

# **DISHONORABLE DISPOSAL**

The Case Against Dumping  
U.S. Naval Vessels at Sea



**BASEL ACTION NETWORK**

July 2011



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### **BASEL ACTION NETWORK**

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BAN is a 501(c)3 charitable organization of the U.S.

The Basel Action Network (BAN) is the world's only organization focused on confronting the global environmental injustice and economic inefficiency of toxic trade (toxic wastes, products and technologies) and its devastating impacts. Working at the nexus of human rights and environment, we confront the issues of environmental justice at a macro level, preventing disproportionate and unsustainable dumping of the world's toxic waste and pollution on our global village's poorest residents. At the same time we actively promote the sustainable and just solutions to our consumption and waste crises – banning waste trade, while promoting green, toxic free and democratic design of consumer products. Learn more by visiting [www.ban.org](http://www.ban.org).



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# CONTENTS

INTRODUCTION .....	1
EXECUTIVE SUMMARY .....	3
Congress Mandate to Eliminate the Obsolete Fleet.....	3
Foreign Dismantling Practices Banned.....	3
Ocean Disposal Practices Adopted.....	4
Ocean Disposal Violates U.S. and International Ocean Dumping Regulations.....	4
Navy Studies Claimed No Harm .....	4
New Evidence Disclaims Navy's No Harm Assumptions .....	5
Despite New Evidence – More Ocean Dumping.....	5
Recommend Domestic Recycling as Preferred Disposal Method .....	5
Chronology of Events .....	6
LEGAL FRAMEWORK.....	7
U.S. Ship Management.....	7
London Convention .....	7
Marine Protection, Research and Sanctuaries Act .....	11
Toxic Substances Control Act.....	14
Stockholm Convention .....	17
OECD .....	17
HUMAN HEALTH RISK.....	18
Artificial Reefs .....	18
Table 1: ORISKANY Site Fish PCB Sampling: Pre-sinking vs. Post-sinking Concentrations 2006-2009 .....	20
Table 2: Fish PCB Sampling: ORISKANY Site vs. Control Reef Site 2008 .....	20
SINKEX.....	22
INTERNALIZED COSTS .....	25
Artificial Reefing Costs .....	25
Table 3: Artificial Reef Costs 2006-2009.....	27
SINKEX Costs.....	28
Table 4: SINKEX Cost Estimates 2005-2008 .....	30
Domestic Recycling Costs.....	30
EXTERNALIZED COSTS .....	32
Natural Resource Costs .....	32
Table 5: Vessel Composition and Material Value of Vessels Dumped at Sea 2000-2010 .....	34
Air Pollution Costs.....	34

Table 6: CO2 Emissions and Hidden Flow Savings from Recycling .....	36
Table 7: Ex-FORRESTAL CO2 Emissions and Hidden Flow Savings from Recycling .....	36
Fishery Resource Costs.....	37
Uptake into the Marine Food Chain.....	39
Future Remediation Costs.....	41
Job Loss Costs.....	43
ALTERNATIVES TO OCEAN DUMPING .....	45
Ship Sales for Reuse .....	45
Ship Donation .....	45
Overseas Shipbreaking .....	47
Table 8: Overseas vs. Domestic Ship Recycling: 1970 – 1997 .....	48
Domestic Recycling .....	52
RECOMMENDATIONS .....	57
Enforce the London Convention .....	57
Amend the Marine Protection, Research and Sanctuaries Act .....	57
End SINKEX: Revoke General Permit .....	57
Enforce the Toxic Substances Control Act .....	59
Eliminate Double Standards .....	59
Ratify the London Protocol and Invoke the Precautionary Principle .....	59
Lead by Example: Honor the Waste Management Hierarchy.....	60
CONCLUSION .....	61
APPENDIX A.....	i
MARAD Scrapping Cost Estimates vs. Actual Costs 2001-2008.....	i
APPENDIX B.....	iv
Naval Vessels Disposed At Sea, 2000-2010 .....	iv
SOURCES .....	i

## INTRODUCTION

Based on faulty analysis and traditional assumptions, the U.S. Federal government has deliberately dumped 600,000 tons of recyclable steel, aluminum and copper at sea over the past decade via the U.S. Navy and U.S. Maritime Administration (MARAD) ship disposal programs. These recyclable resources, existing within the hulls of 95 retired naval vessels, are valued at an estimated \$600 million in today's commodities marketplace; however, these materials now waste away on the ocean floor with all material value forever lost. Lost too are some 20,000 jobs from the economy at large, both green recycling jobs and those indirectly related to the industry, in a time when unemployment rates are debilitating the American economy and way of life.

The Federal government's ocean dumping programs are not solely an economic conundrum; these dumping efforts also pollute the marine environment with toxic materials and heavy metals that forever alter the marine ecosystem. The U.S. government, charged with preventing environmental harm and protecting its natural resources, is guilty of strengthening the paradigm of pollution economics – that is, the practice of making provisional gains (reducing fleet size in this case) without accounting for externalized environmental costs that are forever endured by the taxpayers, the

global commons and future generations.

This report explores the economic, environmental and human health costs, as well as the legal implications of the Federal government's ocean dumping practices, focusing solely on the use of ships as artificial reefs in U.S. coastal waters, and the use of ships as subjects of the Navy's SINKEX program (disposal by sinking during military target practice exercises).

This report follows the sinking of five vessels in 2010, but comes prior to five planned sinkings announced in 2011, including that of the Ex-ARTHUR RADFORD, Ex-NIAGARA FALLS, Ex-CONCORD, Ex-KILAUEA and EX-CORONADO all destined to be scuttled in U.S. waters.

This report concludes that domestic recycling of U.S. naval vessels is the only honorable form of disposal as it is the only method that ensures a legacy of a clean and non-toxic world for future generations. Recycling honors the environment, human health and the economy; it creates green recycling jobs for Americans, while also remaining consistent with the letter and spirit of established national and international policies, principles and laws.

### What is SINKEX?

The Navy's sinking exercise (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 8% of all Navy vessel disposals; but from 2000-2008, SINKEX accounted for an alarming 70% of all disposals.

SINKEX is permitted by the U.S. EPA under a general ocean dumping permit. This general permit allows naval vessels to be sunk with toxic materials left onboard, materials that are known to create hazards to human health and marine life as they transfer through the food chain.

**Image at Right: Ex-USS CONOLLY disposed at sea in April 2009 via SINKEX.** Image Source: U.S. Navy Photo by LT Chris Brown



## What are Artificial Reefs?

The National Fisheries Enhancement Act of 1984 (NFEA) defines an artificial reef as “a structure which is constructed or placed in water...for the purpose of enhancing fishery resources and commercial and recreational fishing opportunities.”<sup>1</sup> There are 14 Gulf and Atlantic States with active artificial reefing programs. Florida alone has 2,400 artificial reefs comprised of sunken cars, buses, tanks, tires, oil rigs and ex-military vessels.<sup>2</sup> The Delaware Artificial Reef program boasts of their 4 ex-military vessels, 10 tugboats and barges, 86 tanks and armored personnel carriers, 1,100 New York City subway cars and 8,000 tons of ballasted truck tires<sup>3</sup> now resting in the Delaware ocean dumping ground that covers approximately one square mile of ocean floor.

States are turning to *materials of opportunity* as a low cost reef solution to attract fish and bring economic benefits to coastal economies through increased fishing and diving opportunities. However, these materials of opportunity, which include Navy and MARAD ships, are essentially waste products, often with toxic residues. Their use is often perpetuated by those that have a waste disposal problem to solve. “The artificial reefs have been sold by a number of specific interests that benefit from them,” said Jack Sobel, former director of strategic conservation science and policy at the Ocean Conservancy in Washington, D.C. “The oil industry in the Gulf of Mexico, the sports-fishing and recreational-diving industries up and down both coasts, and the people who need to dispose of old cars, bridges and boats, all make out better than the fish and sea anemones do.”<sup>4</sup>

Most artificial reefs are developed in areas with featureless bottom topography.<sup>5</sup> These artificial reef sites alter the natural habitat in order to attract fish for increased economic benefits. “At the very least, we are altering marine habitat by sinking ships - somewhat akin to gathering a bunch of old wreck cars in the midst of a forest or grassland. This would create habitat for certain species (e.g. rats), but would definitely alter the natural ecology.”<sup>6</sup> The real benefit is to fishermen’s ability to more easily catch fish, making the sea floor more interesting to divers and provide a cost-effective waste disposal site for those in need of dumping large volumes of waste material.

The only proven impact of artificial reefs is that they attract fish and concentrate populations for rapid harvest. The Gulf States Marine Fisheries Commission (GSMFC) suggests that concentrated populations themselves may lead to overfishing and the decline of species within the vicinity of the reef site.<sup>7</sup> The attracting nature of the reef may actually be detrimental to species populations, as overfishing at target sites rapidly eliminates fishery resources, and soon thereafter, all related economic benefits once attributed to sports fishing and diving tourism. Clearly, when the fishery is closed due to overfishing, so too will be the local businesses that are dependent on fishing and diving tourism.

<sup>1</sup> National Fishing Enhancement Act of 1984, Title II, Appendix B, Artificial Reefs, Public Law 98-632

<sup>2</sup> [http://myfwc.com/Conservation/Conserv\\_Progs\\_Habitat\\_Saltwater\\_AR.htm](http://myfwc.com/Conservation/Conserv_Progs_Habitat_Saltwater_AR.htm)

<sup>3</sup> <http://www.fw.delaware.gov/Fisheries/Pages/ArtificialReefProgram.aspx>

<sup>4</sup> <http://www.newsweek.com/id/142534/page/1>

<sup>5</sup> Stone et al. 1974

<sup>6</sup> <http://www.georgiastrait.org/?q=node/604>

<sup>7</sup> Lukens, R.R. and Selberg, 2004



The Ex-Vandenberg was sunk in the Florida Keys National Marine Sanctuary in 2009 at a cost of \$8.6 million. The vessel is a popular fishing destination as it is said to attract fish away from the protection of natural coral reefs within the marine sanctuary itself. However, it is well known that fish aggregation at a marked site can exacerbate the problem of overfishing, as concentrated fish populations can be easily and more rapidly harvested.

Image Source: Stephen Frink/Florida Keys News Bureau

In 2001, New York City Metropolitan Transportation Authority (MTA) offered up 1,300 Redbird Subway cars and disposed of 23 million pounds of scrap metal on the ocean floor, saving a reported \$11 to \$13 million in disposal costs. The so-called savings was based on estimated costs for proper remediation and land-based disposal of asbestos and other related materials, which the MTA avoided by simply dumping at sea. To date, MTA has provided more than 2,500 retired subway cars to Virginia, Georgia, South Carolina, Delaware, New Jersey and Maryland for artificial reef projects.

Image Source: Virginia Marine Resources Commission



## EXECUTIVE SUMMARY

### Congress Mandate to Eliminate the Obsolete Fleet

The ship disposal programs of the U.S. Maritime Administration (MARAD) and the U.S. Navy are tasked with the responsibility to dispose of all obsolete naval vessels that have been determined to be of insufficient value for commercial or national defense purposes. However, these Federal agencies have repeatedly missed congressionally mandated ship disposal deadlines that were enacted to reduce ship storage and maintenance costs associated with the obsolete fleet as well as eliminate pollution risks to the local marine environment from weakened hulls.

Both MARAD and the Navy explored alternatives to ship recycling in an attempt to meet mandates at least cost to the government. Vessels were at one time exported to the deadly shipbreaking beaches of South Asia, but when that became a subject of shame, they increasingly turned to ocean dumping. Both of these methods find advantage and “least cost” by externalizing costs to the poor and desperate, or to the global commons of our marine environment.

### Foreign Dismantling Practices Banned

The export of government owned vessels for disposal purposes is now banned under U.S. law. This ban was the culmination of several events that spanned the course of twenty years, and included: the discovery of polychlorinated biphenyls (PCBs) in various shipboard components in 1989; the discretionary enforcement of the PCB export ban by the EPA under the Toxic Substances Control Act (TSCA) in 1994; the Federal Moratorium on vessel exports issued by Vice President Al Gore in 1998 following the Baltimore Sun Pulitzer Prize winning exposé on the horrors of shipbreaking practices in South Asia; the lawsuit filed by the Basel Action Network (BAN) and the Sierra Club to block the export of MARAD vessels and to uphold TSCA in 2003; and the recent act of Congress with the passage of the Duncan Hunter National Defense Authorization Act for year 2009 that prevents exports as long as domestic ship recycling capacity exists.



Asbestos is removed from ships at shipbreaking yards in South Asia and sifted to powder for reuse in the local market. Workers do not have access to protective gear nor are they made aware of the risks associated with direct exposures. Asbestos is known to cause lung cancer, mesothelioma, and asbestosis. While the U.S. government no longer sends its vessels to South Asian shipbreaking yards, U.S. commercial ship owners still continue to support this industry.

*Image Source: © Greenpeace/Ruben Dao/FIDH*



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## Ocean Disposal Practices Adopted

Throughout the twenty years leading up to the ban on exports, the Navy and MARAD have looked increasingly favorably toward ocean disposal to meet fleet reduction goals at least cost to the government. While the U.S. government once externalized costs to foreign shipbreaking yards by exporting vessels, the U.S. government now externalizes costs to the ocean for much the same reason.

Ocean disposal of obsolete vessels via artificial reefing and sinking exercises (SINKEX) are deemed cost-effective disposal strategies by the Federal government and are permitted by a

series of exemptions from existing environmental laws, by ignoring obligations under international law and by neglecting to account for externalized costs. While the EPA acknowledges that these vessels are sunk still containing toxic materials within their composition, including asbestos, polychlorinated biphenyls (PCBs), iron, lead paint and antifouling paint, the EPA allows exemptions to various ocean dumping laws that would normally forbid the ocean disposal of such contaminants, purely on the basis of accounting that indicates reduced costs to the government.

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## Ocean Disposal Violates U.S. and International Ocean Dumping Regulations

SINKEX and artificial reefing operations violate U.S. and International ocean dumping regulations including the Marine Protection, Research and Sanctuaries Act (MPRSA); Toxic Substances Control Act (TSCA); London Convention; London Protocol; and the Stockholm Convention. This has been accomplished through inappropriate application of exemptions, waivers and discretion from U.S. and international laws.

Simply stated, the EPA permits the ocean disposal of hazardous waste, even when it is illegal under ordinary circumstances, while also acknowledging that some of these toxic materials, such as PCBs, leach into the marine environment from sunken vessels and accumulate in the bodies of fish and other marine organisms. They have justified this by claiming that the risks to human health and the environment are acceptable risks. Recent evidence however belies this assertion.

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## Navy Studies Claimed No Harm

While the EPA has permitted SINKEX under the MPRSA and provided full exemption from the Toxic Substances Control Act (TSCA), this general permit and TSCA exemption granted in 1999 by EPA Administrator Carol Browner, was based on a limited body of scientific research that was conducted primarily by the Navy itself,

the agency seeking the exemption. The EPA has justified its exemptions based on these Navy led studies. These studies have gone unchecked for more than a decade and have been used to justify the ocean dumping of approximately 95 naval vessels.



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## New Evidence Disclaims Navy's No Harm Assumptions

New fish sampling data, collected by the Florida Fish and Wildlife Conservation Commission as part of their 3 ½ year progress report for the Post-sinking Monitoring Study of the sunken Ex-USS ORISKANY, reveals startling toxic PCB leaching from the sunken aircraft carrier. According to the data, the leaching is occurring at more than twice the Navy's and EPA's pre-sinking modeled expectations of 2006. In fact, leaching PCBs from the sunken vessel has been taken up by fish at the reef site at levels above the Florida Department of Health fish consumption advisory threshold. Total PCB concentrations in fish samples increased 1,446% on average from pre-sinking to post-sinking.

PCBs are stored in fatty tissue where they increase over time (bioaccumulation). As PCBs move up the food chain to marine mammals and humans as we digest contaminated fish, PCB concentrations are magnified (a process known as biomagnification). As PCBs bioaccumulate in organisms and biomagnify in the food chain, they create health risks to organisms of all kinds; due to PCB's properties of persistence and toxicity, many scientists believe there is no safe level of exposure to PCBs.

The risks of consuming fish at the ORISKANY dumpsite are above acceptable levels, yet anglers and their families continue to consume fish from this site without warning.

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## Despite New Evidence – More Ocean Dumping

The revealing ORISKANY data and the release of this report coincides with current, unfortunate government decisions to dump more ships at sea. The Navy and MARAD disposed of five vessels at sea in year 2010, including the Ex-USS ANCHORAGE, Ex-USS NEW ORLEANS, Ex-USS MONTICELLO, Ex-

USS ACADIA, Ex-USNS SATURN via the Navy's SINKEX program. As of 2011, the Navy announced plans to sink five additional vessels in future years, including the Ex-ARTHUR RADFORD, Ex-NIAGARA FALLS, Ex-CONCORD, Ex-KILAUEA and EX-CORONADO.

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## Recommend Domestic Recycling as Preferred Disposal Method

Domestic ship recycling is the environmentally and economically preferred disposal option. It is the only method capable of hazardous waste management, and also provides for the recovery of valuable materials. Ocean disposal removes valuable scrap metal from circulation within the domestic marketplace and necessitates environmentally damaging primary metals mining, refining and manufacture. It also eliminates the creation of green domestic jobs. Recycling has the ability to create jobs many times over when material is reconstituted for use during each cycle of manufacturing.

Creating such jobs within the domestic recycling industry is consistent with the Federal green job initiatives of 2009 and 2010, including the American Recovery and Reinvestment Act (ARRA), which allocated \$787 billion in Federal funds to spur economic activity and create green jobs in America.

This report provides the first comprehensive analysis that makes it fundamentally clear that the environmental, human health and economic costs of dumping these ships at sea are too high.

## Chronology of Events

1946	National Defense Reserve Fleet (NDRF) established under the Merchant Sales Act		issues temporary restraining order until MARAD obtains PCB export authorization under TSCA
1972	Marine Protection, Research and Sanctuaries Act (MPRSA) passes	2004	Stockholm Convention enters into force
1974	The Liberty Ship Act (Public Law 92-402) passed to permit MARAD to donate NDRF vessels to states as artificial reefs	2004	Public Law 108-136 allows Navy to transfer obsolete naval vessels to States, U.S. territories or foreign countries for artificial reefing and permits both the Navy and MARAD to share (with the recipient) costs associated with sinking
1974	Public law 93-254 amends MPRSA to implement the provisions of the London Convention	2006	London Protocol enters into force
1975	London Convention enters into force	2006	MARAD and EPA release guidance document entitled <i>National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs</i> (BMP)
1976	Toxic Substances Control Act (TSCA) passes		
1977	MPRSA allows SINKEX ocean dumping under General Permit	2006	Ex-USS ORISKANY sunk as artificial reef in Florida under a risk-based PCB disposal permit and according to the BMP
1984	The Liberty Ship Act is amended by Public Law 98-623 to include vessels other than Liberty ships		
1989	PCBs are discovered in various shipboard components	2006	Congress mandated ship disposal deadline is not met
1994	EPA enforces with discretion the PCB export ban under TSCA	2007	MARAD annuls contract to export 9 vessels to England as a result of BAN and Sierra Club lawsuit, and recycles vessels in the U.S.
1996	EPA uses enforcement discretion allowing SINKEX to continue in violation of TSCA	2008	Congress passes the Duncan Hunter National Defense Authorization Act and ends export of government owned vessels as long as domestic capacity exists
1997	Baltimore Sun exposé reveals the horrors of shipbreaking practices in South Asia		
1998	Federal Moratorium on vessel exports issued by Vice President Al Gore	2010	ORISKANY Post-sinking monitoring data shows PCB leaching and uptake by fish at levels above Florida Department of Health fish advisory limits
1999	SINKEX General Permit reissued under MPRSA		
1999	EPA Administrator Carol Browner permanently exempts SINKEX from TSCA	2010	Navy and MARAD sink 5 vessels at sea, despite ORISKANY findings
2001	EPA changes the classification of artificial reefing from <i>continued use</i> to <i>disposal</i> , and subsequently lessens the PCB remediation standard from 2 ppm to 50 ppm	2011	Navy extends SINKEX to the Gulf of Alaska, to include two SINKEX events annually
2001	Congress mandated ship disposal deadline is not met	2011	Navy plans to sink 5 vessels at sea
2002	Congress passes Public Law 107-314 and establishes the <i>Pilot Program on Export of Obsolete Vessels for Dismantlement and Recycling</i> to be carried out in 2003 for up to four vessels, the first vessel exports since 1994		
2003	MARAD attempts to export 13 vessels to England under the Pilot Program, and awards \$17.8 million contract to Able UK		
2003	Basel Action Network (BAN) and the Sierra Club files lawsuit and blocks the export of 9 MARAD vessels to England; U.S. federal district court		

## LEGAL FRAMEWORK

### U.S. Ship Management

Following World War II, the National Defense Reserve Fleet (NDRF, now often called the Ghost Fleet) was established by the Merchant Ship Sales Act of 1946 to store inactive vessels in reserve for reactivation during national emergencies. The U.S. Maritime Administration (MARAD) is charged with the responsibility to manage the NDRF, which includes disposing of non-retention government owned merchant class vessels (dry cargo ships, tankers and military auxiliaries) of 1,500 gross tons or more (Federal Property and Administrative Services Act of 1949, as amended). Non-retention vessels are no longer military or non-military useful assets and therefore await disposal designation.

The U.S. Navy is responsible for disposing of all obsolete combatant vessels and merely transfers inactive Navy merchant class vessels to MARAD for storage in the NDRF as described above. Only in instances when overcrowded berthing conditions exist at a Navy Inactive Ship Maintenance Facility (NISMF) may non-retention Battleships, Cruisers, and Aircraft Carriers be transferred to NDRF locations for berthing while awaiting disposal.

These vessels are merely transferred to NDRF locations on a custodial basis in accordance with the Economy Act of 1932 for berthing, maintenance and preservation; the Navy, however, retains title, and therefore disposal responsibility remains with the Navy for all combatant vessels.



Rapidly deteriorating vessels awaiting disposal at the James River Reserve Fleet in Virginia

Image Source:

[www.bigshipwrecks.com/images/mediakit/ghostFleet.jpg](http://www.bigshipwrecks.com/images/mediakit/ghostFleet.jpg)

### 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 (Article I).

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.*”<sup>1</sup> The Convention offers an exception to this

<sup>1</sup>

[http://www.imo.org/Conventions/contents.asp?topic\\_id=258&doc\\_id=681](http://www.imo.org/Conventions/contents.asp?topic_id=258&doc_id=681)

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*” (Article III (1)(b)(ii)).

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

Consistent with these parameters governing placement, Article 4 of the Convention prohibits the dumping of all materials specified in Annex I, otherwise known as the black list. This list was created due to the strong likelihood that these contaminants create hazards to human health, living resources and marine life due to their hazardous characteristics. These characteristics include not only toxicity, but the



Obsolete vessels at the Suisun Bay Reserve Fleet in Northern California will either be recycled or sunk via SINKEX or artificial reefing by 2017. While MARAD acknowledges that more than 21 tons of lead, zinc, barium, copper and other toxic materials have been deposited in the bay from the deteriorating fleet, it remains unclear just how many tons of toxic materials above “trace contaminant” levels are deposited on the sea floor when vessels are sunk.

Image Source: Flickr user NOAA's National Ocean Service under Creative Commons agreement.

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.<sup>2</sup> Trace contaminants were not defined in the original Convention, however the U.S. EPA provides the following guidance: “*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.*”<sup>3</sup> The EPA suggests that when there is a lack of evidence suggesting unacceptable adverse impacts caused by contaminants after dumping, one assumes contaminants are absent or only present as trace contaminants. “*Because the 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.*”<sup>4</sup> By this rationale, the EPA first must allow ocean disposal of contaminants, and then only after post-sinking biological studies are conducted can the EPA determine if contaminants exceeded trace parameters. “*...Marine organisms are regarded, in a sense, as analytical instruments for determining the environmentally adverse consequences (if any) of any contaminants present.*”<sup>5</sup>

Only recently has such a study been conducted on a sunken naval vessel, however, these results have not been publicly released, until now (see *Human Health Risks* section below). According to this new fish data from the sunken EXORISKANY, PCB remediation standards required by the EPA do not meet trace contaminant requirements, as PCBs have

<sup>2</sup> <http://www.austlii.edu.au/au/other/dfat/treaties/1985/16.html>

<sup>3</sup> [www.epa.gov/owow/oceans/gbook/gbook.pdf](http://www.epa.gov/owow/oceans/gbook/gbook.pdf)

<sup>4</sup> *IBID.*

<sup>5</sup> *IBID.*



leached from the sunken vessel and have been taken up by fish at concentrations now exceeding state fish consumption advisory levels. These documented PCB concentrations create hazards to human health and marine life.

Further, 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 provides additional guidance to protect the marine environment from ocean dumping. The Protocol's general obligations under Article III states: "*Contracting Parties shall apply a precautionary approach to environmental protection from dumping of wastes or other matter whereby appropriate preventative measures are taken when there is reason to believe that wastes or other matter introduced into the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects.*"<sup>6</sup> The EPA's approach to identifying trace contaminants to meet the London Convention requirements fully ignores the precautionary approach mandated by the Protocol. By ignoring the precautionary approach, the EPA allowed the Ex-ORISKANY to be sunk with an estimated 680,000 pounds of PCB contaminated material, only to rely on post-sinking studies to determine the impacts of dumping such toxic waste as sea.

### Artificial Reefs

The Maritime Administration (MARAD) and Navy both suggest the act of sinking vessels at sea under the artificial reef designation, is considered placement of matter that serves as an alternative purpose other than mere disposal – that of enhancing and protecting ecological resources. The Navy claims "*artificial reefs enhance ecological resources by increasing the amount of productive hard bottom habitat.*"<sup>7</sup> As the Navy further elaborates in its 2008

Report to Congress, "*The goal of this deepwater (Ex-FORRESTAL) reef project is to provide habitat for the protection and enhancement of deepwater snapper and grouper species.*"<sup>8</sup>

However, the Navy's rationale for sinking vessels contradicts the Gulf States Marine Fisheries Commission (GSMFC), which suggests artificial reefs do not necessarily protect and enhance species of fish, but rather attract species of fish.<sup>9</sup> The attracting nature of the artificial reef can in fact be detrimental to species populations as concentrated populations can lead to fishing targets and thus overfishing, leading to a probable decline of species within the vicinity of the reef site.<sup>10</sup>

Jeff Tinsman, the artificial reef coordinator for the Delaware Department of Natural Resources stated, "*Artificial reefs are very popular with fishermen; they know they do provide a high*



Traditionally, oil and gas platforms are removed after decommissioning, however, under the "Rigs to Reefs" program, platforms can be left in place or toppled to create artificial reefs. This artificial reef designation allows oil and gas companies to evade the costs associated with platform removal and absolve itself from any future environmental damage or liability. States use the Rigs to Reefs program to increase fishing opportunities, as rigs are popular fishing destinations in the Gulf of Mexico.

Image Source: Flickr user mikebaird under Creative Commons agreement. <http://www.flickr.com/photos/mikebaird/3898808431/>

<sup>6</sup> <http://www.austlii.edu.au/au/other/dfat/treaties/2006/11.html>

<sup>7</sup> Navy Inactive Ships Program, Frequently Asked Questions, Artificial Reefing.

<sup>8</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, January 2008, Pg. 26.

<sup>9</sup> Lukens, R.R. and Selberg, 2004.

<sup>10</sup> IBID.

*concentration of fish available for harvest.*"<sup>11</sup> Further, Tinsman said that the sinking of 600 subway cars off the coast of Delaware to create an artificial reef increased the number of annual angling trips from 300 to 13,000.<sup>12</sup>

Thus the real alternate use benefits of artificial reefs are not to the marine ecosystem's health, but rather to fishermen who can more efficiently harvest fish that are attracted to the artificial reef. Altering an ecosystem in this manner, can be considered a form of ocean pollution as this concentration of fishery resources, for the short-term economic benefit to any given region, leads to the depletion of fishery resources and permanent destruction of natural habitat. Therefore, the placement of artificial reefs, such as naval vessels, is contrary to the aim of the London Convention by creating hazards to living resources and marine life by promoting overfishing.

Secondly, the very notion of ecological enhancement, as claimed by artificial reef advocates, is contradiction in terms unless a case can be made that the human activities in question return damaged environments back to their natural former state. Nature and the environment are considered absolute states – a



**Tanks are pushed off a barge in South Carolina; artificial reefs are the justified ocean disposal purpose.**

*Image Source: U.S. Army Environmental Command Flickr photostream*

state absent of human interference that requires protection from human meddling, not enhancement based on human value judgments imposed on it by a particular interest group such as divers or fishermen.

In the case of artificial reefs, replacing one natural ecosystem with another unnatural ecosystem because humans desire to attract certain species or to entertain divers is not an appropriate alternate use as it is inimical to true environmental protection. The ocean environment, being largely out of sight and out of mind to most of us, seems the only place where such proposals are taken seriously. We as a society would not likewise accept dumping old locomotives or automobiles in the deserts of our Southwest, presumably to attract migratory birds for the interest of hikers or hunters.

The dumping of societal wastes into nature for any purpose sends a very dangerous cultural message that the natural world, and in particular our marine environment, can be exploited as the solution to our growing waste problem. The notion that nature can be improved upon by artificial constructs is likewise a dangerous one as it presupposes that humans understand ecology fully and that nature should not be preserved to the extent possible as it is, regardless of whether human beings value it in its natural state or not. A spokeswoman for the Washington State Commissioner of Public Lands office, which manages the state-owned bottom of Puget Sound, said, *"We don't advocate putting foreign objects into the water because it changes the dynamic of the marine ecosystem."*<sup>13</sup>

Further, if the alternative purpose of artificial reefs could be justified as a legitimate alternative use other than mere disposal, one would then have to consider the matter of contamination, which under the London Convention cannot *"create hazards to human*

<sup>11</sup> <http://news.nationalgeographic.com/news/2006/08/060818-subway-reef.html>

<sup>12</sup> <http://www.reuters.com/article/idUSN1643767620080517>

<sup>13</sup> <http://crosscut.com/2009/09/11/ferries/19205/?pagejump=1>



*health, to harm living resources and marine life...".* Consistent with these requirements, materials dumped must not contain contaminants, such as PCBs, above trace contaminant parameters. However as discussed in the introduction to this section and further in the *Human Health Risk* section, the EXORISKANY post-sinking fish data, clearly shows contamination of the food chain by PCBs existing within the hull of this vessel.

Artificial reefing of contaminated ships is not consistent with the aim of the London Convention but rather imposes a violation and misapplication of an appropriate exception. The stated alternative purpose (artificial reef) is in fact detrimental to marine life and sustainable fish populations both from ecosystem alteration and from ecosystem contamination.

### **SINKEX**

SINKEX does not fit within the confines of the Convention's environmental protection aim, nor is it protective in this regard from contamination of Article 4's priority blacklisted materials described above. As discussed, the sudden presence of a ship hulk on the sea bottom can be an ecosystem altering event, and

the presence of PCBs in any concentration above trace amounts violates the primary objective of the Convention and introduces a blacklisted pollutant into the marine environment that is a known hazard to human health, living resources and marine life.

### **Violations**

In conclusion, both SINKEX and artificial reef dumping can be considered a violation, if not of the letter, then certainly of the spirit of the London Convention, a treaty to which the United States is a full Party and obliged to uphold.

The United States is required to *"...take in its territory appropriate measures to prevent and punish conduct in contravention of the provisions of this Convention"* (Article VII (2)). This requires first that the United States create legislation implementing the Convention. Then, if violations of such laws occur, the courts and the Department of Justice can prosecute.

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## **Marine Protection, Research and Sanctuaries Act**

The United States enforces the laws of the London Convention through the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). The EPA's ocean dumping management program enforces MPRSA and *"regulates ocean dumping to protect the environment from any material that will degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities."*

Ocean dumping is prohibited by the MPRSA; however, the EPA has the authority to issue a permit and exception to the law in rare instances. These exceptions are granted for the dumping of the following materials: dredged material (sediments removed from the bottom

of water bodies in order to maintain navigation channels and berthing areas), fish waste, human remains, and vessels.<sup>14</sup>

### **Artificial Reefs**

The MPRSA definition of dumping excludes the intentional placement of materials for a purpose other than disposal when otherwise regulated by federal or state law **or** occurs pursuant to an authorized Federal or State program. *"Because the placement of a vessel to create an artificial reef is regulated under other federal laws, the*

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<sup>14</sup>

<http://www.epa.gov/OWOW/oceans/regulatory/dumpedredged/oc eandumping.html>

*actual placement of vessels for use as an artificial reef is not subject to regulation under the MPRSA.*<sup>15</sup> Rather, Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA) regulate the placement of artificial reefs, but neither act properly regulates ocean disposal with respect to the concerns addressed under the London Convention. Further, the Toxic Substances Control Act (TSCA) regulates the PCB remediation requirements for vessel disposal, but again fails to meet the trace contaminant requirement of the London Convention, as discussed in the next section.

Section 404 of the CWA (33 U.S.C. § 1344) establishes a permitting program for the discharge of dredged or fill material to waters of the United States. Placement of a vessel in waters of the United States as an artificial reef constitutes a discharge of fill material and therefore requires a CWA section 404 permit when vessels are sunk within 3 miles of the U.S. coastline.<sup>16</sup> However, all vessels sunk as artificial reefs in the U.S. since 2002 have been sunk outside 3 miles of the U.S. coastline and have therefore been exempt from CWA.

Section 10 of the RHA of 1899 (33 U.S.C. §§ 403), requires a permit for the construction of any structure (including artificial reefs) in or over any *"navigable water of the United States."*<sup>17</sup> This permit is granted for the placement of an artificial reef on the basis of navigational safety without consideration of the artificial reef as a potential hazard to human health, to living resources or marine life.

Together, the CWA and RHA allow for artificial reefing activities to be exempt from the MPRSA. However, neither law provides an equivalent level of protection for the environment from black listed pollutants, such as PCBs, as

required of the MPRSA, the U.S. law tasked with enforcing the London Convention. The London Convention allows for the placement of material 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,"* (Article III (1)(b)(ii)). The aim of the convention is *"... 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 (Article I)."*

The EPA has exempted the ocean disposal of government vessels for the purpose of artificial reefing from the MPRSA. Yet the act of ocean disposal is not appropriately regulated under any other U.S. law.

### SINKEX

SINKEX is considered ocean dumping under MPRSA, and it is authorized under a general permit<sup>18</sup> (avoiding a case by case approach), originally issued in 1977. This general permit was reevaluated between 1989 and 1999 after the Navy discovered PCBs in various shipboard components. The general permit was reissued in 1999 with new PCB remediation requirements. See the *Toxic Substances Control Act* section below for a discussion on this new rule making.

Currently, the general permit provides for an exception to the standing ocean dumping prohibition. This permit requires appropriate measures be taken *"to remove to the maximum extent practicable all materials which may degrade the marine environment."* The Navy interprets 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,*

<sup>15</sup>

<http://www.epa.gov/owow/oceans/habitat/artificialreefs/documents/appendixb.html>

<sup>16</sup> *IBID.*

<sup>17</sup> *IBID.*

<sup>18</sup> Section 102 of the MPRSA, codified 40 CFR 229.2

*and readily detachable solid PCB items.*<sup>19</sup> Readily detachable or readily removable solid PCB items means items can be removed in a cost effective and efficient manner without the use of heat, chemical stripping, scraping and abrasive blasting or similar processes.<sup>20</sup>

While removal of liquid PCBs found in transformers and capacitors is required to the maximum extent practical prior to vessel sinking, the removal of material containing solid-matrix PCBs is not required to the maximum extent practical. Only readily detachable solid PCB items are required. In fact, the SINKEX general permit issued by the EPA under 40 CFR 229 states *“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...”*

Clearly, the general SINKEX permit granted to the Navy does not fulfill the requirements of the MPRSA *“to remove to the maximum extent practicable all materials which may degrade the marine environment.”* Further, the MPRSA is not providing proper implementation of the London Convention as the London Convention prohibits the dumping of any Annex I substance, such as PCBs, except in trace amounts.

Under MPRSA section 104(d), EPA is to periodically review and revise permits issued under the MPRSA. EPA has the authority *“to alter or revoke partially or entirely the terms of permits where it finds, based on monitoring data from the dump site and surrounding area that such materials cannot be dumped consistently with the criteria and other factors required to be applied in evaluating a permit application (1999 Memorandum of*

*Agreement).”* Further, the EPA Office of Water, Wetlands and Watersheds stated that they were *“prepared to revise the Navy permit, or revoke it, in the event that the results of further studies demonstrate an unexpected unacceptable risk to human health or the environment from SINKEX.”*<sup>21</sup>

As discussed later in this report, the general permit which authorizes ocean dumping under SINKEX, should be revoked based on post-sinking monitoring studies that have now revealed elevated PCB leach rates from sunken vessels that are detrimental to human health and the environment. See *Human Health Risk* section for recent results from the sunken Ex-ORISKANY.



The crew of the GEORGE H.W. BUSH Carrier Strike Group looks on as the USNS SATURN is sunk in October 2010 as part of a SINKEX training event off the Atlantic coast. The 10,205 ton vessel was built in 1965, and likely contained PCBs above trace contaminant levels during sinking.

Image Source: U.S. Navy photo by Mass Communication Specialist 1st Class Jason C. Winn

<sup>19</sup> Navy Frequently Asked Questions, SINKEX

<sup>20</sup>

<http://www.marad.dot.gov/documents/April2001ShipDisposalReportToCongress.pdf>

<sup>21</sup> Official letter from Carol Browner, EPA Administrator, to Richard Danzig, Secretary of the Navy, September 13, 1999

## Toxic Substances Control Act

### Artificial Reefs

The Toxic Substances Control Act (TSCA) regulates the distribution in commerce and disposal of polychlorinated biphenyls (PCBs). Prior to 2001, the U.S. Environmental Protection Agency's (EPA) Office of Pollution, Prevention, Pesticides and Toxics program viewed the sinking of Navy vessels as artificial reefs continued use of material under the guidance of TSCA. However, in 2001, the EPA changed the classification of artificial reefing from continued use to disposal. EPA determined that the original use of the vessel had expired, and therefore the authorized use of PCBs within the construction of the vessel had expired as well. PCB materials left in place are not authorized for continued use but rather must be declared waste and must be disposed of according the requirements of TSCA.

This change in vessel classification came as a result of the Spiegel Grove artificial reefing plan, which could not cost-effectively meet PCB remediation requirements of 2 parts per million (ppm). Incidentally, the reclassification raised the acceptable PCBs remaining on sunken vessels to 50 ppm.<sup>22</sup>

In sum, the EPA views the sinking of vessels for the purpose of artificial reefing an act of disposal under TSCA regulations and therefore has lowered the PCB remediation requirements to a 50 ppm level. However, at the same time, the EPA also considers the act of sinking vessels for the purpose of artificial reefing an act of non-disposal (placement) under the London Convention and MPRSA, thereby avoiding the dumping prohibitions and application of the black list. Thus, the EPA has allowed a double standard in order to facilitate ocean dumping. Under this arrangement, the Navy and MARAD are allowed to dump vessels with least burden

to the budgets of these agencies by externalizing the costs to the marine environment and the food chain.

If artificial reefing is considered disposal under the terms of TSCA, then it does not serve an alternative purpose and can be characterized as ocean dumping under the London Convention and MPRSA, and should be a prohibited action in which trace contaminant levels should apply. However, if a sunken vessel serves an alternative purpose (i.e. artificial reef, fisheries enhancement), the EPA should redefine the ocean disposal action as continued use or reuse. This adjustment would require remediation of PCBs to levels below 2 ppm, as opposed to the 50 ppm under the current disposal designation.

### SINKEX

Throughout the course of three decades up to the year 2000, SINKEX accounted for 8% of all Navy ship disposals.<sup>23</sup> In 1989, the Navy limited the SINKEX program when PCBs were discovered in various shipboard components, and worked with the EPA to develop a two-phase research program to assess the risks associated with the ocean disposal of PCBs. These studies were conducted by the Navy, the agency seeking the TSCA exemption, rather than an independent third party. In March 1994, the Navy began the study – 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*”<sup>24</sup> resulting from sinking naval vessels at sea.

Based on these findings, 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

<sup>22</sup> <http://www.gsmfc.org/publications/GSMFC%20Number%20121.pdf>

<sup>23</sup> RAND Report Pg. 20

<sup>24</sup> Decision Memorandum – EPA Regulation of PCBs on Vessels Used for Navy Sinking Exercises, September 7, 1999

SINKEX vessels. Meanwhile, the Navy was required to conduct the Sunken Vessel Study to substantiate the findings of the 1994 Modeling study, again paid for by the agency seeking exemption, and in the Spring of 1999 presented the study to the EPA suggesting there was a “*lack of evidence of unreasonable risk to human health or the environment*” from SINKEX.

In September 1999, under pressure from the Navy, the EPA Administrator reinstated the SINKEX program under the general permit authorized under 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 actions taken by the Administrator included the



The Department of Defense is the world's largest polluter, producing 750,000 tons of hazardous waste annually, more than the five largest U.S. chemical companies combined (source: Projectcensored.org). On top of generating more waste than any other entity across the globe, the DOD also continues to operate with exemptions to environmental laws to avoid costs associated with pollution prevention and clean up. SINKEX operates under such exemptions.

Image Source: U.S. Navy News Stand photo ID 021009-N-8590B-005

full exemption of SINKEX from TSCA, under the assumption that SINKEX could adequately be regulated solely under MPRSA.

The EPA affirmed: “*We believe there is no public interest in regulating the transportation and disposal of PCBs associated with SINKEX under TSCA...*”<sup>25</sup> SINKEX activities resumed in 1999 with full exemption from TSCA, and continues to operate with full exemption to this day.

However, the EPA made this determination under what has proven to be a false assumption, stating at the time “*Solid PCBs are not believed to be readily leachable to the marine environment.*”<sup>26</sup> The EPA’s decision was further rationalized as follows: “*Considering the type of PCB material involved and the lack of evidence of unreasonable risk to human health or the environment, the Office of Water has determined that the general MPRSA permit for SINKEX is protective of risks associated with PCBs on SINKEX vessels.*”<sup>27</sup>

New findings by the EPA and others in the scientific community now fully acknowledge that solid PCBs leach into the marine environment and are taken up by fish. PCBs can then be transferred to humans as humans digest these contaminated fish. Under these new findings there exists a clear public health interest in regulating transportation and disposal of PCBs associated with SINKEX under TSCA.

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

<sup>25</sup> Official letter from Carol Browner, EPA Administrator, to Richard Danzig, Secretary of the Navy, September 13, 1999

<sup>26</sup> *IBID.*

<sup>27</sup> *IBID.*



circumstances prohibited under TSCA. However, as mentioned above, any PCBs that remain on SINKEK 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. According to the EPA Office of Prevention, Pesticides and Toxic Substances, *“If EPA were to regulate SINKEK under TSCA, SINKEK would be unlawful, and subject to citizen suit...”*<sup>28</sup>

With the Navy’s success in achieving a TSCA exemption for all SINKEK vessels in 1999, they 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. The 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 SINKEK as mentioned above.

EPA’s Position: *“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).”*<sup>29</sup> It remains unclear why the EPA

did not take a similar stance for the SINKEK program.

In this instance, the 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.

*“DoD is attempting to create an exemption from TSCA by having the Administrator transfer authority under section 9 of TSCA to other statutes...DoD claims that TSCA requirements will be met by these other statutes and the proposed reefing standards plan. However, if DoD is completely exempt from TSCA, then section 9 would no longer apply and the transfer of authority to other statutes would not be available as an option to DoD.”*<sup>30</sup>

As mentioned above, the EPA Administrator authorized an exemption from TSCA for SINKEK by transferring authority under section 9 of TSCA to MPRSA. According to the EPA’s position above, this transfer of authority should for the very same reason not be permitted.



Helicopter machine gunner fires .50 caliber rounds on the USNS SATURN target as part of a SINKEK training event off the Atlantic coast. The sinking of this 10,205 ton vessel was exempt from TSCA.

Image Source: U.S. Navy photo by Mass Communication Specialist Seaman Leonard Adams

<sup>28</sup> Official letter from Carol Browner, EPA Administrator, to Richard Danzig, Secretary of the Navy, September 13, 1999

<sup>29</sup> EPA’s comments on DoD’s FY04 Legislative Proposals to the

National Defense Authorization Act:

<http://www.cpeo.org/pubs/EPA%20RRPI%20Response.pdf>

<sup>30</sup> IBID.



## 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). 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. 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, of which PCBs are named. 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.

Article 6 (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, U.S. SINKEX and reefing programs allow the dumping of vessels containing PCBs in concentrations above this level.

## OECD

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

In order to achieve its goals, the OECD can promulgate decisions that are generally binding on its members. OECD Decision C(87)2/Final

focuses specifically on the disposal of 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.<sup>32</sup> 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.

<sup>31</sup> Article V, Convention on the Organization for Economic Cooperation and Development

<sup>32</sup> Article III (2), Decision C(87)2/Final

## HUMAN HEALTH RISK

### Artificial Reefs

PCBs have been implicated as toxic agents that have dioxin-like properties that can lead to carcinogenic effects in humans (U.S. EPA 1996). Yet, the EPA fully acknowledges that PCBs leach into the marine environment from sunken vessels and accumulate in the bodies of fish, which are then transferred through the food web to humans as humans digest contaminated fish. 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 exposure to PCBs than marine organisms themselves.<sup>33</sup>

The U.S. EPA has the authority to approve risk-based disposal of PCBs (63 FR 35384, June 29, 1998), *"if a finding of no unreasonable risk of injury to human health and the environment can be made."* However, the EPA is also noted as saying *"Considering the type of PCB material involved and the lack of evidence of unreasonable risk to human health or the environment, the Office of Water has determined that the general MPRSA permit for SINKEX is protective of risks associated with PCBs on SINKEX vessels."* By the EPA's own admission, there exists a lack of evidence to find *"no unreasonable risk of injury to human health and the environment,"* yet SINKEX continues, a direct result of the EPA not regulating SINKEX under TSCA.

The EPA human health risk assessment includes the following measure: *"Cancer risks are calculated in terms of additional cases of cancer above what is normally expected to occur in a population over a 70-year lifetime. US EPA considers an increase in the range of one additional case in 1,000,000 people up to one additional case in 10,000 people to be*

*acceptable."* According the EPA cancer risk standard, the Redbird Reef off the coast of Delaware, which sees 13,000 angler visits annually, constitutes reasonable and acceptable risk if only one of these anglers or their children develops cancer from exposure to PCBs from the sunken ARTHUR RADFORD, currently slated for sinking in Summer 2011. With an anticipated 60-year life span of the reef, the



Red snapper are sought after by both recreational and commercial fishermen in the Gulf of Mexico. However, red snapper caught at the Oriskany sink site were found to contain PCB concentrations that exceed the Florida Department of Health fish consumption advisory threshold. The vessel was sunk with an estimated 680,000 pounds of PCB contaminated material.

Image Source: Louisiana State University Sea Grant Program, Flickr user lsgcp under Creative Commons agreement

<sup>33</sup> Barnthouse, Glaser, Young, 2003

EPA accepts that 78 people developing cancer from PCB exposure as a reasonable and acceptable risk.

Water quality standards are developed by the EPA to protect 95% of aquatic species tested (U.S. EPA 1991, 1994). The national water quality standard for salt water PCBs is 0.03 ug/L (U.S. EPA 1998b, 1999b, summarized in Buchman 1999). In 2006, prior to the sinking of the ORISKANY, the State of Florida proposed enacting water quality standards for persistent, bio-accumulative, and toxic contaminants such as PCBs to be protective of an exposure equivalent to the “*risk of one in a million for the 90<sup>th</sup> percentile of all Florida adults eating fish found in Florida waters*” (FLDEP 2004).<sup>34</sup>

The new standard for the annual average exposure to PCBs was twice as restrictive as the previous standard, cutting the allowable rate for human exposure from 0.000045 ug/L to 0.000023 ug/L. (F.A.C. 62-302.530). However the Navy concluded that this standard was developed for human health and therefore was not applicable to the ecological risk assessment, which permitted the disposal of PCBs aboard the Ex-USS ORISKANY. Rather, the value of 0.03 ug/L recommended by the national guidance as protective of aquatic organisms was used as the most conservative ecological risk benchmark, as well it was used to calculate the toxic effects from PCB exposure to aquatic life. The Navy stated: “*Because the Ex-ORISKANY is to be sunk outside of the territorial waters of the State of Florida, the State of Florida Water Quality Standards are not legally applicable.*”<sup>35</sup> State of Florida waters extend 9 nautical miles from land, whereas the vessel was sunk 22.5 miles from land.

<sup>34</sup>

[http://environ.spawar.navy.mil/Projects/REEFEX/Reports/HHRA\\_Final\\_1-20-06.pdf](http://environ.spawar.navy.mil/Projects/REEFEX/Reports/HHRA_Final_1-20-06.pdf)

<sup>35</sup> IBID.

On May 17, 2006, the Navy sunk the Ex-USS ORISKANY as an artificial reef off the coast of Florida in accordance with the *National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs* (BMP). The total cost of environmental remediation for the sinking of the Ex-USS ORISKANY was \$11.89 million. Even at that cost, they were unable to remove all of the PCBs and other hazardous substances, and thus real costs were externalized to the marine environment.

The EPA and its Science Advisory Board accepted the Navy’s conclusions that the risks associated with sinking the vessel were negligible and that the sinking would result in a *material value* to sports fisheries. On this basis, the EPA issued the risk-based disposal permit for the sinking of the PCB contaminated vessel. However, the environmental implications of such a decision are only now being realized, 5 years later, that the Navy’s data and their risk-based assumptions were seriously flawed.

According to data from an ongoing study conducted by the Florida Fish and Wildlife Conservation Commission (FWC) as part of the post-sinking monitoring program, PCB concentrations in fish caught at the Ex-USS ORISKANY site are now more than twice that of the EPA’s forecasted levels. All liquid PCBs were removed from the vessel prior to sinking; therefore all documented PCB leaching is from solid PCBs. Thirty-three percent of all fish sampled post-sinking in the vicinity of the Ex-USS ORISKANY had PCB concentrations above 20 parts per billion (ppb), the EPA screening level. Twenty-one percent of all fish sampled post-sinking had PCB concentrations above 50 ppb, the Florida Department of Health fish advisory threshold. Total PCB concentrations in fish samples increased 1,446% on average from pre-sinking to post-sinking.

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

	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*	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

**Table 2: Fish PCB Sampling: 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
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

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-USS ORISKANY site. The control reef samples were taken on the same days as the Ex-USS ORISKANY samples in 2008. PCB concentrations in fish caught at the Ex-USS ORISKANY site in 2008 were more than 932%, on average, higher than PCB concentrations in fish caught at the control reef.

The Ex-USS ORISKANY sampling does not merely show fish contamination in the state of Florida; rather, it shows that approximately 95 naval vessels intentionally sunk in the last 11 years alone (through SINKEX and artificial reefing) have placed the marine environment and human health at unreasonable risk of toxic exposure.

The Ex-USS ORISKANY site is a popular diving and recreational fishing destination. Fish caught at this site clearly contain elevated PCB levels, which the families of anglers are digesting without warning. The Florida Department of Health (DOH) only releases a PCB fish consumption advisory when fish tissue saturation is 50 ppb or above. BAN's analysis of the Ex-USS ORISKANY post-sinking data clearly shows total mean PCB concentrations above this limit. Yet the public remains unaware of the toxins they ingest and the health risks associated.

It is clear that dumping Navy vessels at sea places the public and vital fisheries at unreasonable risk. The Ex-USS ORISKANY case clearly shows detrimental impacts to the environment at unacceptable and unhealthy levels, yet these recent findings have not altered the course of the Ex-USS ARTHUR RADFORD, scheduled for sinking in Summer 2011.

The sinking of the Ex-USS ARTHUR RADFORD is intended to increase recreational fishing and diving opportunities within the artificial reef site, an area where the state itself advises against fish consumption. *"Indeed, they [PCBs] are present in the waters of the tidal Delaware*

*River and Delaware Bay, also referred to as the Delaware Estuary, at concentrations up to 1,000 times higher than allowed under current water quality criteria..."*<sup>36</sup> In fact, the 2009 Delaware Fish Consumption Advisory states that in Delaware Atlantic Coastal Waters, NO CONSUMPTION is advisable for women of childbearing age and children, with all other groups advised to eat no more than one meal per year of the following fish: white perch, American eel, channel catfish, white catfish, **bluefish-greater than 14 inches, weakfish and striped bass** due to polychlorinated biphenyl (PCB) contamination.<sup>37</sup>

It's important to note that the Delaware Artificial Reef Program states *"gamefish such as **bluefish, striped bass and weakfish** are attracted to baitfish, which congregate around reef structures."*<sup>38</sup> In effect, the gamefish that anglers are seeking to catch at the artificial reef sites, are in fact not advisable for human consumption due to PCB contamination.



As the sunken Ex-USS ORISKANY deteriorates on the ocean floor, PCBs are leaching from the vessel and are being taken up by fish at the reef site.

Image Source: FWC Artificial Reef Program

<sup>36</sup>

<http://www.sussexcountian.com/newsnow/x1991985412/Acceptable-PCB-levels-to-be-discussed-by-Delaware-River-Basin-Commission>

<sup>37</sup> <http://www.fw.delaware.gov/Fisheries/Pages/Advisories.aspx>

<sup>38</sup> <http://www.fw.delaware.gov/Fisheries/Pages/ArtificialReefProgram.aspx>



## SINKEX

While the Ex-ORISKANY fish data clearly shows contamination of the food chain from the sinking of ships in shallow waters as artificial reefs, the Navy has long claimed that deep water sinkings conducted through SINKEX do not pose the same contamination risks to the food chain. Below therefore it is necessary to explore the validity of this claim.

Current SINKEX remediation practices were developed 11 years ago (1999) and were based on the Sunken Vessel Study that assessed the impacts of a single SINKEX vessel, the Ex-USS AGERHOLM, 16 years after the vessel's 1982 sinking. At the time of the assessment, solid PCBs were not believed to leach into the marine environment and little was known about PCB transport in the marine environment. This study was conducted by the Navy itself, a compromised source as they were the beneficiaries of ocean dumping allowances, and therefore had good reason to present a case that served their interest. Several follow-up studies including the Modeling Study in March 1994, and the PCB leachability laboratory study based on sediment samples were conducted to verify the Navy's initial conclusions, but again, these studies were conducted by the Navy. In fact, the Navy's conclusions have gone unchallenged for over a decade, until now.

As discussed in the *Legal Framework* section, the EPA allowed SINKEX to operate solely under the General Permit (issued under the Marine Protection, Research and Sanctuaries Act) and exempt from TSCA, because there was a "lack of evidence of unreasonable risk to human health or the environment..." considering the type of PCB material involved (solid PCBs).<sup>39</sup> They stated, "Solid PCBs are not believed to be readily leachable to the marine environment."<sup>40</sup> These conclusions are not

supported by current scientific research as solid PCBs are now known to readily leach into the marine environment as documented in the Navy's own solid PCB leach rate studies.<sup>41</sup> However, the Ex-ORISKANY post-sinking fish data confirms solid PCBs leach more rapidly into the marine environment than the Navy's simulated leach rate estimates and are taken up through the food chain more rapidly than the Navy's environmental risk-based assumptions.<sup>42</sup>

Further, 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 bio-concentration factor, and very low degradation rates, determine their behavior in the environment.<sup>43</sup> 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 geo-accumulation).<sup>44</sup>

<sup>41</sup> *Investigation of PCB Release-Rates from Selected Shipboard Solid Materials Under Laboratory-Simulated Shallow Ocean (Artificial Reef) Environment*; April 2006.  
<http://www.spawar.navy.mil/sti/publications/pubs/tr/1936/tr1936cond.pdf>

<sup>42</sup> ORISKANY Post-sinking Monitoring Study 3 ½ year progress report, 2006-2009

<sup>43</sup> Mackay, D., W.Y. Shiu, and K.C. Ma, 1992. *Illustrated handbook of physical-chemical properties and environmental fate for organic chemicals*, Vol. I, Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs. Lewis Publishers, Boca Raton, FL, 697pp.

<sup>44</sup> Froescheis, Oliver, Ralf Looser, Gregor M. Cailliet, Walter M. Jarman and Karlheinz Ballschmiter, 2000. *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)*,

<sup>39</sup> Official letter from Carol Browner, EPA Administrator, to Richard Danzig, Secretary of the Navy, September 13, 1999

<sup>40</sup> *IBID.*



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, 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.”<sup>45</sup>

**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 bathypelagic 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.”<sup>46</sup>

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.<sup>47</sup> DSLs have been recorded at all depths to 3,000 meters.<sup>48</sup>

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.<sup>49</sup> 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.

**2. Upwelling:** The physical marine transport process called upwelling routinely moves materials from deep water to surface water.<sup>50</sup> Upwelling can occur in coastal regions as well as the open ocean,<sup>51</sup> and can be wind or tide-induced. Both types of upwelling do not typically occur in isolation, but rather coexist.<sup>52</sup>

Open ocean winds cause surface waters to diverge from a region (causing upwelling) or to converge toward some region (causing downwelling).<sup>53</sup> These movements are essential to stirring the ocean, delivering oxygen to depth, distributing heat, and bringing nutrients to the surface.<sup>54</sup>

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*bathypelagic scattering layers on the northern Mid-Atlantic Ridge*

<sup>49</sup> Barnthouse, Glaser, Young, 2003

<sup>50</sup> Tomczak, M., 1998. *Shelf and Coastal Oceanography*. <http://www.es.flinders.edu.au/~mattom/ShelfCoast/notes/chapter06.html>

<sup>51</sup> <http://oceanmotion.org/html/background/upwelling-and-downwelling.htm>

<sup>52</sup> Tomczak, M., 1998. *Shelf and Coastal Oceanography*. <http://www.es.flinders.edu.au/~mattom/ShelfCoast/notes/chapter06.html>

<sup>53</sup> <http://oceanmotion.org/html/background/upwelling-and-downwelling.htm>

<sup>54</sup>

azmanian Aquaculture and Fisheries Institute  
<http://www.redmap.org.au/resources/impact-of-climate-change->

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*Chemosphere*, Volume 40, Issue 6, March 2000, Pages 651-660

<sup>45</sup> <http://www.epa.gov/oppt/tribal/pubs/TribalNewsletter1of2.pdf>

<sup>46</sup> Monterey Bay National Marine Sanctuary Site Characterization – Biological Communities and Assemblages – Pelagic Zone.

<http://montereybay.noaa.gov/sitechar/pelagic5.html>

<sup>47</sup> IBID.

<sup>48</sup> Opdal, A.F., Godo, O.R., Bergstad, O.A., Fiksen, O, 2007. *Distribution, identity, and possible processes sustaining meso- and*

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.

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.<sup>55</sup> 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, with 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.<sup>56</sup> 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.

As evidenced, and contrary to the Navy conceptual model, 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 and pose unnecessary risks to human health.

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*on-the-marine-environment/upwelling-and-downwelling*

<sup>55</sup> <http://oceanmotion.org/html/background/upwelling-and-downwelling.htm>

<sup>56</sup>

<http://earthobservatory.nasa.gov/Newsroom/view.php?id=24124>

# INTERNALIZED COSTS

## Artificial Reefing Costs

The U.S. Maritime Administration (MARAD) recognizes “*the requirements in the BMP [National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs] to remove all solid PCBs [polychlorinated biphenyls] above the regulated limits...for purposes of creating an artificial reef could negate potential cost advantages of artificial reefing compared to conventional dismantling.*”<sup>57</sup> In fact, Maritime Administrator David Matsuda was cited by the Washington Post in 2009 as saying artificial reefing is 3 to 5 times as costly as domestic recycling.<sup>58</sup>

This appears to be a newly realized viewpoint of MARAD under the Obama Administration. However the Navy has not indicated a comparable view, as evidenced by the June 8, 2010 transfer of the Ex-ARTHUR RADFORD, a 563 foot Navy Destroyer to the states of Delaware, New Jersey and Maryland for the Summer 2011 scuttling as an artificial reef. The Navy’s share of the costs associated with this sinking is 200,000 times the costs to taxpayers for recycling this vessel domestically, as evidenced by a domestic recycler’s unsolicited offer to the Navy to recycle the vessel at a cost of \$1. The Navy did not respond to the unsolicited offer from the approved Navy recycling contractor, Esco Marine.

From 2002-2008, MARAD and the Navy disposed of four vessels at sea via artificial reefing. These four sinkings cost a total of \$37.5 million dollars, for which MARAD and the Navy contributed \$25.35 million, or 68% of the total costs, leaving the remaining 32% to be covered

by the state artificial reefing programs. On a disposal cost per ton basis, reefing these vessels costs an average of \$554/ton, for which MARAD and the Navy contributed an average of \$253/ton. However, the costs to recycle these ships domestically during this same period was an average of \$67/ton which would equate to a savings to the U.S. taxpayer of \$21.5 million. Recycling would have also created an estimated 1,865 U.S. jobs.<sup>59</sup>

Disposing of vessels at sea does not bring best value to the Federal government as costly remediation requirements, combined with a lack of returns from commodity metals (see below), negates any perceived cost advantages including financial contributions from state artificial reefing programs or sports fishery



The Ex- ARTHUR RADFORD is now being prepared for sinking as an artificial reef in Summer 2011. The sinking of the RADFORD will discard an estimated \$6 million worth of recyclable materials to the depths of the sea, and forfeit approximately 223 jobs, lasting approximately one year, from the economy at large.

Image Source: Navy Photo ID 021127-N-3653A-004.jpg

<sup>57</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, January 2008

<sup>58</sup> <http://www.washingtonpost.com/wp-dyn/content/article/2009/09/06/AR2009090601989.html>

<sup>59</sup> Author’s calculation using job forecast methodology at [http://www.foeeurope.org/publications/2010/More\\_Jobs\\_Less\\_Waste\\_Sep2010.pdf](http://www.foeeurope.org/publications/2010/More_Jobs_Less_Waste_Sep2010.pdf); and Recycling and Economic Development, A Review of Existing Literature on Job Creation, Capital Investment, and Tax Revenue, CASCADIA, 2009

encouragement.

The sinking of the Ex-ORISKANY, a former aircraft carrier sunk off the coast of Florida in 2006, is a case worth exploring: the total cost of environmental remediation for the sinking of the Ex-ORISKANY was \$11.89 million. Add to that \$3.07 million for towing and berthing; \$4.9 million for scuttling preparation and execution; and \$3.74 million to develop the Prospective Risk Assessment Model (PRAM), all adding up to a total cost of \$23.6 million.<sup>60</sup> Had the vessel been dismantled in the U.S., the recyclable scrap materials would have brought an estimated \$18 million return, more than enough to compensate for the environmental remediation costs, while avoiding the costs of scuttling preparation, execution and the PRAM modeling.

In the last several years the Navy has been preparing another massive aircraft carrier, the Ex-FORRESTAL, for ocean dumping via artificial reefing. The Navy spent a reported \$6.4 million<sup>61</sup> preparing the Ex-FORRESTAL for dumping at sea. But recently the Navy changed their scuttling plans and announced that the Ex-FORRESTAL would now be recycled in the U.S., along with three other aircraft carriers, Ex-SARATOGA, Ex-INDEPENDENCE and Ex-CONSTELLATION. The economic benefits associated with recycling far outweighed the costs of reefing these vessels.

While the Navy and MARAD share artificial reefing costs with recipient states, it is important to note that many of the state artificial reefing programs are largely funded by Federal tax dollars. Up to 75% of the funding can come from the Federal Aid in Sport Fish Restoration Program. The program provides Federal aid to the State for management and restoration of fish having *"material value in*

*connection with sport or recreation in the marine and/or fresh waters of the United States."*<sup>62</sup> These funds are derived from a 10-percent excise tax on certain items of sport fishing tackle (Internal Revenue Code of 1954, sec. 4161), a 3-percent excise tax on fish finders and electric trolling motors, import duties on fishing tackle, yachts and pleasure craft, and motorboat fuel taxes authorized under the Internal Revenue Code (Sec. 9503).<sup>63</sup> This is a use tax, where users (i.e. fishermen) are paying for the service (i.e. fish aggregation around designated artificial reef site). However, this use tax funds programs that have not been proven to restore fish populations, as was the intent of the Federal aid program, but rather has proven to concentrate fish for harvest and population depletion (see *Fishery Resource Costs* section below).



Senator McCain's old aircraft carrier, the Ex-FORRESTAL, will now be recycled in the U.S. rather than being sunk as an artificial reef. The Navy reportedly spent \$6.4 million preparing the vessel for artificial reefing prior to changing disposal plans. Recycling the FORRESTAL will recirculate an estimated \$30-\$33 million worth of recyclable materials in the domestic marketplace and create an estimated 1,927 jobs in the economy at large.

Image Source: Navy Photo ID 021127-N-3653A-004.jpg

<sup>60</sup>

<http://www.epa.gov/OWOW/oceans/habitat/artificialreefs/documents/introduction.html>

<sup>61</sup> Roberts, Kathleen. Public Affairs Specialist, Naval Sea Systems Command

<sup>62</sup> <http://www.fws.gov/laws/lawsdigest/FASPORT.HTML>

<sup>63</sup> *IBID.*

**Table 3: Artificial Reef Costs 2006-2009**

Vessel Name	Tons (LDT)	MARAD/ Navy Cost	Total Cost	MARAD/ Navy Cost/Ton	Total Cost/Ton	Average Recycling Cost/Ton	
SPIEGEL GROVE	6,553	\$0	\$1,300,000 <sup>64</sup>	\$0	(\$198)	(\$127)	2002
ORISKANY*	32,000	\$22,600,000	\$23,600,000 <sup>65</sup>	(\$706)	(\$738)	(\$83)	2006
TEXAS CLIPPER	7,662	\$1,500,000 <sup>66</sup>	\$4,000,000 <sup>67</sup>	(\$196)	(\$522)	(\$79)	2007
VANDENBERG	11,342	\$1,250,000 <sup>68</sup>	\$8,600,000 <sup>69</sup>	(\$110)	(\$758)	\$21	2008
Total	57,557	\$25,350,000	\$37,500,000	(\$253)	(\$554)	(\$67)	

\*Navy vessel

( ) = Expenditure

Source: Table developed by author using data from Navy and MARAD 2008 Report to Congress on the Progress of the Vessel Disposal Program; and <http://www.whitehouse.gov/omb/expectmore/detail/10004010.2006.htm>

<sup>64</sup> <http://www.epa.gov/OWOW/oceans/habitat/artificialreefs/documents/introduction.html>

<sup>65</sup> *IBID.*

<sup>66</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, January 2008

<sup>67</sup> Shively, Dale, Texas Parks and Wildlife, Texas Clipper: A New Artificial Reef in the Gulf of Mexico

<sup>68</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, January 2008

<sup>69</sup> [http://www.marad.dot.gov/news\\_room\\_landing\\_page/news\\_item\\_summary/news\\_item/b09\\_12.htm](http://www.marad.dot.gov/news_room_landing_page/news_item_summary/news_item/b09_12.htm)



## SINKEX Costs

Over the course of 30 years from 1970 to 1999, 178 Navy vessels were sunk via SINKEX (disposal by sinking during military target practice exercises),<sup>70</sup> amounting to 8% of all Navy ship disposals during this period. However, under the Bush Administration, from 2000-2008, SINKEX accounted for approximately 70% of all Navy ship disposals. Not only did this form of disposal result in valuable recyclable metals dumped at sea, the Navy also incurred great financial expense to remove some, though not all, hazardous, polluting substances prior to dumping.

The Navy does not publicly share the total cost estimates for sinking vessels via SINKEX. Rather, they only report costs for environmental preparation. For example, the most expensive SINKEX on record was the sinking of the Ex-AMERICA in 2005 at a total cost of \$22 million,<sup>71</sup> however the Navy only reported a total cost of \$4 million. The 61,174 ton vessel contained approximately \$30 million in recoverable scrap metals, but again the Navy's accounting methods failed to report any material value losses or opportunity cost should these materials have been recycled rather than dumped. The sinking of AMERICA essentially cost the U.S. taxpayers \$52 million, not even accounting for the externalized costs to the environment.

The Navy's environmental remediation cost estimates from 2005-2008 for vessels slated for SINKEX are listed in Table 4 below. This table provides a limited means of cost comparison between SINKEX and domestic recycling as 3 of the 12 vessels listed were in fact recycled rather than sunk. The FORT FISHER is one such example; it was sold in May 2009 to International Shipbreaking Ltd (ISL), a domestic recycling operation in Brownsville,

<sup>70</sup> RAND Report Pg. 17

<sup>71</sup> Navy Plans to Sink America,  
<http://www.msnbc.msn.com/id/7081234/>

## Sinking Navy Destroyers

The Spruance Class Destroyer fleet of 31 vessels were equipped to serve the U.S. Navy for a 35 – year service life, most of which would serve through 2019 with proper maintenance and updates, yet the Bush Administration opted to accelerate their retirement and dump 25 of the 31 destroyers at sea as a means of vessel disposal rather than recycling. Only two vessels survive, the PAUL FOSTER and the Ex-ARTHUR RADFORD, with the latter being the 26th Spruance Class Destroyer slated for ocean disposal in Summer 2011. The Ex-ARTHUR RADFORD dumping now falls under the Obama Administration, who appears to be carrying on the outdated ocean dumping policies of past years.

The 25 vessels dumped contained approximately 156,000 tons of recyclable metals, including steel, aluminum and copper amongst others. In today's market, this material would be worth an estimated \$155 million and over 1,600 U.S. green recycling jobs, each job lasting approximately one year. The sinking of the Radford will contribute another \$6 million of recyclable material to the depths of the sea, and forfeit nearly 228 jobs from the economy at large, in a time when U.S. jobs are scarce at best.



**Ex-John Young, a Spruance Class Destroyer sunk in 2004 via SINKEX**

Image Source: <http://ussthorndd988.com/Thornsistership.html>

Texas, for a total of \$0.02. Recycling this vessel brought significant savings to the Navy when compared to the \$400,000 cost estimate for SINKEX.

ISL also purchased two other vessels in May at a total cost of \$0.02 each, the Ex-Saipan and the Ex-Austin. The Ex-Saipan alone will generate 250 green jobs throughout the dismantling process, which will likely last one

year.<sup>72</sup> One would suspect that the proven economic benefits of ship recycling in these clear examples would steer the Navy's ship disposal program toward ship recycling. But instead, the Navy continued to sink five vessels in 2010 via SINKEX following the successful recycling of the above mentioned vessels. The Navy's plans to sink additional vessels in 2011 adds to the confusion of SINKEX cost rationalization.

Another vessel, the Ex-PROTEUS was sold for recycling in 2008 to Esco Marine in Brownsville, Texas, for a total cost to the Navy of \$1,431,500.<sup>73</sup> In comparing this to the \$800,000 cost estimate for SINKEX, at first glance it appears that SINKEX is economically beneficial in this instance. However, as mentioned above in the case of the Ex-AMERICA, SINKEX cost estimates only account for environmental remediation costs and do not account for storage, towing, weaponry, fleet support and the many other costs associated with SINKEX.

If we simply consider the vessel remediation costs and estimated costs of towing (\$1 million<sup>74</sup>) the vessel from California to Hawaii, where it would have likely taken part in the Rim of the Pacific Exercises (RIMPAC) SINKEX event, the total SINKEX costs for the Ex-PROTEUS would have been approximately \$1.8 million. When this simple cost comparison is made, domestic recycling actually saved the U.S. taxpayer \$368,500 (not counting externalized costs discussed below).

One final example, the Ex-MONTICELLO, a Thomaston-class dock landing ship, was sunk in July 2010 at RIMPAC at an estimated cost to the Navy of \$915,548. Adding to that figure the

towing cost estimate of \$750,000,<sup>75</sup> and the Navy incurred costs of approximately \$1,665,548. Taking into consideration the Ex-MONTICELLO's sister ships, the Ex-PLYMOUTH ROCK and Ex-FORT SNELLING, which were each sold to Peck Recycling of Richmond Virginia for recycling in 1995 for a positive cash flow of \$268,707 each, the sinking of the MONTICELLO was done so at a surprising financial loss. In view of the fact that these exercises can take place with alternative means as described at the outset, these few examples show where SINKEX is clearly not providing a *best value* solution to the government, yet the Navy continues to mask the true costs of this ship disposal program in order to continue business as usual.



The Ex- NEW ORLEANS was sunk via SINKEX during summer 2010, along with four other vessels: the Ex- ANCHORAGE, Ex-MONTICELLO, Ex-ACADIA and Ex-SATURN. These five vessels contributed an estimated 47,521 tons of recyclable material, worth an estimated \$29 million, to the depths of the sea, forfeiting approximately 1,692 jobs from the economy at large while unemployment rates remained steady at 9.5%.

Image Source: Australian Defense Force, RIMPAC 2010

<sup>72</sup> <http://www.themonitor.com/articles/gets-32824-arrival-navy.html>

<sup>73</sup>

<http://www.marad.dot.gov/documents/July2007ReportToCongress.pdf>

<sup>74</sup> Calculated on the basis of Commercial towing estimate for the Monticello

<sup>75</sup> Commercial towing estimate, Compass Maritime Services

**Table 4: SINKEX Cost Estimates 2005-2008**

Vessel Name	Navy SINKEX Cost Estimates
HORNE (CG 30)*	\$750,000 (sunk in 2008)
JOUETT (CG 29)*	\$750,000 (sunk in 2007)
PROTEUS (IX 518)*	\$800,000 (recycled in 2008)
NEW ORLEANS (LPH 11)*	\$800,000 (sunk in 2010)
FORT FISHER (LSD 40)*	\$400,000 (recycled in 2009)
MAUNA KEA (AE 22)**	\$754,550 (sunk in 2006)
MONTICELLO (LSD 35)**	\$915,548 (sunk in 2010)
PYRO (AE 24)**	\$754,549
FLORIKAN (ARS-9)**	\$396,984 (recycled in 2010)
CLAMP (ARS-33)**	\$363,484
BOLSTER (ARS-38)**	\$363,484
RECLAIMER (ARS-42)**	\$363,484

\* Navy vessel                      \*\* Maritime Administration vessel

Source: 2006 & 2008 Report to Congress on the Progress of the Vessel Disposal Program

## Domestic Recycling Costs

Strict regulations and strong oversight now ensure that hazardous materials are disposed of with respect for the environment and human health in U.S. shipbreaking yards. Recycling International, an independent worldwide publication, said in 2006, “*Visits to shipbreaking yards around the world confirm that nobody upholds environmental and safety measures as stringently as the Americans.*” The publication goes on to say, “*...the USA has become the world’s leading ‘green’ recycler of marine ships...*” BAN’s own site visits confirm that ship recycling in Brownsville, while not without room for improvement, is likely the best major ship recycling destination in the world. It is clear that once all externalities are accounted for, domestic recycling that provides U.S. jobs, is overwhelmingly the

environmentally and economically preferred method of vessel disposal.

In 2001, the Maritime Administration presented cost estimates to Congress for domestic scrapping of 140 NDRF vessels. MARAD concluded that each vessel would cost on average \$2.5 million to scrap, which equates to an average of \$338 per ton. In December 2002, MARAD used these cost estimates to ask congress to include a statute in Public Law 107-314 (Bob Stump National Defense Authorization Act for Fiscal Year 2003) to allow MARAD to provide financial assistance to states for environmental preparation, towing, and/or sinking of vessels as artificial reefs in an effort to reduce ship disposal costs as if reefing were in fact cheaper. These cost estimates were also

used as justification to arrange a Memorandum of Agreement with the Navy in 2003 with Congressional support to transfer MARAD vessels to the Navy for SINKEX purposes.

However, Congress was in fact misled. The 2001 cost estimates were inflated by 58%. Of the 140 vessel scrapping cost estimates, 63 were awarded scrapping contracts as of January 2008. The cost estimates for these 63 vessels amounted to \$142,841,160; but the actual contracts amounted to merely \$59,635,469. The actual cost per ton was \$141, compared to the 2001 estimate of \$338 (see Appendix A). The overinflated cost estimates of 2001 helped garner support from Congress to enact laws and amendments to allow the ocean disposal of vessels.

Indeed, recent evidence points to the fact that domestic recycling is most often the best value consideration even with externalities ignored, as evidenced in the sections discussed above. This is due to a combination of factors including commodity price increases, a steady supply of ships allowing domestic yards to maintain an active workforce and increased competition due to greater activity.

Furthermore, a well established and trained workforce allows for faster turnover of ships than other methods and thus lowers government storage and maintenance costs, which amount to approximately \$20,000 per vessel annually. Obsolete vessels await disposal an average of 22 years,<sup>76</sup> equating to approximately \$440,000 per vessel over the course of a ship's obsolete non-retention status. Maintaining the Navy inactive fleet costs taxpayers approximately \$14 million annually.<sup>77</sup>

High steel prices and strong competition in the domestic scrapping industry has reduced costs to the government from an average \$79/ton

(negative value) in 2007 to a profit (positive value) of \$21/ton in 2008.<sup>78</sup> Dismantling costs are well below that of artificial reefing, which cost approximately \$554/ton on average, even when including vessels such as the Ex-ORISKANY in this average, in which only partial remediation was conducted.

Domestic ship recycling is economically sound: it creates U.S. jobs, provides commodities for sale and eliminates most externalities associated with non-recycling options. It is clearly a *best value* solution.



U.S. ship recycling operations in Brownsville, Texas, generate thousands of jobs throughout the dismantling and recycling processes. The dismantling alone of one single vessel, the Ex-SAIPAN, is said to bring 250 green jobs to Brownsville; jobs that are expected to last one year. These recycling jobs support the total job creation of approximately 875 jobs in the wider economy when accounting for indirect and induced employment.

Image Source: [www.clui.org/lotl/v33/k.html](http://www.clui.org/lotl/v33/k.html)

<sup>76</sup> House of Representatives, 2000

<sup>77</sup>

[http://www.navytimes.com/news/2008/02/navy\\_shipdisposal\\_080223w/](http://www.navytimes.com/news/2008/02/navy_shipdisposal_080223w/)

<sup>78</sup>

<http://www.whitehouse.gov/omb/expectmore/detail/10004010.2006.html>



## EXTERNALIZED COSTS

The National Defense Authorization Act of 2001 requires that vessel disposal be conducted “...*in the manner that provides the best value to the Government,*” while also “*giving consideration to worker safety and the environment.*” As discussed in the Internalized Costs section above, the Federal government has a poor record in bringing best value to the Government with respect to ship disposal. However, the best value scenario dims even further for artificial reefing and SINKEX disposal methods when one considers the hidden externalized or deferred costs associated with ocean dumping.

These hidden costs have been externalized to the environment and to the future, but are nevertheless real, and could become the liability of the polluter. It is well known that pollution prevention is far less costly than pollution remediation; in this way, not only are the true costs deferred to the future, but they are dramatically increased by this deferral. Current Federal ocean dumping policies do not account for these hidden costs. This section addresses some of the externalized costs associated with ocean dumping, however this section is in no way exhaustive of all costs externalized and deferred to future generations.

## Natural Resource Costs

Productive resources such as steel, aluminum and copper are limited, yet the human need for them is virtually endless. The reality of our finite earth, coupled with our current loss of biodiversity and global warming crises, should remind us that our “*use it and then lose it*” lifestyle is unsustainable. Primary production of metals is far more damaging to ecosystem health, habitat and biodiversity due to the impacts of mining on the face of the earth, increasingly in wilderness areas in developing countries. Likewise, primary production is far more energy intensive than secondary metals recovery (e.g. recycling) and thus produces greenhouse gas emissions, air and water pollution in higher volumes. According to the University of Colorado at Boulder, recycled aluminum uses 95% less energy when compared to virgin aluminum production alone.<sup>79</sup> In 2008, 52% of aluminum used in North America came from primary production,

with only 34% deriving from recycled material. The remaining 14% was imported.<sup>80</sup>



This open pit copper mine in Bingham Canyon, Utah, is considered the world's largest man-made excavation on earth; however, it only supplies the U.S. with 18% of our annual copper need. Having operated for over 100 years, the mine's ore reserves are expected to be fully depleted by 2020.

Image Source: Flickr user arbyreed under creative commons agreement;  
[http://www.flickr.com/photos/19779889@N00/3746214349/in/photo\\_stream/](http://www.flickr.com/photos/19779889@N00/3746214349/in/photo_stream/)

79

[http://recycling.colorado.edu/education\\_and\\_outreach/recycling\\_facts.html](http://recycling.colorado.edu/education_and_outreach/recycling_facts.html)

80

<http://www.aluminum.org/Content/NavigationMenu/NewsStatistics/StatisticsReports/FactsAtAGlance/factsataglance.pdf>



Steel is North America's top recycled material as it is both economically advantageous and environmentally preferred. Recycled steel requires 33% less energy and 32% less CO<sub>2</sub> emissions to produce when compared to the production of steel from virgin materials alone.<sup>81</sup> Scrap is the steel industries single largest source of material. In fact, over the past 50 years, 50% of steel produced in the U.S. has been recycled through the steel making process.<sup>82</sup>

Steel recycling is paramount to the continued development of infrastructure, both within developed nations and developing nations alike. Steel sparked the Industrial Revolution and helped shape a nation out of the frontier; now in the 21<sup>st</sup> century, rapidly developing nations such as China and India rely on steel as their primary resource necessary to continue development. However, depletion of this valuable natural resource is imminent according to the Worldwatch Institute, which estimates that iron ore reserves could be fully depleted within 64 years based on conservative 2% growth in consumption per year.<sup>83</sup> World consumption of iron ore currently grows at 10% per annum on average, with the United States being one of the world's top consumer.<sup>84</sup>

A limited supply of steel will inevitably slow human development and diminish our options on how to build a sustainable future. Yet, the U.S. government's ongoing dumping of vessels at sea continues to remove valuable scrap metal from circulation within the domestic marketplace and necessitates environmentally damaging primary metals mining, refining and manufacture. With a surplus of obsolete ships

containing millions of tons of scrap steel, it is in the best interests of everyone to responsibly manage and protect this valuable resource rather than squander it by allowing it to erode on the ocean floor.

One example of how basic metals are becoming *critical metals* is demonstrated by the limited stock of armor plating noted in December 2004 as a major cause for concern amongst army personnel in Iraq.

Spc. Thomas Wilson of the Tennessee National Guard told Donald Rumsfeld, Secretary of Defense in 2004, that troops in Kuwait were forced to rummage through landfills for scrap metal to rig armor for their vehicles before storming Iraq.<sup>85</sup> When asked about the shortage or armor plating in vehicles operating in Iraq, Rumsfeld responded, *"It's essentially a matter of physics. It isn't a matter of money. It isn't a matter on the part of the Army of desire. It's a matter of production and capability of doing it."*<sup>86</sup> As of December 2004, of the 30,000 wheeled vehicles U.S. troops operated throughout the Middle East and Central Asia, approximately 8,000 lacked armored protection.<sup>87</sup> This shortage of armor plating, including the benign and peaceful use of such material, will continue to escalate if natural resources are not preserved, reused, recycled and recycled again.

Over the past decade alone, the Federal government has sunk 95 vessels at sea, amounting to 600,000 tons of recyclable material, worth an estimated half a billion dollars in scrap metal. Appendix B shows this list of vessels and their combined material weight. Nearly all vessels listed in Appendix B are Surface Combatant class vessels. Using the recovery indices for different ship types per the 2001 RAND Report, *Disposal Options for Ships*, a report sponsored by the Navy itself, one

<sup>81</sup> Jeremiah Johnson, B.K. Reck, T. Wang and T.E. Graedel, *The energy benefit of stainless steel recycling*, *Energy Policy*. Volume 36, Issue 1, January 2008, Pages 181-192.

<sup>82</sup> <http://www.recycle-steel.org/rates.html>

<sup>83</sup> Brown, Lester Plan B 2.0, New York: W.W. Norton, 2006. p. 109

<sup>84</sup> <http://www.reuters.com/article/pressRelease/idUS141349+01-Feb-2008+PRN20080201>

<sup>85</sup> <http://www.latimes.com/news/nationworld/iraq/complete/la-fg-armor10dec10,1,308448.story?page=1>

<sup>86</sup> *IBID.*

<sup>87</sup> *IBID.*

can use parametric estimating to define the material composition within each vessel and the estimated value of recyclable materials that were dumped at sea.

Referencing Appendix B, the 2001 Rand Report recovery indices, and the current commodity price index, one can estimate the total material value lost over the past decade to the Federal government's ocean dumping programs. With 95 vessels weighing a combined 674,318 tons, only 9% of which was waste, 613,629 tons of material was recyclable, worth an estimated \$611,849,180. Essentially, the Federal government dumped more than half a billion dollars at sea without accounting for any material value loss. On top of this astonishing figure, the Navy also paid substantial amounts to conduct each ocean dumping exercise.



The USS ARLINGTON is under construction using steel salvaged from the September 11, 2001 attack on the Pentagon. The sister ship, USS NEW YORK, was partially constructed of salvaged steel from the Twin Tower site, and the USS SOMERSET was partially constructed using steel from the crash site of Flight 93. Reusing salvaged scrap materials from retired naval vessels to build the new fleet would not only give tribute to those lost and those who served, but it would also reduce environmental impacts associated with primary metals mining to respect the needs of future generations.

*Image Source: Northrop Grumman Shipbuilding*

**Table 5: Vessel Composition and Material Value of Vessels Dumped at Sea 2000-2010**

	Ferrous	Aluminum	Copper & Copper Alloys	Lead	Waste	Total
% of Total Vessel Light Displacement*	79%	4%	4%	4%	9%	100%
Material weight (ldt)	532,711	26,973	26,973	26,973	60,689	674,318
Commodity Price Index	\$400/ton	\$2/pound	\$3.60/pound	\$1/pound	\$0	
Material Value	\$213,084,488	\$120,837,786	\$217,508,014	\$60,418,893	\$0	\$611,849,180

*Note: 2,240 pounds = 1 long ton*

*\* Percentages sourced from the 2001 RAND Report, Disposal Options for Ships*

*See Appendix B for list of vessels*

## Air Pollution Costs

The ocean disposal of naval vessels discards valuable material that would otherwise be recycled to reduce virgin resource extraction and refining and related CO<sub>2</sub> emissions, as

discussed in the previous section. Under a cap and trade model, carbon is a factor in assigning monetary value to various activities. Increasing value is assigned to activities or products that

reduce or offset CO<sub>2</sub>. Therefore, recycled material has a higher value than virgin resources, as it requires less energy and CO<sub>2</sub> emissions to produce the same product.

For every tonne (1 long ton = 1.01604691 tonnes) of recycled copper, 13 to 19.7 tonnes of CO<sub>2</sub> emission equivalents are curbed (see Table 4). Similarly, for every tonne of recycled copper, 346.04 tonnes of hidden flow waste equivalents are curbed. Hidden flow waste is associated with extraction and processing of resources, but is typically unaccounted for in the waste stream. Hidden flow waste typically accounts for 2/3 of a product's impact; these hidden flows are in the form of mining waste, devastated forests, ruined agricultural land, or leachate-producing landfills.<sup>88</sup>

According to the Navy, the Ex-FORRESTAL aircraft carrier alone contains approximately 40,000 tons of recyclable material that can reenter the U.S. market to offset primary production. Referencing Table 5 to make calculations in Table 6, it is revealed that recycling the Ex-FORRESTAL will prevent 73,726 tonnes (162,538,007 pounds) of CO<sub>2</sub> from entering the atmosphere. This is equivalent to removing 14,097 passenger vehicles from the road for a year;<sup>89</sup> the equivalent of preventing 385 railcars of coal from burning in a coal fired-power plant;<sup>90</sup> the equivalent emissions from electricity use of 8,947 homes for one year.<sup>91</sup> The curbed CO<sub>2</sub>

emissions would otherwise require over 15,000 acres of pine or fir forests for adequate carbon sequestration,<sup>92</sup> or 1,890,410 tree seedlings grown for 10 years.<sup>93</sup>

The energy savings and related CO<sub>2</sub> emissions curbed by recycling the Ex-FORRESTAL, as compared to the ocean disposal option can be represented as carbon credits with a related monetary value. 73,726 tonnes of CO<sub>2</sub> emissions would be curbed by recycling the vessel; this is the equivalent of 171,456 barrels of oil consumed,<sup>94</sup> or 8,293,138 gallons of gasoline.<sup>95</sup> If we use crude oil as our energy equivalency, we see an energy savings value of approximately \$14.3 million (171,456 barrels of crude oil x \$83.42 per barrel<sup>96</sup>). However, if we use the retail value of gasoline as our energy equivalency, we see an energy savings value of approximately \$23.7 million (8,293,138 gallons of gasoline x \$2.86 per gallon<sup>97</sup>). These energy equivalencies serve as examples and do not necessarily represent actual values for curbed CO<sub>2</sub> emissions due to the fact that energy savings are likely related to a combination of fossil fuels, including crude oil, gasoline and coal. The Navy spent a reported \$6.4 million<sup>98</sup> preparing the Ex-FORRESTAL for dumping at sea prior to changing their plans to recycle the vessel in the U.S.

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#### **metric tons CO<sub>2</sub>/home.**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>92</sup> **4.69 metric tons of CO<sub>2</sub> per acre of pine or fir forests**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>93</sup> 23.2 lbs C/tree \* (44 units CO<sub>2</sub> / 12 units C) \* 1 metric ton / 2204.6 lbs = **0.039 metric ton CO<sub>2</sub> per urban tree**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>94</sup> 5.80 mmbtu/barrel \* 20.33 kg C/mmbtu \* 44 g CO<sub>2</sub>/12 g C \* 1 metric ton/1000 kg = **0.43 metric tons CO<sub>2</sub>/barrel**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>95</sup> 2,425 grams C/gallon \* 100% oxidation factor \* 44 g CO<sub>2</sub>/12 g C \* 1 metric ton/1,000,000 g = **8.89\*10<sup>-3</sup> metric tons CO<sub>2</sub>/gallon of gasoline**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>96</sup> Crude Oil and Commodity Prices, 4/21/2010, <http://www.oil-price.net/>

<http://www.oil-price.net/>

<sup>97</sup> US Energy Information Administration, 4/19/2010,

<http://tonto.eia.doe.gov/oog/info/gdu/gasdiesel.asp>

<sup>98</sup> Roberts, Kathleen. Public Affairs Specialist, Naval Sea

Systems Command

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<sup>88</sup> Waste & Climate Change Background document for the ISWA & DAKOFA conference on Waste & Climate Change 3-4 December 2009 in Copenhagen - to be held in connection to the UN Climate Summit COP 15 in Copenhagen 7-18 December 2009

<sup>89</sup>  $8.89 \times 10^{-3}$  metric tons CO<sub>2</sub>/gallon gasoline \* 11,720 VMT <sub>car/truck average</sub> \* 1/20.4 miles per gallon <sub>car/truck average</sub> \* 1 CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O/0.977 CO<sub>2</sub> = **5.23 metric tons CO<sub>2</sub>E /vehicle/year**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>90</sup> 22.68 mmbtu/metric ton coal \* 25.34 kg C/mmbtu \* 44g CO<sub>2</sub>/12g C \* 90.89 metric tons coal/railcar \* 1 metric ton/1000 kg = **191.5 metric tons CO<sub>2</sub>/railcar year**

<http://www.epa.gov/cleanenergy/energy-resources/refs.html>

<sup>91</sup> 12,773 kWh per home \* 1,422.40 lbs CO<sub>2</sub> per megawatt-hour delivered \* 1 mWh/1000 kWh \* 1 metric ton/2204.6 lb = **8.24**

**Table 6: CO2 Emissions and Hidden Flow Savings from Recycling**

Material Type	Saved CO2 emissions in recycling compared with virgin manufacture (t/t)	Saved 'hidden flow generation' in recycling compared with virgin manufacture (t/t)
Copper	13-19.7	346.04
Aluminum	4.6-12.4	36.15
Steel	0.9-1.3	7.85

Source: Waste & Climate Change Background document for the ISWA & DAKOFA conference on Waste & Climate Change 3-4 December 2009 in Copenhagen - to be held in connection to the UN Climate Summit COP 15 in Copenhagen 7-18 December 2009

**Table 7: Ex-FORRESTAL CO2 Emissions and Hidden Flow Savings from Recycling**

Material Type	Quantity (tonne)	CO2 per tonne of virgin material (tonne)	Hidden flow waste generation per tonne (tonne)	CO2 Emissions avoided by recycling (tonne)	Hidden flow impacts avoided by recycling (tonne)
Copper	445	19.7	346.04	8,766.5	153,987.8
Brass	208	19.7	346.04	4,097.6	71,976.32
Copper-Nickel	182	19.7	346.04	3,585.4	62,979.28
Ferrous Steel	30,976	1.3	7.85	40,268.8	243,161.6
High Tensile Strength Steel	6,864	1.3	7.85	8,923.2	53,882.4
Aluminum	652	12.4	36.15	8,084.8	23,569.8
Total	39,326			73,726	609,557

Table developed by author using data from:

Navy Request For Proposal, June 2009 ( Solicitation #: N00024-09-R-4224); and Waste & Climate Change Background document for the ISWA & DAKOFA conference on Waste & Climate Change 3-4 December 2009 in Copenhagen - to be held in connection to the UN Climate Summit COP 15 in Copenhagen 7-18 December 2009

Note: 1 long ton = 1.01604691 tonne

## Fishery Resource Costs

Some coastal states are investing in artificial reef programs in an attempt to rebuild or enhance fisheries to sustainable levels. Rebuilding efforts are crucial to respond to past or current overfishing practices, which, according to the National Oceanic Atmospheric Administration (NOAA), still occurs in 48 fisheries in U.S. waters to date.<sup>99</sup> Worldwide, 52% of the world's fisheries are fully exploited, and 24% are overexploited, depleted or recovering from depletion.<sup>100</sup> Unless the current situation improves, stocks of all species currently fished for food are predicted to collapse by 2048.<sup>101</sup> Artificial reefs are not part of the overfishing solution; they are part of the problem.

The Gulf States Marine Fisheries Commission (GSMFC) suggests artificial reefs do not protect and enhance species of fish, but rather attract species of fish.<sup>102</sup> The attracting nature of the artificial reef can in fact be detrimental to species populations as concentrated populations can lead to fishing targets and thus overfishing, leading to a probable decline of species within the vicinity of the reef site.<sup>103</sup>

Jeff Tinsman, the artificial reef coordinator for the Delaware Department of Natural Resources stated, *"Artificial reefs are very popular with fishermen; they know they do provide a high concentration of fish available for harvest."*<sup>104</sup> Further, Tinsman said that the sinking of 600 subway cars off the coast of Delaware to create an artificial reef increased the number of annual angling trips from 300 to 13,000.<sup>105</sup> This

dramatic increase of pressure on fishery resources should signal a warning, clearly, if fisheries are depleted due to the rapid harvest of concentrated fish populations, overfishing will reduce tourist dollars to nothing when depleted fisheries are closed for recovery.

A similar example exists in New Jersey. In 1970, prior to extensive artificial reef developments in New Jersey waters, only 3% of private fishing trips were on artificial reefs. In 1991, New Jersey began an aggressive campaign to sink material to create a reef network of 1,300 reef sites. By 2000, private fishing trips to artificial reefs increased to 90% of all fishing trips.<sup>106</sup> With 90% of all private fishing trips directed at artificial reefs sites, and artificial reefs making up less than 1% (currently .3%) of New Jersey's ocean floor, the benefits of fish aggregation for harvest are clear. However, the economic benefits to the fishing industry by attracting fish to these marked sites (where even commercial



The Ex-Vandenberg was sunk in the Florida Keys National Marine Sanctuary in 2009 at a cost of \$8.6 million. The vessel is a popular fishing destination as it is said to attract fish away from the protection of natural coral reefs within the marine sanctuary itself. However, it is well known that fish aggregation at a marked site can exacerbate the problem of overfishing, as concentrated fish populations can be easily and more rapidly harvested.

Image Source: <http://www.nileguide.com/destination/blog/florida-keys/2010/05/29/vandenberg-artificial-reef-celebrates-first-birthday/>

<sup>99</sup> NOAA Fisheries Service Begins Process To End Overfishing By 2010, New Magnuson-Stevens Act

<sup>100</sup> FAO (2004) State of World Fisheries and Aquaculture (SOFIA) - SOFIA 2004. FAO Fisheries Department

<sup>101</sup> Worm, B. et al (2006) Impacts of biodiversity loss on ocean ecosystem services. *Science*, 314: 787

<sup>102</sup> Lukens, R.R. and Selberg, 2004.

<sup>103</sup> IBID.

<sup>104</sup> <http://news.nationalgeographic.com/news/2006/08/060818-subway-reef.html>

<sup>105</sup> <http://www.reuters.com/article/idUSN1643767620080517>

<sup>106</sup> [www.state.nj.us/dep/fgw/pdf/2001/rfnews01.pdf](http://www.state.nj.us/dep/fgw/pdf/2001/rfnews01.pdf)



fishermen use fishing pots and traps) for easy and rapid harvest, will soon be lost when fishery resources are depleted.

The decline of fish stock in U.S. waters and globally are a direct result of overfishing which has dramatic economic impacts. Cod stocks in Newfoundland, Canada serve as a stark reminder of such immediate yet everlasting effects. In 1990, 110,000 people were employed in the fishing and fish processing industry. But in 1992, the cod fishery collapsed and 40,000 jobs were lost.<sup>107</sup> To date, the cod fishery has not yet recovered and research suggests the ecosystem has changed substantially, meaning that the cod may never return.

Take also into consideration the California salmon fishery closure, which came as a result of decades of environmental degradation. According to State official estimates, the fishery closure led to an economic loss of \$279 million in 2009 alone.<sup>108</sup> Clearly, the economic impacts of fish resource depletion are much greater than

the potential short-term economic boost to regional economies from enhanced fishing opportunities.

The U.S. currently imports 60% of its seafood, resulting in a trade deficit of more than \$7 billion annually, second only to oil among natural products being imported.<sup>109</sup> NOAA is working to end overfishing in U.S. waters, as required by the Magnuson Stevens Act through sustainable management practices. However, artificial reefs that increase fishing opportunities are counterproductive to the Act's goals and have not been scientifically justified to increase fishery resources, but have rather been documented to exploit resources by providing concentrated populations leading to the inevitable ecological and economic collapse of such fisheries.



**Concentrating fish populations for easy and rapid harvest greatly contributes to overfishing, and is counter productive to the Magnuson Stevens Act's mandate to end overfishing in U.S. waters.**

*Image Source: NOAA*

<sup>107</sup>

[http://www.panda.org/about\\_our\\_earth/blue\\_planet/problems/problems\\_fishing/](http://www.panda.org/about_our_earth/blue_planet/problems/problems_fishing/)

<sup>108</sup>

<http://www.sundancechannel.com/sunfiltered/2009/12/federal-agencies-issue-plan-to-ease-water-crisis-in-californias-bay-delta/>

<sup>109</sup>

<http://www.economics.noaa.gov/?goal=ecosystems&file=events/overfishing>

## Uptake into the Marine Food Chain

The long-term environmental effects from the disposal of toxic materials in the marine environment are documented by the EPA. These materials of concern exist in dangerous concentrations within the hulls of naval vessels and have lasting impacts on marine life, however these impacts are considered acceptable under current EPA environmental risk-assessments.

### a. Asbestos

Studies have investigated the effects of asbestos on fish and indicate that asbestos may cause epidermal lesions, epithelial hypertrophy, kidney damage, decreased orientation and swimming ability, degradation of the lateral line, reduced growth and increased mortality.<sup>110</sup> The BMP only requires the removal of loose asbestos and asbestos that may become loose during sinking. Large amounts of asbestos are allowed to remain onboard the vessel during sinking, and this asbestos enters the marine environment with clear potential to harm marine wildlife.

### b. Polychlorinated Biphenyls (PCBs)

PCBs are persistent organic pollutants (POP) targeted for global phase-out and total destruction under the Stockholm Convention. 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.<sup>111</sup> As a result, people who ingest contaminated fish may be exposed to dangerous

levels of PCBs.<sup>112</sup> In fact, due to the toxin's accumulation properties, many scientists believe there is no safe level of exposure to PCBs.<sup>113</sup>

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.<sup>114</sup> The reefing BMP requires all liquid PCBs be removed and all manufactured materials containing more than 50 parts per million (ppm) of solid PCBs. However, many solid matrix PCB contaminated materials containing less than 50 ppm remain onboard for sinking.

The Navy examined the ORISKANY artificial reef to determine the effects PCB leaching has on marine habitat and human health. The ORISKANY was environmentally cleaned in accordance with EPA requirements, yet an estimated 700 pounds of pure PCBs (above 50 ppm concentration) still remained onboard.<sup>115</sup> The study determined PCB concentrations released into the waters surrounding the reef accumulated in the bodies of reef fish and are digested by recreational anglers and their families from eating fish caught at the reef.<sup>116</sup>

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*

<sup>110</sup> Batterman, A.L. and P.M. Cook. 1981; Belanger, S.E., et al 1986; Belanger, S.E., et al 1990; Woodhead, A.D., et al 1983.

<sup>111</sup>

[http://yosemite.epa.gov/R10/TRIBAL.NSF/af6d4571f3e2b1698825650f0071180a/1e4f27736563fc3a882571db00661b15/\\$FILE/910-F-99-001PCBS.pdf](http://yosemite.epa.gov/R10/TRIBAL.NSF/af6d4571f3e2b1698825650f0071180a/1e4f27736563fc3a882571db00661b15/$FILE/910-F-99-001PCBS.pdf)

<sup>112</sup> National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs, May 2006, Pg. 35

<sup>113</sup>

<http://yosemite.epa.gov/r10/owcm.nsf/88fa11a23f885ef3882565000062d635/a9578719c73ad1de882569ed00782e89?OpenDocument#reduces>

<sup>114</sup> Adams, J.A. and S. Slaughter-Williams. 1988; Brouwer, A., et al 1989; Clark, R.B. 1992.; den Beston, et al 1991.

<sup>115</sup> Olsen, Erik, New York Times

<sup>116</sup> Leach Rate Study, Prospective Risk Assessment Model for ex-ORISKANY, US Navy.

*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.”*<sup>117</sup>

### c. Iron

Iron can leach into the environment from steel hulls of sunken vessels. Studies on phytoplankton and macroalgae indicate that in areas where plant nutrients such as nitrate and phosphate are abundant, the availability of iron is actually a limiting factor in growth and biomass.<sup>118</sup>

### d. Lead Paint

The EPA notes that lead paint has been used on the interiors of some vessels; however the BMP does not require intact lead paint to be removed.<sup>119</sup> Lead from paint exhibits accumulation trends in organisms. Corals have been shown to incorporate lead into their skeletons and growth inhibition has been observed in algae species and sea urchins exposed to lead.<sup>120</sup>

### e. Antifouling Paint

Antifouling paints containing tributyltin (TBT) were used to paint vessel hulls to inhibit the growth of organisms below the water line. In 2001, an International Maritime Organization Convention was adopted to prohibit the use of antifouling paints containing TBT. The EPA states in the BMP document, *“Scientific investigations by governments and international organizations have shown that certain anti-fouling systems used on vessels pose a substantial risk of both acute and chronic toxicity and other adverse impacts to*

*ecologically and economically important non-target marine organisms. Because this document [BMP] addresses vessels that would be sunk for the creation of artificial reef habitat, the presence of biocides and other anti-fouling systems that inhibit marine growth are antithetical to this purpose. Furthermore, because anti-fouling systems can be reactivated via physical disturbance and/or biological degradation (e.g., scouring during a storm event or burrowing caused by marine organisms) over time, anti-fouling systems that retain potency may become harmful or be reactivated following the sinking.”*<sup>121</sup>

Antifouling paints containing TBT are present on vessels sunk as artificial reefs. The above EPA statements are merely cautionary as the BMP does not recommend removal of all TBT paints.

### f. Polybrominated Diphenyl Esters

Polybrominated diphenyl esters (PBDEs) are flame retardants and are found in plastics and upholstery foam (National Marine Fisheries Service 2006). PBDEs likely occur in materials on ships, but their presence and concentration levels have not yet been identified. PBDEs are not mentioned in EPA’s BMP, nor any other guidance or regulation concerning sinking of vessels. PBDEs have been linked to health problems, and like PCBs they bio-accumulate (National Marine Fisheries Service 2006).<sup>122</sup>

The Needs Assessment and Scoping Study for Sinking Ships as Diving Sites in Puget Sound identifies PBDEs as a contaminant of concern, but the EPA has not yet addressed remediation of PBDEs for ship sinking preparation.

<sup>117</sup> National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs, May 2006, Pg. 35.

<sup>118</sup> Coale et al. 1996; Frost 1996; Matsunaga et al. 1994; Takeda 1998; Wells et al. 1995.

<sup>119</sup> National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs, May 2006, Pg. 42

<sup>120</sup> Thompson, 1990.

<sup>121</sup> National Guidance: Best Management Practices for Preparing Vessels Intended to Create Artificial Reefs, May 2006, Pg. 41

<sup>122</sup> <http://pubs.usgs.gov/of/2008/1020/pdf/ofr20081020.pdf>

## Future Remediation Costs

The disaster of the Osborne Reef in Broward County, Florida should serve as an example of future unforeseen costs. Two million tires were intentionally dumped in 1972, covering 36 acres of ocean floor with the intention of creating an artificial reef. Not surprisingly, the tires did not create an artificial reef, but rather inflicted harm to nearby coral reefs when storms, hurricanes and currents propelled tires into natural reefs, devastating the marine environment. The dumping site was labeled an environmental disaster. In 2001, a tire removal pilot study removed 1,600 tires at a cost of \$17.00/tire.<sup>123</sup> Due to the magnitude of the project and the total projected cost of \$34 million to remove all 2 million tires, little progress has been made to abate this underwater wasteland.

In 2001, New York City Metropolitan Transportation Authority (MTA) offered up 1,300 Redbird subway cars and disposed of 23 million pounds of scrap metal on the ocean floor, saving a reported \$11 to \$13 million in disposal costs. The so-called savings were based on an estimated costs for proper land-based disposal due to the required asbestos remediation, which the MTA avoided by simply dumping at sea. States such as Delaware welcomed this dumping as it was *free* material for the supposed benefit of artificial reefs, while other states such as New Jersey and Maryland turned the cars away when MTA acknowledged the asbestos contamination. New Jersey Governor Donald DiFrancesco, said at the time, *"While I strongly support the artificial reef program, I believe we must err on the side of safety and the environment."*

New Jersey later opted to sink newer stainless steel subway cars that were apparently free of asbestos. The cars were expected to last 20

years in the submerged environment; however 90% of these cars collapsed entirely on the ocean floor months after deployment in 2008.<sup>124</sup> Their utility as an artificial reef was rendered minimal. Meanwhile the asbestos, lead paint and host of other toxic compounds aboard the Redbird vessels will continue polluting the ocean beyond the expected lifespan of the artificial reef. States such as Delaware are incurring minimal costs to sink waste material such as subway cars and naval vessels, yet the hidden costs to the environment have yet to be accounted for and part of these costs may include future remediation. States do not have reserve funds for future abatement responsibilities, which suggest the Federal government may bear the financial burden in years to come.

Sunken naval vessels are much like tires and subway cars. They are merely a solid waste material that is being disposed of on the ocean floor with *artificial reef* being the justification. However, the ocean floor may not be the final resting place of these waste materials, as future



The Osborne Reef off the coast of Ft. Lauderdale, Florida is comprised of 2 million tires intentionally sunk in 1972. In 2007, U.S. military forces began clean-up of this environmental disaster, however clean-up efforts have only removed a reported 73,000 tires to date.

Image Source: Navy Combat Camera Dive Ex-East

<sup>123</sup>

[http://www.dep.state.fl.us/waste/quick\\_topics/publications/shw/tires/reef/Osborne-History\\_18Aug09.pdf](http://www.dep.state.fl.us/waste/quick_topics/publications/shw/tires/reef/Osborne-History_18Aug09.pdf)

<sup>124</sup> [http://www.state.nj.us/dep/fgw/pdf/2010/reef\\_news10.pdf](http://www.state.nj.us/dep/fgw/pdf/2010/reef_news10.pdf)

remedial efforts will likely be required when science determines actual risks to the environment and human health.

It is very important to note that vessels have short underwater life spans as artificial reefs, estimated at 60 years.<sup>125</sup> The limited 60 year lifespan of a vessel as an artificial reef means that liabilities from contamination that can be remediated will remain an economic consideration of the initial dumping. These costs far outstrip any perceived benefits to fisheries. As Jack Sobel, said, *"There's little evidence that artificial reefs have a net benefit."*<sup>126</sup>

Turning back to the Ex-ORISKANY, it is important to note that despite the clean-up costs, the clean-up was not complete. The \$11.89 million cost for environmental remediation left intact an estimated 700 pounds of solid PCBs found in approximately 362,200 pounds of electric cable insulation, 31,700 pounds of fiberglass bulkhead insulation and 284,000 pounds of contaminated paint all left onboard for sinking.<sup>127</sup> Some material, such as

the electric cable insulation, sampled as high as 19,000 ppm with an average of 1,500 ppm.<sup>128</sup> Legal PCB levels under the Toxic Substances Control Act (TSCA) are equal to or less than 50 ppm.

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 exception to TSCA via a risk-based disposal permit from the 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 this vessel.

The EPA and its Science Advisory Board accepted the Navy's conclusions that the risks associated with sinking the vessel were negligible and that the sinking would result in a *material value* to sports fisheries. On this basis, the EPA issued the risk-based disposal permit for the sinking of the PCB contaminated vessel. However, the environmental implications of such a decision are still yet to be fully realized, but future remediation costs are probable.



**Two U.S Coast Guard HU-25 Falcon jets were sunk off the coast of North Carolina as artificial reefs.**

Image Source: Flickr user Tidewater Muse under Creative Commons agreement. Photo by: Lance Cpl. Randall A. Clinton  
Photo ID: 2006614155548

<sup>125</sup> Lukens, R.R. and Selberg, 2004.

<sup>126</sup> <http://www.reuters.com/article/idUSN2943349920070709>

<sup>127</sup>

<http://www.sdafs.org/flafs/PDF/October%202008%20issue.pdf>

<sup>128</sup>

<http://www.sdafs.org/flafs/PDF/October%202008%20issue.pdf>



## Job Loss Costs

On Feb. 13, 2009, Congress passed the American Recovery and Reinvestment Act (ARRA) and allocated \$787 billion in Federal funds to spur economic activity and create jobs in America. Yet current Federal ocean dumping practices forfeit the creation of dynamic green jobs, in stark contrast to ARRA's intentions of job creation and economic growth.

While ocean disposal simply transfers waste to its final resting place, recycling gives new life to salvageable materials while also creating new job opportunities. Furthermore, recycling has the ability to create jobs including downstream trade jobs many times over when material is reconstituted for use a third and fourth time round etc.

The Ex-SAIPAN, a 27,000-ton, Tarawa-class amphibious assault ship launched in 1974, is currently being recycled in Brownsville, Texas. The project will last approximately one year, and will employ 250 people throughout the dismantling process.<sup>129</sup> This single vessel will generate millions of dollars of economic growth and will stimulate the local economy. This recycled material will then be sold and reused to manufacture new products, generating more jobs in fabrication, transport and resale within one use cycle. This entire process is repeated at the end of a product lifecycle, constantly creating jobs.

Using parametric estimations for warship content by weight, per Table 5 and Appendix B, and the Ex-SAIPAN job creation estimates mentioned above, one can generate a job loss estimate to give context to the labor force impacts from the ocean dumping of naval vessels over the past decade. As a rough approximation, for every 108 tons of material existing within a Combatant class vessel, approximately one U.S. green ship recycling job

is created.<sup>130</sup> When looking over the past decade in which the Federal Government has disposed of 674,318 tons of material at sea of which only 9% was actual waste, (613,629 tons could have been fully recycled) the Federal government squandered away, at the very least, 6,244 direct green recycling jobs, each lasting approximately one year. For every 1 recycling job lost, 1.2 'indirect' jobs were also lost (7,492 jobs) and 1.3 'induced' jobs were lost (8,117 jobs) in the wider economy,<sup>131</sup> adding up to a total job loss estimate of 21,853 jobs lasting approximately one year. Indirect jobs are those created as a result of the industry purchasing goods and services from other types of



President Obama and Vice President Biden speak on creating jobs with ARRA funds; however they fail to recognize the many instances where government waste actually eliminates such job opportunities. One example is the dumping of retired Navy vessels at sea rather than recycling to create immediate job relief. In fact, Vice President Biden's home state of Delaware, along with the neighboring states of New Jersey and Maryland, are preparing the Ex-ARTHUR RADFORD for ocean disposal in Summer 2011. This sinking will send hundreds of jobs to the depths of the sea.

*Image Source: White House Photo/Pete Souza*

<sup>129</sup> <http://www.themonitor.com/articles/gets-32824-arrival-navy.html>

<sup>130</sup> Author's calculation per information gathered from industry: Approximately 108 tons (light displacement) = 1 recycling job

<sup>131</sup>

[http://www.foeeurope.org/publications/2010/More\\_Jobs\\_Less\\_Waste\\_Sep2010.pdf](http://www.foeeurope.org/publications/2010/More_Jobs_Less_Waste_Sep2010.pdf)

businesses (accounting, legal, office supply companies, etc.). Induced jobs are those created as a result of the industry employees and indirect employees spending their wages to bolster another round of economic activity.

Recycling these naval assets brings a high job creation return on investment. With 95 ships, containing 613,629 tons of recyclable material valued at \$611 million, more than 20,000 jobs could have been created. Compare this to President Obama's January 2010 announcement in which \$2.3 billion in Federal tax credits was expected to create 17,000 new green jobs.<sup>132</sup> Clearly, recycling makes job sense, particularly in a time when U.S. unemployment rates continue to hover around 10%.

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<sup>132</sup> <http://www.csmonitor.com/Business/new-economy/2010/0108/Obama-to-create-17-000-green-jobs.-What-s-a-green-job>

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## ALTERNATIVES TO OCEAN DUMPING

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### Ship Sales for Reuse

Friendly foreign governments can purchase decommissioned ships from the Navy to help satisfy their defense requirements, while also meeting U.S. foreign policy objectives to support allied countries by “*fostering interoperability and strengthening mutual defense arrangements.*” The ship transfer program must satisfy the Congressional authorization and notification requirements of Section 7307 of Title 10 of the United States Code.

MARAD is also authorized to sell ships to domestic buyers.

#### i. Capacity

MARAD and the Navy both acknowledge that ship sales and ship transfers are low volume disposal options. MARAD has averaged 3-4 vessel sales per year since 2004.

#### ii. Environmental Considerations

This disposal option is an extension of the vessels productive life and should be considered a reuse option rather than disposal. This reuse option is environmentally sound as toxic

chemicals in the construction of the vessel will not be extracted or exposed to the natural environment. However often sale for reuse is used as a pretext for the real intent which is to export them later to South Asian shipbreaking beaching operations at great profit. It is vital therefore that MARAD stay extremely vigilant to prevent sales of this type, by informing EPA of the export and the implications of violations of the TSCA PCB export ban.

#### iii. Best Value Considerations

Ship transfer is at no cost to the government. This reuse option offers a best value solution to eliminating the obsolete fleets, though few vessels qualify for such reuse.

#### iv. Conclusion

Most vessels being discharged have been determined to be of insufficient value for U.S. commercial or national defense purposes and therefore are likewise of little value to friendly foreign governments. This continues to be a low volume option, but one of primary consideration should it be viable.

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### Ship Donation

The Navy’s ship donation program makes selected decommissioned Naval vessels available for donation for public display as ship museums or memorials (Section 7306 of Title 10 of the United States Code).

#### i. Capacity

To date, 48 ships have been donated to serve as museums and memorials in the United States. The Navy currently has 11 vessels on hold for donation, but acknowledges that ship donation is a low volume disposal option and that only a small number of vessels available for donation will actually be donated.

#### ii. Environmental Considerations

This disposal option is an extension of a vessel’s productive life and should be considered a reuse option rather than disposal. This reuse option is environmentally sound as toxic chemicals in the construction of the vessel are not likely to be made biologically available through exposure to humans or the environment. However, when the donation recipient does not appropriately maintain vessels, pollution and exposure poses a threat. Further, when the donated vessel reaches a point of deterioration in which final disposal is required, environmental and human health risks increase dramatically, as discussed in previous sections.

### iii. Best Value Considerations

Ship donation and transfer occurs at no cost to the taxpayer; the ship recipient is responsible for all costs associated with the transfer, as well as maintenance of the vessel after donation. The Navy acknowledges that donation is generally less expensive to the Navy than reefing or scrapping, but the Navy notes that not all ships are viable for donation.

Furthermore, caution must be used as many current donated ships are falling into disarray due to improper and infrequent maintenance. The states and organizations that manage the memorials have experienced financial challenges in recent years, yet they are still responsible for all ownership costs, including renovation, repair and disposal at the end of the museums productive life. The USS YORKTOWN, located at Patriots Point in South Carolina, serves as a reminder of these unforeseen costs.

The state of South Carolina has been responsible for all ownership costs since 1974. However, these costs are well beyond the financial capabilities of the state program that manages the ship. The Navy estimated in October 2009 that current repair work for the USS YORKTOWN will cost \$100 million to \$120 million.<sup>133</sup> Rear Adm. J.P. McManamon of the Naval Sea System Command said in an interview with the Post and Courier that the Navy is prohibited by law from providing financial assistance for any of its donated ships. In effect, the Navy's ship donation program merely transfers the financial burden of deteriorating vessels to non-profit organizations and state historic programs and is thus free of all liability, including vessel disposal.

### iv. Conclusion

While ship memorials and museums provide a best value to the Navy, this option is limited and merely transfers the storage and maintenance

costs to state and non-profit programs. Vessel donations continue to be a low volume option for the Navy.



**The USS YORKTOWN at Patriots Point, South Carolina**  
*Image Source: Flickr user hyperion327 under Creative Commons agreement.*

<sup>133</sup> <http://www.postandcourier.com/news/2009/oct/21/navy-on-yorktown-fix-it-or-junk-it/>

## Overseas Shipbreaking

The obvious advantage of overseas scrapping in developing nations was reduced cost to the government. However, this reduced cost was not a result of skilled labors and improved efficiencies; rather, this reduced cost was due to cheap labor and accompanying lax labor and environmental rules found in developing countries. In effect, the U.S. government was supporting an industry abroad that touted low wages and minimal regulation as an advantage.

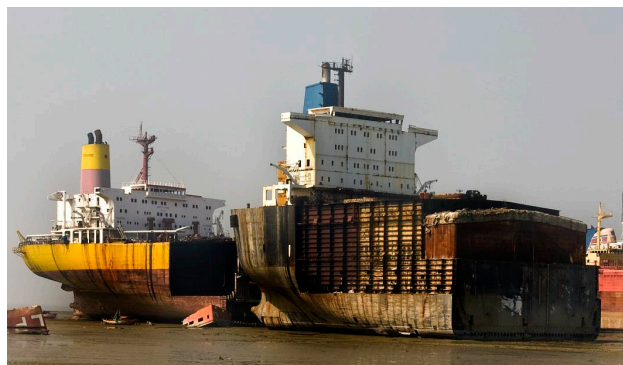
During the 1970s, the world's ship scrapping industries were located primarily in the United States, Spain, Portugal and Italy. By the early 1980s due to environmental regulations, and dangerous and intensive labor, the ship recycling industry had shifted to Taiwan, South Korea and China. In the late 1980s, the market had shifted again for the same reasons to find even far greater opportunities for cost externalization. Today, the world ship scrapping market is dominated by India, Pakistan and Bangladesh.

The Navy eliminated their foreign vessel sales program in 1982,<sup>134</sup> while MARAD continued to work exclusively with foreign buyers throughout the 1980's and early 1990's. From 1983 to 1994, MARAD's ship disposal program sold 212 vessels to foreign buyers for breaking on the beaches of South Asia (see Table 10). During this same period, only one MARAD vessel was recycled domestically.

In 1989, during the course of a normal occupational safety inspection at a Navy shipyard, significant quantities of solid-matrix polychlorinated biphenyls (PCBs) were discovered in various shipboard applications, including electric cables, felt gaskets, rubber mounts, adhesives and paints.<sup>135</sup> This discovery made the export of naval vessels to foreign

shipbreaking yards a violation of the Toxic Substances Control Act (TSCA), which prohibits the export of PCBs under the PCB distribution in commerce rule (40 C.F.R. §761.20(c)) and PCB export for disposal rule (40 C.F.R. §761.97). While the EPA acknowledged the illegality of transporting vessels overseas for disposal purposes, the EPA failed to enforce the law until 1994, simply exercising their enforcement discretion to permit the export of 80 MARAD vessels from 1989-1994 (see table below).

In 1994, fleet reduction progress slowed dramatically as a result of EPA's enforcement of the TSCA ban. As the backlog of ships awaiting disposal continued to grow, so too did storage and maintenance costs for the deteriorating obsolete fleet. To address the growing costs associated with the backlog of ships, Congress included a statute in the National Maritime Heritage Act of 1994 to require all unassigned NDRF vessels to be disposed of by September 30, 1999, later extended to 2001 by the National Defense Authorization Act of 1998 (Public Law 105-85), in a manner that maximizes the return to the United States.<sup>136</sup>



**Ships are driven directly up onto beaches in South Asia where they are broken down by hand.**

Image Source: Flickr user naquib under creative commons agreement: <http://www.flickr.com/photos/naq/2316285684/#/>

<sup>134</sup> EPA, 2001; *A Guide for Ship Scrappers: Tips for Regulatory Compliance*; Appendix A, A-7

<sup>135</sup> RAND Report, Appendix C, *Polychlorinated Biphenyl in Vessels*.

<sup>136</sup> Government Accountability Office, *Federal Surplus Ships: Government Efforts to Address the Growing Backlog of Ships Awaiting Disposal*; October 1998



**Table 8: Overseas vs. Domestic Ship Recycling: 1970 – 1997**

Time Frame	Number of Ships Recycled Domestic		Number of Ships Recycled Overseas	
	Navy	MARAD	Navy	MARAD
1970-82	480	484	53	297
1983-89	3	0	0	132
1990-94	10	1	0	80
1995-97	23	1	0	0

Source: Table created by author from information provided by the U.S. General Accounting Office, National Security and International Affairs Division, B-278781, October 22, 1998

Between 1994 and 1997, the Navy and MARAD each negotiated agreements with EPA to once again permit the export of ships for disposal under the EPA's discretionary enforcement authority.<sup>137</sup>

However, in December 1997, following a Baltimore Sun Pulitzer Prize winning exposé on the horrors of shipbreaking practices in South Asia, the Navy voluntarily suspended all vessel exports for disposal. This article series by Gary Cohn and Will Englund, entitled "*The Shipbreakers*,"<sup>138</sup> hit the stands in December of 1997 and shook the halls of Congress. The Navy and then MARAD suspended indefinitely their ship export plans and programs in early 1998.<sup>139</sup>

In April 1998, the Interagency Panel on Ship Scrapping made final recommendations for the ship disposal programs but failed to agree on a comprehensive approach to overseas disposal. The Panel consisted of MARAD, Navy, EPA, OSHA, Defense Logistics Agency (DLA), National Oceanographic and Atmospheric Administration, Department of Justice and the Department of State. The lack of a final and agreeable recommendation on overseas disposal prompted Vice President Gore to issue a Federal Moratorium on vessel exports for

dismantling on September 23, 1998, effective through October 1, 1999.<sup>140</sup>

With the windfall profits obtainable from cost dumping curtailed as a result of the 1994 enforcement of TSCA and 1998 Federal Moratorium on overseas scrapping, the government ship disposal programs languished. The backlog of ships awaiting disposal grew by 65% from 1994 to 1998.<sup>141</sup> Many of these ships were more than 50 years old, with deteriorating hulls that threatened waterways.

Navy and MARAD officials estimated a minimum cost of \$58 million dollars (in fiscal year 1997 dollars) for storage, maintenance and security of surplus ships between 1999 and 2003 if the obsolete fleet was not substantially reduced.<sup>142</sup> The combined light displacement tons of Navy and MARAD obsolete ships awaiting disposal at that time was approximately one million tons.<sup>143</sup>

In 1998, MARAD and the Navy turned exclusively to the domestic ship recycling market but were prohibited by statute from paying for dismantling services. However the

<sup>137</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, 2001.

<sup>138</sup> <http://www.pulitzer.org/works/1998-Investigative-Reporting>

<sup>139</sup> Government Accountability Office, *Federal Surplus Ships: Government Efforts to Address the Growing Backlog of Ships Awaiting Disposal*; October 1998

<sup>140</sup> Testimony of the Honorable William G. Schubert, Administrator, U.S. Maritime Administration; [http://www.globalsecurity.org/military/library/congress/2003\\_hr/030707-schubert.htm](http://www.globalsecurity.org/military/library/congress/2003_hr/030707-schubert.htm)

<sup>141</sup> Government Accountability Office, *Federal Surplus Ships: Government Efforts to Address the Growing Backlog of Ships Awaiting Disposal*; October 1998.

<sup>142</sup> IBID.

<sup>143</sup> [http://commdocs.house.gov/committees/Trans/hpw105-59.000/hpw105-59\\_0.htm](http://commdocs.house.gov/committees/Trans/hpw105-59.000/hpw105-59_0.htm)

statutes failed to take into consideration the realities of responsible recycling.

Unlike foreign shipbreaking operations, domestic recyclers are required to adhere to strict environmental and worker safety regulations enforced by the EPA and the Occupational Safety and Health Administration (OSHA); these regulations ensure the internalization of ship recycling costs. However, the high levels of contaminants, mixed with the volatility of commodity prices, make domestic recycling primarily a service industry rather than always a source of profit through commodity sales.

From 1997 to 1998, MARAD sold 10 vessels to domestic recyclers at an average cost of \$4.60 per ton paid by the recycling company. In 1999 a total of 12 vessels were sold for an average 27 cents per ton, and three vessels were sold for \$10 each. This was a stark difference from the sales revenue generated prior to 1994 when MARAD externalized costs to the environment and the impoverished foreign work force in South Asia. From 1987 to 1994, MARAD sold 130 ships for export and disposal at an average cost of \$108/ton, netting approximately \$80 million during this period.<sup>144</sup>

As MARAD struggled to reduce the obsolete fleet, they pled poverty without aggressively seeking appropriations from Congress to deal with the mounting crisis, and they failed to meet the disposal mandate in 2001. Congress then issued a new deadline by including a statute in the National Defense Authorization Act of 2001 and mandated vessels be disposed of in a timely manner and extended the disposal deadline to September 30, 2006. Accompanying the new disposal mandate, Congress for the first time appropriated funds under the Department of Defense Appropriations Act of 2001(Public Law 106-259) to pay for the accelerated

domestic scrapping services of vessels in worst condition.

MARAD now had a budget of \$10 million and a first priority to respond to emergency hull deterioration and oil leakage from the James River Reserve Fleet (JRRF), which previously required the emergency removal of fuel on three vessels at a cost of over \$2.4 million.<sup>145</sup> However, the funds were not sufficient as it was estimated to cost \$15 million to remove fuel from weakened vessels in the obsolete JRRF alone.<sup>146</sup>

With increasing pressure placed on MARAD to dispose of the vessels in a timely manner to meet the September 2006 deadline, the government once again began to look favorably toward export. In December 2002, Public Law 107-314 established the Pilot Program on Export of Obsolete Vessels for Dismantlement and Recycling to be carried out in 2003 for up to four vessels. Initially MARAD organized various missions to explore export options, including trips to China, United Kingdom and Mexico. The Basel Action Network (BAN) began raising alarm over the possibility that the U.S. government may attempt to export ships in violation of TSCA and the Basel Convention.

While only 4 vessels were mandated by Congress under the Pilot Program, MARAD awarded a \$17.8 million contract to Able UK, an overseas company in Teeside, England, for the export and dismantling of 13 vessels (and two additional vessels were awarded in this contract for reuse).<sup>147</sup> Instead of going through a proper rulemaking proceeding to allow for an exemption to the TSCA PCB export ban, EPA was simply willing to grant MARAD an exemption from TSCA via enforcement

<sup>144</sup> Testimony of the Honorable William G. Schubert, Administrator, U.S. Maritime Administration; [http://www.globalsecurity.org/military/library/congress/2003\\_hr/030707-schubert.htm](http://www.globalsecurity.org/military/library/congress/2003_hr/030707-schubert.htm)

<sup>145</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, 2001

<sup>146</sup> *IBID.*

<sup>147</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, 2005

discretion – a procedure which short-circuited the public review process required in TSCA.

BAN was advised that should MARAD's ruse to reinstate foreign scrapping practices prove successful, a new precedent would be established in which this same procedure could be used to export PCB laden ships to any nation, including developing countries. For this reason, BAN joined by the Sierra Club and their counsel Earthjustice, filed suit against MARAD and the EPA in September 2003. At the same time BAN released a report on the export to UK case entitled *Needless Risk: The Bush Administration's Scheme to Export Toxic Waste Ships to Europe*.<sup>148</sup>

While the lawsuit was not an overwhelming legal success, with much of the complaint being dismissed for procedural issues, it proved to be a policy success. As a result of the NGO suit, only 4 of the 13 ships intended for export were exported, and not a single U.S. government owned ship has been exported for scrap since that time. EPA also stated that they would never again attempt to export PCB laden ships without going through a full rulemaking process as stipulated in TSCA. Had MARAD's attempt to reinstate foreign scrapping practices been successful, a new precedent would have been established that would have likely lead to the resurgence of policies that permitted export of PCB waste to South Asia.

Despite this, it is well known that MARAD continued to look toward new schemes to take advantage of cheap labor overseas. While the U.S. has suspended export of government owned vessels for scrapping, as recent as 2008 MARAD indicated that they were actively pursuing a change in regulation to allow for the reinstatement of the export disposal option.

MARAD stated, "*Critical factors that impact the achievement of a realistic and environmentally responsible disposal 'end state' include the availability of foreign*

*recycling as a viable disposal option in 2009 and beyond...*"<sup>149</sup> MARAD cites a lack of domestic scrapping capacity as the reason for their request. Yet this claim is highly dubious as domestic ship recycling capacity has never yet been met.

In 2009, Congress passed the omnibus military reform package known as the Duncan Hunter National Defense Authorization Act For Fiscal Year 2009.<sup>150</sup> This legislation in Section 3502 set a prohibition on the export of government owned vessels except where the Administrator of MARAD can claim that all of the following conditions apply:

- (1) a compelling need for dismantling recycling or scrapping the vessel exists;
- (2) there is no available capacity in the United States to conduct the dismantling, recycling, or scrapping of the vessel;
- (3) any dismantling, recycling, or scrapping of the vessel in a foreign country will be conducted in full compliance with environmental, safety, labor and health requirements for ship dismantling, recycling or scrapping that are equivalent to the laws of the United States; and
- (4) the export of the vessel under this section will only be for dismantling, recycling, or scrapping of the vessel.

This ruling in Duncan Hunter appears for the moment to be the end of government plans to export ships for scrap because there is significant and expandable capacity to scrap ships in the United States.

#### **i. Regulatory Agencies / Oversight**

MARAD is now charged with upholding the Duncan Hunter export ban.

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<sup>149</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, January 2008 (pg. 11)

<sup>150</sup> [http://www.dod.mil/dodgc/olc/docs/2009NDAA\\_PL110-417.pdf](http://www.dod.mil/dodgc/olc/docs/2009NDAA_PL110-417.pdf)

<sup>148</sup> <http://www.ban.org/Library/Needless%20Risk%20Final.pdf>

The EPA manages the permitting process as described in the Memorandum of Agreement for exceptions to the Toxic Substances Control Act (TSCA). But the transboundary movement of old ships is governed by more than just the exporting country. For importing and transit countries, that are among the more than 170 Parties to the Basel Convention, the importation of ships containing hazardous waste as part of their structure from the United States is likely to be a violation of their law. This is due to the fact that the Basel Convention forbids trade in hazardous wastes between Parties and non-Parties and the U.S. is currently a non-Party to the Basel Convention. Thus the competent authorities assigned by the Basel Convention in importing and transit countries are likely to have regulatory oversight over exports of ships for scrap and are very likely to deem this importation illegal.

## ii. Capacity

World ship scrapping volume from 1998-2008 was 68 million tons. The MARAD and Navy scrapping requirements for this same period were estimated at 2 million tons, representing a mere 3% of the world's ship scrapping market.<sup>151</sup> Overseas ship scrapping industries are well equipped to manage U.S. demand, but they lack the facilities to manage hazardous waste material in an environmentally sound manner.

## iii. Environmental Considerations

The discovery of PCBs in various shipboard components lead to the suspension of overseas scrapping of government owned vessels in 1994. A federal moratorium on overseas scrapping followed in 1998 as a result of the Toxic Substances Control Act (TSCA) regulations on the export of PCBs and the Baltimore Sun articles. The EPA provided a formal process allowing exemptions to the overseas scrapping moratorium.

Overseas scrapping is available to MARAD under the following possibilities:

**a.** MARAD can seek exceptions through the EPA rule-making. Following the BAN/Sierra Club court case in which MARAD sought to export 13 PCB laden vessels to the UK outside of the norms of TSCA rulemaking and were challenged on those grounds, it is unlikely that any “*enforcement discretion*” absent the public process of rulemaking required by TSCA would be allowed and such rulemaking would need to be done on a case by case basis.

**b.** Congress can modify TSCA to allow for PCB export. In the National Defense Authorization Act of 2001, Congress asked for a recommendation from the President on “*whether it is necessary to amend the Toxic Substances Control Act or any other environmental statute or regulatory requirements relevant to the disposal of vessels...*” This option would be detrimental to the environment and the integrity of Congress. Such a move would also be contrary to the Basel and Stockholm Conventions, which the U.S. has signed and has thus indicated intent to ratify. It would also likely be in violation of the following international accords that the U.S. has ratified:

- The Organization for Economic Cooperation and Development’s 1998 Decision of the Council Concerning the Control of Transfrontier Movement of Waste
- Agreement between the U.S. and Canada Concerning the Transboundary Movement of Hazardous Waste
- Agreement between the U.S. and Mexico on the Cooperation for the Protection and Improvement of the Environment in the Border Area.

Allowing export of hazardous waste laden ships to developing country scrap yards would of course lead to devastating occupational health and environmental damage that is now well documented, particularly in the South Asian beaching operations practiced in Alang, India; Gadani, Pakistan; and Chittagong, Bangladesh.

<sup>151</sup> Report of the Interagency Panel on Ship Scrapping, 1998

Beaching operations allow no opportunity for containment of pollution, access to operations by cranes and emergency equipment (e.g. fire trucks, ambulances) and violate all norms of hazardous waste management. Even dockside operations in countries like China, while superior to beaching methods, must contend with a national context lacking in societal safety nets such as trade unions, tort law, downstream waste management (particularly for PCBs and asbestos), rigorous enforcement, etc.

#### iv. Best Value Considerations

Sending U.S. government owned vessels overseas for scrapping outsources American jobs and toxic waste, while placing the domestic recycling industry at a competitive disadvantage. Many overseas scrapping

facilities in developing countries may provide scrapping services at least cost, but cheap labor, including child labor and a lack of environmental regulations, does not constitute best overall value when externalities are calculated.

#### v. Conclusion

As long as the Duncan Hunter export ban remains the law of the land, export will be impossible as U.S. capacity remains large and expandable. However, schemes to export to U.S. territories such as Saipan may become a possibility. With export being largely taken off the table, the next best avenue for cost externalization, regrettably the overriding theme of U.S. policy, will be ocean dumping via reefing or SINKEX.

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### Domestic Recycling

In 1950, 2,277 vessels formed the National Defense Reserve Fleet (NDRF);<sup>152</sup> this abundant supply of non-retention vessels spawned the development of a strong U.S. ship-recycling industry and a successful public-private disposal partnership that lasted throughout the 1960's and 1970's. By 1974, 30 domestic recycling companies were fulfilling government ship disposal contracts<sup>153</sup> with the capacity to recycle all obsolete Navy and MARAD vessels domestically.

However, ship disposal declined significantly throughout the 1980's Cold War buildup as the Navy worked to increase the active and reserve fleets to maximum capacity. At the same time, ship-scrapping operations shifted overseas to the shipbreaking beaches of South Asia as the U.S. government realized it could maximize profits by exporting vessels to countries lacking

enforceable environmental and occupational health and safety regulations and where cheap labor could be exploited. As a result, the domestic ship recycling industry nearly died out entirely during this period.

As mentioned in the previous section, with the export option being curtailed in 1994, the government was forced to turn back to the domestic recycling industry as it had once before. Though, with the discovery of PCBs in various shipboard components, domestic recycling became more of a service to the government, rather than a profit generating scheme as environment and worker safety requirements brought about higher costs. In an effort to avoid these real costs, the government has long attempted to externalize these costs by any feasible means. And with the export option now securely off the table with the passage of the Duncan Hunter export ban for year 2009 and beyond, the government has looked increasingly favorably toward ocean dumping and currently has unduly prioritized ocean dumping over that of domestic recycling.

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<sup>152</sup>[http://www.marad.dot.gov/ships\\_shipping\\_landing\\_page/national\\_security/ship\\_operations/national\\_defense\\_reserve\\_fleet/national\\_defense\\_reserve\\_fleet.htm](http://www.marad.dot.gov/ships_shipping_landing_page/national_security/ship_operations/national_defense_reserve_fleet/national_defense_reserve_fleet.htm)

<sup>153</sup> Maritime Administration, *Report on the Program for Scrapping Obsolete Vessels*, Report MA-2000-067, March 10, 2000



## Navy

Over the course of 30 years from 1970 to 1999, 178 Navy vessels were sunk via SINKEX (disposal by sinking during military target practice exercises), an average of 6 vessels per year,<sup>154</sup> amounting to 8% of all Navy ship disposals during this period. However, since 1997, the Navy has sunk on average 10 vessels per year.<sup>155</sup> From 2000-2008, SINKEX accounted for approximately 70% of all Navy ship disposals; 39 vessels were recycled domestically during this same period. SINKEX remains the primary method of vessel disposal for the Navy.

Today, all decommissioned vessels that do not satisfy requirements or needs of the vessel sales program to foreign governments or the vessel donation program for historic restoration of ships as memorials and museums become available for the following disposal methods: 1) use as target vessels for weapons testing via sinking exercise (SINKEX); 2) are relegated to becoming artificial reefs; or 3) are available for domestic recycling.

While the government ship disposal programs can utilize all disposal methods at their discretion, the Navy places domestic recycling as their last option of consideration, stating “A ship becomes a candidate for ship dismantlement once it is stricken from the Naval Vessel Register and the ship is not a candidate for donation, SINKEX, Artificial Reefing or a Foreign Military Sales (FMS) transfer.”<sup>156</sup> The Navy further clarifies this preferential disposal order in their Addendum Report to the FY 2009 Report to Congress: “With the exception of nuclear-powered ships, dismantling is the lowest priority for disposal

*of ships and is used when other options are not feasible.”*<sup>157</sup>

However, the Navy’s preferential hierarchy of waste management flies in the face of EPA’s preferred waste management hierarchy, which in order of preference is reduce, reuse, recycle, and disposal only utilized as a last resort.

Furthermore, the Navy’s preferential disposal order ignores the Obama Administration Federal government “*Lead by Example*” mandate under his October 2009 Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance. This Order prioritizes recycling and waste diversion as policy, but the Navy’s ship disposal program remains non-compliant, as it does not prefer recycling and material recovery over that of disposal.

Finally, the artificial reefing authority granted unto the Navy by Congress in the National Defense Authorization Act for Fiscal Year 2004 contradicts the Navy’s preferential disposal order described above; “*Nothing in this section shall be construed to establish a preference for the use as artificial reefs of vessels stricken from the Naval Vessel Register in lieu of other authorized uses of such vessels, including the domestic scrapping of such vessels, or other disposals of such vessels, under this chapter or other applicable authority (Section 1013 (g)).*” The Navy has unduly exercised their ocean disposal authority, when Congress themselves clearly stated authority to dispose of vessels at sea should not be used to establish a preference over that of domestic scrapping.

Yet the Navy has continued their prioritization of reefing with the transfer on June 8, 2010 of the Ex-USS ARTHUR RADFORD to the States of Delaware, New Jersey and Maryland for artificial reefing at an approximate cost of \$200,000 to the Navy. Domestic recyclers

<sup>154</sup> RAND Report Pg. 17

<sup>155</sup>[http://www.navsea.navy.mil/teamships/InactiveShips/SINKEX/FAQ\\_sinkex.aspx](http://www.navsea.navy.mil/teamships/InactiveShips/SINKEX/FAQ_sinkex.aspx)

<sup>156</sup>[http://www.navsea.navy.mil/teamships/InactiveShips/Ship\\_Disposal/FAQ\\_disposal.aspx](http://www.navsea.navy.mil/teamships/InactiveShips/Ship_Disposal/FAQ_disposal.aspx)

<sup>157</sup> Report to Congress on Annual Long-Range Plan for Construction of Naval Vessels for FY 2009 (Page A-4)

offered to purchase the vessel for recycling at no cost to the Navy; however this request was all but ignored.

### MARAD

In 2007, Arc Ecology, San Francisco BayKeeper, Natural Resources Defense Council, and the California Regional Water Quality Control Board (San Francisco Bay Region) filed suit against MARAD for the pollution created by the deteriorating Suisun Bay Ghost Fleet. MARAD estimated the aging fleet was a source of water pollution that deposited 21 tons of paint chips containing toxic material into the bay. In April 2010, MARAD agreed to settle with the environmental groups after MARAD realized they had little defense. MARAD agreed to remove and dispose of 28 ships in worst condition by September 30, 2012, and remove all remaining vessels by 2017.<sup>158</sup>

While the disposal timeline can be achieved through domestic recycling of all vessels, ocean disposal remains an option available to the agency. In fact, MARAD continues to pursue alternative disposal methods, including artificial reefing initiatives.<sup>159</sup> Further, MARAD has the ability to transfer vessels to the Navy to dispose of vessels through SINKEX. One such vessel, the Ex-USS MONTICELLO, was sunk during the Rim of the Pacific Exercises (RIMPAC) in the South Pacific in July 2010.

With a \$15 million ship disposal budget for 2011 (\$3 million of which is dedicated to managing the nuclear inactive ship SAVANNAH) and a ship disposal budget request for year 2012, amounting to \$18.5 million (\$3 million of which is dedicated to managing the SAVANNAH),<sup>160</sup> Ocean disposal via SINKEX is a growing concern as MARAD continues to reduce the inactive fleet within their requested appropriations and in accordance with the April

2010 settlement in California. Under the Obama Administration, new leadership at MARAD has the opportunity to Lead by Example and recycle all vessels domestically; we urge the agency to seize this opportunity.

### i. Regulatory Agencies / Oversight

Ship recycling is a labor-intensive industry with environmental and worker safety risks. These risks are mitigated with strong government oversight, including the permanent onsite placement of MARAD and Navy representatives who oversee and manage the dismantling of vessels. Environmental and worker safety regulations are enforced by the EPA and the Occupational Safety and Health Administration (OSHA). Both the EPA and OSHA work together to enforce the following federal laws and regulations:

- Clean Air Act (40 CFR 50-99)
- Clean Water Act (40 CFR 122)
- Safe Drinking Water Act (40 CFR 142, 144-148)
- Resource Conservation and Recovery Act (40 CFR 261-279)
- Toxic Substances Control Act (40 CFR 761)
- Emergency Planning and Community Right-to-Know Act (40 CFR 355 and 370)
- Comprehensive Environmental Response, Compensation, and Liability act (40 CFR 302)
- General Duty Clause (29 CFR 1910)
- Shipyard Industry Standard (29 CFR 1915)

### ii. Capacity

Today, MARAD works with six domestic scrapping facilities, while the Navy works with two. MARAD suggests the domestic ship recycling industry has demonstrated a potential cost-effective capability to dismantle and recycle 20-25 vessels per year.<sup>161</sup> However discussions with ship recyclers in the Brownsville, Texas ship recycling area indicate that the local government is favorable to almost

<sup>158</sup>

[http://www.marad.dot.gov/documents/100405\\_Fact\\_Sheet.pdf](http://www.marad.dot.gov/documents/100405_Fact_Sheet.pdf)

<sup>159</sup>[http://www.marad.dot.gov/about\\_us\\_landing\\_page/budget\\_information/Budget\\_In\\_Brief.htm](http://www.marad.dot.gov/about_us_landing_page/budget_information/Budget_In_Brief.htm)

<sup>160</sup>[www.dot.gov/budget/2012/budgetestimates/marad.pdf](http://www.dot.gov/budget/2012/budgetestimates/marad.pdf)

<sup>161</sup> *Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, 2007, Pg. 13.*

unlimited expansion of the recycling slips along the existing canal network in Brownsville. In other words, were there demand, current domestic recycling capacity could be quickly and dramatically expanded to fit the demand.

MARAD's total annual disposal goal is 20-24 vessels. This suggests MARAD could rely solely on the domestic scrapping industry to meet their annual disposal goals currently.

The Navy has dismantled on average 6-7 ships per year since 1999.<sup>162</sup>

The domestic recycling industry relies greatly on MARAD and the Navy to provide a consistent supply of vessels to keep skilled labors in the workforce. The domestic industry has consistently worked below capacity and has urged the government agencies to increase supply, therefore reducing storage and maintenance costs, while also creating domestic recycling jobs.

### iii. Environmental Considerations

Strict regulations and strong oversight ensure hazardous materials are disposed of with respect for the environment and human health. Recycling International, an independent worldwide publication, said in 2006, "*Visits to shipbreaking yards around the world confirm that nobody upholds environmental and safety measures as stringently as the Americans.*" The publication goes on to say, "...the USA has become the world's leading 'green' recycler of marine ships..." BAN's own site visits confirm that ship recycling in Brownsville under US laws is probably the best major ship recycling destination in the world currently. This is particularly the case because European yards often fail to address the issue of PCB remediation.

MARAD has expedited disposal of vessels that present the greatest environmental risk, stating "*reutilization and disposal alternatives such as artificial reefing, donation, use in the Navy*

*Fleet training exercises (SINKEX), and sales are less effective at reducing environment risks because the best candidates for those disposal options are generally vessels that are cleaner and in better condition.*"<sup>163</sup> Vessels that pose environmental risks are best disposed of by domestic recyclers. This is the policy accepted by MARAD.

Additionally, the domestic recycling of government owned vessels helps circulate valuable scrap metal into the domestic marketplace. Scrap metals include steel, aluminum, copper, and copper nickel alloy, amongst others. These metals are valuable commodities and help to lessen demand on virgin materials. When comparing lifecycle impacts of 100% steel recycling versus 100% new steel production from virgin materials, recycling operations reduce energy use by 33% and CO<sub>2</sub> emissions by 32%. The primary energy required to produce one metric ton of steel from purely virgin materials is 79 gigajoules and produces 5.3 metric tons of CO<sub>2</sub>, compared to 26 gigajoules and 1.6 metric tons of CO<sub>2</sub> for full recycling.<sup>164</sup> It is clear that recycling obsolete vessels lessens the demand on natural resources, minimizes energy consumption and air pollution, and is the environmentally preferred disposal method.

### iv. Best Value Considerations

It is clear that, once all externalities are accounted for, domestic recycling is overwhelmingly the environmentally and economically preferred method of vessel disposal and it should be the primary, if not the only disposal option available to the government.

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<sup>163</sup> Report to Congress on the Progress of the Vessel Disposal Program, US Department of Transportation, Maritime Administration, 2007, Pg. 9

<sup>164</sup> Jeremiah Johnson, B.K. Reck, T. Wang and T.E. Graedel, The energy benefit of stainless steel recycling, Energy Policy. Volume 36, Issue 1, January 2008, Pages 181-192.

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<sup>162</sup> Navy Ship Disposal Faq

Recent evidence even points to the fact that domestic recycling may win the mantle of “*best value consideration*” with externalities ignored. This is due to a combination of factors including commodity price increases, a more steady supply of ships allowing for maintaining an active workforce in several facilities, and increased competition due to greater activity. Furthermore, a well-established and trained workforce allows for faster turnover of ships than other methods and thus lowers government storage and maintenance costs.

High steel prices and strong competition in the domestic scrapping industry reduced costs (negative value) to the government to an average \$79/ton in 2007 for a profit (positive value) of \$21/ton in 2008.<sup>165</sup> Remediation costs are well below that of artificial reefing which costs approximately \$554/ton. Ship recycling is economically sound: it creates local jobs, provides commodities for sale and eliminates most externalities associated with non-recycling options. It is clearly a best value solution.

#### **v. Conclusion**

It is clear that the domestic ship recycling facilities are beginning to see increased volumes, particularly now that export is off the table and the Suisun Bay fleet is being scrapped as part of the settlement in the NRDC lawsuit and the poor condition those ships are generally in. However, unless the Obama Administration enforces its “*Lead by Example*” mandate under the October 2009 Executive Order 13514 and the Navy and MARAD review their policies, and account for all externalities, ocean dumping via reefing and SINKEX could gain traction and divert many ships to the ocean bottom that could be recycled domestically.



The 15 mile long Brownsville Ship Channel connects the Port of Brownsville in Texas with the Gulf of Mexico. Several leading green U.S. ship recycling companies operate along this stretch.

Image Source: [www.clui.org/lotl/v33/k.html](http://www.clui.org/lotl/v33/k.html)

<sup>165</sup><http://www.whitehouse.gov/omb/expectmore/detail/10004010.2006.html>

## RECOMMENDATIONS

### Enforce the London Convention

Government vessels sunk through SINKEX and through the artificial reefing program can contain polychlorinated biphenyls (PCBs), an organohalogen listed in Annex I that is prohibited from ocean dumping under the original London Convention. Calling artificial reefing *placement* and not *dumping* is an inappropriate designation, as placement can only be deemed an exception to ocean dumping restrictions if it is not contrary to the aims of the Convention: “... *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....*” The EPA’s allowing of an Annex I substance to be dumped in excess of trace amounts for ocean disposal is clearly liable to create hazards to human health and marine life and is contrary to the aims of the Convention.

As demonstrated, both SINKEX and the artificial reefing programs are liable to create such hazards and harm.

Proper implementation and enforcement of U.S. obligations under the London Convention would make it illegal to dump PCBs in excess of trace amounts in the marine environment without exception.

### Amend the Marine Protection, Research and Sanctuaries Act

The MPRSA is meant to implement the objectives of the London Convention in national law. It therefore must regulate artificial reefing, as does the London Convention. Any exemptions for placement must be predicated therefore on ensuring that such placement is not liable to harm the marine environment. Rather, the MPRSA simply claims that placement such as artificial reefing is regulated

under other laws. Yet the other laws fail to regulate it properly and to the same extent as the London Convention. The MPRSA must be reformed to specifically exclude placement of any hazardous waste or London Annex I material above trace amounts, as this is clearly a violation of the aims of the London Convention.

### End SINKEX: Revoke General Permit

SINKEX is an old practice designed to simulate war conditions and provide our military with practice exercises for destroying enemy Navy vessels. It was conceived at a time prior to knowledge about contamination on board vessels and their impacts on the marine environment. It was designed at a time when our concerns for conserving metals, resources and preventing greenhouse gases were not as acute. And moreover, it is a program designed at a time before computer and video simulations were developed as a science.

Today, SINKEX is a relic we no longer need and can no longer afford. The days of using the sea as a dumping ground must end.

BAN has interviewed military experts who claim that today such target practice is not essential for military readiness. If on-sea targets are needed they advised that clean, uncontaminated barges could be substituted. In fact, during the Rim of the Pacific (RIMPAC) war games of 2010, the navy used inflatable and biodegradable balloons called killer tomatoes, as targets for gunnery exercises in an effort to



reduce costs and protect the marine environment during fleet training exercises. Regardless of alternative target availability, the Navy still sunk 3 naval vessels as targets during RIMPAC 2010.

SINKEX is currently considered ocean dumping under the MPRSA and has been authorized under a general permit issued as an exception to the normal rules as long as appropriate measures are taken *“to remove to the maximum extent practicable all materials which may degrade the marine environment.”* As a dumping event, the London Convention prohibits the dumping of PCBs in any levels above trace amounts. Thus SINKEX is illegal under the London Convention.

Further, even by the terms of the general permit, the EPA’s allowance of solid-matrix PCB containing material with concentrations above 50 ppm can hardly be consistent with the remediation requirement of maximum extent practicable; and as the EPA explicitly states, the Navy is only required to remove *“readily detachable solid PCB items”*.<sup>166</sup> Readily detachable or readily removable means items can be removed in a cost effective and efficient manner without the use of heat, chemical stripping, scraping and abrasive blasting or similar processes.<sup>167</sup>

In fact, the SINKEX general permit issued under 40 CFR 229 states *“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...”* This does not constitute removal to the maximum extent practicable. For the reasons cited above, the general permit should be revoked under MPRSA section 104(d), where EPA is to periodically review and revise permits

issued under the MPRSA. EPA has the authority *“to alter or revoke partially or entirely the terms of permits where it finds, based on monitoring data from the dump site and surrounding area that such materials cannot be dumped consistently with the criteria and other factors required to be applied in evaluating a permit application (1999 Memorandum of Agreement).”*

The EPA Office of Water, Wetlands and Watersheds stated that they were *“prepared to revise the Navy permit, or revoke it, in the event that the results of further studies demonstrate an unexpected unacceptable risk to human health or the environment from SINKEX.”*<sup>168</sup>

The recent data from the Ex-ORISKANY sinking shows significant leaching of PCBs into the marine environment and provides the opportunity to revoke the general permit based on a government sponsored biological study.



The Navy is using inflatable and biodegradable balloons called *killer tomatoes*, as low cost targets for gunnery exercises during RIMPAC 2010. Unlike sunken naval vessels, biodegradable balloons are not known to leach toxic materials into the marine environment.

Image Source:

[www.commonswikimedia.org/wiki/Category:Killer\\_tomatoes](http://www.commonswikimedia.org/wiki/Category:Killer_tomatoes)

<sup>166</sup> Navy Frequently Asked Questions, SINKEX

<sup>167</sup>

<http://www.marad.dot.gov/documents/April2001ShipDisposalReportToCongress.pdf>

<sup>168</sup> Official letter from Carol Browner, EPA Administrator, to Richard Danzig, Secretary of the Navy, September 13, 1999.

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## Enforce the Toxic Substances Control Act

According to the Office of Water, *“If EPA were to regulate SINKEX under TSCA, SINKEX would be unlawful, and subject to citizen suit...”* PCBs on SINKEX vessels are 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 EPA 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.

The EPA proclaimed: *“We believe there is no public interest in regulating the transportation*

*and disposal of PCBs associated with SINKEX under TSCA...”* However, this statement was made when there was a lack of hard evidence of significant PCB leaching from solid-matrices into the marine environment. We now know that PCBs leach into the marine environment and are taken up by fish; PCBs are then transferred to humans as humans digest contaminated fish. It is clearly in the public’s interest to regulate the transport and disposal of PCBs via SINKEX under TSCA as SINKEX is detrimental to human health and the environment.

With respect to artificial reef dumping, which allowed such ships as the Ex-ORISKANY to be dumped with PCBs on board in excess of 50 ppm under a risk-based disposal permit, such approvals should be prohibited now that we know that the risks are unacceptable.

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## Eliminate Double Standards

The EPA views the sinking of vessels for the purpose of artificial reefing an act of disposal under TSCA regulations and therefore have lessened the PCB remediation requirements to a 50 ppm level. However, at the same time, the EPA also considers the act of sinking vessels for the purpose of artificial reefing an act of non-disposal (placement) under the London Convention and MPRSA, thereby avoiding the dumping prohibitions and application of the black list. Thus, the EPA has allowed a double standard in order to facilitate ocean dumping. Under this arrangement, the Navy and MARAD are allowed to dump vessels with least burden to the budgets of these agencies, and by

externalizing the costs to the marine environment and the food chain.

If artificial reefing is considered disposal under the terms of TSCA, then it does not serve an alternative purpose and can be characterized as ocean dumping under the London Convention and MPRSA, and should be a prohibited action in which trace contaminant levels should apply. However, if a sunken vessel serves an alternative purpose (i.e. artificial reef, fisheries enhancement), the EPA should redefine the ocean disposal action as continued use or reuse. This adjustment would require remediation of PCBs to levels below 2 ppm, as opposed to the 50 ppm under the current disposal designation.

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## Ratify the London Protocol and Invoke the Precautionary Principle

The EPA states: *“Considering the type of PCB material involved and the lack of evidence of unreasonable risk to human health or the*

*environment, the Office of Water has determined that the general MPRSA permit for SINKEX is protective of risks associated with*

*PCBs on SINKEX vessels.*” Yet this mentality of prove harm first does not place priority on human health or the environment but rather places priority on polluting practices. It is a policy that inappropriately gives pollutants constitutional rights of “*innocent until proven guilty*.” Meanwhile, the rest of the world has adopted the Precautionary Principle with respect to policy and law, which more appropriately and prudently recognizes a “*better safe than sorry*” standard of

circumstantial evidence to authorize actions to prevent probable harm.

This principle is embodied in the 1996 London Protocol (the updating instrument of the London Convention). While the U.S. has signed the Protocol, it has failed to ratify it. The U.S. should adopt the Precautionary Principle as a matter of overarching policy while adopting more rigorous dumping controls by ratifying the London Protocol at the earliest opportunity.

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## Lead by Example: Honor the Waste Management Hierarchy

The Waste Management Hierarchy has long been an anchor in waste management policy. While there are several versions of the waste management hierarchy, they all are generally intended to favor waste prevention over waste reduction, waste reduction over recycling, and waste recycling over treatment, and waste treatment over disposal.

The U.S. government policies favoring cost externalization, and continued use of ocean disposal, flies in the face of the long established policy.

The most recent and active proposal along these lines, one directed specifically at U.S. governmental activities, is the Obama Administration’s “*Lead by Example*” October 2009 Executive Order 13514, entitled Federal Leadership in Environmental, Energy, and Economic Performance. This Order calls, among many environmental leadership initiatives, that all Federal agencies prioritize recycling and waste diversion as policy. This should obviously direct the Navy and MARAD ship disposal programs to prioritize ship recycling and reuse over other means of waste disposal.

The recycling of ships creates dynamic green jobs and is consistent with the Federal green job initiatives of 2009 and 2010, including the American Recovery and Reinvestment Act, which allocated \$787 billion in Federal funds to

spur economic activity and create green jobs in America.

While ocean disposal simply moves waste and any harm stemming there from one area of the environment to another, recycling gives new life to salvageable materials while saving energy and preventing greenhouse gas emissions and destructive primary mining activity. Recycling also creates new green jobs during each cycle of material reconstitution. Artificial reefing and SINKEX both eliminate the opportunity to create these green jobs and are in stark contrast to the ARRA intentions of job creation and economic growth.

It is time that the Navy and MARAD instill the policy of recycle first as called upon by the Lead by Example executive order.

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## CONCLUSION

Ocean disposal of obsolete government ships is currently being justified by what proves to be a series of faulty economic analyses and traditional assumptions. What is true is that artificial reefing and SINKEX involve the ocean dumping of toxic waste with the underlying motivation being the cheap disposal of such waste. The secondary motives of national security, in the case of SINKEX, or fisheries enhancement, in the case of reefing, are upon second examination, faulty or overstated. Ocean disposal simply moves waste and any harm stemming there from one area of the environment to another, not a clear act of disposal, but rather an act of pollution distribution and cost externalization. At the same time it loses forever, critical resources and jobs. These economic costs are scuttled just like the pollution, overboard.

The notion that our seas are vast enough and our natural world resilient enough to act as our dumping ground has long passed. We know now that contaminants do not assimilate

innocuously into the environment but in fact are often persistent (as in PCBs), or immortal (as in heavy metals) and that these contaminants do not just diffuse, but rather bioconcentrate and contaminate the marine food chain for years to come.

Our old ships need to be managed in a more rational, sustainable and economic manner than has been our habit. By prioritizing cost internalization through environmentally sound recycling here at home, the government can create the win win win scenario of protecting the environment, stimulating the economy and creating U.S. jobs.

We urge the government as a matter of obligation to taxpayers and future generations to reconsider future ocean disposal plans and choose recycling over ocean dumping.





# APPENDIX A

## MARAD Scrapping Cost Estimates vs. Actual Costs 2001-2008

Vessel	Tons	2001 Scrapping Cost Estimate	Actual Cost	Over-Estimated Difference
Lynch	1,200	(408,000)	(544,418)	-136,418
Mirfak	2,036	(692,240)	(414,768)	277,472
Mormacdawn	7,545	(2,565,300)	(778,837)	1,786,463
Caloosahatchee	10,000	(3,400,000)	(1,489,895)	1,910,105
Canisteo	10,000	(3,400,000)	(1,551,082)	1,848,918
Canopus	12,000	(4,080,000)	(1,825,194)	2,254,806
Compass Island	4,500	(1,530,000)	(2,049,691)	-519,691
Rigel	8,097	(2,752,980)	(1,171,232)	1,581,748
Catawba Victory	4,518	(1,536,120)	(1,103,206)	432,914
Marine Fiddler	8,199	(2,787,660)	(1,258,890)	1,528,770
Robert Conrad	1,200	(408,000)	(99,000)	309,000
Opportune	1,530	(520,200)	(135,490)	384,710
Petrel	1,653	(562,020)	(166,500)	395,520
Albert Watts	9,000	(3,060,000)	(3,452,193)	-392,193
Santa Elena	8,912	(3,030,080)	(1,349,185)	1,680,895
Patch	12,535	(4,261,900)	(2,732,541)	1,529,359
Wayne Victory	4,442	(1,510,280)	(901,759)	608,521
Wood County	4,164	(1,415,760)	(789,716)	626,044
Export Challenger	7,080	(2,407,200)	(2,473,600)	-66,400
Lauderdale	6,600	(2,244,000)	(985,620)	1,258,380
General Walker	12,451	(4,233,340)	(1,365,350)	2,867,990
General Darby	12,657	(4,303,380)	(1,137,878)	3,165,502
Neosho	9,400	(3,196,000)	(1)	3,195,999
Sunbird	1,653	(562,020)	(85,920)	476,100
Protector	3,500	(1,190,000)	(533,042)	656,958
Tiogo County	2,628	(893,520)	(1,122,850)	-229,330
Wabash	1,980	(673,200)	(1,366,580)	-693,380
Mizar	2,036	(692,240)	(243,900)	448,340
Wahkiakum County	2,686	(913,240)	(1,102,850)	-189,610

Neptune	5,251	(1,785,340)	(398,601)	1,386,739
Waccamaw	11,000	(3,740,000)	(496,319)	3,243,681
Connecticut	9,856	(3,351,040)	(1,299,327)	2,051,713
Marshfield	6,700	(2,278,000)	(335,000)	1,943,000
Nemasket	1,998	(679,320)	(1,252,367)	-573,047
Mormacwave	8,268	(2,811,120)	(1,396,095)	1,415,025
Naeco	8,359	(2,842,060)	500	2,842,560
Builder	7,000	(1,600,000)	(1,613,349)	-13,349
Pawcatuck	9,486	(3,225,240)	(569,373)	2,655,867
Point Loma	9,415	(3,201,100)	(897,792)	2,303,308
Florence	7,789	(2,648,260)	(996,992)	1,651,268
Gilmore	9,734	(3,309,560)	(742,675)	2,566,885
Murphy	4,929	(1,675,860)	5,550	1,681,410
Beaujolias	7,414	(2,520,760)	(1,047,137)	1,473,623
Saugatuck	5,252	(1,785,680)	(549,999)	1,235,681
Orion	9,734	(3,309,560)	(734,230)	2,575,330
Hannibal Victory	4,612	(1,568,080)	(978,698)	589,382
Barnard Victory	4,609	(1,567,060)	(1,442,804)	124,256
Occidental Victory	4,567	(1,552,780)	(1,191,987)	360,793
Sioux Falls Victory	4,490	(1,526,600)	(978,698)	547,902
Mississinewa	9,400	(3,196,000)	(0.02)	3,196,000
Vulcan	9,140	(3,107,600)	(494,000)	2,613,600
Jason	9,140	(3,107,600)	(1,426,035)	1,681,565
Queens Victory	4,566	(1,552,440)	(1,180,000)	372,440
Hunley	10,500	(3,570,000)	1,500	3,571,500
Empire State	8,240	(2,801,600)	(851,194)	1,950,406
Hoist	1,505	(511,700)	(95,000)	416,700
Cape Charles	5,876	(1,997,840)	(488,965)	1,508,875
American Banker	10,048	(3,416,320)	(1,302,877)	2,113,443
Santa Cruz	9,099	(3,039,660)	(1,009,885)	2,029,775
American Ranger	7,545	(2,565,300)	(796,600)	1,768,700
Santa Isabel	9,982	(3,393,880)	(970,772)	2,423,108
Mormacmoon	7,545	(2,565,300)	(1,309,853)	1,255,447
Donner	5,323	(1,809,820)	(565,207)	1,244,613

<b>TOTAL</b>	422,574	(\$142,841,160)	(\$59,635,469)	\$83,205,691
<b>( ) = MARAD Expense</b>		2001 Estimated Average Price/ton	Actual Price/ton	Overestimated Difference
<b>- = Underestimate</b>		\$338	\$141	58%

*Source: Table developed by author using data from Navy and MARAD 2001-2008 Reports to Congress on the Progress of the Vessel Disposal Program.*

## APPENDIX B

### Naval Vessels Disposed At Sea, 2000-2010

Sink Date	Vessel Name	Action	Light Displacement (Long Tons)
2000	USS Worden	SINKEX	5,905
2000	Ashtabula	SINKEX	7,470
2000	Atakapa	SINKEX	1,240
2000	Dale	SINKEX	6,167
2000	USS Gaffey	SINKEX	9,676
2000	USS Buchanan	SINKEX	3,640
2000	USS Ramsey	SINKEX	2,643
2001	Andrew J. Weber	SINKEX	6,000
2001	LaMoure County	SINKEX	5,142
2001	Keywadin	SINKEX	610
2001	Winamac	SINKEX	356
2001	Lynde McCormick	SINKEX	3,619
2001	Elk River	SINKEX	850
2001	Barbel	SINKEX	1,744
2001	USS John Paul Jones	SINKEX	3,028
2001	USS Reeves	SINKEX	5,829
2001	USS Gaum	SINKEX	13,549
2002	USS Okinawa	SINKEX	13,356
2002	Caron (DD 970)	SINKEX	6,810
2002	Towers (DDG 9)	SINKEX	3,190
2002	Hoarold E Holt (FF 1074)	SINKEX	3,225
2002	White Plains (AFS 4)	SINKEX	9,797
2002	Rathburne (FF 1057)	SINKEX	3,305
2002	Wainwright (CG 28)	SINKEX	5,340
2002	Hepburn (FF 1055)	SINKEX	3,238
2003	Yosemite (AD 19)	SINKEX	11,205
2003	Dixon (AS 37)	SINKEX	13,967
2003	Samual Gompers (AD 37)	SINKEX	13,458
2003	Henry B. Wilson	SINKEX	3,190
2003	Merrill	SINKEX	7,021

2003	Seneca	SINKEK	1,240
2003	Mandan	SINKEK	283
2003	Nogalesen	SINKEK	283
2003	Ketchikan	SINKEK	283
2003	Weehawken	SINKEK	283
2003	Navigator	SINKEK	610
2003	Ingersoll (DD 990)	SINKEK	6,373
2003	Downes (FF 1070)	SINKEK	3,187
2003	Leftwich (DD 984)	SINKEK	6,516
2003	Bigelow (DD 942)	SINKEK	6,649
2004	Gosport	SINKEK	1,088
2004	Arcata	SINKEK	283
2004	Portland (LSD 37)	SINKEK	8,615
2004	Decatur (DDG 31)	SINKEK	2,967
2004	Barbour County (LST 1195)	SINKEK	4,982
2004	(IX 542)	SINKEK	600
2004	Inchon (MCS 12)	SINKEK	14,152
2004	Peoria (LST 1183)	SINKEK	5,152
2004	Conserver (ARS 39)	SINKEK	1,497
2004	USS Peterson (DD 969)	SINKEK	6,929
2004	USS John Young (DD 973)	SINKEK	6,722
2004	USS Kinkaid (DD 965)	SINKEK	6,952
2004	USS Harry W. Hill (DD 986)	SINKEK	6,278
2004	USS Nicholson (DD 982)	SINKEK	6,745
2004	USS Hayler (DD 997)	SINKEK	7,467
2004	USS Schenectady (LST 1185)	SINKEK	5,008
2005	Deyo (DD 989)	SINKEK	6,870
2005	Elliot (DD 967)	SINKEK	7,028
2005	USS America (CV 66)	SINKEK	61,174
2005	USS Guadalcanal (LPH 7)	SINKEK	13,465
2005	USS Mount Vernon (LSD 39)	SINKEK	8,762
2005	USS William H. Standley (CG 32)	SINKEK	7,388
2005	USS Oldendorf (DD 972)	SINKEK	7,086
2005	USS Fife (DD 991)	SINKEK	6,646
2005	USS Briscoe (DD 977)	SINKEK	6,765



2006	Comte De Grasse (DD 974)	SINKEX	6,579
2006	Stump (DD 978)	SINKEX	6,636
2006	USS O'Brien (DD 975)	SINKEX	6,877
2006	USNS Butte (T-AE 27)	SINKEX	10,524
2006	USS Mauna Kea (AE 22)	SINKEX	9,286
2006	USS Belleau Wood (LHA 3)	SINKEX	26,520
2006	USNS Mars (T-AFS 1)	SINKEX	9,852
2006	USS Thorn (DD 988)	SINKEX	6,721
2006	USS Valley Forge (CG 50)	SINKEX	7,396
2006	USS Spruance (DD 963)	SINKEX	6,649
2007	La Salle (AGF 3)	SINKEX	9,559
2007	Sailfish (SS 572)	SINKEX	2,030
2007	USS Knox (FF 1052)	SINKEX	3,200
2007	USS Jouett (CG 29)	SINKEX	5,340
2008	Spica (AFS 9)	SINKEX	10,205
2008	USS David R. Ray (DD 971)	SINKEX	6,671
2008	USS Horne (CG 30)	SINKEX	5,340
2008	USS Fletcher (DD 992)	SINKEX	6,593
2008	USS Cushing (DD 985)	SINKEX	7,121
2008	USS O'Bannon (DD 987)	SINKEX	7,039
2009	USS Conolly (DD 979)	SINKEX	6,600
2010	USS Acadia (AD 42)	SINKEX	13,526
2010	USS New Orleans	SINKEX	13,285
2010	USS Monticello	SINKEX	6,880
2010	USS Anchorage	SINKEX	8,325
2010	USNS Saturn	SINKEX	10,205
2002	USS Spiegel Grove	Artificial Reefing	8,899
2006	USS Oriskany	Artificial Reefing	32,519
2007	USS Texas Clipper	Artificial Reefing	7,970
2008	USS Vandenberg	Artificial Reefing	9,950
<b>Total</b>			<b>674,318</b>

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