony	NA	NA	ND	ND
Arsenic	ND	ND	1.59E-01	5.30E-02
Barium	ND	ND	4.94E-02	2.46E-02
Beryllium	NA	NA	ND	ND
Chromium	**1.46E+01**	**2.93E+00**	2.33E-01	4.65E-02
Copper	**1.78E+00**	**1.36E+00**	8.84E-02	6.73E-02
Cyanide	8.93E-01	8.93E-02	ND	ND
Iron	**2.59E+01**	**2.59E+00**	1.31E-01	1.31E-02
Lead	**5.67E+01**	**5.67E+00**	5.07E-01	5.07E-02
Manganese	3.04E-02	3.04E-03	1.07E-03	1.07E-04
Mercury	**8.31E+01**	**8.31E+00**	**2.12E+00**	2.12E-01
Selenium	ND	ND	3.08E-01	1.54E-01
Silver	ND	ND	NA	NA
Tin	3.66E-01	1.47E-01	ND	ND
Vanadium	2.01E-01	2.01E-02	ND	ND
Zinc	**9.80E+00**	**1.08E+00**	**1.86E+00**	2.06E-01
Inorganics Hazard Index	**2.04E+02**	**2.33E+01**	**5.76E+00**	8.57E-01

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the RFI/RI ecological risk assessments (B&R Environmental, 1997; 1998).

NA = Toxicity reference value not available.

ND = Analyte was either not detected in soil (kestrel) or minnows (heron) or its maximum detected concentration was less than ecological screening levels in the RFI/RI ecological risk assessments (B&R Environmental, 1997; 1998).

Bolded items indicate HQ or HI > 1.

TABLE 5-8

HAZARD QUOTIENTS FOR RACCOONS - EASTERN SITES
MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 1 of 2

Ecological Chemical of Potential Concern *	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds (SVOCs)										
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	2.28E-01	2.28E-02	2.27E-01	2.27E-02	2.26E-01	2.26E-02	2.25E-01	2.25E-02	2.24E-01	2.24E-02
Benzo(a)pyrene	2.48E-01	2.48E-02	2.46E-01	2.46E-02	2.45E-01	2.45E-02	2.43E-01	2.43E-02	2.41E-01	2.41E-02
Benzo(b)fluoranthene	2.33E-01	2.33E-02	2.32E-01	2.32E-02	2.32E-01	2.32E-02	2.32E-01	2.32E-02	2.31E-01	2.31E-02
Benzo(g,h,i)perylene	2.21E-01	2.21E-02	2.20E-01	2.20E-02	2.19E-01	2.19E-02	2.17E-01	2.17E-02	2.16E-01	2.16E-02
Bis(2-Ethylhexyl)phthalate	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.22E-02	1.22E-03
Chrysene	2.61E-01	2.61E-02	2.60E-01	2.60E-02	2.58E-01	2.58E-02	2.57E-01	2.57E-02	2.55E-01	2.55E-02
Di-n-butyl phthalate	4.77E-04	1.43E-04	4.75E-04	1.43E-04	4.73E-04	1.42E-04	4.71E-04	1.41E-04	4.69E-04	1.41E-04
Dibenzo(a,h)anthracene	2.18E-01	2.18E-02	2.16E-01	2.16E-02	2.15E-01	2.15E-02	2.13E-01	2.13E-02	2.12E-01	2.12E-02
Fluoranthene	3.74E-01	3.74E-02	3.71E-01	3.71E-02	3.67E-01	3.67E-02	3.63E-01	3.63E-02	3.60E-01	3.60E-02
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	2.30E-01	2.30E-02	2.28E-01	2.28E-02	2.27E-01	2.27E-02	2.25E-01	2.25E-02	2.24E-01	2.24E-02
Phenanthrene	2.57E-01	2.57E-02	2.55E-01	2.55E-02	2.53E-01	2.53E-02	2.51E-01	2.51E-02	2.49E-01	2.49E-02
Pyrene	2.91E-01	2.91E-02	2.89E-01	2.89E-02	2.87E-01	2.87E-02	2.85E-01	2.85E-02	2.83E-01	2.83E-02
SVOC Hazard Index	**2.57E+00**	2.57E-01	**2.56E+00**	2.56E-01	**2.54E+00**	2.54E-01	**2.52E+00**	2.52E-01	**2.51E+00**	2.51E-01
Pesticides and PCBs										
4,4'-DDD	4.15E-01	8.30E-02	4.07E-01	8.15E-02	4.00E-01	7.99E-02	3.92E-01	7.84E-02	3.85E-01	7.69E-02
4,4'-DDE	2.05E-01	4.09E-02	2.01E-01	4.01E-02	1.96E-01	3.93E-02	1.92E-01	3.84E-02	1.88E-01	3.76E-02
4,4'-DDT	3.72E-01	7.45E-02	3.65E-01	7.30E-02	3.58E-01	7.16E-02	3.51E-01	7.02E-02	3.44E-01	6.87E-02
Aroclor-1260	**1.06E+00**	1.06E-01	**1.04E+00**	1.04E-01	**1.03E+00**	1.03E-01	**1.02E+00**	1.02E-01	**1.01E+00**	1.01E-01
beta-BHC	4.37E-02	8.74E-03	4.28E-02	8.57E-03	4.19E-02	8.39E-03	4.11E-02	8.21E-03	4.02E-02	8.03E-03
gamma-BHC (lindane)	2.04E-03	2.04E-04	2.00E-03	2.00E-04	1.96E-03	1.96E-04	1.92E-03	1.92E-04	1.88E-03	1.88E-04
delta-BHC	**1.15E+00**	1.15E-01	**1.13E+00**	1.13E-01	**1.10E+00**	1.10E-01	**1.08E+00**	1.08E-01	**1.06E+00**	1.06E-01
gamma-chlordane	8.26E-03	4.13E-03	8.17E-03	4.08E-03	8.07E-03	4.04E-03	7.98E-03	3.99E-03	7.88E-03	3.94E-03
Dieldrin	**1.62E+00**	1.62E-01	**1.59E+00**	1.59E-01	**1.55E+00**	1.55E-01	**1.52E+00**	1.52E-01	**1.49E+00**	1.49E-01
Endosulfan I	1.35E-01	1.35E-02	1.32E-01	1.32E-02	1.30E-01	1.30E-02	1.27E-01	1.27E-02	1.24E-01	1.24E-02
Endosulfan II	2.46E-01	2.46E-02	2.41E-01	2.41E-02	2.36E-01	2.36E-02	2.31E-01	2.31E-02	2.26E-01	2.26E-02
Endrin	3.57E-01	3.57E-02	3.49E-01	3.49E-02	3.42E-01	3.42E-02	3.35E-01	3.35E-02	3.28E-01	3.28E-02
Endrin Aldehyde	2.56E-01	2.56E-02	2.52E-01	2.52E-02	2.47E-01	2.47E-02	2.42E-01	2.42E-02	2.38E-01	2.38E-02
Heptachlor	1.72E-01	1.72E-02	1.68E-01	1.68E-02	1.65E-01	1.65E-02	1.61E-01	1.61E-02	1.58E-01	1.58E-02

TABLE 5-8

HAZARD QUOTIENTS FOR RACCOONS - EASTERN SITES
MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 2 of 2

	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
Ecological Chemical of Potential Concern *	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**
Methyl parathion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pest/PCB Hazard Index	**6.04E+00**	7.11E-01	**5.93E+00**	6.98E-01	**5.82E+00**	6.84E-01	**5.70E+00**	6.71E-01	**5.59E+00**	6.58E-01
Metals and Inorganic Compounds										
Aluminum	**2.30E+02**	**2.30E+01**	**2.32E+02**	**2.32E+01**	**2.34E+02**	**2.34E+01**	**2.35E+02**	**2.35E+01**	**2.37E+02**	2.37E+01
Antimony	**4.55E+00**	4.55E-01	**4.52E+00**	4.52E-01	**4.49E+00**	4.49E-01	**4.46E+00**	4.46E-01	**4.43E+00**	4.43E-01
Arsenic	**7.26E+00**	7.26E-01	**7.17E+00**	7.17E-01	**7.07E+00**	7.07E-01	**6.98E+00**	6.98E-01	**6.89E+00**	6.89E-01
Barium	7.32E-01	1.89E-01	7.30E-01	1.88E-01	7.28E-01	1.87E-01	7.26E-01	1.87E-01	7.24E-01	1.86E-01
Beryllium	7.00E-02	7.00E-03	6.90E-02	6.90E-03	6.80E-02	6.80E-03	6.70E-02	6.70E-03	6.60E-02	6.60E-03
Cadmium	8.65E-01	8.65E-02	8.52E-01	8.52E-02	8.38E-01	8.38E-02	8.25E-01	8.25E-02	8.12E-01	8.12E-02
Chromium	**2.33E+00**	2.33E-01	**2.30E+00**	2.30E-01	**2.27E+00**	2.27E-01	**2.23E+00**	2.23E-01	**2.20E+00**	2.20E-01
Copper	6.87E-01	5.31E-01	6.82E-01	5.27E-01	6.77E-01	5.23E-01	6.72E-01	5.19E-01	6.66E-01	5.15E-01
Cyanide	7.05E-03	7.05E-04	7.08E-03	7.08E-04	7.12E-03	7.12E-04	7.15E-03	7.15E-04	7.19E-03	7.19E-04
Iron	**8.12E+00**	8.12E-01	**8.27E+00**	8.27E-01	**8.43E+00**	8.43E-01	**8.59E+00**	8.59E-01	**8.74E+00**	8.74E-01
Lead	**2.08E+00**	2.08E-01	**2.07E+00**	2.07E-01	**2.05E+00**	2.05E-01	**2.04E+00**	2.04E-01	**2.03E+00**	2.03E-01
Manganese	4.15E-02	1.29E-02	4.28E-02	1.33E-02	4.42E-02	1.37E-02	4.55E-02	1.41E-02	4.68E-02	1.45E-02
Mercury	**1.26E+00**	2.51E-01	**1.25E+00**	2.51E-01	**1.25E+00**	2.51E-01	**1.25E+00**	2.50E-01	**1.25E+00**	2.50E-01
Nickel	2.53E-02	1.26E-02	2.51E-02	1.26E-02	2.50E-02	1.25E-02	2.49E-02	1.24E-02	2.48E-02	1.24E-02
Selenium	**1.21E+00**	7.35E-01	**1.20E+00**	7.26E-01	**1.18E+00**	7.16E-01	**1.17E+00**	7.07E-01	**1.15E+00**	6.98E-01
Silver	1.88E-01	1.88E-02	1.86E-01	1.86E-02	1.84E-01	1.84E-02	1.82E-01	1.82E-02	1.80E-01	1.80E-02
Tin	1.85E-01	1.24E-01	1.81E-01	1.21E-01	1.78E-01	1.19E-01	1.74E-01	1.16E-01	ND	ND
Vanadium	**9.49E+00**	9.49E-01	**9.36E+00**	9.36E-01	**9.23E+00**	9.23E-01	**9.10E+00**	9.10E-01	**8.98E+00**	8.98E-01
Zinc	2.42E-01	1.21E-01	2.39E-01	1.19E-01	2.36E-01	1.18E-01	2.33E-01	1.17E-01	2.31E-01	1.15E-01
Inorganics Hazard Index	**2.69E+02**	**2.85E+01**	**2.71E+02**	**2.86E+01**	**2.73E+02**	**2.88E+01**	**2.74E+02**	**2.89E+01**	**2.76E+02**	**2.89E+01**

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the RFI/RI ecological risk assessments (B&R Environmental, 1997; 1998).

NA = Toxicity reference value not available.

Bolded items indicate HQ or HI > 1.

TABLE 5-9

HAZARD QUOTIENTS FOR RACCOONS - EASTERN SITES
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 1 of 2

	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
Ecological Chemical of Potential Concern *	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**	**NOAEL HQ**	**LOAEL HQ**
Semivolatile Organic Compounds (SVOCs)										
3-Methylcholanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetophenone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	4.10E-01	4.10E-02	4.13E-01	4.13E-02	4.16E-01	4.16E-02	4.19E-01	4.19E-02	4.22E-01	4.22E-02
Benzo(a)pyrene	**2.36E+00**	2.36E-01	**2.32E+00**	2.32E-01	**2.27E+00**	2.27E-01	**2.23E+00**	2.23E-01	**2.18E+00**	2.18E-01
Benzo(b)fluoranthene	5.22E-01	5.22E-02	5.35E-01	5.35E-02	5.49E-01	5.49E-02	5.62E-01	5.62E-02	5.75E-01	5.75E-02
Benzo(g,h,i)perylene	8.57E-01	8.57E-02	8.46E-01	8.46E-02	8.34E-01	8.34E-02	8.23E-01	8.23E-02	8.11E-01	8.11E-02
Bis(2-Ethylhexyl)phthalate	1.45E-02	1.45E-03	1.44E-02	1.44E-03	1.43E-02	1.43E-03	1.42E-02	1.42E-03	1.41E-02	1.41E-03
Chrysene	**1.16E+00**	1.16E-01	**1.15E+00**	1.15E-01	**1.14E+00**	1.14E-01	**1.13E+00**	1.13E-01	**1.12E+00**	1.12E-01
Di-n-butyl phthalate	1.85E-04	5.56E-05	1.83E-04	5.49E-05	1.81E-04	5.42E-05	1.79E-04	5.36E-05	1.76E-04	5.29E-05
Dibenzo(a,h)anthracene	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02
Fluoranthene	3.28E-01	3.28E-02	3.46E-01	3.46E-02	3.64E-01	3.64E-02	3.82E-01	3.82E-02	3.99E-01	3.99E-02
Hexachlorophene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	**1.27E+00**	1.27E-01	**1.24E+00**	1.24E-01	**1.22E+00**	1.22E-01	**1.20E+00**	1.20E-01	**1.18E+00**	1.18E-01
Phenanthrene	7.84E-01	7.84E-02	7.73E-01	7.73E-02	7.61E-01	7.61E-02	7.50E-01	7.50E-02	7.39E-01	7.39E-02
Pyrene	**1.58E+00**	1.58E-01	**1.56E+00**	1.56E-01	**1.55E+00**	1.55E-01	**1.53E+00**	1.53E-01	**1.52E+00**	1.52E-01
SVOC Hazard Index	**9.41E+00**	9.41E-01	**9.33E+00**	9.33E-01	**9.25E+00**	9.25E-01	**9.17E+00**	9.17E-01	**9.09E+00**	9.09E-01
Pesticides and PCBs										
4,4'-DDD	**1.56E+00**	3.12E-01	**1.53E+00**	3.06E-01	**1.50E+00**	2.99E-01	**1.46E+00**	2.92E-01	**1.43E+00**	2.86E-01
4,4'-DDE	3.50E-01	6.99E-02	3.45E-01	6.90E-02	3.41E-01	6.81E-02	3.36E-01	6.72E-02	3.32E-01	6.63E-02
4,4'-DDT	**1.39E+00**	2.77E-01	**1.36E+00**	2.73E-01	**1.34E+00**	2.69E-01	**1.32E+00**	2.65E-01	**1.30E+00**	2.60E-01
Aroclor-1260	**1.61E+00**	1.61E-01	**2.22E+00**	2.22E-01	**2.82E+00**	2.82E-01	**3.43E+00**	3.43E-01	**4.04E+00**	4.04E-01
beta-BHC	5.31E-02	1.06E-02	5.19E-02	1.04E-02	5.07E-02	1.01E-02	4.94E-02	9.89E-03	4.82E-02	9.64E-03
gamma-BHC (lindane)	3.11E-04	3.11E-05	3.04E-04	3.04E-05	2.98E-04	2.98E-05	2.91E-04	2.91E-05	2.84E-04	2.84E-05
delta-BHC	**1.32E+00**	1.32E-01	**1.29E+00**	1.29E-01	**1.26E+00**	1.26E-01	**1.23E+00**	1.23E-01	**1.20E+00**	1.20E-01
gamma-chlordane	2.38E-03	1.19E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Dieldrin	1.57E-01	1.57E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endosulfan I	2.87E-01	2.87E-02	2.81E-01	2.81E-02	2.74E-01	2.74E-02	2.68E-01	2.68E-02	2.61E-01	2.61E-02
Endosulfan II	2.86E-01	2.86E-02	2.79E-01	2.79E-02	2.73E-01	2.73E-02	2.66E-01	2.66E-02	2.60E-01	2.60E-02
Endrin	2.94E-01	2.94E-02	2.88E-01	2.88E-02	2.82E-01	2.82E-02	2.75E-01	2.75E-02	2.69E-01	2.69E-02
Endrin Aldehyde	8.63E-02	8.63E-03	8.56E-02	8.56E-03	8.48E-02	8.48E-03	8.41E-02	8.41E-03	8.34E-02	8.34E-03

TABLE 5-9

HAZARD QUOTIENTS FOR RACCOONS - EASTERN SITES
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 2 of 2

Ecological Chemical of Potential Concern *	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Heptachlor	1.29E-01	1.29E-02	1.26E-01	1.26E-02	1.23E-01	1.23E-02	1.20E-01	1.20E-02	1.17E-01	1.17E-02
Methyl parathion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pest/PCB Hazard Index	**7.52E+00**	**1.09E+00**	**7.85E+00**	**1.11E+00**	**8.35E+00**	**1.16E+00**	**8.84E+00**	**1.20E+00**	**9.34E+00**	**1.24E+00**
Inorganics										
Aluminum	**3.23E+02**	**3.23E+01**	**3.26E+02**	**3.26E+01**	**3.29E+02**	**3.29E+01**	**3.32E+02**	**3.32E+01**	**3.35E+02**	**3.35E+01**
Antimony	**7.98E+00**	7.98E-01	**8.05E+00**	8.05E-01	**8.13E+00**	8.13E-01	**8.21E+00**	8.21E-01	**8.29E+00**	8.29E-01
Arsenic	**1.56E+01**	**1.56E+00**	**1.54E+01**	**1.54E+00**	**1.52E+01**	**1.52E+00**	**1.50E+01**	**1.50E+00**	**1.49E+01**	**1.49E+00**
Barium	**1.95E+00**	5.02E-01	**1.93E+00**	4.98E-01	**1.92E+00**	4.94E-01	**1.90E+00**	4.90E-01	**1.89E+00**	4.87E-01
Beryllium	2.80E-01	2.80E-02	2.75E-01	2.75E-02	2.70E-01	2.70E-02	2.65E-01	2.65E-02	2.60E-01	2.60E-02
Cadmium	**4.58E+00**	4.58E-01	**4.50E+00**	4.50E-01	**4.42E+00**	4.42E-01	**4.35E+00**	4.35E-01	**4.27E+00**	4.27E-01
Chromium	**5.03E+00**	5.03E-01	**4.99E+00**	4.99E-01	**4.94E+00**	4.94E-01	**4.90E+00**	4.90E-01	**4.86E+00**	4.86E-01
Copper	**2.12E+00**	**1.64E+00**	**2.10E+00**	**1.63E+00**	**2.09E+00**	**1.62E+00**	**2.08E+00**	**1.61E+00**	**2.07E+00**	**1.60E+00**
Cyanide	3.35E-02	3.35E-03	3.37E-02	3.37E-03	3.40E-02	3.40E-03	3.42E-02	3.42E-03	3.44E-02	3.44E-03
Iron	**1.25E+01**	**1.25E+00**	**1.28E+01**	**1.28E+00**	**1.31E+01**	**1.31E+00**	**1.34E+01**	**1.34E+00**	**1.37E+01**	**1.37E+00**
Lead	**6.63E+00**	6.63E-01	**6.60E+00**	6.60E-01	**6.58E+00**	6.58E-01	**6.55E+00**	6.55E-01	**6.52E+00**	6.52E-01
Manganese	5.54E-02	1.72E-02	5.92E-02	1.83E-02	6.30E-02	1.95E-02	6.68E-02	2.07E-02	7.05E-02	2.19E-02
Mercury	**5.72E+00**	**1.14E+00**	**5.77E+00**	**1.15E+00**	**5.81E+00**	**1.16E+00**	**5.86E+00**	**1.17E+00**	**5.90E+00**	**1.18E+00**
Nickel	5.01E-02	2.51E-02	5.03E-02	2.51E-02	5.04E-02	2.52E-02	5.06E-02	2.53E-02	5.08E-02	2.54E-02
Selenium	**4.03E+00**	**2.44E+00**	**3.96E+00**	**2.40E+00**	**3.89E+00**	**2.36E+00**	**3.83E+00**	**2.32E+00**	**3.76E+00**	**2.28E+00**
Silver	**1.02E+00**	1.02E-01	**1.00E+00**	1.00E-01	9.84E-01	9.84E-02	9.68E-01	9.68E-02	9.52E-01	9.52E-02
Tin	4.94E-01	3.31E-01	4.85E-01	3.24E-01	4.75E-01	3.18E-01	4.65E-01	3.11E-01	4.55E-01	3.04E-01
Vanadium	**1.75E+01**	**1.75E+00**	**1.73E+01**	**1.73E+00**	**1.71E+01**	**1.71E+00**	**1.69E+01**	**1.69E+00**	**1.66E+01**	**1.66E+00**
Zinc	4.44E-01	2.22E-01	4.34E-01	2.17E-01	4.23E-01	2.12E-01	4.13E-01	2.06E-01	4.02E-01	2.01E-01
Inorganics Hazard Index	**4.09E+02**	**4.57E+01**	**4.12E+02**	**4.59E+01**	**4.15E+02**	**4.62E+01**	**4.17E+02**	**4.64E+01**	**4.20E+02**	**4.67E+01**

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the ecological risk assessments (B&R Environmental, 1997; 1998).

ND soil = Analyte was not detected in surface soil at the eastern sites. Thus, HQs based on ingestion of maximum detected concentrations of this analyte in surface soil are not applicable.

NA = Toxicity reference value not available.

Bolded items indicate HQ or HI > 1.

TABLE 5-10

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 1 of 3

Ecological Chemical of Potential Concern *	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	7.66E-02	7.66E-03	8.09E-02	8.09E-03	8.51E-02	8.51E-03	8.94E-02	8.94E-03	9.36E-02	9.36E-03
Acenaphthylene	7.60E-02	7.60E-03	8.02E-02	8.02E-03	8.45E-02	8.45E-03	8.88E-02	8.88E-03	9.30E-02	9.30E-03
Anthracene	7.55E-02	7.55E-03	7.98E-02	7.98E-03	8.41E-02	8.41E-03	8.84E-02	8.84E-03	9.26E-02	9.26E-03
Benzo(a)anthracene	6.98E-02	6.98E-03	7.42E-02	7.42E-03	7.86E-02	7.86E-03	8.30E-02	8.30E-03	8.74E-02	8.74E-03
Benzo(a)pyrene	7.31E-02	7.31E-03	7.74E-02	7.74E-03	8.17E-02	8.17E-03	8.61E-02	8.61E-03	9.04E-02	9.04E-03
Benzo(b)fluoranthene	7.03E-02	7.03E-03	7.47E-02	7.47E-03	7.91E-02	7.91E-03	8.35E-02	8.35E-03	8.79E-02	8.79E-03
Benzo(k)fluoranthene	6.96E-02	6.96E-03	7.40E-02	7.40E-03	7.84E-02	7.84E-03	8.28E-02	8.28E-03	8.72E-02	8.72E-03
Bis(2-Ethylhexyl)phthalate	9.16E-03	9.16E-04	9.15E-03	9.15E-04	9.14E-03	9.14E-04	9.13E-03	9.13E-04	9.12E-03	9.12E-04
Chrysene	7.27E-02	7.27E-03	7.71E-02	7.71E-03	8.14E-02	8.14E-03	8.58E-02	8.58E-03	9.01E-02	9.01E-03
Dibenzo(a,h)anthracene	7.60E-02	7.60E-03	8.03E-02	8.03E-03	8.45E-02	8.45E-03	8.88E-02	8.88E-03	9.31E-02	9.31E-03
Fluoranthene	8.06E-02	8.06E-03	8.47E-02	8.47E-03	8.89E-02	8.89E-03	9.30E-02	9.30E-03	9.72E-02	9.72E-03
Fluorene	8.15E-02	8.15E-03	8.56E-02	8.56E-03	8.98E-02	8.98E-03	9.39E-02	9.39E-03	9.81E-02	9.81E-03
Naphthalene	7.71E-02	7.71E-03	8.13E-02	8.13E-03	8.55E-02	8.55E-03	8.98E-02	8.98E-03	9.40E-02	9.40E-03
Phenanthrene	7.96E-02	7.96E-03	8.38E-02	8.38E-03	8.80E-02	8.80E-03	9.21E-02	9.21E-03	9.63E-02	9.63E-03
Pyrene	8.01E-02	8.01E-03	8.42E-02	8.42E-03	8.84E-02	8.84E-03	9.26E-02	9.26E-03	9.67E-02	9.67E-03
SVOC Hazard Index	**1.07E+00**	1.07E-01	**1.13E+00**	1.13E-01	**1.19E+00**	1.19E-01	**1.25E+00**	1.25E-01	**1.31E+00**	1.31E-01
Pesticides and PCBs										
4,4'-DDD	9.84E-04	1.97E-04	1.07E-03	2.14E-04	1.16E-03	2.31E-04	1.24E-03	2.49E-04	1.33E-03	2.66E-04
4,4'-DDE	1.46E-03	2.91E-04	1.65E-03	3.30E-04	1.84E-03	3.68E-04	2.03E-03	4.06E-04	2.22E-03	4.44E-04
4,4'-DDT	1.55E-03	3.10E-04	2.94E-03	5.88E-04	4.32E-03	8.65E-04	5.71E-03	1.14E-03	7.10E-03	1.42E-03
2,4-D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	4.76E-01	4.76E-02	4.65E-01	4.65E-02	4.54E-01	4.54E-02	4.43E-01	4.43E-02	4.32E-01	4.32E-02
Aroclor-1254	8.29E-02	8.29E-03	8.17E-02	8.17E-03	8.04E-02	8.04E-03	7.91E-02	7.91E-03	7.78E-02	7.78E-03
Aroclor-1260	5.23E-01	5.23E-02	4.29E-01	4.29E-02	3.35E-01	3.35E-02	2.41E-01	2.41E-02	1.46E-01	1.46E-02
alpha-BHC	2.72E-02	2.72E-03	2.63E-02	2.63E-03	2.54E-02	2.54E-03	2.45E-02	2.45E-03	2.36E-02	2.36E-03
beta-BHC	1.07E-03	2.14E-04	1.06E-03	2.13E-04	1.06E-03	2.12E-04	1.05E-03	2.10E-04	1.04E-03	2.09E-04
gamma-BHC (lindane)	4.40E-05	4.40E-06	4.25E-05	4.25E-06	4.10E-05	4.10E-06	3.96E-05	3.96E-06	3.81E-05	3.81E-06

TABLE 5-10

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 2 of 3

Ecological Chemical of Potential Concern *	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
delta-BHC	2.51E-02	2.51E-03	2.40E-02	2.40E-03	2.28E-02	2.28E-03	2.17E-02	2.17E-03	2.05E-02	2.05E-03
Dieldrin	3.31E-02	3.31E-03	3.15E-02	3.15E-03	2.99E-02	2.99E-03	2.83E-02	2.83E-03	2.66E-02	2.66E-03
Endosulfan I	3.59E-03	3.59E-04	3.23E-03	3.23E-04	2.87E-03	2.87E-04	2.51E-03	2.51E-04	2.15E-03	2.15E-04
Endosulfan II	7.28E-03	7.28E-04	7.03E-03	7.03E-04	6.77E-03	6.77E-04	6.52E-03	6.52E-04	6.27E-03	6.27E-04
Endosulfan Sulfate	5.75E-03	5.75E-04	5.32E-03	5.32E-04	4.89E-03	4.89E-04	4.47E-03	4.47E-04	4.04E-03	4.04E-04
Endrin	2.05E-02	2.05E-03	1.69E-02	1.69E-03	1.32E-02	1.32E-03	9.49E-03	9.49E-04	5.81E-03	5.81E-04
Endrin Aldehyde	1.40E-02	1.40E-03	1.20E-02	1.20E-03	9.90E-03	9.90E-04	7.85E-03	7.85E-04	5.80E-03	5.80E-04
Heptachlor	3.66E-03	3.66E-04	3.16E-03	3.16E-04	2.65E-03	2.65E-04	2.14E-03	2.14E-04	1.63E-03	1.63E-04
Pest/PCB Hazard Index	**1.23E+00**	1.23E-01	**1.11E+00**	1.12E-01	9.96E-01	1.00E-01	8.80E-01	8.90E-02	7.65E-01	7.76E-02
Metals and Inorganic Compounds										
Aluminum	**1.13E+01**	**1.13E+00**	**1.00E+01**	**1.00E+00**	**8.79E+00**	8.79E-01	**7.56E+00**	7.56E-01	**6.33E+00**	6.33E-01
Antimony	**2.01E+00**	2.01E-01	**2.10E+00**	2.10E-01	**2.18E+00**	2.18E-01	**2.27E+00**	2.27E-01	**2.35E+00**	2.35E-01
Arsenic	**1.80E+01**	**1.80E+00**	**1.79E+01**	**1.79E+00**	**1.77E+01**	**1.77E+00**	**1.76E+01**	**1.76E+00**	**1.75E+01**	**1.75E+00**
Barium	1.22E-01	3.15E-02	1.14E-01	2.93E-02	1.06E-01	2.72E-02	9.74E-02	2.51E-02	8.91E-02	2.29E-02
Beryllium	7.54E-03	7.54E-04	7.42E-03	7.42E-04	7.29E-03	7.29E-04	7.16E-03	7.16E-04	7.04E-03	7.04E-04
Cadmium	1.11E-01	1.11E-02	1.09E-01	1.09E-02	1.07E-01	1.07E-02	1.06E-01	1.06E-02	1.04E-01	1.04E-02
Chromium	9.52E-02	9.52E-03	9.31E-02	9.31E-03	9.10E-02	9.10E-03	8.90E-02	8.90E-03	8.69E-02	8.69E-03
Copper	4.91E-01	3.80E-01	4.74E-01	3.67E-01	4.57E-01	3.53E-01	4.40E-01	3.40E-01	4.24E-01	3.27E-01
Cyanide	7.77E-03	7.77E-04	8.03E-03	8.03E-04	8.29E-03	8.29E-04	8.55E-03	8.55E-04	8.80E-03	8.80E-04
Iron	**2.16E+00**	2.16E-01	**1.96E+00**	1.96E-01	**1.75E+00**	1.75E-01	**1.55E+00**	1.55E-01	**1.34E+00**	1.34E-01
Lead	2.11E-01	2.11E-02	1.90E-01	1.90E-02	1.70E-01	1.70E-02	1.49E-01	1.49E-02	1.28E-01	1.28E-02
Manganese	2.01E-02	6.24E-03	1.75E-02	5.42E-03	1.49E-02	4.61E-03	1.23E-02	3.80E-03	9.65E-03	2.99E-03
Mercury	2.92E-01	5.83E-02	3.28E-01	6.55E-02	3.64E-01	7.27E-02	4.00E-01	7.99E-02	4.36E-01	8.71E-02
Nickel	6.07E-03	3.04E-03	5.48E-03	2.74E-03	4.89E-03	2.45E-03	4.30E-03	2.15E-03	3.72E-03	1.86E-03
Selenium	8.30E-01	5.03E-01	8.25E-01	5.00E-01	8.20E-01	4.97E-01	8.15E-01	4.94E-01	8.09E-01	4.91E-01
Silver	2.84E-02	2.84E-03	2.65E-02	2.65E-03	2.46E-02	2.46E-03	2.27E-02	2.27E-03	2.09E-02	2.09E-03
Thallium	**2.26E+01**	**2.26E+00**	**1.99E+01**	**1.99E+00**	**1.71E+01**	**1.71E+00**	**1.44E+01**	**1.44E+00**	**1.16E+01**	**1.16E+00**
Tin	9.12E-02	6.10E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil

TABLE 5-10

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEAN CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
PAGE 3 of 3

Ecological Chemical of Potential Concern *	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Vanadium	**1.02E+00**	1.02E-01	9.60E-01	9.60E-02	9.04E-01	9.04E-02	8.49E-01	8.49E-02	7.93E-01	7.93E-02
Zinc	5.50E-02	2.75E-02	5.23E-02	2.61E-02	4.96E-02	2.48E-02	4.69E-02	2.35E-02	4.43E-02	2.21E-02
Inorganics Hazard Index	**5.94E+01**	**6.82E+00**	**5.50E+01**	**6.32E+00**	**5.07E+01**	**5.87E+00**	**4.64E+01**	**5.43E+00**	**4.21E+01**	**4.98E+00**

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the ecological risk assessments (B&R Environmental, 1997; 1998).
ND soil = Tin was not analzed in surface soil samples collected from IRs 1, 7, and 8. Thus, HQs based on ingestion of surface soil are not applicable.
NA = Toxicity reference value not available.
Bolded items indicate HQ or HI > 1.

TABLE 5-11

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA
Page 1 of 3

	100% Sediment		75%Sediment/25%Soil		50%Sediment/50%Soil		25%Sediment/75%Soil		100%Soil	
Ecological Chemical of	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**	**NOAEL**	LOAEL
Potential Concern *	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	HQ
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	6.44E-02	6.44E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Acenaphthylene	1.61E-02	1.61E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Anthracene	1.72E-02	1.72E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Benzo(a)anthracene	7.15E-02	7.15E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Benzo(a)pyrene	6.08E-02	6.08E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Benzo(b)fluoranthene	7.08E-02	7.08E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Benzo(k)fluoranthene	6.79E-02	6.79E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Bis(2-Ethylhexyl)phthalate	8.40E-03	8.40E-04	8.28E-03	8.28E-04	8.17E-03	8.17E-04	8.05E-03	8.05E-04	7.93E-03	7.93E-04
Chrysene	1.01E-01	1.01E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Dibenzo(a,h)anthracene	4.08E-02	4.08E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Fluoranthene	1.79E-01	1.79E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Fluorene	5.36E-02	5.36E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Naphthalene	2.25E-02	2.25E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Phenanthrene	1.77E-01	1.77E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Pyrene	1.67E-01	1.67E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
SVOC Hazard Index	**1.12E+00**	1.12E-01	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Pesticides and PCBs										
4,4'-DDD	1.42E-03	2.84E-04	1.83E-03	3.67E-04	2.25E-03	4.50E-04	2.67E-03	5.34E-04	3.09E-03	6.17E-04
4,4'-DDE	6.47E-03	1.29E-03	5.71E-03	1.14E-03	4.95E-03	9.90E-04	4.19E-03	8.38E-04	3.43E-03	6.86E-04
4,4'-DDT	7.17E-03	1.43E-03	1.19E-02	2.38E-03	1.66E-02	3.32E-03	2.13E-02	4.26E-03	2.60E-02	5.20E-03
2,4-D	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
Aroclor-1248	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
Aroclor-1254	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
Aroclor-1260	**3.47E+00**	3.47E-01	**2.80E+00**	2.80E-01	**2.12E+00**	2.12E-01	**1.44E+00**	1.44E-01	7.68E-01	7.68E-02

TABLE 5-11

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

alpha-BHC	3.81E-02	3.81E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
beta-BHC	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
gamma-BHC (lindane)	1.90E-05	1.90E-06	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
delta-BHC	3.24E-02	3.24E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Dieldrin	2.60E-02	2.60E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endosulfan I	1.33E-02	1.33E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endosulfan II	1.97E-02	1.97E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endosulfan Sulfate	2.55E-02	2.55E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endrin	1.64E-01	1.64E-02	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Endrin Aldehyde	5.21E-02	5.21E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Heptachlor	1.54E-02	1.54E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Pest/PCB Hazard Index	**3.88E+00**	3.89E-01	**2.82E+00**	2.84E-01	**2.14E+00**	2.17E-01	**1.47E+00**	1.50E-01	8.01E-01	8.33E-02
Metals and Inorganic Compounds										
Aluminum	**8.63E+01**	**8.63E+00**	**7.62E+01**	**7.62E+00**	**6.61E+01**	**6.61E+00**	**5.61E+01**	**5.61E+00**	**4.60E+01**	**4.60E+00**
Antimony	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab
Arsenic	**3.63E+01**	**3.63E+00**	**3.60E+01**	**3.60E+00**	**3.58E+01**	**3.58E+00**	**3.56E+01**	**3.56E+00**	**3.53E+01**	**3.53E+00**
Barium	6.01E-01	1.55E-01	5.39E-01	1.39E-01	4.78E-01	1.23E-01	4.16E-01	1.07E-01	3.55E-01	9.13E-02
Beryllium	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab	ND crab
Cadmium	3.14E-01	3.14E-02	3.09E-01	3.09E-02	3.05E-01	3.05E-02	3.00E-01	3.00E-02	2.95E-01	2.95E-02
Chromium	5.00E-01	5.00E-02	5.36E-01	5.36E-02	5.72E-01	5.72E-02	6.07E-01	6.07E-02	6.43E-01	6.43E-02
Copper	**1.60E+00**	**1.23E+00**	**1.73E+00**	**1.34E+00**	**1.87E+00**	**1.44E+00**	**2.00E+00**	**1.54E+00**	**2.13E+00**	**1.65E+00**
Cyanide	5.62E-02	5.62E-03	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil	ND soil
Iron	**8.91E+00**	8.91E-01	**8.45E+00**	8.45E-01	**7.99E+00**	7.99E-01	**7.53E+00**	7.53E-01	**7.08E+00**	7.08E-01
Lead	**1.68E+00**	1.68E-01	**1.43E+00**	1.43E-01	**1.19E+00**	1.19E-01	9.43E-01	9.43E-02	6.97E-01	6.97E-02
Manganese	9.34E-02	2.89E-02	7.94E-02	2.46E-02	6.54E-02	2.03E-02	5.14E-02	1.59E-02	3.75E-02	1.16E-02
Mercury	**1.16E+00**	2.31E-01	**1.56E+00**	3.13E-01	**1.97E+00**	3.94E-01	**2.38E+00**	4.76E-01	**2.79E+00**	5.57E-01
Nickel	4.59E-02	2.29E-02	3.81E-02	1.91E-02	3.04E-02	1.52E-02	2.26E-02	1.13E-02	1.49E-02	7.45E-03
Selenium	**2.62E+00**	**1.59E+00**	**2.51E+00**	**1.52E+00**	**2.41E+00**	**1.46E+00**	**2.30E+00**	**1.39E+00**	**2.19E+00**	**1.33E+00**

TABLE 5-11

HAZARD QUOTIENTS FOR RACCOONS - WESTERN SITES
MEANS OF MAXIMUM DETECTED CONCENTRATIONS
BASE WIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Silver	1.22E-01	1.22E-02	1.13E-01	1.13E-02	1.03E-01	1.03E-02	9.43E-02	9.43E-03	8.52E-02	8.52E-03
Thallium	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
Tin	3.95E-01	2.64E-01	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil	ND crab+soil
Vanadium	**2.40E+00**	2.40E-01	**2.22E+00**	2.22E-01	**2.05E+00**	2.05E-01	**1.87E+00**	1.87E-01	**1.69E+00**	1.69E-01
Zinc	1.97E-01	9.86E-02	2.04E-01	1.02E-01	2.10E-01	1.05E-01	2.17E-01	1.08E-01	2.23E-01	1.12E-01
Inorganics Hazard Index	**1.43E+02**	**1.73E+01**	**1.32E+02**	**1.60E+01**	**1.21E+02**	**1.50E+01**	**1.10E+02**	**1.40E+01**	**9.96E+01**	**1.29E+01**

* Ecological chemicals of potential concern (COPCs) consist of all analytes in sediment and surface soil that were identified as COPCs in the ecological risk assessments (B&R Environmental, 1997; 1998).

ND soil = Analyte was not detected or was not analyzed in surface soil samples collected from IRs 1, 7, and 8. Thus, HQs based on ingestion of maximum detected concentrations of this analyte in surface soil are not applicable.

ND crab = Analyte was not detected in crustacean samples collected from IR 1, 7, or 8. Thus, HQs based on maximum detected tissue concentrations of this analyte are not applicable.

ND crab+soil = Analyte was not analyzed in crustacean samples and was not detected (or was not analyzed) in soil samples collected from IR 1, 7, or 8.

NA = Toxicity reference value not available.

Bolded items indicate HQ or HI > 1.

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APPENDIX A

RESPONSES TO COMMENTS

APPENDIX A. RESPONSES TO COMMENTS

This appendix provides comments from EPA along with the Navy's responses to each comment. The Navy's responses have been previously discussed with EPA.

TECHNICAL REVIEW AND COMMENTS REPORT FOR THE BASEWIDE ECOLOGICAL RISK ASSESSMENT FOR NAVAL AIR STATION, KEY WEST, FLORIDA

GENERAL COMMENTS

Comment 1: Site IR3 is not included in the risk assessment because the assumption is made that it does not have an ecological exposure pathway. While it is true that this site provides only poor wildlife habitat, it is likely used by reptiles, invertebrates, birds, and small mammals. Both the American kestrel and the raccoon are species known to inhabit areas near human activity. Thus the American kestrel and the raccoon may utilize this site and ingest prey that utilize this site. Table 1-1 indicates the presumptive remedy for site IR3 is to cap the area, but the description in section 2.1.11 on page 2-6 does not discuss capping. IR3 should be included in the risk assessment for the American kestrel and the raccoon unless the area is capped, thus removing the potential ecological exposure pathway.

Response: *The entire surface area of IR 3 will be covered with an asphalt cap. This capping is scheduled to occur during 1999. This capping will remove any possibility of an ecological exposure pathway, and thus, the site is not included in the basewide ecological risk assessment.*

Comment 2A: Average contaminant concentrations are used in the exposure estimates. To comply with recent Region 4 guidance on exposure point concentrations to be used in risk assessment, the maximum concentration detected should be used in the exposure estimates as well.

Response: *The goal of the basewide risk assessment is to assess cumulative impacts to wide-ranging ecological receptors from multiple sites at NAS Key West. With this goal in mind, mean concentrations of COPCs were used as exposure point contaminant concentrations. This provides a more realistic estimate of actual exposure than the use of maximum concentrations, since such receptors would be exposed to a range of contaminant concentrations at each site within their home range. The Navy concurs with EPA guidance that calls for the use of maximum concentrations as exposure point concentrations in preliminary and baseline risk assessments; this approach was conducted in the two previous RFI/RI reports (B&R Environmental, 1997; 1998). The current study, however, is an attempt to assess risks on a basewide level. The use of maximum concentrations to assess potential risks to wide-ranging ecological receptors would not provide a realistic estimate of potential exposure.*

Evaluation: The Navy makes a good point that a wide-ranging receptor will not be subject to the MDC at a single site for the period of the exposure duration and that another concentration term would be more applicable. Once a wide-ranging receptor guild is chosen, an exposure unit can be specified. The concept of an exposure unit (EU) is applicable to both ecological and human health risk assessment. An EU is the geographic area within which, and with equal probability and random access, a receptor contacts the contaminated medium. Hence, for a receptor with a small home range such as a shrew, the EU would probably be less than an acre. For a wide-ranging receptor, the EU would be greater in size. Of course, the size of the EU has bearing on the determination of the exposure point concentration.

The first decision to address this comment would be to determine the home range and EU of the wide-ranging receptors to be considered. Using this information, the speicific EU for calculation of the concentration term should include the largest number of sites/SWMUs or the most contaminated ("riskiest") sites/SWMUs. To develope a multisite concentration term, the Navy should consider a value that represents the mean value of the MDCs of all sites within the contacted/Fraction ingested) term could be applied to the risk calculation. For example, a receptor with a 100 acre home range may occupy an area in which only 20 acres are contaminated. The FI term in this example would be 0.2.

Comment 2B: Furthermore, the average concentrations of contaminants of potential concern (COPCs) in Tables 5-1, 5-2, 5-3, 5-4, and 5-5 (pages 5-9 to 5-16) may not have been calculated correctly. For example, the only detection of acetophenone in surface soil is reported as 120 micogram per kilogram (μg/kg), but the average concentration is reported as 1033.3 μg/kg. This may be an artifact of using one-half the detection limit for non-detections when calculating the mean concentration. The equation used for calculating the mean concentrations should be included in Section 5.2.4.3 Uncertainty in the Exposure Estimate.

Response: *Average concentrations of COPCs were calculated using one-half the detection limit for non-detected samples. This resulted in average values that were greater than the maximum detected values for a few analytes (primarily VOCs and SVOCs). This occurs when detection limits in non-detected samples exceed the detected concentrations, and especially when the analyte is infrequently detected, as was the case for acetophenone in surface soil. As requested, a discussion of the uncertainty introduced from using average concentrations will be included in section 5.2.4.3.*

Comment 3: Hazard indices (HI) are not presented for any of the ecological receptors. HI tables for each receptor shold be presented in the document.

Response: *EPA Region IV guidance (EPA, 1995) states that when multiple contaminants are involved in the risk assessment, "it is appropriate to sum the HQs if the compounds exhibit consistent modes of* *toxicity and effect endpoints" to obtain a hazard index (HI). In actual practice, when numerous contaminants exist, numerous modes of toxicity exist, and it is usually difficult, impractical, or impossible to differentiate all modes of toxicity. However, it is agreed that most of the organochlorine insecticides that were COPCs in this risk assessment can be considered to exhibit consistent modes of toxicity. While the relationships among COPCs and associated modes of toxicity are not as clear for many of the other COPCs, Table 5-6 will be revised to provide HI values for each category of analytes (inorganics, pesticides/PCBs, and semivolatile compounds) for each representative receptor.*

SPECIFIC COMMENTS

Comment 1: Section 3.1, Page 3-1. This section discusses the derivation of the toxicity reference values (TRVs) used in the risk assessment. An uncertainty factor of 10 for class-to-class extrapolations was employed. Extrapolation between taxonomic classes is not an accepted practice for TRV derivation (EPA 1996). TRVs that employ class-to-class extrapolations should be replace with NA for not available.

Response: *Tetra Tech NUS has contacted several sources, including EPA's National Service Center for Environmental Publications, and Lynn Wellman of EPA Region IV, but we have been unable to locate the reference cited in the comment (EPA, 1996, Use of Uncertainty Factors in Toxicity Extrapolations Involving Terrestrial Wildlife). Nevertheless, Tetra Tech NUS and the Navy are aware that class-to-class extrapolations introduce uncertainty in the risk assessment. The basewide risk assessment utilized these extrapolations to derive avian TRVs for a few chemicals where only mammalian data were available. Whether the uncertainty resulting from these extrapolations is greater than the uncertainty resulting from not assessing the risk of these chemicals is debatable. However, the Navy agrees to comply with the request, and TRVs that employ class-to-class extrapolations will be replaced with NA for not available.*

Comment 2: Table 3-1, Pages 3-3 and 3-4. This table presents the derivation of TRVs for the raccoon. The table has a few errors that shold be corrected. Specifically, the no observed adverse effect level (NOAEL) for copper is 1.17E+01; vanadium is 2.1E-01; and endosulfan I, endosulfan II and endosulfan sulfate is 1.5E-01 for the source cited. Furthermore, a more conservative NOAEL for mercury from a mink study should be used. The lab test result for mercury should be changed to 1.0E+00.

Response: *Concur; the errors will be corrected as requested. In addition, an error in the same table was discovered for cyanide. The endpoint for cyanide in Sample et al (1996) was a NOAEL; thus the NOAEL-to-LOAEL uncertainty factor will be revised to 1, and the derived TRV for cyanide will be revised to 6.87E+01.*

Comment 3: Table 3-2, Pages 3-5 and 3-6. This table presents the derivation of TRVs for the American kestrel and the great blue heron. An uncertainty factor of 10 for class-to-class extrapolations was employed for antimony; arsenic; barium; beryllium; cyanide; nickel; silver; 2,4,5-T; 2,4,5-TP; 2,4-D; heptachlor; benzo(a)pyrene; fluoranthene; and pyrene. Extrapolation between taxonomic classes is not an accepted practice for TRV derivation. Furthermore, NOAELs are available for avian species in Sample et al. (1996) for arsenic, barium, and nickel. The avian TRVs should be used where available. The TRVs which employ class-to-class extrapolations should be replaced with NA for not available.

Response: *The TRVs for arsenic, barium, and nickel will be revised as requested. TRVs for the other analytes listed in the comment will be replaced with NA (for not available) where class-specific TRVs are not available. Also, see response to specific comment # 1.*

Comment 4: A more conservative NOAEL for endrin is available than the value cited. Sample et al. (1966) includes a screech owl study with a LOAEL of 1E-01 milligram per kilogram per kilogram per day (mg/kg/day). The most conservative value from an avain study should be used.

Response: *Concur; the TRV for endrin will be revised based on the screech owl study of Sample et al (1996).*

Comment 5: Tables 3-1 and 3-2. Footnote c for Tables 3-1 and 3-2 indicates the "Total Uncertainty Factor=(1/UF^a*1UF^b)." This equation does not correspond to the values entered in the Total Uncertainty Factor columns in these tables. The equation should be Total Uncertainty Factor=(UF^a*UF^b). Also, footnote d indicates the "Derived Wildlife TRV=Lab Test Result*Total Uncertainty Factor." This would be accurate if the numbers in the Total Uncertainty Factor column had been entered according to the equation given in footnote c. However, given the numbers as entered, this equation should be: Derived TRV=Lab Test Result/Total Uncertainty Factor. The equations should be changed to accurately reflect the values in the tables.

Response: *Concur; footnotes c and d will be revised to accurately reflect the process by which the TRVs were derived.*

Comment 6: Section 4.1, Paragraph 2, Page 4-1. This section discuesses the exposure point contaminant concentrations. The second paragraph states that, "mean concentrations of COPC were used as exposure point contaminant concentrations." To be conservative, the maximum concentrations detected should be used as well.

Response: *See response to first portion of general comment # 2.*

<u>Comment 7</u>: Section 5.1, Page 5-2. This section summarizes the risk assessment approach. The section indicates that the sediment data and the crab tissue data are used to estimate the doses to the raccoons. Raccoons are an omnivorous terrestrial species, thus they would also be potentially exposed to surface soil contamination. The surface soil data should be incorporated into the dose estimates for the raccoon.

<u>Response</u>: *The percentage of an animal's diet that is made up of incidentally ingested soil and sediment is usually estimated by the acid-insoluble ash content of the animal's scat or digestive tract contents. This was the case for the raccoon soil/sediment ingestion rate of 9.4 percent (EPA, 1993) that was used in the basewide risk assessment. Thus, the ratio of soil to sediment cannot be determined. It is true that raccoons probably ingest some soil. However, raccoons foraging along the shorelines of the sites assessed in this study probably ingest more sediment than surface soil. In addition, an examination of Tables 5-1, 5-2, and 5-3 indicates that average concentrations of most analytes were greater in sediment than in surface soil. Thus, assuming that the sediment/soil ingestion rate is 100 percent sediment is a conservative approach. In summary, since the ratio of soil to sediment cannot be determined, and since sediment concentrations of analytes usually exceeded soil concentrations, the incorporation of soil data into the dose estimates would be of little value.*

<u>Evaluation:</u> Fundamentally, risk assessment is more a decision tool than a reflection of reality. EPA agrees with the Navy's assertion that it would be impossible to know which of the combinations of soil and sediment would most closely reflect reality. However, since this aspect of the receptor's behavior remains unknown, the prudent approach is to base decisions on the possible range of risks given this particular uncertainty. Because there may be different groups of chemicals in soil versus sediment, performing the calculation using 100% sediment and 100% soil as the only two possibilities will not provide sufficient information to the risk managers. A combination of chemicals across two media may result in greater risk than all chemicals in one as opposed to all in the other. EPA does not consider it onerous to perform the calculation a mere four additional times with different combinations of soil/sediment forming the raccoon's incidental ingestion (more effort probably went into avoiding the work than would have taken to do it). Performing these additional simple calculations will provide bounds on the risk estimate and would be useful to the risk managers.

<u>Comment 8</u>: Table 5-4, Page 5-15. This table summarizes the ecological COPCs in minnows. Two of the columns in the table have the same heading "Average Concentration." The last column is presumably the average background concentration. The column heading should be corrected.

<u>Response</u>: *Concur; the word "average" will be added to the last column in Table 5-4.*

Comment 9: Table 5-6, Page 5-17 and 5-18. This table summarizes the hazard quotients (HQ) for the wildlife receptors. The HQs should be recalculated to incorporate the general comments and specific comments above.

Response: *Concur; Table 5-6 and the report text will be revised to incorporate the revisions discussed in the previous responses.*

References

Sample, B. E., D. M. Opresko, and G. W. Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*. Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, TN, June.

U.S. Environmental Protection Agency (EPA). 1996. *Use of Uncertainty Factors in Toxicity Extrapolations Involving Terrestrial Wildlife*. Office of Research and Development. Washington, D.C., September.

APPENDIX B

FOOD CHAIN MODELING CALCULATIONS

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

American Kestrel

Body Weight	0.1380 kg
Food Ingestion Rate	0.0400 kg/day
Water Ingestion Rate	0.0000 L/day
Soil Ingestion Rate	0.0000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	MEAN CONCENTRATION Soil Concentration (mg/kg)	MEAN CONCENTRATION Food Concentration (mg/kg)	MEAN CONCENTRATION Dose (mg/kg/day)	MEAN CONCENTRATION NOAEL HQ	MEAN CONCENTRATION LOAEL HQ	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Soil Concentration (mg/kg)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Food Concentration (mg/kg)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Dose (mg/kg/day)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS NOAEL HQ	MEAN OF MAXIMUM DETECTED CONCENTRATIONS LOAEL HQ
Semivolatile Organic Compounds												
3-Methylcholanthene			2.8303	2.8303	0.8204	NA	NA	ND	ND	ND	ND	ND
Acenaphthene			0.7107	0.7107	0.2060	NA	NA	ND	ND	ND	ND	ND
Acenaphthylene	10.0000	100.0000	0.7107	0.7107	0.2060	2.06E-02	2.06E-03	ND	ND	ND	ND	ND
Anthracene	10.0000	100.0000	0.7059	0.7059	0.2046	2.05E-02	2.05E-03	0.2800	0.2800	0.0812	8.12E-03	8.12E-04
Acetophenone			1.0333	1.0333	0.2995	NA	NA	0.1200	0.1200	0.0348	NA	NA
Benzo(a)anthracene	10.0000	100.0000	0.7940	0.7940	0.2302	2.30E-02	2.30E-03	2.5300	2.5300	0.7333	7.33E-02	7.33E-03
Benzo(a)pyrene	10.0000	100.0000	0.7731	0.7731	0.2241	2.24E-02	2.24E-03	2.1125	2.1125	0.6123	6.12E-02	6.12E-03
Benzo(b)fluoranthene	10.0000	100.0000	0.9577	0.9577	0.2776	2.78E-02	2.78E-03	5.0850	5.0850	1.4739	1.47E-01	1.47E-02
Benzo(g,h,i)perylene	10.0000	100.0000	0.7461	0.7461	0.2163	2.16E-02	2.16E-03	1.7000	1.7000	0.4928	4.93E-02	4.93E-03
Benzo(k)fluoranthene	10.0000	100.0000	0.6820	0.6820	0.1977	1.98E-02	1.98E-03	0.3600	0.3600	0.1043	1.04E-02	1.04E-03
Bis(2-Ethylhexyl)phthalate	1.1000	11.0000	0.8867	0.8867	0.2570	2.34E-01	2.34E-02	0.7400	0.7400	0.2145	1.95E-01	1.95E-02
Chrysene	10.0000	100.0000	0.8739	0.8739	0.2533	2.53E-02	2.53E-03	3.6925	3.6925	1.0703	1.07E-01	1.07E-02
Di-n-butyl phthalate	0.1100	1.1000	0.9103	0.9103	0.2639	2.40E+00	2.40E-01	0.2300	0.2300	0.0667	6.06E-01	6.06E-02
Dibenzo(a,h)anthracene	10.0000	100.0000	0.6989	0.6989	0.2026	2.03E-02	2.03E-03	0.6045	0.6045	0.1752	1.75E-02	1.75E-03
Fluoranthene	10.0000	100.0000	0.9560	0.9560	0.2771	2.77E-02	2.77E-03	5.0600	5.0600	1.4667	1.47E-01	1.47E-02
Fluorene	10.0000	100.0000	0.7100	0.7100	0.2058	2.06E-02	2.06E-03	ND	ND	ND	ND	ND
Hexachlorophene			10.3036	10.3036	2.9865	NA	NA	0.8900	0.8900	0.2580	NA	NA
Indeno(1,2,3-cd)pyrene	10.0000	100.0000	0.7383	0.7383	0.2140	2.14E-02	2.14E-03	1.5325	1.5325	0.4442	4.44E-02	4.44E-03
Naphthalene	10.0000	100.0000	0.7231	0.7231	0.2096	2.10E-02	2.10E-03	ND	ND	ND	ND	ND
Phenanthrene	10.0000	100.0000	0.7600	0.7600	0.2203	2.20E-02	2.20E-03	1.4305	1.4305	0.4146	4.15E-02	4.15E-03
Pyrene	10.0000	100.0000	0.9291	0.9291	0.2693	2.69E-02	2.69E-03	4.3500	4.3500	1.2609	1.26E-01	1.26E-02
Pesticides and PCBs												
4,4'-DDD	0.0028	0.0280	0.2317	0.2317	0.0672	2.40E+01	2.40E+00	0.3939	0.3939	0.1142	4.08E+01	4.08E+00
4,4'-DDE	0.0028	0.0280	0.1420	0.1420	0.0412	1.47E+01	1.47E+00	0.4369	0.4369	0.1266	4.52E+01	4.52E+00
4,4'-DDT	0.0028	0.0280	0.2164	0.2164	0.0627	2.24E+01	2.24E+00	1.5978	1.5978	0.4631	1.65E+02	1.65E+01
2,4,5-T			0.0310	0.0310	0.0090	NA	NA	0.0070	0.0070	0.0020	NA	NA
2,4,5-TP (Silvex)			0.0188	0.0188	0.0055	NA	NA	0.0040	0.0040	0.0012	NA	NA
2,4-D			0.0310	0.0310	0.0090	NA	NA	0.0074	0.0074	0.0022	NA	NA
Aroclor-1248			0.1616	0.1616	0.0469	NA	NA	ND	ND	ND	ND	ND
Aroclor-1254			0.1838	0.1838	0.0533	NA	NA	ND	ND	ND	ND	ND
Aroclor-1260	0.1800	1.8000	0.6163	0.6163	0.1786	9.92E-01	9.92E-02	5.8283	5.8283	1.6894	9.39E+00	9.39E-01
alpha-BHC	0.5600	2.2500	0.0126	0.0126	0.0037	6.54E-03	1.63E-03	0.0113	0.0113	0.0033	5.85E-03	1.46E-03
beta-BHC	0.5600	2.2500	0.0131	0.0131	0.0038	6.77E-03	1.68E-03	0.0305	0.0305	0.0088	1.58E-02	3.93E-03
gamma-BHC (lindane)	2.0000	20.0000	0.0122	0.0122	0.0035	1.76E-03	1.76E-04	0.0010	0.0010	0.0003	1.45E-04	1.45E-05
delta-BHC	0.5600	2.2500	0.0126	0.0126	0.0037	6.53E-03	1.63E-03	0.0010	0.0010	0.0003	5.18E-04	1.29E-04
gamma chlordane			0.0414	0.0414	0.0120	NA	NA	ND	ND	ND	ND	ND
Dieldrin	0.0770	0.7700	0.0243	0.0243	0.0071	9.16E-02	9.16E-03	ND	ND	ND	ND	ND
Endosulfan I	10.0000	100.0000	0.0130	0.0130	0.0038	3.77E-04	3.77E-05	0.0066	0.0066	0.0019	1.90E-04	1.90E-05
Endosulfan II	10.0000	100.0000	0.0254	0.0254	0.0074	7.36E-04	7.36E-05	0.0041	0.0041	0.0012	1.19E-04	1.19E-05
Endosulfan Sulfate	10.0000	100.0000	0.0256	0.0256	0.0074	7.43E-04	7.43E-05	0.0030	0.0030	0.0009	8.70E-05	8.70E-06
Endrin	0.0100	0.1000	0.0249	0.0249	0.0072	7.21E-01	7.21E-02	0.0139	0.0139	0.0040	4.03E-01	4.03E-02
Endrin Aldehyde	0.0100	0.1000	0.0230	0.0230	0.0067	6.67E-01	6.67E-02	0.0238	0.0238	0.0069	6.88E-01	6.88E-02
Heptachlor			0.0126	0.0126	0.0036	NA	NA	0.0028	0.0028	0.0008	NA	NA
Toxaphene			0.6891	0.6891	0.1998	NA	NA	0.3430	0.3430	0.0994	NA	NA
Methyl parathion			0.0183	0.0183	0.0053	NA	NA	ND	ND	ND	ND	ND
Metals and Inorganic Compounds												
Aluminum	109.7000	1097.0000	1904.1563	1904.1563	551.9294	5.03E+00	5.03E-01	4170.4000	4170.4000	1208.8116	1.10E+01	1.10E+00
Antimony			7.3889	7.3889	2.1417	NA	NA	30.8988	30.8988	8.9562	NA	NA
Arsenic	2.4600	7.3800	2.7826	2.7826	0.8066	3.28E-01	1.09E-01	8.5044	8.5044	2.4651	1.00E+00	3.34E-01
Barium	20.8000	41.7000	26.6647	26.6647	7.7289	3.72E-01	1.85E-01	39.6100	39.6100	11.4812	5.52E-01	2.75E-01
Beryllium			0.0734	0.0734	0.0213	NA	NA	0.1943	0.1943	0.0563	NA	NA

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

American Kestrel

Body Weight	0.1380 kg
Food Ingestion Rate	0.0400 kg/day
Water Ingestion Rate	0.0000 L/day
Soil Ingestion Rate	0.0000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	MEAN CONCENTRATION Soil Concentration (mg/kg)	MEAN CONCENTRATION Food Concentration (mg/kg)	MEAN CONCENTRATION Dose (mg/kg/day)	MEAN CONCENTRATION NOAEL HQ	MEAN CONCENTRATION LOAEL HQ	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Soil Concentration (mg/kg)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Food Concentration (mg/kg)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS Dose (mg/kg/day)	MEAN OF MAXIMUM DETECTED CONCENTRATIONS NOAEL HQ	MEAN OF MAXIMUM DETECTED CONCENTRATIONS LOAEL HQ
Cadmium	1.4500	20.0000	1.2535	1.2535	0.3633	2.51E-01	1.82E-02	5.2938	5.2938	1.5344	1.06E+00	7.67E-02
Chromium	1.0000	5.0000	18.9689	18.9689	5.4982	5.50E+00	1.10E+00	50.5350	50.5350	14.6478	1.46E+01	2.93E+00
Copper	47.0000	61.7000	211.9407	211.9407	61.4321	1.31E+00	9.96E-01	288.6100	288.6100	83.6551	1.78E+00	1.36E+00
Cyanide	4.5000	45.0000	2.5054	2.5054	0.7262	1.61E-01	1.61E-02	13.8667	13.8667	4.0193	8.93E-01	8.93E-02
Iron	100.0000	1000.0000	4593.9949	4593.9949	1331.5927	1.33E+01	1.33E+00	8931.6000	8931.6000	2588.8696	2.59E+01	2.59E+00
Lead	1.1300	11.3000	157.7271	157.7271	45.7180	4.05E+01	4.05E+00	221.0750	221.0750	64.0797	5.67E+01	5.67E+00
Manganese	997.0000	9970.0000	55.7510	55.7510	16.1597	1.62E-02	1.62E-03	102.3600	102.3600	29.6696	2.98E-02	2.98E-03
Mercury	0.0064	0.0640	0.5939	0.5939	0.1721	2.69E+01	2.69E+00	1.8339	1.8339	0.5316	8.31E+01	8.31E+00
Nickel	77.4000	107.0000	6.1366	6.1366	1.7787	2.30E-02	1.66E-02	14.1644	14.1644	4.1056	5.30E-02	3.84E-02
Selenium	0.4000	0.8000	2.3142	2.3142	0.6708	1.68E+00	8.38E-01	0.9600	0.9600	0.2783	6.96E-01	3.48E-01
Silver			0.7952	0.7952	0.2305	NA	NA	3.2150	3.2150	0.9319	NA	NA
Thallium			0.2133	0.2133	0.0618	NA	NA	ND	ND	ND	ND	ND
Tin	6.8000	16.9000	3.1628	3.1628	0.9167	1.35E-01	5.42E-02	8.5750	8.5750	2.4855	3.66E-01	1.47E-01
Vanadium	11.4000	114.0000	4.4073	4.4073	1.2775	1.12E-01	1.12E-02	7.9200	7.9200	2.2957	2.01E-01	2.01E-02
Zinc	14.5000	131.0000	274.9990	274.9990	79.7099	5.50E+00	6.08E-01	490.2500	490.2500	142.1014	9.80E+00	1.08E+00

NA = NOAEL and LOAEL not available. Thus, HQ cannot be calculated.
ND = Analyte not detected in surface soil. Thus, food concentrations, doses, and HQs are not applicable.
Note: Concentrations in prey items of the kestrel were assumed to be equal to soil concentrations.

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Great Blue Heron

Body Weight	2.2290000 kg
Food Ingestion Rate	0.4010000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment Ingestion Rate	0.0000000 kg/day

			MEAN CONCENTRATION				MEAN OF MAXIMUM DETECTED CONCENTRATIONS			
Analyte	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Minnow Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL HQ	LOAEL HQ	Minnow Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds										
3-Methylcholanthrene			1.380851064	0.248	NA	NA	ND	ND	ND	ND
Acenaphthene			0.783191489	0.141	NA	NA	ND	ND	ND	ND
Acenaphthylene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Anthracene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Acetophenone			0.783191489	0.141	NA	NA	ND	ND	ND	ND
Benzo(a)anthracene	10	100	1.031702128	0.186	1.86E-02	1.86E-03	ND	ND	ND	ND
Benzo(a)pyrene	10	100	1.380851064	0.248	2.48E-02	2.48E-03	ND	ND	ND	ND
Benzo(b)fluoranthene	10	100	1.031702128	0.186	1.86E-02	1.86E-03	ND	ND	ND	ND
Benzo(g,h,i)perylene	10	100	1.554255319	0.280	2.80E-02	2.80E-03	ND	ND	ND	ND
Benzo(k)fluoranthene	10	100	1.031702128	0.186	1.86E-02	1.86E-03	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	1.1	11	1.054042553	0.190	1.72E-01	1.72E-02	ND	ND	ND	ND
Chrysene	10	100	1.031702128	0.186	1.86E-02	1.86E-03	ND	ND	ND	ND
Di-n-butyl phthalate	0.11	1.1	0.92712766	0.167	1.52E+00	1.52E-01	ND	ND	ND	ND
Dibenzo(a,h)anthracene	10	100	1.554255319	0.280	2.80E-02	2.80E-03	ND	ND	ND	ND
Fluoranthene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Fluorene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Hexachlorophene			188.0857143	33.837	NA	NA	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	10	100	1.554255319	0.280	2.80E-02	2.80E-03	ND	ND	ND	ND
Naphthalene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Phenanthrene	10	100	0.783191489	0.141	1.41E-02	1.41E-03	ND	ND	ND	ND
Pyrene	10	100	0.775319149	0.139	1.39E-02	1.39E-03	0.43	0.077	7.74E-03	7.74E-04
Pesticides and PCBs										
4,4'-DDD	0.0028	0.028	0.070580467	0.013	4.53E+00	4.53E-01	0.85268	0.153	5.48E+01	5.48E+00
4,4'-DDE	0.0028	0.028	0.051563333	0.009	3.31E+00	3.31E-01	0.327083333	0.059	2.10E+01	2.10E+00
4,4'-DDT	0.0028	0.028	0.005097143	0.001	3.27E-01	3.27E-02	0.025934	0.005	1.67E+00	1.67E-01
2,4,5-T			a				a			
2,4,5-TP (Silvex)			a				a			
2,4-D			a				a			
Aroclor-1248			0.017899048	0.003	NA	NA	ND	ND	ND	ND
Aroclor-1254			0.017899048	0.003	NA	NA	ND	ND	ND	ND
Aroclor-1260	0.18	1.8	0.05837	0.011	5.83E-02	5.83E-03	0.214933333	0.039	2.15E-01	2.15E-02
alpha-BHC	0.56	2.25	0.00096081	0.000	3.09E-04	7.68E-05	0.002156667	0.000	6.93E-04	1.72E-04
beta-BHC	0.56	2.25	0.001299457	0.000	4.17E-04	1.04E-04	0.0044	0.001	1.41E-03	3.52E-04
gamma-BHC (lindane)	2	20	0.000817029	0.000	7.35E-05	7.35E-06	0.00215	0.000	1.93E-04	1.93E-05
delta-BHC	0.56	2.25	0.00095439	0.000	3.07E-04	7.63E-05	0.00267	0.000	8.58E-04	2.13E-04
gamma-chlordane			0.000570833	0.000	NA	NA	ND	ND	ND	ND
Dieldrin	0.077	0.77	0.00118181	0.000	2.76E-03	2.76E-04	0.0036	0.001	8.41E-03	8.41E-04
Endosulfan I	10	100	0.001159429	0.000	2.09E-05	2.09E-06	0.0058	0.001	1.04E-04	1.04E-05
Endosulfan II	10	100	0.000976571	0.000	1.76E-05	1.76E-06	0.002466667	0.000	4.44E-05	4.44E-06
Endosulfan Sulfate	10	100	0.005251048	0.001	9.45E-05	9.45E-06	0.038333333	0.007	6.90E-04	6.90E-05
Endrin	0.01	0.1	0.001425714	0.000	2.56E-02	2.56E-03	0.0014	0.000	2.52E-02	2.52E-03
Endrin Aldehyde	0.01	0.1	0.004766	0.001	8.57E-02	8.57E-03	0.02	0.004	3.60E-01	3.60E-02
Heptachlor			0.001096486	0.000	NA	NA	0.005033333	0.001	NA	NA

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Great Blue Heron

Body Weight	2.2290000 kg
Food Ingestion Rate	0.4010000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment Ingestion Rate	0.0000000 kg/day

			MEAN CONCENTRATION				MEAN OF MAXIMUM DETECTED CONCENTRATIONS			
Analyte	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Minnow Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL HQ	LOAEL HQ	Minnow Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL HQ	LOAEL HQ
Toxaphene			0.091619048	0.016	NA	NA	ND	ND	ND	ND
Methyl parathion			a				a			
Inorganics										
Aluminum	109.7	1097	9.158571429	1.648	1.50E-02	1.50E-03	181.65	32.679	2.98E-01	2.98E-02
Antimony			1.642075472	0.295	NA	NA	ND	ND	ND	ND
Arsenic	2.46	7.38	0.572792453	0.103	4.19E-02	1.40E-02	2.173666667	0.391	1.59E-01	5.30E-02
Barium	20.8	41.7	2.286372642	0.411	1.98E-02	9.86E-03	5.71	1.027	4.94E-02	2.46E-02
Beryllium			0.081183962	0.015	NA	NA	ND	ND	ND	ND
Cadmium	1.45	20	0.267320755	0.048	3.32E-02	2.40E-03	ND	ND	ND	ND
Chromium	1	5	0.50795283	0.091	9.14E-02	1.83E-02	1.293333333	0.233	2.33E-01	4.65E-02
Copper	47	61.7	5.207254717	0.937	1.99E-02	1.52E-02	23.09	4.154	8.84E-02	6.73E-02
Cyanide	4.5	45	a				a			
Iron	100	1000	27.32214286	4.915	4.92E-02	4.92E-03	72.7	13.079	1.31E-01	1.31E-02
Lead	1.13	11.3	1.363084906	0.245	2.17E-01	2.17E-02	3.1865	0.573	5.07E-01	5.07E-02
Manganese	997	9970	3.493	0.628	6.30E-04	6.30E-05	5.833333333	1.049	1.05E-03	1.05E-04
Mercury	0.0064	0.064	0.014627358	0.003	4.11E-01	4.11E-02	0.0755	0.014	2.12E+00	2.12E-01
Nickel	77.4	107	0.535613208	0.096	1.24E-03	9.01E-04	ND	ND	ND	ND
Selenium	0.4	0.8	0.410490566	0.074	1.85E-01	9.23E-02	0.684	0.123	3.08E-01	1.54E-01
Silver			0.243311321	0.044	NA	NA	4.58	0.824	NA	NA
Thallium			0.301433962	0.054	NA	NA	ND	ND	ND	ND
Tin	6.8	16.9	2.501666667	0.450	6.62E-02	2.66E-02	ND	ND	ND	ND
Vanadium	11.4	114	0.318518868	0.057	5.03E-03	5.03E-04	ND	ND	ND	ND
Zinc	14.5	131	56.55160377	10.174	7.02E-01	7.77E-02	150.1333333	27.009	1.86E+00	2.06E-01

a = Chemical not analyzed. Thus, doses and HQs were not calculated.
NA = NOAEL and LOAEL not available. Thus, HQ cannot be calculated.
ND = Chemical not detected in minnows. Thus, doses and HQs were not calculated.

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean Crustacean Concentration (mg/kg)	Mean Sediment Concentration (mg/kg)	Mean Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Semivolatile Organic Compounds										
3-Methylcholanthrene			2.5325	2.5325	2.8303	5.43E-01	5.45E-01	5.46E-01	5.48E-01	5.49E-01
Acenaphthene	1	10	1.0284	1.0284	0.7399	2.21E-01	2.19E-01	2.18E-01	2.16E-01	2.15E-01
Acenaphthylene	1	10	1.0284	1.0284	0.7399	2.21E-01	2.19E-01	2.18E-01	2.16E-01	2.15E-01
Anthracene	1	10	1.0030	1.0030	0.7345	2.15E-01	2.14E-01	2.12E-01	2.11E-01	2.10E-01
Acetophenone			1.2400	1.2400	1.0333	2.66E-01	2.65E-01	2.64E-01	2.63E-01	2.62E-01
Benzo(a)anthracene	1	10	1.0646	1.0646	0.8326	2.28E-01	2.27E-01	2.26E-01	2.25E-01	2.24E-01
Benzo(a)pyrene	1	10	1.1569	1.1569	0.8093	2.48E-01	2.46E-01	2.45E-01	2.43E-01	2.41E-01
Benzo(b)fluoranthene	1	10	1.0840	1.0840	1.0148	2.33E-01	2.32E-01	2.32E-01	2.32E-01	2.31E-01
Benzo(g,h,i)perylene	1	10	1.0310	1.0310	0.7792	2.21E-01	2.20E-01	2.19E-01	2.17E-01	2.16E-01
Benzo(k)fluoranthene	1	10	1.5272	1.5272	0.7078	3.28E-01	3.24E-01	3.19E-01	3.15E-01	3.11E-01
Bis(2-Ethylhexyl)phthalate	18.3	183	1.0507	1.0507	0.9865	2.25E-01	2.25E-01	2.25E-01	2.24E-01	2.24E-01
Chrysene	1	10	1.2187	1.2187	0.9215	2.61E-01	2.60E-01	2.58E-01	2.57E-01	2.55E-01
Di-n-butyl phthalate	550	1833	1.2238	1.2238	1.0016	2.63E-01	2.61E-01	2.60E-01	2.59E-01	2.58E-01
Dibenzo(a,h)anthracene	1	10	1.0144	1.0144	0.7267	2.18E-01	2.16E-01	2.15E-01	2.13E-01	2.12E-01
Fluoranthene	1	10	1.7450	1.7450	1.0130	3.74E-01	3.71E-01	3.67E-01	3.63E-01	3.60E-01
Fluorene	1	10	1.0058	1.0058	0.7391	2.16E-01	2.14E-01	2.13E-01	2.12E-01	2.10E-01
Hexachlorophene			11.1731	11.1731	10.3036	2.40E+00	2.39E+00	2.39E+00	2.38E+00	2.38E+00
Indeno(1,2,3-cd)pyrene	1	10	1.0700	1.0700	0.7705	2.30E-01	2.28E-01	2.27E-01	2.25E-01	2.24E-01
Naphthalene	1	10	1.0292	1.0292	0.7536	2.21E-01	2.19E-01	2.18E-01	2.17E-01	2.15E-01
Phenanthrene	1	10	1.1966	1.1966	0.7948	2.57E-01	2.55E-01	2.53E-01	2.51E-01	2.49E-01
Pyrene	1	10	1.3552	1.3552	0.9829	2.91E-01	2.89E-01	2.87E-01	2.85E-01	2.83E-01
Pesticides and PCBs										
4,4'-DDD	0.8	4	1.5468	1.5468	0.3467	3.32E-01	3.26E-01	3.20E-01	3.14E-01	3.08E-01
4,4'-DDE	0.8	4	0.7635	0.7635	0.0957	1.64E-01	1.60E-01	1.57E-01	1.54E-01	1.50E-01
4,4'-DDT	0.8	4	1.3885	1.3885	0.2472	2.98E-01	2.92E-01	2.86E-01	2.81E-01	2.75E-01
2,4,5-T			0.0580	0.0580	0.0297	1.25E-02	1.23E-02	1.22E-02	1.20E-02	1.19E-02
2,4,5-TP (Silvex)			0.0404	0.0404	0.0221	8.68E-03	8.58E-03	8.49E-03	8.40E-03	8.31E-03
2,4-D			0.0580	0.0580	0.0297	1.25E-02	1.23E-02	1.22E-02	1.20E-02	1.19E-02
Aroclor-1248	0.01	0.1	0.2779	0.2779	0.1159	5.96E-02	5.88E-02	5.80E-02	5.72E-02	5.63E-02
Aroclor-1254	0.068	0.68	0.2996	0.2996	0.1373	6.43E-02	6.34E-02	6.26E-02	6.18E-02	6.10E-02
Aroclor-1260	0.068	0.68	0.3345	0.3345	0.1659	7.18E-02	7.09E-02	7.01E-02	6.92E-02	6.84E-02
alpha-BHC	0.014	0.14	0.0731	0.0731	0.0111	1.57E-02	1.54E-02	1.51E-02	1.47E-02	1.44E-02
beta-BHC	0.4	2	0.0815	0.0815	0.0110	1.75E-02	1.71E-02	1.68E-02	1.64E-02	1.61E-02
gamma-BHC (lindane)	8	80	0.0761	0.0761	0.0103	1.63E-02	1.60E-02	1.57E-02	1.53E-02	1.50E-02
delta-BHC	0.014	0.14	0.0751	0.0751	0.0111	1.61E-02	1.58E-02	1.55E-02	1.51E-02	1.48E-02
gamma-chlordane	4.6	9.2	0.1772	0.1772	0.0891	3.80E-02	3.76E-02	3.71E-02	3.67E-02	3.62E-02
Dieldrin	0.02	0.2	0.1511	0.1511	0.0206	3.24E-02	3.18E-02	3.11E-02	3.04E-02	2.98E-02
Endosulfan I	0.15	1.5	0.0945	0.0945	0.0117	2.03E-02	1.99E-02	1.94E-02	1.90E-02	1.86E-02
Endosulfan II	0.15	1.5	0.1722	0.1722	0.0223	3.69E-02	3.62E-02	3.54E-02	3.47E-02	3.39E-02
Endosulfan Sulfate	0.15	1.5	0.1655	0.1655	0.0228	3.55E-02	3.48E-02	3.41E-02	3.33E-02	3.26E-02
Endrin	0.092	0.92	0.1529	0.1529	0.0212	3.28E-02	3.21E-02	3.15E-02	3.08E-02	3.02E-02
Endrin Aldehyde	0.092	0.92	0.1100	0.1100	0.0252	2.36E-02	2.32E-02	2.27E-02	2.23E-02	2.19E-02
Heptachlor	0.1	1	0.0801	0.0801	0.0110	1.72E-02	1.68E-02	1.65E-02	1.61E-02	1.58E-02
Toxaphene			4.8791	4.8791	0.6627	1.05E+00	1.03E+00	1.00E+00	9.83E-01	9.62E-01
Methyl parathion			0.0450	0.0450	0.0202	9.65E-03	9.52E-03	9.40E-03	9.27E-03	9.15E-03

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean Crustacean Concentration (mg/kg)	Mean Sediment Concentration (mg/kg)	Mean Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Inorganics										
Aluminum	1.93	19.3	2068.7949	2068.7949	2762.3779	4.44E+02	4.47E+02	4.51E+02	4.54E+02	4.58E+02
Antimony	0.125	1.25	2.6523	2.6523	1.8732	5.69E-01	5.65E-01	5.61E-01	5.57E-01	5.53E-01
Arsenic	0.126	1.26	4.2617	4.2617	1.9861	9.14E-01	9.03E-01	8.91E-01	8.80E-01	8.68E-01
Barium	5.1	19.8	17.4034	17.4034	15.3028	3.73E+00	3.72E+00	3.71E+00	3.70E+00	3.69E+00
Beryllium	0.66	6.6	0.2154	0.2154	0.0831	4.62E-02	4.55E-02	4.49E-02	4.42E-02	4.35E-02
Cadmium	1	10	4.0310	4.0310	1.4197	8.65E-01	8.52E-01	8.38E-01	8.25E-01	8.12E-01
Chromium	3.28	32.8	35.6737	35.6737	14.3009	7.65E+00	7.55E+00	7.44E+00	7.33E+00	7.22E+00
Copper	11.7	15.14	37.4576	37.4576	25.6269	8.04E+00	7.98E+00	7.92E+00	7.86E+00	7.80E+00
Cyanide	68.7	687	2.2568	2.2568	2.7254	4.84E-01	4.87E-01	4.89E-01	4.91E-01	4.94E-01
Iron	50	500	1891.5128	1891.5128	3442.3559	4.06E+02	4.14E+02	4.21E+02	4.29E+02	4.37E+02
Lead	8	80	77.4556	77.4556	58.4699	1.66E+01	1.65E+01	1.64E+01	1.63E+01	1.62E+01
Manganese	88	284	17.0224	17.0224	40.3332	3.65E+00	3.77E+00	3.89E+00	4.00E+00	4.12E+00
Mercury	0.032	0.16	0.1874	0.1874	0.1792	4.02E-02	4.02E-02	4.01E-02	4.01E-02	4.00E-02
Nickel	40	80	4.7121	4.7121	3.7183	1.01E+00	1.01E+00	1.00E+00	9.96E-01	9.91E-01
Selenium	0.2	0.33	1.1300	1.1300	0.5333	2.42E-01	2.39E-01	2.36E-01	2.33E-01	2.30E-01
Silver	1.8	18	1.5748	1.5748	0.8907	3.38E-01	3.34E-01	3.31E-01	3.28E-01	3.24E-01
Thallium	0.0074	0.074	0.8691	0.8691	0.2950	1.86E-01	1.84E-01	1.81E-01	1.78E-01	1.75E-01
Tin	23.4	35	20.1962	20.1962	3.1628	4.33E+00	4.25E+00	4.16E+00	4.08E+00	3.99E+00
Vanadium	0.21	2.1	9.2862	9.2862	3.9650	1.99E+00	1.97E+00	1.94E+00	1.91E+00	1.88E+00
Zinc	160	320	180.1784	180.1784	94.1983	3.87E+01	3.82E+01	3.78E+01	3.74E+01	3.69E+01

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN CONCENTRATION

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
			NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds												
3-Methylcholanthrene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	1	10	2.21E-01	2.21E-02	2.19E-01	2.19E-02	2.18E-01	2.18E-02	2.16E-01	2.16E-02	2.15E-01	2.15E-02
Acenaphthylene	1	10	2.21E-01	2.21E-02	2.19E-01	2.19E-02	2.18E-01	2.18E-02	2.16E-01	2.16E-02	2.15E-01	2.15E-02
Anthracene	1	10	2.15E-01	2.15E-02	2.14E-01	2.14E-02	2.12E-01	2.12E-02	2.11E-01	2.11E-02	2.10E-01	2.10E-02
Acetophenone			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1	10	2.28E-01	2.28E-02	2.27E-01	2.27E-02	2.26E-01	2.26E-02	2.25E-01	2.25E-02	2.24E-01	2.24E-02
Benzo(a)pyrene	1	10	2.48E-01	2.48E-02	2.46E-01	2.46E-02	2.45E-01	2.45E-02	2.43E-01	2.43E-02	2.41E-01	2.41E-02
Benzo(b)fluoranthene	1	10	2.33E-01	2.33E-02	2.32E-01	2.32E-02	2.32E-01	2.32E-02	2.32E-01	2.32E-02	2.31E-01	2.31E-02
Benzo(g,h,i)perylene	1	10	2.21E-01	2.21E-02	2.20E-01	2.20E-02	2.19E-01	2.19E-02	2.17E-01	2.17E-02	2.16E-01	2.16E-02
Benzo(k)fluoranthene	1	10	3.28E-01	3.28E-02	3.24E-01	3.24E-02	3.19E-01	3.19E-02	3.15E-01	3.15E-02	3.11E-01	3.11E-02
Bis(2-Ethylhexyl)phthalate	18.3	183	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.23E-02	1.23E-03	1.22E-02	1.22E-03
Chrysene	1	10	2.61E-01	2.61E-02	2.60E-01	2.60E-02	2.58E-01	2.58E-02	2.57E-01	2.57E-02	2.55E-01	2.55E-02
Di-n-butyl phthalate	550	1833	4.77E-04	1.43E-04	4.75E-04	1.43E-04	4.73E-04	1.42E-04	4.71E-04	1.41E-04	4.69E-04	1.41E-04
Dibenzo(a,h)anthracene	1	10	2.18E-01	2.18E-02	2.16E-01	2.16E-02	2.15E-01	2.15E-02	2.13E-01	2.13E-02	2.12E-01	2.12E-02
Fluoranthene	1	10	3.74E-01	3.74E-02	3.71E-01	3.71E-02	3.67E-01	3.67E-02	3.63E-01	3.63E-02	3.60E-01	3.60E-02
Fluorene	1	10	2.16E-01	2.16E-02	2.14E-01	2.14E-02	2.13E-01	2.13E-02	2.12E-01	2.12E-02	2.10E-01	2.10E-02
Hexachlorophene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1	10	2.30E-01	2.30E-02	2.28E-01	2.28E-02	2.27E-01	2.27E-02	2.25E-01	2.25E-02	2.24E-01	2.24E-02
Naphthalene	1	10	2.21E-01	2.21E-02	2.19E-01	2.19E-02	2.18E-01	2.18E-02	2.17E-01	2.17E-02	2.15E-01	2.15E-02
Phenanthrene	1	10	2.57E-01	2.57E-02	2.55E-01	2.55E-02	2.53E-01	2.53E-02	2.51E-01	2.51E-02	2.49E-01	2.49E-02
Pyrene	1	10	2.91E-01	2.91E-02	2.89E-01	2.89E-02	2.87E-01	2.87E-02	2.85E-01	2.85E-02	2.83E-01	2.83E-02
Pesticides and PCBs												
4,4'-DDD	0.8	4	4.15E-01	8.30E-02	4.07E-01	8.15E-02	4.00E-01	7.99E-02	3.92E-01	7.84E-02	3.85E-01	7.69E-02
4,4'-DDE	0.8	4	2.05E-01	4.09E-02	2.01E-01	4.01E-02	1.96E-01	3.93E-02	1.92E-01	3.84E-02	1.88E-01	3.76E-02
4,4'-DDT	0.8	4	3.72E-01	7.45E-02	3.65E-01	7.30E-02	3.58E-01	7.16E-02	3.51E-01	7.02E-02	3.44E-01	6.87E-02
2,4,5-T			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.01	0.1	5.96E+00	5.96E-01	5.88E+00	5.88E-01	5.80E+00	5.80E-01	5.72E+00	5.72E-01	5.63E+00	5.63E-01
Aroclor-1254	0.068	0.68	9.45E-01	9.45E-02	9.33E-01	9.33E-02	9.21E-01	9.21E-02	9.09E-01	9.09E-02	8.97E-01	8.97E-02
Aroclor-1260	0.068	0.68	1.06E+00	1.06E-01	1.04E+00	1.04E-01	1.03E+00	1.03E-01	1.02E+00	1.02E-01	1.01E+00	1.01E-01
alpha-BHC	0.014	0.14	1.12E+00	1.12E-01	1.10E+00	1.10E-01	1.08E+00	1.08E-01	1.05E+00	1.05E-01	1.03E+00	1.03E-01
beta-BHC	0.4	2	4.37E-02	8.74E-03	4.28E-02	8.57E-03	4.19E-02	8.39E-03	4.11E-02	8.21E-03	4.02E-02	8.03E-03
gamma-BHC (lindane)	8	80	2.04E-03	2.04E-04	2.00E-03	2.00E-04	1.96E-03	1.96E-04	1.92E-03	1.92E-04	1.88E-03	1.88E-04
delta-BHC	0.014	0.14	1.15E+00	1.15E-01	1.13E+00	1.13E-01	1.10E+00	1.10E-01	1.08E+00	1.08E-01	1.06E+00	1.06E-01
gamma-chlordane	4.6	9.2	8.26E-03	4.13E-03	8.17E-03	4.08E-03	8.07E-03	4.04E-03	7.98E-03	3.99E-03	7.88E-03	3.94E-03
Dieldrin	0.02	0.2	1.62E+00	1.62E-01	1.59E+00	1.59E-01	1.55E+00	1.55E-01	1.52E+00	1.52E-01	1.49E+00	1.49E-01
Endosulfan I	0.15	1.5	1.35E-01	1.35E-02	1.32E-01	1.32E-02	1.30E-01	1.30E-02	1.27E-01	1.27E-02	1.24E-01	1.24E-02
Endosulfan II	0.15	1.5	2.46E-01	2.46E-02	2.41E-01	2.41E-02	2.36E-01	2.36E-02	2.31E-01	2.31E-02	2.26E-01	2.26E-02
Endosulfan Sulfate	0.15	1.5	2.37E-01	2.37E-02	2.32E-01	2.32E-02	2.27E-01	2.27E-02	2.22E-01	2.22E-02	2.17E-01	2.17E-02
Endrin	0.092	0.92	3.57E-01	3.57E-02	3.49E-01	3.49E-02	3.42E-01	3.42E-02	3.35E-01	3.35E-02	3.28E-01	3.28E-02
Endrin Aldehyde	0.092	0.92	2.56E-01	2.56E-02	2.52E-01	2.52E-02	2.47E-01	2.47E-02	2.42E-01	2.42E-02	2.38E-01	2.38E-02
Heptachlor	0.1	1	1.72E-01	1.72E-02	1.68E-01	1.68E-02	1.65E-01	1.65E-02	1.61E-01	1.61E-02	1.58E-01	1.58E-02
Toxaphene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl parathion			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN CONCENTRATION

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
			NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Inorganics												
Aluminum	1.93	19.3	2.30E+02	2.30E+01	2.32E+02	2.32E+01	2.34E+02	2.34E+01	2.35E+02	2.35E+01	2.37E+02	2.37E+01
Antimony	0.125	1.25	4.55E+00	4.55E-01	4.52E+00	4.52E-01	4.49E+00	4.49E-01	4.46E+00	4.46E-01	4.43E+00	4.43E-01
Arsenic	0.126	1.26	7.26E+00	7.26E-01	7.17E+00	7.17E-01	7.07E+00	7.07E-01	6.98E+00	6.98E-01	6.89E+00	6.89E-01
Barium	5.1	19.8	7.32E-01	1.89E-01	7.30E-01	1.88E-01	7.28E-01	1.87E-01	7.26E-01	1.87E-01	7.24E-01	1.86E-01
Beryllium	0.66	6.6	7.00E-02	7.00E-03	6.90E-02	6.90E-03	6.80E-02	6.80E-03	6.70E-02	6.70E-03	6.60E-02	6.60E-03
Cadmium	1	10	8.65E-01	8.65E-02	8.52E-01	8.52E-02	8.38E-01	8.38E-02	8.25E-01	8.25E-02	8.12E-01	8.12E-02
Chromium	3.28	32.8	2.33E+00	2.33E-01	2.30E+00	2.30E-01	2.27E+00	2.27E-01	2.23E+00	2.23E-01	2.20E+00	2.20E-01
Copper	11.7	15.14	6.87E-01	5.31E-01	6.82E-01	5.27E-01	6.77E-01	5.23E-01	6.72E-01	5.19E-01	6.66E-01	5.15E-01
Cyanide	68.7	687	7.05E-03	7.05E-04	7.08E-03	7.08E-04	7.12E-03	7.12E-04	7.15E-03	7.15E-04	7.19E-03	7.19E-04
Iron	50	500	8.12E+00	8.12E-01	8.27E+00	8.27E-01	8.43E+00	8.43E-01	8.59E+00	8.59E-01	8.74E+00	8.74E-01
Lead	8	80	2.08E+00	2.08E-01	2.07E+00	2.07E-01	2.05E+00	2.05E-01	2.04E+00	2.04E-01	2.03E+00	2.03E-01
Manganese	88	284	4.15E-02	1.29E-02	4.28E-02	1.33E-02	4.42E-02	1.37E-02	4.55E-02	1.41E-02	4.68E-02	1.45E-02
Mercury	0.032	0.16	1.26E+00	2.51E-01	1.25E+00	2.51E-01	1.25E+00	2.51E-01	1.25E+00	2.50E-01	1.25E+00	2.50E-01
Nickel	40	80	2.53E-02	1.26E-02	2.51E-02	1.26E-02	2.50E-02	1.25E-02	2.49E-02	1.24E-02	2.48E-02	1.24E-02
Selenium	0.2	0.33	1.21E+00	7.35E-01	1.20E+00	7.26E-01	1.18E+00	7.16E-01	1.17E+00	7.07E-01	1.15E+00	6.98E-01
Silver	1.8	18	1.88E-01	1.88E-02	1.86E-01	1.86E-02	1.84E-01	1.84E-02	1.82E-01	1.82E-02	1.80E-01	1.80E-02
Thallium	0.0074	0.074	2.52E+01	2.52E+00	2.48E+01	2.48E+00	2.44E+01	2.44E+00	2.40E+01	2.40E+00	2.36E+01	2.36E+00
Tin	23.4	35	1.85E-01	1.24E-01	1.81E-01	1.21E-01	1.78E-01	1.19E-01	1.74E-01	1.16E-01	1.70E-01	1.14E-01
Vanadium	0.21	2.1	9.49E+00	9.49E-01	9.36E+00	9.36E-01	9.23E+00	9.23E-01	9.10E+00	9.10E-01	8.98E+00	8.98E-01
Zinc	160	320	2.42E-01	1.21E-01	2.39E-01	1.19E-01	2.36E-01	1.18E-01	2.33E-01	1.17E-01	2.31E-01	1.15E-01

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean of MDCs Crustacean Concentration (mg/kg)	Mean of MDCs Sediment Concentration (mg/kg)	Mean of MDCs Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Semivolatile Organic Compounds										
3-Methylcholanthrene			0.6900	0.6900	ND	0.1480	ND	ND	ND	ND
Acenaphthene	1	10	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	1	10	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1	10	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone			0.7900	0.7900	0.1200	0.1695	0.1661	0.1627	0.1593	0.1560
Benzo(a)anthracene	1	10	1.9100	1.9100	2.5300	0.4098	0.4129	0.4160	0.4191	0.4223
Benzo(a)pyrene	1	10	11.0000	11.0000	2.1125	2.3599	2.3151	2.2702	2.2254	2.1806
Benzo(b)fluoranthene	1	10	2.4325	2.4325	5.0850	0.5219	0.5352	0.5486	0.5620	0.5754
Benzo(g,h,i)perylene	1	10	3.9960	3.9960	1.7000	0.8573	0.8457	0.8341	0.8225	0.8110
Benzo(k)fluoranthene	1	10	ND	ND	0.3600	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	18.3	183	1.2360	1.2360	0.8525	0.2652	0.2632	0.2613	0.2594	0.2574
Chrysene	1	10	5.3857	5.3857	3.6925	1.1554	1.1469	1.1383	1.1298	1.1213
Di-n-butyl phthalate	550	1833	0.4750	0.4750	0.2300	0.1019	0.1007	0.0994	0.0982	0.0970
Dibenzo(a,h)anthracene	1	10	0.6100	0.6100	0.6045	0.1309	0.1308	0.1308	0.1308	0.1308
Fluoranthene	1	10	1.5300	1.5300	5.0600	0.3282	0.3460	0.3639	0.3817	0.3995
Fluorene	1	10	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene			8.1000	8.1000	0.8900	1.7377	1.7014	1.6650	1.6286	1.5923
Indeno(1,2,3-cd)pyrene	1	10	5.9000	5.9000	1.5325	1.2658	1.2437	1.2217	1.1997	1.1776
Naphthalene	1	10	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	1	10	3.6533	3.6533	1.4305	0.7838	0.7726	0.7613	0.7501	0.7389
Pyrene	1	10	7.3607	7.3607	4.3500	1.5791	1.5639	1.5488	1.5336	1.5184
Pesticides and PCBs			0.0000	0.0000	0.0000					
4,4'-DDD	0.8	4	5.8227	5.8227	0.5827	1.2492	1.2227	1.1963	1.1699	1.1435
4,4'-DDE	0.8	4	1.3036	1.3036	0.5933	0.2797	0.2761	0.2725	0.2689	0.2653
4,4'-DDT	0.8	4	5.1672	5.1672	1.8329	1.1085	1.0917	1.0749	1.0581	1.0413
2,4,5-T			ND	ND	0.0070	ND	ND	ND	ND	ND
2,4,5-TP (Silvex)			ND	ND	0.0040	ND	ND	ND	ND	ND
2,4-D			ND	ND	0.0074	ND	ND	ND	ND	ND
Aroclor-1248	0.01	0.1	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1254	0.068	0.68	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	0.068	0.68	0.5100	0.5100	8.7000	0.1094	0.1507	0.1920	0.2333	0.2747
alpha-BHC	0.014	0.14	0.0056	0.0056	0.0113	0.0012	0.0012	0.0013	0.0013	0.0013
beta-BHC	0.4	2	0.0990	0.0990	0.0020	0.0212	0.0207	0.0203	0.0198	0.0193
gamma-BHC (lindane)	8	80	0.0116	0.0116	0.0010	0.0025	0.0024	0.0024	0.0023	0.0023
delta-BHC	0.014	0.14	0.0861	0.0861	0.0010	0.0185	0.0180	0.0176	0.0172	0.0167
gamma-chlordane	4.6	9.2	0.0510	0.0510	ND	0.0109	ND	ND	ND	ND
Dieldrin	0.02	0.2	0.0146	0.0146	ND	0.0031	ND	ND	ND	ND
Endosulfan I	0.15	1.5	0.2008	0.2008	0.0066	0.0431	0.0421	0.0411	0.0401	0.0392
Endosulfan II	0.15	1.5	0.2000	0.2000	0.0041	0.0429	0.0419	0.0409	0.0399	0.0390
Endosulfan Sulfate	0.15	1.5	ND	ND	0.0030	ND	ND	ND	ND	ND
Endrin	0.092	0.92	0.1261	0.1261	0.0139	0.0270	0.0265	0.0259	0.0253	0.0248
Endrin Aldehyde	0.092	0.92	0.0370	0.0370	0.0238	0.0079	0.0079	0.0078	0.0077	0.0077
Heptachlor	0.1	1	0.0600	0.0600	0.0028	0.0129	0.0126	0.0123	0.0120	0.0117
Toxaphene			ND	ND	0.3430	ND	ND	ND	ND	ND
Methyl parathion			0.0372	0.0372	ND	0.0080	ND	ND	ND	ND

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean of MDCs Crustacean Concentration (mg/kg)	Mean of MDCs Sediment Concentration (mg/kg)	Mean of MDCs Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Inorganics			0.0000	0.0000	0.0000					
Aluminum	1.93	19.3	2904.0000	2904.0000	4096.7143	623.0135	629.0294	635.0453	641.0612	647.0771
Antimony	0.125	1.25	4.6480	4.6480	6.5650	0.9972	1.0068	1.0165	1.0262	1.0358
Arsenic	0.126	1.26	9.1357	9.1357	4.9000	1.9599	1.9386	1.9172	1.8958	1.8745
Barium	5.1	19.8	46.3000	46.3000	31.6571	9.9330	9.8592	9.7853	9.7115	9.6376
Beryllium	0.66	6.6	0.8625	0.8625	0.1833	0.1850	0.1816	0.1782	0.1748	0.1713
Cadmium	1	10	21.3700	21.3700	5.5357	4.5846	4.5048	4.4249	4.3450	4.2652
Chromium	3.28	32.8	76.9143	76.9143	48.4643	16.5009	16.3574	16.2139	16.0704	15.9269
Copper	11.7	15.14	115.4000	115.4000	86.9143	24.7575	24.6138	24.4701	24.3265	24.1828
Cyanide	68.7	687	10.7250	10.7250	13.8667	2.3009	2.3167	2.3326	2.3484	2.3643
Iron	50	500	2912.8571	2912.8571	5880.7143	624.9137	639.8832	654.8526	669.8221	684.7915
Lead	8	80	247.2714	247.2714	204.3357	53.0487	52.8321	52.6156	52.3990	52.1825
Manganese	88	284	22.7143	22.7143	88.8714	4.8730	5.2067	5.5404	5.8741	6.2078
Mercury	0.032	0.16	0.8533	0.8533	1.1425	0.1831	0.1845	0.1860	0.1874	0.1889
Nickel	40	80	9.3429	9.3429	10.6829	2.0044	2.0111	2.0179	2.0247	2.0314
Selenium	0.2	0.33	3.7533	3.7533	1.1033	0.8052	0.7919	0.7785	0.7651	0.7518
Silver	1.8	18	8.5225	8.5225	2.8380	1.8284	1.7997	1.7710	1.7424	1.7137
Thallium	0.0074	0.074	ND	ND	ND	ND	ND	ND	ND	ND
Tin	23.4	35	53.9333	53.9333	8.5750	11.5707	11.3419	11.1131	10.8843	10.6555
Vanadium	0.21	2.1	17.1714	17.1714	7.8429	3.6839	3.6368	3.5898	3.5427	3.4957
Zinc	160	320	331.3143	331.3143	0.0000	71.0790	69.4079	67.7367	66.0656	64.3945

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
			NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds												
3-Methylcholanthrene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1	10	4.10E-01	4.10E-02	4.13E-01	4.13E-02	4.16E-01	4.16E-02	4.19E-01	4.19E-02	4.22E-01	4.22E-02
Benzo(a)pyrene	1	10	2.36E+00	2.36E-01	2.32E+00	2.32E-01	2.27E+00	2.27E-01	2.23E+00	2.23E-01	2.18E+00	2.18E-01
Benzo(b)fluoranthene	1	10	5.22E-01	5.22E-02	5.35E-01	5.35E-02	5.49E-01	5.49E-02	5.62E-01	5.62E-02	5.75E-01	5.75E-02
Benzo(g,h,i)perylene	1	10	8.57E-01	8.57E-02	8.46E-01	8.46E-02	8.34E-01	8.34E-02	8.23E-01	8.23E-02	8.11E-01	8.11E-02
Benzo(k)fluoranthene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	18.3	183	1.45E-02	1.45E-03	1.44E-02	1.44E-03	1.43E-02	1.43E-03	1.42E-02	1.42E-03	1.41E-02	1.41E-03
Chrysene	1	10	1.16E+00	1.16E-01	1.15E+00	1.15E-01	1.14E+00	1.14E-01	1.13E+00	1.13E-01	1.12E+00	1.12E-01
Di-n-butyl phthalate	550	1833	1.85E-04	5.56E-05	1.83E-04	5.49E-05	1.81E-04	5.42E-05	1.79E-04	5.36E-05	1.76E-04	5.29E-05
Dibenzo(a,h)anthracene	1	10	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02	1.31E-01	1.31E-02
Fluoranthene	1	10	3.28E-01	3.28E-02	3.46E-01	3.46E-02	3.64E-01	3.64E-02	3.82E-01	3.82E-02	3.99E-01	3.99E-02
Fluorene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1	10	1.27E+00	1.27E-01	1.24E+00	1.24E-01	1.22E+00	1.22E-01	1.20E+00	1.20E-01	1.18E+00	1.18E-01
Naphthalene	1	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	1	10	7.84E-01	7.84E-02	7.73E-01	7.73E-02	7.61E-01	7.61E-02	7.50E-01	7.50E-02	7.39E-01	7.39E-02
Pyrene	1	10	1.58E+00	1.58E-01	1.56E+00	1.56E-01	1.55E+00	1.55E-01	1.53E+00	1.53E-01	1.52E+00	1.52E-01
Pesticides and PCBs												
4,4'-DDD	0.8	4	1.56E+00	3.12E-01	1.53E+00	3.06E-01	1.50E+00	2.99E-01	1.46E+00	2.92E-01	1.43E+00	2.86E-01
4,4'-DDE	0.8	4	3.50E-01	6.99E-02	3.45E-01	6.90E-02	3.41E-01	6.81E-02	3.36E-01	6.72E-02	3.32E-01	6.63E-02
4,4'-DDT	0.8	4	1.39E+00	2.77E-01	1.36E+00	2.73E-01	1.34E+00	2.69E-01	1.32E+00	2.65E-01	1.30E+00	2.60E-01
2,4,5-T			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-D			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	0.01	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1254	0.068	0.68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	0.068	0.68	1.61E+00	1.61E-01	2.22E+00	2.22E-01	2.82E+00	2.82E-01	3.43E+00	3.43E-01	4.04E+00	4.04E-01
alpha-BHC	0.014	0.14	8.58E-02	8.58E-03	8.79E-02	8.79E-03	8.99E-02	8.99E-03	9.20E-02	9.20E-03	9.40E-02	9.40E-03
beta-BHC	0.4	2	5.31E-02	1.06E-02	5.19E-02	1.04E-02	5.07E-02	1.01E-02	4.94E-02	9.89E-03	4.82E-02	9.64E-03
gamma-BHC (lindane)	8	80	3.11E-04	3.11E-05	3.04E-04	3.04E-05	2.98E-04	2.98E-05	2.91E-04	2.91E-05	2.84E-04	2.84E-05
delta-BHC	0.014	0.14	1.32E+00	1.32E-01	1.29E+00	1.29E-01	1.26E+00	1.26E-01	1.23E+00	1.23E-01	1.20E+00	1.20E-01
gamma-chlordane	4.6	9.2	2.38E-03	1.19E-03	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	0.02	0.2	1.57E-01	1.57E-02	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	0.15	1.5	2.87E-01	2.87E-02	2.81E-01	2.81E-02	2.74E-01	2.74E-02	2.68E-01	2.68E-02	2.61E-01	2.61E-02
Endosulfan II	0.15	1.5	2.86E-01	2.86E-02	2.79E-01	2.79E-02	2.73E-01	2.73E-02	2.66E-01	2.66E-02	2.60E-01	2.60E-02
Endosulfan Sulfate	0.15	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	0.092	0.92	2.94E-01	2.94E-02	2.88E-01	2.88E-02	2.82E-01	2.82E-02	2.75E-01	2.75E-02	2.69E-01	2.69E-02
Endrin Aldehyde	0.092	0.92	8.63E-02	8.63E-03	8.56E-02	8.56E-03	8.48E-02	8.48E-03	8.41E-02	8.41E-03	8.34E-02	8.34E-03
Heptachlor	0.1	1	1.29E-01	1.29E-02	1.26E-01	1.26E-02	1.23E-01	1.23E-02	1.20E-01	1.20E-02	1.17E-01	1.17E-02
Toxaphene			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl parathion			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Raccoon (Eastern Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	100% Sediment NOAEL HQ	100% Sediment LOAEL HQ	75%Sed, 25%Soil NOAEL HQ	75%Sed, 25%Soil LOAEL HQ	50%Sed,50%Soil NOAEL HQ	50%Sed,50%Soil LOAEL HQ	25%Sed,75%Soil NOAEL HQ	25%Sed,75%Soil LOAEL HQ	100%Soil NOAEL HQ	100%Soil LOAEL HQ
Inorganics												
Aluminum	1.93	19.3	3.23E+02	3.23E+01	3.26E+02	3.26E+01	3.29E+02	3.29E+01	3.32E+02	3.32E+01	3.35E+02	3.35E+01
Antimony	0.125	1.25	7.98E+00	7.98E-01	8.05E+00	8.05E-01	8.13E+00	8.13E-01	8.21E+00	8.21E-01	8.29E+00	8.29E-01
Arsenic	0.126	1.26	1.56E+01	1.56E+00	1.54E+01	1.54E+00	1.52E+01	1.52E+00	1.50E+01	1.50E+00	1.49E+01	1.49E+00
Barium	5.1	19.8	1.95E+00	5.02E-01	1.93E+00	4.98E-01	1.92E+00	4.94E-01	1.90E+00	4.90E-01	1.89E+00	4.87E-01
Beryllium	0.66	6.6	2.80E-01	2.80E-02	2.75E-01	2.75E-02	2.70E-01	2.70E-02	2.65E-01	2.65E-02	2.60E-01	2.60E-02
Cadmium	1	10	4.58E+00	4.58E-01	4.50E+00	4.50E-01	4.42E+00	4.42E-01	4.35E+00	4.35E-01	4.27E+00	4.27E-01
Chromium	3.28	32.8	5.03E+00	5.03E-01	4.99E+00	4.99E-01	4.94E+00	4.94E-01	4.90E+00	4.90E-01	4.86E+00	4.86E-01
Copper	11.7	15.14	2.12E+00	1.64E+00	2.10E+00	1.63E+00	2.09E+00	1.62E+00	2.08E+00	1.61E+00	2.07E+00	1.60E+00
Cyanide	68.7	687	3.35E-02	3.35E-03	3.37E-02	3.37E-03	3.40E-02	3.40E-03	3.42E-02	3.42E-03	3.44E-02	3.44E-03
Iron	50	500	1.25E+01	1.25E+00	1.28E+01	1.28E+00	1.31E+01	1.31E+00	1.34E+01	1.34E+00	1.37E+01	1.37E+00
Lead	8	80	6.63E+00	6.63E-01	6.60E+00	6.60E-01	6.58E+00	6.58E-01	6.55E+00	6.55E-01	6.52E+00	6.52E-01
Manganese	88	284	5.54E-02	1.72E-02	5.92E-02	1.83E-02	6.30E-02	1.95E-02	6.68E-02	2.07E-02	7.05E-02	2.19E-02
Mercury	0.032	0.16	5.72E+00	1.14E+00	5.77E+00	1.15E+00	5.81E+00	1.16E+00	5.86E+00	1.17E+00	5.90E+00	1.18E+00
Nickel	40	80	5.01E-02	2.51E-02	5.03E-02	2.51E-02	5.04E-02	2.52E-02	5.06E-02	2.53E-02	5.08E-02	2.54E-02
Selenium	0.2	0.33	4.03E+00	2.44E+00	3.96E+00	2.40E+00	3.89E+00	2.36E+00	3.83E+00	2.32E+00	3.76E+00	2.28E+00
Silver	1.8	18	1.02E+00	1.02E-01	1.00E+00	1.00E-01	9.84E-01	9.84E-02	9.68E-01	9.68E-02	9.52E-01	9.52E-02
Thallium	0.0074	0.074	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin	23.4	35	4.94E-01	3.31E-01	4.85E-01	3.24E-01	4.75E-01	3.18E-01	4.65E-01	3.11E-01	4.55E-01	3.04E-01
Vanadium	0.21	2.1	1.75E+01	1.75E+00	1.73E+01	1.73E+00	1.71E+01	1.71E+00	1.69E+01	1.69E+00	1.66E+01	1.66E+00
Zinc	160	320	4.44E-01	2.22E-01	4.34E-01	2.17E-01	4.23E-01	2.12E-01	4.13E-01	2.06E-01	4.02E-01	2.01E-01

Note: Chemical Concentrations in crustaceans (food items of the raccoon) at eastern sites were assumed to be equal to sediment concentrations.
NA = NOAEL and LOAEL not available. HQ cannot be calculated.
ND = Chemical not detected in sediment or not detected in soil.

FOOD CHAIN MODELING CALCULATIONS
BASEWIDE ECOLOGICAL RISK ASSESSMENT
NAS KEY WEST, FLORIDA

Raccoon (Western Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN CONCENTRATION

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean Crustacean Concentration (mg/kg)	Mean Sediment Concentration (mg/kg)	Mean Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Semivolatile Organic Compounds										
Acenaphthene	1	10	0.3571	0.3571	1.2000	7.66E-02	8.09E-02	8.51E-02	8.94E-02	9.36E-02
Acenaphthylene	1	10	0.3540	0.3540	1.2000	7.60E-02	8.02E-02	8.45E-02	8.88E-02	9.30E-02
Anthracene	1	10	0.3520	0.3520	1.2000	7.55E-02	7.98E-02	8.41E-02	8.84E-02	9.26E-02
Benzo(a)anthracene	1	10	0.3252	0.3252	1.2000	6.98E-02	7.42E-02	7.86E-02	8.30E-02	8.74E-02
Benzo(a)pyrene	1	10	0.3406	0.3406	1.2000	7.31E-02	7.74E-02	8.17E-02	8.61E-02	9.04E-02
Benzo(b)fluoranthene	1	10	0.3275	0.3275	1.2000	7.03E-02	7.47E-02	7.91E-02	8.35E-02	8.79E-02
Benzo(g,h,i)perylene	1	10	0.3546	0.3546	1.2000	7.61E-02	8.03E-02	8.46E-02	8.89E-02	9.31E-02
Benzo(k)fluoranthene	1	10	0.3243	0.3243	1.2000	6.96E-02	7.40E-02	7.84E-02	8.28E-02	8.72E-02
Bis(2-Ethylhexyl)phthalate	18.3	183	0.7814	0.7814	0.7450	1.68E-01	1.67E-01	1.67E-01	1.67E-01	1.67E-01
Chrysene	1	10	0.3391	0.3391	1.2000	7.27E-02	7.71E-02	8.14E-02	8.58E-02	9.01E-02
Di-n-butyl phthalate	550	1833	0.7400	0.7400	1.2000	1.59E-01	1.61E-01	1.63E-01	1.66E-01	1.68E-01
Dibenzo(a,h)anthracene	1	10	0.3542	0.3542	1.2000	7.60E-02	8.03E-02	8.45E-02	8.88E-02	9.31E-02
Fluoranthene	1	10	0.3756	0.3756	1.2000	8.06E-02	8.47E-02	8.89E-02	9.30E-02	9.72E-02
Fluorene	1	10	0.3799	0.3799	1.2000	8.15E-02	8.56E-02	8.98E-02	9.39E-02	9.81E-02
Indeno(1,2,3-cd)pyrene	1	10	0.3483	0.3483	1.2000	7.47E-02	7.90E-02	8.33E-02	8.76E-02	9.19E-02
Naphthalene	1	10	0.3592	0.3592	1.2000	7.71E-02	8.13E-02	8.55E-02	8.98E-02	9.40E-02
Phenanthrene	1	10	0.3710	0.3710	1.2000	7.96E-02	8.38E-02	8.80E-02	9.21E-02	9.63E-02
Pyrene	1	10	0.3732	0.3732	1.2000	8.01E-02	8.42E-02	8.84E-02	9.26E-02	9.67E-02
Pesticides and PCBs										
4,4'-DDD	0.8	4	0.0014	0.0256	0.0394	7.87E-04	8.57E-04	9.26E-04	9.95E-04	1.06E-03
4,4'-DDE	0.8	4	0.0029	0.0295	0.0598	1.17E-03	1.32E-03	1.47E-03	1.62E-03	1.78E-03
4,4'-DDT	0.8	4	0.0016	0.0459	0.2658	1.24E-03	2.35E-03	3.46E-03	4.57E-03	5.68E-03
2,4-D			a	0.0080	0.0060	ND	ND	ND	ND	ND
Aroclor-1248	0.01	0.1	0.0164	0.0780	0.0562	4.76E-03	4.65E-03	4.54E-03	4.43E-03	4.32E-03
Aroclor-1254	0.068	0.68	0.0164	0.1215	0.1042	5.64E-03	5.55E-03	5.47E-03	5.38E-03	5.29E-03
Aroclor-1260	0.068	0.68	0.0385	1.3927	0.1215	3.56E-02	2.92E-02	2.28E-02	1.64E-02	9.94E-03
alpha-BHC	0.014	0.14	0.0009	0.0100	0.0075	3.80E-04	3.68E-04	3.55E-04	3.43E-04	3.30E-04
beta-BHC	0.4	2	0.0009	0.0131	0.0125	4.29E-04	4.26E-04	4.23E-04	4.20E-04	4.18E-04
gamma-BHC (lindane)	8	80	0.0008	0.0099	0.0075	3.52E-04	3.40E-04	3.28E-04	3.16E-04	3.05E-04
delta-BHC	0.014	0.14	0.0007	0.0107	0.0075	3.52E-04	3.36E-04	3.19E-04	3.03E-04	2.87E-04
Dieldrin	0.02	0.2	0.0012	0.0215	0.0150	6.62E-04	6.30E-04	5.97E-04	5.65E-04	5.33E-04
Endosulfan I	0.15	1.5	0.0009	0.0182	0.0075	5.39E-04	4.85E-04	4.31E-04	3.77E-04	3.23E-04
Endosulfan II	0.15	1.5	0.0033	0.0226	0.0150	1.09E-03	1.05E-03	1.02E-03	9.78E-04	9.40E-04
Endosulfan Sulfate	0.15	1.5	0.0016	0.0277	0.0150	8.62E-04	7.98E-04	7.34E-04	6.70E-04	6.06E-04
Endrin	0.092	0.92	0.0012	0.0822	0.0150	1.89E-03	1.55E-03	1.21E-03	8.73E-04	5.34E-04
Endrin Aldehyde	0.092	0.92	0.0024	0.0408	0.0033	1.29E-03	1.10E-03	9.11E-04	7.22E-04	5.33E-04
Heptachlor	0.1	1	0.0008	0.0101	ND	3.66E-04	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Toxaphene			0.0850	0.4432	0.2815	2.55E-02	2.46E-02	2.38E-02	2.30E-02	2.22E-02
Inorganics										
Aluminum	1.93	19.3	3.3818	1044.1780	573.0000	2.17E+01	1.93E+01	1.70E+01	1.46E+01	1.22E+01
Antimony	0.125	1.25	1.0136	2.7061	4.8000	2.52E-01	2.62E-01	2.73E-01	2.83E-01	2.94E-01

Raccoon (Western Sites)

Body Weight	3.9900000 kg
Food Ingestion Rate	0.7755000 kg/day
Water Ingestion Rate	0.0000000 L/day
Sediment/Soil Ingestion Rate	0.0805000 kg/day

MEAN CONCENTRATION

Chemical	NOAEL (mg/kg/day)	LOAEL (mg/kg/day)	Mean Crustacean Concentration (mg/kg)	Mean Sediment Concentration (mg/kg)	Mean Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Arsenic	0.126	1.26	11.1727	4.8292	1.5000	2.27E+00	2.25E+00	2.24E+00	2.22E+00	2.20E+00
Barium	5.1	19.8	1.7564	13.9568	5.6000	6.23E-01	5.81E-01	5.39E-01	4.97E-01	4.54E-01
Beryllium	0.66	6.6	0.0182	0.0716	0.0550	4.98E-03	4.89E-03	4.81E-03	4.73E-03	4.64E-03
Cadmium	1	10	0.5055	0.6107	0.2850	1.11E-01	1.09E-01	1.07E-01	1.06E-01	1.04E-01
Chromium	3.28	32.8	0.7868	7.8900	6.5500	3.12E-01	3.05E-01	2.99E-01	2.92E-01	2.85E-01
Copper	11.7	15.14	23.7682	55.9341	16.6500	5.75E+00	5.55E+00	5.35E+00	5.15E+00	4.96E+00
Cyanide	68.7	687	2.4892	2.4892	6.0000	5.34E-01	5.52E-01	5.69E-01	5.87E-01	6.05E-01
Iron	50	500	79.5591	4590.1039	2560.0000	1.08E+02	9.78E+01	8.76E+01	7.74E+01	6.71E+01
Lead	8	80	0.5000	78.7579	46.1000	1.69E+00	1.52E+00	1.36E+00	1.19E+00	1.03E+00
Manganese	88	284	2.2986	65.6360	19.9500	1.77E+00	1.54E+00	1.31E+00	1.08E+00	8.49E-01
Mercury	0.032	0.16	0.0395	0.0817	0.3100	9.33E-03	1.05E-02	1.16E-02	1.28E-02	1.39E-02
Nickel	40	80	0.4168	8.0218	3.3500	2.43E-01	2.19E-01	1.96E-01	1.72E-01	1.49E-01
Chromium	0.2	0.33	0.8091	0.4318	0.2300	1.66E-01	1.65E-01	1.64E-01	1.63E-01	1.62E-01
Silver	1.8	18	0.1636	0.9567	0.2850	5.11E-02	4.77E-02	4.43E-02	4.09E-02	3.76E-02
Thallium	0.0074	0.074	0.4300	4.1467	0.1150	1.67E-01	1.47E-01	1.27E-01	1.06E-01	8.59E-02
Tin	23.4	35	9.9519	9.9519	ND	2.14E+00	ND	ND	ND	ND
Vanadium	0.21	2.1	0.6077	4.7124	2.4000	2.13E-01	2.02E-01	1.90E-01	1.78E-01	1.67E-01
Zinc	160	320	30.6182	141.0347	56.0000	8.80E+00	8.37E+00	7.94E+00	7.51E+00	7.08E+00

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN CONCENTRATION

Chemical	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds										
Acenaphthene	7.66E-02	7.66E-03	8.09E-02	8.09E-03	8.51E-02	8.51E-03	8.94E-02	8.94E-03	9.36E-02	9.36E-03
Acenaphthylene	7.60E-02	7.60E-03	8.02E-02	8.02E-03	8.45E-02	8.45E-03	8.88E-02	8.88E-03	9.30E-02	9.30E-03
Anthracene	7.55E-02	7.55E-03	7.98E-02	7.98E-03	8.41E-02	8.41E-03	8.84E-02	8.84E-03	9.26E-02	9.26E-03
Benzo(a)anthracene	6.98E-02	6.98E-03	7.42E-02	7.42E-03	7.86E-02	7.86E-03	8.30E-02	8.30E-03	8.74E-02	8.74E-03
Benzo(a)pyrene	7.31E-02	7.31E-03	7.74E-02	7.74E-03	8.17E-02	8.17E-03	8.61E-02	8.61E-03	9.04E-02	9.04E-03
Benzo(b)fluoranthene	7.03E-02	7.03E-03	7.47E-02	7.47E-03	7.91E-02	7.91E-03	8.35E-02	8.35E-03	8.79E-02	8.79E-03
Benzo(g,h,i)perylene	7.61E-02	7.61E-03	8.03E-02	8.03E-03	8.46E-02	8.46E-03	8.89E-02	8.89E-03	9.31E-02	9.31E-03
Benzo(k)fluoranthene	6.96E-02	6.96E-03	7.40E-02	7.40E-03	7.84E-02	7.84E-03	8.28E-02	8.28E-03	8.72E-02	8.72E-03
Bis(2-Ethylhexyl)phthalate	9.16E-03	9.16E-04	9.15E-03	9.15E-04	9.14E-03	9.14E-04	9.13E-03	9.13E-04	9.12E-03	9.12E-04
Chrysene	7.27E-02	7.27E-03	7.71E-02	7.71E-03	8.14E-02	8.14E-03	8.58E-02	8.58E-03	9.01E-02	9.01E-03
Di-n-butyl phthalate	2.89E-04	8.66E-05	2.93E-04	8.79E-05	2.97E-04	8.91E-05	3.01E-04	9.04E-05	3.06E-04	9.17E-05
Dibenzo(a,h)anthracene	7.60E-02	7.60E-03	8.03E-02	8.03E-03	8.45E-02	8.45E-03	8.88E-02	8.88E-03	9.31E-02	9.31E-03
Fluoranthene	8.06E-02	8.06E-03	8.47E-02	8.47E-03	8.89E-02	8.89E-03	9.30E-02	9.30E-03	9.72E-02	9.72E-03
Fluorene	8.15E-02	8.15E-03	8.56E-02	8.56E-03	8.98E-02	8.98E-03	9.39E-02	9.39E-03	9.81E-02	9.81E-03
Indeno(1,2,3-cd)pyrene	7.47E-02	7.47E-03	7.90E-02	7.90E-03	8.33E-02	8.33E-03	8.76E-02	8.76E-03	9.19E-02	9.19E-03
Naphthalene	7.71E-02	7.71E-03	8.13E-02	8.13E-03	8.55E-02	8.55E-03	8.98E-02	8.98E-03	9.40E-02	9.40E-03
Phenanthrene	7.96E-02	7.96E-03	8.38E-02	8.38E-03	8.80E-02	8.80E-03	9.21E-02	9.21E-03	9.63E-02	9.63E-03
Pyrene	8.01E-02	8.01E-03	8.42E-02	8.42E-03	8.84E-02	8.84E-03	9.26E-02	9.26E-03	9.67E-02	9.67E-03
Pesticides and PCBs										
4,4'-DDD	9.84E-04	1.97E-04	1.07E-03	2.14E-04	1.16E-03	2.31E-04	1.24E-03	2.49E-04	1.33E-03	2.66E-04
4,4'-DDE	1.46E-03	2.91E-04	1.65E-03	3.30E-04	1.84E-03	3.68E-04	2.03E-03	4.06E-04	2.22E-03	4.44E-04
4,4'-DDT	1.55E-03	3.10E-04	2.94E-03	5.88E-04	4.32E-03	8.65E-04	5.71E-03	1.14E-03	7.10E-03	1.42E-03
2,4-D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	4.76E-01	4.76E-02	4.65E-01	4.65E-02	4.54E-01	4.54E-02	4.43E-01	4.43E-02	4.32E-01	4.32E-02
Aroclor-1254	8.29E-02	8.29E-03	8.17E-02	8.17E-03	8.04E-02	8.04E-03	7.91E-02	7.91E-03	7.78E-02	7.78E-03
Aroclor-1260	5.23E-01	5.23E-02	4.29E-01	4.29E-02	3.35E-01	3.35E-02	2.41E-01	2.41E-02	1.46E-01	1.46E-02
alpha-BHC	2.72E-02	2.72E-03	2.63E-02	2.63E-03	2.54E-02	2.54E-03	2.45E-02	2.45E-03	2.36E-02	2.36E-03
beta-BHC	1.07E-03	2.14E-04	1.06E-03	2.13E-04	1.06E-03	2.12E-04	1.05E-03	2.10E-04	1.04E-03	2.09E-04
gamma-BHC (lindane)	4.40E-05	4.40E-06	4.25E-05	4.25E-06	4.10E-05	4.10E-06	3.96E-05	3.96E-06	3.81E-05	3.81E-06
delta-BHC	2.51E-02	2.51E-03	2.40E-02	2.40E-03	2.28E-02	2.28E-03	2.17E-02	2.17E-03	2.05E-02	2.05E-03
Dieldrin	3.31E-02	3.31E-03	3.15E-02	3.15E-03	2.99E-02	2.99E-03	2.83E-02	2.83E-03	2.66E-02	2.66E-03
Endosulfan I	3.59E-03	3.59E-04	3.23E-03	3.23E-04	2.87E-03	2.87E-04	2.51E-03	2.51E-04	2.15E-03	2.15E-04
Endosulfan II	7.28E-03	7.28E-04	7.03E-03	7.03E-04	6.77E-03	6.77E-04	6.52E-03	6.52E-04	6.27E-03	6.27E-04
Endosulfan Sulfate	5.75E-03	5.75E-04	5.32E-03	5.32E-04	4.89E-03	4.89E-04	4.47E-03	4.47E-04	4.04E-03	4.04E-04
Endrin	2.05E-02	2.05E-03	1.69E-02	1.69E-03	1.32E-02	1.32E-03	9.49E-03	9.49E-04	5.81E-03	5.81E-04
Endrin Aldehyde	1.40E-02	1.40E-03	1.20E-02	1.20E-03	9.90E-03	9.90E-04	7.85E-03	7.85E-04	5.80E-03	5.80E-04
Heptachlor	3.66E-03	3.66E-04	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics										
Aluminum	1.13E+01	1.13E+00	1.00E+01	1.00E+00	8.79E+00	8.79E-01	7.56E+00	7.56E-01	6.33E+00	6.33E-01
Antimony	2.01E+00	2.01E-01	2.10E+00	2.10E-01	2.18E+00	2.18E-01	2.27E+00	2.27E-01	2.35E+00	2.35E-01

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN CONCENTRATION

Chemical	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Arsenic	1.80E+01	1.80E+00	1.79E+01	1.79E+00	1.77E+01	1.77E+00	1.76E+01	1.76E+00	1.75E+01	1.75E+00
Barium	1.22E-01	3.15E-02	1.14E-01	2.93E-02	1.06E-01	2.72E-02	9.74E-02	2.51E-02	8.91E-02	2.29E-02
Beryllium	7.54E-03	7.54E-04	7.42E-03	7.42E-04	7.29E-03	7.29E-04	7.16E-03	7.16E-04	7.04E-03	7.04E-04
Cadmium	1.11E-01	1.11E-02	1.09E-01	1.09E-02	1.07E-01	1.07E-02	1.06E-01	1.06E-02	1.04E-01	1.04E-02
Chromium	9.52E-02	9.52E-03	9.31E-02	9.31E-03	9.10E-02	9.10E-03	8.90E-02	8.90E-03	8.69E-02	8.69E-03
Copper	4.91E-01	3.80E-01	4.74E-01	3.67E-01	4.57E-01	3.53E-01	4.40E-01	3.40E-01	4.24E-01	3.27E-01
Cyanide	7.77E-03	7.77E-04	8.03E-03	8.03E-04	8.29E-03	8.29E-04	8.55E-03	8.55E-04	8.80E-03	8.80E-04
Iron	2.16E+00	2.16E-01	1.96E+00	1.96E-01	1.75E+00	1.75E-01	1.55E+00	1.55E-01	1.34E+00	1.34E-01
Lead	2.11E-01	2.11E-02	1.90E-01	1.90E-02	1.70E-01	1.70E-02	1.49E-01	1.49E-02	1.28E-01	1.28E-02
Manganese	2.01E-02	6.24E-03	1.75E-02	5.42E-03	1.49E-02	4.61E-03	1.23E-02	3.80E-03	9.65E-03	2.99E-03
Mercury	2.92E-01	5.83E-02	3.28E-01	6.55E-02	3.64E-01	7.27E-02	4.00E-01	7.99E-02	4.36E-01	8.71E-02
Nickel	6.07E-03	3.04E-03	5.48E-03	2.74E-03	4.89E-03	2.45E-03	4.30E-03	2.15E-03	3.72E-03	1.86E-03
Chromium	8.30E-01	5.03E-01	8.25E-01	5.00E-01	8.20E-01	4.97E-01	8.15E-01	4.94E-01	8.09E-01	4.91E-01
Silver	2.84E-02	2.84E-03	2.65E-02	2.65E-03	2.46E-02	2.46E-03	2.27E-02	2.27E-03	2.09E-02	2.09E-03
Thallium	2.26E+01	2.26E+00	1.99E+01	1.99E+00	1.71E+01	1.71E+00	1.44E+01	1.44E+00	1.16E+01	1.16E+00
Tin	9.12E-02	6.10E-02	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	1.02E+00	1.02E-01	9.60E-01	9.60E-02	9.04E-01	9.04E-02	8.49E-01	8.49E-02	7.93E-01	7.93E-02
Zinc	5.50E-02	2.75E-02	5.23E-02	2.61E-02	4.96E-02	2.48E-02	4.69E-02	2.35E-02	4.43E-02	2.21E-02

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	Mean of Max's Crustacean Concentration (mg/kg)	Mean of Max's Sediment Concentration (mg/kg)	Mean of Max's Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Semivolatile Organic Compounds								
Acenaphthene	0.3000	0.3000	ND	0.0644	ND	ND	ND	ND
Acenaphthylene	0.0750	0.0750	ND	0.0161	ND	ND	ND	ND
Anthracene	0.0800	0.0800	ND	0.0172	ND	ND	ND	ND
Benzo(a)anthracene	0.3333	0.3333	ND	0.0715	ND	ND	ND	ND
Benzo(a)pyrene	0.2833	0.2833	ND	0.0608	ND	ND	ND	ND
Benzo(b)fluoranthene	0.3300	0.3300	ND	0.0708	ND	ND	ND	ND
Benzo(g,h,i)perylene	0.2050	0.2050	ND	0.0440	ND	ND	ND	ND
Benzo(k)fluoranthene	0.3167	0.3167	ND	0.0679	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	0.7167	0.7167	0.2900	0.1538	0.1516	0.1494	0.1473	0.1451
Chrysene	0.4700	0.4700	ND	0.1008	ND	ND	ND	ND
Di-n-butyl phthalate	0.1600	0.1600	ND	0.0343	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.1900	0.1900	ND	0.0408	ND	ND	ND	ND
Fluoranthene	0.8367	0.8367	ND	0.1795	ND	ND	ND	ND
Fluorene	0.2500	0.2500	ND	0.0536	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.1900	0.1900	ND	0.0408	ND	ND	ND	ND
Naphthalene	0.1050	0.1050	ND	0.0225	ND	ND	ND	ND
Phenanthrene	0.8233	0.8233	ND	0.1766	ND	ND	ND	ND
Pyrene	0.7767	0.7767	ND	0.1666	ND	ND	ND	ND
Pesticides and PCBs								
4,4'-DDD	0.0012	0.0446	0.1108	0.0011	0.0015	0.0018	0.0021	0.0025
4,4'-DDE	0.0094	0.1664	0.0459	0.0052	0.0046	0.0040	0.0034	0.0027
4,4'-DDT	0.0022	0.2630	1.0100	0.0057	0.0095	0.0133	0.0170	0.0208
2,4-D	ND	0.0401	ND	0.0008	ND	ND	ND	ND
Aroclor-1248	ND	0.1200	ND	ND	ND	ND	ND	ND
Aroclor-1254	ND	0.2474	ND	ND	ND	ND	ND	ND
Aroclor-1260	0.2600	9.2030	0.0850	0.2362	0.1902	0.1442	0.0982	0.0522
alpha-BHC	0.0016	0.0110	ND	0.0005	ND	ND	ND	ND
beta-BHC	ND	0.0740	0.0590	ND	ND	ND	ND	ND
gamma-BHC (lindane)	0.0005	0.0027	ND	0.0002	ND	ND	ND	ND
delta-BHC	0.0006	0.0168	ND	0.0005	ND	ND	ND	ND
Dieldrin	0.0009	0.0172	ND	0.0005	ND	ND	ND	ND
Endosulfan I	0.0010	0.0893	ND	0.0020	ND	ND	ND	ND
Endosulfan II	0.0066	0.0830	ND	0.0030	ND	ND	ND	ND
Endosulfan Sulfate	0.0014	0.1758	ND	0.0038	ND	ND	ND	ND
Endrin	0.0010	0.7378	ND	0.0151	ND	ND	ND	ND
Endrin Aldehyde	0.0049	0.1906	ND	0.0048	ND	ND	ND	ND
Heptachlor	0.0064	0.0150	ND	0.0015	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics								
Aluminum	6.2000	8193.3333	4342.3333	166.5091	147.0852	127.6613	108.2374	88.8135
Antimony	ND	13.7500	103.9000	ND	ND	ND	ND	ND

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	Mean of Max's Crustacean Concentration (mg/kg)	Mean of Max's Sediment Concentration (mg/kg)	Mean of Max's Soil Concentration (mg/kg)	100% Sediment Dose (mg/kg/day)	75%Sed, 25%Soil Dose (mg/kg/day)	50%Sed,50%Soil Dose (mg/kg/day)	25%Sed,75%Soil Dose (mg/kg/day)	100%Soil Dose (mg/kg/day)
Arsenic	21.2667	21.7667	15.7133	4.5726	4.5420	4.5115	4.4810	4.4504
Barium	3.2667	120.4333	58.1667	3.0647	2.7506	2.4366	2.1225	1.8085
Beryllium	ND	0.1900	0.2600	ND	ND	ND	ND	ND
Cadmium	1.1450	4.5333	3.6000	0.3140	0.3093	0.3046	0.2999	0.2952
Chromium	5.1000	32.2000	55.3667	1.6409	1.7577	1.8746	1.9914	2.1083
Copper	49.5667	449.0000	759.2333	18.6926	20.2574	21.8221	23.3869	24.9517
Cyanide	18.0000	18.0000	ND	3.8617	ND	ND	ND	ND
Iron	154.2333	20593.3333	16050.3333	445.4565	422.5422	399.6280	376.7137	353.7994
Lead	1.7000	649.4000	260.1333	13.4323	11.4689	9.5055	7.5421	5.5787
Manganese	3.0667	377.6667	133.8333	8.2156	6.9858	5.7559	4.5260	3.2962
Mercury	0.1250	0.6300	3.2167	0.0370	0.0501	0.0631	0.0761	0.0892
Nickel	0.3300	87.7267	26.3500	1.8341	1.5245	1.2149	0.9053	0.5958
Chromium	2.2000	4.8000	0.5300	0.5244	0.5029	0.4814	0.4598	0.4383
Silver	0.2600	8.3433	5.1000	0.2189	0.2025	0.1861	0.1698	0.1534
Thallium	ND	168.0000	ND	ND	ND	ND	ND	ND
Tin	43.0667	43.0667	ND	9.2394	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Vanadium	0.9900	15.4000	8.1000	0.5031	0.4663	0.4295	0.3927	0.3558
Zinc	68.1667	907.5333	1114.6667	31.5588	32.6036	33.6483	34.6931	35.7378

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Semivolatile Organic Compounds										
Acenaphthene	6.44E-02	6.44E-03	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	1.61E-02	1.61E-03	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	1.72E-02	1.72E-03	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	7.15E-02	7.15E-03	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	6.08E-02	6.08E-03	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	7.08E-02	7.08E-03	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	4.40E-02	4.40E-03	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	6.79E-02	6.79E-03	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	8.40E-03	8.40E-04	8.28E-03	8.28E-04	8.17E-03	8.17E-04	8.05E-03	8.05E-04	7.93E-03	7.93E-04
Chrysene	1.01E-01	1.01E-02	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl phthalate	6.24E-05	1.87E-05	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	4.08E-02	4.08E-03	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	1.79E-01	1.79E-02	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	5.36E-02	5.36E-03	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	4.08E-02	4.08E-03	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	2.25E-02	2.25E-03	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	1.77E-01	1.77E-02	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	1.67E-01	1.67E-02	ND	ND	ND	ND	ND	ND	ND	ND
Pesticides and PCBs										
4,4'-DDD	1.42E-03	2.84E-04	1.83E-03	3.67E-04	2.25E-03	4.50E-04	2.67E-03	5.34E-04	3.09E-03	6.17E-04
4,4'-DDE	6.47E-03	1.29E-03	5.71E-03	1.14E-03	4.95E-03	9.90E-04	4.19E-03	8.38E-04	3.43E-03	6.86E-04
4,4'-DDT	7.17E-03	1.43E-03	1.19E-02	2.38E-03	1.66E-02	3.32E-03	2.13E-02	4.26E-03	2.60E-02	5.20E-03
2,4-D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor-1260	3.47E+00	3.47E-01	2.80E+00	2.80E-01	2.12E+00	2.12E-01	1.44E+00	1.44E-01	7.68E-01	7.68E-02
alpha-BHC	3.81E-02	3.81E-03	ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
gamma-BHC (lindane)	1.90E-05	1.90E-06	ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	3.24E-02	3.24E-03	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	2.60E-02	2.60E-03	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	1.33E-02	1.33E-03	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	1.97E-02	1.97E-03	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	2.55E-02	2.55E-03	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	1.64E-01	1.64E-02	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	5.21E-02	5.21E-03	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	1.54E-02	1.54E-03	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics										
Aluminum	8.63E+01	8.63E+00	7.62E+01	7.62E+00	6.61E+01	6.61E+00	5.61E+01	5.61E+00	4.60E+01	4.60E+00
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Raccoon (Western Sites)
Body Weight
Food Ingestion Rate
Water Ingestion Rate
Sediment/Soil Ingestion Rate

MEAN OF MAXIMUM DETECTED CONCENTRATIONS

Chemical	100% Sediment		75%Sed, 25%Soil		50%Sed,50%Soil		25%Sed,75%Soil		100%Soil	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Arsenic	3.63E+01	3.63E+00	3.60E+01	3.60E+00	3.58E+01	3.58E+00	3.56E+01	3.56E+00	3.53E+01	3.53E+00
Barium	6.01E-01	1.55E-01	5.39E-01	1.39E-01	4.78E-01	1.23E-01	4.16E-01	1.07E-01	3.55E-01	9.13E-02
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	3.14E-01	3.14E-02	3.09E-01	3.09E-02	3.05E-01	3.05E-02	3.00E-01	3.00E-02	2.95E-01	2.95E-02
Chromium	5.00E-01	5.00E-02	5.36E-01	5.36E-02	5.72E-01	5.72E-02	6.07E-01	6.07E-02	6.43E-01	6.43E-02
Copper	1.60E+00	1.23E+00	1.73E+00	1.34E+00	1.87E+00	1.44E+00	2.00E+00	1.54E+00	2.13E+00	1.65E+00
Cyanide	5.62E-02	5.62E-03	ND	ND	ND	ND	ND	ND	ND	#VALUE!
Iron	8.91E+00	8.91E-01	8.45E+00	8.45E-01	7.99E+00	7.99E-01	7.53E+00	7.53E-01	7.08E+00	7.08E-01
Lead	1.68E+00	1.68E-01	1.43E+00	1.43E-01	1.19E+00	1.19E-01	9.43E-01	9.43E-02	6.97E-01	6.97E-02
Manganese	9.34E-02	2.89E-02	7.94E-02	2.46E-02	6.54E-02	2.03E-02	5.14E-02	1.59E-02	3.75E-02	1.16E-02
Mercury	1.16E+00	2.31E-01	1.56E+00	3.13E-01	1.97E+00	3.94E-01	2.38E+00	4.76E-01	2.79E+00	5.57E-01
Nickel	4.59E-02	2.29E-02	3.81E-02	1.91E-02	3.04E-02	1.52E-02	2.26E-02	1.13E-02	1.49E-02	7.45E-03
Chromium	2.62E+00	1.59E+00	2.51E+00	1.52E+00	2.41E+00	1.46E+00	2.30E+00	1.39E+00	2.19E+00	1.33E+00
Silver	1.22E-01	1.22E-02	1.13E-01	1.13E-02	1.03E-01	1.03E-02	9.43E-02	9.43E-03	8.52E-02	8.52E-03
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tin	3.95E-01	2.64E-01	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	ND	ND
Vanadium	2.40E+00	2.40E-01	2.22E+00	2.22E-01	2.05E+00	2.05E-01	1.87E+00	1.87E-01	1.69E+00	1.69E-01
Zinc	1.97E-01	9.86E-02	2.04E-01	1.02E-01	2.10E-01	1.05E-01	2.17E-01	1.08E-01	2.23E-01	1.12E-01

Note: Chemical concentrations of SVOCs, cyanide, and tin in crustaceans were assumed to be equal to sediment concentrations, since these compounds were not analyzed in crustacean tissues. Otherwise, concentrations of metals, pesticides, and PCBs in crustaceans were based on actual analyses of crab tissues.

NA = NOAEL and LOAEL not available. HQ cannot be calculated.

ND = Chemical not detected or not analyzed (tin) in applicable media.

a = Chemical not analyzed.

Chemical	East Sediment Mean (mg/kg)	West Sediment Mean (mg/kg)	East Sediment Mean of MDCs (mg/kg)	West Sediment Mean of MDCs (mg/kg)	All Soil Mean (mg/kg)	All Soil Mean of MDCs (mg/kg)	East Soil Mean (mg/kg)	West Soil Mean (mg/kg)	East Soil Mean of MDCs (mg/kg)	West Soil Mean of MDCs (mg/kg)	Minnow Mean (mg/kg)	Minnow Mean of MDCs (mg/kg)	Crustacean Mean (mg/kg)	Crustacean Mean of MDCs (mg/kg)
Semivolatile Organic Compounds														
3-Methylcholanthrene	2.5325	ND	0.6900	ND	2.8303	ND	2.8303	ND	ND	ND	1.3809	ND	ND	ND
Acenaphthene	1.0284	0.3571	ND	0.3000	0.7107	ND	0.7399	1.2000	ND	ND	0.7832	ND	ND	ND
Acenaphthylene	1.0284	0.3540	ND	0.0750	0.7107	ND	0.7399	1.2000	ND	ND	0.7832	ND	ND	ND
Anthracene	1.0030	0.3520	ND	0.0800	0.7059	0.2800	0.7345	1.2000	0.2800	ND	0.7832	ND	ND	ND
Acetophenone	1.2400	0.0000	0.7900	ND	1.0333	0.1200	1.0333	0.0000	0.1200	0.0000	0.7832	ND	ND	ND
Benzo(a)anthracene	1.0646	0.3252	1.9100	0.3333	0.7940	2.5300	0.8326	1.2000	2.5300	ND	1.0317	ND	ND	ND
Benzo(a)pyrene	1.1569	0.3406	11.0000	0.2833	0.7731	2.1125	0.8093	1.2000	2.1125	ND	1.3809	ND	ND	ND
Benzo(b)fluoranthene	1.0840	0.3275	2.4325	0.3300	0.9577	5.0850	1.0148	1.2000	5.0850	ND	1.0317	ND	ND	ND
Benzo(g,h,i)perylene	1.0310	0.3546	3.9960	0.2050	0.7461	1.7000	0.7792	1.2000	1.7000	ND	1.5543	ND	ND	ND
Benzo(k)fluoranthene	1.5272	0.3243	ND	0.3167	0.6820	0.3600	0.7078	1.2000	0.3600	ND	1.0317	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	1.0507	0.7814	1.2360	0.7167	0.8867	0.7400	0.9865	0.7450	0.8525	0.2900	1.0540	ND	ND	ND
Chrysene	1.2187	0.3391	5.3857	0.4700	0.8739	3.6925	0.9215	1.2000	3.6925	ND	1.0317	ND	ND	ND
Di-n-butyl phthalate	1.2238	0.7400	0.4750	0.1600	0.9103	0.2300	1.0016	1.2000	0.2300	ND	0.9271	ND	ND	ND
Dibenzo(a,h)anthracene	1.0144	0.3542	0.6100	0.1900	0.6989	0.6045	0.7267	1.2000	0.6045	ND	1.5543	ND	ND	ND
Fluoranthene	1.7450	0.3756	1.5300	0.8367	0.9560	5.0600	1.0130	1.2000	5.0600	ND	0.7832	ND	ND	ND
Fluorene	1.0058	0.3799	ND	0.2500	0.7100	ND	0.7391	1.2000	ND	ND	0.7832	ND	ND	ND
Hexachlorophene	11.1731	ND	8.1000	ND	10.3036	0.8900	10.3036	0.0000	0.8900	ND	188.0857	ND	ND	ND
Indeno(1,2,3-cd)pyrene	1.0700	0.3483	5.9000	0.1900	0.7383	1.5325	0.7705	1.2000	1.5325	ND	1.5543	ND	ND	ND
Naphthalene	1.0292	0.3592	ND	0.1050	0.7231	ND	0.7536	1.2000	ND	ND	0.7832	ND	ND	ND
Phenanthrene	1.1966	0.3710	3.6533	0.8233	0.7600	1.4305	0.7948	1.2000	1.4305	ND	0.7832	ND	ND	ND
Pyrene	1.3552	0.3732	7.3607	0.7767	0.9291	4.3500	0.9829	1.2000	4.3500	ND	0.7753	0.4300	ND	ND
Pesticides and PCBs														
4,4'-DDD	1.5468	0.0256	5.8227	0.0446	0.2317	0.3939	0.3467	0.0394	0.5827	0.1108	0.0706	0.8527	0.0014	0.0012
4,4'-DDE	0.7635	0.0295	1.3036	0.1664	0.1420	0.4369	0.0957	0.0598	0.5933	0.0459	0.0516	0.3271	0.0029	0.0094
4,4'-DDT	1.3885	0.0459	5.1672	0.2630	0.2164	1.5978	0.2472	0.2658	1.8329	1.0100	0.0051	0.0259	0.0016	0.0022
2,4,5-T	0.0580	0.0037	ND	ND	0.0310	0.0070	0.0297	0.0060	0.0070	ND	ND	ND	ND	ND
2,4,5-TP (Silvex)	0.0404	0.0037	ND	ND	0.0188	0.0040	0.0221	0.0060	0.0040	ND	ND	ND	ND	ND
2,4-D	0.0580	0.0080	ND	0.0401	0.0310	0.0074	0.0297	0.0060	0.0074	ND	ND	ND	ND	ND
Aroclor-1248	0.2779	0.0780	ND	0.1200	0.1616	ND	0.1159	0.0562	ND	ND	0.0179	ND	0.0164	ND
Aroclor-1254	0.2996	0.1215	ND	0.2474	0.1838	ND	0.1373	0.1042	ND	ND	0.0179	ND	0.0164	ND
Aroclor-1260	0.3345	1.3927	0.5100	9.2030	0.6163	5.8283	0.1659	0.1215	8.7000	0.0850	0.0584	0.2149	0.0385	0.2600
alpha-BHC	0.0731	0.0100	0.0056	0.0110	0.0126	0.0113	0.0111	0.0075	0.0113	ND	0.0010	0.0022	0.0009	0.0016
beta-BHC	0.0815	0.0131	0.0990	0.0740	0.0131	0.0305	0.0110	0.0125	0.0020	0.0590	0.0013	0.0044	0.0009	ND
gamma-BHC (lindane)	0.0761	0.0099	0.0116	0.0027	0.0122	0.0010	0.0103	0.0075	0.0010	ND	0.0008	0.0022	0.0008	0.0005
delta-BHC	0.0751	0.0107	0.0861	0.0168	0.0126	0.0010	0.0111	0.0075	0.0010	ND	0.0010	0.0027	0.0007	0.0006
gamma-chlordane	0.1772	0.0593	0.0510	ND	0.0414	ND	0.0891	0.0873	ND	ND	0.0006	ND	0.0000	0.0000
Dieldrin	0.1511	0.0215	0.0146	0.0172	0.0243	ND	0.0206	0.0150	ND	ND	0.0012	0.0036	0.0012	0.0009
Endosulfan I	0.0945	0.0182	0.2008	0.0893	0.0130	0.0066	0.0117	0.0075	0.0066	ND	0.0012	0.0058	0.0009	0.0010
Endosulfan II	0.1722	0.0226	0.2000	0.0830	0.0254	0.0041	0.0223	0.0150	0.0041	ND	0.0010	0.0025	0.0033	0.0066
Endosulfan Sulfate	0.1655	0.0277	ND	0.1758	0.0256	0.0030	0.0228	0.0150	0.0030	ND	0.0053	0.0383	0.0016	0.0014
Endrin	0.1529	0.0822	0.1261	0.7378	0.0249	0.0139	0.0212	0.0150	0.0139	ND	0.0014	0.0014	0.0012	0.0010
Endrin Aldehyde	0.1100	0.0408	0.0370	0.1906	0.0230	0.0238	0.0252	0.0033	0.0238	ND	0.0048	0.0200	0.0024	0.0049
Heptachlor	0.0801	0.0101	0.0600	0.0150	0.0126	0.0028	0.0110	ND	0.0028	ND	0.0011	0.0050	0.0008	0.0064
Toxaphene	4.8791	0.4432	ND	ND	0.6891	0.3430	0.6627	0.2815	0.3430	ND	0.0916	ND	0.0850	ND
Methyl parathion	0.0450	0.0369	0.0372	ND	0.0183	ND	0.0202	0.0041	ND	ND	ND	ND	ND	ND
Inorganics														
Aluminum	2068.7949	1044.1780	2904.0000	8193.3333	1904.1563	4170.4000	2762.3779	573.0000	4096.7143	4342.3333	9.1586	181.6500	3.3818	6.2000
Antimony	2.6523	2.7061	4.6480	13.7500	7.3889	30.8988	1.8732	4.8000	6.5650	103.9000	1.6421	ND	1.0136	ND
Arsenic	4.2617	4.8292	9.1357	21.7667	2.7826	8.5044	1.9861	1.5000	4.9000	15.7133	0.5728	2.1737	11.1727	21.2667
Barium	17.4034	13.9568	46.3000	120.4333	26.6647	39.6100	15.3028	5.6000	31.6571	58.1667	2.2864	5.7100	1.7564	3.2667
Beryllium	0.2154	0.0716	0.8625	0.1900	0.0734	0.1943	0.0831	0.0550	0.1833	0.2600	0.0812	ND	0.0182	ND
Cadmium	4.0310	0.6107	21.3700	4.5333	1.2535	5.2938	1.4197	0.2850	5.5357	3.6000	0.2673	ND	0.5055	1.1450
Chromium	35.6737	7.8900	76.9143	32.2000	18.9689	50.5350	14.3009	6.5500	48.4643	55.3667	0.5080	1.2933	0.7868	5.1000
Copper	37.4576	55.9341	115.4000	449.0000	211.9407	288.6100	25.6269	16.6500	86.9143	759.2333	5.2073	23.0900	23.7682	49.5667
Cyanide	2.2568	2.4892	10.7250	18.0000	2.5054	13.8667	2.7254	6.0000	13.8667	ND	ND	ND	ND	ND
Iron	1891.5128	4590.1039	2912.8571	20593.3333	4593.9949	8931.6000	3442.3559	2560.0000	5880.7143	16050.3333	27.3221	72.7000	79.5591	154.2333
Lead	77.4556	78.7579	247.2714	649.4000	157.7271	221.0750	58.4699	46.1000	204.3357	260.1333	1.3631	3.1865	0.5000	1.7000
Manganese	17.0224	65.6360	22.7143	377.6667	55.7510	102.3600	40.3332	19.9500	88.8714	133.8333	3.4930	5.8333	2.2986	3.0667
Mercury	0.1874	0.0817	0.8533	0.6300	0.5939	1.8339	0.1792	0.3100	1.1425	3.2167	0.0146	0.0755	0.0395	0.1250
Nickel	4.7121	8.0218	9.3429	87.7267	6.1366	14.1644	3.7183	3.3500	10.6829	26.3500	0.5356	ND	0.4168	0.3300
Selenium	1.1300	0.4318	3.7533	4.8000	2.3142	0.9600	0.5333	0.2300	1.1033	0.5300	0.4105	0.6840	0.8091	2.2000

Chemical	East Sediment Mean (mg/kg)	West Sediment Mean (mg/kg)	East Sediment Mean of MDCs (mg/kg)	West Sediment Mean of MDCs (mg/kg)	All Soil Mean (mg/kg)	All Soil Mean of MDCs (mg/kg)	East Soil Mean (mg/kg)	West Soil Mean (mg/kg)	East Soil Mean of MDCs (mg/kg)	West Soil Mean of MDCs (mg/kg)	Minnow Mean (mg/kg)	Minnow Mean of MDCs (mg/kg)	Crustacean Mean (mg/kg)	Crustacean Mean of MDCs (mg/kg)
Silver	1.5748	0.9567	8.5225	8.3433	0.7952	3.2150	0.8907	0.2850	2.8380	5.1000	0.2433	4.5800	0.1636	0.2600
Thallium	0.8691	4.1467	#DIV/0!	168.0000	0.2133	ND	0.2950	0.1150	ND	ND	0.3014	ND	0.4300	ND
Tin	20.1962	9.9519	53.9333	43.0667	3.1628	8.5750	3.1628	ND	8.5750	ND	2.5017	ND	NA	NA
Vanadium	9.2862	4.7124	17.1714	15.4000	4.4073	7.9200	3.9650	2.4000	7.8429	8.1000	0.3185	ND	0.6077	0.9900
Zinc	180.1784	141.0347	331.3143	907.5333	274.9990	490.2500	94.1983	56.0000	0.0000	1114.6667	56.5516	150.1333	30.6182	68.1667

ND = Chemical not detected or not analyzed.