P r o c e e d i n g s
16th IAMU Annual General Assembly
Opatija, Croatia, 2015

Sveučilište u Rijeci
Pomorski fakultet Rijeka
University of Rijeka
Faculty of Maritime
Studies Rijeka

IAMU
International Association of Maritime Universities

ENVIRONMENTAL EDUCATION FOR THE MARINER

Nadolny, Walt*

Marine Transportation
State University of New York
Maritime College
USA

Abstract. Under the STCW[1] code all of are charged with teaching Pollution Prevention, Environmental Ethics and Environmental Regulations. We are also directed to teach about overall health and safety. The overarching charge to a mariner is to protect Human Life, The Environment and Property. The compliance of environmental regulations beyond MARPOL is further complicated by differing regulations amongst flag states as well as different areas of said flag states.

This paper will discuss the importance of Incorporating Environmental Management in perspective officer's curricula. At SUNY Maritime we offer a class, Environmental Management that is relevant to both deck and engine students. I would like to present the elements of the class and their relevance to Voyage Planning, Energy Efficient Voyage Planning, Environmental Awareness and Sustainability. The paper will go on to discuss the criminalization of the profession as well as the recommended steps to take to continually prove one's self and vessel in compliance.

The paper and talk will present tools available to assist the mariner in the understanding of his/her responsibilities, references on regulations available and a short film. Penalties for non-compliance will be discussed from a United States Department of Justice point of view. Much of the content was developed with help from a grant by the United States Fish and Wildlife Foundation to further mariner environmental education. The deliverables from the grant included the film as well as a website marinedefenders.com.

My intent would be to present a paper then do a presentation using PowerPoint and a short film. I would like to make my course curricula freely available to any interested member institution.

Key words: culture and communication, human element, maritime education, environmental responsibilities

***Corresponding author**
wnadolny@sunymaritime.edu

[1] Tables A II/1, A II/3, A III/7, A V/1-2-2, A V1-1-2, etc. STCW Code

1 INTRODUCTION

The purpose of this paper is to present an example of a stand-alone environmental course for mariners, both deck and engine. This was developed in 2007 as an elective credit bearing course. Given the importance of the subject it is now mandatory in several deck and engine license curricula.

Under the STCW[2] code all of us are charged with teaching Pollution Prevention, Environmental Ethics and Environmental Regulations. We are also directed to teach about overall health and safety. The overarching charge to a mariner is to protect Human Life, The Environment and Property. Compliance with environmental regulations beyond MARPOL is further complicated by differing regulations among flag states as well as within different areas of said flag states.

In the latest iteration of the STCW code the teaching of environmental awareness, regulations and responsibilities are mandated. The purpose of this class is to makes students aware of the enormous responsibilities they hold with respect to environmental issues, the compliance with ever changing regulations and the legal ramifications of non-compliance.

In 2010 I applied for and was subsequently awarded a grant of $325,000 USD by the United States Fish and Wildlife Foundation. The purpose of the grant was to develop a comprehensive set of tools that were to be used for Mariner Environmental Education. In executing the grant, several components were developed. These included:

A web site (www.marine defenders.com[3]) containing educational material suitable for mariners of every level, from casual through commercial. The website also contains reference links for International, Federal, State and Local regulations. The site includes a direct link for reporting pollution.

A video: "Oil in our Waters"[4] is a 22-minute documentary about the illegal dumping of oil from ships. This film explores the extent of the problem, the impact of oil on the marine environment, the creation of MARPOL, the rewards for whistleblowers, and the penalties faced by polluters caught in the United States.

An iPhone app to be used in reporting spills/incidents to the National Response Center, which is the clearinghouse in the United States for the investigation of marine reporting incidents.

All of the material on the web site, as well as the film are in the public domain of the United States. This material is freely available to any person or institution, provided it is properly attributed.

The class is given over a standard fourteen-week semester and has three credit hours attached to it. The objective of the class is to give the students a thorough understanding of the current environmental laws effecting vessel operation and management. The class will equip students with the knowledge required to operate vessels in full compliance and to reduce individual and corporate legal exposure. The class will also focus on topics such as fuel and waste efficiencies and how they can affect the bottom line of a business or vessel. The class is not exclusive to mariners seeking a license. It is also valuable to both undergraduate and graduate students seeking a thorough understanding of environmental issues and the management of them shore-side.

Key themes throughout the course are:

- Environmental Awareness
- Environmental Responsibilities
- Environmental Appreciation/Stewardship
- Environmental Implications and Impact of Shipping
- Sustainability in Shipping
- Legal Exposure of the Mariner

2 CURRICULA

I Oil Pollution

- MARPOL Annex I[5]

  Discussion of the need for MARPOL[6] due to the Torry Canyon disaster of 1967 and other subsequent tanker disasters.

- Oil Pollution Act of 1990 and amendments (OPA-90)[7]

  This was enacted in response to the Exxon Valdez grounding and defines financial penalties as well as transparency in the tanker trade.

- Clean Water Act (CWA)[8]

  The clean water act applies to all vessels within three nautical miles of the United States Coastline as well as all vessels in US inland waters.

[2] Tables A II/1, A II/3, A III/7, A V/1-2-2, A V1-1-2, etc. STCW Code

[3] http://marinedefenders.com/

[4] http://marinedefenders.com/video/

[5] http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Air%20pollution/Resolution%20MEPC.176%2858%29%20Revised%20MARPOL%20Annex%20VI.pdf

[6] http://www.imo.org/OurWork/Environment/PollutionPrevention/OilPollution/Pages/Background.aspx

[7] http://www.epw.senate.gov/opa90.pdf

[8] http://www2.epa.gov/laws-regulations/summary-clean-water-act

The CWA has been strengthened to include the Vessel General Permit Program[9,10](VGP). This is required of all vessels calling in US waters. It mandates more stringent effluent limits for oil to sea interfaces and exhaust gas scrubber wastewater. This program allows for electronic recordkeeping, requiring an annual report of all vessels.

- State Statutes which exceed CWA and OPA-90
  A number of coastal states have emission caps as well as liabilities exceeding US federal standards. Amongst those are California, Washington and Alaska.
- Discharge Log Requirements and Audits
  All discharge logs are introduced as well as the proper way to make entries. Audit as well as Port State Control supervision is emphasized in the proper method of recordkeeping.
- The Oil Record Book (ORB)
  MEPC and industry guidelines for ORB entries as well as the correct codes are demonstrated. This is very important as the ORB is essential in proving a mariner innocent. Usually this is the first time a deck officer cadet sees and understands how the ORB relates to his/her function on the ship.
- Bilge and Oil/Water Separators
  The bilge systems as well as the types of separators are presented in depth. Proper logging of the operation and discharge limits are explained.
- Legal Exposure, Fines, Accountability, Case Studies
  A mariner in today's regulatory climate is arguably the most legally exposed profession. This is demonstrated by introducing case studies of mariner prosecution. Errors of commission and errors of omission are discussed. Errors or crimes of commission are the illegal violation of one or more laws. Resultant jail time or significant fines can be levied against the company and/or individual mariners. Errors of omission are where mariners may be prosecuted for improper documentation of emissions. These errors include improper filling out of logs, ORB's, etc.

II Sewage Discharges

- MARPOL Annex IV
  The difference between black water and gray water is discussed as well as the discharge areas and limits by coastal states. The impact of sewage pollution is presented from a scientific standpoint.
- Marine Sewage Treatment Plants (Marine Sanitation Devices or MSD's)
  Different types of MSD's are introduced as well as the use of them. The differences between sewage demands of vessel types are explained. A normal cargo vessel, which may have a crew of 25, would have a plant vastly different from a passenger vessel that may have a combined passenger and crew capacity exceeding 6000 people.
- Documentation and Discharge Logs
  The logs and documentation are less onerous than the Annex I responsibilities, but are still important. These insure the vessel is following proper procedure in the discharge of sewage waste.
- Legal Exposure, Fines, Accountability, Case Studies

III Garbage – Chemical Management – Hazardous Waste

- Waste Identification
  All waste falls into several categories. Amongst those are hazardous waste, universal waste, biomedical waste (Red Bag), food waste, United States Department of Agriculture defined food waste, plastics and general trash. Each waste stream requires a different method of proper legal storage, disposal and accounting.
- MARPOL V
  Recent changes in Annex V[11] are explained as well as strategies for waste reduction and recycling. Costs associated with disposal are explained as well as how recycling and waste minimization are effective strategies for both individual vessels and fleets. Types of incinerators as well as proper documentation are presented.
- Resource Conservation and Recovery Act[12] (RCRA)
  This is a US law that mandates the proper identification, storage and disposal of hazardous waste. It applies penalties for improper handling of the waste.
- Garbage Logs
  Under MARPOL V the accounting of waste is done through the garbage log. The log is also subject to inspection by Port State Control. On many vessels a junior officer maintains the log. The proper ways of categorizing, as well as the importance of acute receipts/manifests are explained as well as possible penalties.

[9] http://water.epa.gov/polwaste/npdes/vessels/upload/vgp_fact_sheet2013.pdf

[10] http://water.epa.gov/polwaste/npdes/vessels/Vessel-General-Permit.cfm

[11] http://www.imo.org/OurWork/Environment/PollutionPrevention/Garbage/Documents/Annex%20V%20discharge%20requirements%2001-2013.pdf

[12] http://www.epa.gov/agriculture/lrca.html

- Vessel Sanitation
  Responsibilities regarding vessel sanitation are discussed. Vessels calling in United States Ports are subject to inspection by two additional agencies. The United States Department of Agriculture[13] (USDA) is charged with protecting the United States from food born pathogens originating from different countries. In the US, disposal of all food waste from other countries is required to be processed via high temperature incineration and therefore needs to be landed to a sealed container. The USDA is also charged with the inspection of any imported foodstuffs as well as bulk grain being exported.
  The United States Public Health Service [14](USPHS) is the agency that will conduct sanitation inspections of vessels with emphasis on food preparation areas and potable water. All cruise vessels are inspected twice a year on average. USPHS is also required to investigate any disease outbreaks on vessels and issue quarantine where necessary. This may be done in coordination with the Center for Disease Control (CDC).
- Hazardous Material (HAZMAT)
  The stowage, disposal and personal protection requirements of hazardous material and chemicals are covered. This segment introduces "best management practices" and how proper understanding can result in fewer injuries and deaths.
- Legal Exposure, Accountability
  The improper understanding of chemical and physical material by ships supervisory personnel have resulted in convictions and jail time for involuntary manslaughter in the United States.
- Case Studies
  "Green" alternatives as well as successful waste reduction strategies are discussed.

IV Air Pollution

- MARPOL VI
  MARPOL Annex VI is perhaps one of the most contentious areas of discussion at the IMO-Marine Environmental Protection Committee. The UN, through various conferences and instruments has mandated a reduction of green house gasses worldwide. Shipping as well as aviation are regulated transnationally and come under these auspices.[15] This annex is continually updated in order to reduce emission of GHG's including Carbon Dioxide (CO_2), Nitrous Oxide (NOx), Methane (CH_4), Sulfur Dioxide (SOx) and Particulate Matter (PM) especially in the form of Black Carbon. Black Carbon is damaging to the planets albedo in the arctic.[16]
- California Statutes[17]
  Due to the nature of California's coastal geography, the state has the most restrictive air emissions standards within the United States. The standards are aggressively enforced throughout the state. The ports of LA-Long Beach and Oakland are the gateway ports for US Asian Trade and have the largest number of vessels calling. These ports are the largest sources of air pollution in the state.
- Alaska Statutes[18]
  These pertain to vessels, in particular cruise ships operating in Alaskan waters.
- Low Sulfur Fuel Areas
  The North American Emission Control Area[19] (ECA) mandates Low sulfur fuel within 200 miles of the coastline as well as US possessions. Marine fuels in this area are not to exceed a Sulfur content of 0.10%. Strategies of fuel switching and recordkeeping are introduced. The North American ECA will be the forerunner of ECA's introduced through out the world. It is perhaps the major driver in the search for cleaner fuels in shipping.
- Montreal Protocol[20] and the ship owner/operator
  The Montreal protocol regulates ozone gasses in the atmosphere and is of particular interest due to refrigeration gasses and legacy firefighting systems. This calls for recapture of refrigeration gasses and the documentation of the proper disposal of refrigeration equipment onboard ships. The proper filling out of the associated logbooks is explained.
- Alternative Fuels[21,22]/Cold Ironing[23]/Slow Steaming[24]
  The marine industry is transitioning away from bunker fuel. It has been the fuel of choice due to its low comparative cost versus distillates, etc. The current tide of air and pollution regulations are

[13] http://www.aphis.usda.gov/library/forms/pdf/449_Instructions.pdf

[14] http://www.cdc.gov/nceh/vsp/

[15] http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Greenhouse-Gas-Studies-2014.aspx

[16] http://phys.org/news/2013-08-arctic-sensitive-black-carbon-emissions.html

[17] http://www.arb.ca.gov/ports/marinevess/marinevess.htm

[18] http://dec.alaska.gov/water/cruise_ships/cruise_air.htm

[19] http://www.imo.org/MediaCentre/PressBriefings/Pages/28-eca.aspx

[20] http://ozone.unep.org/new_site/en/montreal_protocol.php

[21] http://www.dnv.com/binaries/PositionPaper_Alt-Fuels_280214_tcm4-592866.pdf

[22] http://www.gastechnology.org/Training/Documents/LNG17-proceedings/7-1-Frederick_Adamchak.pdf

[23] http://www.martrans.org/docs/theses/papoutsoglou.pdf

[24] http://cleantech.cnss.no/best-practices/slow-steaming-to-stay/

making the use of bunkers prohibitive in many areas as more and more ECA's are being introduced.
Cold ironing as a strategy for air pollution has been introduced in many ports. Students are made aware of the benefits as well as the costs.
The concept of "slow steaming" is discussed as a fuel saving/emission reduction strategy.

V Bulk and Packaged Shipments

– MARPOL Annexes II[25] and III
The discussions of Annexes II and III center around how these work with the IMDG[26] code as well as applicable areas of the Safety of Life at Sea Code [27] relate to environmental protection.

VI Ballast Water Management[28]

This newly added set of regulations governs the treatment and release of ballast water. These regulations were needed in order to prevent the spread of invasive species. Invasive species in the United States introduced by shipping have caused Billions of dollars of damage. Treatment methods are explored as well as ballast water exchange. There are differing standards amongst Port States, such as Brazil for example[29], as well as States in the United States[30]. Regulations differ for vessels entering North America's Great Lakes[31] as well. These differing regulations can cause confusion to the ships crew as well as the owners. This segment looks at ways of identifying unique regulations in order to prevent fines or operational delays.

VII Special Area Restrictions[32] and Particularly Sensitive Sea Areas[33] (PSSA)

The process of voyage planning is one of the most important tasks of a mariner. In this process may of the concepts taught in this class come into play as a voyage may pass through one or more special discharge areas under MARPOL. In addition to discharge areas, other factors such as fuel efficiency during the passage, weather, biota and other variables pertaining to proper environmental stewardship are encountered. In sailing through designated PSSA's and Special Areas all of the aforementioned regulation and annexes may come into play. A thorough understanding of the regulations and restrictions makes for a more robust voyage plan. Amongst the areas discussed are:

– Hawaiian Waters[34]
This area has required ship-reporting areas
– Mediterranean
Restrictions relation to Annex's I and V. Also Marine protection areas.[35]
– Wider Caribbean
An ECA restricting Sulfur Dioxide, Nitrous Oxide and Particulate Matter
– Right Whales[36] – US East Coast
This section demonstrates the importance of sharing the seas with other species. The whale regulations are enforced along the US East Coast and serve as a model for speed restrictions, operational awareness and reporting. The dangers of Whale strikes are explained as well as a mariner's obligation under the United States Endangered Species Act[37]. These regulations regarding our obligations to other species serve as an introduction to other areas with similar protections worldwide.
– Polar Areas
Vessels operating in Antarctic waters are under numerous restrictions. These waters are regulated under both MARPOL and the Antarctic treaty[38]. Arctic areas may hold the potential for massive oil and mineral extraction. In response to that, the IMO-MEPC has adopted the International Code for Ships Operating in Polar Waters (Polar Code)[39]. Upon its implementation it will place stricter discharge regulations on vessel operations within the defined waters. These are in addition or other Port State regulations in place.

[25] http://www.imo.org/OurWork/Environment/PollutionPrevention/ChemicalPollution/Pages/Default.aspx

[26] http://www.imo.org/KnowledgeCentre/IndexofIMOResolutions/Documents/MSC%20-%20Maritime%20Safety/328%2890%29.pdf

[27] http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-%28SOLAS%29,-1974.aspx

[28] http://www.imo.org/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx

[29] https://exchange.dnv.com/Documentation/DNVExchange/Fleet/Downloads/Brazil_Ballast%20Water%20Management.pdf

[30] http://www.invasivespeciesinfo.gov/aquatics/ballast.shtml

[31] http://www.greatshipsinitiative.org/GLC_BW_Summary_2013.pdf

[32] http://www.imo.org/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx

[33] http://www.imo.org/OurWork/Environment/PSSAs/Pages/Default.aspx

[34] http://www.papahanaumokuakea.gov/

[35] http://www.cetaceanalliance.org/download/pdf/MedMPA_Hoyt.pdf

[36] http://www.nmfs.noaa.gov/pr/shipstrike

[37] http://www.nmfs.noaa.gov/pr/laws/esa/

[38] http://www.ats.aq/documents/recatt/Att011_e.pdf

[39] http://www.imo.org/blast/blastDataHelper.asp?data_id=29985&filename=A1024%2826%29.pdf

VIII International Safety Management Code[40] (ISM) and Auditing

The ISM code as a tool for environmental compliance is introduced. This sets the stage for the importance of ISM, Class and Port State Control audits of a vessel in continually complying with ever-changing regulations.

3 CONCLUSION

The material presented above is of vital importance to both the mariner and the ship owner. A good understanding of these concepts can prevent fines, detentions, illegal discharges and even incarceration. Criminal charges are not limited to mariners but in many cases the ship owner is held criminally liable [41]. The student taking this class will come away with a thorough knowledge of:

- Environmental Awareness
- Environmental Appreciation/Stewardship
- Environmental Responsibilities
- Environmental Implications and impact of shipping
- Sustainability in Shipping
- A Mariners Legal Exposure
- An understanding of Domestic/International/Regional regulations
- How to ensure compliance via logging/reporting/maintenance requirements
- The importance of environmental aspects of voyage planning
- Penalties for non-compliance including Vessel Detention, Criminal and Financial Liability

It is the author's contention that any curricula for mariners, whether deck, engine or management needs to include a stand-alone course on environmental management/ regulations. The Marine Industry has much at stake in the stewardship and protection of the environment and this necessitates having a full and open discussion with future leaders in the field.

Author's note:

We as a society/industry are relying much more on digital media. All of the texts used in the course are in digital form. Many of the footnotes herein are required reading for student.

[40] http://www.imo.org/OurWork/HumanElement/SafetyManagement/Pages/ISMCode.aspx

[41] http://www.marinelog.com/DOCS/NEWSMMIV/MMIVNov26.html