U.S. NAVY OCEAN DUMPING PROGRAM

PETITION TO EPA TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT FROM UNREASONABLE RISKS ASSOCIATED WITH THE NAVY'S SINKING EXERCISE PROGRAM (SINKEX)

SUBMITTED BY:

BASEL ACTION NETWORK
SIERRA CLUB
AND
CENTER FOR BIOLOGICAL DIVERSITY

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TABLE OF CONTENTS

PETITION TO EPA: REQUEST FOR ACTION

The Basel Action Network, Sierra Club, and Center for Biological Diversity petition the U.S. Environmental Protection Agency (EPA) to take immediate action to protect human health and the marine environment from polychlorinated biphenyls (PCBs) that leach from ships sunk through the Navy's sinking exercise (SINKEX) program as required by the Marine Protection, Research and Sanctuaries Act (MPRSA)[1] and the Toxic Substances Control Act (TSCA).[2] Specifically, pursuant to the petition provisions of the Administrative Procedure Act[3] and TSCA,[4] the Basel Action Network, Sierra Club, and Center for Biological Diversity request that EPA amend the existing MPRSA permit for SINKEX or, in the alternative, enact TSCA rules:

1. **Effective immediately, requiring all PCB-contaminated materials in concentrations of 50 parts per million or greater to be removed from SINKEX vessels prior to sinking;**
2. **Requiring all PCB-contaminated materials in concentrations of less than 50 parts per million to be removed from SINKEX vessels prior to sinking to the maximum extent practicable; and**
3. **Requiring additional studies to determine whether PCB-contaminated materials in concentrations of less than 50 parts per million constitute "trace" contaminants, such that their dumping will not cause undesirable effects including the possibility of bioaccumulation. Such additional studies should include the most recent data on the toxicity, persistence, and bioaccumulation of PCBs and should include monitoring at multiple recent sink sites. Studies should also assess the releases of other potentially hazardous pollutants into the marine environment from the SINKEX program including heavy metals, asbestos and radioactive substances.**

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[1] 33 U.S.C. §§ 1401–45.

[2] 15 U.S.C. §§ 2601–92.

[3] 5 U.S.C. § 553(e).

[4] 15 U.S.C. § 2620(a).

EXECUTIVE SUMMARY

The Navy's SINKEX program allows the Navy to fire on inactive naval warships to practice gunnery and torpedo accuracy, while also disposing of unwanted ships at sea. From 1970-1999 SINKEX accounted for only 8% of all Navy vessel disposals, but from 2000-2010 it accounted for 65% of all disposals. Ocean disposal of obsolete vessels via SINKEX is deemed a cost-effective disposal strategy by the Federal government and is permitted by a series of exemptions from existing environmental laws. EPA acknowledges that these vessels are sunk while still containing toxic materials within their composition, including asbestos, polychlorinated biphenyls (PCBs), iron, lead paint and antifouling paint, yet EPA allows exemptions for SINKEX to various ocean dumping laws that would normally forbid the ocean disposal of such contaminants. These exemptions are contrary to the requirements of the MPRSA and TSCA and ignore obligations under international law.

The negative health and environmental impacts of PCBs are well-known. PCBs are persistent bioaccumulative chemicals that have demonstrated carcinogenic and non-carcinogenic effects on animals and humans. PCBs are non-flammable and chemically stable, so after they are released into the environment they persist for many years.[5] Due to their longevity as a molecule, and their capacity to be attracted to fatty tissue and accumulate in the marine food chain, PCBs are perhaps the greatest concern of all shipboard contaminants. PCBs bind to sediments, bioaccumulate in fish and other animals, and biomagnify in the food chain, creating hazards at all levels.

New information has demonstrated that PCBs on sunk vessels in concentrations and materials allowed by the SINKEX program are released into the environment after sinking and pose substantial and unreasonable risks to human health and the marine environment. First, a number of ships have been sunk in U.S. waters for the purpose of reef-building. Recently

[5] U.S. EPA. PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures (1996). EPA/600/P-96/001F(1996) *available at* http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=12486

released data on fish tissue levels of PCBs at one of these sites compared to a reference reef of concrete indicate that the reefed ship is likely a source of substantial PCB pollution in fish. This data also indicates that the amount of PCBs on sunken vessels likely exceeds by a very large amount the amount assumed at the time the current exemptions for SINKEX were granted. Second, the only real-world monitoring study on which the existing MPRSA permit and TSCA waiver are based is outdated and significantly limited, and is further undermined by the more recent results from the artificial reef study. Third, the models upon which existing estimates of PCB leaching from SINKEX ships are based are overly simplified and do not include complex features of the ecological system, including water density layering, localized currents, upwellings and sedimentation. All of these features can be and are affected by the presence of a large sunken ship which may in fact dominate the local hydrography. Considering the latest data, the current state of knowledge concerning the persistent toxic effects of PCBs, and the available information about ecosystem functions, the SINKEX program is not currently operating in a manner that adequately protects the marine environment and human health. The existing MPRSA permit, and the lack of TSCA regulation, are inadequate and contrary to law.[6]

Accordingly, BAN, Sierra Club, and Center for Biological Diversity hereby petition EPA to amend the existing MPRSA permit to require removal of all materials containing PCBs to the maximum extent practicable <u>and</u> to require that no disposed materials contain PCBs in concentrations greater than 50 parts per million. In the alternative, BAN, Sierra Club, and Center for Biological Diversity petition EPA to enact rules governing the marine disposal of PCBs via the SINKEX program that likewise requires removal of all materials containing PCBs to the maximum extent practicable <u>and</u> to require that no disposed materials contain PCBs in concentrations greater than 50 parts per million.

Additionally, BAN, Sierra Club, and Center for Biological Diversity petition EPA to require additional studies to determine whether PCB-contaminated materials in concentrations

[6] Dr. Peter deFur, Environmental Stewardship Concepts, LLC (See Appendix)

of less than 50 parts per million constitute “trace” contaminants, such that their dumping will not cause undesirable effects including the possibility of bioaccumulation.[7] Such additional studies should include the most recent data on the toxicity, persistence, and bioaccumulation of PCBs and should include monitoring at multiple recent sink sites. Additional study is warranted in light of the shortcomings of the single study on which the current MPRSA permit and TSCA waiver are based and in light of the results of the recent data on PCB contamination from an artificial reef site in Florida.

Because the protections BAN, Sierra Club, and Center for Biological Diversity are requesting are required under both the MPRSA and TSCA, if EPA grants this petition and amends the MPRSA permit to be sufficiently protective of human health and the marine environment, then EPA should determine whether a continued exemption under TSCA based on the amended MPRSA permit is appropriate.

This petition is submitted pursuant to both the APA and TSCA: the request that EPA amend the MPRSA permit is submitted pursuant to the APA;[8] the request that EPA enact rules governing the marine disposal of PCBs is submitted pursuant to the citizen’s petition provision of TSCA;[9] and the request that EPA conduct additional studies is submitted pursuant to both the MPRSA and TSCA. Under the TSCA citizen’s petition provision, EPA must grant or deny this petition within 90 days.[10] In order to meet this requirement of TSCA, EPA should take steps to act on and amend the existing MPRSA permit within the timeframe proscribed by TSCA. If EPA fails to act in a timely manner under TSCA, BAN, Sierra Club, and Center for Biological Diversity may seek review of EPA’s failure to enact adequate regulations under TSCA.

[7] *See* 40 C.F.R. § 227.6.

[8] 5 U.S.C. § 553(e); *see also* 33 U.S.C. § 1414(d); U.S. EPA, Decision Memorandum: EPA Regulation of PCBs on Vessels Used for Navy Sinking Exercises (Sept. 7, 1999) (“The Office of Water is prepared to revise the Navy permit, or revoke it, in the event that the results offuI1her studies demonstrate an unexpected unacceptable risk to human health or the environment from SINKEX.”).

[9] 15 U.S.C. § 2620(a); *see also id.* §§ 2603, 2605.

[10] *Id.* § 2620(b)(3).

BACKGROUND

I. THE GENERAL PERMIT FOR SINKEX IS OUTDATED AND BASED ON INADEQUATE INFORMATION

In 1977, the EPA issued a general permit for SINKEX under section 102 of the Marine Protection, Research and Sanctuaries Act (MPRSA) that remained in effect for approximately twelve years.[11] In 1989, the Navy limited the SINKEX program when PCBs were discovered in various shipboard components because PCB disposal was a violation of the Toxic Substances Control Act (TSCA). The Navy worked with the EPA to develop a two-phase research program to assess the risks associated with the ocean disposal of PCBs through the SINKEX program and to seek an exemption from TSCA. These studies were conducted by the Navy rather than an independent third party. In March 1994, the Navy began an ecological assessment based solely on available literature on PCB solubility, temperature, and partitioning characteristics, to model the risks associated with PCB leaching and concluded that there was *"no notable threat to benthic organisms"*[12] resulting from sinking naval vessels at sea (hereinafter the *Modeling Study*).

Based on the results of this study, the Navy and EPA negotiated an agreement in 1996 in which the EPA would use its discretion not to enforce TSCA against SINKEX for a limited number of SINKEX vessels. Meanwhile, the Navy was required to conduct the *Sunken Vessel Study* to substantiate the findings of the 1994 *Modeling Study* with empirical data, again paid for by the agency seeking exemption.

In the Spring of 1999 the Navy presented an initial draft of the *Sunken Vessel Study* to the EPA suggesting there was a *"lack of evidence of unreasonable risk to human health or the environment"* from SINKEX. This study assessed the impacts of a single SINKEX vessel, the Ex-AGERHOLM, 16 years after the vessel's 1982 sinking, on the basis of sediment samples taken

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[11] This permit is codified at 40 C.F.R § 229.2.

[12] U.S. EPA, Decision Memorandum: EPA Regulation of PCBs on Vessels Used for Navy Sinking Exercises(Sept. 7, 1999).

at three intervals and a PCB leachability laboratory study based on these sediment samples.[13] Significant uncertainties in that study, however, render problematic any attempt to draw broad conclusions from this single study.

In September 1999, under pressure from the Navy, the EPA Administrator reinstated the SINKEX program under a general permit authorized under the MPRSA and determined that PCBs on SINKEX vessels should be regulated solely under the MPRSA, rather than both TSCA and MPRSA. This determination was made under the authority of section 9(b) of TSCA, which provides that if the Administrator determines that a risk to health or the environment associated with a chemical substance or mixture could be eliminated or reduced to a sufficient extent by actions taken under the authorities contained in other federal laws, the Administrator shall use those authorities to protect against such risk unless he determines it is in the public interest to take action under TSCA. Under this authority, the Administrator exempted SINKEX from TSCA, under the assumption that SINKEX could adequately be regulated solely under MPRSA. EPA concluded: *"We believe there is no public interest in regulating the transportation and disposal of PCBs associated with SINKEX under TSCA…"*[14] SINKEX activities resumed in 1999 under the MPRSA general permit, with a full exemption from TSCA, and continues to operate in this fashion to this day.

II. THE MARINE DISPOSAL OF PCBS VIA SINKEX POSES SIGNIFICANT RISKS TO HUMAN HEALTH AND THE MARINE ENVIRONMENT.

A. PCBs Are A Highly Toxic And Pervasive Pollutant

PCBs (polychlorinated biphenyls) are mixtures of synthetic organic chemicals that are highly toxic and dangerous to human health: in a 1996 report, prepared at the direction of Congress, the U.S. Environmental Protection Agency (EPA) found that PCBs cause cancer in

[13] *See* Final Report: Risk Assessment of the Potential Release of PCBs and Other Contaminants from Sunken Navy Ships in the Deep Ocean: Ex-AGERHOLM Case Study (March 2006), *available at* http://www.navsea.navy.mil/teamships/Inactiveships/SINKEX/pdfs/SINKEX_Project_Final_Report_March%202006.pdf

[14] *Id.* (emphasis added).

animals and are probable carcinogens for humans. Other known significant ecological and human health effects of PCBs include neurotoxicity, reproductive and developmental toxicity, immune system suppression, liver damage, skin irritation, and endocrine disruption.[15] PCBs are non-flammable and chemically stable, so after they are released into the environment they persist for many years.[16] The manufacture of PCBs has been banned in the United States due to their highly toxic effects and persistence in the environment once released.[17] PCBs are also a persistent organic pollutant (POP) targeted for global phase-out and action under the Stockholm Convention.[18]

Due to their longevity as a molecule, and their capacity to be attracted to fatty tissue and accumulate in the marine food chain, PCBs are perhaps the greatest concern of all shipboard contaminants. PCBs bind to sediments, bioaccumulate in fish and other animals, and biomagnify in the food chain, creating hazards at all levels.[19] As a result, people who ingest fish may be exposed to dangerous levels of PCBs.[20] In fact, due to the toxin's accumulation properties, many scientists believe there is no safe level of exposure to PCBs.[21]

Higher trophic level (higher in the food chain) organisms such as fish-eating birds, omnivorous birds, and marine mammals are exposed to PCBs via their consumption of prey. Generally, the typical PCB levels increase by a factor of 10- to 100-fold when ascending major consumption levels in a food chain (Gobas et al. 1995). Specifically, Wasserman et al. (1979)

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[15] U.S. EPA, PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. EPA/600/P-96/001F, (1996), *available at* http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=12486.

[16] *Id.*

[17] *See* 15 U.S.C. § 2605(e).

[18] Annex A, Stockholm Convention on Persistent Organic Pollutants.

[19] U.S. EPA, Polychlorinated Biphenyls (PCBs) and You, EPA 910-F-99-001, *available at* http://yosemite.epa.gov/R10/TRIBAL.NSF/af6d4571f3e2b1698825650f0071180a/1e4f27736563fc3a882571db00661b15/$FILE/910-F-99-001PCBS.pdf

[20] U.S. EPA and U.S. Maritime Administration, National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs(May 2006) at 35, *available at* http://www.epa.gov/owow/oceans/habitat/artificialreefs/documents/0605finalreefguidance.pdf.

[21] U.S. EPA, Polychlorinated Biphenyls (PCBs) and You, EPA 910-F-99-001, *available at* http://yosemite.epa.gov/R10/TRIBAL.NSF/af6d4571f3e2b1698825650f0071180a/1e4f27736563fc3a882571db00661b15/$FILE/910-F-99-001PCBS.pdf.

reported that for marine food webs, zooplankton range from < 0.003 μg/g to 1 μg/g, whereas top consumers, such as seals and fish, had ranges of PCB from 0.03 to 212 μg/g. Therefore, if PCBs are abundant in lower trophic levels, they will be amplified through the food chain to levels that can adversely affect higher trophic level organisms.[22]

The EPA has characterized PCBs as "mutation-causing, cancer-causing, and teratogenic [meaning they can interfere with normal embryonic development]."[23] The EPA notes *"PCBs have been shown to cause cancer in animals and have also been shown to cause a number of serious non- cancer health effects…including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects. Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs."*[24]

The Agency for Toxic Substances and Disease Registry[25] states that women who ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Other studies suggest that children's immune system was affected, most likely through exposure to PCBs in breast milk. Transfer of PCBs across the placenta has also been reported.

PCBs also have significant adverse effects on wildlife: the EPA has noted that effects on avian species include *"morbidity, tremors, upward pointing beaks, muscular incoordination, and hemorrhagic areas in the liver,"* as well as *"delayed reproduction and chromosomal aberrations in Ringed Turtle-doves; courtship and nestbuilding behavioral impairments in Mourning Doves; reduced hatchability in chicken eggs; and decline in sperm concentration in*

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[22] Dr. Peter deFur, Environmental Stewardship Concepts, LLC (See Appendix)

[23] U.S. EPA, Region 5 Superfund, Ecological Toxicity Information, *available at* http://www.epa.gov/reg5sfun/ecology/toxprofiles.htm

[24] U.S. EPA and U.S. Maritime Administration, National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs(May 2006) at 35 (emphasis added), *available at* http://www.epa.gov/owow/oceans/habitat/artificialreefs/documents/0605finalreefguidance.pdf.

[25] Agency for Toxic Substances & Disease Registry, Public Health Assessments and Health Consultations, Public Health Implications (A)(1)(a) (updated April 14, 2010), *available at* http://www.atsdr.cdc.gov/hac/pha/pha.asp?docid=1159&pg=2

American Kestrels."[26] Effects on aquatic organisms include *"growth reduction in algae and brook trout; reduced egg survival and reduced fertilization success in flounder, minnows, sea urchins (prior to fertilization, eggs were more resistant to PCBs at insemination and afterwards); and complete reproductive failure in brook trout. Cancer-causing effects and biochemical perturbations were observed in trout liver cells and marine fishes; with anemia, hyperglycemia, and altered cholesterol metabolism in brown trout fed diets with 10 PPM PCBs."*[27] PCBs have been implicated in: reduced primary productivity in phytoplankton, reduced hatchability of contaminated fish and bird eggs, reproductive failure in seals, reproductive impairment in fish, and reduced fertilization efficiency in sea urchins.[28]

B. PCBs From Sunk Vessels Leach Into The Marine Environment

A recent study of the EX-ORISKANY demonstrates that PCBs on sunken vessels leach into the marine environment at levels that pose a significant risk to human health and the marine environment. The EX-ORISKANY was sunk off the coast of Florida in 2006 after remediation, including removal of some PCBs. All liquid PCBs were removed from the vessel prior to sinking, but some solid PCBs were left on board because their removal was not deemed practicable. Environmental remediation left intact an estimated 722 pounds of solid PCBs found in approximately 362,240 pounds of electric cable insulation, 31,700 pounds of fiberglass bulkhead insulation and 284,044 pounds of contaminated paint all left onboard for sinking.[29] Some material, such as the electric cable insulation, sampled as high as concentrations of 19,000 parts per million PCBs, with an average concentrations of 1,500 parts per million PCBs.[30]

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[26] U.S. EPA, Region 5 Superfund, Ecological Toxicity Information, *available at* http://www.epa.gov/reg5sfun/ecology/toxprofiles.htm.

[27] *Id.* (citing U.S. EPA, Ambient Water Quality Criteria for Polychlorinated Biphenyls, EPA 440/5-80-068 (1980)).

[28] Adams, J.A. and S. Slaughter-Williams. 1988; Brouwer, A., et al 1989; Clark, R.B. 1992.;den Beston, et al 1991.

[29] J. Dodrill, K. Mille, B. Horn, & R. Turpin, Progress report summarizing the reef fish sampling, PCB analysis results and visual monitoring associated with the Oriskany Reef, a decommissioned former Navy aircraft carrier sunk in 2006 as an artificial reef in the Northeastern Gulf of Mexico off Pensacola, Florida (Apr. 13, 2011) at pp. 19-20.

[30] *Id.*

The Navy claimed that the estimated 680,000 pounds of PCB-contaminated material, existing in hundreds of compartments at various levels below the main deck, was not accessible unless the vessel was fully dismantled. Rather than dismantling and recycling the vessel at an approved domestic facility, the Navy identified remediation of these PCBs as cost-prohibitive and sought an exemption from the Toxic Substances Control Act (TSCA) via a risk-based disposal permit from EPA. The Navy developed the Prospective Risk Assessment Model (PRAM) and conducted a study at a cost of $3.74 million to illustrate a limited risk to human health and the environment from the ocean disposal of PCBs during the sinking of the vessel. The EPA granted the PCB risk-based disposal permit thereby allowing the EX-ORISKANY to be sunk with PCBs onboard.

The PCB remediation requirements for the EX-ORISKANY under the risk-based disposal permit were similar in scope to PCB remediation requirements for SINKEX vessels. All liquid PCBs were removed from the EX-ORISKANY prior to sinking, so all documented leaching is from solid PCBs where the removal of the PCB-contaminated material was not deemed practicable. Similarly, while the SINKEX general permit requires removal of liquid PCBs prior to sinking, the permit and related agreements provide that solid PCBs may be left on board if their removal is not practicable.[31]

Prior to the sinking of the EX-ORISKANY, the Navy and EPA modeled the PCB leach rates and identified an acceptable level they deemed safe for fish uptake and human consumption. To test their modeling assumptions, the EPA required a post-sinking monitoring program conducted by the Florida Fish and Wildlife Conservation Commission (FWC). According to data from the post-sinking monitoring program, PCB concentrations in fish caught at the EX-ORISKANY site are now more than twice that of the EPA's pre-sinking forecasted levels. 33% of all fish sampled post-sinking in the vicinity of the EX-ORISKANY had PCB

[31] *See* Agreement between Elsie L. Munsell, Deputy Assistant Secretary of the Navy, and Robert H. Wayland III, Director, EPA Office of Wetlands, Oceans, and Watersheds (Aug. 2, 1999).

concentrations above 20 parts per billion (ppb), the EPA screening level.[32] 21% of all fish sampled post-sinking had PCB concentrations above 50 ppb, the Florida Department of Health fish advisory threshold.[33] Total PCB concentrations in fish samples increased 1,446% on average from pre-sinking to post-sinking.[34]

Table 1: EX-ORISKANY Site Fish PCB Sampling: Pre-sinking vs. Post-sinking Concentrations 2006-2009

	Pre Sinking Site	Post Sinking Site
Red Snapper Samples	17	157
Red Snapper Mean PCB Concentration	2.36 ppb	54 ppb
Total Samples	62	180
Total Mean PCB Concentration	3.8 ppb	58.75 ppb
Total Fish Above 20 ppb (EPA Screening Level)	2*	60
Total Fish Above 50 ppb (Florida DoH Fish Advisory Threshold)	1*	38

**Gag and king mackerel – species not sampled post-sinking.*
Source: Table developed by author using data provided by Florida Fish and Wildlife Conservation Commission Post-Sinking Monitoring Study 2006-2009

There were also two sampling events in 2008 on a control reef (see Table 2). The control reef is a concrete bridge rubble reef that is 8 miles from the EX-ORISKANY site. The control reef samples were taken on the same days as the EX-ORISKANY samples in 2008. PCB concentrations in fish caught at the EX-ORISKANY site in 2008 were more than 932%, on average, higher than PCB concentrations in fish caught at the control reef.[35]

Table 2: Fish PCB Sampling: EX-ORISKANY Site vs. Control Reef Site 2008

	Control Reef 2008	ORISKANY Reef 2008
Red Snapper Samples	45	60
Red Snapper Mean PCB Concentration	7.6 ppb	55.22 ppb

[32] Dr. Peter deFur, Environmental Stewardship Concepts, LLC (See Appendix)

[33] *Id.*

[34] *Id.*

[35] *Id.*

Total Samples	61	61
Total Mean PCB Concentration	7.89 ppb	81.44 ppb
Total Fish Above 20 ppb (EPA Screening Level)	5	16
Total Fish Above 50 ppb (Florida DoH Fish Advisory Threshold)	0	12

Source: Table developed by author using data provided by Florida Fish and Wildlife Conservation Commission Post-Sinking Monitoring Study

These actual results from the Florida study stand in stark contrast to the Navy's pre-sinking estimates of the effects of the sinking, contained in the Final Report Ex-ORISKANY Artificial Reef Project Ecological Risk Assessment (PEO, 2006).[36] That pre-sinking assessment stated that the no effect threshold for total PCB would be exceeded only in dolphins, cormorants, and herring gulls. The study suggested PCB exposure levels posed no risks to plants, invertebrates, fishes, sea turtles, and sharks/barracudas that could live, feed, and forage on the reef. Further, the study concluded that due to the conservative estimates used in the analysis, "*it is very unlikely that potential risks were under estimated.*"[37] However, the Florida study found PCBs in the tissues of organisms associated with the reef and in the diet of reef consumers at levels more than twice that of the conservative estimates predicted by the Navy and EPA. These levels pose elevated risks to human health and the environment, and demonstrate that the Navy and EPA's pre-sinking assessments do not adequately anticipate these risks.

In fact, the Florida Department of Health (FDOH) considered issuing a fish consumption advisory for snapper caught at the EX-ORISKANY site prior to the June 1, 2010 opening of snapper fishing season. However, a fish consumption advisory was not released by FDOH because a Federal fishing closure was released in May as a result of the Deepwater Horizon Oil

[36] *See* Ecological Risk Assessment, Ex-ORISKANY Artificial Reef Project (Jan. 2006) at p.1-3, *available at* http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ada485008.

[37] *Id.* at p.1-4.

spill. Fishing was prohibited under Federal closure which encompassed the EX-ORISKANY site; therefore a PCB fish advisory was not deemed necessary. The facts leading FDOH to consider issuing a fish advisory (including elevated PCB concentrations above FDOH thresholds), however, indicate a serious risk to human health and the marine environment from PCB exposure.

In sum, the data from the EX-ORISKANY Post-Sinking Monitoring Program demonstrate that solid PCBs on sunken vessels do leach into the marine environment at levels that pose a significant risk to human health and the marine environment.

C. <u>PCBs May Be Transported From The Deep Ocean To Shallow Marine Ecosystems</u>

The Navy has long argued that PCB releases in the deep ocean from SINKEX vessels (6,000 feet or greater) do not pose adverse risks to marine life at that depth. The Navy has also suggested that the deep benthic environment has minimal chance of physical or biological transport to the shallow marine ecosystem. However, the EPA acknowledges the physicochemical properties of PCBs, including low solubility in water, very high bioconcentration factor, and very low degradation rates, which determine their behavior in the environment.[38] And because PCBs are very hydrophobic (readily come out of solution), persistent and highly lipophilic (partition into lipids and organic carbon) they readily adsorb onto particles and thus readily build up in the food chain (bio and geoaccumulation).[39] These known characteristics suggest there are at least three scientifically acknowledged modes of material transport from the deep ocean to shallow waters: Biographic Transport; Upwelling; and Meridional Circulation Overturning. The EPA itself recognizes that persistent organic pollutants (POPs) such as PCBs, *"circulate globally via the atmosphere, oceans, and other pathways,*

[38] D. Mackay, K.C. Ma, and W.Y. Shiu Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals, Vol. I:Monoaromatic Hydrocarbons, Chlorobenzens, and PCBs 697 (Lewis Publishers 1992).

[39] Oliver Froescheiset al, The Deep-Sea as a Final Global Sink of Semivolatile Persistent Organic Pollutants? Part I: PCBs in Surface and Deep-Sea Dwelling Fish of the North and South Atlantic and the Monterey Bay Canyon (California), 40 Chemosphere 6, March 2000, at 651–60.

POPs released in one part of the world can travel to regions far from their source of origin. Therefore, they are chemicals of both local and global concern."[40] Because PCBs persist in the environment for decades or more after they are released, PCBs circulated via any of these transport mechanisms may pose risks far into the future and even if these mechanisms work slowly to transport contaminants from depth.

1. Biographic Transport

Marine life that has taken up PCBs in deep water at the disposal site can transport PCB material via migration and predatory consumption to the shallow marine ecosystem, which can continue up the food chain to humans. Sunken SINKEX vessels typically rest in the bathylpelagic zone (1,000-4,000 meters). Biographically speaking, organisms from each zone have contact with organisms from the zone above and below, allowing for food transfer and PCB uptake through the water column. "*Undoubtedly, there is considerable trophic* [feeding] *interaction among these larger epipelagic fishes* [albacore, blue shark, swordfish, etc.] *and their meso- and bathypelagic counterparts during diel* [daily] *vertical migration."*[41]

Additionally, an assemblage of vertically migrating marine organisms called the Deep Scattering Layer (DSL), travel from the deep ocean to the shallows at night to feed where trophic interaction occurs.[42] DSLs have been recorded at all depths to 3,000 meters.[43]

The ocean food web is interconnected, with humans acting as quaternary [fourth layer] consumers (consuming tertiary consumers). PCB's ability to accumulate in the environment and in organisms means that organisms at higher trophic levels (higher in the food chain), such as humans, are at higher risk of toxic concentrations of PCBs than marine organisms themselves.[44]

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[40] U.S. EPA, U.S. Signs Treaty on POPs, OPPTS Tribal News, EPA 745-N-00-001, Vol. 3 No. 2 (2001), at 7 (emphasis added), *available at* http://www.epa.gov/oppt/tribal/pubs/TribalNewsletter1of2.pdf

[41] Monterey Bay National Marine Sanctuary Site Characterization,Biological Communities &Assemblages, Pelagic Zone , (A) Epipelagic Zone, http://montereybay.noaa.gov/sitechar/pelagic5.html (emphasis added).

[42] *Id.*

[43] A.F. Opdal, et al , Distribution, Identity, and Possible Processes Sustaining Meso- and baBhypelagic Scattering Layers on the Northern Mid-Atlantic Ridge (2007).

[44] Barnthouse, Glaser, Young, 2003

Marine mammals such as whales and dolphins are also at higher risk.

The conceptual model used by the Navy and MARAD to evaluate the human health and ecological risks of sunken warships suggests the deep sea community does not interact with the shallow marine ecosystem, and as such, they failed to recognize the realities of the ocean food web. In fact, PCB material can be transported great distances from the initial sink site via physical and biological means. PCBs and other hazardous materials left on SINKEX vessels are in no way contained to the dumping site.

2. Upwelling

The physical marine transport process called *upwelling* routinely moves materials from deep water to surface water.[45] Upwelling can occur in coastal regions as well as the open ocean,[46] and can be wind or tide-induced. Both types of upwelling do not typically occur in isolation, but rather coexist.[47]

Open ocean winds cause surface waters to diverge from a region (causing upwelling) or to converge toward some region (causing downwelling).[48] These movements are essential to stirring the ocean, delivering oxygen to depth, distributing heat, and bringing nutrients to the surface.[49]

Upwelling is a vital ecological process that delivers nutrients from the benthic zone (sea floor); however, this same process is also capable of delivering PCBs from sunken naval vessels to shallow waters.

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[45] M. Tomczak,.Upwelling Dynamics in Deep and Shallow Water, Shelf and Coastal Oceanography (1998), *available at* http://www.es.flinders.edu.au/~mattom/ShelfCoast/notes/chapter06.html

[46] NASA, Wind-Driven Surface Currants: Upwelling and Downwelling, Background, http://oceanmotion.org/html/background/upwelling-and-downwelling.htm

[47] M. Tomczak,.Upwelling Dynamics in Deep and Shallow Water, Shelf and Coastal Oceanography (1998), *available at* http://www.es.flinders.edu.au/~mattom/ShelfCoast/notes/chapter06.html.

[48] NASA, Wind-Driven Surface Currants: Upwelling and Downwelling, Background, http://oceanmotion.org/html/background/upwelling-and-downwelling.htm.

[49] Tazmanian Aquaculture and Fisheries Institute, Upwelling and Downwelling in the Ocean, http://www.redmap.org.au/resources/impact-of-climate-change-on-the-marine-environment/upwelling-and-downwelling

Coastal upwelling occurs when wind blows parallel to the coast, deflecting surface water away from the coastline (Ekman Transport) as influenced by the Coriolis effect (Earth's rotation). Surface water is pushed offshore and is replaced by cool, nutrient-rich water from the deep ocean.[50] This process is also capable of delivering PCBs from sunken naval vessels to shallow waters, yet upwelling has not been assessed by the Navy as a material transport risk.

3. Meridional Circulation Overturning

Deep ocean currents and water circulation produces dynamic uplift capable of delivering sediments, to which PCBs adhere, to surface waters on a global scale. Traditionally, this is known as Meridional Circulation Overturning, in which currents driven by wind, thermohaline [salinity and temperature interactive] circulation, and atmospheric conditions transport deep water to shallow water.[51] Similar to upwelling, this naturally occurring ocean circulation has not been assessed by the Navy as a potential PCB transport mechanism from sunken naval vessels.

D. Past Navy Studies Finding No Risk From PCBs On SINKEX Vessels Have Been Discredited Or Conclusively Contradicted

To date only a single SINKEX vessel – the Ex-AGERHOLM – has been the subject of any significant post-sinking monitoring or study to assess whether and how PCBs are leaching from sunk vessels and harming the marine environment, but the scope of this study was limited in critical respects. First, the Navy did not sample the vessel for PCBs prior to sinking; rather, they carried out a source characterization study in 1998 to estimate the volume of PCBs left onboard in 1982 during sinking, and estimated a range of anywhere from 12 pounds to 80 pounds of PCBs.[52] Second, the study investigates leaching at only a single vessel, despite the fact that at the planning stages of the study a scientific review panel advised that it would be necessary to

[50] NASA, Wind-Driven Surface Currants: Upwelling and Downwelling, Background, http://oceanmotion.org/html/background/upwelling-and-downwelling.htm.

[51] NASA, Ocean Life Depends on Single Circulation Pattern In Southern Hemisphere (Dec. 31, 2003), http://earthobservatory.nasa.gov/Newsroom/view.php?id=24124

[52] *See* Final Report: Risk Assessment of the Potential Release of PCBs and Other Contaminants from Sunken Navy Ships in the Deep Ocean: Ex-AGERHOLM Case Study (March 2006) at 2-9 to 2-11, *available at* http://www.navsea.navy.mil/teamships/Inactiveships/SINKEX/pdfs/SINKEX_Project_Final_Report_March%202006.pdf.

investigate multiple sites.[53] At that time, the Ex-AGERHOLM was the only sunken vessel that could be located; however, since 1997 the Navy has documented all sunk vessels with precise latitude and longitude coordinates, making it fairly easy to locate a target vessel to conduct additional assessments now. Finally, the study does not address whether and how leaching occurred in the initial 16 years following sinking. Based on the samples taken 16 years after the vessel's sinking, however, the study found that PCB concentrations in sablefish at the site were higher than sablefish sampled at reference locations, and sediment samples taken from close to the ship had PCB concentrations twice as high as samples taken at a greater distance.[54]

Dr. Peter deFur, an independent environmental scientist with expertise in ecological risk assessment, conducted a thorough review of the studies the Navy relied on to support their "no unreasonable risk" conclusions from PCBs on sunken naval vessels. He found critical faults and limitations in the Navy's conclusions, including a reliance on base assumptions that are outdated and do not take into consideration the current scientific understanding of PCBs in the marine environment. Dr. deFur suggests that PCBs, once introduced to a system, continuously cycle through, become bioavailable, and bioaccumulate up the food chain. The only remedy is to limit or prevent their introduction to the marine environment. His general comments and conclusions are summarized in this section, and his direct comments are included in the Appendix to this document.

The studies conducted on the Ex-ORISKANY prior to sinking analyzed the risks associated with sinking in shallow water ecosystems via artificial reefing; these studies are the most recent and thorough pre-sinking assessments of any sunken naval vessel. Further, the Ex-ORISKANY is the only sunken naval vessel in which there exists both pre-sinking assessments as well as reliable post-sinking fish data to measure the accuracy of the pre-sinking conclusions. Dr. deFur suggests the basic processes behind leaching of toxic chemicals and subsequent

[53] *Id.* at 1-19.

[54] *Id.* at 1-17.

movement into the food web, with harmful consequences to the environment and human health, are not affected by sink depth such that less protective measures can be afforded vessels sunk in deeper waters through SINKEX. For this reason, the Ex-ORISKANY serves as a critical example of PCB leach rates in real marine environments (not modeled) from sunken naval vessels, regardless of sink depth. Dr. deFur concludes that the release of PCBs from ships such as the Ex-ORISKANY causes an unacceptable risk to human health and the marine environment. Further, he concludes that based on the recent data for PCB levels in fish tissue at the Ex-ORISKANY reef site and a control reef, general permitting under MPRSA for SINKEX underestimates the impact of PCBs found in solid materials left on-board a vessel for sinking.

The Ex-AGERHOLM remains the only SINKEX vessel studied by the Navy and EPA via the *Sunken Vessel Study*, the conclusions of which relied on sediment samples taken at three intervals 16 years after sinking and a PCB leachability laboratory study based on these sediment samples. Dr. deFur suggests the *Sunken Vessel Study* does not provide adequate data for building a sediment-based hydrological model for ships sunk under SINKEX or in other waters that are in fundamentally different hydrological and oceanographic regions. Indeed, the Navy relied on the Ex-AGERHOLM sediment data to develop leach rate studies to predict leaching from the Ex-ORISKANY—and, as discussed above, the "conservative" pre-sinking estimates of PCB leach rates from the Ex-ORISKANY substantially underestimated the actual leach rates as established by post-sinking monitoring. This now-discredited sediment data was the primary scientific support for EPA's decision to issue the SINKEX general permit and to waive TSCA's otherwise applicable requirements.

While the post-sinking Ex-ORISKANY findings clearly suggest the EX-AGERHOLM sediment data and modeling studies have serious faults, new evidence suggests sediment data is not even an accurate measure for PCB impacts on the marine food chain. In the *PCB Strategy for the Commonwealth of Virginia* created by the Virginia Department of Environmental Quality (2005), a subgroup was formed to develop screening levels and cleanup levels for PCBs in soils and sediments. The purpose of the screening levels is to help prioritize PCB contaminated sites, but the subgroup cautioned against relying solely on the soil and sediment screening levels alone:

"… the subgroup recognized that the risk-based screening levels would likely be too low to be an effective prioritization tool. The risk-based approaches confirmed that very low levels of PCBs (1.8 to 49 ppb) in sediments could result in elevated fish tissue concentrations" (VA DEQ, 2005)

Further, the subgroup notes that in many cases, the small sample size may account for the lack of elevated sediment data. The hitting or missing of PCBs during sediment collection is a reality in the sediment risk-based approach. In addition to other problems with that study, reliance on the Sunken Vessel Study may have led EPA and the Navy to underestimate risks both because sediment sample collection may not capture actual PCB levels and because PCB levels in sediments may not be an accurate proxy for effects on marine life.

Also, because PCBs bioaccumulate as well as biomagnify up the food chain, high PCB levels in marine sediments are not necessary for the presence of higher PCB levels in fish. The data collected in the Virginia Department of Environmental Quality Fish Tissue and Sediment Monitoring program show that there is often no direct correlation between sediment levels and fish tissue levels. The subgroup also concludes that local conditions may be such that the low levels of PCBs that do occur in the sediments are bioavailable (VA DEQ, 2005).

In sum, there is substantial recent evidence supporting the conclusion that PCBs on board sunken SINKEX vessels pose unreasonable risks to human health and the marine environment. PCB (and other toxic chemical) remediation needs to be based on leaching, toxicology, persistence and accumulation and other scientific matters, no matter the purpose of the sinking. There is little to no difference in PCB bioavailability between deep sea and shallow waters because the same chemical, physical and biological mechanisms operate in all cases. In both cases, corrosion and breakdown of the vessel will occur over time, making all of the PCB containing solid materials biologically available through water and sediment uptake.

The factors that form the basis for determining the risks of PCBs have developed substantially in recent years, providing data on toxicity, persistence, and bioaccumulation that was simply not available 30 years ago—yet the current SINKEX permit, and lack of TSCA regulation, is based on studies and data that are outdated and demonstrably inaccurate. Because the breakdown processes and bioavailability of PCBs are similar whether a vessel is sunk in shallow or deep ocean waters, studies used to regulate PCBs on vessels used for artificial reefs apply to setting standards for regulating PCBs on vessels used in the SINKEX program. All of the above evidence shows that the current SINKEX permit standards are inadequate and should be revised.[55]

III. FEDERAL AND INTERNATIONAL LAW STRICTLY REGULATE THE DISPOSAL OF PCBS IN THE MARINE ENVIRONMENT

A. Federal Law Requires EPA To Protect Human Health And The Marine Environment From PCB Contamination.

1. *Federal Law Governing Ocean Dumping*

The MPRSA was passed in 1972 to curtail the practice of ocean dumping, particularly the ocean dumping of highly toxic substances.[56] Accordingly, the MPRSA generally prohibits all ocean dumping unless authorized by permit issued pursuant to the Act.[57] The EPA Administrator may issue a permit for ocean dumping if she finds that the proposed dumping *"will not unreasonably degrade or endanger"* human health or the marine environment.[58] Additionally, the MPRSA provides that the Administrator shall review permits periodically and

[55] Dr. Peter deFur, Environmental Stewardship Concepts, LLC (See Appendix)

[56] 33 U.S.C. § 1401; S. Rep. 92-451 (Nov. 12, 1971).

[57] *Id.* § 1411.

[58] *Id.* § 1412(a).

may revoke them if she finds that the dumping is no longer consistent with the criteria she must consider in approving permits initially.[59]

The MPRSA provides specific criteria that the Administrator shall consider in determining whether to issue a permit for ocean dumping, including:

> (A) The need for the proposed dumping.
>
> (B) The effect of such dumping on human health and welfare, including economic, esthetic, and recreational values.
>
> (C) The effect of such dumping on fisheries resources, plankton, fish, shellfish, wildlife, shore lines and beaches.
>
> (D) The effect of such dumping on marine ecosystems, particularly with respect to—
>
> (i) the transfer, concentration, and dispersion of such material and its byproducts through biological, physical, and chemical processes.
>
> (ii) potential changes in marine ecosystem diversity, productivity, and stability, and
>
> (iii) species and community population dynamics.
>
> (E) The persistence and permanence of the effects of the dumping.
>
> (F) The effect of dumping particular volumes and concentrations of such materials.
>
> (G) Appropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest.
>
> (H) The effect on alternate uses of oceans, such as scientific study, fishing, and other living resource exploitation, and non-living resource exploitation.[60]

The regulations implementing the MPRSA further elaborate on the criteria the Administrator will consider in determining whether to grant a permit for ocean dumping.[61] Specifically, the regulations provide that *"known carcinogens, mutagens, or teratogens or materials suspected to be carcinogens, mutagens, or teratogens by responsible scientific*

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[59] *Id.* § 1414(d); *see also* 40 C.F.R. § 223.2–223.5 (procedure for limiting or revoking permits).

[60] *Id.* § 1412(a).

[61] 40 C.F.R. pt. 227.

opinion" will not be approved for ocean dumping unless they are only present as *"trace"* contaminants, defined as *"such forms and amounts [of the pollutants] that the dumping . . . will not cause significant undesirable effects, including the possibility of danger associated with their bioaccumulation in marine organisms."*[62]

2. Federal Law Governing Toxic Substances

TSCA authorizes the U.S. Environmental Protection Agency (EPA) to regulate chemical substances that pose an unreasonable risk of injury to health or the environment,[63] and to require additional testing of substances if there is not enough information to determine whether the use, distribution, or disposal of a substance poses an unreasonable risk.[64] Unlike most chemical substances, which the Administrator must list before regulating, the Act itself singles out PCBs for regulation. The PCB provision, section 6(e) of the Act,[65] contains strict requirements intended to phase out entirely the manufacture and use of PCBs in the United States, and contains broad prohibitions on the manufacture, processing, commercial distribution, and use of PCBs. Section 6(e) also requires the Administrator to issue rules requiring PCBs to be marked with *"clear and adequate warnings."*[66] Section 6(e) also requires the Administrator to issue rules prescribing methods for the disposal of PCBs.[67] Accordingly, EPA has enacted extensive rules governing domestic disposal of PCBs.[68] Additionally, EPA has banned the export for disposal of PCBs in concentrations greater than 50ppm without an exemption.[69]

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[62] 40 C.F.R. § 227.6(a)–(b).

[63] 15 U.S.C. § 2605(a).

[64] *Id.* § 2603.

[65] *Id.* § 2605(e).

[66] *Id.* § 2605(e)(1)(B).

[67] *Id.* § 2605(e)(1)(A).

[68] 40 C.F.R. § 761.50.

[69] Id. § 761.97; *see also id.* § 761.20(c)(3) (authorizing distribution in commerce for the purposes of export for disposal if conducted in accordance with the disposal rules).

As discussed above, TSCA contains a waiver provision allowing EPA to waive TSCA's applicability when another federal law adequately protects against the risks posed by a toxic substance.[70] TSCA also contains a specific citizen petition provision; under this provision, EPA must respond to all petitions for rulemaking, such as this one, within 90 days, and EPA's denial of such a petition is afforded particularly searching judicial review.[71]

B. International Law Governing Ocean Dumping

1. London Convention

The United States is a party to the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (also known as the London Convention), which imposes restrictions on the deliberate ocean disposal of waste material. The Convention aims " . . . *to prevent the pollution of the sea by the dumping of waste and other matter that is liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea*."

The act of sinking vessels at sea for the purpose of disposal is considered *ocean dumping* under the provisions of the Convention: "*Dumping has been defined as the deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures, as well as the deliberate disposal of these vessels or platforms themselves.*"[72] The Convention offers an exception to this definition when *"placement of matter serves an alternative purpose other than mere disposal thereof, provided that such placement is not contrary to the aims of this Convention."*

In other words, the act of sinking vessels at sea for the purpose of disposal is not considered ocean dumping if the sunken vessel serves an alternative purpose and provided that

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[70] 15 U.S.C. § 2608.

[71] *Id.* § 2620(b)(3).

[72] *Id.*

alternative purpose does not create a hazard to human health, living resources and/or marine life, damages amenities or interferes with other legitimate uses of the sea.

The 1996 London Protocol which the U.S. has not ratified but has signed (showing agreement and intent to ratify) acts as an amendment to the London Convention and goes further in its aim to eliminate ocean dumping. It allows an exception for vessels to be dumped only if contaminants have been *"removed to the maximum extent."* Further, the London Protocol calls on Parties to make decisions on such exceptions to be decided based on the Precautionary Principle and the principle against transferring harm from one part of the environment to another.[73]

2. Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants is a global treaty created to protect human health and the environment from persistent organic pollutants (POPs).[74] More than 100 countries negotiated this treaty in 2001, with the U.S. playing a leading role in pushing for international action to ban or severely restrict the production, use, sale and/or release of these chemicals.[75] The U.S. has not as yet ratified the Convention, but this is expected during the Obama Administration.

Of the twelve chemicals initially named in the Convention, nine chemicals are listed in Annex A with the intent for global elimination, including PCBs.[76] The Convention is unequivocal in its mandate that Annex A chemicals, such as PCBs, must be destroyed or irreversibly transformed so that they no longer exhibit the characteristics of POPs.

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[73] *Id.*

[74] Stockholm Treaty, *available at* http://www.pops.int/documents/convtext/convtext_en.pdf

[75] U.S. EPA, U.S. Signs Treaty on POPs, OPPTS Tribal News, EPA 745-N-00-001, Vol. 3 No. 2 (2001), *available at* http://www.epa.gov/oppt/tribal/pubs/TribalNewsletter1of2.pdf.

[76] Annex A, Stockholm Convention on Persistent Organic Pollutants.

Article 6 (1) (d) of the Convention provides that each Party must:

"Take appropriate measures so that such wastes, including products and articles upon becoming wastes, are . . .

(ii) Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards, and guidelines, including those that may be developed pursuant to paragraph 2, and relevant global and regional regimes governing the management of hazardous wastes."

The Basel Convention was tasked with developing guidelines on PCB disposal, and in particular, setting low POP content levels to work cooperatively with the Stockholm Convention. The guidelines identify PCB concentrations of 50 ppm to be detrimental and should therefore require the destruction or irreversible transformation prior to disposal. However, the U.S. SINKEX program allows the dumping of vessels containing PCBs in concentrations above that Stockholm Convention disposal level.

3. Convention on the Organization for Economic Co-operation and Development (OECD)

On December 14, 1960, 20 nations adopted the Convention on the Organization for Economic Co-operation and Development (OECD Guidelines for Multinational Enterprises) to promote a global market economy.[77] Today, the OECD is composed of 31 of the most developed nations in the world; the U.S. being one of the original members.[78]

In order to achieve its goals, the OECD can promulgate decisions that are generally binding on its members.[79] OECD Decision C(87)2/Final focuses specifically on the disposal of

[77] OECD Guidelines for Multinational Enterprises, *available at* http://www.oecd.org/dataoecd/56/36/1922428.pdf
[78] *Id.*
[79] *Id.*

PCBs and recommends that member countries, as far as practicable, ensure that disposal of PCB containing waste is carried out in a manner that avoids the release of PCBs into the environment.[80] The U.S. fails to respect this recommendation in good faith by permitting the ocean disposal of PCBs that remain in naval vessels during and after sinking.

IV. EPA IS VIOLATING FEDERAL AND INTERNATIONAL LAW BY ALLOWING THE MARINE DISPOSAL OF PCBS VIA SINKEX.

A. The SINKEX General Permit Fails To Protect Human Health And The Marine Environment And Is Inconsistent With The MPRSA Criteria

EPA has issued a MPRSA general permit authorizing SINKEX dumping by the Navy.[81] The general permit requires the Navy, prior to sinking, to *"remove to the maximum extent practicable all materials which may degrade the marine environment."*[82] A letter of agreement between EPA and the Navy in 1999 details how this requirement applies specifically to PCBs, namely what specific steps are considered *"practicable"* with regards to removal of PCBs in various locations on vessels. While some major PCB items must be removed – e.g., transformers and capacitors – other items, such as bonded felt gaskets and bulkhead insulation, are left in place:

> *when [PCB] objects cannot be practicably removed or their removal threatens the structural integrity of the vessels so as to impede the SINKEX, the Navy may leave such items in place (e.g, felt materials that are bonded in bolted flanges or mounted under heavy equipment. certain paints and adhesives). Objects may be considered not capable of practicable removal if equipment must be disassembled or removed for access to the objects, if the objects must be removed by heat, chemical stripping, scraping, abrasive blasting or similar process, or if removal would endanger human safety or health even when conducted with protective equipment and reasonable safety measures.*[83]

While the permit requires appropriate measures be taken *"to remove to the maximum extent practicable all materials which may degrade the marine environment,"* the Navy interprets

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[80] *Id.* art. III(2).

[81] 40 C.F.R. § 229.2; see also 33 U.S.C. § 1414(c) (authorizing Administrator to issue general permits).

[82] 40 C.F.R. § 229.2(a)(4) (emphasis added).

[83] *See* Agreement between Elsie L. Munsell, Deputy Assistant Secretary of the Navy, and Robert H. Wayland III, Director, EPA Office of Wetlands, Oceans, and Watersheds(Aug. 2, 1999).

this to mean that vessel remediation is conducted in a manner that includes *"the removal of all PCB transformers and large capacitors, all small capacitors to the greatest extent practical, trash, floatable materials, mercury or fluorocarbon containing materials, and readily detachable solid PCB items."*[84] Readily detachable or readily removable solid PCB items means items that can be removed in a cost effective and efficient manner without the use of heat, chemical stripping, scraping and abrasive blasting or similar processes.[85]

While removal of liquid PCBs found in transformers and capacitors is required to the *greatest extent practical* prior to vessel sinking, the removal of material containing solid-matrix PCBs is not required to the *greatest extent practical*. Only *readily detachable solid PCB items* are required to be removed, which by no means constitutes the *greatest extent practical*.

The Navy suggested— without any confirming study of actual vessel PCB removal results—that for smaller vessels, up to 30 pounds of pure PCBs could be left onboard and for larger vessels, up to 100 pounds could be left after remediation without significant effects on marine life. The Navy then assumed that their remediation practices would lead to a worst case scenario in which 100 pounds of pure PCBs would be left onboard large SINKEX vessels but *"would pose no notable threat to benthic organisms."*[86]

These rough estimates are not vessel specific and there exists the high probability, given the lack of PCB inventory taken on each vessel, that quantities of PCB contaminated material could significantly exceed the Navy's rough estimates. For example, as seen with the EX-ORISKANY, an estimated 722 pounds of solid PCBs were believed to be left intact for sinking, found in approximately 362,240 pounds of electric cable insulation, 31,700 pounds of fiberglass

[84] U.S. Navy, Sea 21 Navy Inactive Ships Program(SINKEX) http://www.navsea.navy.mil/teamships/Inactiveships/SINKEX/default.aspx

[85] *See* Agreement between Elsie L. Munsell, Deputy Assistant Secretary of the Navy, and Robert H. Wayland III, Director, EPA Office of Wetlands, Oceans, and Watersheds(Aug. 2, 1999).

[86] U.S. EPA, Decision Memorandum: EPA Regulation of PCBs on Vessels Used for Navy Sinking Exercises (Sept. 7, 1999).

bulkhead insulation and 284,044 pounds of contaminated paint.[87] 722 pounds of solid PCBs left intact for sinking is well above the Navy's 100 pound estimate for large vessels. There is no evidence to show that the level of remediation performed on SINKEX vessels is substantially more extensive than that performed for the EX-ORISKANY, which remains the only sunken vessel in which extensive sampling, modeling and post-sinking monitoring has been conducted. Of course, the PCB levels on this vessel both significantly exceeded the Navy's SINKEX estimate of 100 pounds for large vessels *and* the PCBs present in that vessel leached into the marine environment and led to PCB levels in fish that rendered them unsafe for human consumption. Moreover, as discussed above, established ocean transport mechanisms allow for the transport of PCBs from the deep ocean to shallow marine ecosystems.

The current SINKEX remediation practices were developed in 1999 and were based on the *Sunken Vessel Study that* assessed the impacts of a single SINKEX vessel, the Ex-AGERHOLM, sixteen years after the vessel's 1982 sinking, the *Modeling Study* of March 1994, and the PCB leachability laboratory study based on sediment samples. These three pieces of evidence are the basis for the current General Permit.

This permit has allowed more than 100 vessels to be sunk to date. Unfortunately, the permit is based on what has proven to be inaccurate assumptions both about the quantity of PCBs remaining on SINKEX vessels and about the availability of the PCBs to the marine environment. New findings by EPA and others in the scientific community now fully acknowledge that solid PCBs leach into the marine environment and are taken up by fish and other aquatic life. PCBs can then be transferred to humans as humans digest these contaminated fish, or may bioaccumulate up the food chain in various marine species. In addition, the available evidence indicates that the amount of PCBs that remain on SINKEX vessels is likely much higher than the estimates that form the basis for the current permit. These new findings

[87] J. Dodrill, K. Mille, B. Horn, & R. Turpin, Progress report summarizing the reef fish sampling, PCB analysis results and visual monitoring associated with the Oriskany Reef, a decommissioned former Navy aircraft carrier sunk in 2006 as an artificial reef in the Northeastern Gulf of Mexico off Pensacola, Florida (Apr. 13, 2011).

show there exists a clear risk to public health and the marine environment from SINKEX ship disposal under the MPRSA general permit that has not been addressed or considered by EPA.[88] The significant adverse effects of leached PCBs on human health and welfare, fisheries resources, marine ecosystems, and the persistence and permanence of PCBs once released all demonstrate that continued dumping of PCB-contaminated ships is not consistent with the MPRSA criteria for ocean dumping,[89] especially where the evidence regarding the quantities of PCBs being disposed is unreliable and likely much too low. Accordingly, the Administrator must review and revoke or substantially amend the MPRSA general permit for SINKEX.[90]

B. TSCA Waiver For SINKEX Is Not Warranted.

SINKEX now operates under a special permit under MPRSA, which requires the PCB contaminated vessels be sunk a minimum of 50 nautical miles from land. The act of transporting PCB contaminated vessels beyond U.S. territorial waters to SINKEX locations is considered export of PCB material for disposal purposes, and is therefore under normal circumstances prohibited under TSCA. According to the EPA Office of Prevention, Pesticides and Toxic Substances, *"If EPA were to regulate SINKEX under TSCA, SINKEX would be unlawful, and subject to citizen suit . . . "*[91] However, as discussed above, any PCBs that remain on SINKEX vessels in compliance with the general permit under MPRSA are not subject to TSCA regulations due to the exemption granted by EPA signed by Administrator Carol Browner in 1999. This exemption was granted without any public process wherein the public could submit comments or be heard on the matter. Section 9(b) does not provide a lawful waiver from TSCA because the MPRSA does not adequately protect against the risk of PCB leaching into the marine environment, for the reasons discussed above. Accordingly, if EPA does not amend the

[88] 33 U.S.C. § 1412(a).

[89] Id. § 1414(d).

[90] 33 U.S.C. § 1414(d); *see also* 40 C.F.R. § 223.2 to 223.5 (procedure for limiting or revoking permits).

[91] U.S. EPA, Decision Memorandum: EPA Regulation of PCBs on Vessels Used for Navy Sinking Exercises (Sept. 7, 1999).

existing MPRSA permit to comply fully with the requirements of the MPRSA, EPA must enact rules under TSCA that adequately regulate the export for disposal of PCBs via SINKEX by requiring that no disposed materials contain PCBs in concentrations greater than 50 parts per million, and that PCB-contaminated materials in concentrations less than 50 parts per million are removed to the greatest extent practicable.

EPA's position regarding a legislative exemption from TSCA for Navy vessels supports this conclusion. With the Navy's success in achieving a TSCA exemption for all SINKEX vessels in 1999, it requested a provision in the National Defense Authorization Act of 2004 that would exempt both the Navy and the recipients of any naval vessel from all sections of TSCA when vessels were sunk as artificial reefs. EPA opposed this proposal and responded sharply, and Congress sided with the EPA. However, the EPA's stand against this requested TSCA exemption is contradictory to the previously granted TSCA exemption for SINKEX. In opposing this legislative exemption, EPA stated:

> *"EPA opposes this proposal, which removes safeguards and allows for sinking of vessels that could pose future clean-up problems and unreasonable risks to human health and the environment. This provision would exempt both the Navy and the recipients of any naval vessels from all sections of the Toxic Substances Control Act, not just the PCB prohibitions under TSCA section 6(e), as long as the ship is used as an artificial reef. It would also limit any future liability on the part of the Navy for remedial action under CERCLA and exempt vessels from regulations as hazardous waste as provided by the Solid Waste Disposal Act (SWDA)."*[92]

It remains unclear why EPA did not take a similar stance for the SINKEX program. While EPA supports the continuation of the artificial reefing program only if it is subject to TSCA, which requires PCBs be remediated to below 50 ppm and disallows PCB export for disposal, it has granted a TSCA exemption for SINKEX based on an inadequate MRSPA permit.

EPA should re-examine the TSCA exemption for SINKEX while it reviews and revises the MPRSA permit for the program. It should revoke the exemption and enact TSCA rules requiring

[92] EPA's Comments on DoD's FY04 Legislative Proposals to the National Defense Authorization Act, *available at*http://www.cpeo.org/pubs/EPA%20RRPI%20Response.pdf

strict remediation of SINKEX vessels unless the MPRSA permit is substantially revised to protect human health and the marine environment.

C. Additional Study Is Needed to Determine the Full Effects of PCBs on SINKEX Vessels

As discussed above, to date only a single SINKEX vessel – the Ex-AGERHOLM – has been the subject of any significant post-sinking monitoring or study to assess whether and how PCBs are leaching from sunk vessels and harming the marine environment, but the scope of this study was limited in critical respects and so did not provide sufficient information to make firm conclusions about risks posed by PCBs on SINKEX vessels. Moreover, the results of the Ex-AGERHOLM study are significantly undermined by the results of the post-sinking monitoring study on the Ex-ORISKANY artificial reef in Florida.

Under EPA regulations, the ocean dumping of contaminants such as PCBs is permissible only in "trace" amounts, such that they "will not cause significant undesirable effects, including the possibility of danger associated with their bioaccumulation in marine organisms."[93] Under both the MPRSA and TSCA, EPA should require additional study and monitoring of post-sink sites to determine what PCB concentrations constitute "trace" contaminants.[94] If such additional study demonstrates that a level lower than 50 parts per million is necessary to protect human health and the marine environment, then EPA should amend the MPRSA general permit and/or enact TSCA regulations requiring such levels.

D. SINKEX Remediation Standards Are Unlawful And Do Not Meet Requirements Of International Law

The SINKEX permit under the MPRSA and the exemption under TSCA do not provide proper implementation of the London Convention which prohibits the dumping of any Annex I substance, such as PCBs, except as trace contaminants (e.g. PCB concentrations that will not cause an unacceptable adverse impact after dumping in terms of persistence, toxicity, and

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[93] *See* 40 C.F.R. § 227.6.

[94] *See* 15 U.S.C. § 2603; 33 U.S.C. § 1414(d).

bioaccumulation). Considering all SINKEX vessels constructed prior to 1985 likely contain PCB concentrations in excess of 50 ppm even after remediation, the EPA's general permit for SINKEX fails to meet the requirements of the London Convention to which the U.S. is a party.

The ocean dumping of inadequately remediated vessels via SINKEX does not fulfill the Convention's environmental protection aim of not creating *"hazards to human health, to harm living resources and marine life . . . "* Nor are SINKEX vessels free of contamination by Article 4's priority blacklisted materials. Article 4 of the Convention prohibits the dumping of materials listed in Annex I, otherwise known as the *black list*. This list includes the contaminants most likely to cause great harm to living resources, marine life and human health due to their hazardous characteristics. These hazardous characteristics include not only toxicity, but the propensity to bio-accumulate and bio-magnify in the human food chain.

This black list includes all organohalogen compounds (e.g. PCBs), except in cases where only *"trace contaminants"* are present. According to the EPA,

> *"Trace contaminants are not defined in terms of numerical chemical limits, but rather in terms of persistence, toxicity, and bioaccumulation that will not cause an unacceptable adverse impact after dumping. By this definition of trace contaminants, marine organisms are regarded, in a sense, as analytical instruments for determining the environmentally adverse consequences (if any) of any contaminants present. This definition of trace contaminants requires that the lack of unacceptable adverse effect in biological studies be taken to mean that contaminants are absent, or present only in amounts and/or forms that are not environmentally active, and therefore do not exceed the trace contaminant definition.... Because assessment of trace contaminants depends upon the determination of the potential for effects, an assessment cannot be made until the impact evaluation is completed and interpreted. Only then can effects, and thus the presence of materials as other than trace contaminants, be determined."*[95]

The Ex-ORISKANY post-sinking fish data, as described in the above sections, clearly shows effects from PCBs that have leached from the vessel and have been taken up by fish at the reef site. This PCB fish uptake confirms the presence of PCB materials in amounts beyond trace contaminant parameters within the Ex-ORISKANY, by EPA's own definition. Considering all U.S. naval vessels constructed prior to 1985 likely contain PCB concentrations in excess of 50

[95] U.S. EPA, Evaluation of Dredged Material Proposed for Ocean Disposal, EPA 503/8-91/001, (Feb. 1991) *available at* http://www.epa.gov/owow/oceans/gbook/gbook.pdf

parts per million (ppm), and considering the Ex-ORISKANY PCB remediation requirements were comparable in scope with that of SINKEX PCB remediation requirements, it can be reasonably concluded that many SINKEX vessels are sunk with solid matrix PCBs above trace contaminant parameters. Moreover, the remediation requirements for the Ex-ORISKANY are similar to the remediation requirements under the general permit and related agreements for SINKEX: the Ex-ORISKANY was sunk with electric cables, bulkhead insulation and contaminated paint, and similarly the General Permit for SINKEX allows: *"The Navy may leave in place wire cables, felt gaskets and other felt materials that are bonded in bolted flanges or mounted under heavy equipment, paints, adhesives, rubber mounts and gaskets and other objects in which the Navy has found PCBs…"* Accordingly, vessels sunk through SINKEX likely fail to meet the trace contaminant requisite as did the sinking of the Ex-ORISKANY. Finally, the no effect threshold for PCB exposure is extremely difficult to ascertain as many scientists agree that there is no safe level of exposure to PCBs due to the bioaccumulation and health related effects on marine organisms.

In sum, sinking contaminated ships is not consistent with the aim of the London Convention. SINKEX is in fact detrimental to marine life and sustainable fish populations from ecosystem contamination.

ACTIONS NEEDED TO CORRECT EPA'S LEGAL VIOLATIONS

For the reasons discussed above, pursuant to the petition provisions of the APA[96] and the TSCA,[97] BAN, Sierra Club, and Center for Biological Diversity request that the EPA amend the existing MPRSA permit for SINKEX or, in the alternative, enact TSCA rules:

1. **Effective immediately, requiring all PCB-contaminated materials in concentrations of 50 parts per million or greater to be removed from SINKEX vessels prior to sinking;**

[96] 5 U.S.C. § 553(e).

[97] 15 U.S.C. § 2620(a).

2. **Requiring all PCB-contaminated materials in concentrations of less than 50 parts per million to be removed from SINKEX vessels prior to sinking to the maximum extent practicable; and**

3. **Requiring additional studies to determine whether PCB-contaminated materials in concentrations of less than 50 parts per million constitute "trace" contaminants, such that their dumping will not cause undesirable effects including the possibility of bioaccumulation. Such additional studies should include the most recent data on the toxicity, persistence, and bioaccumulation of PCBs and should include monitoring at multiple recent sink sites. Studies should also assess the releases of other potentially hazardous pollutants into the marine environment from the SINKEX program including heavy metals, asbestos and radioactive substances.**

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APPENDIX

Comments on:
PCBs in Sunken ex-Navy Ships

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for
Basel Action Network

August 25, 2010

Summary

PCBs are persistent bioaccumulative chemicals that have demonstrated carcinogenic and non-carcinogenic effects on animals and human health. SINKEX is the government program for allowing the scuttling of obsolete ships as a result of military exercises. There are several technical concerns regarding potential PCB releases to the environment found in the studies and reports that have been used to support the implementation of the SINKEX general permit granted under the Marine Protection Research and Sanctuaries Act in 1999. First, a number of ships have been sunk in US waters for the purpose of reef-building, yet there is a paucity of empirical data collected from these ships on the extent of leaching of toxic chemicals (metals and organics) into water, sediment and biota. Recently released data on fish tissue levels of PCBs at the Oriskany reef site compared to a reference reef of concrete indicate that the reefed ship may be a source of substantial PCB pollution in fish. Second, the models upon which estimates of PCB leaching are based are overly simplified and do not include complex features of the ecological system, including water density layering, localized currents, upwellings, and sedimentation. All of these features can be and are affected by the presence of a ship as large as the Oriskany which may in fact dominate the local hydrography. Considering the latest data on PCBs in fish, the current state of knowledge concerning the persistent toxic effects of PCBs, the SINKEX program is not currently practiced in a manner that adequately protects the environment and human health.

Wildlife Exposure to PCBs

According to the study “Assessing the Ecological Risk of Creating Artificial Reefs from ex-Warships” by Johnston et al. (2003), contaminants of concern can enter the intercontinental shelf system through releases from the sunken warship as well as from inputs from the coastal waters. Direct and indirection exposure to these chemicals can result from a contaminated habitat, where indirect exposure occurs through a process of bioaccumulation up the food chain. Bioaccumulation exposes organisms higher on the food chain to greater concentrations of PCBs through their multiple prey items. For example, demersal fish, such as flounder, are bottom feeders and live on the sea floor. Grouper, snapper, and black sea bass dwell near the bottom. All feed on various invertebrates that inhabit the reef and sea floor, and invertebrates in turn eat prey items that are in direct contact with the PCBs found in the sand and sediment (see Figure 1); some invertebrates consume sediment. If the recreational anglers catch and eat these fish, they are also exposed to the PCBs through their diet.

Other higher trophic level organisms such as fish-eating birds, omnivorous birds, and marine mammals are exposed to PCBs via the prey items that have PCBs in their tissues. Generally, the typical PCB levels increase by a factor of 10- to 100-fold when ascending major consumption levels in a food web (Gobas et al., 1995; Rice et al., 2003). Specifically, Wasserman (Wasserman et al., 1979; Rice et al., 2003) reported that for marine food webs, zooplankton range from < 0.003 µg/g to 1 µg/g, whereas top consumers, such as seals and fish, had tissue PCB levels ranging from 0.03 µg/g to 212 µg/g. Therefore, PCBs that are abundant in lower trophic levels, will be amplified through the food chain to levels that can adversely affect higher trophic level organisms (see also Rice et al., 2003 for comprehensive treatment of the topic).

Also, there is a direct relationship between fish distribution and abundance and the PCBs at the newly created reef site. This interaction is not random and will occur because fish will be attracted to the ship site and the food resources there. These same processes, bioaccumulation and biomagnification within the food web, occur in both shallow water ecosystems and deep ocean water systems with similar exposure pathways and similar outcomes for the assessment endpoints.

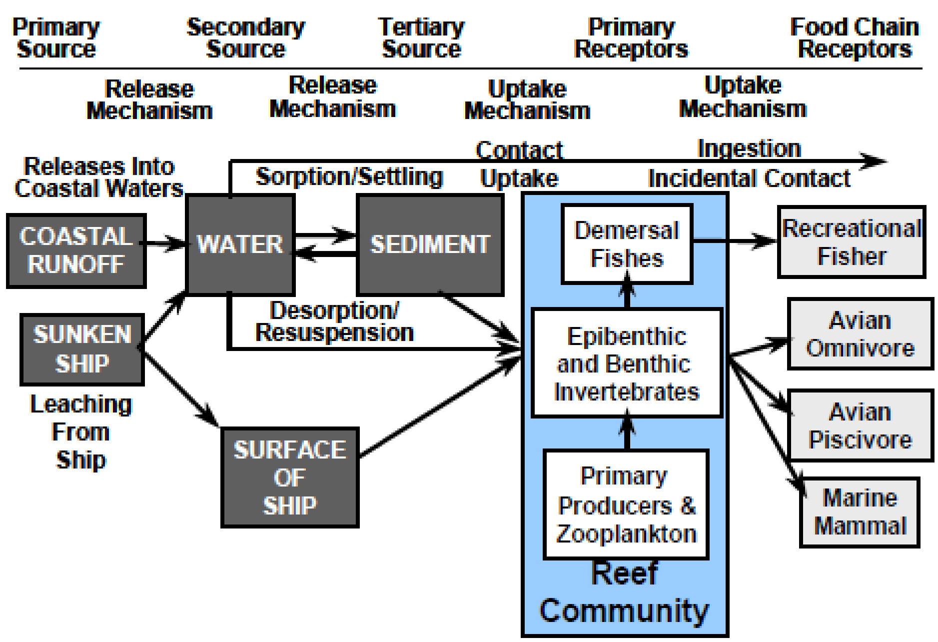

Fig. 1. Exposure pathways and assessment endpoints.

(Johnston et al., 2003)

Regulations and Wildlife

The EPA has the authority to approve risk-based disposal of PCBs, regulated under Sec. 761.62 Disposal of PCB bulk product waste (40 CFR 761.62), if a finding of no unreasonable risk of injury to human health and the environment can be made. The sinking of the Navy vessel the Oriskany was sunk under this risk-based disposal permit. This permitting is not subject to the Toxic Substances Control Act (TSCA) which requires remediation of PCBs of 50 ppm or greater. Similarly, the Navy's SINKEX program is generally permitted under the Marine Protection, Research, and Sanctuaries Act (MPRSA) which does not require remediation to 50 ppm as is required of artificial reefing vessels under TSCA. In theory, PCBs at any concentration in any materials can be a significant source and therefore subject to regulatory removal requirements.

There is no fundamentally scientific basis for setting protective standards or processes of determining protective levels of PCBs on the basis of program design, including water depth for a ship sinking. PCB (and other toxic chemical) remediation needs to be based on leaching, toxicology, persistence and accumulation and other scientific matters, no matter the purpose of the sinking. There is little to no difference in PCB bioavailability between deep sea and shallow waters because the same chemical, physical and biological mechanisms operate in all cases. In both cases, corrosion and breakdown of the vessel will occur over time, making all of the PCB containing solid materials biologically available through water and sediment uptake. The factors that form the basis for determining the risks of PCBs have developed substantially in recent years, providing data on toxicity, persistence, and bioaccumulation that was simply not available 30 years ago when many PCB standards were first set under TSCA.

PCBs in Solid Materials

Because the breakdown processes and bioavailability of PCBs will be similar whether a vessel is sunk in shallow or deep ocean waters, studies used to regulate PCBs on vessels used for artificial reefs should also be considered in regulating PCBs on vessels used in the SINKEX program. The Navy report "Investigation of PCB Release-Rates from Selected Shipboard Solid Materials Under Laboratory-Simulated Shallow Ocean (Artificial Reef) Environments" (George et al., 2006) estimated that the Ex-Vermillion Navy vessel had potentially 9.5 lbs to 267 lbs of PCBs onboard. Based on the highest amount, 50% of PCBs were present in felt gasket material, 25% in electrical cables, 12% in the paint, 10% in residual oils and greases, and 0.1% in the bulkhead insulation. For the lowest estimated total pounds of PCBs, paints accounted for 85% of the mass of PCBs on the ship and electric cable accounted for 9%.

The Navy report also calculated the release rate of the PCBs from the solid materials onboard. They determined that for the highest estimated total pounds of PCBs, although bulkhead insulation only accounted for 0.1% of the total PCB mass on the ship, it accounted for about 13% of the PCBs released from the ship. However, for the lower estimated total pounds of PCBs, paints contained 85% of the mass of PCBs and accounted for 68% of the PCBs released (George et al., 2006). If regulations to protect the marine environment are to be based on their own calculation of release rates, logically, extensive paint removal should be a larger part of the vessel preparation and clean up. On a technical level, the release of toxic chemicals is determined by both the rate of release (PCB/pound material) as well as the total bulk release (PCB/unit time), taking into account the total quantity of contaminated material as well as the rate at which that material releases PCBs (or other toxic chemicals).

Based on these leach rates for PCBs from solids aboard the Ex-Vermillion, the Navy reached the conclusion that removal of the materials with the highest leach rates would result in the greatest reduction in PCB loading per unit material removed. Their leach rate model showed that removing .001 kg of pure Aroclor 1254 (PCB) would reduce leaching by the same amount as removing 0.143 kg of bulkhead insulation, 1.855 kg of foam insulation, 3.8 kg of felt gaskets, 5.3 kg of rubber products, 56.5 kg of paint, or 80 kg of electrical cable (George et al., 2006). For each material listed, the weight of the material removed demonstrates an advantageous return on the elimination of PCBs from the vessel. Ultimately, physical and chemical breakdown of every aspect of the ship will occur over time and will become a part of the marine environment, increasing the interaction between PCBs and the marine environment.

The Final Report on PCB Source Term Estimates for ex-Oriskany by the Navy Inactive Ships Program (PEO, 2006) outlined the several sources of PCBs in the materials on the vessel. The amount of PCBs contained within the solid materials onboard ranged from 377.5 kg to 699.6 kg. The sources of PCBs onboard included the bulkhead insulation, rubber products (door gaskets, pipe hangers, mounts, etc.), paints, electrical cable insulation, ventilation gaskets, and lubricants. The electrical cable accounted for 95% of the total PCB loading from the Oriskany into the marine environment, with bulkhead insulation the second highest at 3%.

Reduction of PCB loading due to removal of items as part of the preparation process outlined in the EPA's "National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs: Polychlorinated Biphenyls" (U.S. EPA, May 2006) requires removal of 100% of the lubricants, 5% of the paint, 72.6% of the bulkhead insulation and only 10% of the electrical cable, and no removal of rubber products or ventilation gaskets. The EPA makes the false assumption that low level PCB content in solid materials is permissible. Both the paint and lubricant make similar contributions to the PCB load on the ship, but supposedly 100% of the lubricants are removed and only 5% of the paint.

Following removal based on the EPA BMP, the total amount of PCBs remaining ranged from 327.79 kg to 608.85 kg, where more than 97% of the PCBs remaining on the vessel are associated with electrical cables. No risk-based permit or otherwise should allow for the cables to remain onboard. The EPA's "National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs" admits that "Because PCB sampling and analytical procedures can be expensive and time consuming, there may be situations when the cost of sampling and analysis far exceeds the cost for removal and disposal. In some cases, vessel-to-reef projects have shown that removal of all electrical cables and wires suspected of containing PCBs was the most economical course of action."

Time Dynamic Model

The Final Report Ex-ORISKANY Artificial Reef Project Time Dynamic Model (TDM) (PEO, 2006) predicts concentrations of PCBs in abiotic media in the marine environment that may result from PCB releases from the ex-ORISKANY, but only for the first two years after sinking. This model was necessary, however, to fill in the first two years for the Prospective Risk Assessment Model (PRAM), which only modeled biotic predictions after the first two years of sinking a vessel for use as a reef.

However, there are several over-simplifications within the TDM model. The TDM treats the ship as a single point source and the surrounding waters as discrete boxes, each subsequent box located at a greater distance from the source. Assuming complete mixing and complete exchange between the "boxes" in each time step of the model is not dynamic enough for the conditions found in the Gulf of Mexico. Building the model using applied hydrodynamic data would create a more realistic model.

Additionally, the overly simplified pycnocline and mixing assumptions ignore seasonal differences, where the water is vertically mixed in the winter and stratified in the summer. The simple two layer model certainly neglects the changes in pycnocline strength and the possible effects of storms to move and mix large amounts of water and sediment over short periods of time.

The assumption of instantaneous mixing and equilibration within the ship is also most certainly not correct. The TDM assumes 99% equilibrium concentrations within 24 hours without any evidence to support the validity of this assumption. Another concern is the total lack of movement of PCB-laden sediments in the model, where sediments are likely the largest PCB sink. There will also be a continuous flux in PCB adsorption and desorption between the water and the sediment within each bin. Equally important is the assumption that no sediment occurs in the ship, which is not correct.

The TDM assumes first order kinetics between the ship sources, water, TSS, and DOC. This assumption is also likely wrong. PCBs and PCDD/PCDFs function on other than first order kinetics in most systems. Overall, the model is too simplistic in moving PCBs in a linear and sequential fashion from the ship's sources into water, DOC and TSS, and then ultimately to marine wildlife.

Another concern is the impact of the vessel size relative to the water column depth. In section 1.3.3, the authors discuss concerns about the upwelling and turbulence that may be generated by the presence of the vessel sitting on the sea floor. The vessel is 888 feet long, 90 feet wide and about 90 feet high, but 135 feet at its highest. It would be likely to assume that the vessel has a bigger impact on the immediate dynamics than the bin hydrodynamic model allows for.

There are problems with the collection of leaching rate data presented in Table 1 of the TDM (PEO, 2006). The lack of any detectable leaching of octochlorobiphenyl is remarkable and should have resulted in running more trials. The zero results for octochlorobiphenyl underestimates the leach rate. Depending on the conditions of the experimental work, if the rates were not measured over a sufficiently long period of time, then the model and all the estimates are potentially inaccurate and underestimate the physical-chemical loss of PCBs from the ship into the marine environment.

Sediment Data

Another weakness in the data used to support SINKEX is that the sediment data used for the Navy leach rate studies for the Vermilion and Oriskany came from the Agerholm, a single sunken vessel site in which they took sediment samples. The Ex-Agerholm was sunk in 1982 but the study that was the basis for SINKEX permitting (Johnston et al.) was published in 2003. Undoubtedly, PCB levels would be much higher had the study taken place more recently to the sinking of the Ex-Agerholm. Additional studies should be done to collect more sediment data and to verify the sediment sampling methods used at the Agerholm site.

Field-collected data and choice of observed (test) animal species has inherent limitations in sampling design and possible outcomes, and could possibly misrepresent exposure or impacts. The Johnston et al. (2003) study does not define the invertebrates used in the tissue analysis. Identification of invertebrate species used in the study is important based on their individual physiology, habitat use, and prey items. For example, oysters are not mobile and may better correlate exposure effects of a certain area. Also, while the assumption that food chain receptors would consume 100% of their diet from the Navy vessel reef may be conservative, the omission of direct ingestion of water and sediment are not conservative, especially for benthic feeders. Two of the most significant limitations of field toxicity are the inability to confirm (or perhaps even determine) the exposure conditions and the complete inability to measure or confirm mortalities that will be lost to natural predation and decomposition processes.

Ultimately, the conclusions in Johnston et al. do not logically follow from the data provided in the study. This study is not sufficient to determine the health of an ex-vessel reef and should not be the basis for decisions about acceptable PCB levels.

In the *PCB Strategy for the Commonwealth of Virginia* created by the Virginia Department of Environmental Quality (2005), a subgroup was formed to develop screening levels and cleanup levels for PCBs in soils and sediments. The purpose of the screening levels is to help prioritize PCB contaminated sites, but the subgroup cautioned against relying solely on the soil and sediment screening levels alone:

> "... the subgroup recognized that the risk-based screening levels would likely be too low to be an effective prioritization tool. The risk-based approaches confirmed that very low

levels of PCBs (1.8 to 49 ppb) in sediments could result in elevated fish tissue concentrations" (VA DEQ, 2005)

This approach is counter to the Navy's reliance on the Agerholm study sediment data, on which they based their modeling. Further, the subgroup notes that in many cases, the small sample size may account for the lack of elevated sediment data. The hitting or missing of PCBs during sediment collection is a reality in the sediment risk-based approach.

Also, because PCBs bioaccumulate as well as biomagnify up the food chain (as noted in the above "Wildlife Exposure to PCBs" section), high PCB levels in marine sediments are not necessary for the presence of higher PCB levels in fish. The data collected in the Virginia Department of Environmental Quality Fish Tissue and Sediment Monitoring program show that there is often no direct correlation between sediment levels and fish tissue levels. The subgroup also concludes that local conditions may be such that the low levels of PCBs that do occur in the sediments are bioavailable (VA DEQ, 2005).

New Data

The Ex-USS Oriskany was sunk as an artificial reef 23 nautical miles off the coast of Florida in 2006 and was prepared for sinking in much the same way as SINKEX vessels. All liquid PCBs were removed from the vessel prior to sinking; therefore all documented PCB leaching is from solid PCBs. In an Oriskany post-sinking monitoring study that has not yet been completed by the Florida Fish and Wildlife Conservation Commission (FWC), 33% of all fish sampled post-sinking in the vicinity of the Oriskany had PCB concentrations above 20 parts per billion (ppb), the EPA screening level (Table 1). Twenty-one percent of all fish sampled post-sinking had PCB concentrations above 50 ppb, the Florida Department of Health fish advisory threshold. PCB concentrations in fish samples increased 1,446% on average from pre-sinking to post-sinking.

The FWC study also included two sampling events in 2008 on a control reef (Table 2); these results were also just released in April 2010. The control reef is a concrete bridge rubble reef that is 8 miles from the Oriskany site. The control reef samples were taken on the same days as the Oriskany samples in 2008. PCB concentrations in fish caught at the Oriskany site in 2008 were more than 932%, on average, higher than PCB concentrations in fish caught at the control reef.

Table 1. All Six Sampling Events Through Nov. 2009

	Pre-Sinking Oriskany Site	Post-Sinking Oriskany Site
Red Snapper Samples	17	157
Red Snapper Mean PCB Concentration	2.36 ppb	54 ppb
Total Samples	62	180
Total Mean PCB Concentration	3.8 ppb	58.75 ppb
Total Fish Above 20 ppb (EPA Screening Level)	2 (gag & king mackerel	60
Total Fish Above 50 ppb (Florida DoH Fish Advisory Threshold)	1 (king mackerel)	38

In contrast to these results from the FWC study, the Final Report Ex-Oriskany Artificial Reef Project Ecological Risk Assessment conducted by the Navy (PEO, 2006) stated that the no effect threshold for total PCB was exceeded only in dolphins, cormorants, and herring gulls. Contact with elevated PCB levels in water inside the vessel was determined to be the predominant route of exposure and transfer of PCBs through the food web. However, despite these findings, the conclusion of the Ex-Oriskany Artificial Reef ERA deems the levels of PCBs in the tissues of organisms associated with the reef and in the diet of reef consumers acceptable. These conclusions do not logically follow the data collected and does not address the unacceptable level of risk to human health and the environment.

Table 2. 2008 Control Reef Samples vs. 2008 Oriskany Reef Samples

	2008 Control Reef	2008 Oriskany Reef
Red Snapper Samples	45	60
Red Snapper Mean PCB Concentration	7.6 ppb	55.22 ppb
Total Samples	61	61
Total Mean PCB Concentration	7.89 ppb	81.44 ppb
Total Fish Above 20 ppb (EPA Screening Level)	5	16
Total Fish Above 50 ppb (Florida DoH Fish Advisory Threshold)	0	12

Conclusions

- Based on the recent data for PCB levels in fish tissue at the Oriskany reef site and a control reef, general permitting under MPRSA underestimates the impact of PCBs found in solid materials left on-board a vessel.
- The release of PCBs from ships such as the Oriskany causes an unacceptable risk to human health and the environment.
- The basic processes behind leaching of toxic chemicals and subsequent movement into the food web, with harmful consequences to the environment and human health, are not affected by depth such that less protective measures can be afforded vessels sunk in deeper waters.
- The Ex-Agerholm study is not adequate enough data for building a sediment-based hydrological model for ships sunk under SINKEX or in other waters that are in fundamentally different hydrological and oceanographic regions.
- The Time Dynamic Model does not adequately express the complexity of the coastal system off the coast of Pensacola and is too simplistic to adequately model the impacts of the ex-Oriskany.

- The Florida Fish and Wildlife Conservation Commission (FWC) study provides new data that contradicts the findings of previous Naval studies. These new data add to the paucity of research done on sunken Naval vessels.
- PCBs, once introduced to a system, continuously cycle through, become bioavailable, and bioaccumulate up the food chain. The only remedy is to limit or prevent their introduction to the marine environment.

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