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U.S. Disposal of Chemical Weapons in the Ocean: Background and Issues for Congress

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David M. Bearden
Analyst in Environmental Policy
Resources, Science, and Industry Division

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Summary

The U.S. Armed Forces disposed of chemical weapons in the ocean from World War I through 1970. At that time, it was thought that the vastness of ocean waters would absorb chemical agents that may leak from these weapons. However, public concerns about human health and environmental risks, and the economic effects of potential damage to marine resources, led to a statutory prohibition on the disposal of chemical weapons in the ocean in 1972. For many years, there was little attention to weapons that had been dumped offshore prior to this prohibition. However, the U.S. Army completed a report in 2001 indicating that the past disposal of chemical weapons in the ocean had been more common and widespread geographically than previously acknowledged. The Army cataloged 74 instances of disposal through 1970, including 32 instances off U.S. shores and 42 instances off foreign shores. The disclosure of these records has renewed public concern about lingering risks from chemical weapons still in the ocean today.

The risk of exposure to chemical weapons dumped in the ocean depends on many factors, such as the extent to which chemical agents may have leaked into seawater and been diluted or degraded over time. Public health advocates have questioned whether contaminated seawater may contribute to certain symptoms among coastal populations, and environmental advocates have questioned whether leaked chemical agents may have affected fish stocks and other marine life. There also has been public concern that chemical weapons could wash ashore or be accidentally retrieved during activities that disturb the seabed, such as dredging and trawl fishing. Although such incidents have occurred domestically and abroad, they are rare relative to the thousands of weapons dumped in the ocean. Assessing the degree of risks is difficult because of a lack of information.

Whether the risks are low or high, how to respond to them is fraught with many challenges. The primary obstacle is locating the weapons in the ocean. The lack of coordinates for most of the disposal sites, and the possibility that ocean currents may have moved weapons beyond these areas, makes finding the weapons difficult at best, if not impracticable in some cases. Enacted in the second session of the 109th Congress, the John Warner National Defense Authorization Act for FY2007 (P.L. 109-364, H.R. 5122) requires further review of historical records to attempt to identify where chemical and conventional weapons were dumped off U.S. shores, research of the effects of these weapons on the ocean environment, and monitoring to determine whether contamination or health or safety risks are present. The funding and implementation of these requirements are potential issues for the 110th Congress.

In the event that the weapons are located, retrieving them from the seabed could be technically challenging and could introduce new risks during retrieval and transport for onshore disposal. Leaving located weapons in place, and warning the public to avoid these areas, may be more feasible and involve fewer immediate risks. However, long-term risks would remain. Responding to potential risks is further complicated by insufficient information to reliably estimate response costs and by the uncertain availability of federal funding to pay for such actions.

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Introduction

Greater awareness of the past disposal of chemical weapons in the ocean has motivated growing concern among the public about potential risks to human health, safety, and the marine environment. The Department of Defense (DOD) reports that the United States ceased the disposal of chemical weapons in the ocean in 1970. Congress later enacted legislation in 1972 that banned the disposal of wastes in the ocean in general, including chemical weapons. Although DOD has indicated that chemical weapons are no longer dumped in the ocean, much is unknown about the potential risks from the past disposal of such weapons still in the ocean today.

A report completed by the U.S. Army in 2001[1] provided more information than previously released on specific areas of the ocean where the U.S. Armed Forces had disposed of chemical weapons.[2] In its report, the Army acknowledged that some of these weapons were damaged or leaking at the time of disposal. In light of this more recent information, public health and environmental advocates, marine conservationists, and the general public have raised questions about the potential risks of chemical weapons in the ocean and have suggested that scientific study is needed to assess these risks.

This report provides a brief history of the disposal of chemical weapons in the ocean by the U.S. Armed Forces, discusses potential risks to human health and the marine environment, reviews findings of relevant scientific studies of risks from the disposal of chemical weapons off the coasts of Europe and Russia, analyzes factors that determine the feasibility of responding to potential risks, identifies possible response authorities in existing federal law, and examines historical review, scientific research, and monitoring requirements in Section 314 of the John Warner National Defense Authorization Act for FY2007 (P.L. 109-364, H.R. 5122).

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[1] Department of Defense. U.S. Army Research, Development, and Engineering Command, Aberdeen Proving Ground, Maryland. Corporate Information Office. Historical Research and Response Team. *Off-shore Disposal of Chemical Agents and Weapons Conducted by the United States*. March 29, 2001. 15 pp.

[2] According to the Army's 2001 report, chemical weapons disposed of in the ocean by the U.S. Armed Forces included surplus and damaged bombs, rockets, projectiles, and other munitions containing chemical warfare agents, and barrels, cylinders, and other containers filled with surplus chemical warfare agents produced for use in munitions. In this report, the term *chemical weapons* includes of all these items and, as such, refers to both chemical munitions and containers of chemical warfare agents.

History of U.S. Disposal of Chemical Weapons in the Ocean

In the late 1960s, DOD first publicly acknowledged that the U.S. Armed Forces had routinely disposed of chemical weapons in the ocean since World War I. In its 2001 report, the Army provided more extensive historical records on the number of instances and areas of the ocean where the U.S. Armed Forces disposed of chemical weapons. The Army catalogued 74 instances of disposal in the ocean, of which 32 were off U.S. shores and 42 were off foreign shores. The first recorded instance was in 1918 at an unknown location in the Atlantic Ocean between the United States and England. The Army's records did not note other instances of ocean disposal until 1941. Therefore, the extent to which ocean disposal may have occurred in between these years is unknown. According to the Army, the last instance of disposal occurred in 1970, approximately 250 miles off the coast of Florida.

Estimating the cumulative quantity of chemical weapons dumped in the ocean, and identifying all types of such weapons, is not possible because of incomplete historical records. The Army's 2001 report indicated that the number of chemical weapons in each instance of disposal ranged widely, from a few weapons to thousands. The Army also indicated that in some instances, conventional explosives and radiological waste were dumped in the ocean along with chemical weapons. The volume of chemical weapons agents also varied widely, from 30 pounds or less to thousands of tons. The types of chemical weapons varied as well, commonly including sulfur mustard[3] and nerve agents.[4] At some sites, the Army does not know the exact substances that were disposed of in the ocean. The reasons for ocean disposal also varied. Some weapons were deemed surplus. Others were damaged and leaking chemical agents, presenting an immediate risk to the military personnel who managed them. Certain weapons were not produced by the United States, but were captured from foreign nations and were disposed of to prevent their use.

The dumping of chemical weapons in the ocean was widespread geographically, including areas off the coast of the continental United States in the Atlantic and Pacific Oceans and the Gulf of Mexico, off the coast of Hawaii, and two instances of disposal in the Mississippi River in Louisiana. Although the Army identified individual instances of disposal by site, the exact coordinates for many of these sites are unknown. Rather, a broad geographic reference to a state or city on the coast and the approximate distance from shore is specified to denote the location. In some instances, only the Atlantic or Pacific Ocean at large is identified. The Army also acknowledged disposal by the U.S. Armed Forces off the coasts of foreign nations in the Atlantic and Pacific Oceans, North Sea, Mediterranean Sea, and Indian Ocean. (See the following table for a list of instances of disposal in the ocean off U.S. shores. A complete list, including disposal off foreign shores, is provided in the Army's 2001 report.)

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[3] Sulphur mustard is a viscous liquid that becomes solid at 58 degrees Fahrenheit. Chemical weapons contain sulphur mustard in either form depending on temperature. Upon impact, chemical weapons release sulphur mustard in a gaseous vapor, referred to as "mustard gas."

[4] Common nerve agents include tabun, sarin, soman, and VX. They are liquid in form, but when exposed to the air, they evaporate quickly into a gas. Chemical weapons contain nerve agents in liquid form, to be released as a gas upon delivery to an intended target.

U.S. Army Records of Past Disposal of Chemical Weapons in the Ocean off the Coasts of the United States through 1970

Date or Time Period	Approximate Location of Disposal and Point of Origin Onshore	Chemical Weapon or Agent
World War II	Atlantic Ocean, off Charleston, South Carolina	105 millimeter (mm) mustard projectiles and M70 115-pound mustard bombs
World War II	Atlantic Ocean, off Norfolk, Virginia	Unknown
August 1944	Pacific Ocean, neither shoreline point of reference nor originating point are specified	36 M47A2 100-pound mustard bombs and approximately 15,000 unspecified bombs
1944	Pacific Ocean, off Pearl Harbor, Oahu, Hawaii	4,220 tons of unspecified toxics and hydrogen cyanide
1944	Pacific Ocean, about five miles off Oahu, Hawaii	approximately 16,000 M47A2 100-pound mustard bombs
1944 (year uncertain)	Mississippi River, originating from New Orleans, Louisiana	More than 20 (number uncertain) leaking M70 115-pound mustard bombs
September 14-December 21, 1945	Atlantic Ocean, “Disposal Area Number 1,” originating from Edgewood Arsenal, Maryland	1,154 55 gallon drums of arsenic trichloride 375 tons of diphenylaminechloroarsine (adamsite) smoke candles 75,852 4.2-inch distilled mustard shells 924 M74 10-pound white phosphorus cluster bombs approximately 56,000 smoke canisters approximately 23,000 smoke projectiles
October 17-November 2, 1945	Pacific Ocean, off Hawaii, originating from Waianae, Hawaii	20 M79 1000-pound hydrogen cyanide bombs 1,100 M79 1000-pound cyanogen chloride bombs 125 M78 500-pound cyanogen chloride bombs 14,956 M70 114-pound mustard bombs 30,917 4.2-inch mortar mustard shells

Date or Time Period	Approximate Location of Disposal and Point of Origin Onshore	Chemical Weapon or Agent
		1,038 one-ton containers of mustard agent 190 one-ton containers of lewisite
1945	Mississippi River, 3-4 miles south of Braithwaite, Louisiana, as a result of accidental sinking in quicksand in a ship canal	2 unspecified bombs
March 7, 1946	Gulf of Mexico, originating from New Orleans, Louisiana	Unspecified quantity of mustard projectiles
March 10, 1946	Gulf of Mexico, originating from Edgewood Arsenal, Maryland, and loaded for sea disposal at New Orleans, Louisiana	2 leaking mustard bombs
March 21-25, 1946	Atlantic Ocean, “Baker” Site off Charleston, South Carolina, originating from Naval Mine Depot, Virginia	4 “carloads” of mustard projectiles
May 1946	Gulf of Mexico, originating point not specified	3 phosgene bombs (German origin)
July 13, 1946	Gulf of Mexico, 20 miles offshore, originating from Mobile, Alabama	30 500 kg mustard bombs 3 250 kg mustard bombs (German origin)
August 1-October 17, 1946	Atlantic Ocean, “Baker” Site off Charleston, South Carolina	lewisite, mustard, phosgene bombs German mustard and tabun bombs mustard one-ton containers mustard projectiles (quantities unspecified)
June 30- July 15, 1947	Pacific Ocean, 12 miles off Aleutian Islands, originating from Attu and Adak, Alaska	61 containers of mustard agent 887 containers bulk lewisite
December 15-20, 1948	Atlantic Ocean, 300 miles off Florida, originating from Gulf Chemical Warfare Depot, Alabama, via Charleston, South Carolina	3,711 containers of lewisite 60 M14 bulk lewisite
February 20, 1954	Gulf of Mexico, originating from Mobile, Alabama	one “barge” of riot-control agent projectiles (quantity not specified)

Date or Time Period	Approximate Location of Disposal and Point of Origin Onshore	Chemical Weapon or Agent
January-February 1955	Gulf of Mexico, originating from Mobile, Alabama	"1 or 2 barges" of unspecified toxic munitions (quantity not specified)
November 13-14, 1957	Atlantic Ocean, originating from Edgewood Arsenal, Maryland, and loaded for sea disposal at Colts Neck Naval Pier, Earle, New Jersey	48 one-ton containers of lewisite
March 20-27, 1958	Atlantic Ocean, off South Carolina, originating from Pine Bluff Arsenal, Arkansas, and loaded for sea disposal at Sunny Point, North Carolina	1,507 one-ton containers of lewisite 63 one-ton containers of nitrogen mustard
April 19, 1958	Pacific Ocean, 117 miles off San Francisco, California, originating from Navajo Army Depot, Arizona, and Tooele Army Depot, Utah, and loaded for sea disposal at Concord Naval Weapons Station, California	301,000 M70 115-pound mustard bombs 1,479 one-ton containers of lewisite
May 25, 1958	Pacific Ocean, 117 miles off San Francisco, California, originating from Tooele Army Depot, Utah, and loaded for sea disposal at Concord Naval Weapons Station, California	6 M47 100-pound mustard bombs 335 one-ton containers of lewisite 11 one-ton containers of nitrogen mustard 2 mustard projectiles
June 14-15, 1960	Atlantic Ocean, originating from Edgewood Arsenal, Maryland	2 one-ton containers of lewisite 1 lewisite cylinder non-chemical weapons materials (unspecified quantity of radiological waste)
June 18, 1962	Atlantic Ocean, originating from Edgewood Arsenal, Maryland	378 105 mm mustard projectiles 341 155 mm mustard projectiles 1 one-ton container of lewisite 20 drums of cyanide 5,252 white phosphorous munitions non-chemical weapons materials (421,757 pounds of radiological waste)

Date or Time Period	Approximate Location of Disposal and Point of Origin Onshore	Chemical Weapon or Agent
August 6-7, 1964	Atlantic Ocean near 1960 and 1962 sites noted above, originating from Edgewood Arsenal, Maryland	456 one-ton containers of riot control agent 1,700 75 mm mustard projectiles 74 one-ton containers of mustard agent 10 M78 500-pound cyanogen chloride bombs non-chemical weapons materials (800 55-gallon drums of radiological waste)
June 15, 1967	Atlantic Ocean, originating from Colts Neck Naval Pier, Earle, New Jersey	4,577 one-ton containers of mustard agent 7,380 M55 sarin rockets in concrete vaults
June 19, 1968	Atlantic Ocean, originating from Colts Neck Naval Pier, Earle, New Jersey	38 one-ton containers of sarin and VX 1,460 vaults holding M55 sarin and VX rockets 120 drums of canisters of arsenic and cyanide
August 7, 1968	Atlantic Ocean, originating from Colts Neck Naval Pier, Earle, New Jersey	3,500 one-ton containers contaminated with mustard agent and filled with water non-chemical weapons materials (unspecified quantity and type of conventional explosives)
August 18, 1970	Atlantic Ocean, 250 miles east of Cape Kennedy, Florida, originating from Sunny Point, North Carolina	12,508 M55 sarin rockets in vaults 3 155mm sarin projectiles 1 M23 VX land mine

Source: Prepared by the Congressional Research Service with information from the Department of Defense, U.S. Army Research, Development, and Engineering Command, Aberdeen Proving Ground, Maryland, Corporate Information Office, Historical Research and Response Team, *Off-shore Disposal of Chemical Agents and Weapons Conducted by the United States*, March 29, 2001, 15 pp.

Cessation of U.S. Disposal in the Ocean

In the late 1960s, DOD's acknowledgment of the disposal of chemical weapons in the ocean, and heightened public awareness of the ocean disposal of wastes in general, raised concerns about potential risks to human health and the marine environment, and the economic effects of potential damage to marine resources. In light of these concerns, DOD requested that the National Academy of Sciences (NAS) assess the hazards of disposing of surplus chemical weapons, including land and sea disposal. The NAS released a report in 1969 recommending the pursuit of methods to safely destroy or neutralize chemical weapons, rather than bury them intact on land or at sea.[5] These recommendations and continuing public concerns led the United States to cease disposal of chemical weapons in the ocean in 1970 and to explore methods to destroy surplus weapons at military facilities where they could be managed safely.

In 1972, Congress enacted the Ocean Dumping Act[6] to prohibit the disposal of wastes into the ocean waters of the United States, extending to the contiguous zone (24 nautical miles seaward). Consistent with the decision of the executive branch in 1970 to cease the disposal of chemical weapons in the ocean, Congress included provisions in the Ocean Dumping Act that explicitly prohibited the offshore disposal of chemical warfare agents. Although the act granted limited authority for the Environmental Protection Agency (EPA) to issue permits allowing the offshore disposal of certain types of wastes, it specifically excluded chemical warfare agents and other hazardous substances from this permit authority.[7] (See CRS Report RS20028, *Ocean Dumping Act: A Summary of the Law*, by Claudia Copeland.)

Subsequent to the enactment of the Ocean Dumping Act, DOD continued its efforts to seek safer methods for disposing of chemical weapons on the land, resulting in the development of incinerators to destroy them.[8] Although incineration remains the primary method by which chemical weapons are disposed of today, concerns about potential health and environmental risks from incineration have spurred the research and development of safer technologies to neutralize them. Under international agreement, the United States has committed to destroying its chemical weapons stockpile by 2012. However, there are questions as to whether this deadline can be met, considering the current capacity of existing disposal facilities. (For further discussion of ongoing efforts to dispose of chemical weapons

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[5] National Academy of Sciences. *Disposal Hazards of Certain Chemical Warfare Agents and Munitions*. June 24, 1969. 14 pp.

[6] 33 U.S.C. 1401 et seq. The "Ocean Dumping Act" is the common reference to Title I of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, P.L. 92-532), as amended.

[7] 33 U.S.C. 1412.

[8] The U.S. Army Chemical Materials Agency administers the disposal of chemical munitions, including the operation of four disposal facilities located in Anniston, Alabama; Pine Bluff, Arkansas; Umatilla, Oregon; and Tooele, Utah. For further information, see the agency's website at [http://www-pmcd.apgea.army.mil].

at onshore facilities, see CRS Report RL32158, *Chemical Weapons Convention: Issues for Congress,* by Steve Bowman.)

Potential Risks from Disposal in the Ocean

Although alternative technologies are now available for the onshore disposal of chemical weapons, DOD contends that, at the time, disposal in the ocean was deemed safer than disposal on land for two reasons. First, methods for disposal on land were initially limited to burial, presenting a long-term risk if weapons leaked or were recovered. Second, it was generally assumed that chemical agents released into seawater would be diluted to safe levels in the vastness of the ocean. However, this assumption was questioned in later years as scientific understanding of the effects of ocean pollution grew, leading to the general prohibition on the disposal of wastes into the ocean, including chemical weapons.

Exposure to chemical weapons can have numerous harmful effects on human beings. Depending on the particular chemical agent, these effects can include burns and sores on the skin, vomiting, respiratory dysfunction, mental impairment, damage to the immune and nervous systems, infertility, and death. Public health advocates have questioned whether possible exposure to such substances in seawater from leaking weapons may contribute to various symptoms experienced by coastal residents, swimmers, divers, fishermen, and individuals who may have consumed contaminated fish or shellfish. Marine conservationists and environmental advocates also have raised questions about the possible effects of chemical weapons agents on the marine environment, including the possible contribution to declines in populations of certain fish and other marine life in and around areas where weapons were dumped in the ocean.

The degree of risk from weapons leaking chemical agents into seawater depends on numerous factors. The extent to which an agent is diluted and the duration of exposure determine whether there is potential for harm. For example, most nerve agents are soluble and dissolve in water within several days. Less soluble agents still degrade over time as a result of hydrolysis. However, certain agents are less susceptible to hydrolysis, allowing them to remain in harmful forms for longer periods. For example, sulphur mustard in liquid or solid form turns into an encrusted gel when released in seawater. In this form, it can persist for many years before degrading.

Density is another critical factor. Chemical weapons agents denser than seawater tend to remain on the ocean floor, rather than float to shallower waters where they may present greater risk. For example, encrusted sulphur mustard is denser than seawater, making it unlikely to migrate off the ocean floor. However, ocean currents can disperse such substances along the seabed, spreading contamination beyond the location where the release occurred. Colder water temperatures also can slow degradation and allow contamination along the seabed to persist in harmful concentrations and forms for longer periods.

In addition to contamination of seawater, there have been concerns among the public that chemical weapons could wash ashore, or that they could be retrieved accidentally during dredging operations or trawl fishing along the seabed. The

likelihood of such events is difficult to predict. Generally, the greater the depth of disposal, the less likely that accidental retrieval or washing ashore would occur. Although ocean currents could move weapons into shallower waters and present a greater safety risk, the accumulation of sediment and marine growth could help anchor weapons to the seabed, making them less susceptible to movement.

In its 2001 report, the Army documented few incidents of accidental retrieval of chemical weapons,[9] or of them washing ashore.[10] Only one other incident has been reported in the United States since then.[11] One could observe that these incidents are rare considering the thousands of chemical weapons dumped off the coasts of the United States over 50 years, and that the risks of such events appear *relatively* small. On the other hand, one could argue that even a few incidents prove that some risks do exist, and that study and monitoring of disposal areas are warranted to assess the likelihood of future risks.

Relevant Scientific Studies in Europe and Russia

Thus far, there have been no comprehensive scientific studies of potential risks to human health and the marine environment in specific areas of the ocean where chemical weapons were dumped off the coast of the United States. Therefore, it is difficult to provide definitive answers to questions about risks raised by public health and environmental advocates, marine conservationists, and the general public. However, there have been numerous scientific studies of risks from the disposal of chemical weapons off the coasts of Europe and Russia in the Atlantic Ocean, North Sea, Baltic Sea, and Mediterranean Sea. The former Soviet Union, Germany, Great Britain, and France disposed of chemical weapons in these waters, including weapons captured during World War II. Although these studies focus on risks to coastal populations in Europe and Russia, and the marine environments of these waters, their

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[9] For example, a fisherman accidentally retrieved a container of sulphur mustard off the coast of Australia in 1970 that the U.S. Armed Forces had dumped in 1945 along with thousands of tons of chemical weapons. In 1976, a dredging operation off the coast of Hawaii accidentally retrieved a mortar round containing chemical agents, injuring one crewman. The Army suspects that the mortar round was one of thousands of tons of chemical weapons dumped in 1944 off Pearl Harbor.

[10] For example, a mustard gas bomb floated ashore in the Gulf of Mexico in 1946 (location unspecified) after it and 32 others were disposed of 20 miles off the coast at depths ranging from 200 to 600 feet. The bomb was recovered safely. Also in 1946, an unspecified number of mustard gas bombs appeared floating in Manfredonia Bay, Italy, within three weeks after they had been disposed of 54 miles from shore. In the 1970s (year not specified), a container of sulphur mustard washed ashore off the coast of Australia in the same area where a fisherman accidentally retrieved a container in 1970. According to the Army, the government of Australia has since designated this area hazardous.

[11] A report by U.S. Army personnel acknowledged the accidental retrieval of a World War I era mustard gas munition by a clam dredging operation off the coast of New Jersey in 2004. The report, *Mitigating the Possible Damaging Effects of Twentieth-Century Ocean Dumping of Chemical Munitions*, by Emily E. Baine and Margaret P. Simmons, was prepared independently by these authors, not by the U.S. Army. Numerous press reports also have acknowledged this incident.

findings may offer insights into potential risks from the disposal of chemical weapons off the coasts of the United States.

In 2005, the Imperial College of London compiled the findings of these European and Russian studies.[12] As a whole, they concluded that risks remain relatively small if weapons or persisting contamination on the seabed, such as encrusted sulphur mustard, remain undisturbed. On the other hand, human disturbances, such as dredging, trawl fishing, or work on underwater pipelines, caused risks to rise significantly. The studies linked instances of human exposure primarily to such disturbances, rather than to ocean currents washing weapons or contamination ashore.

In shallower waters, such as in the Baltic Sea, the studies noted that the greatest risk is to fishermen who reported many instances of catching encrusted sulphur mustard in their nets when trawling the seabed. However, the number of such instances declined as the depth of the water increased. Although the studies noted more instances of exposure than reported in the United States, the depths of disposal off the coasts of Europe and Russia generally are shallower than those off the coasts of the United States. The finding that potential risks appear to decrease relative to greater depths of disposal suggests that there may be less potential risk domestically than in the waters of these foreign nations.

Response Options and Issues

As DOD has disclosed more information about the past disposal of chemical weapons in the ocean, interest in how best to respond to potential risks has grown among the public. Thus far, the U.S. Army has prepared materials for commercial maritime industries to educate individuals about the hazards of chemical and conventional weapons that may be present in the ocean. These materials include safety guidelines in the event that weapons are accidentally retrieved from the seabed, and provide contact information to inform federal officials of the presence of such weapons, so that appropriate actions may be taken to ensure public safety. However, the locations of the disposal sites are not disclosed, preventing the public from being able to avoid areas where they may encounter weapons dumped offshore.

The primary obstacle to responding to potential risks is locating the weapons in the ocean. The lack of coordinates for most of the disposal sites, and the possibility that ocean currents may have moved weapons beyond these areas, makes finding the weapons difficult at best, if not impracticable in some cases. In the event that the weapons are located, one option to prevent exposure would be to leave the weapons in place and warn the public to avoid these areas. This option may address immediate risks and avoid new risks associated with retrieving weapons from the ocean (see below). However, the long-term risks of leaving the weapons in place is

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[12] Imperial College of London. *Munitions Dumped at Sea: A Literature Review*. June 2005. 90 pp. As noted in the Army's 2001 report, the U.S. Armed Forces also disposed of chemical weapons off the coasts of Europe in the Atlantic Ocean, North Sea, and Mediterranean Sea. The studies reviewed in the Imperial College report do not distinguish between risks from U.S. disposal and disposal by other nations in these foreign waters.

uncertain, because of a lack of information on the leaking of chemical agents in the ocean and the extent to which ocean currents may cause munitions to migrate to shallower waters or wash ashore in the future. Leaving the weapons in place and publicly disclosing their location also could present risks to national security in the event that individuals may retrieve weapons and use them for harmful purposes.

If the weapons are found, a more difficult option would be to remove them from the seabed and to remediate contaminated seawater surrounding these areas. Once retrieved, these weapons would need to be disposed of safely onshore, through incineration or emerging alternative technologies to neutralize them. Although this option may more effectively address long-term risks, it likely would require substantial financial resources and time, and would be technically challenging. This option also could present new risks, such as risks to workers who would remove and transport the weapons, and to populated areas in the event of an accidental release during transporting or disposing of the weapons at an onshore facility. Regardless of the desired option, the practical feasibility of responding to potential risks is limited by the many inherent challenges discussed below.

Locating Disposal Sites. Locating where chemical weapons were dumped in the ocean would be the first step toward assessing potential risks and determining the feasibility of response actions. However, the *precise* coordinates of most of these sites are unknown, both in U.S. and foreign waters. The specificity of the geographic locations of the disposal sites in historical records varies widely. Rough coordinates are known or assumed for some sites, whereas only approximate distances from the coast are identified for others. The location of many sites is completely unknown, with only the body of water identified, such as the Atlantic or Pacific Ocean in general. Consequently, attempts to locate most of the disposal sites would be difficult at best, if not impracticable in some cases. The Army's 2001 report indicated that only four disposal sites where the exact location is known have been surveyed, with no contamination detected at the time. The last survey occurred in 1975. Some have advocated that at least these four known sites be revisited to determine if chemical weapons agents may have leaked since then.

Identifying Weapons and Containers. In the event that a disposal site is located, identifying *individual* weapons underwater still is likely to be difficult. At many sites, weapons were disposed of one-by-one, or "loose dumped" as the Army describes in its 2001 report. At these sites, ocean currents may have moved weapons and containers far enough away from their original point of disposal to make finding them problematic. Weapons also may be difficult to locate, depending on their size and depth, because of the accumulation of sediment and biological growth over many years. Sites where there are topographical irregularities in the ocean floor also could be challenging to survey with sonar technologies, because of the difficulty in distinguishing among natural formations that may be similar to weapons in size and shape. The Army's report listed numerous sites where weapons were sunk inside the hulls of obsolete vessels, which may be easier to identify because of their size and shape. As noted above, DOD has located and surveyed four of sites where weapons were sunk inside obsolete vessels, with the last surveyed in 1975.

Retrieving Munitions for Onshore Disposal. Safely retrieving weapons from the ocean floor is generally more challenging the greater the depth. The

suspected disposal depth varies widely. In its 2001 report, the Army indicated disposal depths ranging from 200 feet in the Gulf of Mexico to over 16,000 feet off the coast of Florida. However, these records do not indicate the depths of many disposal sites. Another factor is structural integrity. Weapons casings and containers may be weakened as result of water pressure, and the corrosive effects of saltwater, over prolonged periods. Especially at greater depths, changes in water pressure during retrieval could cause weakened casings and containers to rupture, resulting in the release of chemical weapons agents into shallower waters where they may pose greater risks of exposure. Existing leaks also could be exacerbated in such circumstances, increasing the quantity of chemical weapons agents released.

Remediating Contaminated Seawater. Experience in remediating contaminated seawater primarily has been limited to the removal of oil and fuel spilled on surface waters. Oil and fuel tend not to mix with water because of their physical composition, making them easier to remove. Chemical weapons agents that are soluble, such as nerve agents, mix easily with seawater, making removal impracticable. However, other agents that do not mix well with water, such as sulphur mustard, could be easier to remove. The depth at which contamination occurs is another important factor. The feasibility of remediating contamination far below the surface is highly uncertain because of the lack of experience in performing this type of remediation.

Although there may be a greater possibility for effective remediation if insoluble chemical weapons agents were to migrate to the surface, currents and winds in open waters could spread such agents rapidly over unmanageably large areas, especially at sites far from the coast where currents and winds can be stronger. The Army's 2001 report indicated at least one instance of remediation of contaminated surface waters during World War II in Bari Harbor, Italy, where a German air raid destroyed a U.S. Naval vessel containing mustard gas bombs and resulted in contamination of the harbor. However, the Army's report does not provide any information to assess the degree or adequacy of the cleanup, relative to today's standards.

Costs. Considering that much is unknown about the quantity and condition of weapons dumped in the ocean, developing reliable estimates of the costs to respond to potential risks is, and will continue to be, nearly impossible without such information. The availability of federal funding to pay the costs of response actions is an issue as well, whatever amount they may be. There already is ongoing debate within Congress about the adequacy of funding to pay for the cleanup of land-based contamination on military lands, for which the estimated costs are substantial.

In its most recent environmental report to Congress in March 2006, DOD estimated that a total of $34.4 billion would be needed to complete cleanup at active military installations, closed bases, and other former military properties.[13] Certain factors could cause these costs to rise, including efforts to clean up unexploded ordnance (UXO), the cleanup of another round of base closings approved in 2005 to

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[13] Department of Defense. *Defense Environmental Programs Annual Report to Congress for Fiscal Year 2005*. March 2006. Appendix J, p. J-6-1.

prepare these properties for civilian reuse, and possibly more stringent cleanup standards in the future.

Addressing the disposal of chemical weapons in the ocean could add to these costs, placing further demands on military funding for cleanup. Appropriating additional funds to meet these needs could prove challenging, considering the many other competing needs within the overall federal budget, such as other military needs, homeland security, and domestic programs, and constraints on spending as a result of the federal budget deficit.

Response Authorities

Although the Ocean Dumping Act has specifically prohibited the disposal of chemical weapons in the ocean since 1972, it does not explicitly authorize response to human health and environmental risks resulting from past disposal. However, there are at least three federal statutes that one might examine for possible authority to respond to risks from the past disposal of chemical weapons in certain areas of the ocean off U.S. shores. These statutes include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),[14] the Clean Water Act,[15] and the Resource Conservation and Recovery Act (RCRA).[16] Of these three statutes, CERCLA appears to raise the fewest questions regarding applicability, because it explicitly applies within specific ocean waters off the coasts of the United States. RCRA appears to raise the most questions of the three, because the applicability of that statute to ocean waters is unclear.

The applicability of response authorities in federal law hinges upon whether a particular substance is *legally* defined as a "hazardous substance" or "pollutant or contaminant," in the case of CERCLA; a "hazardous substance" or "pollutant," in the case of the Clean Water Act; or a "solid waste" or "hazardous waste," in the case of RCRA. Response authorities in these statutes also hinge upon whether there is an "imminent and substantial" danger to public health or welfare, or the environment. Although what constitutes imminent and substantial in this context is not defined in federal statute, courts generally have deferred to the Environmental Protection Agency (EPA) in making such determinations.

Further, the scope of these three statutes has not been interpreted to apply outside the United States and the adjacent waters over which the United States asserts limited jurisdiction (explained below). The Army's acknowledgment that the U.S. Armed Forces disposed of chemical weapons off the coasts of foreign nations raises questions regarding the liability of the United States under international law, or under the domestic laws of such foreign nations in the event that disposal occurred within their respective territorial seas.

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[14] 42 U.S.C. 9601 et seq.

[15] 42 U.S.C. 1251 et seq.

[16] 42 U.S.C. 6901 et seq.

There appears to be existing authority in federal law for the United States to respond to potential risks from chemical weapons disposed of off its shores. However, as discussed above, the primary obstacle to responding to potential risks is locating the weapons in the ocean. In the event that the weapons are found, many factors, such as technical capabilities, the possible introduction of new risks, and costs, could constrain the types of actions that could be carried out under these authorities. Possible applicability of each authority is discussed further below.

CERCLA. Section 104(a) of CERCLA authorizes the President to respond to a release, or a threat of a release, of a hazardous substance, pollutant, or contaminant into the environment.[17] The authority to respond to a release of a pollutant or contaminant is dependent upon whether there is an imminent and substantial danger to public health or welfare. The statute does not explicitly require such danger to be present to respond to a release or threatened release of a hazardous substance, primarily because the *nature* or *characteristics* of a hazardous substance clearly imply such danger by the fact that such substance is "hazardous." In practice, the President typically delegates the authority to respond to a release or threatened release to one or more federal agencies.

Authorized response actions may include removal or remediation or both. A "removal" is defined more broadly in CERCLA than the literal removal of contamination or source of contamination. Rather, a removal is an immediate or short-term response to an exposure threat, including but not limited to containing waste, preventing access to contaminated areas, and providing emergency assistance.[18] A "remedial action" may include many of the same activities as a removal, but is meant as a permanent remedy.[19] Remedial actions are also subject to more thorough review prior to implementation, including opportunity for public comment. In practice, a removal action is often performed as an *interim* response to an immediate threat, while a remedial action is planned to provide protection over the *long-term*.

Although CERCLA does not explicitly address threats from the release of chemical warfare agents, a "hazardous substance" is defined in that statute[20] to include those substances defined as such by EPA under the Clean Water Act.[21] EPA has listed many chemical warfare agents as hazardous substances under this authority.[22] "Pollutant or contaminant" also is broadly defined in CERCLA in a way that arguably could include all chemical warfare agents, because of the physiological effects on humans and nonhuman organisms that can result from exposure.[23]

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[17] 42 U.S.C. 9604(a).

[18] 42 U.S.C. 9601(23).

[19] 42 U.S.C. 9601(24).

[20] 42 U.S.C. 9601(14).

[21] 33 U.S.C. 1321(b)(2)(A).

[22] 40 C.F.R. 116.4.

[23] 42 U.S.C. 9601(33). CERCLA defines "pollutant or contaminant" as "any element, (continued...)

Further, "release" is defined in CERCLA to include dumping, disposing, or leaking into the environment, including the discarding of containers, whether or not they have leaked.[24] The "environment" is defined to include the ocean waters of the U.S. Exclusive Economic Zone (EEZ).[25] The outer boundary of the EEZ is 200 nautical miles seaward of the baseline from which the territorial sea is measured, which is no greater than 12 nautical miles from U.S. shores.

Thus, the past disposal of chemical weapons by the U.S. Armed Forces in the ocean within the seaward boundary of the U.S. EEZ arguably could be considered a release of a hazardous substance, pollutant, or contaminant into the environment,[26] thereby authorizing the federal government to take response actions to protect public health or welfare, or the environment. Although CERCLA could be interpreted as being applicable, finding the weapons in the ocean is a significant obstacle to taking a response action. If the weapons are found, many factors still could constrain the feasibility of certain actions, as explained above.

Clean Water Act. Section 311(c) of the Clean Water Act authorizes the President to "ensure effective and immediate removal of a discharge, and mitigation or prevention of a substantial threat of a discharge, of oil or a hazardous substance" into the navigable waters and adjoining shorelines of the United States, and into the ocean waters of the U.S. EEZ.[27] As is the case with CERCLA, the President typically delegates this responsibility to one or more federal agencies.

As noted above, EPA has categorized many chemical warfare agents as hazardous substances both for the purposes of the Clean Water Act, and in turn

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[23] (...continued)
substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring...."

[24] 42 U.S.C. 9601(22). "Release" includes dumping, disposing, or leaking into the environment, including the "abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant." Thus, the dumping or disposal of containers of chemical agents could constitute a release, and munitions containing chemical agents could constitute a *closed receptacle,* and the dumping or disposing of them therefore a release.

[25] 42 U.S.C. 9601(8). In this subsection, the "ocean waters" of the United States specifically refer to ocean waters of which the natural resources are under the exclusive management authority of the United States under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), which extend to the seaward boundary of the U.S. EEZ.

[26] Liability under CERCLA is retroactive. Therefore, the fact that the U.S. Armed Forces disposed of chemical weapons in the ocean long before 1980 when Congress enacted CERCLA does not remove the disposal of these weapons from the applicability of that statute.

[27] 33 U.S.C. 1321(c).

CERCLA. Discharge is defined in Section 311(a)(2) of the Clean Water Act to include "dumping" and "leaking."[28] Depending on how these statutory definitions are interpreted, Section 311(c) of the Clean Water Act could authorize the President to remove chemical weapons from the ocean within the seaward boundary of the U.S. EEZ, including those that may be leaking chemical agents into seawater. Similar to CERCLA, the applicability of the Clean Water Act does not necessarily mean that a desired response action could be taken in practice. As indicated above, finding the weapons is a significant obstacle, and if the weapons are found, many factors could constrain the feasibility of response actions.

Section 504 of the Clean Water Act also grants "emergency powers" to EPA to bring suit to compel persons contributing to pollution, or to take other action, to stop the discharge of pollutants that present an imminent and substantial endangerment to human health or welfare.[29] "Pollutant" is defined in the Clean Water Act for the purposes of this section to include munitions and chemical wastes.[30] However, there are longstanding questions regarding the ability of one federal agency to enforce an action against another, in the case of chemical weapons, likely EPA enforcing an action to be taken by DOD. There also are questions as to whether Section 504 allows EPA to order a response be taken, in the event that the original action that caused the pollution is no longer ongoing but has long since ended, such as the disposal of chemical weapons in the ocean from the World War I era through 1970.

RCRA. The applicability of response authorities in RCRA to risks from chemical weapons in the ocean is less clear than in CERCLA and the Clean Water Act. Section 7003 of RCRA authorizes EPA to take any action necessary to respond to an imminent and substantial endangerment to human health or the environment resulting from the disposal of a solid waste, including a hazardous waste.[31] As defined in RCRA, disposal includes "dumping" into water, but does not specify whether ocean waters are included.[32] A "solid waste,"[33] or a "hazardous waste"[34] as a type of solid waste, also are not explicitly defined in RCRA to include chemical weapons or agents.

However, RCRA does authorize EPA to promulgate regulations to determine when munitions, including chemical munitions, are considered a solid waste, or a hazardous waste, for purposes of that statute.[35] EPA promulgated such regulations

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[28] 33 U.S.C. 1321(a)(2).

[29] 33 U.S.C. 1364(a).

[30] 33 U.S.C. 1362(6).

[31] 42 U.S.C. 6973(a).

[32] 42 U.S.C. 6903(3).

[33] 42 U.S.C. 6903(27).

[34] 42 U.S.C. 6903(5).

[35] 42 U.S.C. 6924(y).

in 1997.[36] Among other circumstances, the regulations specify that a military munition, including a chemical munition, is considered a solid waste, and by its characteristics a hazardous waste, when it is abandoned as a result of disposal. However, like the statute, the regulations do not clarify their applicability to disposal in ocean waters.

If these regulations were interpreted to apply to ocean waters, and the disposal of chemical munitions resulted in imminent and substantial endangerment to human health or the environment, EPA arguably could have response authorities under Section 7003 of RCRA. EPA also has authority under Section 6001(b) of RCRA to issue an administrative order to another federal agency, likely DOD in the case of chemical weapons, to specify response actions that EPA deems necessary.[37] Section 6001(a) of RCRA specifies that federal agencies must comply with such orders.[38] Similar to CERCLA and the Clean Water Act, whether a desired response action could be taken would depend on whether the weapons could be found, and whether the desired action would be practically feasible.

Legislation Enacted in the 109th Congress

In its second session, the 109th Congress enacted legislation to gain a better understanding of the past disposal of chemical weapons in the ocean by the U.S. Armed Forces, and the potential health, safety, and environmental risks that these weapons may pose. Section 314 of the John Warner National Defense Authorization Act for FY2007 (P.L. 109-364, H.R. 5122) requires further review of historical records to attempt to identify areas where the U.S. Armed Forces disposed of both chemical *and* conventional weapons off U.S. shores. Although the past dumping of chemical weapons motivated initial concerns, there also were questions about the extent to which the U.S. Armed Forces may have dumped surplus or damaged conventional weapons into the ocean. To learn more about potential risks, Section 314 also requires the Secretary of Defense to research the effects of these weapons on the ocean environment and to monitor identified sites to determine whether contamination is *currently* being released or significant health or safety risks are present.

The provisions in Section 314 were based on legislation introduced earlier in the second session of the 109th Congress in the Hawaiian Waters Chemical Munitions Safety Act of 2006 (H.R. 4778) and its companion bill in the Senate (S. 2295). Whereas these bills focused on chemical weapons dumped off the coast of Hawaii, the scope of Section 314 in P.L. 109-364 was expanded to encompass all U.S. coastal areas and to include conventional weapons, as noted above. An analysis of provisions in Section 314 as enacted, and a comparison to the original provisions in the House and Senate versions of H.R. 5122, are provided below.

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[36] 40 C.F.R. 266.200.

[37] 42 U.S.C. 6961(b).

[38] 42 U.S.C. 6961(a).

Subsection(a) of Section 314 requires the Secretary of Defense to review historical records to determine the number and "probable" locations of sites where the U.S. Armed Forces disposed of military munitions within U.S. coastal waters, the size of these sites, and the types of munitions dumped at these locations. The original House bill also would have required the disclosure of the *quantities* of munitions dumped at each site, whereas the enacted bill did not. The areas of the ocean covered in the historical review are to include areas extending from the U.S. shoreline to the outer boundary of the Outer Continental Shelf.[39] The Secretary of Defense is required to *request* the assistance of the U.S. Coast Guard, the National Oceanic and Atmospheric Administration (NOAA), and other relevant federal agencies in reviewing historical records of disposal in the ocean. This provision is consistent with the original House bill, whereas the original Senate bill would have *required* the cooperation of these agencies.

Subsection(a) also requires the Secretary of Defense to release the information compiled from its historical review on an annual basis. The Secretary is required to include this information in the Department's annual report to Congress on its environmental restoration activities.[40] However, the Secretary is authorized to withhold from the public the "exact nature and locations of munitions," if he determines that the potential for unauthorized retrieval of these weapons could present a significant threat to national defense or public safety. Determining when it would be appropriate to withhold information about an individual site would be at the discretion of the Secretary.

Subsection(a) further requires the Secretary of Defense to complete the historical review of munitions disposal sites within a time frame necessary for it to be included in the Department's FY2009 environmental restoration report to Congress. The original House bill did not specify a time frame for the completion of the historical review. Instead, it would have required annual reporting as the Secretary compiles records of munitions disposal in the ocean, with an implied presumption that the review would be complete at some point in time.

Subsection(b) requires the Secretary of Defense to share information on the disposal of munitions in the ocean with the Secretary of Commerce to assist NOAA in preparing nautical charts and other navigational aids to identify known or likely hazards to the public, including commercial shipping and fishing operations. This subsection also requires the Secretary of Defense to continue activities to inform the

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[39] Section 314 of P.L. 109-364 uses the existing statutory definition of Outer Continental Shelf referenced in the Outer Continental Shelf Lands Act (43 U.S.C. 1331).

[40] 10 U.S.C. 2706(a) requires the Secretary of Defense to submit an annual report to Congress on its environmental restoration activities, including the number of contaminated sites, the status of cleanup by site, incurred costs, and estimates of future costs to complete cleanup. 10 U.S.C. 2706(b) requires the Secretary of Defense to submit an annual report to Congress on other environmental activities on military lands, including compliance with pollution control requirements, pollution prevention efforts, and compliance with natural resource and historic preservation requirements. Beginning in FY2004, DOD consolidated these two annual environmental reports into one document covering all environmental programs and activities. Accordingly, the information required in Section 314 of P.L. 109-364 presumably would be included in this consolidated annual environmental report.

public of the possible hazards of coming into contact with military munitions on the seabed, and to continue efforts to identify appropriate actions to mitigate such hazards if contact does occur. As noted earlier, the U.S. Army has prepared materials for commercial maritime industries to educate individuals about the hazards of munitions that may be present in the ocean. These materials include safety guidelines in the event that munitions are accidentally retrieved from the seabed, and provide contact information to inform federal officials of the presence of munitions, so that appropriate actions may be taken to ensure public safety.

Subsection(c) requires the Secretary of Defense to research the effects of munitions disposed of in coastal waters on the ocean environment and those who "use" ocean waters. The scope of "effects" is not specified. Presumably, examined effects could include human health, safety, and environmental risks, and the economic impacts of potential damage to marine resources. However, the scope could be narrower or broader than these potential effects, and presumably would be at the discretion of the Secretary. Subsection(c) also authorizes the Secretary to award grants and enter into cooperative agreements to "qualified" entities to perform this research, but does not stipulate criteria for determining whether an entity would be qualified for this task. This determination therefore presumably would be at the discretion of the Secretary, whereas the original House bill explicitly stated that this determination would have been at the discretion of the Secretary.

To conduct this research, the Secretary is required to select at least two "representative" (i.e., typical) sites along the Atlantic coast, two along the Pacific coast (including the coast of Alaska), and two off the coast of Hawaii. Factors for selecting representative sites include depth, water temperature, nature of the military munitions, and proximity to coastal populations. The physical scope of the study of disposal sites is ambiguous in terms of the surface area and volume of seawater that is to be examined. Required research at each site is to entail (1) sampling and analysis of ocean waters and the seabed at or adjacent to the locations where munitions were dumped; (2) assessment of the long-term effects of exposure to seawater on military munitions, particularly *chemical* munitions; and (3) development of "effective" safety measures when dealing with (i.e., handling) military munitions that have been disposed of in seawater.

Subsection(c) further requires a study of the feasibility of removing or otherwise remediating munitions in the ocean and requires study of the impacts on the ocean environment and those who use it, including public health risks. The original House bill did not contain similar language regarding study of the feasibility of removal or remediation, but did include language that would have required an epidemiological study of the effects of munitions in the ocean on human health in coastal populations located in the "vicinity" of disposal sites. However, it is unclear how close a community would had to have been located to an offshore disposal site for it to have been included in such study.

If contamination *currently* is being released into ocean waters at identified sites or a significant health or safety risk is present, Subsection(d) requires the Secretary of Defense to put "appropriate" mechanisms into place at those sites to monitor the contamination. However, such mechanisms are not specified in the law or in the accompanying conference report on the final version of the bill. If monitoring would

be so required, the Secretary must report to the congressional defense committees on additional measures that may be needed to address the release of contamination or potential risks. Although monitoring information may be used to inform decisions as to whether further response is needed to address potential risks, neither the final bill signed into law nor the original House or Senate versions require or authorize such action. As explained earlier, at least three existing federal statutes could be interpreted to provide authority for responding to such risks, without possibly requiring new authority from Congress.

As the House and Senate originally proposed, Section 314 of P.L. 109-364 does not authorize a specific amount of funding to carry out the historical review, research, and monitoring of munitions disposal sites in the ocean. However, the law provides general authority[41] for the Secretary of Defense and other relevant federal agencies to *engage* in these activities. Whether or not a specific funding level is authorized for an activity, actual funding to pay for it is subject to appropriations. In the 109th Congress, neither of the two FY2007 defense appropriations bills (H.R. 5631, as signed into law, or H.R. 5385, as passed by the House and Senate) contained specific funding to implement a study of offshore munitions disposal sites.

Absent a set-aside appropriation, DOD still could allocate funds for a study of offshore munitions disposal sites in FY2007 out of funds appropriated to accounts for broader purposes which are within its discretion. Considering that the study of offshore sites would involve the assessment of contamination, DOD's environmental restoration accounts may be a likely source of funding. However, as discussed earlier, there are substantial funding needs estimated for the cleanup of land-based contamination with these funds, raising questions about the availability of funding within these accounts to address offshore contamination. The many other competing national security needs within DOD's budget also could limit available funding, unless Congress were to provide targeted appropriations for the study.

The funds needed to study offshore munitions disposal sites is uncertain. The cost of reviewing historical records to identify disposal sites would likely be relatively small, primarily involving personnel expenses. However, the cost of researching and monitoring identified sites could be substantially higher, involving the use of vessels to reach offshore areas, scientific equipment to gather seawater samples at possibly great depths, specialized personnel trained in the operation of such equipment, and laboratory analysis of monitoring data. Research and monitoring costs would depend on numerous factors, including the geographic scope

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[41] Statutory authority for an agency to carry out an action constitutes what is often referred to as "program authority." In authorizing an activity, Congress often also provides "funding authority" that may specify a dollar amount for certain fiscal years, or may simply authorize "such sums as may be necessary." Authorized funding levels are non-binding and are subject to annual appropriations. As such, Congress may appropriate amounts that differ from a funding authorization. If funding authority is not provided or has expired, Congress may still appropriate funding for an activity for which it has provided program authority. A department or an agency also may fund an activity for which it has program authority even if Congress does not explicitly set aside funding for it, if appropriated funds are available to allocate to that activity at the discretion of the department or agency.

of the sites, their distance from the shore, the depth at which munitions are present, and the methodologies used to evaluate contaminants and associated risks.

Conclusion

Although the Army has disclosed more information than previously available, much remains unknown about the exact quantities, types, and present locations of chemical and conventional weapons that the U.S. Armed Forces dumped in the ocean. Incomplete historical records significantly limit the ability to identify and assess the condition of these weapons, particularly to determine whether chemical agents may have leaked, or are likely to do so. Section 314 of P.L. 109-364 (H.R. 5122) requires the Secretary of Defense to attempt to identify sites where weapons were dumped off U.S. shores, and to research and monitor identified sites where contamination is being released or there is a significant health or safety risk. However, considering the lack of complete records of disposal released thus far, it would appear that this task would be difficult at best, if not impracticable in some cases, especially in instances in which the known location of disposal is in a broad area of the ocean in very deep waters.

Assessing the degree of potential risks is nearly impossible without knowing the specific location and condition of weapons on the seabed. Risks to human health and the environment could be lessened if the volume and effects of seawater may have diluted leaked chemical agents into less threatening concentrations or degraded them into less dangerous components. However, the possibility of harmful exposure remains, especially in the event that a weapon is accidentally retrieved or washes ashore, and a chemical agent is released in a harmful concentration and form or a "live" conventional weapon were to detonate. While the number of such instances has been rare relative to the thousands of weapons dumped in the ocean, the possibility of future instances and associated risks remain.

Retrieving weapons from the ocean to address potential risks is fraught with many practical challenges. The primary obstacle is locating the weapons in the ocean. In the event that the weapons are found, retrieving them would introduce new risks if weapons casings ruptured in the ascent from great depths, or if an accidental release occurred during transport to onshore facilities for disposal. Considering these challenges and risks, leaving identified weapons in place, and warning the public to avoid areas of the ocean where they were dumped, may be more feasible. However, the long-term risks of leaving located weapons in place is uncertain due to a lack of information on the effects of chemical agents in ocean waters, and the extent to which weapons may migrate along the seabed to shallower waters or wash ashore over time where they may present greater risks. Further, public disclosure of the location and types of weapons could present national security risks, in the event that individuals were to retrieve these weapons and use them for harmful purposes.

Regardless of which option is desired, finding most of the weapons in the ocean to respond to potential risks would appear to be highly unlikely. The substantial challenge of accurately identifying the boundaries of former disposal areas without complete historical records, and the possibility that ocean currents may have moved weapons and contamination beyond these boundaries, makes the implementation of any response option difficult at best, if not impracticable in some cases. The

feasibility of responding to potential risks is further complicated by unknown costs of response actions and the uncertain availability of federal funding to pay for them.