**PAME II-2018: SEG pre-meeting and agenda item 6.9(c)**

**PAME Proposal submitted by WWF: Recommending Measures for Reducing the Impacts of Grey Water discharges from Vessels in the Arctic**

**Context**

The impacts from shipping can be severe and the risks real to both marine habitat and Indigenous and community food security in the Arctic. Risks are equally high if essential goods and development don’t reach people in the north. The challenge for policy makers is to get the rules right to decrease the impacts and provide opportunity for people in the Arctic. Part of contributing to effective management and regulation of shipping is being on top of emerging social and environmental issues early, to give operators plenty of lead time for adaptive management, which will reduce impacts as soon and as effectively as possible. Grey Water discharges from ships is one such issue.

Vessel grey water is considered accommodation (e.g. shower, bath), laundry, dishwasher, and galley wastewater, and is distinct from drainage from toilets, urinals, hospitals, and cargo spaces.[[1]](#footnote-1) Grey water can contain a variety of environmentally harmful pollutants and contaminants, including microplastics.

Grey water discharge, and the associated impacts of microplastics on the marine environment and its effects on marine biodiversity, have received increasing attention as of late. For example, in a submission[[2]](#footnote-2) to the IMO’s MEPC 72 co-sponsors outline concerns associated with vessel grey water discharges from international shipping, and that same Committee took the significant step by agreeing to develop an action plan to address marine plastic litter from ships and linking grey water as a vector for microplastic pollution.

Various IMO member states have raised the grey water issue in the past,[[3]](#footnote-3) and in paragraph 2.36 of MEPC 63/23, the Committee agreed “that handling of grey water and sewage water on board ships should be regulated under MARPOL Annex IV and invited Parties to propose relevant amendments to that Annex for consideration at a future session of the Committee.”

At the IMO’s MEPC72 meeting there was agreement to establish a working group on marine plastic litter and the need for the “Development of an action plan to address marine plastic litter from ships in the 2018-2019 biennial agenda of the MEPC, assigning the PPR Sub-Committee as the associated organ, with a target completion year of 2020.”[[4]](#footnote-4) In addition the Committee invited Member Governments and international organizations to submit concrete proposals to MEPC 73 on the development of the action plan. In its (draft) report from MEPC 72 the Committee stated “…there were many different vectors in relation to the sources of marine plastic litter which were worth considering, including the microplastics vector via laundry waste from grey water from ships; [and] …marine litter posed an increasing threat to the marine environment and coastal communities; microplastics had been recognized as a threat to human health due to their potential for entry into the food chain; a policy of prevention and reduction was the key to the fight against marine litter;’

**Background – Grey Water**

The discharge of waste from vessels is regulated by the International Maritime Organization (IMO) under the International Convention for the Prevention of Pollution from ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78). Vessel sewage has been regulated under MARPOL Annex IV since 2003. However, vessel grey water is not regulated internationally, even though it has similar pollution impacts and is produced in greater quantities than sewage on commercial vessels[[5]](#footnote-5) On cruise ships, grey water can constitute 90 percent of liquid waste generated on board.[[6]](#footnote-6)

**Vessel grey water characteristics and environmental impacts[[7]](#footnote-7)**

Vessel grey water constituents and characteristics include nutrients, elevated temperatures, increased turbidity, oil and grease, detergent and soap residue, metals (e.g. copper, lead, mercury), bacteria, pathogens, hair, food particles, organic matter, oxygen-depleting substances, suspended solids, bleach, pesticides, and phosphates.[[8]](#footnote-8)

Bacteria and biochemical oxygen demand levels, among others, are often higher in vessel grey water than black water.[[9]](#footnote-9) Pollutants in grey water can contribute to adverse environmental effects such as shellfish contamination,[[10]](#footnote-10) algal blooms, hypoxic waters, the smothering of benthic biota (e.g. reef-building corals), and invasive species introductions.

These contaminants can also impact economically and culturally important fisheries (reference pending). Grey water discharges can impair (more detail on how) phytoplankton, which are the base of the food chain for higher trophic level species such as salmon. Commercial salmon fishing in the state of Alaska generates millions of dollars in revenue annually, while sport fishing is important for tourism. In addition, subsistence salmon fisheries provide food for hundreds of Alaskan coastal communities, including indigenous villages, and help sustain their way of life.

Vessel grey water pollutant loads can be substantial. One study determined that in the port waters of Dubrovnik, Croatia, a large proportion of the estimated 1.4 x 1015 of faecal coliforms from cruise ship wastewater is likely attributed to untreated grey water.[[11]](#footnote-11) Other pollutants in grey water, however, may present an even greater environmental threat. The U.S. EPA has remarked that “Graywater has the potential to cause adverse environmental effects because measured concentrations and estimated loadings of nutrients and oxygen-demanding substances are significant.”[[12]](#footnote-12) The agency has further indicated that “Copper, lead, mercury (a bioaccumulative chemical of concern), nickel, silver, and zinc were detected in concentrations that exceed acute Federal criteria and State acute water quality criteria.”[[13]](#footnote-13)

Micropollutants from vessel discharges are also an emerging concern. Cruise ship grey water effluent may contain UV-filters, ointment residues, caffeine, flame retardants,[[14]](#footnote-14) and microplastics.[[15]](#footnote-15) The microplastic content in grey water would derive from personal care products, washing of laundry etc., and is correlated to the number of persons on board the ship.[[16]](#footnote-16)

**Vessel grey water generation rates**

Passenger vessels tend to produce more grey water on a per capita basis than cargo ships.[[17]](#footnote-17) The U.S. EPA, based on 29 cruise ships, indicated average grey water production to be 255 litres per person per day (l/p/d). The Alaskan Cruise Ship Initiative used 189 to 246 l/p/d of grey water as a rule of thumb.[[18]](#footnote-18) A 2009 DNV study found median grey water production rates of 179 l/p/d, which aligned with an earlier Norwegian-based study that revealed passenger ships produced 200 l/p/d.[[19]](#footnote-19) Meanwhile, DNV indicated crew generation rates of 105 l/p/d for tankers, 127 l/p/d for cargo ships, and 175 l/p/d for offshore vessels. VARD, in its 2015 report, estimated grey water production rates of 125 l/p/d aboard cargo ships.[[20]](#footnote-20)

Hence, even moderately sized cruise ships can produce extensive amounts of grey water over short durations. WWF Canada estimated that during the **Crystal Serenity’s** 12-day transit through Arctic Canadian waters it produced and discharged 5,000 m3 of grey water.[[21]](#footnote-21) Cruise ship size, though, is increasing substantially, and Royal Caribbean’s Oasis-class vessels can carry nearly 9,000 passengers and crew, yielding about 2,000 m3 of grey water a day. While many cruise ships are equipped with Advanced Wastewater Treatment Systems (AWTS), some cruise ships are being built with traditional, underperforming Type II marine sanitation devices (MSDs)/sewage treatment plants (STPs).[[22]](#footnote-22)

Aggregate calculations on vessel grey water production or discharge at the national and sub-national levels are relatively scarce. Nevertheless, there is some available information. For instance, ships generated 5,979,640 m3 of grey water in Norwegian waters, according to a DNV study in 2007.[[23]](#footnote-23) In Arctic Canadian waters, in 2013, vessels rendered 27,445 m3 of grey water.[[24]](#footnote-24) For the Croatian Adriatic Sea, in 2009, cruise ship grey water generation was 565,080 m3.[[25]](#footnote-25) A 2011 EPA study found that ships in the Great Lakes and coastal U.S. waters – out to 3nm – produced between 12.8M and about 14.4M cubic meters of grey water per year.[[26]](#footnote-26) Locally, vessel grey water amounts can be sizeable, too. Grey water production by cruise ships at the Port of Dubrovnik for 2009 and August 2014 through July 2015 were 201,253 m3 and 89,457 m3, respectively.[[27]](#footnote-27)

Consolidated global vessel grey water generation or discharge figures aren’t readily available. However, based on European, Arctic Canadian, and U.S. numbers, and making some reasonable assumptions, a worldwide figure for grey water production for the commercial vessel sector would likely be in the hundreds of millions of cubic meters annually.

**Grey water regulation in certain areas**

The present 2013 U.S. EPA Vessel General Permit (VGP)[[28]](#footnote-28) grey water requirements are related to vessel type and location. For example, vessels greater than 400 gt that routinely travel more than 1 nm from the coast and can store grey water would have to discharge it at least 1 nm from shore while underway, treat it to the appropriate standard, or offload it to a landside facility. In addition, cruise ships (both large and medium size) at dock must treat the grey water to applicable standards (as defined in 40 CFR 133.102)[[29]](#footnote-29) or dispose of it to a reception facility. These vessel categories, along with large ferries, must keep records estimating all discharges of untreated grey water that reference volume, date, location, and vessel speed at time of discharge.[[30]](#footnote-30) The VGP also includes mandatory best practices, such as minimizing the generation and discharge of grey water in ports, that apply to all relevant vessels. A separate regulatory system in the United States, under the Clean Water Act, pertains to commercial vessels operating on the Great Lakes, and mandates grey water treatment through an approved MSD, or onboard storage for subsequent shore-side disposal.[[31]](#footnote-31)

The State of Alaska’s treatment of vessel grey water extends nearly two decades and is governed by federal and state legislation.[[32]](#footnote-32) Large cruise ships in Alaskan waters must treat grey water (and sewage) to standards only achievable through an AWTS.[[33]](#footnote-33) These AWTS, if properly maintained, can be “very effective at removing pathogens, oxygen-demanding substances, [and] suspended solids” and moderately effective in reducing levels of nutrients and dissolved metals.[[34]](#footnote-34) The Alaskan regulatory scheme also requires sampling, testing, recordkeeping, and reporting of grey water, among other pollutants, for large cruise ships,[[35]](#footnote-35) and institutes an innovative third-party monitoring scheme, called the Ocean Ranger program, to ensure and verify compliance. Finally, the U.S. EPA can designate grey water no-discharge zones in Alaskan waters.

The four California National Marine Sanctuaries and the Olympic Coast Sanctuary in Washington also impose vessel grey water discharge restrictions. As well, California has banned grey water discharge into its marine waters or a marine sanctuary by large passenger vessels and ocean-going vessels with adequate storage capacity. Maine has prohibited the discharge of untreated grey water or a mixture of grey water and sewage into state waters by large passenger ships. These waste streams may be discharged when treated to comply with federal standards established for Alaskan waters, a discharge record book is maintained, and periodic sampling and reporting are undertaken.

Operators of new large passenger vessels voyaging in Canadian waters south of 60 degrees north latitude must treat grey water prior to discharging it within 3 nm of the coast or release it outside of 3 nm.[[36]](#footnote-36) Vessel grey water is also prohibited from release in British Columbia’s inland waters.[[37]](#footnote-37) But, vessel grey water discharge is allowed in Arctic Canadian waters, if not deemed a “waste” that would degrade the natural environment and attendant human uses.[[38]](#footnote-38)

In Europe, the EU Inland Waterway Directive (2012/49/EU) has grey water discharge requirements equivalent to sewage standards and an enforcement regime. HELCOM has also recently discussed vessel grey water matters,[[39]](#footnote-39) and Svalbard has vessel grey water discharge restrictions for certain protected areas.[[40]](#footnote-40)

With respect to the Pacific, Australia’s Great Barrier Reef Marine Park Authority offers guidance on the types of soaps and cleaners to be used on vessels within the marine park as well as location of grey water discharges.[[41]](#footnote-41) In addition, Vanuatu prohibits the discharge of vessel grey water in port waters.[[42]](#footnote-42)

**Recommending Measures for Reducing the Impacts of Grey Water discharges from Vessels in the Arctic – Partnerships and Linkages**

* Participation from industry such as AECO, CLIA, and the PAME Best Practices Forum, are essential to ensure study and guidelines are grounded in operational and logistical realities of shipping in the Arctic.
* Linkages should be explored with: CAFF, in relation to invasive species; and PAME’s current Marine Litter project as it relates to microplastic impacts
* The proposal will advance the implementation of all 4 goals of the Arctic Council's Arctic Marine Strategic Plan (2015-2025); more precisely it will contribute to implementing the following AMSP strategic actions: (<http://www.pame.is/images/03_Projects/AMSP/AMSP_implementation_Final.pdf>)
  + 7.1.2 Improve, synthesize, and respond to emerging knowledge across all disciplines and sectors to include government, academic and industry information, and traditional and local knowledge
  + 7.1.3 Improve the understanding of cumulative impacts on marine ecosystems from multiple human activity-induced stressors such as climate change, ocean acidification, local and long range transported pollution (land and sea-based), marine litter, noise, eutrophication, biomass overharvesting, invasive alien species and other threats
  + 7.1.8 Improve awareness of Arctic shipping activity and its impacts, promote expanded information sharing of ship traffic data among Arctic states and, as appropriate, other stakeholders, and update selected parts of the 2009 Arctic Marine Shipping Assessment (AMSA) Report, including those pertaining to the volume, composition and destination of Arctic shipping, shipping impacts, and key infrastructure needs such as hydrographic surveying and nautical charting.
  + 7.1.11 Support continued development of circumpolar indicators of changes and stressors across the Arctic marine environment, as well as metrics for monitoring biodiversity. [not sure]
  + 7.2.1 Promote the implementation of the ecosystem approach to management in the Arctic through synthesis and application of the results of relevant work by the Arctic Council and associated efforts by relevant organizations.
  + 7.2.2 Identify and assess threats and impacts to areas of heightened ecological and cultural significance and how such areas may be influenced in the future by climate change and other human induced changes and activities.
  + 7.2.3 Identify and develop tools and methodologies for assessing cumulative impacts and risks for Arctic marine ecosystems and areas of heightened ecological and cultural significance with the aim of using them for integrated assessments.
  + 7.2.4 Encourage the Arctic states to implement appropriate measures, – or to pursue such measures at relevant international organizations to protect Arctic marine Areas of Heightened Ecological and Cultural Significance. Focus should be on species and ecosystems particularly at risk from climate change and cumulative impacts, including areas of refuge for ice-associated species that are, or are expected to become particularly important to Arctic marine biodiversity under future climate conditions.
  + 7.2.7 Promote cooperation among Arctic and non-Arctic states to address threats to the staging and wintering grounds and migrating corridors of migratory species using the marine environment.
  + 7.2.10 Develop a pan-Arctic network of marine protected areas, based on the best available knowledge, to strengthen marine ecosystem resilience and contribute to human wellbeing, including traditional ways of life.
  + 7.3.1 Advance EBM as an overarching framework for conservation and sustainable use of living and non-living resources in the Arctic marine environment, taking into account cumulative impacts on the Arctic and the need for adaptation to climate change.
  + 7.3.5 Develop recommendations for consideration by Arctic states to promote maritime safety and environmental protection with the objective of reducing risks related to international shipping activities in Arctic waters.7.3.6 Advance continuous improvement of safety and environment protection performance and the use of best and most appropriate practices and technology for all marine activities.
  + 7.3.8 Promote the management of human activities in the circumpolar Arctic in accordance with Ecosystem Based Management and international law to ensure long term sustainability of stocks and ecosystems.
  + 7.3.12 Strengthen the dialogue with relevant business, industry and environmental stakeholders and Arctic inhabitants in order to foster conservation and sustainable use of the Arctic marine environment.
  + 7.3.13 Strengthen the dialogue with industry (including through the Arctic Economic Council) in order to foster sustainable development in the Arctic.
  + 7.4.1 Improve meaningful engagement of Arctic indigenous peoples and other Arctic inhabitants in relevant decisions, including through the consideration and use of traditional and local knowledge (TLK) in avoiding or mitigating negative environmental, subsistence, and cultural impacts, as well as in maintaining or increasing wellbeing and socioeconomic opportunities.
  + 7.4.2 Facilitate coastal community exchanges between Arctic states to improve sharing of knowledge and experiences and to strengthen the dialog with relevant business and industry in the Arctic in order to foster the conservation and sustainable use of the Arctic marine environment.
  + 7.4.4 In cooperation with the Permanent Participants, encourage engagement, as appropriate, with indigenous peoples organizations and bodies, that have specialized in traditional knowledge and that can inform the work of the Arctic Council in the protection of the marine environment and in enhance the well-being and the capacity of Arctic inhabitants, including Arctic indigenous peoples to deal with a changing Arctic and increased activity.
* The proposal will also advance the implementation of the following CAFF Actions for Arctic Biodiversity:
  + Advance ecosystem-system based management recommendations approved in the Kiruna Declaration (including Actions 3.1 to 3.4).
  + Strengthen and develop new strategic partnerships, particularly with industry, to seek innovative solutions and expand responsibility for taking care of biodiversity (Action 4.1).
  + Provide information, expertise, and recommendations on conservation of Arctic ecosystems to policymakers (action 4.5).

**Potential PAME Outputs and Activities**

Phase one – Guideline drafting

1. Reach out to CAFF and within PAME to explore partnerships and linkages.
2. Invite presentations and advice from leading academic, Indigenous, and science experts on grey water discharges to be given to the PAME expert shipping group. Also investigate approaches within HELCOM, Barcelona Convention, and Regional Seas initiatives.
3. Convene a subcommittee including Member States, PP, Observers of the PAME expert shipping group, to study and draft the Guidelines. Ensure diverse participation and views, especially from PPs are included in the discussion.
4. Submit the draft Guidelines to the PAME expert group for discussion and comment.
5. Submit the finalized Guidelines to PAME for adoption and inclusion on the PAME website as a resource.

Phase two – Knowledge Sharing

1. Members of the PAME expert group participate in a side event at the IMO’s MEPC to build awareness on the Guidelines.

1. *E.g.*, Resolution MEPC.219(63), 2012 Guidelines for the Implementation of MARPOL Annex V. [↑](#footnote-ref-1)
2. MEPC 72/16/6 [↑](#footnote-ref-2)
3. *See also* Norway, MEPC 60/21/1, 12 Jan. 2010; Norway, DE 54/INF.5, 20 Aug. 2010; Norway, DE 54/13/7, 20 Aug. 2010; New Zealand, DE 55/12/3, 17 Dec. 2010. [↑](#footnote-ref-3)
4. MEPC 72 draft final report [↑](#footnote-ref-4)
5. Five times as much grey water is generated and processed compared to sewage every day for a standard size cruise ship of 4,000 passengers and crew (1000 m3 v. 200 m3). R. Fiebrandt (Director, Environmental Operations, NCL), Standardization for Marine Sanitation Devices Operator Perspective, prepared for ATSM Committee F25 on Ships and Marine Technology, slide 3, undated. [↑](#footnote-ref-5)
6. C. Copeland (2008). Congressional Research Service Report for Congress. Cruise Ship Pollution: Background, Laws and Regulations, and Key Issues. Updated July 1, 2008, CRS-4, *available at* https://digital.library.unt.edu/ark:/67531/metadc87283/. [↑](#footnote-ref-6)
7. Since ship’s holding tanks are often inter-connected, grey water transport, holding, and discharges may interfere with compliant management of regulated waste streams, such as sewage, bilge water, food wastes, and ballast water (see Norway, MEPC 63/2/18, 23 Dec. 2011). [↑](#footnote-ref-7)
8. U.S. EPA (2009). Cruise Ship Discharge Assessment Report, 4-1, EPA 842-R-07-005 [hereinafter EPA Cruise Ship Report]; U.S. EPA (2011). Graywater Discharges from Vessels, 2, EPA 800-R-11-001; U.S. EPA (1999). Technical Development Document for Phase I Uniform National Discharge Standards for Vessels of the Armed Forces, Appendix A, Graywater 5-6, EPA 821-R-99-001. [↑](#footnote-ref-8)
9. EPA Cruise Ship Report, at 3-9; MEPC 72/INF.21; Alaska Cruise Ship Initiative Part 2 Report. Juneau, AK. “The conclusion that [*sic*] can be drawn from the pollutant concentration data in Table 4 [Table 2 in MEPC 72/INF.21] is that graywater from commercial vessels has the potential to be as environmentally damaging to surface waters as untreated domestic sewage discharged in similar quantities.” EPA 2011, at 9. [↑](#footnote-ref-9)
10. *See* J. Carlos et al. (2014). Environmental transmission of human noroviruses in shellfish waters. Applied and Environmental Microbiology 80 (2014) 3552-3561. [↑](#footnote-ref-10)
11. T. Peric (2016). Wastewater pollution from cruise ships in coastal sea area of the Republic of Croatia. Scientific Journal of Maritime Research 30 (2016) 160-164. [↑](#footnote-ref-11)
12. EPA 1999 at Appendix A, Graywater 7; *see also* Wärtsilä, FOEI, and WWF (2015). Marine Wastewater Pollution: Confronting Grey Water and Implementing Annex IV effectively, presentation by Dr. Wei Chen (Wärtsilä) for MEPC 68 side event (May 2015). [↑](#footnote-ref-12)
13. *Id.*, at 5-15. [↑](#footnote-ref-13)
14. L. Westhof et al. (2016). Occurrence of micropollutants in the wastewater streams of cruise ships. Emerging Contaminants 2 (2016) 178-184. [↑](#footnote-ref-14)
15. *E.g.*, F. De Falco et al. (2017). Evaluation of microplastic release caused by textile washing processes of synthetic fabrics. Environmental Pollution XXX (2017) 1-10, in press (estimating over 6 million synthetic microfibers released from polyester fabrics per wash load); *cf.* Secretariat, LC 39/9/1, 18 Aug. 2017. [↑](#footnote-ref-15)
16. K. Magnusson et al. (2017). Swedish sources and pathways for microplastics to the marine environment. Swedish Environmental Research Institute 2016, Report C183, at 55. [↑](#footnote-ref-16)
17. This is the case because cruise passengers “are engaged in leisure activities and more likely to use larger quantities of water for bathing, food preparation, etc.” EPA 2011, at 6. [↑](#footnote-ref-17)
18. EPA Cruise Ship Report, *supra* note 5, at 3-3. [↑](#footnote-ref-18)
19. Det Norske Veritas (2009). Study on Discharge Factors for Legal Operational Discharges to Sea From Vessels in Norwegian Waters, 12, prepared for the Norwegian Maritime Authority (Report No. 2009-0284, rev. 2). [↑](#footnote-ref-19)
20. VARD (2015). Projections for ship-generated waste traveling through the Canadian Arctic, 27, Report #: 319-000. June 26, 2015. [↑](#footnote-ref-20)
21. Melissa Nacke, WWF Canada, Harmonizing Grey Water Regulations Nationally & Internationally, CMAC Nov. 15-16 2017, Iqaluit, Canada. [↑](#footnote-ref-21)
22. “[W]e estimate that at least 47% of newly built capacity over the next 10 years will be using advanced wastewater treatments.” EERA (2017). Final Report: Evaluation of Cruise Industry Global Environmental Practices and Performance, prepared for CLIA, at E-2, *available at* http://cruising.org/docs/default-source/research/environment-research-2017.pdf. [↑](#footnote-ref-22)
23. DNV 2009 report citing Driftsutslipp till luft og sjo fra skistrafikk i norske havomrader. DNV Report No. 2007-2030, Revision 1. On behalf of NIVA and SFT. [↑](#footnote-ref-23)
24. VARD 2015, *supra* note 16, at 32. [↑](#footnote-ref-24)
25. H. Caric (2012). Cruise Tourism Environmental Risks (Chap. 5) *in* Cruise Tourism and Society: A Socio-economic Perspective, A. Papathanassis et al. (Eds.), Springer-Verlag Berlin Heidelberg. [↑](#footnote-ref-25)
26. EPA 2011, *supra*  note 5, at 7. [↑](#footnote-ref-26)
27. Caric 2012, *supra* note 21; Peric 2016, *supra* note 8. [↑](#footnote-ref-27)
28. *See* Final National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges Incidental to the Normal Operation of a Vessel, 78 Fed. Reg. 21,938 (Apr. 12, 2013); EPA VGP webpage *at* https://www.epa.gov/npdes/vessels-vgp/. [↑](#footnote-ref-28)
29. Grey water discharge standards are 20 CFU/100 ml (30-day geometric mean) for fecal coliform bacteria, 10 µg/L for total residual chlorine, and secondary treatment standards for suspended solids, BOD5, and pH. [↑](#footnote-ref-29)
30. EPA 2011, *supra* note 5, at 4. EPA has reckoned that between 43,000 and 50,000 vessels are subject to grey water discharge limitations in the 2013 VGP. *Id.*  [↑](#footnote-ref-30)
31. *See* 33 U.S.C. § 1322(a)(10). [↑](#footnote-ref-31)
32. *See* Title XIV of Division B of H.R. 5666, 114 Stat. 2763A-315, codified at 33. U.S.C. Sec. 1901 Note; ALASKA STAT. §§ 46.03.460-46.03.490; ALASKA ADMIN. CODE tit. 18 §§ 69.010-69.990. [↑](#footnote-ref-32)
33. *Id.*  [↑](#footnote-ref-33)
34. EPA Cruise Ship report, *supra* note 5, at 2-13; *see also* ADEC (2014). Large Commercial Passenger Vessel Wastewater Discharge Fact Sheet for General Permit No. 2013DB0004 (Revision 1), Appendix D. [↑](#footnote-ref-34)
35. Title XIV of Division B of H.R. 5666, 114 Stat. 2763A-315, codified at 33. U.S.C. Sec. 1901 Note; ALASKA STAT. § 46.03.460. [↑](#footnote-ref-35)
36. Pollution Prevention Guidelines for the Operation of Cruise Ships under Canadian Jurisdiction - TP14202E (2013), Secs. 18 & 90. [↑](#footnote-ref-36)
37. <http://www.env.gov.bc.ca/bcparks/explore/gen_info/greywater_fact_sheet.pdf>. [↑](#footnote-ref-37)
38. *See* Arctic Waters Pollution Prevention Act, Secs. 2 & 4(1). [↑](#footnote-ref-38)
39. *See* HELCOM (2016). Outcome of the 16th Meeting of the Maritime Working Group (Maritime 16-2016), Tallinn, Estonia, 6-8 September 2016, especially section 5.13 and Annex 4, section III. [↑](#footnote-ref-39)
40. https://www.sysselmannen.no/globalassets/sysselmannendokument/kart/ferdselsreguleringer\_rev2014\_engelsk.pdf [↑](#footnote-ref-40)
41. <http://www.gbrmpa.gov.au/onboard/stewardship-and-best-practice/responsible-reef-practices/wastewater-sewage,-greywater-and-bilge-water>. [↑](#footnote-ref-41)
42. Secretariat, MEPC 47/12, 6 Nov. 2001. [↑](#footnote-ref-42)