

# WASTEWATER PRACTICES IN THE ARCTIC: QUALITATIVE INSIGHTS

REPORT OF  
FINDINGS

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ARCTIC COUNCIL

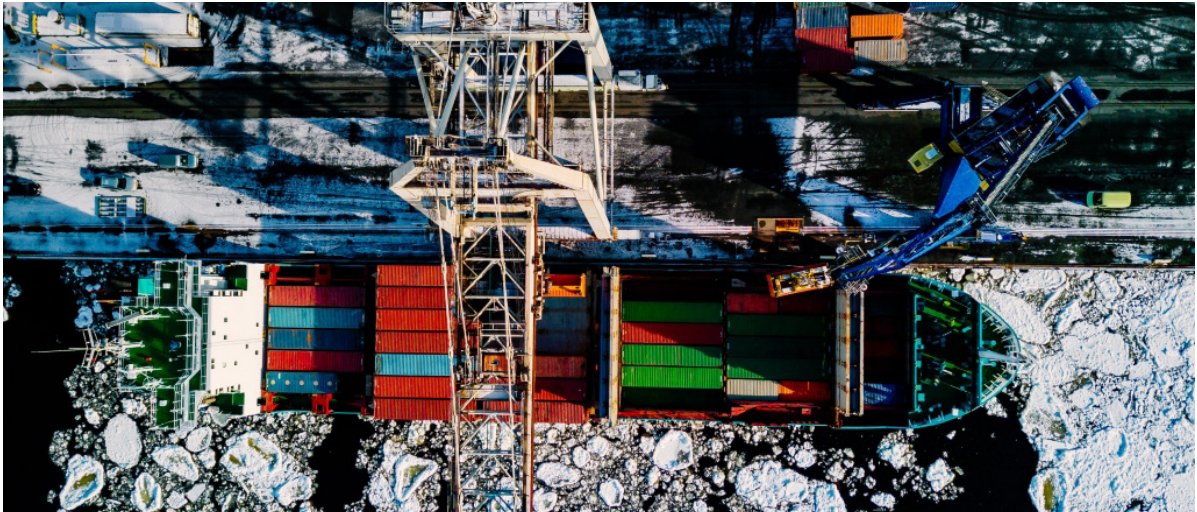
**PAME**

Protection of the Arctic Marine Environment

**ENVIRONICS  
RESEARCH**

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## INTRODUCTION

The Arctic Council's Working Group on the Protection of the Arctic Marine Environment (PAME) initiated this project to understand current practices for select wastewaters in the Arctic, i.e., scrubber wash water, greywater and sewage.

The project was included in the PAME Work Plan 2021-2023. It was led by Iceland, WWF and CCU with support from the United States, China, and AECO (Arctic Expedition Cruise Operators).

The Environment Agency of Iceland and WWF supported the project with a financial contribution.

Environics Research, one of Canada's leading research consulting firms, was hired to conduct the research. This report presents the contractor's interpretation of the study results.



# PROJECT OBJECTIVES

**Goal: build foundational knowledge about wastewater practices in the Arctic.**

With the expectation that Arctic shipping traffic will increase, there is a clear policy challenge in developing rules and regulations for wastewater (scrubber effluent, sewage and greywater). An important starting point is **understanding current practices, the opportunities that exist and the barriers to change.**

These research findings will inform dialogue within the Arctic Council as well as the International Maritime Organization (IMO).



# METHODOLOGY

## Approach:

Environics used an “in-depth interview” (IDI) approach. Without a list of direct email or phone contacts for shipping companies operating in the Arctic, project champions assisted in locating interviewees. From there, a conversation-based approach to the research helped us build rapport with respondents, ensuring they felt comfortable participating.

IDIs are a qualitative methodology (i.e., do not produce quantitative statistics). This approach was deliberately selected because (a) it is guided by a standard set of questions while still giving the moderator flexibility to navigate the conversation to get the full benefit of respondents’ expertise, and (b) goes beyond survey questions to uncover the reasons behind respondents’ wastewater practices. Responses reflect what participants told us they do, and why.

## Completions:

12 interviews completed, averaging 30-45 minutes in length. Interviews were conducted with one or more individuals identified by their organization as best positioned to speak about wastewater practices.



# LIMITATIONS

## Barriers and limitations:

- Reluctance to participate in the research stemmed from a few reasons:
  - Timing and the impact of COVID-19 on operators (both cruise and shipping/supply chains)
  - Lack of engagement in topic/not having anything to share
  - Concerns about how the information would be used, especially on the regulatory side
- These concerns are not specific to this topic but exist for all surveys of experts/professionals. The most effective solution is the involvement of project champions to build trust and engagement.
- On the recommendation of PAME, an online (open link) version of the survey was attempted but received no take up (zero completions).
- Despite these limitations, we highly appreciate the project steering committee members who worked hard to make connections, resulting in 12 insightful interviews.
- The amount of content included in the interview guide was too much to cover during the time allotted for each interview (30-45). Thus, not every question was asked in each interview; in particular, the garbage questions had to be excluded from most interviews.



# INTERPRETING THE RESULTS

## Profile of participating organizations (12):

Industry: Cargo (3), passenger/cruise (9) including one association representative

Geographic location: Europe (Norway, Germany, France), Canada, Alaska. Skews to companies operating in areas with more stringent regulations (Arctic, Baltic, Alaska) and thus have greater interest in the research topic.

Vessel age and type: Skews to companies with new or recent builds, often with Advanced Wastewater Treatment Systems (AWTS) on board. No participating vessels reported using scrubbers.

**Limitations:** Due to the small sample size and limited representation across the shipping industry, results from this research should be considered directional in nature.

**Interpreting the results:** Despite the limitations, there is considerable value to be gained from this research.

- 1. Cruise ship operators are highly relevant to this discussion.** Although the sample size is small relative to the number of Arctic operators globally, the interviews included some of the most impactful actors – with cruise ships generally producing far more wastewater than other vessel types.
- 2. Change requires a starting point.** This research represents the start of a conversation about how to achieve change (the “thin edge of the wedge”), by focusing on an audience that skews towards early adoption of advanced wastewater practices.
- 3. Developing a deeper understanding.** The interviewees are experts in their fields and have shared their hard-earned knowledge in good faith, so that we can learn from their experiences. Their responses provide a deeper understanding of the opportunities for and challenges to improved wastewater practices, which can serve as the basis for future information-gathering.

## KEY INSIGHTS

The following key insights are drawn from interviews with a small number of shipping operators who are further along the adoption curve of advanced technology to treat wastewater:

- 1. Identify and promote technological solutions.** All participating operators reported following the minimum MARPOL (the International Convention for the Prevention of Pollution from Ships) and Polar Code regulations, and some of them report sometimes going above and beyond. Passenger/cruise operators referred mainly to AWTS installation as evidence of their efforts to treat greywater and sewage/blackwater beyond current requirements; it is unclear how bulk carriers are treating greywater (if at all). Thus, there is a need to identify solutions for non-passenger vessels (e.g., cargo, fishing); other research on small units by offshore oil and gas platforms suggests the potential for advanced technology for vessels with smaller crews. (There is also a need to understand technological solutions to scrubber effluent, which was not relevant to the vessels in this study).
- 2. Address pain points along the technology adoption curve.** While participating operators acknowledged the value of AWTS in addressing wastewater, a few raised the need to **for training and strict enforcement to ensure AWTS is used as intended.** Other barriers that could be addressed include:
  - If AWTS are typically limited to new builds, what can be done about retrofits?
  - Ensuring a forward-looking regulatory environment that allows companies to effectively plan ahead
  - Addressing port infrastructure so it is not a barrier to zero discharge
  - Compiling better data on wastewater treatment facilities in/capacities of Arctic ports

## KEY INSIGHTS (CONTINUED)

- 3. Change is difficult to achieve without regulation.** Participating shipping companies **acknowledge the importance** of improving wastewater practices in the Arctic, but **don't believe things will shift quickly enough by relying on voluntary change by individual companies.** They suggest change of this magnitude requires the weight of numbers: all companies required to make changes, by levelling the playing field through regulation (international and local). Industry guidelines may have a role to play but are insufficient given their voluntary nature.
- 4. Share learnings.** Early adopters are creating considerable knowledge as they lead the way in wastewater treatment, particularly around practices that generate the best environmental outcomes and how to overcome barriers. **This information needs to be shared & disseminated more widely to speed up adoption** – including among smaller companies with fewer resources that may not be part of industry networks.



# DEFINING THE PROBLEM



## IS WASTEWATER A PRIORITY?

**Among this group of companies, wastewater is an organizational priority as one pillar of their environmental commitments.** Participants express a responsibility to protect the ocean environment in which they operate. Operators report that their primary focus currently is on reducing greenhouse gas emissions, but that improving wastewater and solid waste (garbage) treatment/handling are also considerations.

The two most prominent reasons given for prioritizing wastewater management are industry-driven:

- **Regulations** – to comply with MARPOL and local regulations
- **Industry guidelines** (e.g., promoted by industry associations)

Less commonly cited are external pressures:

- **Public perception** – addressing media/public concerns, thereby demonstrating the social license to operate in busy and/or sensitive areas
- **Marketing in the cruise industry** – filling a niche market that appeals to a certain clientele

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[Wastewater] is a priority. It falls under sustainability... Why? It's the right thing for the environment. And there is a commitment from our CEO.

*SOURCE: BULK CARRIER SHIPS*

[Our industry association] requires its members to follow additional standards beyond minimum maritime compliance [in the Arctic].

*SOURCE: PASSENGER/CRUISE SHIPS*

Our baseline is following current regulations. We are interested in what options there are to improve, but not that interested to put the newest equipment available in an older fleet.

*SOURCE: BULK CARRIER SHIPS*

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## PERCEPTIONS OF GREYWATER

There was a **generally common understanding of greywater** as the wastewater collected from sinks, showers and laundry; there is less clarity on how galley water is categorized. One of the key challenges of greywater treatment is the volume created, particularly in the cruise industry.

**There was also a general consensus among participating shipping operators that greywater has an impact on marine ecosystems**, and that the topic is gaining profile/attention, particularly in the Arctic. At the same time, there is a sense that we **lack a thorough assessment of its impacts**, which hampers our ability to focus on actions that have a positive environmental outcome.

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*Of course [greywater] has an impact. The question is that as traffic grows, so will impact grow. Honestly, I don't know if greywater impact is such that you can see it in short-term...It depends on if its greywater that has only chemicals that are biologically degradable or greywater that has other chemicals. — Bulk carrier*

*It's not clear why greywater is so left out [of regulations]. Our company policy is treating greywater, we don't want to see untreated greywater in our books. Greywater being totally unregulated was a shock for me, coming from [my previous position]...Today, with the technology already available, there is no need to discharge untreated greywater anymore. That should be the baseline for all vessels. — Passenger/cruise*

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# CURRENT PRACTICES



## CURRENT PRACTICES: FOCUS ON TECHNOLOGY/AWTS

**Participating operators referred to technology as their main solution for treating wastewater.** Large cruise operators reported having AWTS on board, which treats sewage/blackwater and greywater, exceeding MARPOL regulations in the Arctic. Smaller passenger/expedition and carrier vessels reported using marine sanitation devices or sewage treatment plants which comply with MARPOL.

**Implication:** The technology exists to effectively address sewage and greywater. However, installation of these advanced systems needs to be broadened and correct use promoted.

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*What is thrown overboard [from sewage treatment system] is biologically neutral. If you drink it, you wouldn't get sick, it has a lot of nutrients but the bacteria is taken out of it. AWTS has a larger filter installed to take away nutrients like phosphorus and nitrogen as well. Imagine very sensitive areas like coral reefs, those nutrients will influence the ecosystem even if docked there for a day, so you need AWTS. – Passenger/cruise*

*The baseline is following current regulations. We are interested in what options there are to improve but not that interested to put in the newest equipment available in an older fleet. We are treating blackwater a bit over the minimum requirement, and greywater is going out straight or via holding tank and then released when we are further from shore. – Bulk carrier*

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## LIMITATIONS TO AWTS BENEFITS

There are some issues that limit the benefits of AWTS:

- **Limited to new builds** – the perception exists among participants that AWTS are difficult to retrofit for older ships due to size and space restrictions (aside from any cost implications)
- **Complexity of operation** - AWTS are challenging to operate and maintain **so the system runs as designed**. While they are increasingly “user-friendly” in design, it nonetheless requires choosing the right manufacturer (with track record of performance, maintenance and operational support) and significant personnel training implications – all of which also increase operational costs. This also argues for greater monitoring of effluent to ensure the AWTS is being used as intended.



*AWPS (advanced wastewater purification systems) are really advanced technologies . Success is so dependent on the competence of the crew. Otherwise, they will reduce the performance of the system, they will try to bypass steps because it's not mandatory, to make it easier [for themselves].” – Passenger/cruise*

*Technical installation [of advanced treatment systems] is the same as anything else. It's the human aspect on the operating side that is most complex. – Passenger/cruise*



## CURRENT PRACTICES: OTHER EFFORTS

Some shipping operators report undertaking voluntary (non-technology) measures at least some of the time to address wastewater, such as:

- Surpassing MARPOL regulations (example given was discharging further from shore than required)
- Conserving/reducing water use
- Using specific soaps/cleaning products

It is difficult to identify patterns of use of such efforts, aside from the fact that the reported number & extent of efforts are higher for companies with an environmental strategy or commitments in place.



*Best prevention would be monitoring. Invest in such technologies for reduction of the flow of showers etc. to monitor water used in galleys - don't clean with hose, wipe surfaces clean, monitor chemicals because they can affect status of AWTS. Small things like that. Institute good culture on board. All of these add up in the long term. – Passenger/cruise*

*We treat all blackwater even outside of 12 nautical miles, even though IMO does not regulate outside of 12 miles in Arctic. – Bulk carrier*

*Installation of flow rate reduction devices on all faucets to reduce fresh-water consumption. Flow rate reduction saves up to 70% water. In our hygiene products, we have banned all micro plastics from our portfolio. – Passenger/cruise*



## CURRENT PRACTICES: PLANNING FOR DESIGN & OPERATIONS

A key learning for participating companies is the **planning and forethought** needed to comply with regulations and integrate practical operational considerations in Arctic waters. These rules must be factored in at an early stage, such as when designing new build vessels, and making decisions about routes and ports.

**Implication:** On balance, companies prefer to plan ahead rather than back-engineer to meet requirements, analogous to how they have planned to meet regulations for greenhouse gas emissions.



*It's most important to know where the ship is going to sail, what is the purpose of the ship. Then map to regulatory benchmarks to know what you have to fulfill." – Passenger/cruise*

*The regulations are complicated. It's easy to understand in a table, but how does the galley know if we are more than 12 miles from land (to use food grinder that goes into sewage tank)? How does the engineer know they can put on the sewage treatment plant - are we 3 miles out? You have to ask the bridge. These are complicating things. The technical installation is the same as anything else. It's the human aspect on operating side that is most complex. – Passenger/cruise*



## LIMITATIONS: PORT INFRASTRUCTURE

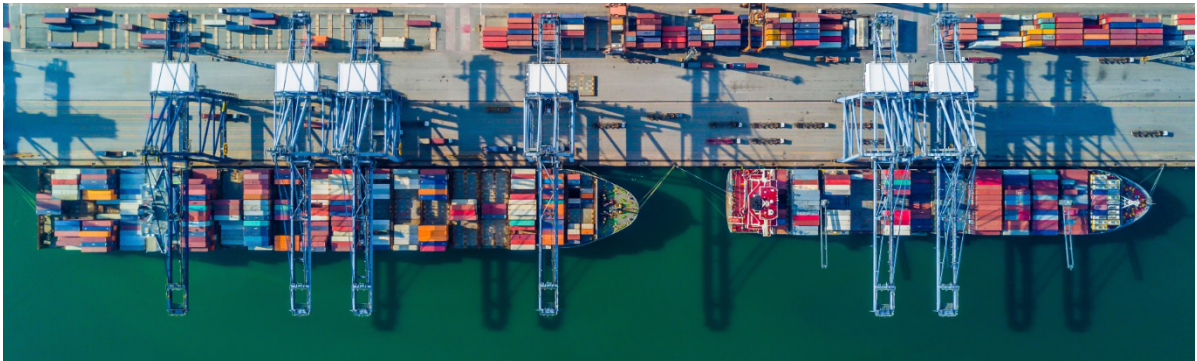
One barrier that shipping companies do not directly control is the port infrastructure available to them for discharging treated and stored wastewater. Even if shipping companies are striving to produce “clean” or zero discharge, ports are not necessarily in the position to receive the volume or cleanliness of this wastewater. Particularly within the cruise industry, there is a desire to understand how ports treat waste discharged from ships.

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*We can only perform as well as the port interface is keeping up with our standards. In regards of wastewater, we experience limited availability to offload treated wastewater to shoreside facilities. Ports say it's too clean to put into the communal wastewater in port, it messes with their balance – Passenger/cruise*

*[New build will incorporate hydrothermal carbonization, producing bricks of charcoal from wastewater] Question marks remain about where are we going to be able to dispose of this. Some port facilities may be able to take that, some maybe not. Something we have to fine tune. Not many ships have such equipment. Some ports will likely take it as regular garbage. – Passenger/cruise*

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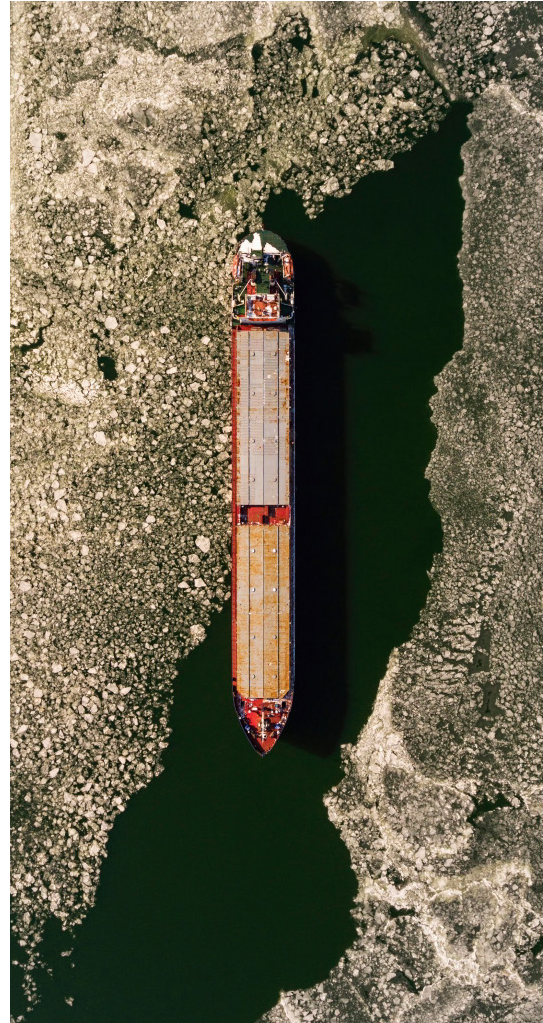




# VIEW ON POTENTIAL SOLUTIONS

## THE FUTURE: VIEWS ON HOW CHANGE HAPPENS

- 1. International regulation** – The general consensus is that improved wastewater handling cannot be achieved without clear and consistent international standards. With technology mostly available, the greater issue is motivation. Given competing demands and priorities for companies (e.g., economic/cost considerations, focus on greenhouse gas emissions), regulation is a clear signal and one that can show companies the path forward.
- 2. Local regulation** – while local regulations make things more complicated for shipping operators, more ambitious standards at the regional level are nonetheless recognized as a potentially faster way to create momentum.
- 3. Monitoring and enforcement** – Promoting good culture and practices onboard, thereby addressing the human risk that AWTS/technology may not be operated as intended.
- 4. Encouraging customer demand** – An alternate approach to regulation is to create demand for better wastewater handling among customers (cargo and cruise), analogous to demand for addressing greenhouse gas emissions. However, there is no sense that this demand currently exists; efforts would be needed to build public awareness / lobby for cargo interests to make these commitments.
- 5. Sharing information** to help address the pain points or barriers for individual companies, especially smaller companies or those with less capacity/resources who are currently excluded from the conversation.



## REGULATION – INTERNATIONAL AND LOCAL



It's hard if regional standards exist, from one point of view... the more rules out there, there is more probability you are missing one. It really helps to have international standards. But sometimes it's a patchwork. Some good examples regionally can push for ambitious standards and technology.

*SOURCE: PASSENGER/CRUISE*

We cannot have a less stringent requirement [for wastewater] outside the Arctic and a more stringent one inside. It will be prone to errors, risks and people on board might not understand, they won't have the routine or training. Being consistent around the world is a good idea...no matter where we are, this is what is required.

*SOURCE: PASSENGER/CRUISE*



## MONITORING/ENFORCEMENT



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*SOURCE: PASSENGER/CRUISE*



## CUSTOMER DEMAND

// Customers [passengers] do not realize that they will generate waste, garbage, sewage – they don't realize at all. Sometimes they ask where it is going and are surprised it's going into the sea (even though it's treated first).

*SOURCE: PASSENGER/CRUISE SHIPS*

We cannot hold [wastewater] training with passengers because they come on board to relax. Instead, we use screens and in room documentation to educate them about the small things they can do.

*SOURCE: PASSENGER/CRUISE SHIPS*

If we want quicker change, [demand] has to come from people and cargo customers – because they can work quicker than IMO and local governments.

*SOURCE: BULK CARRIER SHIPS*



## INFORMATION-SHARING

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Depends on the size of the company. All bigger companies are members of an industry association, we meet regularly where we discuss our achievements, future regulations, what we can do better, how we can meet regulations. For small companies with a couple of ships, maybe they are not members due to financial challenges, and are left out of the conversation.

*SOURCE: PASSENGER/CRUISE SHIPS*

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# APPENDIX



# INTERVIEW DISCUSSION GUIDE

## Profile

First, I have a couple of questions to better understand your fleet.

1. How many vessels does your organization currently have in its fleet? \_\_\_\_\_#
2. What **types of vessels** are part of your organization's fleet? CHECK ALL THAT APPLY.
  - Passenger/cruise ships
  - Container ships
  - Community re-supply
  - Bulk carrier ships
  - Tankers
  - Larger fishing vessels/fishing processors
  - Research vessels
  - Other \_\_\_\_\_

Please exclude from answers: tugs, barges, small fishing vessels

3. What is the average age of your fleet? \_\_\_\_\_ years
4. How many of your vessels are:
  - a. Ship size
    - Under 100 gross tons \_\_\_\_\_ #
    - Between 100 and 400 gross tons \_\_\_\_\_ #
    - Over 400 gross tons \_\_\_\_\_ #
  - b. For non-passenger ships under 400 gross tons, people onboard (crew and others)
    - Up to 15 people \_\_\_\_\_ #

## INTERVIEW DISCUSSION GUIDE (CONT.)

More than 15 people \_\_\_\_\_ #

- c. For passenger vessels, number of passengers (day boats & ferries)

12 to 150 passengers \_\_\_\_\_ #

150 or more passengers \_\_\_\_\_ #

If ferries, 250 or more passengers \_\_\_\_\_ #

- d. For passenger vessels, number of overnight passengers (cruise ships)

12 to 49 passengers \_\_\_\_\_ #

50 to 99 passengers \_\_\_\_\_ #

100 to 499 passengers \_\_\_\_\_ #

500 or more passengers \_\_\_\_\_ #

5. How many of your vessels use scrubbers (exhaust gas cleaning systems)? \_\_\_\_\_ #

- a. (IF Q5>0) How many of these use open loop systems (that discharge near shore or in port)? \_\_\_\_\_ #

### Overall approaches

6. To what extent is improved handling and treatment of wastewater from your fleet a priority for your organization? Does the level of priority differ for sewage vs. greywater vs. scrubber effluent (exhaust gas cleaning systems – if applicable)? Why or why not?

*Easy starting questions to broadly gauge how much energy/attention org is dedicating to the issue.*

7. Are your company's sewage and greywater treatment and discharge practices based on regulations (IMO & national), or do you also have company policies/follow best practices that go beyond regulatory requirements?

*Doing only what they have to do, or going above & beyond?*

01 – Based on regulations

02 – Have additional company policies/best practices

## INTERVIEW DISCUSSION GUIDE (CONT.)

### IF HAVE POLICIES/BEST PRACTICES:

8. What do those company policies/best practices include? (Circle those used & elaborate, probe specifics for greywater vs sewage vs. scrubber effluent as necessary)
  - a. Where/location of discharge (e.g., area of no discharge, sensitive areas, distance from baseline, shoreside discharge)
  - b. How/when discharge (e.g., minimum speed of vessel, depth of water, rate of discharge)
  - c. Holding tanks (e.g., type – sludge, effluent, influent; capacity – volume or no. hours/days)
  - d. Waste reduction (e.g., types of soaps/cleaning products, banned products, chemical use, minimize use of freshwater/re-use treated wastewater)
  - e. Training/education for crew and/or passengers
  - f. Other (e.g., certification programs, BMPs/best management practices)
9. *Why* have you implemented these specific policies/practices? (i.e., what are objectives/benefits of doing so?)
10. What are your lessons learned from implementing these policies/practices?

# INTERVIEW DISCUSSION GUIDE (CONT.)

## ASK ALL:

11. What challenges/barriers exist to implementing company policies/practices regarding wastewater treatment and discharge? Are the challenges/barriers the same or different for sewage vs. greywater vs. scrubber effluent?
12. Does your company have...?
  - a. A waste management plan? Yes/no. If yes, what does it cover?
  - b. An incident report plan? Yes/no. What do you do in case of an incident?

## Treatment

13. What equipment do you use to treat wastewater? Is this classified as an AWTs (Advanced Wastewater Treatment System)?

*Probe: Any prescreening of solids? Same system for all wastewater, or separate for greywater/sewage/scrubber effluent?*
14. What are the benefits & drawbacks to this system/technology?
15. Approximately what proportion of your fleet directly discharges untreated greywater \_\_\_\_\_%

*Appreciate that answer may be more related to occasion/regulations (i.e., have to treat when in Alaskan waters), but provides framework for discussion/respondents will correct us if this is not the right way to distinguish (and knowing that we will be speaking to people responsible for more than one vessel)*

## INTERVIEW DISCUSSION GUIDE (CONT.)

b. How do you define greywater, that is, what sources of waste go into greywater for your fleet? (e.g., sewage, food waste, deck drains)

### FOR VESSELS THAT DON'T TREAT GREYWATER:

16. What are the reasons why not?

### Maintenance

17. How often is your wastewater treatment system serviced, including both regular crew maintenance and outside specialists? Do you have a preventative maintenance program in place? If yes, what does that look like?

### Monitoring, recordkeeping and sampling

18. What kind of monitoring & recordkeeping practices do you currently have in place for wastewater discharge (greywater, sewage, scrubber effluent)?

*Probe: Use testing or sampling program, either onboard or sent to a lab? Document discharge in a logbook or other records?*

### Future

19. Looking ahead, have you looked into wastewater treatment systems for new-build vessels? Do you think what's available on the market will meet your need? Why or why not?

*What is the market demand for advanced technologies?*

## INTERVIEW DISCUSSION GUIDE (CONT.)

20. In your view, how significant an impact does untreated greywater discharge have on the health of marine life & habitat, and on human health?

*To what extent do companies see a problem that needs to be addressed?  
Speaks to need for communications/awareness-building efforts.*

21. What do you think will be the most effective way to encourage/improve wastewater treatment practices in the shipping industry?

*How do they anticipate that change will come about? Is it purely regulatory or are there other solutions?*

### Garbage

I have a couple of last questions specifically about the discharge of garbage.

22. Briefly, how do you manage garbage and recycling created on board?

23. What challenges, if any, do you encounter with the discharge of garbage when your vessels come into port?

### Wrap-up

24. Is there anything else you would like to add? Was there you think I should have asked you that I did not?

**Thank and end survey**

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