MITIGATING THE POSSIBLE DAMAGING EFFECTS OF TWENTIETH-CENTURY OCEAN DUMPING OF CHEMICAL MUNITIONS

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I. INTRODUCTION

Oceans cover approximately seventy-one percent of the Earth's surface.[1] Years of treating the ocean as an inexhaustible resource and receptacle have "taken their toll."[2] As with other forms of subsurface ocean pollution, discarded military munitions, including chemical munitions (CM),[3] are usually "out of sight," and are therefore often "out of mind."[4] Although it is highly unlikely that CM poses as great a threat as other forms of ocean pollution, the presence of CM in the ocean may still pose some risks. The most tangible risk may be to personnel on fishing vessels who catch CM in their nets.[5] The recent discovery of military munitions, including one containing suspected blister agent, in crushed clamshells lining driveways in Delaware, United States, indicates that other workers and consumers may also be exposed to some risk.[6]

The duty not to pollute the oceans and liability for that breach of duty are found in both customary international law and under international agreements such as the United Nations Convention on the Law of the Sea (UNCLOS), although an injured state may not be able to

enforce such liability.[7] In the case of 20th Century ocean dumping, the question of who should be responsible for cleanup of dumping sites and how liability can be enforced is complicated by several factors, including the passage of time, the commonality of the practice, the connection of dumping activity to the conduct of war and national defense, safety and engineering issues, and the difficulty of one nation taking responsibility for clean-up that touches on international interests. This paper seeks to highlight these difficulties and point out future issues for research and policy development where appropriate.

First, the history of regulation of ocean dumping in general, which included dumping of CM, is examined to show why and how ocean dumping was stopped and what laws continue to restrict it today. Second, this paper lays out the history of where ocean dumping of CM is known to have occurred across the world, and the circumstances and nations involved. Within this section, the cases of fishermen injured near Bari, Italy, are noted to illustrate the kinds of injuries that can occur. The discovery of almost exclusively non-chemical munitions in Delaware, United States, is also discussed in order to demonstrate responses made by United States federal (military and civilian) organizations and state agencies to illustrate what might be done if more CM were found in the United States. Third, the complicated question of jurisdiction over the sea is discussed to delineate which parts of the ocean one or more nations may exercise jurisdiction over, and whether clean-up is an activity that may be performed. Fourth, the paper pulls together all of these ideas to discuss possible responses to mitigate the potential damages of past ocean dumping. The paper concludes that coordinating would be an extremely difficult and not necessarily ideal action. Rather, continued education of the public, especially commercial entities engaged in fishing and other activities at sea and their workers, and residents of coastal areas, is the best defense against possible future harm. If incidents arise in the future, the success

of federal and state authorities of dealing with the situation in Delaware, U.S.A., indicates that appropriate response mechanisms are in place, both on the Defense Department's side to coordinate clean-up and the federal and state agencies' side to enforce safety for workers. Injured consumers (there have been none as of yet) can likely seek redress through domestic law channels in the law of torts.

II. REGULATION OF OCEAN DUMPING OF CHEMICAL MUNITIONS

Ocean dumping of CM was an accepted disposal method from World War I until the early 1970s.[8] There is little documentation of ocean dumping before the 1940s.[9] From a U.S. perspective, a lack of record keeping and the absence of effective technology to monitor low-level emissions made it difficult to evaluate the success of ocean dumping and other disposal techniques used by the U.S. Army before 1970.[10]

The absence of records and effective monitoring technology may have contributed to the lack of readily available information about the general effects of ocean dumped CM on human health and the environment generally. As of today, few studies have been completed or definitive conclusions reached about the effects of ocean dumping, including the dumping of CM.[11] However, in the early 1970s, a series of developments on this topic gained the attention of the U.S. Congress.[12] Concern about ocean dumping of CM was only a part of this movement.

The Executive Summary of the U.S. Army's 1994 "Alternative Demilitarization Technology Report for Congress" indicates that pre-1970 disposal operations, including ocean dumping, "were standard industrial practices and were conducted without fatality or adverse public reaction." [13] Nevertheless, in May 1969, the Department of Defense halted the planned disposal of over 25,000 tons of CM by burial in the deep ocean in response to public concerns

about the possible effects on the ocean environment and the dangers associated with the transportation of CM.[14] Also in 1969, a report of the National Academy of Sciences' National Research Council concluded that ocean dumping of chemical warfare agents or munitions should be avoided, as its environmental effects were unknown.[15]

In 1970, the Council on Environmental Quality (formed under the National Environmental Policy Act of 1969) [16] submitted a report at former President Nixon's request about the problems of ocean dumping.[17] Sparked by this report,[18] and possibly by the report of the National Academy of Sciences, Congress passed the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), which ended the practice of ocean dumping of many materials by the United States.[19] Title I of MPRSA prohibits transportation of chemical warfare agents from the U.S. for the purpose of dumping beyond the territorial jurisdiction of the U.S.[20]

Similar changes were taking place in the international arena. In 1972, during the U.N. Conference on the Human Environment in Stockholm, the United Nations called for a convention on the issue of ocean dumping.[21] Representatives and observers to the resulting convention met in London for two weeks in 1972, representing ninety-four countries and eight international organizations.[22] The convention adopted the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention), which opened for signature on December 29, 1972, and entered into force on August 30, 1975.[23]

The London Convention prohibits the deliberate disposal of certain harmful wastes, including chemical warfare agents, outside the internal waters of the states who are parties to the convention.[24] As of October 2003, eighty countries, including the United States and the United Kingdom, have signed the London Convention.[25] Today, the London Convention "remains the basic international framework for controlling ocean dumping."[26]

III. EFFECTS OF CHEMICAL MUNITIONS IN THE OCEAN AND AREAS WHERE OCEAN DUMPING MAY HAVE OCCURRED

Considering that uncertainty about possible negative effects of ocean dumping of CM is much of what led to its discontinuation as a form of disposal, and that the practice has not been used since the late 1960s or early 1970s, it is not surprising that few definitive conclusions have been reached today about its potential dangers to the environment. However, despite a lack of information about general environmental effects, there are documented instances of human injuries or potential human injuries associated with ocean dumping of CM. In this context, chemical munitions may be CM or related training materials intentionally disposed of in the sea.[27] Nations may have dumped their own CM or the captured CM of wartime adversaries.[28]

A. Post-World War II Dumping and Injuries to Fishermen

A website created by Mitretek provides the best summary of areas known to have ocean dumping and its effects found during research for this paper, and its key findings will be summarized in the following sections.[29] The earliest recorded incident of dumping of CM into the ocean by the United States occurred when the U.S. dumped lewisite into the Atlantic Ocean somewhere between England and the U.S. at the end of World War I.[30] During Winter 1945, the United States may have dumped unspecified quantities of phosgene, hydrogen, cyanide, cyanogen chloride bombs in the Adriatic Sea, near Bari, Italy.[31] In April 1946, unspecified quantities of mustard and/or Lewisite bombs may have been dumped in the same location.[32] However, intentional disposal or "dumping"[33] is not the only possible source of mustard found in the Bari region. In December 1943, the American freighter, the S.S. John Harvey, exploded and sank during a German raid on Bari, Italy, while carrying 2,000 bombs, each containing 60 to 70 pounds of sulfur mustard (H).[34]

From 1946 to 1997, medical researchers at the University of Bari conducted a study of fishermen in Molfetta, located thirty kilometers north of Bari.[35] Two hundred thirty-two (232) male residents of Molfetta were exposed to mustard during this time period by picking it up in their nets.[36] Ninety-seven (97) cases, including five casualties, occurred between 1946 and 1955.[37] The most common anatomical sites of injury for these fishermen were arms (45% of the contaminated subjects), hands (39.2%), face (32.5%) and eyes (27.2%).[38] Reportedly, only 0.7% of fishermen had respiratory symptoms, which were a common injury among veterans of World War I.[39] The most recent case reported through this study occurred in June 1997.[40] However, this was only one of twelve incidents reported between 1986 and 1997.[41]

In addition to ocean dumping in the Adriatic, the United States and United Kingdom have reportedly dumped approximately 215,000 tons of CM into the sea, much of it from the German stockpile.[42] Between 1945 and 1948, the United States dumped 32,000 tons and the British dumped 75,000 tons of captured German CM.[43] During the same period, the British also dumped 100,000 tons of CM from Scotland. Some of the British dumps at the end of this period may have been in the North Sea.[44] During the 1950s, the British dumped another 17,000 tons from the German stockpile and the 8,000 tons remaining in their stockpile, possibly in the Irish Sea.[45]

Approximately 50,000-150,000 tons of CM stores found in Japan and Germany were dumped in the Baltic Sea between 1946 and 1947, with most of the dumping occurring in the Bornholm Basins, fifteen miles northeast of the Danish island of Bornholm.[46] Dumping also occurred in the Pacific Ocean and the Sea of Japan after World War II.[47]

In addition to injuries reported by the fisherman near Bari, Italy, accidents have also been reported in the Baltic Sea, the Pacific Ocean, and Japanese coastal waters. Most reports are from

fishermen who have caught lumps of mustard gas in their nets.[48] The Mitretek website explains how this might happen: "When exposed to sea water, mustard forms a thick outer 'crust' over a core of mustard which allows the mustard to be brought to the surface where it can injure unsuspecting fishermen."[49]

B. Possible Effects of Ocean Dumping in the Continental United States: Other Military Munitions Incidents in Delaware, U.S.A.

Between 1946 and 1970, the U.S. military dumped CM near the coastal waters of the United States.[50] During that time, CM was loaded at approximately 10 states for dumping near the Gulf of Mexico and other locations.[51] Dumps like these may have been the source of munitions, including the CM found in a clamshells generated as a processing by-product and used for paving in Delaware, United States , in 2004.

In February, 2004, a Delaware man found 32 live grenades ("pineapple" hand grenades and rifle grenades) in the crushed clamshells he purchased to pave his driveway.[52] Smaller batches of World War I and World War II munitions turned up in a clamshell paved service road near mobile home communities between Port Delmarva and Rehoboth Bay, Delaware, and in two driveways near Laurel, Delaware, in March and April 2004.[53]

These crushed clamshells have been purchased by residents and farms as an economical driveway paving material.[54] A Milford, Delaware-area trucker hauled all of the shells used to pave Delaware driveways where these munitions has been discovered from the Milford clam processing plant of Sea Watch International.[55]

The Department of Defense has responsibility to respond to requests from law enforcement for help in addressing military munitions. The responding explosives ordnance disposal (EOD) team evaluates the condition of the item and when necessary removes the item for destruction at a military demolition range. Three members of an Air Force EOD team were

injured at a military range when destroying a World War I mustard agent filled munition that they had recovered during an explosives and munitions emergency response from a clamshell driveway in Bridgeville, Delaware.[56] This was the only CM in these incidents. The EOD team was responding to a state law enforcement request for help with this munition.[57]

Fisherman harvesting clams operate a dredge for 15 minutes, bring up one or two tons of clams in cages, which are then placed on a truck and shipped to the Milford processing plant.[58] The U.S. Army Corps of Engineers (USACE) identified 33 vessels that dredged clams potentially containing munitions five miles off the New Jersey coast.[59] Sea Clams are harvested in relatively shallow water, usually from about 60 feet to as much as 120 feet in depth.[60] The recorded CM disposal sites off the mid-Atlantic coast are at significantly greater depths than commercial fishing operations. Thus explanation of the recovered CM item is unexplained and USACE is currently investigating to identify the areas where munitions have been recovered.

Although only one CM item was discovered, the discovery of other types of munitions raises interesting questions about appropriate actions to deal with possible future problems. Further, the effects of the one CM item found indicate that although caution is needed in handling munitions, procedures in place have been protective of the public.

USACE investigation of all sites in Delaware where military munitions have been found in clamshell paving materials ensures that no more munitions remain.[61] The Corps also inspected Sea Watch International's Milford, Delaware, plant, and the property of the clamshell hauler.[62] Over 300 munitions have been found in Sussex County, Delaware.[63]

The cost of clearing clamshell paving materials of unexploded ordnance delivered during the 2003 to 2004 clam fishing season may run as much as $20 million.[64] The Department of Defense investigation closely coordinated with the Delaware state Department of Natural

Resources and Environmental Control (DNREC), the Delaware State Police, and U.S. Environmental Protection Agency.[65] This coordination was done to assure that no further deliveries of munitions would occur, to streamline response to any citizen concerns or munitions discoveries, to establish communications channels, and plan investigation and when necessary removals at other clamshell delivery locations. One hundred six (106) customers of the clamshell hauler have been identified, all of whom will be visited to determine if their property requires a munition response (investigation and removal).[66]

In a citation issued October 13, 2004, the federal Occupational Safety and Health Administration (OSHA) accused Sea Watch International of subjecting their workers "to explosion, skin contact and inhalation hazards due to military munitions being discovered during the processing and packing operations."[67] Further, the company was alleged to have no emergency response plan to address munitions found during the clam shucking and sorting process.[68] Sea Watch employees had found 12 explosive devices which they improperly stored in a company basement.[69] The munitions were recovered by an EOD team and have been destroyed.[70]

OSHA fined Sea Watch $9,000, giving the company 15 working days to pay the fine, fix the hazard, formally contest, or request an informal conference.[71] According to the company's attorney, Sea Watch planned to ask for a conference.[72] OSHA instructed Sea Watch to screen each cage of clams to ensure no metal is present, and to notify state law enforcement and Dover AFB to deal with any munitions found.[73] Sea Watch's attorney reported that clams arriving at the plant are inspected, and a disposal container is on site to hold any munitions discovered.[74] Sea Watch's attorney stated that a device had been ordered that could detect metal components

as small as a fish hook.[75] This would be used to stop processing on the conveyor belt if munitions are discovered.[76]

There is no record at OSHA of another complaint against Sea Watch.[77]

DNREC issued a cease and desist order in October 2004 to stop the hauler from stockpiling and transporting processed clamshells until all military munitions has been removed.[78] The Corps performed an initial screening of the hauler's stockpiled clamshells.[79] After the initial screening by the Corps, all further requirements were the hauler's responsibility as part of his ongoing business. The hauler was notified by the regulators that he could not sell any more clamshells directly to consumers until all shells have been screened, or face a $2,500 to $25,000 penalty for violating the order.[80] The Corps discussed options for eliminating the risk at the processing plant in December 2004, which also addressed the hauler's need to screen the shells.[81] DNREC issued similar orders to the hauler on November 26, 2004, and in late December 2004.[82]

Also in late December, DNREC issued a cease and desist order to Sea Watch's Milford-area processing plant not to allow any shells to be removed from the plant before being cleared of munitions.[83] As of December 31, 2004, Sea Watch's attorney stated that a metal detector was already in place to detect any munitions before it is placed in the hauler's truck, and that they would notify the Corps of Engineers if any munitions were found.[84]

IV. JURISDICTION OVER THE SEA

Customary international law of the sea was generally based "freedom of the seas," or the idea that no single nation state or states could assert sovereignty over the seas.[85] However, there has also been disagreement over "the length of the territorial sea, which is the area of the adjacent water over which states can exercise sovereignty."[86] This concept remained in dispute

after two United Nations conferences, until the third conference resulted in the 1982 United Nations Convention on the Law of the Sea, which came into force in November 1994.[87]

This convention establishes the maximum breadth of the territorial sea at twelve miles, and set out different zones of the sea in which states have different rights.[88] In addition to the territorial sea, these zones include the internal waters, the contiguous zone, the exclusive economic zone, the continental shelf, and the high seas.[89] A majority of countries follow the 12 mile distinction.[90]

Generally states have absolute sovereignty over internal waters, but most states will not exercise jurisdiction over a foreign vessel docked in an internal port unless it affects the local peace or safety.[91] Exercise of jurisdiction over the territorial sea is great but subject to the laws of the Convention and to "other rules of international law."[92] "States can claim an exclusive economic zone (EEZ) of up to 200 nautical miles from the baselines from where the length of the territorial sea is measured," and jurisdiction of a state in its EEZ includes "protection and preservation of the marine environment."[93] High seas are waters not part of the internal waters, the territorial seas, the contiguous zone, or the exclusive economic zone, and are generally open to all nations.[94] Freedom of the high seas includes "freedom of navigation, overflight, fishing, scientific research, freedom to lay submarine cables and pipelines, freedom to construct artificial islands and other installations permitted under international law."[95]

From a United States perspective, President Regan expanded the territorial sea of the U.S. to twelve miles by Presidential Proclamation No. 5928.[96] However, the Proclamation specifically applied only to international matters and did not affect domestic law.[97] Therefore, the historical definition of the territorial jurisdiction of the United States in domestic law remains at three nautical miles.[98] American "states regulate marine resources in the first three miles of

ocean, while the federal government regulates marine resources in the next 197 miles of the United States' EEZ and continental shelf."[99] American states extend their borders into the first three miles of the ocean for the purpose of regulating the ocean in their jurisdiction.[100]

Importantly, application of a domestic statute outside the territorial jurisdiction of the United States is not permitted unless "the affirmative intention of the Congress" to do so is "clearly expressed."[101] However, as a number of statutes unrelated to environmental clean-up are extending territorial U.S. waters to twelve miles for domestic purposes as well, "the question of whether state jurisdiction and boundaries should also be extended will likely become a major issue."[102]

V. POSSIBLE FUTURE ACTION

Obviously, ocean dumping of CM was a potential problem that ended definitively after the early 1970s.[103] At the time, uncertainty about its long term effects caused the international community, including the United States, to stop the practice.[104] There is no more certainty today about its long-term effects,[105] although sites may have been monitored occasionally to look for ill effects. However, it is also significant that ocean dumping of CM was a common practice across the world before 1970, it was used without recorded incident uncovered by this research, and the number of incidents since 1970 has been fairly limited.[106] This does not discount the serious injuries suffered by those unfortunate enough to be exposed to dumped munitions.[107] So what could or should be done to address any potential threat that exists?

A. Possible Clean-up

1. *State Actor "Volunteer"*

Assuming for the sake of argument that clean-up of dumped CM is a desired measure, and a nation wishes to take responsibility, there are several complications that must be met.

First, to initiate clean-up, a nation must generally have jurisdiction over the area it wishes to remediate, or have the permission of the nation with jurisdiction. These parameters will likely be set by the 1982 United Nations Convention on the Law of the Sea, depending on what an individual nation state has set for itself. For an area of the ocean to be "within a nation's jurisdiction" for this purpose, it may be within the territorial sea or, perhaps, the EEZ.[108] If a nation does have jurisdiction over the area of the ocean to be addressed, it is more a question of domestic law. In the United States, for example, it is unclear whether domestic laws that provide for clean-up of CM sites in certain circumstances could even address such ocean dumping sites. International law would probably have little to say about it, as long as no transboundary pollution resulted[109] or the methods of clean-up did not violate international agreements.[110]

If a nation wishes to clean a site that is in the "high seas" it is hard to argue that the nation could not in light of the Convention.[111] However, the nation would probably be subject to a general duty not to pollute or interfere with the uses of other nations as it did so. Whether a nation is violating international law within its own jurisdiction or the high seas, there is a possibility that other nations could intercede through an international tribunal, although the ability to do so effectively is not always certain.[112]

Assuming that a nation willingly seeks to clean-up a dumping area, and has jurisdiction or permission to do so, there are still practical and legal problems. Practically, it is not clear whether technology exists to effectively and safely target and remove CM from the ocean. Even when a dumping area is known historically, the lack of stability in the ocean may have affected the position of dumped CM, and historical records do not even exist for many dumps. Because munitions other than CM were disposed of in the ocean, the task of potential clean-up engineers is complicated further by the necessity of distinguishing between types of munitions.

Legally, even if a nation jumps the hurdle of jurisdiction or permission from a state with jurisdiction, international and national laws may limit the actual methods of disposal available for ultimate disposal of CM. Although a detailed discussion is beyond the scope of this paper, it bears mention that the incineration of stockpile CM, the current method used by the U.S. Defense Department, has been a source of controversy.[113] If a nation attempted to incinerate, or use any other possible method of disposal at sea, particularly in international waters, there may be international law restrictions to consider. It is also not clear, as a practical safety matter, if conventional demilitarization methods would be less safe when used on CM subject to half a century of sea water.

2. *State Actor: Forced Liability*

In the much more likely case of no nation volunteering to take responsibility for clean-up, all the same practical and legal difficulties apply, and one additional difficulty: who should take responsibility and how could liability be enforced? In the case of known, historically verified ocean dumps, the nation that comes closest to responsibility may be the nation that did the dumping. However, even in that case, the answer is not clear.

First, all ocean dumping occurred with some connection to war or national defense. This makes it questionable, as a matter of policy, to hold "dumping" nations responsible, especially if a nation was dumping the stockpiles of a former, belligerent enemy.[114] Also, most military treaties existing at the time that ocean dumping took place "provide indirect environmental protection through measures safeguarding property and human welfare," and do not speak to environmental damage alone.[115] More contemporary agreements and policy do not proscribe past actor liability[116] or explicitly advocate only prospective effect only.[117]

Second, in many cases, the actor or actors responsible for a particular injury or dump site will not be known. Short of "enterprise liability" for many nations of the world, in spite of sovereign immunity and many other legal hurdles, this option seems almost impossible to implement.

Third, even if some international consensus about liability existed with respect to a particular state actor, how could it be enforced? Even if it did apply to past acts, the London Convention lacks an enforcement mechanism.[118] Even though UNCLOS may provide an enforcement mechanism, it probably has no effect on past action. Under customary international law, even when a particular actor is suspected, it is very difficult to meet the test of showing actual damage (in the absence of an actual injury) and a causal connection between the action and resulting damage to the level of clear and convincing evidence.[119] With so many actors using ocean dumping as a disposal method so many years ago, and so often with intervening causes of injury (e.g., the commercial entity employing workers on a fishing boat), it would be almost impossible to force a nation to take responsibility for cleanup or pay damages under existing law.

B. Liability for Potential Consumer or Worker Injuries: A U.S. Perspective

Although only several hundred military munitions were discovered in Delaware during the on-going DoD explosives and munitions emergency response, only one was a CM. These discoveries provide an example of CM that may be discovered and demonstrates that there are effective methods of dealing with *potential* future problems with CM. First, the Department of Defense and its agencies were able to respond to an immediate threat by investigating the source of munitions, screening the clamshell products already purchased by consumers and in the possession of the hauler, and discussing technology options with the commercial entity

processing the contaminated clams. Second, another federal agency (OSHA) was able to address worker safety at the processing plant. Third, a state agency was able to exert jurisdiction over state actors, issuing cease and desist orders, to ensure that safety precautions were followed. Fourth, state and local police were able to respond to immediate threats, and Defense Department EOD military personnel responded to law enforcement requests for support of these explosives and munitions emergencies and they remain ready to respond to future incidents. The Department of Defense is attempting to identify the source of the munitions and if successful will update navigation charts with an appropriate warning to mariners. This demonstrates that should another munitions incident arise, partnerships between state, federal, and military agencies can respond, prevent, and protect against injury.

In addition, injuries to workers at a processing plant can be avoided by OSHA regulation, and if injuries nevertheless do occur, they can be compensated through the worker's compensation system. As discussed above, federal and state actors can work together to avoid consumer injury. However, if a consumer injury occurred, the commercial entities involved may be liable through commercial products liability or other tort and strict liability principles, especially when commercial entities know about the possibility of munitions in their products.

For fishermen injuries, different domestic or international laws of liability might apply.[120] However, the nation under whose flag a ship sails normally has complete jurisdiction over that ship, even on the high seas.[121] Accordingly, domestic laws of that nation should apply. On an international note, international labor agreements may establish minimum international standards, subject to exceptions.[122]

C. Other Preventive Measures

Besides waiting for another potential incident to occur and then responding, other steps can further mitigate risks of past ocean dumping. Education and outreach, even in limited and inexpensive forms, can go a long way to avoid future accidents. It is important to target education to commercial entities to avoid known dumping areas whenever possible, and perhaps more importantly, to educate their crews and other personnel about how to most safely deal with discovered munitions. The general public, especially those who live in coastal areas, should also be educated. To a great extent, known dump sites are already marked on mariners' charts.

The U.S. Defense Department, for example, has already notified state regulators, fishing and trade organizations of the incidents in Delaware, and about what to do if a future incident occurs. Accordingly, commercial entities should also apply their own resources to educating their workers, as it will save money in potential regulatory fines, worker's compensation claims, or consumer tort actions.

There is always a possibility of international regulation of fishing in such areas, but experience with international agreements restricting fishing for environmental reasons have been met with questionable success.[123] Without more research about which areas are best to avoid, and what impact avoiding such areas will realistically have on international fishing interests, this would be difficult to implement.

VI. CONCLUSION

In conclusion, the possible dangers, and legal and practical obstacle course meeting anyone wishing to remove ocean dumped CM, justify and possibly require leaving it in the ocean. A recent incident in Delaware indicates that appropriate government resources are in place to respond to potential threats, should a similar scenario occur with respect to CM.

Further, continuing education efforts offer the best defense against damage in future incidents with any kind of military munitions.

With respect to what can be done internationally, it does not appear that any international agreements already in effect could force clean-up or other action in past ocean dumping. However, the international community may choose to take a different path in the future. In the meantime, coordination of efforts for outreach and education may be helpful, especially when incidents occur.

Domestic laws probably provide the best defense for injured workers or injured consumers (should there ever be any), although parties to international agreements may have minimum international standards to meet in labor laws if they do not take exception.

Ideally, further research about which areas of dumping are the most volatile or house the most potentially dangerous set of weapons would be conducted. This would reduce risk to humans and the environment even further, as these areas could be avoided or special precautions could be taken by those who use them for fishing or other activities. Additionally, it would help promote a better understanding of how these munitions interact with the environment and better technology to address this potential problem, if necessary, in the future.

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[1] James Waczweski, Comment, *Legal, Political, and Scientific Response to Ocean Dumping and Sub-Seabed Disposal of Nuclear Waste*, 7 J. TRANSNATIONAL L. & POL'Y 97, 97 (1997).

[2] Robin Kundis Craig, *Taking Steps Toward Marine Wilderness Protection? Fishing and Coral Reef Marine Reserves in Florida and Hawaii*, 34 MCGEORGE L. REV. 155, 200 (2003).

[3] Munitions which contained a chemical agent fill.

[4] *See* Craig, *supra* note 2.

[5] *See* David A. Koplow, *How Do We Get Rid of These Things?*: *Dismantling Excess Weapons While Protecting the Environment*, 89 NW. U. L. REV. 445, 515 (1995).

[6] *See*, *e.g.*, Jeff Montgomery & Patrick Jackson, *Chemical in WWI-era Shell Injures Three*, NEWS J., July 24, 2004, http://www.delawareonline.com/newsjournal/ (last visited Nov. 11, 2004).

[7] Douglas John Steding, Comment, *Russian Floating Nuclear Reactors: Lacunae in Current International Environmental and Maritime Law and the Need for Proactive International Cooperation in the Development of Sustainable Energy Sources*, 13 PAC. RIM L. & POL'Y J. 711, 737 (2004). *See also* Jutta Brunnée, *The United States and International Environmental Law: Living with an Elephant*, 15 EUR. J. INT'L L. 617, 628 (2004) (The prohibition against causing transboundary environmental damage is a cornerstone of international environmental law. One early source of this prohibition is the Trail Smelter arbitration between the U.S. and Canada).

[8] Mitretek Systems*, Ocean Dumping of Chemical Weapons*, *at* http://www.mitretek.org/home.nsf/HomelandSecurity/OceanDumpChemWeap (last modified May 5, 2004).

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[11] Charles B. Anderson, *Ocean Dumping and the Marine Protection, Research and Sanctuaries Act*, 1 LOY. MAR. L.J. 79, 82 (2002).

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[13] Lieutenant Colonel Warren G. Foote, *The Chemical Demilitarization Program – Will It Destroy the Nation's Stockpile of Chemical Weapons by December 31, 2004?*, 146 MIL. L. REV. 1, 6 n.28 (1994).

[14] Rouse, *supra* note 10, at 34.

[15] *See* COMM. ON REVIEW AND EVALUATION OF THE ARMY CHEM. STOCKPILE DISPOSAL PROGRAM, NAT'L RESEARCH COUNCIL, RECOMMENDATIONS FOR THE DISPOSAL OF CHEMICAL AGENTS AND MUNITIONS, at 23 (1994). *See also* Koplow, *supra* note 5, at 515.

[16] 42 U.S.C. § 4342 (2004).

[17] Anderson, *supra* note 11, at 82.

[18] *Id*.

[19] Koplow, *supra* note 5, at 515 (citing Pub. L. No. 92-532, 86 Stat. 1052 (1972)(codified at 33 U.S.C. §§ 1401-1444 (2004)).

[20] Anderson, *supra* note 11, at 84 (citing 33 U.S.C. § 1412(a)).

[21] Yale Lewis, *Cargo Residues & Cargo-Associated Garbage: Are They Regulated by the Ocean Dumping Act or the Act to Prevent Pollution from Ships?*, 14 U.S.F. MAR. L.J. 269, 273 (2002).

[22] *Id*.

[23] *Id*. at 273.

[24] *See* Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter [hereinafter London Convention], Dec. 29, 1972, art. IV(1)(a),(3),(4), art. III(1)(a)(i), annex I(7), 26 U.S.T. 2403, 1046 U.N.T.S. 120, http://www.londonconvention.org/documents/lc72/lc1972.doc (last visited Mar. 2, 2004). *See also* Lewis, *supra* note 21, at 274.

[25] Office for the London Convention 1972, IMO, *A Brief Description of the London Convention 1972 and the 1996 Protocol*, *at* http://www.londonconvention.org/main.htm (last visited Mar. 2, 2004).

[26] Lewis, *supra* note 21, at 273.

[27] Lieutenant Colonel Warren G. Foote, *Operation Safe Removal: Cleanup of World War I Era Munitions in Washington, D.C.*, 1994 ARMY LAW. 34, 34 (1994). This scope of this paper does not address CM that was not intentionally disposed of, or "dumped," under the definition in the London Convention, art. III(1)(a). One example of CM not intentionally disposed of is the American freighter, the S.S. John Harvey, which exploded and sank during a German raid on Bari, Italy, while carrying 60 to 70 pounds of sulfur mustard (H) bombs. *See* Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8.

[28] Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8 (The United States and Great Britain disposed of captured German stockpiles in the ocean).

[29] *See id*. (provides more detailed information, other sources, and charts and figures). *See also*, U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND, HISTORICAL RESEARCH AND RESPONSE TEAM, SEA DUMPING OF CHEMICAL AGENTS AND WEAPONS CONDUCTED BY THE UNITED STATES, Historical Database No. 26, March 29, 2001, at 1.

[30] U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND, *supra* note 29, at 1.

[31] Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8.

[32] *Id*.

[33] *See* London Convention, *supra* note 24.

[34] Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8.

[35] G. Assennato, D. Sivo, and F. Lobuono, *Health Effects of Sulfar Mustard Exposure Among Apulian Trawlers*, Abstract, *at* http://www.mitretek.org/home.nsf/HomelandSecurity / OceanDumpChemWeap (last viewed Mar. 2, 2004).

[36] *Id*.

[37] *Id*.

[38] *Id*.

[39] *Id*.

[40] Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8.

[41] *Id*.

[42] *Id*.

[43] *Id*.

[44] *Id*.

[45] *Id*.

[46] Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8.

[47] *Id*.

[48] *Id*.

[49] *Id*.

[50] *Id*.

[51] *Id*. *See also*, U.S. ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND, *supra* note 29.

[52] Michele Besso & Mike Billington, *Thirty-Two Live Grenades Found in Clamshells*, NEWS J., Feb. 26, 2004, http://www.delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[53] Terri Sanginiti, *More Old Explosives Found*, NEWS J., Mar. 30, 2004, http://www. delawareonline.com/newsjournal / (last visited Nov. 24, 2004).; Terri Sanginiti, *Grenades Again Found in Clamshells*, NEWS J., Apr. 7, 2004, at 3B, http://www.delawareonline.com/ newsjournal/ (last visited Mar. 3, 2005). Terri Sanginiti & Chip Guy, *Vintage Explosives Found*

in Another Sussex Driveway, NEWS J., Apr. 8, 2004, at 3B, http://www. delawareonline.com/ newsjournal / (last visited Nov. 24, 2004).

[54] Terri Sanginiti & Chip Guy, *A Case of Shell Shock,* NEWS J., May 4, 2004, http://www. delawareonline.com/newsjournal / (last visited Nov. 24, 2004).

[55] Sanginiti & Guy, *supra* note 54. *See also* http://www.seaclam.com/ (last visited Mar. 3, 2005) (website for Sea Watch International states it is the "the world's largest harvester and processor of clamproducts").

[56] Jeff Montgomery & Patrick Jackson, *Chemical in World War I-era Shell Injures Three*, NEWS J., July 24, 2004, http://www.delawareonline.com/ newsjournal / (last visited Nov. 24, 2004). *See also* Jeff Montgomery, *Officials Puzzled by Chemical Shell*, NEWS J., July 28, 2004, at 5B, http://www.delawareonline.com/ newsjournal / (last visited Mar. 3, 2005).

[57] Montgomery, *supra* note 56.

[58] Sanginiti & Guy, *supra* note 54.

[59] Terri Sanginiti, *Up to $20 Million Set Aside to Clear Clamshell Ordnance*, NEWS J., Oct. 1, 2004, at 1, http://www.delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[60] Mid-Atlantic Foods, *Everything You Always Wanted to Know about Clams!*, http://www.mafi. com/mida_allaboutclams.html (last viewed March 14, 2005).

[61] Terri Sanginiti, *Clamshell Ordnance Gets Army Attention*, NEWS J., Aug. 4, 2004, at 1, http://www.delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[62] *Id*.

[63] Terri Sanginiti, *Driveways Searched for Explosives*, NEWS J., Sept. 29, 2004, at 1, http://www. delawareonline. com/newsjournal/ (last visited Mar. 3, 2005).

[64] Sanginiti, *supra* note 59.

[65] *Id*.

[66] *Id*.

[67] Terri Sanginiti, *Clam Plant with Old Ammo Fined $9,000*, NEWS J., Oct. 21, 2004, at A1, http://www. delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[68] *Id*.

[69] Sanginiti, *supra* note 59.

[70] *Id*.

[71] Sanginiti, *supra* note 67.

[72] *Id*.

[73] *Id*.

[74] *Id*.

[75] Terri Sanginiti, *DNREC Issues Orders on Clamshells*, NEWS J., Dec. 31, 2004, at B1, http://www. delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[76] Sanginiti, *supra* note 67.

[77] *Id*.

[78] Terri Sanginiti, *DNREC Orders a Halt to Clamshell Shipments*, NEWS J., Oct. 28, 2004, at B1, http://www.delawareonline.com/newsjournal/ (last visited Mar. 3, 2005).

[79] *Id*.

[80] *Id*.

[81] *Id*.

[82] Sanginiti, *supra* note 75.

[83] *Id*.

[84] *Id*.

[85] Shannon Renton Wolf, Note, *Making Waves: Circumventing Domestic Law on the High Seas*, 14 HASTING'S WOMEN'S L.J. 109, 115 (2003).

[86] *Id*. at 116.

[87] *Id*.

[88] *Id*.

[89] *Id*.

[90] Melanie M. Laflin, Note*, Kidnapped Terrorists: Bringing International Criminals to Justice Through Irregular Rendition and Other QuasiI-Legal Options*, 26 J. LEGIS. 315, 325 (2000) (citing United States v. Williams, 617 F.2d 1063, 1073) (5th Cir. 1980).

[91] Wolf, *supra* note 90, at 117.

[92] *Id*.

[93] *Id*. at 116.

[94] Carol Elizabeth Remy, *U.S. Territorial Sea Extension: Jurisdiction and International Environmental Protection*, 16 FORDHAM INT'L L.J. 1208, 1244 n.220 (1993).

[95] *Id*.

[96] Donna R. Christie, *Living Marine Resources Management: A Proposal for Integration of United States Management Regimes*, 34 ENVTL. L. 107, 164 n.419 (2004).

[97] *Id*.

[98] *See, e.g.*, Cunard S.S. Co. v. Mellon, 262 U.S. 100, 122 (1923).

[99] Robin Kundis Craig, *Regulation of U.S. Marine Resources: An Overview of the Current Complexity*, 19 NAT. RESOURCES & ENV'T 3, 4 (2004).

[100] Craig, *supra* note 104 at 4.

[101] *See, e.g.*, Spector v. Norwegian Cruise Line Ltd., 356 F.3d 641, 649 (5th Cir. 2004).

[102] Christie, *supra* note 101, at 164 n.419.

[103] *See*, *e.g.*, London Convention, *supra*, note 24.

[104] The London Convention has been cited as an example of the "precautionary principle" at work; that is, when countries agree to take preventive action when they believe dumped material is likely to cause harm even when there is not scientific certainty as to that fact. Michael J. Kelly, *Overcoming Obstacles to the Effective Implementation of International Environmental Agreements*, 9 GEO. INT'L ENVTL. L. REV. 447, 482 (1997).

[105] *See* Anderson, *supra*, note 11.

[106] *See*, *e.g.*, Foote, *supra*, note 13.

[107] *See*, *e.g.*, G. Assennato, D. Sivo, and F. Lobuono, *supra* note 35.

[108] *See*, *e.g.*, Christie, *supra* note 101 (discussing the UNCLOS definition of EEZ).

[109] See, *e.g.*, Brunnée, *supra* note 7 at 628.

[110] It would obviously violate the London Convention, for example, to dump most recovered CM elsewhere in the ocean.

[111] *See*, *e.g.*, Remy, *supra* note 99.

[112] *See*, *e.g.*, Steding, *supra* note 7, at 737.

[113] Ekundayo B. George, *Whose Line in the Sand: Can Environmental Protection and National Security Coexist, and Should the Government Be Held Liable for Not Attaining This Goal?*, 27 WM. & MARY ENVTL. L. & POL'Y REV. 651, 681-682 (2003).

[114] *See*, *e.g.,* Mitretek Systems, *Ocean Dumping of Chemical Weapons*, *supra* note 8..

[115] Meredith DuBarry Huston, Comment, *Wartime Environmental Damages: Financing the Cleanup*, 23 U. PA. J. INT'L ECON. L. 899, 904 (2002) (discussing the 1907 Hague Convention IV and Geneva Convention IV).

[116] *E.g.*, the London Convention.

[117] *See*, *e.g.*, EUROPEAN COMMISSION, DIRECTORATE—GENERAL FOR THE ENVIRONMENT, WHITE PAPER ON ENVIRONMENTAL LIABILITY, 9 Feb. 2000, at 29 n.26, http://europa.eu.int/comm/ environment /liability/ white_paper.htm.

[118] James R. McCullagh, Comment, *Russian Dumping of Radioactive Wastes in the Sea of Japan: An Opportunity to Evaluate the Effectiveness of the London Convention 1972*, 5 PAC. RIM L. & POL'Y J. 399, 409-410 (1996).

[119] *Id*. at 412.

[120] *See*, *e.g.*, Daniel H. Wooster, *Welcome Aboard, OSHA: Occupational Safety and Health Regulations May Apply to Uninspected Vessels in State Waters*, 27 MAR. LAW. 227 , 231-232 (2002) (discussing that although OSHA's jurisdiction reaches the Outer Continental Shelf, their ability to regulate some times intersects with the Coast Guard's authority to regulate the high seas).

[121] David S. Weitzel, *Where No Lawyer Has Gone Before? What A Cyberspace Attorney Can Learn from Space Law's Legacy*, 10 COMMLAW CONSPECTUS 191, 202 n.127 (2002).

[122] *See*, *e.g.*, INT'L LABOR ORGANIZATION, C55 SHIPOWNER'S LIABILITY (SICK AND INJURED SEAMEN) CONVENTION, 1936, http://www.ilo.org/ilolex/english/convdisp1.htm.

[123] Carol J. Miller & Jennifer L. Croston, *WTO Scrutiny v. Environmental Objectives: Assessment of the International Dolphin Conservation Program Act*, 37 AM. BUS. L.J. 73, 75 (1999).