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NAS PENSACOLA
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TECHNICAL MEMORANDUM REGARDING FISH TISSUE QUALITY RISK ASSESSMENT
SITE 40 NAS PENSACOLA FL
2/28/2003
NAS PENSACOLA TIER I PARTNERING TEAM

Technical Memorandum

To: NASP Tier 1
From: EnSafe Inc.
Date: 2/28/2003
Re: Fish Tissue Quality Near NAS Pensacola
Bayou Grande, Site 40

1.0 INTRODUCTION

In the 1999 *Final Remedial Investigation Report for the Naval Air Station in Pensacola, Florida* (NAS Pensacola), EnSafe Inc. prepared a risk assessment for Bayou Grande. The assessment identified recreational fish ingestion as a scenario that could result in unacceptable human health risk. The 1999 risk assessment used conservative assumptions, and these were refined in the 2002 *Final Remedial Investigation Report Addendum I for Site 40—Bayou Grande Naval Air Station, Pensacola, Florida* report (EnSafe, 1999; EnSafe, 2002). In 1998, prey species (Killifish and Pinfish) were collected from one location. The highest PCB concentrations in sediment were reported at that location. Polychlorinated biphenyls (PCBs) reported in whole body tissue were the primary contributors to risk in the addendum. These data were modeled to estimate bioaccumulation into game fish tissues as part of the addendum. In the addendum, the cumulative cancer risk estimate was two-in-one-million (2E-6) for the recreational fisherman (EnSafe, 2002).

This memorandum addresses FDEP comments on fish tissue ingestion rates, the site foraging factor, and PCB concentrations reported in fish collected in reference areas. A literature search was performed to obtain reference game fish tissue concentrations for PCBs. Results of the literature search and revised calculations are summarized below. Risk estimates for PCBs and other contaminants were also revised and are summarized below for the recreational fishing scenario.

2.0 LITERATURE SEARCH RESULTS

2.1 Fish tissue quality in near-coastal areas of the Gulf of Mexico receiving point source discharges

Fish were collected from two reference locations during the *Fish tissue quality in near-coastal areas of the Gulf of Mexico receiving point source discharges* study. Fish samples were filleted, and the fillets were analyzed for polychlorinated biphenyls (PCBs). The average total PCB concentration reported in fish collected from the two reference areas was 4.81 ng/g (Lewis et al, 2001). This is equivalent to 0.00481 mg/kg. Catfish were collected from the St. Joseph's Bay reference location, while largemouth bass were collected from the Blackwater River reference location (Lewis et al., 2001).

2.2 National Study of Chemical Residues in Fish

The *National Study of Chemical Residues in Fish*, formerly referred to as the national bioaccumulation study, contains fish data for sample locations throughout the US, and includes

background fish tissue data (USEPA, 1992). As shown on Table 6-4 of this study, background PCB concentrations are reported from nondetect to 44.8 ng/g, which includes only select location and only samples that were filleted (USEPA, 1992). This is equivalent to 0.0448 mg/kg.

2.3 Sediment Toxicity in Four Bays of the Florida Panhandle

The *Magnitude and Extent of Sediment Toxicity in Four Bays of the Florida Panhandle: Pensacola, Choctawhatchee, St. Andrew and Apalachicola* was reviewed, and it stated that PCBs in Bayou Grande sediment were elevated when compared to PCB concentrations in the main basin (Long et al., 1997). As shown on Table 15 of the NOAA document, average sediment PCB concentrations exceeded the ERM in Pensacola Bay. The Bayou Grande data (which was not collected within the Site 40 boundary) was included as a reference concentration within the Draft RI Addendum.

3.0 DISCUSSION

3.1 Comparison of Reference Fish Tissue Concentrations and Fish Data Collected During the Site 40 Investigation

As shown in Table 1, fish tissue samples collected from the location with the highest reported PCB concentrations in Site 40 sediment contained 0.1 mg/kg total PCB in prey fish tissue (whole body). Table 2 shows the estimates for fish tissue concentrations for trophic level 4 fish. The concentration for total PCB in trophic level 4 fish tissue was 0.24 mg/kg. The average total PCB concentration (fillet) reported in fish collected from two reference areas was 0.00481 mg/kg (Lewis et al., 2001). This value used because other background values cited were not limited to the Gulf or were collected near outfalls.

3.2 Comparison of Exposure Information Used in Risk Estimates and Exposure information

Exposure information was developed using the FDEP fish advisory, EPA's exposure factors handbook, fishing use, and other fractions detailed below. Fishing use information for Bayou Grande was obtained from the Florida Marine Patrol Office and was excerpted from the Site 40 Remedial Investigation (RI) (EnSafe, 1999).

Fish Advisory and Ingestion Rate

The Florida Department of Health issued a fish advisory in January 2003. Florida's fish advisory states that a limited advisory is applicable to children under age 10 and women of childbearing ages (FDEP, 2003). The intake is limited to 8 oz. per four weeks (FDEP, 2003). This would be equivalent to 0.008 kg/day, assuming daily ingestion over four weeks.

Exposure was estimated separately for adults' fish tissue intake that would not be limited by the FDEP fish advisory (adults that are not women of childbearing ages). The ingestion rate of 0.026 kg/day for the recreational fishing scenario was obtained from the recommendations in USEPA's Exposure Factors Handbook (USEPA, 1997).

Body Weight

The adult body weight was used in the addendum. The child body weight would be more appropriate because the fish advisory specifically mentions children under age 10. The lifetime weighted average was used to estimate risk to a person following the fish advisory during childhood and while they are of child-bearing age. The lifetime weighted average for a resident was assumed to represent this scenario when using the fish ingestion rate obtained from the FDEP fish advisory. Risk calculations are shown in Tables 1 through 5 and are summarized in Section 4.0.

Site Forage Factor

The site foraging factor (SFF) of 0.32 was revised. The SFF accounts for the preference of fish to use Site 40 as a forage area, and the fraction of 0.32 was developed based on site area relative to Bayou Grande. The Navy side of Bayou Grande appears to contain more detritus and cover, and the banks are more forested than the opposite sides of the bayou. The Navy side of Bayou Grande is also quieter. Consequently, fish may forage on the Navy side of Bayou Grande more frequently than other areas within Bayou Grande. The SFF was doubled to account for potential preference of the Navy side of the bayou, so a value of 0.64 was used in the revised calculations. Table 2 shows the revised SFF and estimated concentrations in trophic level 4 fish.

Fraction Contaminated Area Within Site 40 Area

In 1998, fish tissue samples were collected from Site 40 where the highest sediment concentrations of PCBs were reported. Figures in the Site 40 remedial investigation show sediment chemical distribution was limited to certain areas within Site 40. Therefore, the fraction of the contaminated area within the total Site 40 area was developed using these figures and contours to account for the fraction of contaminated area within the total site area.

Sediment data were contoured using GIS. Figures were not developed for aldrin or chlordane during the Site 40 remedial investigation. Therefore, figures were developed for aldrin and chlordane as part of this technical memorandum and were used to estimate the fraction of contaminated area within the total site area. All figures used are provided in Attachment 1. Table 3 summarizes the calculated fractions.

There is some uncertainty in using fractions based on sediment distribution because fish tissue concentrations were assumed to correlate with high sediment concentrations. Chemical uptake from sediment to fish could be distributed in a larger area when considering the food web. Therefore, the fractions calculated using sediment data may underestimate exposure. To address this uncertainty, contaminants were assumed to be more mobile within the food chain relative to sediment contours shown in Attachment 1, and fractions were increased 100% as shown in Table 3.

Assumptions were required to develop the aldrin figure because no FDEP or EPA sediment screening value was available for aldrin, and the contours used for other chemicals were based on either FDEP or EPA screening values (whichever was most conservative). A buffer of 20 feet was placed around each location where aldrin was detected to estimate the fraction of contaminated area within the total site area. Using this buffer area could underestimate exposure because it is not contoured using GIS based on a sediment screening value. Literature sources were subsequently reviewed to obtain a sediment screening value for aldrin. Aldrin concentrations reported in sediment ranged from nondetect to 0.0018 mg/kg. The sediment Apparent Effects Threshold (AET) of 0.01 mg/kg for aldrin was obtained from NOAA. All site sediment concentrations were below NOAA's AET.

Fraction Use of Contaminated Area By Fishermen and Successful Fishing

Bayou Grande is used for recreational fishing. The Florida Marine Patrol Office was contacted to obtain fishing frequency information for Bayou Grande. They reported approximately 10 boats per day fishing Bayou Grande during April through September, and only one or two boats per day during October through March (EnSafe, 1999). Consequently, recreational fishing was assumed to occur year-round in Bayou Grande.

The Florida Marine Patrol Office reported that a full bag limit (one redfish and five trout) is not frequently observed in Bayou Grande (EnSafe, 1999). This implies a fraction of less than 0.5 for obtaining a full bag limit from Bayou Grande. The Site 40 area is approximately one-third of Bayou Grande, so assuming fishing would occur equally throughout Bayou Grande, the fraction would be $0.5 \times 0.3 = 0.15$ to represent successful fishing within Site 40. Although some areas of Site 40 are inaccessible to recreational fishermen and other areas are shallow, the forested bank may be attractive to fishermen. The fraction of 0.15 was doubled to 0.3 as a conservative measure, assuming fishermen would find Site 40 more attractive than other areas in Bayou Grande.

4.0 COMPARISON OF RISK ESTIMATES AND SUMMARY

The effect of the revised intake factors on risk estimates is summarized below. Revised risk estimates were calculated using the existing files in the addendum and are summarized below. Tables 1 through 5 provide revised calculations and summary tables. Risks for recreational fishing were estimated in the Site 40 Addendum based on an adult (EnSafe, 2001). The lifetime weighted average risk for recreational fishermen that would be exposed under the auspices of the fish advisory (lifetime weighted average risk estimate) as well as recreational fishermen that would not be restricted by the fish advisory (adult risk estimate) were included in this memorandum.

Table 4 shows chronic daily intake estimates using the fractions discussed in Section 3, and Table 5 shows risk estimates. Risk estimates are summarized below.

Risk Estimate Summary

Chemical	Addendum Risk Estimate ¹	LWA Risk Estimate ²	Adult Risk Estimate ²
4,4'-DDT	2.4E-7	1.2E-9	3.3E-9
4,4'-DDE	1.2E-7	1.1E-8	3.3E-8
Aldrin	9.0E-8	1.2E-10	3.5E-10
Aroclor-1260	5.9E-6	1.1E-6	3.2E-6
Dieldrin	1.8E-7	1.1E-7	3.2E-7
Lindane	7.8E-9	4.3E-9	1.3E-8
Chlordane	9.4E-9	4.3E-9	1.3E-8
TOTAL	6E-6	1E-6	4E-6

¹Addendum risk estimate obtained from Table 5 in the 2001 Site 40 Addendum (EnSafe, 2001).

²LWA and Adult Risk Estimates obtained from Table 5.

Although risks were estimated using different exposure assumptions when compared to those used the Addendum for Site 40, risk estimates were similar (i.e., within the same order of magnitude). PCB Aroclor-1260 was the primary contributor to the risk estimates. Dieldrin was a secondary contributor to the risk estimates.

5.0 REFERENCES

EnSafe Inc. *Final Remedial Investigation Report Addendum I for Site 40—Bayou Grande Naval Air Station, Pensacola*. NAS Pensacola Remedial Investigation Reports. 1999.

EnSafe Inc. *Addendum I – Final Remedial Investigation Report Addendum I for Site 40—Bayou Grande Naval Air Station, Pensacola*. NAS Pensacola Remedial Investigation Reports. 2002.

- Florida Department of Environmental Protection (FDEP). *Florida Fish Consumption Advisories*. Limited Consumption, p. 3; Table 3, p. 6. www.doh.state.fl.us/environment/hsee/fishconsumptionadvisories/. 2003.
- Lewis, Michael A., Geoff I. Scott, Dan W. Bearden, Robert L. Quarles, James Moore, Erich D. Strozier, Scott K. Siversten, Aaron R. Dias, Marion Sanders. *Fish tissue quality in near-coastal areas of the Gulf of Mexico receiving point source discharges*. *The Science of the Total Environment* 284 (2002) 249-261. Elsevier Science. p. 257. 2002.
- Long, Edward R., et al. *Magnitude and Extent of Sediment Toxicity in Four Bays of the Florida Panhandle: Pensacola, Choctawhatchee, St. Andrew and Apalachicola*. Coastal Monitoring and Bioeffects Assessment Division, Office of Ocean Resources Conservation and Assessment, National Ocean Service. NOAA Technical Memorandum NOS ORCA 117, p. 31.. www.epa.gov/ged/publica/gokey21.htm. 1997.
- USEPA. *Exposure Factors Handbook*. Office of Research and Development. Washington, DC. EPA/600/P-95/002Fb. Volume II. Table 10-83. 1997.
- USEPA. *National Study of Chemical Residues in Fish*. Volume I (EPA 823-R-92-008a) and Volume II (EPA 823-R-92-008b). Office of Science and Technology. Washington, DC. Table 6-4. www.epa.gov/waterscience/library/fish/. 1992.

TABLE 1
Comparison of Maximum Detections in
Whole Body Prey Fish to RBCs

Constituents	Max. Detected Concentrations (mg/kg)	Fish RBCs (mg/kg)¹		Exceeds RBC?
		Carcinogens	Non-carcinogens	
4,4'-DDD	3.8E-03	1.3E-02	NA	No
4,4'-DDE	1.2E-02	9.3E-03	NA	Yes
Aldrin	6.6E-04	1.9E-04	9.5E-02	Yes
Aroclor-1260	1.0E-01	1.6E-03	NA	Yes
Dieldrin	1.3E-03	2.0E-04	1.6E-01	Yes
Lindane	7.4E-04	2.4E-03	9.5E-01	No
Chlordane	1.7E-03	9.0E-03	1.6E+00	No

RBC = risk-based concentration

¹Fish RBC values represent risk-based concentrations calculated for subsistence

TABLE 2
Estimated Concentrations in Level 4 Fish Species at Site 40

Constituents	Measured Conc. in Prey Fish (mg/kg)	TTC¹	Estimated Conc. in Level 4 Fish with SFF² = 0.64 (mg/kg)
4,4'-DDD	3.8E-03	3.254	7.9E-03
4,4'-DDE	1.2E-02	3.602	2.8E-02
Aldrin	6.6E-04	1.006	4.2E-04
Aroclor-1260	1.0E-01	3.733	2.4E-01
Dieldrin	1.3E-03	1.063	8.8E-04
Lindane	7.4E-04	1.021	4.8E-04
Chlordane	1.7E-03	1.999	2.2E-03

¹TTC = trophic transfer coefficient from USEPA, Draft Water Quality Criteria Methodology Revisions: Human Health, Federal Register, August 14, 1998.

²SFF = Site Foraging Factor; assuming Site 40 is preferred twice as much as other areas

TABLE 3
Calculation of Fraction of Total Site Area

Compound	Area Compound Identified in Sediment¹ (sq. ft.)	/	Total Site 40 Area¹ (sq. ft.)	=	Fraction Site 40 Contaminated
4,4'-DDD	559529	/	27309178	=	0.020
4,4'-DDE	1040046	/	27309178	=	0.038
Aldrin	14428	/	27309178	=	0.001
Aroclor-1260	2010467	/	27309178	=	0.074
Dieldrin	6755346	/	27309178	=	0.247
Lindane	5938125	/	27309178	=	0.217
Chlordane	2391993	/	27309178	=	0.088

¹ Total Site 40 Area and Area Compound Identified in Sediment obtained from the 1999 Site 40 Remedial Investigation.

² Fractions were increased by 100% to account for uncertainty in prey fish mobility; fra

TABLE 4
Calculation of Chronic Daily Intakes of Constituents in Fish Tissue:
Carcinogenic Effects

Constituents	Concentration In Level 4 Fish (mg/kg)	Ing. Rate Fish Advisory Child - rec 95	Ing. Rate Adult rec 95	Fraction of Successful Fishing	FC/Area	CDI rec 95 Adult with no advisory	CDI for Carcinogenic Effects (mg/kg-day)	
							Based on LWA health advisory fish intake rate	Based on adult fish intake rate
4,4'-DDD	7.9E-03	8.0E-03	2.6E-02	3.0E-01	4.1E-02	1.5E-08	5.1E-09	1.5E-08
4,4'-DDE	2.8E-02	8.0E-03	2.6E-02	3.0E-01	7.6E-02	9.6E-08	3.3E-08	9.6E-08
Aldrin	4.2E-04	8.0E-03	2.6E-02	3.0E-01	1.1E-03	2.1E-11	7.0E-12	2.1E-11
Aroclor-1260	2.4E-01	8.0E-03	2.6E-02	3.0E-01	1.5E-01	1.6E-06	5.5E-07	1.6E-06
Dieldrin	8.8E-04	8.0E-03	2.6E-02	3.0E-01	4.9E-01	2.0E-08	6.9E-09	2.0E-08
Lindane	4.8E-04	8.0E-03	2.6E-02	3.0E-01	4.3E-01	9.6E-09	3.3E-09	9.6E-09
Chlordane	2.2E-03	8.0E-03	2.6E-02	3.0E-01	1.8E-01	1.7E-08	6.0E-09	1.7E-08

RME = reasonable maximum exposure

LWA = lifetime weighted average, based on the 2003 FDEP fish advisory for limited consumption (8oz fish/4 weeks ~ 0.008 kg/day)

Adult only fish tissue intake rate is 0.026 kg/day (USEPA, 1997)

FC/Area = fraction of contaminated area; See Table 3

CDI = chronic daily intake

rec 95 = recreational RME estimate

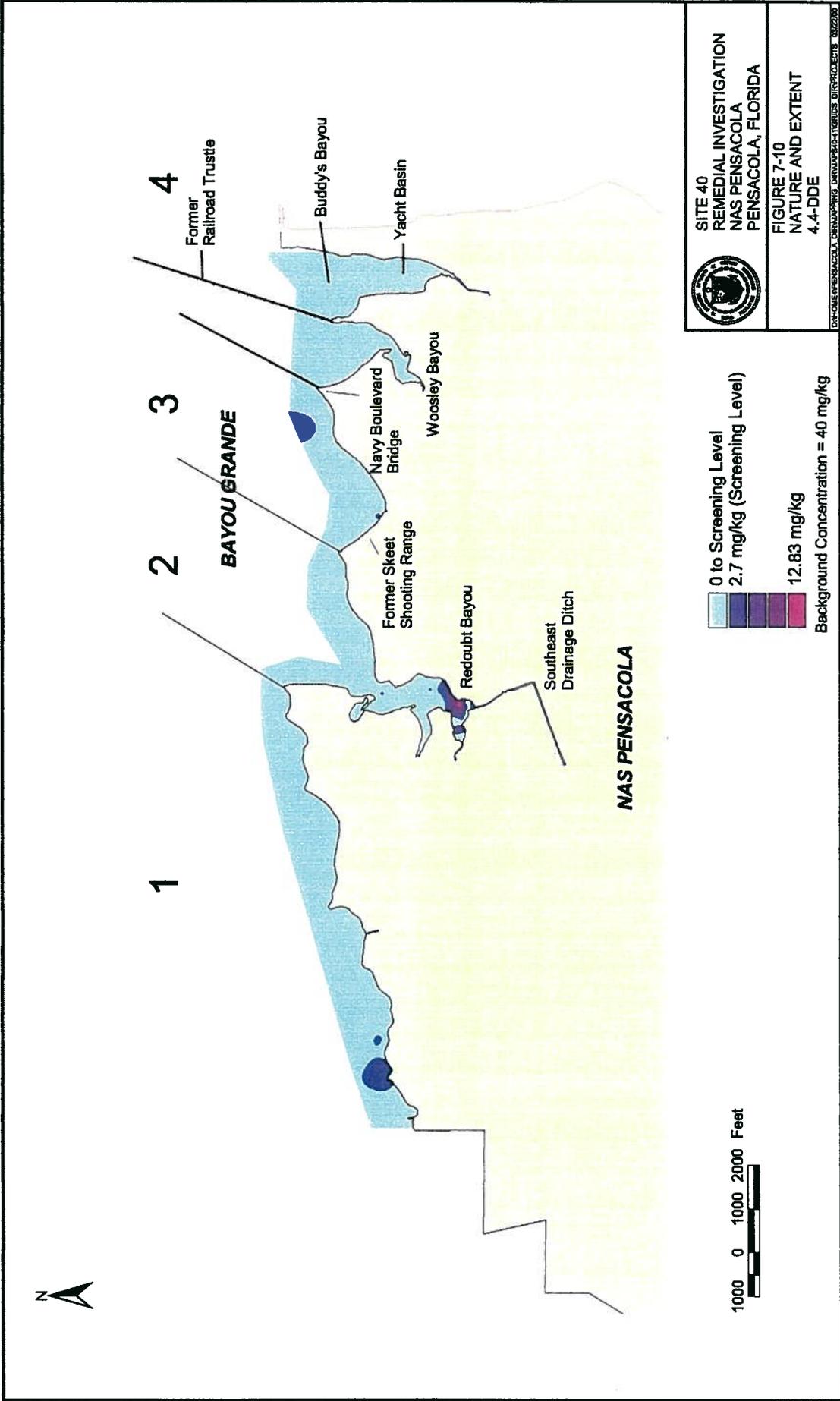
TABLE 5
Summary of Risk Characterization Results: Carcinogenic Effects

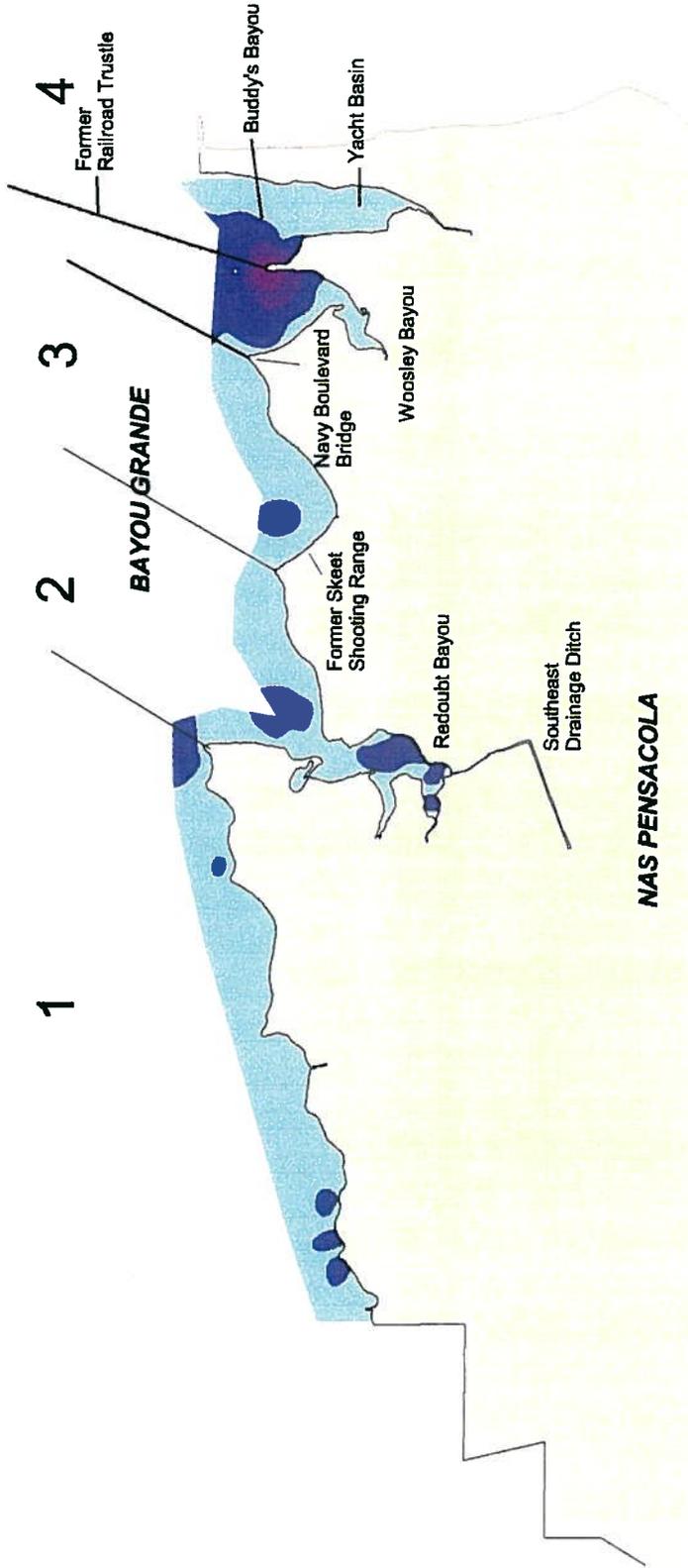
Constituents	CDI (mg/kg-day)			Carcinogenic Risk	
	Recreational Fishermen			Recreational Fishermen	
	Based on LWA health advisory fish intake rate	Based on adult fish intake rate	Oral Slope Factor (mg/kg-day) ⁻¹	Based on LWA health advisory fish intake rate	Based on adult fish intake rate
4,4'-DDD	5.1E-09	1.5E-08	2.4E-01	1.2E-09	3.6E-09
4,4'-DDE	3.3E-08	9.6E-08	3.4E-01	1.1E-08	3.3E-08
Aldrin	7.0E-12	2.1E-11	1.7E+01	1.2E-10	3.5E-10
Aroclor-1260	5.5E-07	1.6E-06	2.0E+00	1.1E-06	3.2E-06
Dieldrin	6.9E-09	2.0E-08	1.6E+01	1.1E-07	3.2E-07
Lindane	3.3E-09	9.6E-09	1.3E+00	4.3E-09	1.3E-08
Chlordane	6.0E-09	1.7E-08	3.5E-01	2.1E-09	6.1E-09
			Total =	1E-06	4E-06

LWA = lifetime weighted average
 CDI = chronic daily intake

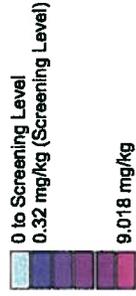
Attachment 1

**Figures Used to Estimate the Fraction
Contaminated Area Within the Site 40 Area**





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SITE 40
REMEDIAL INVESTIGATION
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FIGURE 7-14
NATURE AND EXTENT
GAMMA-BHC (LINDANE)

ENVIRONMENTAL PROTECTION AGENCY (EPA) REGION 4 OFFICE, PENSACOLA, FLORIDA

