



PHASE I UNIFORM NATIONAL DISCHARGE STANDARDS FOR VESSELS OF THE ARMED FORCES

TECHNICAL DEVELOPMENT DOCUMENT

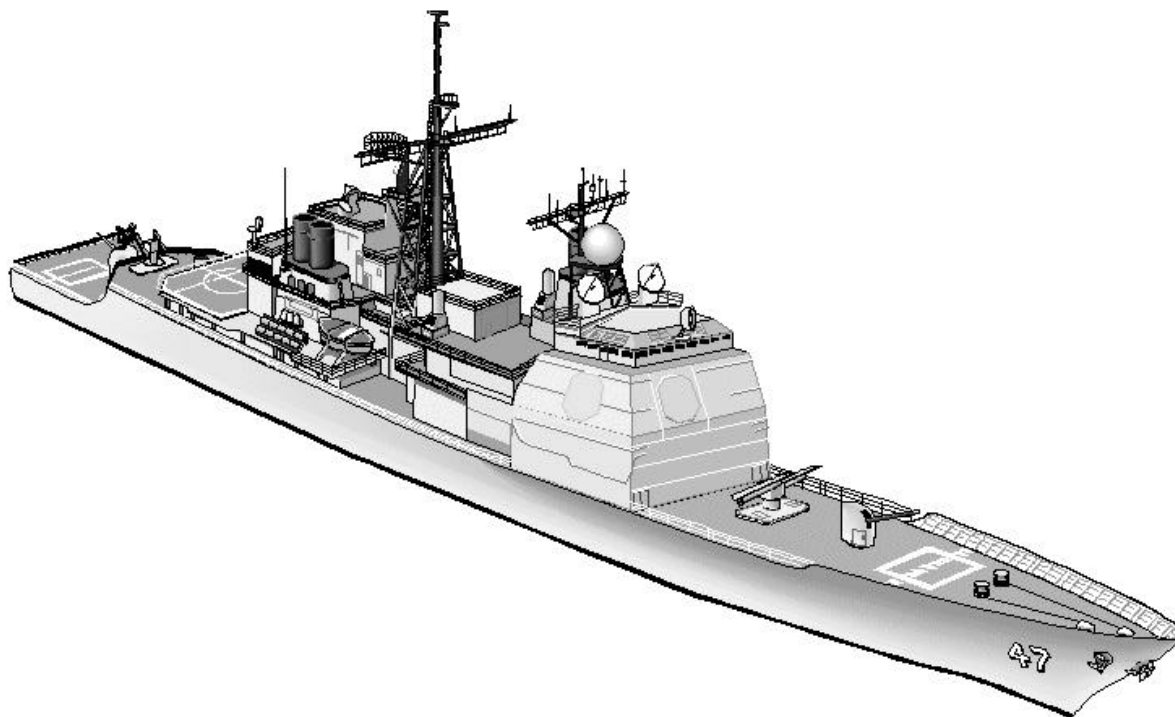


Table 2. Annual Discharge Due to Tests, Inspections And Certifications

The Ship Class	Number Of Ships Per Class	The Armed Force Owner	Number of Foam Stations	The Foam Dispensing Means	Discharge Events Per Year Per Station (See Table 1)	Solution Disch. Per Station per Event (gal) (See Note 3)	Solution Disch. per Class (gal) (See Note 4)	Foam Con. Disch. Per Class (gal) (See Note 4)	Seawater Disch. Per Class (gal) (See Note 4)	Clean-up Seawater Per Class (gal) (See Note 5)
FFG 7	43	NAVY	2	Hose	1.33	125	14298	858	13440	0
	43	NAVY	2	Fl. Dk.	0.67	182	10510	631	9879	87582
IX 308	2	NAVY	1	Hose	1.33	125	333	20	313	0
IX 35	2	NAVY	1	Hose	1.33	125	333	20	313	0
IX 501	1	NAVY	1	Hose	1.33	125	166	10	156	0
LCC 19	2	NAVY	2	Hose	1.33	125	665	40	625	0
	2	NAVY	2	Fl. Dk.	0.67	320	857	51	805	7140
LHA 1	5	NAVY	12	Hose	1.33	250	19950	1197	18753	0
	5	NAVY	12	Fl. Dk.	0.67	1000	40200	2412	37788	335000
LHD 1	4	NAVY	12	Hose	1.33	250	15960	958	15002	0
	4	NAVY	12	Fl. Dk.	0.67	1000	32160	1930	30230	268000
LPD 4	8	NAVY	4	Hose	1.33	125	5320	319	5001	0
	8	NAVY	4	Fl. Dk.	0.67	1021	21882	1313	20569	182347
LPH 2	2	NAVY	10	Hose	1	250	5000	540	4700	0
	2	NAVY	10	Fl. Dk.	0.67	1000	13400	804	12596	111667
LSD 36	5	NAVY	4	Hose	1.33	125	3325	200	3126	0
	5	NAVY	4	Fl. Dk.	0.67	365	4888	293	4595	40736
LSD 41	8	NAVY	4	Hose	1.33	125	5320	319	5001	0
	8	NAVY	4	Fl. Dk.	0.67	936	20068	1204	18864	167232
LSD 49	3	NAVY	4	Hose	1.33	125	1995	120	1875	0
	3	NAVY	4	Fl. Dk.	0.67	936	7525	452	7074	62712
LST 1179	3	NAVY	1	Hose	1.33	125	499	30	469	0
	3	NAVY	1	Fl. Dk.	0.67	216	434	26	408	3618
MCM 1	14	NAVY	1	Hose	1.33	125	2328	140	2188	0
MHC 51	12	NAVY	1	Hose	1.33	125	1995	120	1875	0
PC 1	13	NAVY	1	Hose	1.33	125	2161	130	2032	0
	13	NAVY	1	Fl. Dk.	0.67	162	1408	85	1324	11737
Misc. (See Note 6)	30	MSC	N/A	N/A	N/A	N/A	27500	1650	25850	220000
TOTAL							722537	42902	679931	4244144

Table 1. Annual Surface, Scum, and Bottom Blowdown Volumes for each Ship Class of the Navy, MSC, and USCG

Armed Force Owner	Ship Classes with Main Propulsion Boilers	Number of Ships per Class	Number of Boilers per Ship	Boiler Volume During Steaming (gallons per boiler)	Surface Blowdown Volume per year (5% of boiler steaming volume in gallons)	Scum Blowdown Volume per year (1% of boiler steaming volume in gallons)	Bottom Blowdown Volume per year (10% of boiler steaming volume in gallons)	Total Blowdown Volume per year within 12 n.m. (gallons)
Navy	CV 63	3	8	2,200	58,080	10,560	52,800	121,440
	CV 59	1	8	2,000	17,600	3,200	16,000	36,800
	LPH 2	2	2	1,600	7,040	1,280	6,400	14,720
	LPD 7	3	2	1,300	8,580	1,560	7,800	17,940
	LPD 4	3	2	1,200	7,920	1,440	7,200	16,560
	LPD 14	2	2	1,200	5,280	960	4,800	11,040
	LSD 36	5	2	1,600	17,600	3,200	16,000	36,800
	AGF 3	1	2	1,200	2,640	480	2,400	5,520
	AGF 11	1	2	1,300	2,860	520	2,600	5,980
	AO 177	5	2	2,900	31,900	5,800	29,000	66,700
	AOE 1	4	4	1,900	33,440	6,080	30,400	69,920
	AS 33	1	2	1,500	3,300	600	3,000	6,900
	AS 39	3	2	1,400	9,240	1,680	8,400	19,320
	LCC 19	2	2	1,400	6,160	1,120	5,600	12,880
	LHD 1	4	2	3,100	27,280	4,960	24,800	57,040
	LHA 1	5	2	3,100	34,100	6,200	31,000	71,300
Total Boiler Blowdown for Navy Main Propulsion Boilers =570,860								
MSC	T-AE 26	8	3	1,500	39,600	NA	36,000	75,600
	T-AFS 1	8	3	1,500	39,600	NA	36,000	75,600
	T-AGM 22	1	2	1,000	2,200	NA	2,000	4,200
	T-AG 194	2	2	1,000	4,400	NA	4,000	8,400
	T-AH 19	2	2	1,000	4,400	NA	4,000	8,400
	T-AKR 287	8	2	1,000	17,600	NA	16,000	33,600
Total Boiler Blowdown for MSC Main Propulsion Boilers =205,800								
Note: Information obtained from NAVSSES Memo of 23 August, 1991, ⁵ and M. Rosenblatt & Son, Inc.								

**Table 1. Listing of Vessels,
Navy, MSC, Army, and USCG using Cathodic Protection**

Class	Description	Quantity of Vessels	Cathodic Protection System
Navy Combatants			
ATC	River Raider Class Mini Armored Troop Carriers	20	Sacrificial Anodes
AT	Armored Troop Carriers	21	Sacrificial Anodes
CM	Landing Craft, Mechanized	151	Sacrificial Anodes
CU	Landing Craft, Utility	40	Sacrificial Anodes
CV 59	Forrestal Class Aircraft Carrier	1	ICCP
CVN 65	Enterprise Class Aircraft Carrier	1	ICCP
CV 63	Kitty Hawk Class Aircraft Carrier	3	ICCP
CVN 68	Nimitz Class Aircraft Carrier	7	ICCP
CG 47	Ticonderoga Class Guided Missile Cruisers	27	ICCP
CGN 38	Virginia Class Guided Missile Cruiser	1	ICCP
CGN 36	California Class Guided Missile Cruiser	2	ICCP
DDG 993	Kidd Class Guided Missile Destroyers	4	ICCP
DDG 51	Arleigh Burke Class Guided Missile Destroyers	18	ICCP
DD 963	Spruance Class Destroyers	31	ICCP
FFG 7	Oliver Hazard Perry Guided Missile Frigates	1	ICCP
FFG 7	Oliver Hazard Perry Guided Missile Frigates	42	Sacrificial Anodes
LCC 19	Blue Ridge Class Amphibious Command Ships	2	ICCP
LCM 3	Mechanized Landing Craft	2	Sacrificial Anodes
LCM 6	Mechanized Landing Craft	60	Sacrificial Anodes
LCM 8	Mechanized Landing Craft	100	Sacrificial Anodes
LCU 1610	Utility Landing Craft (LCU 1600)	40	Sacrificial Anodes
LHD 1	Wasp Class Amphibious Transport Docks	4	ICCP
LHA 1	Tarawa Class Amphibious Assault Ships	5	ICCP
LPD 4	Austin Class Amphibious Transport Docks	3	ICCP
LPD 7	Amphibious Transport Docks	3	ICCP
LPD 14	Amphibious Transport Docks	2	ICCP
LPH 2	Iwo Jima Class Assault Ships	2	Sacrificial Anodes
LSD 36	Anchorage Class Dock Landing Ships	5	Sacrificial Anodes
LSD 41	Whidbey Island Class Dock Landing Ships	8	ICCP
LSD 49	Harpers Ferry Dock Landing Ships	3	ICCP
MCM 1	Avenger Class Mine Countermeasure Vessels	14	Sacrificial Anodes
MHC 51	Osprey Class Coastal Minehunter Vessels	12	Sacrificial Anodes
PB	Mk III and Mk IV Patrol Boats	31	Sacrificial Anodes
PBR	Mk II River Patrol Boats	25	Sacrificial Anodes
PC 1	Cyclone Class Coastal Defense Ships	13	ICCP
SSBN 726	Ohio Class Ballistic Missile Submarine	17	Sacrificial Anodes
SSN 637	Sturgeon Class Attack Submarine	13	Sacrificial Anodes
SSN 688	Los Angeles Class Attack Submarine	56	Sacrificial Anodes
SSN 671	Narwhal Class Submarines	1	Sacrificial Anodes
SSN 640	Benjamin Franklin Class Submarines	2	Sacrificial Anodes
Navy Auxiliary			
AFDB 4	Large Auxiliary Floating Dry Dock	1	ICCP
AFDB 8	Large Auxiliary Floating Dry Dock	1	ICCP
AFDL 1	Small Auxiliary Floating Dry Docks	2	ICCP
AFDM 14	Medium Auxiliary Floating Dry Dock	1	ICCP
AFDM 3	Medium Auxiliary Floating Dry Docks	4	ICCP
AGF 3	Raleigh Class Miscellaneous Flagship	1	Sacrificial Anodes

Table 2. Vessels Estimated Annual Sacrificial Anode Cathodic Protection Discharges

Class	Description	Quantity of Vessels w/ Zincs	Wetted Surface Area per Vessel (sq ft)	Wetted Surface Area of Class (sq ft)	Total Amount of Anodes by Class (lbs)		Days in Port per Vessel		Number of Transits per Vessel (e)	Days Operating within 12 n.m.	Zinc Discharged within 12 n.m. (lbs)
Navy Combatants											
ATC	River Raider Class Mini Armored Troop Carriers	20	362	7,244	417	a	305	b	0	60	32
AT	Armored Troop Carriers	21	362	7,606	437	a	305	b	0	60	33
CM	Landing Craft, Mechanized	151	4,275	645,525	129,105	a	305	b	0	60	9,798
CU	Landing Craft, Utility	40	3,860	154,400	30,880	a	305	b	0	60	2,344
FFG 7	Oliver Hazard Perry Guided Missile Frigates	42	19,850	833,700	166,152	c	167		13	0	5,477
LCM 3	Mechanized Landing Craft	2	990	1,980	114	a	305		0	60	9
LCM 6	Mechanized Landing Craft	60	990	59,400	3,416	a	305		0	60	259
LCM 8	Mechanized Landing Craft	100	1,603	160,300	9,217	a	305		0	60	700
LCU 1610	Utility Landing Craft (LCU 1600)	40	3,915	156,600	31,320	d	200		6	0	1,165
LPH 2	Iwo Jima Class Assault Ships	2	49,945	99,890	19,964	c	186		11	0	716
LSD 36	Anchorage Class Dock Landing Ships	5	45,405	227,025	51,060	c	215		13	0	2,121
MCM 1	Avenger Class Mine Countermeasure Vessels	14	8,410	117,740	9,982	c	232		28	0	481
MHC 51	Osprey Class Coastal Minehunter Vessels	12	6,418	77,016	9,936	c	232		28	0	479
PB	Mk III and Mk IV Patrol Boats	31	897	27,796	1,598	a	305	b	0	60	121
PBR	Mk II River Patrol Boats	25	261	6,531	376	a	305	b	0	60	29
Navy Auxiliary											
AGF 3	Raleigh Class Miscellaneous Flagship	1	41,595	41,595	8,326	c	183		12	0	296
AGF 11	Austin Class Miscellaneous Flagship	1	51,830	51,830	8,326	c	183		12	0	296
AGOR 21	Gyre Class Research Ships	1	8,834	8,834	1,767	a	113		11	0	40
AGOR 23	Thom. G. Thompson Class Research Ships	2	13,960	27,920	5,584	a	113		11	0	127
ARD 2	Auxiliary Repair Dry Docks	1	46,994	46,994	5,405	c	305	b	60	0	372
AS 39	Emory S Land Class Submarine Tenders	3	59,630	178,890	41,400	c	293		6	0	2,228
AS 33	Simon Lake Class Submarine Tenders	1	59,630	59,630	13,800	c	229		6	0	585
TR	Torpedo Retrievers	22	1,125	24,750	1,423	a	305	b	0	60	108
YC	Open Lighters (nsp)	254	6,475	1,644,650	94,567	d	305	b	0	60	7,177
YD	Floating Cranes (nsp)	63	12,875	811,125	162,225	d	305	b	0	60	12,312
YDT	Diving Tenders	3	8,885	26,655	5,331	d	305	b	0	60	405
YFN	Covered Lighters (nsp)	157	6,680	1,048,760	209,752	d	305	b	0	60	15,919
YFNB	Large Covered Lighters (nsp)	11	15,955	175,505	35,101	d	305	b	0	60	2,664
YFNX	Lighter - Special Purpose (nsp)	8	4,760	38,080	7,616	d	305	b	0	60	578
YFP	Floating Power Barges (nsp)	2	15,590	31,180	6,236	d	305	b	0	60	473
YFRT	Covered Lighters - Range Tender (self propelled)	2	5,490	10,980	2,196	d	305	b	0	60	167
YFU	Harbor Utility Craft (YFU 83 & 91)	2	3,915	7,830	1,566	d	305	b	0	60	119

Table 6a. Tidal Prism Model - Zinc From Sacrificial Cathodic Protection Anodes

Class	Description	Quantity of Vessels w/ Zincs	Total Amount of Anodes by Class (kg)	Days in Port per Vessel	Number of Transits per Vessel (a)	Zinc Discharged in Port (kg) (b)	Zinc Conc. in Port (µg/L)
	San Diego						
FFG	Oliver Hazard Perry Guided Missile Frigates	11	16,243	167	13	989	
SSN	Los Angeles Class Attack Submarines	9	8,261	183	6	389	
SSN	Sturgeon Class Attack Submarine	1	918	183	6	43	
LSD	Anchorage Class Dock Landing Ships	3	13,894	215	13	965	
AGF	Raleigh Class Miscellaneous Flagship	1	3,776	183	12	232	
AS	Emory S Land Class Submarine Tender	1	6,259	293	6	417	
LPH	Iwo Jima Class Assault Ship	1	4,527	186	11	269	
					Total	3,304	0.0876
	Mayport						
FFG	Oliver Hazard Perry Guided Missile Frigates	10	14,766	167	13	899	1.35
	Pearl Harbor						
FFG	Oliver Hazard Perry Guided Missile Frigates	2	2,953	167	13	180	
SSN	Los Angeles Class Attack Submarine	15	13,769	183	6	648	
SSN	Sturgeon Class Attack Submarine	4	3,672	183	6	173	
SSN	Benjamin Franklin Class Submarines	1	918	183	6	43	
					Total	1,043	0.306
	(a) Denotes round-tip transits						
	(b) Based on a hourly zinc dissolution rates of 7.4E-6 lbs. of zinc/lb.anode (static) and 3.0E-5 lbs. of zinc/lb. anode (dynamic)						

Table 1. Listing of Ships and Vessels for Deck Runoff
Navy, MSC, USCG and Army

<u>Vessel Category</u>	<u>Homeported In U.S.*</u>	<u>Additional Projected</u>	<u>Ship Dimensions</u>		<u>Helo Pad Dimensions</u>		<u>Weather Deck Area (sq ft)</u>	<u>Days within 12 n.m.</u>
			<u>Length (ft)</u>	<u>Beam (ft)</u>	<u>Length (ft)</u>	<u>Width (ft)</u>		
* Where ships of this class are homeported in foreign ports, their number appears in parentheses, e.g., 8 (2) indicates 8 ships in the class, 2 homeported overseas, therefore only six are considered in calculating the deck runoff in that class.								
** Denotes ships which do not embark helicopters as part of their normal complement, so helicopter flight deck area is included in weather deck area								
*** DDG 51-78 do not have helos embarked; DDG 79 and Follow will have two embarked helos.								
<u>Navy Ships</u>								
<u>Aircraft Carriers</u>								
Forrestal Class Carrier (CV 59)	1 (1)	0	1052	130			220,000	0
Kitty Hawk Class Carriers (CV 63)	3	0	1063	130			220,000	139
Enterprise Class Carriers (CVN 65)	1	0	1123	133			230,000	78
Nimitz Class Carriers (CVN 68)	7	2	1092	134			230,000	149
<u>Amphibious Assault Ships</u>								
Wasp Class Assault Ship (LHD 1)	4	3	819	106			86,814	188
Tarawa Class Assault Ship (LHA 1)	5 (1)	0	820	118			92,800	175
Iwo Jima Class Assault Ship (LPH 2)	2	0	602	104			62,608	189
<u>Submarines</u>								
Ohio Class Ballistic Missile Submarines (SSBN 726)	17	0	560	42			15,288	185
Sturgeon Class Attack Submarine (SSN 637)	13	0	302.2	31.8			6,246	185
Los Angeles Class Attack Submarine (SSN 688)	56	0	362	33			7,765	185
Narwhal Class Submarine (SSN 671)	1	0	314.6	37.7			7,709	185
Benjamin Franklin Class Submarines (SSN 640)	2	0	425	33			9,116	185
<u>Surface Ships</u>								
Virginia Class Cruisers (CGN 38)	1	0	585	63	20**	27	28,747	164
California Class Cruisers (CGN 36)	2	0	596	61	43**	38	28,358	146
Ticonderoga Class Cruisers (CG 47)	27 (2)	0	567	55	54	40	22,164	169
Kidd Class Destroyers (DDG 993)	4	0	563.3	55	52**	41	24,166	104
Arleigh Burke Class Destroyers (DDG 51)***	18 (2)	30	504.5	66.9	49**	42	26,326	178
Spruance Class Destroyers (DD 963)	31 (3)	0	563.2	55.1	52	42	22,021	181
Oliver Hazard Perry Class Frigates (FFG 7)	43 (2)	0	445	45	54	36	13,676	170
Blue Ridge Class Command Ships (LCC 19)	2 (1)	0	636.5	107.9	72**	74	53,569	181
Austin Class Amphibious Transport Dock (LPD 4)	3	0	570	100	209**	61	44,460	181
Austin Class Amphibious Transport Dock (LPD 7)	3 (1)	0	570	100	199**	61	44,460	191
Austin Class Amphibious Transport Dock (LPD 14)	2	0	570	100	203**	75	44,460	195
Whidbey Class Dock Landing Ships (LSD 41)	8 (2)	0	609.5	84	189**	71	39,934	171
Harpers Ferry Class Dock Landing Ships (LSD 49)	3	1	609.5	84	188**	72	39,934	216
Anchorage Class Dock Landing Ships (LSD 36)	5	0	553.3	84	78**	78	36,252	218
Newport Class Tank Landing Ships (LST 1179)	3	0	522.3	69.5	49**	54	28,314	183
Avenger Class Mine Countermeasures Ship (MCM 1)	14 (2)	0	224	39			6,814	239
Osprey Class Coastal Minehunters (MHC 51)	12	6	188	35.9			5,264	239
Cyclone Class Patrol Ships (PC 1)	13	1	170.3	24.9			3,308	110

**Table 2. Estimate of Annual Weather Deck Runoff From Precipitation
Navy Surface Ships, By Port**

Ship Class		Home Port:	Bremerton, WA	Everett, WA	Ingleside, TX	Little Creek, VA	Mayport, FL
	Average Annual Rainfall (in):		50	31	30	45	52
	Weather Deck Area (sq ft)	Days within 12 n.m.	No. Ships	No. Ships	No. Ships	No. Ships	No. Ships
Virginia Class Cruisers (CGN 38)	28,747	164	1				
California Class Cruisers (CGN 36)	28,358	146	1				
Ticonderoga Class Cruisers (CG 47)	22,164	169					5
Kidd Class Destroyers (DDG 993)	24,166	104		2			
Arleigh Burke Class Destroyers (DDG 51)	26,326	178					2
Spruance Class Destroyers (DD 963)	22,021	181		2			6
Oliver Hazard Perry Class Frigates (FFG 7)	13,676	170		3			10
Blue Ridge Class Command Ships (LCC 19)	53,569	181					
Austin Class Transport Docks (LPD 4)	44,460	181					
Austin Class Transport Docks (LPD 7)	44,460	191					
Austin Class Transport Docks (LPD 14)	44,460	195					
Whidbey Class Dock Landing Ships (LSD 41)	39,934	171				4	
Harpers Ferry Class Dock Landing Ships (LSD 49)	39,934	216				2	
Anchorage Class Dock Landing Ships (LSD 36)	36,252	218				2	
Newport Class Tank Landing Ships (LST 1179)	28,314	183				1	
Avenger Class Mine Countermeasures Ship (MCM 1)	6,814	239			12		
Osprey Class Coastal Minehunters (MHC 51)	5,264	239			9		
Cyclone Class Patrol Ships (PC 1)	3,308	110				9	
Austin Class Command Ship (AGF 11)	29,250	186					
Safeguard Class Salvage Ships (ARS 50)	10,144	214				2	
Emory S Land Class Submarine Tenders (AS 39)	42,684	295					
Estimated Surface Runoff, (gal/yr):			756,138	1,057,434	1,581,483	5,623,465	6,684,183

**Table 2. Estimate of Annual Weather Deck Runoff From Precipitation
Navy Surface Ships, By Port**

Ship Class		Home Port:	Norfolk, VA	Pearl Hr, HI	Pascagoula, MS	San Diego, CA
		Average Annual Rainfall (in):	45	25	72	10
	Weather Deck Area (sq ft)	Days within 12 n.m.	No. Ships	No. Ships	No. Ships	No. Ships
Virginia Class Cruisers (CGN 38)	28,747	164				
California Class Cruisers (CGN 36)	28,358	146	1			
Ticonderoga Class Cruisers (CG 47)	22,164	169	7	3	2	8
Kidd Class Destroyers (DDG 993)	24,166	104	2			
Arleigh Burke Class Destroyers (DDG 51)	26,326	178	7	2		5
Spruance Class Destroyers (DD 963)	22,021	181	9	4		6
Oliver Hazard Perry Class Frigates (FFG 7)	13,676	170	12	2	2	12
Blue Ridge Class Command Ships (LCC 19)	53,569	181	1			
Austin Class Transport Docks (LPD 4)	44,460	181	1			2
Austin Class Transport Docks (LPD 7)	44,460	191	1			1
Austin Class Transport Docks (LPD 14)	44,460	195	2			
Whidbey Class Dock Landing Ships (LSD 41)	39,934	171				3
Harpers Ferry Class Dock Landing Ships (LSD 49)	39,934	216				1
Anchorage Class Dock Landing Ships (LSD 36)	36,252	218				3
Newport Class Tank Landing Ships (LST 1179)	28,314	183		1		
Avenger Class Mine Countermeasures Ship (MCM 1)	6,814	239				
Osprey Class Coastal Minehunters (MHC 51)	5,264	239				
Cyclone Class Patrol Ships (PC 1)	3,308	110				4
Austin Class Command Ship (AGF 11)	29,250	186				1
Safeguard Class Salvage Ships (ARS 50)	10,144	214		2		
Emory S Land Class Submarine Tenders (AS 39)	42,684	295	1			1
Estimated Surface Runoff, (gal/yr):			14,458,310	2,165,816	1,492,969	3,451,692
			Estimated Total, All Ports (gal/yr):			37,271,490

A single RO plant on a typical Navy MHC 51 coastal minehunter produces 1,600 gpd of freshwater.³ Therefore:

$$(1,600 \text{ gpd freshwater}) (4) = 6,400 \text{ gpd brine discharge}$$

Current Navy vessel water purification plant operating practice is for steam-propelled ships to operate one distilling plant in port for one to five days before departure (to fill boiler feed water tanks) and while transiting through coastal waters less than (<) 12 n.m.). Submarines are normally supplied boiler feed water by shore or a tender while in port. The distilling plants on all these vessels can be operated at full capacity while at sea (greater than (>) 12 n.m.)).

Table 1 shows estimated distilling and RO plant brine discharge quantities for various vessel classes. The estimates are based on available information regarding the number of vessels in each class, type and capacity of water purification plant(s), vessel operating schedules (number of transits and days in port per year), and water purification plant operating practices while in port, in transit (<12 n.m.) and at sea (>12 n.m.). The assumptions and formulas used to calculate the brine discharge estimates are summarized in the notes section of Table 1, and include four hours per vessel transit in coastal waters. The assumptions also include operation of one distilling plant to produce boiler feedwater for four hours prior to departure from port in the case of submarines.³ Surface steam-powered vessels may operate a distilling plant for as much as three days prior to departure from port (i.e., every second transit).^{3,5} The calculation of the total annual brine discharge within 12 n.m. of shore consists of an in-port component and a transit component, which are added together. The formula for a Navy vessel class is:

$$\begin{aligned} \text{Annual Flow within 12 n.m. (gals/yr)} = \\ (\text{number of vessels in class}) (\text{single distiller brine flow in gal/day/vessel}) (\text{number of} \\ \text{distillers/vessel}) (\text{number of transits/yr}) ((3 \text{ days before each transit} / 2 \text{ transits}) + \\ (4 \text{ hours/transit} \times 1 \text{ day} / 24 \text{ hours})) \end{aligned}$$

A sample calculation for the LSD 36 Class dock landing ship is as follows:

$$(5 \text{ ships}) (510,000 \text{ gal/day/ship}) (26 \text{ transits/yr}) ((3 \text{ days before each transit} / 2) + (4/24 \text{ day per transit})) = 111 \text{ million gals/yr}$$

Table 1 lists the results of the above calculation for all vessels of the Armed Forces. A total of approximately 2.47 billion gallons of distilling and RO plant brine discharges occur annually within 12 n.m. from shore. Of this, approximately 1.84 billion gallons is discharged in port and 620 million gallons is discharged in transit within 12 n.m. These calculations overestimate the actual discharge rate because steam-powered surface ships can operate a distilling plant for less than three days prior to leaving port.

The volume of influent seawater to a distilling plant can be estimated using the ratio of brine produced to gallons of freshwater produced, or 17:1. This ratio indicates that for every 18

VESSEL CLASSIFICATION INFORMATION						WATER PURIFICATION SYSTEM			TRANSIT INFORMATION		ANNUAL BRINE WASTE WATER DISCHARGE (million gals/year)			
CLASS ID NO.	ARMED SVCE	CLASS NAME	VESSEL TYPE	NO. OF VESSELS	PRO-PULSION SYSTEM	TYPE AND NO. OF PLANTS	TOTAL H2O FLOW (gpd)	TOTAL BRINE FLOW (gpd)	TRAN-SITS	DAYS IN PORT	IN-PORT	IN TRANSIT	>12 n.m.	TOTAL
AS 39	NAVY	Emory S Land	Submarine Tender	3	Steam	Distill/	2 100,000	1,700,000	12	293	45.9	5.1	357.0	408.0
CG 47	NAVY	Ticonderoga	Guided Missile Cruiser	27	Gas	Distill/	2 24,000	408,000	24	166	0	0	2126.1	2126.1
CGN 36	NAVY	California	Guided Missile Cruiser	2	Nuclear	Distill/	2 36,000	612,000	22	143	20.2	2.2	265.0	287.4
CGN 38	NAVY	Virginia	Guided Missile Cruiser	1	Nuclear	Distill/	2 36,000	612,000	22	143	10.1	1.1	132.5	143.7
CV 59 (CV 62)	NAVY	Forrestal	Aircraft Carrier	1	Steam	Distill/	5 380,000	6,460,000	14	137	27.1	3.0	1450.3	1480.4
CV 63	NAVY	Kitty Hawk	Aircraft Carrier	1	Steam	Distill/	5 380,000	6,460,000	14	137	27.1	3.0	1450.3	1480.4
CV 63 (CV 64)	NAVY	Kitty Hawk	Aircraft Carrier	1	Steam	Distill/	6 400,000	6,800,000	14	137	23.8	2.6	1526.6	1553.0
CVN 65	NAVY	Enterprise	Aircraft Carrier	1	Nuclear	Distill/	5 350,000	5,950,000	12	76	21.4	2.4	1701.7	1725.5
CV 67	NAVY	Kennedy	Aircraft Carrier	1	Steam	Distill/	5 450,000	7,650,000	14	137	32.1	3.6	1717.4	1753.1
CVN 68	NAVY	Nimitz	Aircraft Carrier	7	Nuclear	Distill/	4 400,000	6,800,000	14	147	249.9	27.8	10210.2	10487.9
DD 963	NAVY	Spruance	Destroyer (Typical)	27	Gas	Distill/	2 16,000	272,000	24	178	0	0	1329.3	1329.3
DD 963	NAVY	Spruance	Destroyer (DD 963 & DD 964)	2	Gas	RO/	2 24,000	96,000	24	178	0	0	34.8	34.8
DD 963	NAVY	Spruance	Destroyer (DD 992)	1	Gas	Distill/RO	3 25,000	308,000	24	178	0	0	55.7	55.7
DD 997	NAVY	Spruance	Destroyer	1	Gas	Distill/	2 24,000	408,000	24	178	0	0	73.8	73.8
DDG 51	NAVY	Arleigh Burke	Guided Missile Destroyer	18	Gas	RO/	2 24,000	96,000	22	101	0	0	446.7	446.7
DDG 993	NAVY	Kidd	Guided Missile Destroyer	4	Gas	Distill/	2 20,000	340,000	24	175	0	0	250.2	250.2
FFG 7	NAVY	Oliver Hazard Perry	Guided Missile Frigate	43	Gas	Distill/	2 8,000	136,000	26	167	0	0	1119.9	1119.9
LCC 19	NAVY	Blue Ridge	Amphibious Command Ship	2	Steam	Distill/	2 100,000	1,700,000	16	179	40.8	4.5	618.8	664.1
LHA 1	NAVY	Tarawa	Amphibious Assault Ship	5	Steam	Distill/	2 140,000	2,380,000	18	173	160.7	17.9	2231.3	2409.8
LHD 1	NAVY	Wasp	Amphibious Assault Ship	4	Steam	Distill/	2 200,000	3,400,000	26	185	265.2	29.5	2359.6	2654.3
LPD 4	NAVY	Austin	Amphibious Transport Dock	3	Steam	Distill/	2 60,000	1,020,000	22	178	50.5	5.6	555.4	611.5
LPD 7	NAVY	Austin	Amphibious Transport Dock	3	Steam	Distill/	2 60,000	1,020,000	24	188	55.1	6.1	523.3	584.5
LPD 14	NAVY	Austin	Amphibious Transport Dock	2	Steam	Distill/	2 60,000	1,020,000	22	192	33.7	3.7	341.7	379.1
LPH 2	NAVY	Iwo Jima	Amphibious Assault Helicopter Carrier	2	Steam	Distill/	2 100,000	1,700,000	22	186	56.1	6.2	589.9	652.2
LSD 36	NAVY	Anchorage	Dock Landing Ship	5	Steam	Distill/	2 60,000	1,020,000	26	215	99.5	11.1	731.9	835.4
LSD 41	NAVY	Whidbey Island	Dock Landing Ship	8	Diesel	Distill/	2 60,000	1,020,000	26	170	0	0	1538.2	1538.2
LSD 49	NAVY	Harpers Ferry	Dock Landing Ship	3	Diesel	Distill/	2 60,000	1,020,000	NA	NA	0	0	NA	NA
MCM 1 (1-10)	NAVY	Avenger	Mine Countermeasure Vessel	10	Diesel	Distill/	2 4,000	68,000	56	232	0	0	80.9	80.9
MCM 1 (11-14)	NAVY	Avenger	Mine Countermeasure Vessel	4	Diesel	Distill/RO	2 6,000	76,000	56	232	0	0	36.2	36.2

Distillation and Reverse Osmosis Brine

Table 1. Wet and Dry Fireremains of the Navy, MSC, USCG, and Army

Class	Description	Quantity of Vessels	Wet/Dry
Navy Ships			
SSBN	Ohio Class Ballistic Missile Submarines	17	Dry
SSN	Sturgeon Class Attack Submarines	13	Dry
SSN	Los Angeles Class Attack Submarines	56	Dry
SSN	Narwhal Class Submarine	1	Dry
SSN	Benjamin Franklin Class Submarines	2	Dry
CV	Forrestal Class Aircraft Carrier	1	Wet
CVN	Enterprise Class Aircraft Carrier	1	Wet
CV	Kitty Hawk Class Aircraft Carriers	3	Wet
CVN	Nimitz Class Aircraft Carriers	7	Wet
CGN	Virginia Class Guided Missile Cruiser	1	Wet
CG	Ticonderoga Class Guided Missile Cruisers	27	Wet
CGN	California Class Guided Missile Cruisers	2	Wet
DDG	Kidd Class Guided Missile Destroyers	4	Wet
DDG	Arleigh Burke Class Guided Missile Destroyers	18	Wet
DD	Spruance Class Destroyers	31	Wet
FFG	Oliver Hazard Perry Guided Missile Frigates	43	Wet
LCC	Blue Ridge Class Amphibious Command Ships	2	Wet
LHD	Wasp Class Amphibious Assault Ships	4	Wet
LHA	Tarawa Class Amphibious Assault Ships	5	Wet
LPH	Iwo Jima Class Assault Ships	2	Wet
LPD	Austin Class Amphibious Transport Docks	3	Wet
LPD	Amphibious Transport Docks	2	Wet
LPD	Amphibious Transport Docks	3	Wet
LSD	Whidbey Island Class Dock Landing Ships	8	Wet
LSD	Harpers Ferry Dock Landing Ships	3	Wet
LSD	Anchorage Class Dock Landing Ships	5	Wet
MCM	Avenger Class Mine Countermeasure Vessels	14	Wet
MHC	Osprey Class Minehunter Coastal Vessels	12	Wet
PC	Cyclone Class Coastal Defense Ships	13	Wet
Navy Auxiliary Ships			
AGF	Raleigh Class Miscellaneous Command Ship	1	Wet
AGF	Austin Class Miscellaneous Command Ship	1	Wet
AO	Jumboised Cimarron Class Oilers	5	Wet
AOE	Supply Class Fast Combat Support Ships	3	Wet
AOE	Sacramento Class Fast Combat Support Ships	4	Wet
ARS	Safeguard Class Salvage Ships	4	Wet
AS	Emory S Land Class Submarine Tenders	3	Wet
AS	Simon Lake Class Submarine Tender	1	Wet
AGOR	Gyre Class Oceanographic Research Ship	1	Dry
AGOR	Thompson Class Oceanographic Research Ships	2	Dry
Military Sealift Command			
T-AE	Kilauea Class Ammunition Ships	8	Wet
T-AFS	Mars Class Combat Stores Ships	8	Wet
T-ATF	Powhatan Class Fleet Ocean Tugs	7	Dry
T-AO	Henry J Kaiser Class Oilers	13	Dry

Table 2. Theoretical Upper Bound-Estimate of Annual Wet Firemain Discharge

Class	Description	Quantity of Vessels	Flow Rate per Vessel (GPM)	Days w/in 12 n.m.	Estimated Annual Volume for Class, Gal
Navy					
CV	Forrestal Class Aircraft Carrier	1	1,000	143	205,920,000
CVN	Enterprise Class Aircraft Carrier	1	1,000	76	109,440,000
CV	Kitty Hawk Class Aircraft Carriers	3	1,000	137	591,840,000
CVN	Nimitz Class Aircraft Carriers	7	1,000	147	1,481,760,000
CGN	Virginia Class Guided Missile Cruiser	1	250	166	59,760,000
CG	Ticonderoga Class Guided Missile Cruisers	27	250	161	1,564,920,000
CGN	California Class Guided Missile Cruisers	2	250	143	102,960,000
DDG	Kidd Class Guided Missile Destroyers	4	250	175	252,000,000
DDG	Arleigh Burke Class Guided Missile Destroyers	18	500	101	1,308,960,000
DD	Spruance Class Destroyers	31	250	178	1,986,480,000
FFG	Oliver Hazard Perry Guided Missile Frigates	43	250	167	2,585,160,000
LCC	Blue Ridge Class Amphibious Command Ships	2	400	179	206,208,000
LHD	Wasp Class Amphibious Assault Ships	4	800	185	852,480,000
LHA	Tarawa Class Amphibious Assault Ships	5	800	173	996,480,000
LPH	Iwo Jima Class Assault Ships	2	600	186	321,408,000
LPD	Austin Class Amphibious Transport Docks	3	300	178	230,688,000
LPD	Amphibious Transport Docks	2	300	178	153,792,000
LPD	Amphibious Transport Docks	3	300	178	230,688,000
LSD	Whidbey Island Class Dock Landing Ships	8	300	170	587,520,000
LSD	Harpers Ferry Dock Landing Ships	3	300	215	278,640,000
LSD	Anchorage Class Dock Landing Ships	5	300	215	464,400,000
MCM	Avenger Class Mine Countermeasure Vessels	14	150	232	701,568,000
MHC	Osprey Class Minehunter Coastal Vessels	12	100	232	400,896,000
PC	Cyclone Class Coastal Defense Ships	13	50	50	46,800,000
Navy Auxiliary					
AGF	Raleigh Class Miscellaneous Command Ship	1	400	183	105,408,000
AGF	Austin Class Miscellaneous Command Ship	1	400	183	105,408,000
AO	Jumboised Cimarron Class Oilers	5	200	188	270,720,000
AOE	Supply Class Fast Combat Support Ships	3	500	114	246,240,000
AOE	Sacramento Class Fast Combat Support Ships	4	600	183	632,448,000
ARS	Safeguard Class Salvage Ships	4	100	202	116,352,000
AS	Emory S Land Class Submarine Tenders	3	400	293	506,304,000
AS	Simon Lake Class Submarine Tender	1	400	229	131,904,000
Military Sealift Command					
T-AE	Kilauea Class Ammunition Ships	8	300	183	632,448,000
T-AFS	Mars Class Combat Stores Ships	8	300	45	155,520,000
				Total Estimated Annual Volume, (gal):	18,623,520,000

Table 1. Ships of the Navy, MSC, USCG, and Army; Annual Graywater Discharge

Class	Description	Vessels ¹⁰	Crew Size	Transits per Year ¹¹	Estimated Total Time in Transit (hr)	Graywater Discharge, in Transit (gal/yr)	Vessels Discharging Overboard at Pier	Days in Port, per year ¹¹	Graywater Discharged Pierside (gal/yr)	Total Graywater Generation, 0 to 12 n.m. (gal/year)	Total Discharge, 0 to 12 n.m. (gal/yr)
Navy Ships											
CG 47	Ticonderoga Class Cruiser	27	409	24	96	1,325,160				1,325,160	1,325,160
CGN 36	California Class Guided Missile Cruiser	2	603	22	88	132,660				132,660	132,660
CV 62	Forrestal Class Aircraft Carrier	1	5,624	6	24	168,720				168,720	168,720
CVN 65	Enterprise Class Aircraft Carrier	1	5,815	12	48	348,900				348,900	348,900
CV 63	Kitty Hawk Class Aircraft Carrier	3	5,624	14	56	1,181,040				1,181,040	1,181,040
CVN 68	Nimitz Class Aircraft Carrier	7	6,286	14	56	3,080,140				3,080,140	3,080,140
CGN 40	Virginia Class Guided Missile Cruiser	1	600	22	88	66,000				66,000	66,000
DDG 993	Kidd Class Guided Missile Destroyers	4	386	24	96	185,280				185,280	185,280
DDG 51	Arleigh Burke Class Guided Missile Destroyers	18	303	22	88	599,940				599,940	599,940
DD 963	Spruance Class Destroyers	31	396	24	96	1,473,120	4	175	1,663,200	3,136,320	3,136,320
FFG 7	Oliver Hazard Perry Guided Missile Frigates	43	220	26	104	1,229,800				1,229,800	1,229,800
LCC 19	Blue Ridge Class Amphibious Command Ships	2	1,516	16	64	242,560				242,560	242,560
LHD 1	Wasp Class Amphibious Transport Docks	4	3,151	26	104	1,638,520				1,638,520	1,638,520
LHA 1	Tarawa Class Amphibious Assault Ships	5	2,292	18	72	1,031,400	4	173	9,516,384	10,547,784	10,547,784
MCS 12	Iwo Jima Class Assault Ships	2	1,746	18	72	314,280				314,280	314,280
LPD 4	Austin Class Amphibious Transport Docks	3	1,487	22	88	490,710				490,710	490,710
LSD 41	Whidbey Island Class Dock Landing Ships	8	852	26	104	886,080				886,080	886,080
LSD 36	Anchorage Class Dock Landing Ships	5	794	26	104	516,100				516,100	516,100
MCM 1	Mine Countermeasures Ship Avenger Class	14	72	56	224	282,240				282,240	282,240
MHC 51	Mine Countermeasures Ship Osprey Class	12	50	50	200	150,000				150,000	150,000
PC 1	Cyclone Class Coastal Defense Ships	13	4	36	144	9,360				9,360	9,360
SSN 640	Benjamin Franklin Class Attack Submarines	2	120	16	64	0				19,200	0
SSN 671	Narwhal Class Attack Submarine	1	129	16	64	0				10,320	0
SSN 688	Los Angeles Class Attack Submarines	56	120	16	64	0				537,600	0
SSN 637	Sturgeon Class Attack Submarines	13	107	16	64	0				111,280	0
SSBN 726	Ohio-Class Ballistic Missile Submarines	17	136	16	64	0				184,960	0
Navy Auxiliary Ships											
AE 28	Kilauea Class Ammunition Ships	8	383	8	32	122,560		26	477,984	600,544	600,544
AO 177	Cimarron Class Oilers	12	135	20	80	162,000		188	1,827,360	1,989,360	1,989,360
AOE 6	Supply Class Fast Combat Support Ships	3	667	12	48	120,060				120,060	120,060
AOE 1	Sacramento Class Fast Combat Support Ship	4	601	22	88	264,440				264,440	264,440
ARS 50	Safeguard Class Savage Ships	4	90	44	176	79,200				79,200	79,200
AS 36	LY Spear and Emory S Land Class Submarine Tenders	3	604	10	40	90,600				90,600	90,600
AS 33	Simon Lake Class Submarine Tenders	1	915	12	48	54,900				54,900	54,900
Military Sealift Command											
T-AE	Kilauea Class Ammunition Ships	8	187	40	160	299,200		45	403,920	703,120	703,120
T-AFS	Mars Class Combat Stores Ships	5	135	40	160	135,000				135,000	135,000
T-AFS	Sirius Class Combat Stores Ships	3	165	40	160	99,000				99,000	99,000

Table 1. Navy, MSC, and USCG, Army, and Air Force Mass Loadings for Ships, and Small Boats and Craft

Ship Class	Ship Class Description	Quantity of Ships per Class	Days in Port per Year	Number of Transits per year (each is a transit in and out) ^T	Days of Operation within 12 n.m.	Ship's Wetted Surface Area (sq ft)	*Copper Loading per ship class (kg/yr)	**Zinc Loading per ship class (kg/yr)
LPD 4	Austin Class Amphibious Transport Docks	3	178	11	0	51,830	446	176
LPD 7	Amphibious Transport Docks	3	178	11	0	51,830	446	176
LPH 2	Iwo Jima Class Amphibious Assault Ships	2	186	11	0	49,945	299	118
LSD 36	Anchorage Class Dock Landing Ships	5	215	13	0	45,405	786	310
LSD 41	Whidbey Island Class Dock Landing Ships	8	170	13	0	51,020	1,124	443
LSD 49	Harpers Ferry Dock Landing Ships	3	215	13	0	41,595	432	170
LST 1179	Tank Landing Ships	3	178	11	0	34,650	298	118
MCM 1	Avenger Class Mine Countermeasures Vessels	14	232	28	0	8,410	449	177
MHC 51	Osprey Class Coastal Minehunters	12	232	28	0	6,418	294	116
PC	Cyclone Class Coastal Defense Ships	13	105	18	0	3,704	84	33
SLWT	Side Loadable Warping Tugs	24	305	0	0	not available	--	--
SSBN 726	Ohio Class Ballistic Missile Submarine	17	183	6	0	74,575	3,704	1,460
SSN 640	Sturgeon Class Attack Submarine	13	183	6	0	27,075	1,028	405
SSN 688	Los Angeles Class Attack Submarine	56	183	6	0	34,765	5,688	2,242
SSN 671	Narwhal Class Submarines	1	183	6	0	29,135	85	34
SSN 637	Benjamin Franklin Class Submarines	2	183	6	0	44,061	257	101
YC	Open Lighters (nsp)	254	305	0	60	6,475	9,480	3,736
YCF	Car Float (nsp)	1	305	0	60	not available	--	--
YCV	Aircraft Transportation Lighters (nsp)	9	305	0	60	not available	--	--
YD	Floating Cranes (nsp)	63	305	0	60	12,875	4,676	1,843
YDT	Diving Tenders	3	305	0	60	8,885	154	61
YFB	Ferryboat or Launch (nsp)	2	305	0	60	3,895	45	18
YFN	Covered Lighters (nsp)	157	305	0	60	6,680	6,046	2,383
YFNB	Large Covered Lighters (nsp)	11	305	0	60	15,955	1,012	399
YFND	Dry Dock Companion Craft (nsp)	2	305	0	60	not available	--	--
YFNX	Lighter - Special Purpose (nsp)	8	305	0	60	4,760	220	87
YFP	Floating Power Barges (nsp)	2	305	0	60	15,590	180	71
YFRT	Covered Lighters - Range Tender (self propelled)	2	305	0	60	5,490	63	25
YFU 83	Harbor Utility Craft (self propelled)	1	305	0	60	3,915	23	9
YFU 91	Harbor Utility Craft (self propelled)	1	305	0	60	3,915	23	9
YGN 80	Garbage Lighters (nsp)	3	305	0	60	not available	--	--
YLC	Salvage Lift Crane (nsp)	1	305	0	60	not available	--	--
YM	Dredges (self propelled)	2	305	0	60	not available	--	--
YMN	Dredge (nsp)	1	305	0	60	not available	--	--
YNG	Gate Craft (nsp)	2	305	0	60	4,760	55	22
YO 65	Fuel Oil Barges (self propelled)	3	305	0	60	10,205	176	70
YOG 5	Gasoline Barges (self propelled)	2	305	0	60	10,205	118	46
YOGN	Gasoline Barges (nsp)	12	305	0	60	8,512	589	232
YON	Fuel Oil Barges (nsp)	48	305	0	60	8,512	2,355	928
YOS	Oil Storage Barges (nsp)	14	305	0	60	8,512	687	271
YPD	Floating Pile Drivers (nsp)	4	305	0	60	not available	--	--
YR	Floating Workshops (nsp)	25	305	0	60	7,350	1,059	417
YRB	Repair and Berthing Barges (nsp)	4	305	0	60	4,320	100	39
YRBM	Repair, Berthing and Messing Barges (nsp)	39	305	0	60	10,180	2,289	902
YRDH	Floating Dry Dock Workshop (Hull) (nsp)	1	305	0	60	not available	--	--
YRR	Radiological Repair Barges (nsp)	9	305	0	60	6,405	332	131
YRST	Salvage Craft Tenders (nsp)	3	305	0	60	10,965	190	75
YSD 11	Seaplane Wrecking Derrick (self propelled)	1	305	0	60	3,845	22	9

^TZero entered for number of transits per year when no further information was available.

nsp = not self-propelled

N/A = Not enough information available to calculate a wetted surface area.

Table 4. Copper and Zinc Loading into San Diego, Pearl Harbor, and Mayport for Use in Concentration Estimate

Ship Class	Ship Class Description	Quantity of Ships per Class	*Copper Loading per year (kg/yr)	*Zinc Loading per year (kg/yr)
SAN DIEGO HARBOR				
CG 47	Ticonderoga Class Guided Missile Cruisers	8	813	320
CV 63	Kitty Hawk Class Aircraft Carrier	2	623	245
DD 963	Spruance Class Destroyers	6	616	243
DDG 51	Arleigh Burke Class Guided Missile Destroyers	5	263	104
LHA 1	Tarawa Class Amphibious Assault Ships	2	524	207
LHD 1	Wasp Class Amphibious Transport Docks	2	532	210
LPD 4	Austin Class Amphibious Transport Docks	5	743	293
LSD 41	Whidbey Island Class Dock Landing Ships	2	281	111
LSD 49	Harpers Ferry Dock Landing Ships	1	144	57
PC	Cyclone Class Coastal Defense Ships	4	26	10
FFG 7	Oliver Hazard Perry Guided Missile Frigates	11	590	233
SSN	Los Angeles Class Attack Submarines	9	914	360
SSN	Sturgeon Class Attack Submarine	1	79	31
LSD	Anchorage Class Dock Landing Ships	3	472	186
AGF	Raleigh Class Miscellaneous Flagship	1	123	48
AS	Emory S Land Class Submarine Tender	1	278	109
LPH	Iwo Jima Class Assault Ship	1	150	59
		Total Loading =	7,171	2,826
PEARL HARBOR				
AO 177	Jumboised Cimarron Class Oilers	2	382	150
ARS 50	Safeguard Class Savage Ships	2	91	36
CG 47	Ticonderoga Class Guided Missile Cruisers	3	305	120
DD 963	Spruance Class Destroyers	4	411	162
DDG 51	Arleigh Burke Class Guided Missile Destroyers	3	158	63
FFG	Oliver Hazard Perry Guided Missile Frigates	2	107	42
SSN	Los Angeles Class Attack Submarine	15	1,524	601
SSN	Sturgeon Class Attack Submarine	4	316	125
SSN	Benjamin Franklin Class Submarines	1	129	51
		Total Loading =	3,423	1,350
MAYPORT HARBOR				
CG 47	Ticonderoga Class Guided Missile Cruisers	5	508	200
CV 63	Kitty Hawk Class Aircraft Carrier	1	311	123
DD 963	Spruance Class Destroyers	5	514	202
DDG 51	Arleigh Burke Class Guided Missile Destroyers	2	105	41
FFG	Oliver Hazard Perry Guided Missile Frigates	10	537	212
		Total Loading =	1,975	778

Table 1. Navy Ships - Lower Rudder Bearing Type and Lubrication Method

Ship Class	Lower Rudder Bearing & Type of Lubrication	# in Class
AGF 3	Stave Brg., Grease	1
AGF 11	Stave Brg., Grease	1
AO 177	Roller Brg., Grease	13
AOE 1	Roller Brg., Oil/Grease	2/2
AOE 6	Stave Brg., Grease	3
ARS 50	Stave Brg., Grease	4
AS 36/39	Roller Brg., Oil	3
ATS 1	Stave Brg., Grease	3
CG 47	Roller Brg., Grease	27
CGN 36	Stave Brg., Water	2
CGN 40	Stave Brg., Water	1
CV 62	Stave Brg., Water	1
CV 63	Stave Brg., Water	2
CV 67	Stave Brg., Water	1
CVN 65	Stave Brg., Water	1
CVN 68	Stave Brg., Water	7
DD 963	Roller Brg., Grease	31
DDG 51	Roller Brg., Grease	18
DD 993	Roller Brg., Grease	4
FFG 7	Roller Brg., Grease	43
LCC 19	Stave Brg., Grease	2
LHA 1	Roller Brg., Grease	5
LHD 1	Roller Brg., Grease	4
LPD 4	Stave Brg., Grease	9
LPH 2	Stave Brg., Grease	2
LSD 36	Stave Brg., Grease	5
LSD 41	Stave Brg., Grease	11
MCM 1	Stave Brg., Grease	14
MCS 12	Stave Brg., Grease	1
		223

Table 1. Typical Ship Movement Data

Vessel Class	Quantity	Number of Transits/Vessel/Year	Hours per Transit	Days in Port/Vessel/Year	Days Operating within 12 n.m.
Surface Ships, Submarines					
Forrestal Class Aircraft Carriers CV 59	1	6	4	143	0
Kitty Hawk Class Aircraft Carriers CV 63	3	7	4	137	0
Enterprise Class Aircraft Carriers CVN 65	1	6	4	76	0
Nimitz Class Aircraft Carriers CVN 68	7	7	4	147	0
Ticonderoga Class Guided Missile Cruisers CG 47	27	12	4	166	0
California Class Guided Missile Cruisers CGN 36	2	11	4	143	0
Virginia Class Guided Missile Cruisers CGN 38	1	11	4	161	0
Spruance Class Destroyers DD 963	31	12	4	178	0
Arleigh Burke Destroyers DDG 51	18	11	4	101	0
Kidd Class Destroyers DDG 993	4	12	4	175	0
Oliver Hazard Perry Guided Missile Frigates FFG 7	43	13	4	167	0
Submarines, SSN, SSBN, All Classes	89	6	4	183	0
Blue Ridge Class Amphibious Command Ships LCC 19	2	8	4	179	0
Wasp Class Amphibious Assault Ships LHD 1	4	13	4	185	0
Tarawa Class Amphibious Assault Ships LHA 1	5	9	4	173	0
Iwo Jima Class Amphibious Assault Ships LPH 2	2	11	4	186	0
Austin Class Amphibious Transport Docks LPD 4	3	11	4	178	0
Amphibious Transport Docks LPD 7	3	12	4	188	0
Amphibious Transport Docks LPD 14	2	11	4	192	0
Anchorage Class Dock Landing Ships LSD 36	5	13	4	215	0
Whidbey Island Class Dock Landing Ships LSD 41	8	13	4	170	0
Harpers Ferry Class Dock Landing Ships LSD 49	3	13	4	215	0
Avenger Class Mine Countermeasures Vessels MCM 1	14	28	4	232	0
Osprey Class Coastal Minehunters MHC 51	12	28	4	232	0
Cyclone Class Coastal Defense Ships PC 1	13	18	4	105	0
Auxiliaries					
Emory S Land Class Submarine Tenders AS 39	3	6	4	293	0
Simon Lake Class Submarine Tender AS 33	1	6	4	229	0
Command Ships AGF	2	12	4	183	0
Jumboised Cimarron Class Oilers AO 177	5	10	4	188	0
Sacramento Class Fast Combat Support Ships AOE 1	4	11	4	183	0

Table 3a. Estimated Annual Flows, Seawater Cooling Water, Navy and MSC

		Estimated Flow Rates (gpm)			Estimated Times within 12 n.m. (hrs)			Estimated Annual Flows (gal)		
	Qty	Pierside	Start-up/ Securing	In Transit	Pierside	Start-up/ Securing	In Transit	Pierside	Start-up/ Securing	In Transit
Surface Ships, Submarines										
Forrestal Class Aircraft Carriers CV 59	1	4,100	170,000	170,000	3,432	288	48	844,272,000	2,937,600,000	489,600,000
Kitty Hawk Class Aircraft Carriers CV 63	3	4,100	170,000	170,000	3,288	336	56	2,426,544,000	10,281,600,000	1,713,600,000
Enterprise Class Aircraft Carriers CVN 65	1	4,100	170,000	170,000	1,824	576	48	448,704,000	5,875,200,000	489,600,000
Nimitz Class Aircraft Carriers CVN 68	7	4,100	170,000	170,000	3,528	672	56	6,075,216,000	47,980,800,000	3,998,400,000
Ticonderoga Class Guided Missile Cruisers CG 47	27	1,650	0	7,000	3,984	0	96	10,649,232,000	0	1,088,640,000
California Class Guided Missile Cruisers CGN 36	2	1,650	7,000	7,000	3,432	1,056	88	679,536,000	887,040,000	73,920,000
Virginia Class Guided Missile Cruisers CGN 38	1	1,650	7,000	7,000	3,864	1,056	88	382,536,000	443,520,000	36,960,000
Spruance Class Destroyers DD 963	31	1,500	0	6,840	4,272	0	96	11,918,880,000	0	1,221,350,400
Arleigh Burke Destroyers DDG 51	18	1,680	0	6,840	2,424	0	88	4,398,105,600	0	650,073,600
Kidd Class Destroyers DDG 993	4	1,500	0	6,840	4,200	0	96	1,512,000,000	0	157,593,600
Oliver Hazard Perry Guided Missile Frigates FFG 7	43	1,750	0	3,000	4,008	0	104	18,096,120,000	0	804,960,000
Submarines, SSN, SSBN, All Classes	89	2,000	11,000	11,000	4,392	576	48	46,906,560,000	33,834,240,000	2,819,520,000
Blue Ridge Class Amphibious Command Ships LCC 19	2	3,000 *	40,500	40,500 *	4,296	384	64	1,546,560,000	1,866,240,000	311,040,000
Wasp Class Amphibious Assault Ships LHD 1	4	3,000	40,500	40,500	4,440	624	104	3,196,800,000	6,065,280,000	1,010,880,000
Tarawa Class Amphibious Assault Ships LHA 1	5	3,000 *	40,500	40,500 *	4,152	432	72	3,736,800,000	5,248,800,000	874,800,000
Iwo Jima Class Amphibious Assault Ships LPH 2	2	3,000 *	40,500	40,500 *	4,464	528	88	1,607,040,000	2,566,080,000	427,680,000
Austin Class Amphibious Transport Docks LPD 4	3	3,000 *	40,500	40,500 *	4,272	528	88	2,306,880,000	3,849,120,000	641,520,000
Amphibious Transport Docks LPD 7	3	3,000 *	40,500	40,500 *	4,512	576	96	2,436,480,000	4,199,040,000	699,840,000
Amphibious Transport Docks LPD 14	2	3,000 *	40,500	40,500 *	4,608	528	88	1,658,880,000	2,566,080,000	427,680,000
Anchorage Class Dock Landing Ships LSD 36	5	3,000 *	40,500	40,500 *	5,160	624	104	4,644,000,000	7,581,600,000	1,263,600,000
Whidbey Island Class Dock Landing Ships LSD 41	8	3,000 *	0	40,500 *	4,080	0	104	5,875,200,000	0	2,021,760,000
Harpers Ferry Class Dock Landing Ships LSD 49	3	3,000 *	0	40,500 *	5,160	0	104	2,786,400,000	0	758,160,000
Avenger Class Mine Countermeasures Vessels MCM 1	14	1,650 *	0	7,000 *	5,568	0	224	7,717,248,000	0	1,317,120,000
Osprey Class Coastal Minehunters MHC 51	12	1,500 *	0	6,840 *	5,568	0	224	6,013,440,000	0	1,103,155,200
Cyclone Class Coastal Defense Ships PC 1	13	200 *	0	1,500 *	2,520	0	144	393,120,000	0	168,480,000
Auxiliaries										
Emory S Land Class Submarine Tenders AS 39	3	2,000 *	40,500	40,500 *	7,032	288	48	2,531,520,000	2,099,520,000	349,920,000
Simon Lake Class Submarine Tender AS 33	1	2,000 *	40,500	40,500 *	5,496	288	48	659,520,000	699,840,000	116,640,000
Command Ships AGF	2	2,000 *	40,500	40,500 *	4,392	576	96	1,054,080,000	2,799,360,000	466,560,000
Jumboised Cimarron Class Oilers AO 177	5	2,000 *	40,500	40,500 *	4,512	480	80	2,707,200,000	5,832,000,000	972,000,000
Sacramento Class Fast Combat Support Ships AOE 1	4	1,650 *	7,500	7,500 *	4,392	528	88	1,739,232,000	950,400,000	158,400,000
Supply Class Fast Combat Support Ships AOE 6	3	1,650 *	0	7,500 *	2,736	0	48	812,592,000	0	64,800,000
Safeguard Class Salvage Ships ARS 50	4	1,500 *	0	6,840 *	4,992	0	176	1,797,120,000	0	288,921,600
Gyre Class Oceanographic Research Ships AGOR 21	1	1,500 *	0	6,840 *	2,712	0	88	244,080,000	0	36,115,200
T.G.Thompson Oceanographic Research Ships AGOR 23	2	1,500 *	0	6,840 *	2,712	0	88	488,160,000	0	72,230,400

Seawater Cooling Overboard Discharge

Table 1. Vessel Classes Generating Steam Condensate Discharge

VESSEL CLASS	VESSEL DESCRIPTION	QUANTITY OF VESSELS PER CLASS	NUMBER OF DAYS IN PORT PER YEAR
CVN 68	Nimitz Class Aircraft Carriers	7	147
CV 63	Kitty Hawk Class Aircraft Carriers	3	137
CVN 65	Enterprise Class Aircraft Carriers	1	76
CV 59	Forrestal Class Aircraft Carriers	1	143
CG 47	Ticonderoga Class Guided Missile Cruisers	27	166
CGN 38	Virginia Class Guided Missile Cruiser	1	161
CGN 36	California Class Guided Missile Cruisers	2	143
DDG 993	Kidd Class Guided Missile Destroyers	4	175
DD 963	Spruance Class Destroyers	31	178
AGF 11	Austin Class Miscellaneous Command Ship	1	183
AGF 3	Raleigh Class Miscellaneous Command Ship	1	183
LCC 19	Blue Ridge Class Amphibious Command Ship	2	179
LHD 1	Wasp Class Amphibious Assault Ship	4	185
LHA 1	Tarawa Class Amphibious Assault Ship	5	173
LPH 2	Iwo Jima Class Amphibious Assault Ship	2	186
LPD 4	Austin Class Amphibious Transport Docks	3	178
LSD 49	Harpers Ferry Class Dock Landing Ships	3	170
LSD 41	Whidbey Island Class Dock Landing Ships	8	170
LSD 36	Anchorage Class Dock Landing Ships	5	215
MCM 1	Avenger Class Mine Countermeasures Vessels	14	232
T-AE 26	Kilauea Class Ammunition Ships	8	26
T-AFS 1	Mars Class Combat Stores Ships	8	148
AO 177	Jumboised Cimarron Class Oilers	5	188
T-AO 187	Henry J. Kaiser Class Oilers	12	78
AOE 1	Sacramento Class Fast Combat Support Ships	4	183
AOE 6	Supply Class Fast Combat Support Ships	3	114
T-AG 194	Mission Class Navigation Research Ships	2	151
T-AGM 22	Compass Island Class Missile Range Instrumentation Ships	1	133
T-ARC 7	Zeus Class Cable Repairing Ships	1	8
ARS 50	Safeguard Class Salvage Ships	4	208
T-AH 19	Mercy Class Hospital Ships	2	184
AS 33	Simon Lake Class Submarine Tenders	1	229
AS 39	Emory S Land Class Submarine Tenders	3	293

Notes:

Number of days inport per year for each ship class taken from the Ship Movement Database.

Vessel classes receiving shore steam are identified in Military Handbook 1025/2, Dockside Utilities for Ship Service.

Table 2. Steam Condensate Discharge By Vessel Class At Outdoor Temperatures of 50 Degrees F

VESSEL CLASS	ACTIVE	(a) Total Heating Load in lbs/hr per vessel	(b) Condensate Drain in gallons/yr per vessel	(c) Condensate Drain in gallons/yr per vessel class
CVN 68	7	15,000	6,582,090	46,074,627
CV 63	3	13,000	5,316,418	15,949,254
CVN 65	1	15,000	3,402,985	3,402,985
CV 59	1	13,000	5,549,254	5,549,254
CG 47	27	1,100	545,075	14,717,015
CGN 38	1	3,400	1,634,030	1,634,030
CGN 36	2	3,400	1,451,343	2,902,687
DDG 993	4	1,800	940,299	3,761,194
DD 963	31	1,800	956,418	29,648,955
AGF 11	1	2,650	1,447,612	1,447,612
AGF 3	1	2,650	1,447,612	1,447,612
LCC 19	2	7,700	4,114,328	8,228,657
LHD 1	4	6,300	3,479,104	13,916,418
LHA 1	5	6,300	3,253,433	16,267,164
LPH 2	2	5,800	3,220,299	6,440,597
LPD 4	3	4,400	2,337,910	7,013,731
LSD 49	3	3,600	1,826,866	5,480,597
LSD 41	8	3,600	1,826,866	14,614,925
LSD 36	5	3,600	2,310,448	11,552,239
MCM 1	14	1,000	692,537	9,695,522
T-AE 26	8	2,300	178,507	1,428,060
T-AFS 1	8	3,350	1,480,000	11,840,000
AO 177	5	3,350	1,880,000	9,400,000
T-AO 187	12	3,350	780,000	9,360,000
AOE 1	4	5,600	3,059,104	12,236,418
AOE 6	3	5,600	1,905,672	5,717,015
T-AG 194	2	1,500	676,119	1,352,239
T-AGM 22	1	2,700	1,071,940	1,071,940
T-ARC 7	1	2,700	64,478	64,478
ARS 50	4	500	310,448	1,241,791
T-AH 19	2	500	274,627	549,254
AS 33	1	6,500	4,443,284	4,443,284
AS 39	3	6,500	5,685,075	17,055,224
			Total =	295,504,776

Notes:

Source: Military Handbook 1025/2, Dockside Utilities for Ship Service.

Total heating load values include constant loads and intermittent loads.

Intermittent loads were taken at 50 °F outside air temperature.

Calculations based on water at 212 °F.

Table 1. Vessels Equipped With Oil/Water Separator Systems (cont'd)

SHIP CLASSIFICATION INFORMATION						TRANSIT INFORMATION	
CLASS ID NO.	ARMED SERVICE	CLASS NAME	SHIP TYPE	NO. OF SHIPS	PROPULSION SYSTEM	TRAN-SITS	DAYS IN PORT
LPD 4	NAVY	Austin	Amphibious Transport Dock	3	Steam	11	178
LPD 7	NAVY	Austin	Amphibious Transport Dock	3	Steam	12	188
LPD 14	NAVY	Austin	Amphibious Transport Dock	2	Steam	11	192
LPH 2	NAVY	Iwo Jima	Amphibious Assault Helicopter Carrier	2	Steam	11	186
LSD 36	NAVY	Anchorage	Dock Landing Ship	5	Steam	13	215
LSD 41	NAVY	Whidbey Island	Dock Landing Ship	8	Diesel	13	170
LSD 49	NAVY	Harpers Ferry	Dock Landing Ship	3	Diesel	NA	NA
LST 1179	NAVY	Newport	Tank Landing Ship	3	Diesel	13	191
LSV	ARMY	Frank S Besson	Vehicle Landing Ship	6	Diesel	NA	NA
LT	ARMY	100 / 130	Large Tug	25	Diesel	NA	NA
MCM 1	NAVY	Avenger	Mine Countermeasure Vessel	14	Diesel	28	232
MHC 51	NAVY	Osprey	Minehunters Coastal	12	Diesel	NA	NA
WAGB 290	USCG	Mackinaw	Icebreaker	1	Diesel	NA	NA
WAGB 399	USCG	Polar	Icebreaker	2	Diesel	4	139
WHEC 378	USCG	Hamilton/Hero Class	High Endurance Cutter	12	Diesel	13	151
WIX 295	USCG	Eagle	Sail Training Cutter	1	Diesel	7	188
WLB 180A	USCG	Balsam	Seagoing Tender	8	Diesel	18	190
WLB 180B	USCG	Balsam	Seagoing Tender	2	Diesel	5	120
WLB 180C	USCG	Balsam	Seagoing Tender	13	Diesel	16	123
WLB 225	USCG	Juniper	Seagoing Tender	2	Diesel	NA	NA
WLI 65303	USCG	Blackberry	Buoy Tender, Inland	2	Diesel	NA	NA
WLI 65400	USCG	Bayberry	Buoy Tender, Inland	2	Diesel	NA	NA
WLI 100A	USCG	Blue Bell	Buoy Tender, Inland	1	Diesel	NA	NA
WLI 100C	USCG	Blue Bell	Buoy Tender, Inland	1	Diesel	NA	NA
WLIC 75A	USCG	Anvil/Clamp	Construction Tenders, Inland	2	Diesel	NA	NA
WLIC 75B	USCG	Anvil/Clamp	Construction Tenders, Inland	3	Diesel	NA	NA
WLIC 75D	USCG	Anvil/Clamp	Construction Tenders, Inland	2	Diesel	NA	NA
WLIC 100	USCG	Cosmos	Construction Tenders, Inland	3	Diesel	NA	NA
WLIC 115	USCG	?	Construction Tenders, Inland	1	Diesel	NA	NA
WLIC 160	USCG	Pamlico	Construction Tenders, Inland	4	Diesel	NA	NA
WLM 157	USCG	Red	Buoy Tender, Coastal	9	Diesel	NA	NA
WLM 551	USCG	Keeper	Buoy Tender, Coastal	2	Diesel	NA	NA
WLR 65	USCG	Ouachita	Buoy Tender, River	6	Diesel	NA	NA
WLR 75	USCG	F/Gasconade	Buoy Tender, River	13	Diesel	NA	NA
WLR 115	USCG	Sumac	Buoy Tender, River	1	Diesel	NA	NA
WMEC 210A	USCG	Reliance	Medium Endurance Class	5	Diesel	13	235
WMEC 210B	USCG	Reliance	Medium Endurance Class	11	Diesel	9	149

organisms, plants, and soil, and then moved to a designated clean area to await reloading on the ship. The effluent from the vehicles and equipment washed in the welldeck drains overboard or is pumped overboard by an eductor.²

The landing craft are also washed and inspected. LCACs, however, are not usually given a special wash because enough sea spray is created in their operation that all the exterior surfaces are flushed free of foreign organisms, plants, and soil before the LCAC boards the ship at sea and is inspected. LCUs are washed with fresh water in the welldeck or pierside and then inspected.²

2.2 Releases to the Environment

Effluent is discharged to the environment by washout or surge when landing craft are operating in the welldeck. Effluent from the various washes performed in the welldeck are discharged as it drains overboard from the welldeck or is pumped overboard by an eductor.

Welldeck washout and the effluent from the washes can contain fresh water, distilled water, firemain water, graywater, air-conditioning condensate, sea-salt residues, paint chips, wood splinters, dirt, sand, organic debris, oil, grease, fuel, detergents, combustion by-products, and lumber treatment chemicals.

2.3 Vessels Producing the Discharge

Only the Navy has ships with welldecks. Ship classes with welldecks include general purpose amphibious assault ships (LHAs), multipurpose amphibious assault ships (LHDs), amphibious transport docks (LPDs), and dock landing ships (LSDs). While there are differences among welldeck designs, the primary process variance is due to the type and number of landing craft onboard. Applicable data is listed below.¹

<u>Ship Class</u>	<u>No. of Ships</u>	<u>Welldeck Dimensions</u>	<u>Landing Craft Loading Schemes</u>
LHA 1	5	268'x 78'	4 LCU, 1 LCAC, or 45 AAV
LHD 1	4	267'x 50'	3 LCAC or 2 LCU
LPD 4	8	168'x 50'	1 LCU or 28 AAV
LSD 36	5	430'x 50'	4 LCAC, 3 LCU, or 52 AAV
LSD 41	8	440'x 50'	4 LCAC, 3 LCU, or 64 AAV
LSD 49	3	265'x 50'	2 LCAC or 1 LCU

3.0 DISCHARGE CHARACTERISTICS

This section contains qualitative and quantitative information that characterizes the discharge. Section 3.1 describes where the discharge occurs with respect to harbors and near-shore areas, Section 3.2 describes the rate of the discharge, Section 3.3 lists the constituents in the discharge, and Section 3.4 gives the concentrations of the constituents in the discharge.

3.1 Locality

Welldeck discharges can occur both within and beyond 12 n.m.

3.2 Rate

3.2.1 Welldeck Washouts

The flow from a welldeck washout can be estimated based on the welldeck dimensions listed in Section 2.3. The washout volume was estimated by multiplying the dimensions of the welldeck (length and width in feet) by the approximate height of water needed by an LCU (5' ² The numbers shown in parenthesis are estimated values for the amount of water entering the welldeck during LCAC operations (using an assumed depth of 4 inches of water spread uniformly across the welldeck). The water in the welldeck during LCAC operations is the result of the surge created when the LCACs enter the ship and is not the result of ballasting.

<u>Ship Class</u>	<u>Estimated Gallons Per Washout (or Surge)</u>
LHA 1	1,100,000 (52,000)
LHD 1	700,000 (33,000)
LPD 4	440,000 (0, no LCACs)
LSD 36	1,130,000 (54,000)
LSD 41	1,150,000 (55,000)
LSD 49	700,000 (33,000)

On average, an amphibious ship will have one six-month deployment every two years. During such a deployment, ballasting/deballasting will take place approximately 40 times (unless LCACs are deployed in which case the seawater surge will enter the welldeck 40 times).² It is variable how many times the ballasting/surge will take place within U.S. waters or how many local exercises will take place during that two year period. This is because the amount of time that a ship spends in U.S. waters varies from ship to ship.

3.2.2 LCAC Gas Turbine Engine Washes

Approximately 12 gallons of distilled water is used for a propulsion gas turbine daily wash. The flow from a detergent wash would be 12.5 gallons of distilled water/detergent mix followed by 12 gallons of distilled water rinse for a total of 24.5 gallons. For each APU, the flow from a detergent wash would be 0.375 gallon of distilled-water-detergent mix followed by a 0.25 gallon distilled water rinse for a total of 0.625 gallon. Thus, each LCAC is capable of producing 48 gallons of effluent from the daily washes of the four propulsion gas turbines and 99.25 gallons of effluent if all of the engines (four propulsion and two APUs) are washed with a water-detergent mix.^{2,6}

Appendix B

Navy Vessel Discharges to be Regulated

Ship Class	Aqueous Film Forming Foam	Catapult Water-Brake Tank & Post-Launch	Chain Locker Effluent	Clean Ballast	Compensated Fuel Ballast	CPP Hydraulic Fluid	Deck Runoff	Dirty Ballast	Distillation & Reverse Osmosis Brine	Elevator Pit Effluent	Firemain Systems	Gas Turbine Water Wash	Graywater	Hull Coating Leachate	MOGAS Compensated Overboard Discharges	Non-Oily Machinery Wastewater	Photo Lab Drains	Seawater Cooling Overboard Discharge	Seawater Piping Biofouling Prevention	Small Boat Engine Wet Exhaust	Sonar Dome Discharge	Submarine Bilgewater	Surface Vessel Bilgewater/OWS Discharge	Underwater Ship Husbandry	Welldeck Discharges
HH							X						X							X			X		
HL							X							X						X			X		
HS							X							X						X			X		
IX							X						X	X						X			X		
IX 35							X						X	X						X			X		
IX 501							X						X	X						X			X		
IX 308				X			X						X	X						X			X		
LA							X							X						X			X		
LCAC 1							X				X	X	X	X									X		
LCC 19	X			X			X		X	X			X	X		X	X	X					X	X	
LCM(3)				X			X						X	X				X					X	X	
LCM(6)				X			X						X	X				X					X	X	
LCM(8)				X			X						X	X				X					X	X	
LCPL				X			X						X	X				X					X		
LCU 1610				X			X						X	X				X					X	X	
LCVP				X			X							X				X		X			X		
LH							X							X						X			X		
LHA 1	X		X	X			X		X	X	X		X	X	X	X	X	X					X	X	X
LHD 1	X		X	X			X		X	X	X		X	X		X	X	X					X	X	X
LPD 4	X		X	X			X		X	X	X		X	X	X	X	X	X					X	X	X
LPD 7	X		X	X			X		X	X	X		X	X	X	X	X	X					X	X	X
LPD 14	X		X	X			X		X	X	X		X	X	X	X	X	X					X	X	X
LPH 2	X		X	X			X		X	X	X		X	X		X		X					X	X	
LSD 36	X		X	X		X	X		X	X	X		X	X		X		X					X	X	X
LSD 41	X		X	X		X	X		X	X	X	X	X	X		X		X					X	X	X

Appendix B
Navy Vessel Discharges Not to be Regulated

Ship Class	Boiler Blowdown	Catapult Wet Accumulator Discharge	Cathodic Protection	Freshwater Lay-up	Mine Countermeasures Equipment Lubrication	Portable Damage Control Drain Pump Discharges	Portable Damage Control Drain Pump Wet Exhaust	Refrigeration/AC Condensate	Rudder Bearing Lubrication	Steam Condensate	Stern Tube Seals & Underwater Bearing Lubrication	Submarine Acoustic Countermeasures Launcher Discharge	Submarine Emergency Diesel Engine Wet Exhaust	Sub Outboard Equip. Grease & External Hydraulics
HH														
HL														
HS														
IX														
IX 35														
IX 501								X						
IX 308								X						
LA														
LCAC 1														
LCC 19	X		X			X	X		X	X	X			
LCM(3)			X								X			
LCM(6)			X								X			
LCM(8)			X								X			
LCPL											X			
LCU 1610			X			X	X				X			
LCVP											X			
LH														
LHA 1	X		X			X	X	X	X	X	X			
LHD 1	X		X			X	X	X	X	X	X			
LPD 4	X		X			X	X	X	X	X	X			
LPD 7	X		X			X	X	X	X	X	X			
LPD 14	X		X			X	X	X	X	X	X			
LPH 2	X		X			X	X	X	X	X	X			
LSD 36	X		X			X	X	X	X	X	X			
LSD 41	X		X			X	X	X	X	X	X			