

2022 Air Compliance Annual Report On Cruise Ships & State Ferries

AIR QUALITY COMPLIANCE PROGRAM



Lindblad National Geographic Sea Bird and Princess Cruise Lines Majestic Princess docked in Juneau May 24, 2022



Alaska Department of Environmental Conservation

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ABBREVIATIONS AND ACRONYMS

AAC:	Alaska Administrative Code
ADEC:	Alaska Department of Environmental Conservation
AS:	Alaska Statute
CFR:	Code of Federal Regulations
COBC:	Compliance Order by Consent
DG:	Diesel Generator
ECA:	Emissions Control Area
EGCS:	Exhaust Gas Cleaning System
EPA:	United States Environmental Protection Agency
EU:	Emission Unit
GT:	Gas Turbine
HFO:	Heavy Fuel Oil
IMO:	International Maritime Organization
LSFO:	Low sulfur fuel oil (Sulfur content of 1.14%)
MGO:	Marine gas oil, a distillate fuel
MOU:	Memorandum of Understanding
NOV:	Notice of Violation
OFB:	Oil fired boiler
PM:	Particulate Matter
SO _x :	Sulfur oxides
SA:	Settlement Agreement
USFS:	United States Forest Service
UW:	Underway

INTRODUCTION

This report is prepared annually by the Alaska Department of Environmental Conservation (ADEC) Division of Air Quality, Compliance Program (AQ Program). The intent of this report is to provide information on the air quality monitoring, compliance, and enforcement efforts with cruise ship and state ferries air pollution.



Victory Cruise Line Ocean Victory anchored in Petersburg May 21, 2022

COMPLIANCE MONITORING & ENFORCEMENT SUMMARY

Objective: To protect the Alaskan environment by ensuring that air emissions from marine vessels in the state do not create unhealthy air. This is accomplished through the direct monitoring of the opacity of air emissions from cruise ships and state ferries.

The goal in monitoring opacity is to conduct consistent opacity readings primarily within Alaska's three busiest cruise ship ports: Juneau, Ketchikan, and Skagway. Additionally, both ADEC staff and the contractor will travel to other ports during the season to conduct readings. While the primary focus is to monitor large cruise ships, reasonable efforts are made by ADEC staff and the contractor to conduct opacity readings on small cruise ships and state ferries.

Authority. AS 46.03.488 & 18 AAC 50.070 establishes marine vessel visible emission standards.

Implementation. The regulation applies to visible emissions, excluding water vapor, of marine vessels within three miles of the Alaska coastline. The AQ compliance program uses EPA Reference Method 9 (Method 9) readings to provide the source of data for determining compliance with marine vessel visible emission standards. This method has been approved by the US Environmental Protection Agency (EPA) as part of the Federally Enforceable Air Quality Control State Implementation Plan under 40 CFR §52.70(28)(i). The AQ compliance program monitors environmental compliance, as well as the direct and indirect environmental effects of cruise ships and state ferries.

2022 Results. Summaries of opacity results are available in Tables 1 to 4. Summaries of formal enforcement actions are available in Tables 5 to 10.

Compliance:	524 Method 9 readings performed
Enforcement:	14 Pending Notice of Violations

Compliance Monitoring. Compliance with opacity requirements is determined through use of Method 9 observations. Observations are made by trained ADEC staff and contracted opacity readers. The current contractor for opacity readings is FLAT LAKE Engineering LLC, based in Ketchikan, AK with additional staff in Juneau, AK. The US Forest Service (USFS) signed on to a Memorandum of Understanding (MOU) with ADEC Division of Water to monitor air emissions and wastewater discharges from marine vessels operating in Holkham Bay, Tracy Arm, and/or Endicott Arm. The latest MOU was executed May 21, 2018 and is effective through April 30, 2023. In 2019 and in 2021, the USFS and ADEC coordinated together in order to perform Method 9 observations while vessels were underway in Tracy Arm and Endicott Arm. USFS provided the watercraft and operator while ADEC provided the certified opacity reader. In 2022, ADEC provided the necessary funding for two USFS personnel to become certified in Method 9. Discussions are underway to renew the MOU between USFS and ADEC.

Enforcement.

1. NOV issued July 15, 2019 on the Princess Cruise Line, Ltd. (PCL) M/S Royal Princess for an May 29, 2019 non-compliance event in Skagway.
2020 Action: Princess Cruise Line, Ltd. (PCL) Settlement Agreement (SA) signed October 13, 2020. PCL signed a Settlement Agreement for the 2019 alleged visible air emission violations. The State of Alaska suspends the total assessed amount of \$37,500.00 provided that the M/S Royal Princess fully and timely complies with all Alaska air-quality laws and regulations during the entirety of the vessel's next season operating in Alaska.
2022 Action: ADEC issued a SA Closure Letter on December 9, 2022. PCL has fulfilled all terms and conditions required by the SA.

2. NOV issued July 15, 2019 on the Norwegian Cruise Line Holdings (NCLH) M/S Oceania Regatta for an August 21, 2019 non-compliance event in Sitka.
2020 Update: Settlement Pending.
2021 Action: NCLH Settlement Agreement signed January 20, 2021. NCLH signed a Settlement Agreement for the 2019 alleged visible air emission violation. The State of Alaska suspends the total assessed amount of \$18,750.00 provided that the M/S Oceania Regatta fully and timely complies with all Alaska air-quality laws and regulations during the entirety of the vessel’s next season operating in Alaska.
2022 Action: ADEC issued a SA Closure Letter on December 9, 2022. NCLH has fulfilled all terms and conditions required by the SA.

3. NOV issued October 15, 2019 on the Alaska Marine Highway System (AMHS) Kennicott for an August 21, 2019 non-compliance event in Juneau.
2020 Update: Settlement Pending.
2021 Action: NOV issued January 27, 2021 on the AMHS Kennicott for four (4) counts of alleged non-compliance. These events occurred July 8, 2020, August 5, 2020, and August 19, 2020 in Juneau and October 7, 2020 in Whittier.
2021 Update: Settlement Pending.
2022 Action: Department of Transportation & Public Facilities, Alaska Marine Highway System (DOT&PF/AMHS) Compliance Order by Consent (COBC) – Effective June 6, 2022. The Respondent is the operator of the marine vessel Kennicott. **Details:** The Respondent entered into a COBC settlement Agreement June 2022 based on five (5) counts of noncompliance by exceeding the visible emission standards while operating in Alaskan waters spanning the 2019 and 2020 operating seasons. The COBC requires the Respondent to fully and timely perform, comply with and/or complete remedial measures and corrective actions as required by the Order. **Suspended payment:** The suspended portion in the amount of \$187,500 shall remain suspended, and shall not become due, provided that the Kennicott complies with all conditions of this Order.

4. NOV issued September 9, 2019 on the Carnival Cruise Line (Carnival) Carnival Legend for a June 29, 2019 non-compliance event in Juneau.
2020 Action: Carnival Settlement Agreement signed October 13, 2020. Carnival signed a Settlement Agreement for the 2019 alleged visible air emission violations. The State of Alaska suspends the total assessed amount of \$37,500.00 provided that the M/S Carnival Legend fully and timely complies with all Alaska air-quality laws and regulations during the entirety of the vessel’s next season operating in Alaska.
2022 Update: The M/S Carnival Legend is not projected to return to Alaska waters in the next three (3) years.

Table 1: 2022 Contractor Opacity Readings

Location	Readings
Juneau	342
Ketchikan	42
Skagway	36
Haines	6
Hoonah (Icy Strait Point)	4
Sitka	0
Seward	0
Whittier	3
Total Opacity Readings	433

Table 2: 2022 ADEC Staff Opacity Readings

Location	Readings
Juneau	15
Ketchikan	13
Skagway	19
Haines	5
Hoonah (Icy Strait Point)	16
Sitka	16
Whittier	1
Petersburg	6
Total Opacity Readings	91

Table 3: 2022 Opacity Reading Count by Port

Port	Readings
Juneau	357
Ketchikan	55
Skagway	55
Haines	11
Hoonah (Icy Strait Point)	20
Sitka	16
Whittier	4
Petersburg	6

Table 4: Opacity Readings Per Year Summary

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Readings	382	343	388	552	480	447	12	533	524

Table 5: Opacity Violations Issued (2018)

Vessel	Date	Port	Status
HAL Nieuw Amsterdam	6/19/2018	Skagway	Settled
HAL Westerdam	6/20/2018	Haines	Settled
NCL Norwegian Jewel	7/11/2018	Ketchikan	Settled
PCL Emerald Princess	7/31/2018	Ketchikan	Settled
PCL Golden Princess	7/31/2018	Juneau	Settled
HAL Eurodam	8/2/2018	Ketchikan	Settled
RCL Radiance of the Seas	8/8/2018	Ketchikan	Resolved
RCL Radiance of the Seas	8/17/2018	Seward	Resolved
HAL Amsterdam	8/24/2018	Ketchikan	Resolved

Table 6: Opacity Notice of Violations Issued (2019)

Vessel	Date	Port	Status
PCL Norwegian Joy	5/21/2019	Juneau	Settled
Oceania Regatta	6/1/2019	Sitka	Settled
PCL Royal Princess	5/29/2019	Skagway	Settled
Carnival Legend	6/29/2019	Juneau	Settled
RCL Ovation of the Seas	8/18/2019	Juneau	Settled
AMHS Kennicott	8/21/2019	Juneau	Settled
Silver Seas Silver Muse	9/8/2019	Juneau	Settled

Table 7: Opacity Notice of Violations Issued (2020)

Vessel	Date	Port	Status
AMHS Kennicott	7/8/2020	Juneau	Settled
AMHS Kennicott	8/5/2020	Juneau	Settled
AMHS Kennicott	8/19/2020	Juneau	Settled
AMHS Kennicott	10/7/2020	Whittier	Settled

Table 8: Opacity Notice of Violations Issued (2021)

Vessel	Date	Port	Status
RCL Ovation of the Seas	8/22/2021	Juneau	Settled
RCL Ovation of the Seas	10/4/2021	Juneau	Settled
RCL Ovation of the Seas	10/10/2021	Ketchikan	Settled

Table 9: Opacity Notice of Violations Issued (2022)

Vessel	Date	Port	Status
CCL Carnival Splendor	5/6/2022	Juneau	Pending
CCL Carnival Splendor	5/6/2022	Juneau	Pending
Celebrity Solstice	5/9/2022	Juneau	Pending
PCL Majestic Princess	5/10/2022	Juneau	Pending
RCL Ovation of the Seas	5/15/2022	Juneau	Pending
SilverSeas Silver Muse	5/21/2022	Juneau	Pending
NCL Norwegian Sun	5/23/2022	Juneau	Pending
CCL Carnival Splendor	5/28/2022	Juneau	Pending
Uncruise Adventures SS Legacy	6/4/2022	Juneau	Pending
CCL Carnival Spirit	6/12/2022	Juneau	Pending
CCL Carnival Spirit	6/12/2022	Juneau	Pending
CCL Carnival Spirit	7/24/2022	Juneau	Pending
RCL Quantum of the Seas	7/29/2022	Juneau	Pending
NCL Norwegian Jewel	8/25/2022	Juneau	Pending

- Pending indicates a case is currently under negotiation
- Settled indicates an enforcement settlement has been reached
- Resolved indicates a case has been closed without formal enforcement

Table 10: Violations Per Year Summary

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Violations	25	0	0	2	9	7	4	3	14



Alaska Marine Highway System M/V LeConte docked in Skagway August 16, 2022

PUBLIC COMPLAINTS RESPONSE SUMMARY

The Department responds to public complaints regarding cruise ship pollution. Important information to provide the Department is the date and time, name of the vessel, location, and the duration of the emissions exceedance. The Department will investigate the complaint and will notify the vessel operators or owners as soon as possible so that mitigating steps can be taken. Depending on availability, the Department will often follow up complaints with an opacity reading by Department staff or the contractor. The number of public complaints received by the Department each year is available in Figure 1 below.

The Department received twenty-two (22) public complaints during the 2022 cruise ship season.

Complaint No. 1:

4/27/22 JNU @1230 – Visible emissions from stack at Juneau Main Cruise Ship Dock. It is the only ship in town. Norwegian Jewel. I was driving into town and saw it clearly against the contrasted background of the forest.

Action Taken: An email was sent to the operator 4/27/22.

- Operator Response: The ship arrived at 1304 operating on MGO. Every maneuver arrival/departure as per our SMS has to be done with 3 Diesel Generators to ensure safe operations which might create slightly white smoke on engines running on very low loads due to extra air supplied.

SnowCloud Webcam footage shows increased visible emissions from 1229-1259 as the ship approached the dock to make fast to shore. Current Webcam (1445PM) shows negligible or no visible emissions. No further action.

Complaint No. 2:

5/2/22 Underway @1030 - Photos were taken of the Norwegian Bliss while underway in Stephen Passage at 1030. These photos were sent by a float plane pilot who was flying by and was concerned by the potential air pollution.

Action Taken: An email was sent to the operator 5/3/22.

- Operator Response: The big white puffy plume is condensed water vapor (or steam).



Complaint No. 3:

5/6/22 JNU @0830 - Seeing considerable emissions from the Carnival Splendor cruise ship and wondering if we (ADEC) are monitoring.

Action Taken: Method 9 readings performed by contractor and ADEC staff throughout the day. See Table 9.

Complaint No. 4:

5/19/22 JNU @2045 - NCL departing @2045 from the AJ Dock in Juneau. Obviously burning the low grade diesel. They might be using their scrubber, but the sky is filling with smoke that is not going anywhere other than creating bigger and bigger clouds in the sky. I haven't seen a ship do that in a long time in Juneau because they have been going to clean fuel in port. It looks terrible. Please go back to clean fuel when you're in port and inside borough boundaries.

Action Taken: An email was sent to the operator on 5/20/22

- Operator Response: The Norwegian Jewel begin initial startup for purposes of testing equipment in preparation to cast off @2029. The ship began casting off @2045. Only DG#3 & Boiler #1 were running while the ship was in port, 2 more DGs were started for departure (DG#1 @ 20:40 and DG#5 @ 20:47), Incinerator was stopped on May 19 @ 05:05 and was not started until May 21. Scrubber operations were

stopped on May 19 @0812 after Fuel Oil Change over from HFO (1.5%S) to MGO (0.01%S) was completed on May 19 @0804. No further action.

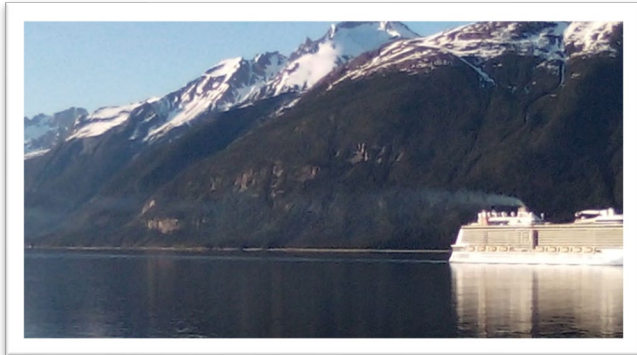
Complaint No. 5:

5/26/22 KTN – “The Discovery Princess is at it again.”

Action Taken: ADEC requested continuous monitoring of the vessel.

Complaint No. 6:

5/26/22 Underway @2030 – The emissions coming out of the Quantum of the Seas is terrible and leaving a trail of smoke. Sun is to the west (behind the complainant).



Action Taken: An email was sent to the operator 5/28/22.

- Operator Response: At the time of the complaint, Quantum of the Seas was underway. DG1 and DG3 were online operating on LSFO with the EGCS systems

in closed loop mode (no discharge) (departing Skagway @ 1716).

General practice for the fuel change from LSFO to MGO commence 2 hours before pilot station or 2 hours before the end of sea passage (EOSP) if there are no Pilot Station(pilot onboard) , in accordance with the vessels fuel changeover SOP. For arrival in Juneau, the fuel switch over from LSFO to MGO was already complete at 0500 LT prior to entering Endicott Arm (Fuel changeover was started at 0330hrs) and the ship kept running on MGO throughout from Endicott Arm to Juneau until Juneau departure in the evening on the same day. For departure, the fuel change over takes place approximately a half hour after departure with EGCS online prior to commencing the change

Complaint No. 7:

5/27/22 JNU @1251 – Quantum of the Seas is belting out a lot of smoke and has been for quite a while. Wanted it on the record.

Action Taken: An email was sent to the operator 5/28/22.

- Operator Response: The vessel made fast shore at approximately 12:45. On arrival to Juneau, DG1, DG3, and OFB1 were online. All three sources operating on MGO (less than 0.1% sulfur). There was a minor technical concern with the fuel system supplying DG3, which required an additional engine (DG2) to be started at approximately 13:40. Once DG2 was started, DG 3 was stopped. The cause was attributed to a leak on the low-pressure fuel line for DG3 after arrival at approximately 13:47; which was addressed by the onboard team and fixed prior to departure.

Complaint No. 8:

5/27/22 JNU @1252 – The vessel arrived at 1:00pm. Starting about 10 minutes ago, the ship was emitting some of the grayest, filthiest looking air emissions that I have seen from any ship yet this season, and we're only in May. This is supposedly a brand new ship. I don't know what the scrubbers are doing, but evidently not working too well. I assume within the time frame of docking, that you guys are not going to have any concern with the air emissions, but it is disgusting what is coming out of the stack in our community. I can only imagine what it is emitting once it's out of sight the communities of southeast.”

Action Taken: An email was sent to the operator 5/28/22.

- Operator Response: The vessel made fast shore at approximately 12:45. On arrival to Juneau, DG1, DG3, and OFB1 were online. All three sources operating on MGO (less than 0.1% sulfur). There was a minor

technical concern with the fuel system supplying DG3, which required an additional engine (DG2) to be started at approximately 13:40 LT. Once DG2 was started, DG 3 was stopped. The cause was attributed to a leak on the low-pressure fuel line for DG3 after arrival at approximately 13:47; which was addressed by the onboard team and fixed prior to departure.

Complaint No. 9:

6/10/22 JNU @1240 – I would like to lodge a complaint that the Quantum of the Seas, first vessel towards town, has been putting out a lot of exhaust for a while now. Making the whole downtown kind of hazy.”

Action Taken: An email was sent to the operator 5/28/22.

- Operator Response: The vessel made fast ashore at 12:49. At the time, the vessel was still maneuvering to make fast ashore. During this time DG1 and DG4 were online (compliant MGO – Sulfur content less than 0.1%). OFBs were not online during maneuvering. OFB2 was started at approximately 13:00.

Complaint No. 10:

6/22/22 JNU @0915 – The Silver Muse was described as emitting substantial grey-blue haze being which lingered and spread across a horizontal layer in the atmosphere. The incident began at 0915 and emission continued for more than 1-hour after arriving at dock. The incident occurred on **May 21, 2022**

Action Taken: An email was sent to the operator 6/22/22.

- Operator Response: The vessel made fast at 0927. During the maneuvering operation and coming alongside DGs 1, 3 and 4 were running and Boiler A were running. After the vessel made fast @0927, only DG# 4 and Boiler A remained running. This vessel is not equipped with an Exhaust Gas Cleaning System (scrubbers). Method 9 reading performed by contractor later that day. See Table 9.

Complaint No. 11:

6/22/22 JNU @2208 – The Norwegian Spirit was leaving Juneau and was emitting an enormous amount of smoke from its stack. Even as far down as Thane. It is very disconcerting.

Action Taken: An email was sent to the operator 6/23/22.

- Operator Response: The vessel was anchored with only one DG (DG #2) online, second DG (DG #4) started at 1737; third DG (DG #3) started at 1746. Anchor aweigh @1810. The vessel is running on MGO.

Complaint No. 12:

7/18/22 Underway @0808 – Photo provided of the Ovation of the Seas underway enroute to Skagway. Thick exhaust emitting from stack.

Action Taken: An email was sent to the operator 7/19/22.

- Operator Response: 1. During the time period of the complaint, the vessel was operating DG2 and DG3, both connected to EGCS in closed loop mode. Incinerator #1 was also in operation. At approximately 0751, the vessel began the process of changing the engines over from IFO (Sulfur content 1.67%) to MGO (Sulfur content less than 0.1%); the EGCS system remains online until the

changeover to MGO is complete. The vessel completed the fuel changeover on both engines at approximately 0927. The incinerator always is operating on MGO.



Complaint No. 13:

7/25/22 JNU @1415 – Cruise ship in port looks like it's pumping out a lot of emissions right now. Noting only being able to see the discoloration against the clouds while the complainant was walking as well stated seeing dark blue near the stack. At 1448, the complainant stated it no longer seemed that the vessel was emitting large amounts of

emissions. At 1508, the Norwegian Sun was no longer anchored (scheduled to depart 1500). Pictured are the Koningsdam and Eurodam.



Complaint No. 14 & 15:

8/10/2022 JNU @1200 - Significant visible smoke coming from combustion exhaust pipes on the Norwegian Spirit while leaving port. Four other vessels leaving on same day had lesser or no visible opacity.

8/10/22 JNU @1930 – Photo provided of the Norwegian Spirit with the message "This has been going on for about an hour now".

Action Taken: An email was sent to the operator 8/18/22.

- Operator Response: 1. The Norwegian Spirit arrived @0631. The Norwegian Spirit begin initial startup for purposes testing equipment in preparation to weighing anchor @1925 and weigh anchor @19:42. Generators were operating at around 45% load throughout the day. Vessel is only using MGO while in port.



Complaint No. 16:

8/10/22 @1235 JNU – I've been watching the Discovery Princess docked at one of the city docks, emitting a very opaque whitish-grey air emission. It's starting to luff now, it's now 1235. But prior to now for about last 15 minutes there was a terrible opaque whitish-grey emission. this is not steam, it is smoke and I can tell that because it is still lingering over the city. It is quite obviously bluish now, it being gently blown North over downtown Juneau. There are 5 large cruise ships docks right now and it is the only ship that has any visible air emissions. this just gets tiresome, why the ships continue to pollute like this. As far as I know this ship has been sitting at dock for several hours, it's not like it is just arriving or preparing to leave.

Action Taken: An email was sent to the operator 8/18/22.

- Operator Response: The Discovery Princess complete all maneuvers to make fast to shore @1200. The Discovery Princess begin initial startup for purposes of testing equipment in preparation to cast off @1847 (2-hour notice for departure) with cast off @2055. While

maneuvering upon arrival: DGs #1,2,3 in operation. In port DG #3 in operation, maneuvering upon departure DGs 2,3,4 in operation. The incinerator was off since 0206 the same day, Boiler #1 was operating in port during the stay. The vessel's engines were



operating on MGO since 0445 that day. The

following upset was reported: Soon after the arrival, with only one engine in port (DG#3), the pressure in the steam system began to drop and the boiler automatically intervened to restore steam pressure. Unfortunately, the fuel compound of the forward boiler did not work and the boiler automatically did not start. Immediately after, the officer on watch started the aft boiler which for some reason did not start as well. This operation was repeated four times on the aft boiler. At this point, the officer on watch asked his assistant to make an emergency manual start of the forward boiler, and that was successful.

Complaint No. 17:

8/13/22 JNU @1435 – Carnival Splendor is putting out significant visual emissions. I'm assuming they are getting ready to leave. I'm sure, or I hope you've been monitoring that ship during the summer.

Complaint No. 18:

8/20/22 JNU @2000 – I am writing to report the Norwegian Spirit. I understand the importance of tourism to our community, but it is out of hand. The amount of pollution they create is untenable. I have attached a photo for you as well.

Action Taken: An email was sent to the operator 8/25/22.

- Operator Response: The Norwegian Spirit begin initial startup for purposes testing equipment in preparation to weighing anchor @1849. The Norwegian Spirit began weighing anchor @1940, 3rd Engine started. The Norwegian Spirit is not equipped with scrubbers and only operates on MGO.

Complaint No. 19:

8/26/22 JNU @0830 – The Quantum of the Seas is spewing dark pollution into Juneau air right now. I've been down here for an hour watching. It's hard to get a photo against the white clouds, but it is definitely polluting and this is not related to it showing up at the dock.

Action Taken: Method 9 readings performed by contractor and ADEC staff throughout the day. An email was sent to the operator 8/26/22.

- Operator Response: The vessel made fast ashore at approximately 0607. DG4 and OFB1 were in operation at the time of complaint, operating on Marine Gas Oil (MGO – Less than 0.1% Sulfur). DG4 was operating on 69% load at the time of complaint.

Complaint No. 20:

9/7/22 JNU @2010 – The Norwegian Spirit was emitting a huge amount of blue/black smoke. And now steaming down Gastineau Channel leaving a huge blue plume. This is a clear violation of the air quality standards.

Action Taken: An email was sent to the operator 9/23/22.

- Operator Response: The Norwegian Spirit begin initial startup for purposes testing equipment in preparation to weighing anchor @1825. The Norwegian Spirit weighed anchor @1924.

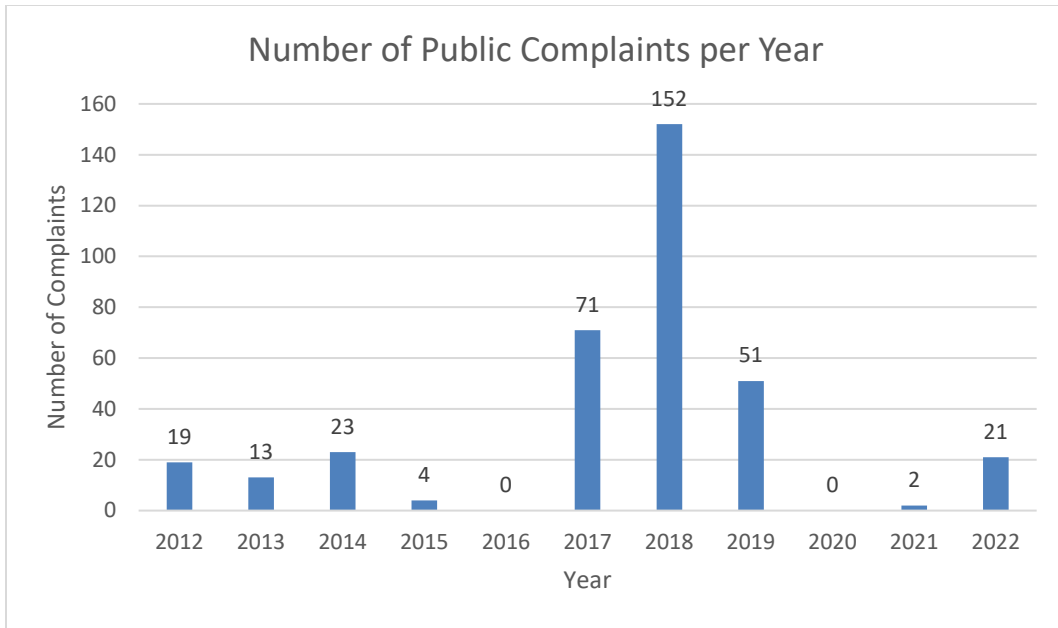
Complaint No. 21:

9/16/22 JNU @1408 – The Ovation of the Seas that has been belting out pollution all day. As it does every time it's in port.

Action Taken: An email was sent to the operator 9/21/22.

- Operator Response: The vessel made fast ashore at approximately 0734. DG4 and OFB1 were in operation at the time of complaint, operating on Marine Gas Oil (MGO – Less than 0.1% Sulfur).

Figure 1



AMBIENT AIR MONITORING SUMMARY

The Air Monitoring & Quality Assurance Program (AMQA) implemented an ambient air monitoring saturation study during the 2019 cruise ship season in downtown Juneau. A saturation study is a type of investigation that uses multiple samplers in a small geographic area over a limited amount of time. By using a tightly spaced grid of *Purple Air* (PA) low-cost particulate monitors (PM_{2.5}) and several *Ogawa* passive sulfur dioxide monitors (SO₂), the goals of the saturation study were:

- to address ambient air quality complaints centered on the cruise ship industry emissions;
- to determine which areas of downtown Juneau are most affected (maximum impact locations); and
- to assess if the scale in terms of frequency, duration, spatial variability and severity of these impacts has the potential to significantly affect public health and/or violate Clean Air Act air quality standards.

Key Points from the 2019 Study:

- Based on the particulate matter measurements from the PA monitors, the air quality in Juneau during the study period can be considered as “Good” using the EPA Air Quality Index (AQI) classifications, with only a few days during wildfire smoke events considered as “Moderate” to “Unhealthy for Sensitive Groups”.
- While there is strong evidence cruise ships had short term impacts on air quality in downtown Juneau, there is no evidence to suggest the cruise ship industry air quality impacts in Juneau during the 2019 cruise ship season would have led to 24-hour PM_{2.5} violations of the NAAQS.
- During the six-month study, emissions events from cruise ships were typically brief and only lasted one or two hours. The monitors detected short term emissions plumes from cruise ships in the form of widespread elevated PM_{2.5} concentrations affecting multiple sites simultaneously. Slash burning, outdoor food vendors, and residential activities also had noticeable short-term impacts on air quality.
- Early in the 2019 cruise season, cruise line companies worked together to reduce their impact on local air quality. Two of the strategies used for reducing emissions were reducing idle times in the harbor and switching to a low sulfur marine fuel while in port. While it is difficult to compare Juneau’s 2019 cruise ship related air quality impacts to previous year’s impacts as no monitoring data exists for 2018, the 2019 season had fewer complaints than the previous two years.
- The data collected did not identify a single maximum impact site but indicated that various parts of the downtown Juneau were impacted simultaneously by emission plumes, depending on weather conditions.

The study report can be found at the following link: [Cruise Ship Impacts - Southeast Alaska Air Quality Monitoring Project](#).

Based on the study findings, AMQA concluded there are three distinct subregions of downtown Juneau for ongoing monitoring – the flats, waterline, and elevated area. AMQA selected **a non-regulatory, low-cost sensor technology, AQMesh sensor pods (<https://www.aqmesh.com/>)**, for the ongoing monitoring. AMQA selected AQMesh sensor pods because the pods have a large suite of available sensors and transmit data over available 4G, 5G or LTE cellular networks. The pods used in the State of Alaska network are configured to measure particulate matter (PM₁, PM_{2.5}, PM₄ and PM₁₀), NO, NO₂, CO, and SO₂, humidity, temperature, and atmospheric pressure. The addition of gaseous monitoring combined with meteorological data will provide more data for source identification. Measurements are taken in 15-minute intervals for all parameters and then transmitted via cellular network on a real-time basis. Currently one site is operational in Juneau and is reporting real time data to the AMQA website (<https://dec.alaska.gov/air/air-monitoring/aqmesh-community-based-monitoring>). Two additional sites will be reinstalled by spring 2023 after repairs and upgrades.

The three AQMesh sites in Juneau are part of the larger Community-Based Air Monitoring Project AMQA is developing throughout Alaska. The goal of the project is to collect baseline ambient air quality data in communities that otherwise do not have available data and get a pulse on local air quality conditions. Additionally, the project aims

to build relationships with tribal and rural partners by providing outreach, education, and assistance with sensor network development. As of December 2022, AMQA has deployed AQMesh sensors to Homer, Juneau, Ketchikan, Kodiak, Kotzebue, Nome, Seward, Sitka, Skagway, and Soldotna with plans to continue the expansion with ongoing funding.



Cunard Queen Elizabeth docked in Sitka June 28, 2022