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July 22, 2020

California Air Resources Board
Attention: Clerk's Office
1001 I Street
Sacramento, CA 95814

Re: Second 15-Day Changes to the
Control Measure for Ocean-Going Vessels At Berth ("At-Berth Rule")

California Air Resources Board:

On behalf of Crowley Maritime Corporation (Crowley), we thank you for the opportunity to comment on the second 15-day changes to the At-Berth Rule proposed by California Air Resources Board ("CARB"). As the largest operator of tankers and ATBs in the United States, Crowley, whose tankers and ATBs operate regularly in California ports, is directly affected by the proposed regulation.

ATBs carry 15% of the clean petroleum products annually transported to and from California, and are a significant part of the ocean-going vessel traffic calling at California ports today. Crowley's ATBs of more than 120,000 bbl. capacity are the functional equivalent of ocean-going tankers and they should not be excluded from the At-Berth Rule.

Crowley fully supports the environmental goal of the At-Berth Rule to reduce emissions from ocean-going vessels docked at California ports. The current measure, which amends and supersedes the existing 2007 At-Berth regulation, offers CARB the opportunity to extend the At-Berth Rule to all categories of ocean-going vessels calling at California ports, including ATBs. Therefore, Crowley has, since the spring of 2019, consistently demanded that ATBs be included in the At-Berth Rule in order to achieve the maximum benefit of localized harmful emissions reductions, particularly for at-risk California communities.

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By the second 15-day changes, CARB has focused on the operations of certain categories of vessels affected by the At-Berth Rule and proposed changes designed to achieve improved emissions reductions to benefit Californians living in the vicinity of its ports. The second 15-day changes thus provided CARB with the ideal opportunity to further strengthen the At-Berth Rule by the inclusion of ATBs. To date, CARB has failed to take this opportunity, and should do so now.

The second 15-day changes amend the definitions provision of the control measure, section 93130.2(b). These changes highlight the inconsistency of the definition used for ATBs and CARB's rationale for the ATB exclusion.

In the second 15-day changes, CARB amends the definition of ATB, subsection (b)(7), which now reads as follows:

> "Articulated tug barge" means a tanker barge [sic] that is mechanically linked with a paired tug that functions as one vessel. For the purposes of this Control Measure, articulated tug barges are not considered ocean-going vessels[1].

This definition makes clear that CARB defines an ATB as a tank vessel that functions as <u>one vessel</u>. This is correct: An ATB is an innovative, highly efficient, and flexible form of modern tank vessel. An ATB carries cargo in a tank barge with a double hull configuration, equipped with sumped cargo tanks, remote radar gauging, two ballast pumps, a dual-mode inert gas vapor collection system and other systems, and is propelled and maneuvered by a high-horsepower tug that is physically a part of the whole vessel, positioned in a notch in the stern of the barge, and attached by rigid, articulating pins. ATBs function as a <u>single unit</u> in a system that allows for improved maneuverability and sea-keeping. By definition, an articulated tug barge is an ocean-going vessel that functions "<u>as one vessel</u>."

This definition is belied by CARB's stated rationale for excluding ATBs from the At-Berth Rule. In the Initial Statement of Reasons ("ISR"), CARB states as its sole reason offered for excluding ATBs from the At-Berth Rule is the following:

2-15-1.1

> "When an articulated tug barge is fully connected, it may meet the definition of an ocean-going vessel, as defined in this chapter (Section 93130.2(b)). However, despite being defined as a subcategory of tankers, articulated tug barges are considered a barge and a tug separately." [ISR, p. IV-6.]

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[1] Under subsection (b)(82), the term "vessel" is used interchangeably with the term "ocean-going vessel." The ATB definition in subsection (b)(7) is therefore internally inconsistent.

2-15-1.1 This statement of a purported rationale for the ATB exclusion is unsupported by reference to any industry studies, analyses or definitions, particularly as to under what circumstances, and by whom, an ATB in operation could be "considered" to be "a barge and a tug separately". CARB offers no insight as to the source of its stated rationale, which is not borne out by Crowley's experience of its ATB operations. During operations in California waters, an ATB of over 120,000 bbl. capacity is the functional equivalent of an ocean-going tanker. Based on their California operations, Crowley's ATBs cannot be "considered a barge and a tug separately".

When the rationale given in the Initial Statement of Reasons is compared to the definitions section in the second 15-day changes, the reason for the ATB exclusion is shown to be circular and entirely arbitrary. Where a barge and tug are separated, they do not and cannot function "as one vessel". According to the regulations, as confirmed by the second 15-day changes, an "articulated tug barge", *by definition*, functions as one vessel, <u>not</u> as "barge and tug separately". A separated barge and tug therefore do not, and cannot, meet the regulatory definition, in section 93130.2(b)(7), of "articulated tug barge".

2-15-1.2 In excluding ATBs from the At-Berth Rule, CARB failed to consider all relevant industry and environmental factors, and so it did not demonstrate any a rational connection between those factors, the choice made, and the purposes of the enabling statute. Under the circumstances, the only conclusion that can be drawn is that the continuing exclusion of ATBs from the definition of "ocean-going vessels" in the At-Berth Rule, as set forth in section 93130.2(b)(50) of the second 15-day changes, is that CARB refuses to reconsider an arbitrary and capricious decision it made at the outset of this regulatory process. CARB should now reverse this ATB exclusion before the final rule is submitted.

A Crowley ATB of at least 120,000 bbl. capacity should be regulated like any other ocean-going tank vessel. Crowley submits that, by including ATBs from the At-Berth Rule, CARB will not only improve air quality for at-risk communities in the vicinity of California's ports, but it will also strengthen the At-Berth Rule by making it internally consistent and removing the arbitrary and capricious exclusion of a significant portion of ocean-going vessels calling in California.

CARB's consideration of the second 15-changes affords an opportunity for CARB to delete the ATB exclusion in section 93130.2(b)(50). This exclusion that does not further the purpose of the At-Berth Rule to reduce emissions from ocean-going vessels docked at California ports and is operationally and practically unjustifiable.

Yours respectfully,

CROWLEY MARITIME CORPORATION

Art Mead

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Art Mead
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July 23, 2020

CARB Board Members
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Second 15-Day Changes on the Proposed Control Measure for Ocean-Going Vessels At Berth

Dear Honorable Board Members:

Thank you for the opportunity to comment on the Second 15-Day Changes for the Proposed Control Measure for Ocean-Going Vessels At Berth. South Coast AQMD staff appreciates the efforts by CARB staff in making subsequent modifications to the originally proposed regulation through two 15-day changes to address comments from all stakeholders.

As stated in our letter dated November 26, 2019, NOx emissions in our Basin need to be reduced by 45% and 55% beyond all existing regulations by 2023 and 2031, respectively, to meet the upcoming deadlines for attaining federal ozone standards. Ocean-going vessels (OGVs), combined with harbor craft, will represent the single largest source of NOx emissions in the Basin by 2023. Therefore, it is absolutely essential to maximize both short-term and long-term reductions in the proposed regulation to help achieve our attainment goals.

We support the adoption of the proposed At-Berth regulation with the Second 15-Day Changes and offer the following recommendations for your consideration:

Compliance Date Changes

2-15-2.1 Under the latest changes, CARB staff proposes to delay the compliance start date for container ships, reefers and cruise ships by two years from 2021 to 2023 and allow these vessels to remain under the existing At-Berth Regulation without any additional controls beyond 2020. Although we recognize the potential economic impact on the maritime industry due to the coronavirus pandemic, we are concerned with the negative impact of this proposed change on NOx and diesel particulate matter (DPM) emissions. Based on data provided in the second 15-day document, the proposed delay in the compliance date would result in increased NOx emissions at berth by 0.74 ton per day (tpd) in 2021 and 0.79 tpd in 2022 (and 0.01 tpd of DPM in 2021 and 2022) in our Basin compared to the initially-proposed regulation in December 2019. Given the significant contribution of emissions from these vessels, uncertainties regarding potential impact of the pandemic on marine industry, and the need to achieve early reductions for our local port communities and the regional air quality, we believe the proposed two-year delay is too long. Instead, South Coast AQMD staff recommends a maximum one-year delay to provide a reasonable level of relief to the marine industry which will start the compliance date for container ships, reefers and cruise ships on January 1, 2022.

For RoRo vessels, South Coast AQMD staff supports the proposed change to return the compliance start date to 2025 as originally proposed. Staff also supports accelerating the compliance start dates for tankers by two years from 2027 to 2025 for tanker vessels visiting the Ports of Los Angeles and Long Beach and from 2029 to 2027 for tanker vessels visiting other ports (first 15-day changes).

Innovative Concept

2-15-2.2 South Coast AQMD staff supports the innovative concept provision proposed in the first 15-day changes which provides options for the regulated entities to achieve equivalent emissions reductions through implementation of alternative control strategies in the port communities. The Second 15-Day Changes proposes to extend the compliance period for approved innovative concepts from three years to up to five years. South Coast AQMD staff is agreeable to this proposed extension as long as the benefits of the approved alternative control strategies are monitored, evaluated and quantified based on credible and transparent methodologies to ensure that the emissions reductions achieved are real, surplus, quantifiable and enforceable.

The proposed regulation is a significant rulemaking for the South Coast Air Basin. South Coast AQMD staff strongly supports the adoption of the Proposed At Berth Regulation as achieving emissions reductions from OGVs will be essential in meeting the ozone attainment deadlines in our Basin as well as providing considerable public health benefits in the port communities. We are also fully committed to continue to work collaboratively with CARB staff in the development and implementation of innovative programs to reduce emissions from OGVs and other sources.

Sincerely,

Wayne Nastri
Executive Officer

WN:SR:ZP:BC

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July 24, 2020

To whom it may concern:

"Additional" opinion Statement to "Second Proposed 15-Day changes to the control measure for ocean-going vessels at berth, dated on July 10, 2020"

We have compiled our "2nd additional" opinion on the use of electric shore power for Airborne Toxic Control for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in California Port as a position to operate vessels.

*Note
The red colored text is a quote from "ATTACHMENT A PROPOSED REGULATION ORDER -SECOND PROPOSED 15-DAY CHANGES TO THE CONTROL MEASURE FOR OCEAN-GOING VESSELS AT BERTH -" on July 10, 2020.

1. Page A-30 on Attachement A
   Section 93130.7(b) Requirements for vessel auxiliary engines
   <NYK comment>
   We concern to expand the regulations to ro-ro (PCTC = vehicle carriers) vessels.
   Because it is only about 20 ro-ro vessels (PCTC) out of 110 ro-ro vessels(PCTC) call California
2-15-3.1 frequently and regularly, and other ro-ro vessels (PCTC) may call only several times a year and very short stay at berth. Moreover, some vessels may not call CARB. But all of our ro-ro vessels (PCTC) have to comply this new regulation because of any ro-ro vessels (PCTC) may have chance to call California. Therefore, it will be required to install AMP on all of our ro-ro vessels (PCTC).
   Based on our past experience of installation of retrofit AMP on container ships, we estimate approximate costs of USD 700,000 to 900,000/vessel.
   Please understand this cost impact is very serious for vessel operators (Owners), and we would like you to cooperate in the development of future technology rather than investing for vessels with such low numbers of calling at CARB. Absolutely, we comply with current regulations.

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2. Page A-25 on Attachment A

Section 93130.5. CARB Approved Emission Control Strategy

(g) Source testing.

A person shall use source testing to demonstrate that a proposed emission control strategy achieves the performance standards in section 93130.5 (d) of this Control Measure. Testing must be done by third party source testers specified in the test plan. Alternative test methods or emission verifications may be used when specified in the test plan upon written approval from the Executive Officer. The following requirements shall apply to source testing conducted under this Control Measure:

<NYK comment>

2-15-3.2 In this year, LNG fueled ships will be delivered into service in place of conventional heavy fuel oil, but regarding the generator of LNG fueled ship, it should be approved as "type approval", means we'd like to suggest not approval for each generator engine of vessel individually. In other words, the exhaust gas of LNG fuel engine itself equipped on board to be not measured, but exhaust gas of engine of same model/type to be measured at the manufacturer's factory and that it is approved.

Furthermore, although we are studying with one of university in US for the sample collection procedure for PM/NOx/ROG measurement and method for exhaust gas analysis, found that it is tremendously difficult to install the measurement equipment on board (due to space restriction and impossible to apply various required load on Diesel generator for testing) and costs a huge amount.

Basically concerning that the sparks on the shore power cable connection may cause a very dangerous situation, so strongly request to exempt use of shore power during bunkering and LNG fueled vessels, however, if it is difficult to accept, at least LNG fuel auxiliary engines retain as an approved control option, or LNG fuel engines should be approved as "type approval" as mentioned above.

3. Page A-37 on Attachment A

Section 93130.9. Terminal Operator Requirements.

(d) Terminal operator compliance checklist.

(4) Use shore power or another CAECS during the vessel visit.

(C) Cease controlling emission with shore power or another CAECS no sooner than one hour before "Pilot on Board"; and

<NYK comment>

Although it is stipulated that it is no sooner than one hour before POB, in the case of RoRo vessels, it becomes quite busy because there are many complicated tasks such as securing ramps, checking the lashing condition of all cargoes from the end of loading until sailing.

2-15-3.3 Most pilots come aboard before the sailing time, but just before that is the busiest time for the crew.

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2-15-3.3 Therefore, we would like to request a change in the regulation "no sooner than two hours before ETD" regardless of the time of POB.

Furthermore, should be considered that is necessary to idling operation without applying electric power load for a while before stopping and after starting generator engines. Idling operation is needed at least 15

2-15-3.4 minutes after starting till apply electric load and 15 minutes to stop after taking out electric load (for cooling down). Therefore, 30 minutes of idling time should not be included in CAECS usage time such as shore power. Thus, this time consuming should be considered for next opinion of item.4 (berthing period).

4. CAECS exemption due to berthing period.

<NYK comment>

2-15-3.5 In the case of RoRo, berthing period is often quite short. Crew members are busy working on port entry and leaving work at California ports and preparation for cargo operation. In addition, with considering the idling operation time after starting the engine and before stopping as mentioned above, would like to request exempt that if it is berthing period within 10 hours.

Due to shore power connection and disconnection work, there is a possibility that will be pointed out by PSC in other countries no as to comply with MLC regulations (shortage of rest hours).

5. Confirmation of charges shore power used at the terminal in CARB

<NYK comment>

We need to make a budget for operating expenses of vessels. It does not specify the charges for using shore

2-15-3.6 power when using it at RoRo terminal.

For the reference, would like to know how you are considering the expenses of electricity usage at this stage. It must be considered as an additional cost for entering in the port of CARB.

Yours faithfully,

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April 28, 2020

Duplicate see 15-day comment letter 24

To whom it may concern:

"Additional" opinion Statement to "Proposed 15-Day changes to the control measure for ocean-going vessels at berth, dated on March 26, 2020 "

We have compiled our "additional" opinion on the use of electric shore power for Airborne Toxic Control for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in California Port as a position to operate vessels.

We would like to submit the opinion statement below.
Some of comments are duplicates with WSC's comments submitted on April 21, 2020, but will list here as well, and please note that the initial opinion for previous draft dated on October 15, 2019 are also attached in this statement from page.4 to 7.

1. Implementation date
   <NYK comment>
   The biggest change we see between this draft and the original proposal is the change in implementation dates (page 28-29). As proposed, Ro-Ros would be required to comply in 2024 rather than 2025, tankers going to LA/LB in 2025 rather than 2027, and all remaining tanker trade in 2027 rather than 2029. As far as we can tell, CARB has offered no explanation for this revision.
   Given the current global circumstances and likely impact on the industry, we recommend providing comments to request the original compliance dates be maintained to allow sufficient time for fleets to come into compliance.

2. Page A-11 on Attachment A
   Section 93130.2. Section Summary, and Definitions.
   (b)Definitions.
   (40) "IMO NOx tier" means the NOx tier level of a vessel as citified in the Engine International Air Pollution Prevention (EIAPP) Certificate. Vessel without an IMO NOx tier are considered pre-tier I vessel.
   <NYK comment>

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What is difference in correspondence between each vessel due to differences in tier?

If the vessel satisfied with tier 2 or 3, is there some preferential treatment?

3. Page A-19 on Attachment A

Section 93130.5. CARB Approved Emission Control Strategy

(d) Requirement for CARB approval of an emission control strategy.

(1) Emission reductions.

To receive CARB approval, a person must demonstrate that the emission controls strategy achieves emission rates less than 2.8g/kW-hr for NOx, 0.03g/kW-hr for PM-2.5, and 0.1g/kW-hr for ROG for auxiliary engines. Additionally, for strategies approved after 2020, GHG emissions from the strategy must be grid-neutral using the grid emission rate for the year that the technology is granted an Executive Order. Default emission rates of auxiliary engines on ocean-going vessels are 13.8g/kW-hr for NOx, 0.17g/kW-hr for PM-2.5, and 0.52g/kW-hr for ROG.

<NYK comment>

It is necessary to reduce the values of NOx, PM, and ROG respectively to the specified values, but we would like to know clearly the basis (reason) of these presented values, 2.8(NOx), 0.03(PM2.5) and 0.1(ROG).

In addition, enormous cost and time are required for measurement of above. Therefore, implementation date of regulation should not be advanced, and cost assistance is required for NOx, PM2.5 and ROG measurement.

Further, we should be able to refrain from using shoreside electrical power for LNG-fueled vessel by reporting or verifying that LNG fuel has been used in port.

4. Page A-56/57 on Attachment A

Section 93130.17. Innovative Concept Compliance Option.

(a)Genera; requirements for using an innovative concept compliance option.

(1) Applicants seeking approval of an innovative concept must submit their applications to the Exclusive Officer on or before the following dates in Table 5 for each vessel category:

Table 5: Innovative Concept Application Due Date	
Vessel Type	Due Date
Container/Reefer	July 1, 2021
Passenger	July 1, 2021

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Ro-ro	December 1, 2021
LA/LB Tankers	December 1, 2021
Other Tankers	December 1, 2021

(2) The proposed innovative concept must reduce NOx, PM 2.5, and ROG emissions equivalent to or greater than the level that would have been achieved by the Control Measure, while not increasing GHG. Emission reductions are verified each year through annual reporting in section 93130.17(d) of this Control Measure

<NYK comment>

It will be necessary to issue some documents from engine manufacturer such as the NOx Technical File, in order to comply with new regulation of NOx, and to describe who will allow CARB to approve the test result for PM2.5 and ROG measurement.

If CARB accept the method/equipment for reduction of NOx/PM/ROG, we would like to request CARB to compensate the cost for test.

5. Page B-4 on Attachment B

Summary of the 15-Day Changes

8)Connection time from “Ready to Work” determination. The Proposed Regulation adjusts the time allowed for connection to shore power or an alternative CAECS for vessels at berth from one hour after “Ready to Work”. This Change is expected to have a minor impact to the emissions reductions compared to the connection time definition listed in the ISOR. This is based on past compliance data for the original At-Berth Regulation. Staff do not connect to shore power or to an alternative CAECS. This change has no impact on costs.

<NYK comment>

Who has responsibility for emission control violations if more than two hours have passed since "Ready to Work" due to delays by shore-side works and/or any other reason to connect shore power. It should not be on vessel.

6. Page B-4 on Attachment B

Summary of the 15-Day Changes

9)Updated non-cancer mortality. Total costs for all entities is expected to be about $2.4 billion through 2032, with a statewide valuation of avoided health impacts valued at $2.44 billion from 250 fewer premature deaths, 78 fewer hospital admissions, and 126 fewer emergency room visits statewide. More

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information on the updates to the Health Analysis can be found in Attachment D of the 15-day package.

Page D-3 on Attachment D

2. Updates to Regional PM2.5 Mortality and Illness Analysis for California Air Basins: PM Mortality and Illness: Reduction in Health Outcomes.

California Air Resource Board (CARB) staff estimated the reduction in health outcomes from reduced emission of PM2.5 from the 15-day change version of the Proposed Regulation. These health outcomes include cardiopulmonary mortality, hospital admissions, and emergency room visits. Based on the analysis, staff estimates that the total number of cases statewide that would be reduced due to the implementation of the Proposed Regulation are as follows:

- 250 premature deaths (195 to 305; 95 percent confidence interval (Cl)).
- 78 hospital admissions (10 to 145; 95 percent (Cl).
- 126 emergency room visit (79 to 172; 95 percent Cl)

Updated Tables 20 through 22 show the estimated reductions in health outcomes resulting from the Proposed Regulation summed over 1 12-year period from 2021 to 2032. The values in parentheses represent the 95 percent confidence interval for each health outcome.

<NYK comment>

It understands as estimated figure, however, it is not just because of vessels. It seems to be not considered the underlying disease, inherited diseases, lifestyle-related diseases, etc.

Yours faithfully,

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October 22, 2019

To whom it may concern:

Opinion Statement to "Appendix Proposed Regulation Order for At-Berth in a California Port "

We have compiled our opinion on the use of electric shore power for Airborne Toxic Control for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At-Berth in California Port as a position to operate vessels.

As can be seen at the link below, NYK has been working with POLA (Port of LA) since 2004 to make use of shoreside electrical power systems for containerships.

https://www.portoflosangeles.org/environment/air-quality/alternative-maritime-power-(amp)

Based on this, we would like to submit the opinion statement below.

1. Page 7

(21) "Diesel Engine" means an internal combustion, compression-ignition engine with operating characteristics substantially similar to the theoretical diesel combustion cycle. Regulating power by controlling fuel supply in lieu of a throttle indicates a compression ignition engine.

<NYK comment>

We should be able to refrain from using shoreside electrical power for LNG-fueled vessel by reporting the amount of fuel (or ROB at berthing and at sailing) and verifying that LNG fuel has been used.

2. Page 8

(41) "Malfunction" means any sudden and unavoidable failure to operate in a normal manner by air pollution control equipment that is not caused in any way by poor maintenance, negligent operation, or any other reasonably preventable upset condition or equipment breakdown.

<NYK comment>

If a malfunction occurs, please specify what kind of maintenance record should be prepared and submitted in order to certify "Not poor maintenance, negligent operation, or any other reasonably preventable upset condition or equipment breakdown."

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3. Page 14

(1) Any person who owns, operates, charters, or leases any United States or foreign-flag ocean-going vessel that visits a California port, terminal, or berth;

<NYK comment>

Who would be chiefly responsible? If the vessel is chartered, will the owner be responsible? As can be seen from the phrase "All responsible parties may be held jointly and severally liable," we can assume that CARB takes the stance that chartered vessels, owners, and shippers can *all* be held responsible. Please clarify the responsible person.

4. Page 22

(a) No person shall discharge or cause the discharge from any ocean-going vessel at berth and at anchor, into the atmosphere, any visible emissions of any air pollutant, for a period of periods aggregating three minutes in any 1 hour from any operation on the vessel that is:

<NYK comment>

It is said that black smoke on a Ringelmann 2 or more scale and other pollutants must not be discharged for more than three minutes out of every hour. Do we need to monitor the funnel with cameras and store recorded video? Video that can be adequately verified at night can be difficult to obtain.

5. Page 22

Section 93130.7. Vessel Operator Requirement

Vessel operators that visit a berth or terminal in California shall meet the following requirements. Any failure to perform any specific items in this section shall constitute a separate violation for each day that the failure occurs.

Operator definitions are stated as follows:

“Page13

(79) "Vessel Operator" means any person who decides where a vessel is to call or who is in direct control of the vessel. The party in direct control of the vessel may be a third-party hired to carry cargo or passengers for the person under a charter agreement to operate the vessel. Direct control does not include the vessel master or any other member of the vessel crew, unless the vessel master or crew member is also the owner of the vessel or decides where a vessel is to call.”

<NYK comment>

From these definitions, it is possible to understand that the owner considers the charterer to be the operator, and the charterer considers the shipper to be the operator. Please add a sentence that clearly indicates the requirements imposed on the shipper.

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6. Page 24

(3) Use shore power or another CARB approved emission control strategy during the vessel visit.

(A) Begin using shore power or another CARB approved emission control strategy within 1 hour after "Ready to Work".

(B) Cease using shore power or another CARB approved emission control strategy no sooner than 1 hour before "Pilot on Board."

Ready to Work can be defined as follows:

"Ready to Work" means that the vessel is tied to the berth, the gangway has been lowered with netting down, and the United States Coast Guard, United States Customs and Border Protection, and other government authorities have cleared the vessel.

<NYK comment>

There are virtually no opportunities for government authorities to visit and “clear” a vessel at every time. Therefore, can we regard the vessel to be “Ready to Work” when the gangway is set up or the when the captain signs documentation in communication with the agent? Please provide clear guidance as to what would constitute a clearance by government authorities.

Since it is expected that the loading/discharging start time will be delayed, the stern ramp should be set up regardless of whether power has been switched to shoreside electrical power.

7. Page 28

(1) Operators of terminals with berths equipped to receive compatible shore power vessels must connect these vessels to shore power when visited by a commissioned shore power vessel.

<NYK comment>

If the terminal is responsible for installing the shoreside electrical power supply, the specifications of the systems should be decided early and disseminated.

Please note that all our operating PCTCs have a distribution voltage of 440V / 60 Hz. The 440V distribution systems are not ideal for providing shore-based power because of the high amperage required. To reduce the loss caused by the augmented electrical resistance, the voltage supply at berth is required to be as high as 6.6kV, and have a stepdown transformer that can be located either on board the ship or at berth to connect with 440V distribution systems.

The stepdown transformer and the cable management system should remain on board for smooth operation. The installation location for equipment like power transformers, electrical power systems, switchboard, control panel, and cable reel system (possible and on berth) will be a significant challenge due to space

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restrictions and ship construction and type.

Modification of ship structure may be required depending on space availability. In addition, the frequency of the onboard power system is 60 Hz. A frequency converter may be required depending on the port frequency, and the plug and socket that are currently used at POLA (Port of LA) should be standardized so that they can be used at ports throughout the world.

Since car carriers have a very high freeboard, the equipment can be placed as per either of the two options.

1st Option - It is conceivable that a truck equipped with cables and transformers can be loaded on the vessel. Therefore, the "1 hour" indicated in Section 93130. 7(e)(3)(A) and (B) should be relaxed to "6 hours."

2nd Option - Installation of the electrical fittings and hoist mechanism on the aft mooring station (Deck 9). However, we are not sure of the size of the equipment required to be installed and dimensions of the cable reel because the aft mooring deck has height and space limitations, and modification of construction may be required.

3rd Option – A 20-foot container with complete installations may be placed on the weather deck (deck 12/13). A shore crane needs to have a high reach of about 40 m.

8. Page 31

Unlike containerships, RORO vessels have a short berthing time. Therefore, the target vessels should limit the number of annual calls to seven or more and berthing time to 24 hours or more.

The NYK RORO division would like to propose the following:

<u>General</u>

1. Shore power connection box capacity is not sufficient for the ventilation fan load. Some modification would be needed. None of our current PCTCs are fitted with AMP (Alternate Management Power Supply system). If shore power is deemed compulsory in California ports, all our ships will have to undergo conversion to be considered.
2. Time is constrained for connecting the power to shore power.
3. If a mobile truck mounted unit is used, some cargo may need to be discharged prior to the truck entering the car hold (related to first option mentioned above), and during this time the DGs would need to continue running.
4. Delay is often a result of something outside of the vessels control (clearance delay/labor delay, terminal equipment issues)
5. Differentiations between existing and newly built ship standards should be clarified. Expecting old vessels to comply with latest performance standards is impractical. Limitations (like derating) should be acceptable.

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6. If vessel is not shore power capable, vessel is responsible for providing Alternate strategy which has to be approved by CARB. The issues as of now are on the process for preparing the alternate strategy and obtaining the approval from CARB, this may also include follow up with AE makers on what measures are required to ensure emissions are within limits set by CARB.
7. Vessel which are suitable for shore power – the issues are mainly safety related, e.g. blackout while taking shore supply and again after shore supply is removed – resulting in its impact on vessel's equipment, particularly Navigational Equipment / Gyro Compasses. Also have to ensure the shore power supply is sufficient for safe cargo operations and vessel's safe stay at berth.

Yours faithfully,

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July 24, 2020

Ms. Mary D. Nichols, Board Chair
Mr. Richard Corey, Executive Officer
California Air Resources Board
1001 I Street
Sacramento, California 95812

Submitted via docket as directed at: http://www.arb.ca.gov/lispub/comm/bclist.php
Also transmitted via email

Cc (email): Heather Arias, Bonnie Soriano, Angela Csondes, Nicole Light

Subject: **Maersk Comments on the Second Public Availability of Modified Text and Availability of Additional Documents and Information for the Proposed Control Measure for Ocean-Going Vessels At Berth, Board item ogvatberth2019**

Dear Board Chair Nichols and Mr. Corey,

Thank you for this opportunity to comment on the Second Public Availability of Modified Text and Availability of Additional Documents and Information for the Proposed Control Measure for Ocean-Going Vessels At Berth, Board item ogvatberth2019. We have provided five sets of written comments in 2019 - 2020 (March 8, March 26, June 10, December 6 and April 29th), as well as less formal communications including analyses of arrival time feasibilities. We also provided input and analyses to PMSA and the World Shipping Council to incorporate in their consolidated industry comments.

Maersk is an integrated international container logistics company, operating about 750 container vessels globally as well as marine terminals, warehouses and other essential supply chain functions. Each year 45 to 60 of our vessels make over 500 calls in California ports. Typically, each of these international vessels spends less than 5% of its operable lifetime in the waters of any one state or country. Network changes and vessel redeployments are an essential part of supply chain operations.

Maersk has long been an environmental leader in shipping. Since 2008 we have reduced our fuel consumed and related emissions by 43% on a per container per kilometer basis. We have committed to a 60% reduction and to launch a first carbon-neutral vessel by 2030 on our way to zero carbon emissions shipping by 2050. In the past Maersk voluntarily used dramatically cleaner fuels in California ports, and supported establishing both the California fuel rule and the North American Emissions Control Area. We are committed to going beyond compliance to

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achieve environmental excellence and hope these comments will be taken in the constructive spirit with which they are offered.

We appreciate that some of our previous comments were considered and adopted and look forward to CARB's full response to comments. The comments in this letter will focus on the changes made in the Second 15-day package.

1. The notice and proposed regulatory language modifying the implementation, transition and reporting timelines are clear and well-written, and the use of strikeout formats to designate the changes was very helpful.

2. We greatly appreciate the 2-year continuation of the existing regulation and date adjustments to address the timeline inconsistencies identified the proposed rule, move past the worst of the COVID-19 disruptions, and conduct a thorough interim review. During this time the performance of the currently regulated fleets can be determined under the final requirements of the existing rule and related provisions such as Proposition 1B, which were implemented as of 1/1/2020.

3. **Plans and infrastructure timing:** The revised timeline is not fully aligned with public works project timing in the ports. For example, terminal and port plans are due December 2021, with CARB approval lasting up to 90 days. We question whether the required infrastructure improvements can then be funded, permitted and in place to support the 1/1/2023 implementation of the new rules for the currently regulated fleets. This is particularly troubling due to the lack of viable alternative CAECS in most California ports.

2-15-4.1

   Recommendations:
   - Include a provision to allocate additional VIEs or TIEs in locations where the necessary infrastructure improvements cannot be achieved in the allotted time.
   - Consider allowing unlimited use of the remediation fund or other alternatives to achieve timely reductions and enable compliance in the gap between the vessel compliance dates and completion of needed infrastructure projects.
   - Consider allowing use of the remediation fund in situations where no alternatives CAECS are feasible.
   - During the 2 years before implementation of the new rule clarify the application and compliance options for lay-by berths and repair berths, where usage and access are by definition variable. Data on these facilities is limited, so the interim review should be used to determine any practicality issues and if needed, adjust the low activity terminals provisions.

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4. **Interim review:** As directed by the Board on June 25th, the Interim review scheduled December 2021 should now cover the full shore power program. We look forward to working with CARB Staff during this period.

2-15-4.2 The interim review should address issues regarding rule implementation raised by stakeholders over the next two years. As work on implementation continues, it will be critical to resolve issues, including the sufficiency of TIEs/VIEs, incorporation of fleet averaging under Innovative Concepts or CARB Approved Emission Control Systems (CAECS), sufficient compliance pathways for non-frequent fliers, and other issues identified in this letter. This period should also enable updating of the emissions inventory projections.

2-15-4.3 5. **Innovative Concepts:** The Innovative Concepts (IC) section of the proposed regulation remains extremely complex. Changes should be considered to make the concept more viable as a long-term compliance option.

a. We support the increase of the term from three to five years. This change will be helpful in encouraging investments. However the window of opportunity for proposals remains overly short, with plans due no later than 12/2021. This greatly limits the usefulness of this concept. CARB should consider ways to encourage innovation in emissions reductions by lengthening the opportunity to propose additional ICs after 2021.

2-15-4.4

2-15-4.5 b. Section 93130.17(a)(3) and following, starting on page A-61, are extraordinarily complex and restrictive, stating:

> *"(3) The proposed innovative concept must achieve emissions reductions that …. are early or in excess of: (1) any other state, federal or international rule, regulation, statute or any other legal requirement (including any requirement under a Memorandum of Understanding with a government entity); or (2) of an emissions reduction strategy identified in an AB 617 ..program…"*
>
> *"(6) The proposed innovative concept must achieve emissions reductions that exceed any reductions other wise required by law, regulation or*

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legally binding mandate, and that exceed any reductions that would otherwise occur in a conservative business-as-usual scenario"

"(12) No innovative concept shall be partially or fully funded with a public incentive program."

These and other restrictions in this section appear to exclude participation by:

2-15-4.5

- Technologies or operational programs that have been part of a Technology Advancement program in California (e.g., SPBP CAAP), other states, the EU or elsewhere in the world.
- Any technology or program that might conceivably become part of an AB 617 plan that includes an Indirect Source Rule or other broadly defined community recommendation.

We also question how the applicant and CARB staff are to ensure that there are no disqualifying regulations or issues anywhere globally, and who will define the "conservative business-as-usual scenarios."

Recommendations:

- Section 93130.17 should be clarified and streamlined in order to achieve the needed reductions without discouraging innovation or participation in technology demonstrations and incentive programs in other parts of the world (e.g. Canada).
- In addition, it should be clearly stated that CARB's Low Carbon Fuel Credits are not considered to be incentives under this section.

6. Allocation of VIEs and TIEs: Section 93130.11

2-15-4.6

a. Section 93130.11(a)(1) calls for reporting of vessel visits to CARB by January 7th. This seven-day period is inconsistent with the 30-day reporting required in other sections. Please clarify whether this report is a simple vessel call count or the full individual call reports for each vessel call that would normally be reported in 30 days.

2-15-4.7

We fully recognize and support the need for operators to know the VIE/TIE allocation as early as feasible in the year. However large vessels arriving on December 31 may have longer calls due to the holidays, so full data may not yet be available. Occasionally a vessel may still be alongside.

Recommendation: We suggest that either a simple actual vessel arrival/departure schedule be accepted for this purpose, or that preliminary

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2-15-4.7 reports be allowed by Jan. 7th for calls after Dec. 7th, with updates allowed for those calls when full details are available.

2-15-4.8 b. Section 93130.11(a)(1) also excludes calls made under Innovative concepts from being part of the VIE/TIE allocation. Provisions should be made for situations where the innovative concept is not available due to expiring approval or other technical or operational issues.

2-15-4.9 c. Section 93130.11(a)(3) has been aligned with the revised timeline. However the 5% values shown for vessel operators are not sufficient based on the analyses we submitted to CARB over the last year. This should be reviewed further during the period prior to implementation and specifically addressed in the interim review.

d. Section 93130.11(e): We appreciate the clarification that TIEs and VIEs can be used as needed by the owner.

2-15-4.10 7. **Liabilities:** The liability provisions in the new rule should be clarified before January 2023. The proposed rule still calls for joint and several liability for violating the control measure. This conflicts with the basic premise that the new rule should define clear requirements and responsibilities for each participant: ports, terminals, vessels and alternative compliance operators.

Thank you again for this opportunity to comment on the proposed regulatory language. We stand ready to work with CARB and other stakeholders over the next two years to identify and address practical issues and achieve a smooth transition.

Sincerely,

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Subject: **Industry Coalition Comments on Second Supplemental 15-Day Notice, Proposed Regulation of Oceangoing Vessels At Berth**

Thank you for the opportunity to comment on the proposed At Berth Regulation. This coalition of industry stakeholders appreciates the opportunity to work with California Air Resources Board (CARB) staff during regulatory development on behalf of our maritime industry member companies and stakeholders, including oceangoing vessel operators, marine terminals, and ports.

The second 15-Day Notice provides for changes to the regulatory structure of the proposed At Berth Regulation and addresses some of the concerns that this coalition has raised during rule development. In particular, we believe changes to the effective date for proposed new rules to incorporate the existing regulated fleet from 2021 to 2023 and for restoring the originally proposed Ro/Ro effective date are steps in the right direction. These amendments provide some short-term continuity and an opportunity for future improvements. However, the latest 15-Day changes do not resolve numerous implementing, operational, and feasibility hurdles in this complex rule, and this coalition remains concerned that many of the foundational and technical issues that have been raised over the course of this rulemaking have not yet been addressed or responded to by the time of proposed rule adoption. Given these outstanding issues, if CARB adopts the rule as proposed, we envision that continued heavy lifting and future changes to this regulation will be necessary in order to facilitate a successful implementation.

New Effective Date Provides an Opportunity to Address Challenges for Existing Regulated Fleets

Industry stakeholders appreciate the revised effective date of 2023 for the application of the proposed rule to the existing regulated fleets. This date will allow all stakeholders an opportunity to continue to work with CARB staff to improve the rule structure and to ensure that any final rule will not penalize vessels, terminals and ports which have already committed to a shore power compliance pathway and are currently complying with the existing rule. This industry coalition remains concerned that the proposed rule as currently written and conceived cannot be successfully complied with even by vessels which are currently compliant with and have made required investments in shore power under the current regulation. Resolution of these concerns will only occur with concerted additional efforts to

2-15-5.1

create a robust fleet-averaging construct or other new avenues for compliance prior to 2023. Given the limited time, the industry stakeholders request that the Board direct staff to continue meetings with stakeholders to address and resolve outstanding issues regarding the current regulated fleet.

CARB Must Still Address Challenges for Expanding Regulation to Additional Fleets

2-15-5.2 With respect to expansion of the scope of the existing rule, serious concerns remain regarding the feasibility and true cost-effectiveness of controlling tanker and Ro/Ro vessels. The opportunity to address these concerns regarding Ro/Ro vessels will benefit from the proposed 15-Day Changes to reapply the original date of implementation in this sector. However, it is imperative that CARB work with the impacted fleets to address outstanding concerns prior to commencement of the technical review period.

Interim Evaluation

The text of the interim evaluation contained in the proposed regulation presupposes the feasibility of emission control technology for tanker and Ro/Ro vessels. The language should be clear that the interim evaluation will evaluate the feasibility of technology to control emissions successfully and cost-effectively from tankers and Ro/Ro vessels. The ability to package the existing technology to reduce emissions in exhaust streams in a manner that can safely operate on tanker and Ro/Ro vessels is an open question. The technology has a number of technical, safety, and operational constraints it must overcome. At the same time, any proposed system needs to also abide by Coast Guard, OSHA, and other regulatory requirements, while not being prohibitively expensive. The interim evaluation should be clear that it will evaluate all considerations that would impact the success of new control
2-15-5.3 technologies.

With that in mind, the demonstrations proposed by CARB staff will be inadequate to inform the interim evaluation. First there are no proposed demonstrations to address Ro/Ro vessels. The configuration of Ro/Ro vessels make reaching the exhaust challenge an engineering challenge. The height and reach needed for such vessels will result in larger counterweights and increasing system weight. It is not known if such a system can be successfully placed on a barge or existing wharf structures. The only way to answer these questions is with a demonstration that must be completed before the interim evaluation is conducted. The proposed demonstration for tanker vessels will be unable to inform the interim evaluation. With a presentation date of December 2022, it is likely that the demonstration will not even be operating before CARB staff must prepare their evaluation and is not expected to be complete until long after the interim evaluation is complete. An interim evaluation that is not informed by a complete demonstration is mere speculation.
2-15-5.3

The interim evaluation should also address issues regarding rule implementation raised by stakeholders over the next two years. As work on implementation continues, it will be critical to resolve issues, including the sufficiency of TIEs/VIEs, incorporation of fleet averaging under Innovative Concepts or CARB Approved Emission Control Systems (CAECS), sufficient compliance pathways for non-frequent fliers, and other issues identified in this letter.

Innovative Concepts

2-15-5.4 This coalition appreciates proposed changes to the Innovative Concepts (IC) of the proposed regulation but believes that these changes remain insufficient. While increasing the term to five years does provide some additional certainty for select regulated parties to propose an innovative concept, it still fails to provide the long-term assurance necessary to make it a viable compliance pathway. A number of other changes should be considered to make the concept viable.

2-15-5.5
- A fleet averaging concept should be a defined path within the IC section. Fleet averaging, as a program whose parameters are known, should not be subject to unnecessary restrictions for new concepts. Given the known success of fleet averaging to reduce emissions, it is not necessary to create uncertainty by having a five-year term with extension subject to uncertain approval. In addition, concerns remain that at this time it is unknown how fleet averaging would be handled under the IC provisions and that CARB staff cannot describe or even assure that fleet averaging is consistent with all the requirements of the IC provisions.

2-15-5.6
- While IC must be "surplus" at the time of creation, CARB could revoke or decline to renew approval if the emission reduction became subject to regulation at a future date, or by any CARB-approved AB 617 Community Emission Reduction Plan. The IC section should be modified to allow IC reductions without this limitation.

2-15-5.7
- Limiting the location of IC emissions reductions only to "adjacent" communities and distances no greater than 3 nautical miles may have unintended consequences. Neither "adjacent" nor "community" are defined in the Proposed Regulation, so it is unclear how close an area would need to be in order to be deemed "adjacent," and where the boundaries of that area would end. The IC section should be modified to encourage any project (adjacent or not) that would benefit the port and terminal communities.

2-15-5.8
- The IC section sets a single, one-time deadline for submitting a proposal. This implies that ICs will not be considered after December 1, 2021. The deadline should be removed and replaced with a process for IC plan review at any date such plans are submitted in the future. In addition, if IC will be used to facilitate fleet averaging, the ability to use fleet averaging should be available beyond 2021. Fleets will encounter different circumstances over the life of this regulation that may allow them to comply with the proposed regulation versus making use of a fleet average approach. New fleets may want to enter the California market after the 2021 deadline and this ensures they will be forever precluded from using fleet averaging. The original rule contained a similar fixed date requirement for alternative technologies, CARB staff eventually were forced to revise that through the use of an "Advisory". As a result, we strongly recommend that IC applications be accepted continuously with the understanding that CARB needs a minimum lead time before an approved application becomes effective.

2-15-5.9
- The prohibition on public funding for ICs is too broad. Funding may come from different sources, including federal, other states, or other nations. In addition, such a prohibition would exclude demonstration projects. Fleets that are likely to engage in ICs, including fleet averaging,

are also likely to participate in demonstration projects sought by CARB or other air quality agencies. Being innovative should not prohibit technology advancement.

2-15-5.10

- Revocation of the IC plan provides for a 30-day notice. This is likely to be inadequate for an ocean carrier to transition to original provisions of the rule. The risk of a 30-day transition at the uncertain end of a five-year program is enough to prevent an ocean carrier opting to implement an IC. The IC section should include a nine-month transition period upon revocation of an IC plan.

Industry Grappling with the Effects of COVID-19

The scale of the current crisis is unprecedented. The World Trade Organization (WTO) has estimated that global trade could decline up to 32% this year.[1] As a result of this crisis, the analyses on which this rule is based are out of date and no longer valid. The ISOR analysis is predicated on strong growth assumptions based on a number of forecasts. Questions about those assumptions were raised prior to the current crisis. For example, the ISOR analysis assumes that from 2016 (the inventory base year) through 2020 container cargo at the ports of Long Beach and Los Angeles would grow 4.5% per year. Last year (before the current crisis), the two ports declined 3.3%. Since the crisis, the decline has accelerated, with year-over-year declines in January (-5.1%), February (-16.9%), March (-19.7%), April (-11.4%), May (-13.7%), and June (-10.3%). For the first six months of the year, the two ports are down 12.5% over the same period last year. Before even considering the rest of the year, the current crisis means the emissions inventory contained in the ISOR is wrong. That gap only grows if the rest of 2020 is forecast based on WTO projections. By the end of this year, the baseline forecast used in the ISOR will overestimate cargo volumes by between 26% and 62%.

The economic impact of COVID-19 on the cruise industry is substantial. The suspension of operations will have a pronounced detrimental impact on families and communities globally. Of the 421,000 industry supported jobs in the United States, 12% are in California, yielding 49,369 jobs in The Golden State and generating $3.26 billion in total wages and salaries.

In a similar fashion, fuel consumption has precipitously declined as a result of the crisis. With an unprecedented number of people filing jobless claims that need and demand for fuel has plummeted. Refinery demand will directly impact demand for liquid bulk vessels calling California ports. It is clear that the forecasts contained in the ISOR no longer represent a reasonable expectation of future activity of tankers in California.

The crisis is also forecast to impact auto sales in this country and globally. Decreased auto sales will translate into reduced Ro/Ro activity. The base case scenario has volumes declining from 2019 by 14%. In a worst-case scenario, volume declines would plunge 28% from 2019 levels. The Automotive from Ultima Media forecast auto sales slightly growing by the end of the decade, the proposed rule is based on a growth rate that would see Ro/Ro activity 83.5% higher than 2016 levels in the ports of Los Angeles

[1] https://www.wto.org/english/news_e/spra_e/spra303_e.htm

and Long Beach by 2030 and 31.9% higher at the Port of Hueneme[2]. These numbers are not realistic or a reasonably foreseeable outcome of the current economic climate.

2-15-5.11 The estimates of benefits, emissions estimates, costs, cost-effectiveness, and health impacts, which presume the rate of growth contained in the ISOR, are now no longer valid. Even if growth were to immediately resume at levels assumed in the ISOR, cargo volumes and resulting activity will likely be millions of containers off from the cargo volume estimate.

Projections and Analyses Must Be Revised

2-15-5.12 During the June 25th hearing, CARB staff acknowledged that the COVID-19 crisis has impacted existing and future cargo volumes in California ports. Staff also stated that the current crisis will have disparate effects across the maritime industry, with the timeline to recovery being long. Even before the current crisis, this coalition submitted data demonstrating that the cargo and resulting emissions estimates were wrong. The crisis has amplified those errors. The derived data from the cargo forecasts has led to unreliable information presented in the updated emissions forecast. As stated in the letter on the first 15-Day Notice[3], cargo volumes in 2020 for the ports of Los Angeles and Long Beach will be at least 26% below the values contained CARB's data set. CARB staff has not addressed any of forecast issues raised in the prior letter. As a result, all dependent analyses, including rule emissions benefits, health benefits, CEQA review including the Statement of Overriding Considerations, and cost-effectiveness, will all be based on flawed data. CARB should re-evaluate baseline emissions, proposed emission reductions, health benefits, costs, and cost-effectiveness based on a revised forecast and assumptions.

Fundamental Problems with Emissions Inventory Unresolved

Even before addressing the changes brought about by the COVID-19 crisis, the emissions inventory has not addressed known problems as described in previous industry stakeholder comment letters. The inventory overestimates growth, resulting in a significant overestimation of the proposed rule's emissions benefit. The inventory does not consider the emission reductions associated with Proposition 1B funding, requiring emission reductions of 90% under the existing rule – 10% more than the proposed rule. This results in the inappropriate attribution of emission reductions from existing requirements to the proposed rule. The emissions inventory also inappropriately caps emission reductions under the existing rule at 80%. Every vessel with a call greater than 15 hours will result in emission reductions greater than 80%. In San Pedro Bay, where calls greater than 100 hours are typical, emission reductions can exceed 97%. Section 93118.3(e)(4)(A) of the current regulation explicitly states that any vessel using grid power is assumed to reduce emissions 90%. Yet, no explanation or reason is given in the emissions inventory for capping emission reductions at 80%. The inventory must be updated to correct these issues.

2-15-5.13

CARB inventory staff have acknowledged these issues in a variety of phone calls and emails with stakeholders and have indicated that these issues will be resolved sometime this summer. That delay does a disservice to both the public and decisionmakers in understanding the benefits of the proposed rule changes.

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[2] https://ww3.arb.ca.gov/regact/2019/ogvatberth2019/apph.pdf
[3] https://www.arb.ca.gov/lists/com-attach/137-ogvatberth2019-UzpXP1w5UnQCd1Im.pdf

Timed Connection Requirement

2-15-5.14 CARB staff has revised the one-hour limit on the connect and disconnect times for shore power to a two-hour connect time limit and one-hour disconnect time limit. While it is appreciated that the infeasibility of the one-hour requirement was acknowledged, a two-hour requirement is still arbitrary and not based on any evidence that it is safe or feasible. As we have said in previous letters, the existing rule permits multiple connection strategies, some of which will require more than one hour. More importantly, the shore power connection process requires individual people to manhandle heavy, high-voltage equipment and energize that equipment – sometimes in adverse weather conditions. Under no circumstances should that work be performed under a stopwatch. The two-hour requirement would likely be ineffective because any exceedance of the one-hour requirement would likely result in a safety exemption being sought, as having labor move faster handling high voltage equipment would be fundamentally unsafe.

CARB staff has still provided no basis on which it can be assumed that connection times can be consistently and safely accelerated. In fact, no data is available from CARB justifying the previous one-hour connection window or the new two-hour connection window.

VIEs/TIEs

2-15-5.15 This industry coalition remains concerned that the number of Vessel Incident Events (VIEs) and Terminal Incident Events (TIEs) are insufficient to ensure rule compliance. An analysis prepared by Starcrest Consulting Group previously submitted, demonstrated that there are insufficient VIEs/TIEs available to ensure compliance for known issues identified by CARB. As discussed earlier, VIEs/TIEs will be needed for unknown and unexpected changes in trade, vessel deployments or equipment failures and maintenance. If VIEs/TIEs are not increased, CARB will penalize ocean carriers and terminals for already known and unavoidable circumstances.

Previous Comments Continue to Be Unaddressed

Over the course of the rule development, this coalition, individually and collectively have submitted numerous comment letters[4] and all of those previous comments are incorporated herein by reference and they reserve all rights thereto. No direct responses have yet been provided. This coalition, again, renews its request that CARB staff review and respond to all substantive industry comments prior to Board consideration of the proposed regulation. Hundreds of pages of technical comments, data, and information have been provided to CARB during the entirety of this process. None of which has been agreed to, refuted, or rebutted. An iterative rulemaking process can only exist if CARB staff directly *responds* to the data submitted by stakeholders during the process, and the earlier in the process, the better the outcome for all.

2-15-5.16

Conclusion

The industry coalition looks forward to the opportunity to continue to improve the proposed rule and ensure successful and full compliance can be achieved. The rule in its current form remains problematic with a number of issues that will make full compliance unachievable at times, but these 15-Day Changes

[4] https://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=ogvatberth2019

to move the effective date of the proposed rule to 2023 for the existing regulated fleet will allow stakeholders to continue to work with CARB staff to address these issues.

Sincerely,

California Association of Port Authorities
Pacific Merchant Shipping Association
World Shipping Council
Cruise Lines International Association
Western States Petroleum Association

World Shipping Council Comments

to the

California Air Resources Board (CARB)

on the

SECOND PROPOSED 15-DAY CHANGES TO THE CONTROL MEASURE FOR OCEAN-GOING VESSELS AT BERTH

27 July 2020

The World Shipping Council (WSC) is a non-profit trade association that represents the liner shipping industry, which is comprised primarily of operators of containerships and roll-on/roll-off (ro-ro) vessels (including vehicle carriers). Together, WSC's members operate approximately 90% of the world's liner vessel services. Vessels operated by WSC members make frequent calls in California ports and WSC's members would be directly and substantially affected by the proposed rule.[1]

In addition to participating in CARB workshops, webinars and informal discussions, WSC has filed two rounds of formal, written comments on this proposed rule - on 9 December 2019 in response to the proposed control measure and on 1 May 2020 in response to the first round of 15-day changes to the proposed control measure. Each of our comments on the proposed rule has been accompanied by a specific and practical recommendation to address the issue discussed in the comment.

While we indeed appreciate the changes that CARB staff has made to the proposed control measure in response to WSC's comments, we note that few of our comments and recommendations on the first round of 15-day changes have been incorporated into the proposed rule. This concerns us because our comments contain policy and technical recommendations that will help ensure California's revised at-berth rules are practicable, provide a fair and reasonable compliance pathway for regulated vessels, and achieve the state's emissions reduction goals.

[1] A full description of the Council and a list of its members are available at www.worldshipping.org.

Before turning to our detailed comments on the second round of 15-day changes, we offer the following higher-level comments on three elements of the proposed rule:

***Support for Adjusted Implementation Dates**:* WSC supports the proposed adjustment of the new rule's implementation dates. One of the main benefits of this adjustment is that it will put the infrastructure implementation and assessment steps in the correct order. Under the original proposed rule, port and marine terminal infrastructure plans to comply with the rule would not be due to CARB staff for review and approval until six months *after* the rule's requirements took effect. Under the proposed adjustment, CARB will be able to review and approve port and marine terminal infrastructure plans more than a year before the new implementation date takes effect for existing regulated vessels. The infrastructure plan information submitted to CARB by ro-ro ports and terminals will also be an important input to the December 2022 interim evaluation of control technologies for ro-ro auxiliary emissions.

***Need for Robust Ro-Ro Feasibility Analysis as Part of the Interim Evaluation**:* Under the proposed rule, CARB staff will publish in December 2022 the findings of an "interim evaluation" of emissions control technologies as well as landside infrastructure to control auxiliary emissions from ro-ro vessels and other classes of vessels that may in the future be subject to the rule. While we appreciate CARB staff's expansion of the scope of the interim evaluation to include shoreside infrastructure and information from port and terminal infrastructure plans, we strongly
2-15-6.1 encourage CARB to expand the interim review so that it includes an assessment of the feasibility of controlling ro-ro auxiliary emissions, including a detailed cost versus benefit analyses based on updated ro-ro vessel visit, emissions and control technology information.

***Innovative Concepts Option**:* WSC supports the proposed extension of the period during which an innovative concept (IC) may be used as a compliance option from three to five years. Along with that change, we recommend that CARB eliminate the December 2021 IC application deadline and develop a process through which IC applications may be submitted on a rolling basis. This change would help encourage innovation to develop and deploy new emissions reduction technologies that may not be ready by December 2021. Finally, we wish to note that, in describing the IC option, CARB staff has indicated that it could be used by regulated vessel fleets to comply with the at-berth requirements. The provision, however, makes only an indirect reference to vessel fleets when it notes that visits made under an IC are not counted towards a fleet's vessel incident exceptions. We therefore recommend that CARB add a new sub-paragraph
2-15-6.2 under the general requirements section (93130.17 (a)) that states that ICs may be used as a compliance option by regulated vessels, vessel fleets, ports and marine terminals.

WSC's additional technical comments and recommendations on CARB's second round of 15-day changes to the proposed control measure follow. Our comments are listed in the order that the issues appear in the proposed rule. Please direct any questions on these comments to Doug Schneider of the WSC staff at dschneider@worldshipping.org.

1. **Definitions** (Section 93130.2 (b)):

2-15-6.3

a. ***Ready to Work*:** We recommend that CARB amend this definition by inserting the following after "*netting down*" and before "*all*": "*, the ramp is down and secure (if applicable), required shore side labor technicians are present, and".* These changes are needed to accommodate vessels equipped with ramps (which would not therefore use a gangway) and to note the presence of labor technicians that are essential to hooking the vessel up to shore power or to an alternative compliance method.

2-15-6.4

b. ***Visit*:** We recommend that the words "*at a different marine terminal*" be inserted after the word "*another*" so shifts within a single marine terminal would not constitute a new vessel visit. To correspond to the above change, the words "at a different marine terminal" must also be inserted after the word "berth" in Section 93130.7(e)(4)(I).

2. **CARB Approved Emissions Control Strategy (CAECS) Operators** (Section 93130.5):

2-15-6.5

a. ***Requirements for CARB Approval*** (Section 93130.5 (d)): Under current CARB at-berth regulations, LNG-fired auxiliary engines are treated as an approved control option. The proposed rule would, however, require time-consuming and costly testing of LNG-fired auxiliary engines before they may apply for CARB approval. This will discourage investments in a promising alternative to oil-fired auxiliaries. We therefore recommend that CARB retain the provisions in the current at-berth regulations that designate LNG-fired auxiliaries as an approved control option.

3. **Vessel Operator Requirements** (Section 93130.7):

2-15-6.6

a. ***Amendment to General Requirement Provision*** (Section 93130.7): This section contains vessel checklist items that a commissioned shore power equipped ship cannot complete unless the terminal/port and/or CAECS operator complete their checklist obligations under the rule. Section 93130.7's statement that "Any failure to perform any specific items in this section shall constitute a separate violation…" could thus be used to penalize a shore power equipped ship that could not complete its checklist items because the terminal/port or CAECS operator failed to meet its obligations. To correct this issue, we recommend that the second sentence in the opening paragraph of Section 93130.7 be replaced with:

> *"Any failure to perform any specific items in this section shall constitute a separate violation for each calendar day that the failure occurs, except to the extent a vessel operator cannot perform any requirement due to (1) a terminal and/or port's failure to comply with the portions of this Control Measure that impose requirements upon terminals and/or ports, and/or (2) a CARB Approved Emission Control Strategy Operator's failure to comply with the portions of this Control Measure that impose requirements upon CARB Approved Emission Control Strategy Operators."*

b. ***Amendment to Shore Power Provision*** (Section 93130.7 (a)): Changes are needed to eliminate ambiguity and prevent this provision from being used to dictate to vessels on which side they must be able to plug in to shore power. We recommend that 93130.7 (a) be replaced with:

2-15-6.7

> *"(a) Shore power requirements for at berth emissions reductions.*
>
> *Vessel operators with shore power vessels that have been commissioned by the terminal (or port) at which the vessel will call (or deemed compatible based on a previous commissioning) shall plug in to shore power on each visit to the terminal. Commissioning of vessel shore power equipment should be based on the following technical standards: IEC/ISO/IEEE 80005-1/80005-2 and IEC 62613-1."*

c. ***Expansion to Ro-Ro Vessels*** (Section 93130.7(b))*:*

WSC continues to have significant concerns with CARB's proposal to expand the applicability of the at berth regulations to ro-ro vessels (including vehicle carriers). Ro-ro vessels make infrequent and very short port calls in California. Over the course of a year, each vessel in a ro-ro fleet may call only 2 or 3 times and for a very short period of time. This means the CARB's at berth emissions requirement would become applicable to all ro-ro vessels that may at some point in a given year call California. The problem is that ro-ro vessels and the terminals they call have limited viable or cost-effective compliance options.

2-15-6.8

CARB is predicating its regulation of ro-ro auxiliary emissions on the premise that barge or shore-based emissions capture and control technologies will become a viable and practicable emissions control option. Experience to date with the existing barge-based capture and control service providers has demonstrated that those services are often unreliable, are exceedingly costly, and would pose substantial operational and safety problems for ro-ros. For example, the systems cannot be used in windy weather, cannot always reach ro-ro stacks (which may be 40 meters laterally and 40 meters above the waterline), and often prevent simultaneous alongside bunkering operations. Shore-based emissions capture systems may be better able to reach ro-ro stacks, but obstruct shoreside cargo operations, may not be useable in windy weather and exceed the load bearing capabilities at many of the terminals in California where ro-ro vessels must call.

2-15-6.9

CARB has estimated that the control cost per ton of emissions reduced for ro-ro vessels is $53,600. Even using that cost estimate, which we believe is low[2], it is worth

[2] Starcrest Consulting Group, LLC, published in December 2019 a ro-ro cost analysis study for PMSA and the Ports of Los Angeles and Long Beach. The study estimated that the costs to control ro-ro auxiliary emissions ranges from approximately $115,000 to $200,000 per weighted ton of emissions. A copy of this study may be found in the CARB at-berth docket at: https://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=ogvatberth2019.

2-15-6.9 noting for comparison that CARB estimated that the control cost per ton of emissions reduced for containerships is $13,500. When asked what cost-benefit threshold was used to decide which classes of vessels to regulate and which not to regulate, CARB staff reported that there is no threshold and that the decision to regulate ro-ro emissions was based simply on aggregate emissions. There has been no considered analysis of the costs and benefits of regulating ro-ro auxiliary emissions. We also note that ro-ro auxiliary emissions occur in distinctly different geographic locations, where their impacts and the related cost-benefit analyses for controlling those emissions may be quite different.

2-15-6.10 In summary, CARB's proposal fails to demonstrate that a cost-effective and practicable pathway exists for controlling ro-ro vessels' auxiliary emissions, fails to address the major operational, safety and cost issues emissions capture systems pose for ro-ro vessels and fails to account fully for the emissions generated by emissions capture systems. Compelling ro-ro carriers to try to comply with the rule using the operationally impractical, complex and costly emissions capture systems on the market is not appropriate and will delay the adoption and benefits of more practicable zero-emission technologies that still need to be developed.

WSC therefore recommends that CARB not proceed with the proposal to regulate ro-ro auxiliary emissions and instead monitor ro-ro emissions and the ongoing development of technologies that may in the future provide a viable and economically achievable compliance option for these vessels.

d. ***Vessel Compliance Checklists*** (Section 93130.7 (e)):

2-15-6.11
- **Shore Power Connection Time:** While CARB proposes to modify § (3) (A) to require vessels to begin using shore power or another CAECS within two hours after "Ready to Work", a substantial number of arriving vessels would still be unable to meet this requirement. Establishing shore power connections must be done safely by longshore technicians, who may not be immediately available given their other extensive responsibilities. Unreasonably short time limits for connecting high-voltage systems could pose safety risks to workers, result in unnecessary damage to the equipment, and subject a substantial percentage of compliant vessel calls to noncompliance for tasks the vessel cannot control. We therefore recommend that vessels be required to begin using shore power or another CAECS within three hours after "Ready to Work".

2-15-6.12
- **Shore Power Disconnection Time:** § (3) (B) would require vessels to cease using shore power no sooner than one hour before "Pilot on Board". There will be situations in which this is not a practicable disconnection deadline for ocean carriers because of delayed vessel departures due to weather or vessel traffic or if labor unplugs the vessels early due to their own shift schedules. We therefore recommend that the shore power disconnection time be no sooner than two hours before "Pilot on Board".

- **Post-Visit Reporting:** We support CARB's proposal in § (4) to require reporting of information for each visit to a California terminal within 30 days of vessel departure instead of the previously proposed 7 days of vessel departure. We recommend that CARB develop an online system/dashboard into which each vessel (and terminal) operator could upload its post-visit reports. The dashboard should provide each operator with an updated snapshot of its compliance as well as VIE/TIE allowances versus usage and other relevant metrics for the designated fleet.

2-15-6.13

4. **Terminal Operator Requirements** (Section 93130.9):

   a. ***General Requirement*:** We support CARB's decision to include in the proposed rule clear and appropriate obligations for marine terminals and ports to provide the shore side infrastructure to connect ships to at-berth power and to connect commissioned ships in a timely manner when they call. These are functions that commercial ships cannot themselves perform and lack commercial power to require. Including these requirements in the regulation will establish balanced obligations for ships and the terminals they call and will set clear expectations regarding what ports and marine terminals will need to do to fulfill their obligations under the rule.

   b. ***Commissioning*** (Section 93130.9 (a)(2)): This proposed change could be read as allowing ports or terminal operators to dictate on which side vessels seeking to have their installed shore power systems commissioned must connect. Vessel shore power equipment is designed to enable the vessel to connect to shore power on one, but not both, sides and the vessel has no ability to quickly switch the equipment to the other side. We strongly recommend that this provision be replaced with the following: "*(2) The port or terminal is responsible for commissioning vessels fitted with installed shore power equipment*."

2-15-6.14

5. **VIEs and TIEs** (Section 93130.11):

   a. ***Exclusion of Innovative Concept Visits in VIE and TIE Allocations*** (Section 93130.11 (a)): We support the allocation of VIEs based on company vessel fleets and support CARB's proposal to exclude from the annual VIE allocations visits made under an innovative concept covered under Section 93130.17 of the rule.

   b. ***VIE and TIE Rates*** (Section 93130.11 (b)): The proposed VIE allocation (5%) needs to be increased to account for the fact that the rule will require *all* containerships and refrigerated cargo vessels to use at-berth power. We anticipate, based on historical compliance data, that more than 5% of vessel fleets will be unable to comply due to onboard equipment problems, the need to rotate vessels into and out of California services for required surveys and dry-dockings, and due to unpredictable commercial demands that may require shipping companies to deploy or phase-in non-commissioned vessels to meet U.S. import and export trade needs. With the above considerations in mind, we recommend that CARB increase the VIE allocation for the first three years after implementation to 10 percent per year.

2-15-6.15

2-15-6.16

c. ***Requests for Additional VIEs and TIEs*** (Section 93130.11 (c)): Since vessel operators may encounter situations that warrant additional VIEs that could not be anticipated by 1 December, we recommend that CARB modify 93130.11 (c) by inserting the following after the third full sentence: *"(Note: CARB staff will consider, and respond within 60 calendar days, to written requests for additional VIE and TIEs submitted at any time during the year)".*

2-15-6.17

d. ***VIE and TIE Expiration*** (Section 93130.11 (d)): To provide more flexibility, particularly to address chaotic market conditions, we recommend that CARB allow companies to carry over any unused TIEs or VIE until June 30 of the year after they were granted.

2-15-6.18

6. **Terminal and Port Plans** (Section 93130.14): WSC believes that there would be value in explicitly articulating in the revised rule that port and terminal plans should include, among other things: a) appropriate changes to existing infrastructure design (e.g., inadequate electrical sub-station/electrical vault configurations); b) expansion of existing electrical infrastructure in container ports to accommodate to enable all shore power equipped container ship calls to be accommodated through shore-side power; and c) that approved plans include a realistic timeframe for design and construction consistent with the final regulatory dates promulgated in the final rule.

7. **Interim Evaluation of New Control Technologies** (Section 93130.14 (d): Please see our comments and recommendations on page 2 of this document.

2-15-6.19

8. **Remediation Fund Users** (Section 93130.15): We recommend that CARB expand the list of circumstances in which vessel operators may use the remediation fund to include vessels that make infrequent calls to California ports (e.g. less than 3 calls per year). This is a logical regulatory approach for addressing infrequent calling vessels (e.g. vessels rotated in to California to address increased demand or "extra loaders" brought in to ease port congestion) because it would enable the vessels to have a compliance option if CAECS operators are not available or operational for a particular visit.

9. **Innovative Concept Compliance Option** (Section 93130.17): Please see our comments and recommendations on page 2 of this document.

2-15-6.20

10. **Summary of Responsibilities** (Section 93130.18): The last row in Table 6 suggests that in the case of a CAECS equipment failure or failure to perform, the vessel, terminal and the CAECS operator would be held responsible. This is not appropriate and creates ambiguity with respect to compliance. The vessel operator has no ability to control the performance or maintenance of a CAECS operator. Under this rule, CAECS operators will be CARB approved, regulated entities that are subject to penalty action for noncompliance. If a CAECS operator fails to meet its obligations under the rule, the CAECS operator alone should be subject to penalty action or an exception (e.g. if the equipment failure was due to a safety issue). We

therefore recommend that “vessel” and “terminal” be removed from the list of responsible parties in Table 6 when a CAECS has an equipment failure or failure to perform.

# # #

July 27, 2020

Clerk of the Board
California Air Resources Board
1001 I Street
Sacramento, California 95812
cotb@arb.ca.gov
https://www.arb.ca.gov/lispub/comm/bcsubform.php?listname=ogvatberth2019&comm_period=2

Subject: Cruise Lines International Association (CLIA) Comments on Second Supplemental 15-Day Notice - Proposed Regulation of Oceangoing Vessels At Berth

Dear Clerk:

Thank you for the opportunity to comment on the proposed At Berth Regulation Second 15-Day Changes. CLIA on behalf of the cruise lines that visit California ports appreciates the opportunity over the last few years to work with California Air Resources Board members and staff directly and through the Industry Coalition during regulatory development of this rule.

The Second 15-Day Notice provides for changes to the regulatory structure of the proposed At Berth Regulation and includes one very important change requested by CLIA and the Industry Coalition: the ability for the currently regulated fleet to continue to use the existing fleet average rule for at least an additional two years from 2021 to 2023. These amendments provide the ability for cruise line fleets to continue in compliance with the existing shore power rule as has been the case since 2014 when the original rule went into effect, and which is particularly important given the extreme impacts the COVID-19 pandemic has had on cruise line operations. Importantly, it also provides an opportunity for discussions over the next two years to address issues that remain to be adequately addressed in the new rule for fleets. Those issues are discussed below. In addition, CLIA supports the Industry Coalition Second Supplemental 15-Day Notice comments.

CLIA SUPPORTS THE NEW EFFECTIVE DATE TO ALLOW TIME TO ADDRESS ONGOING CONCERNS WITH THE NEW RULE AND DEVELOP OPTIONS FOR FLEETS

As previous comments stated, CLIA and the industry coalition have serious concerns with the proposed rule, particularly that it contains provisions that will result in noncompliance even though these existing regulated ships have been in compliance since the existing shore power rule was put in place. CLIA supports the delay of implementation of the new regulation until January 1, 2023 for existing regulated fleets and welcome using this time to continue meetings with staff to discuss concerns that remain to be resolved in the new regulation, and determine solutions that meet the needs of fleets and allow them to remain in compliance.

CLIA REQUESTS STAFF DEVELOP SUFFICIENT COMPLIANCE PATHWAYS FOR NON-FREQUENT FLIERS TO AVOID REQUIRING THESE VESSELS TO CONTINUE TO PULL CALLS OUT OF CALIFORNIA

2-15-7.1 The cruise lines request that CARB staff work over the next year with cruise lines and other stakeholders that have non-frequent fliers to find an alternative compliance option for vessels that rarely or unexpectedly visit California ports. The goal will be to allow cruise vessels to continue to make 4 or fewer calls in California without being forced to either put in shore power that is rarely used or eliminate calls in California ports to stay in compliance. CARB has unfortunately classified these non-frequent fliers as "unregulated" because they are exempted from the existing At Berth rule.

Out of hundreds of cruise vessels worldwide, only a limited number continually visit California and are equipped with shore power. Cruise vessels that are visiting California ports only once every few years cannot support the huge investment in shore power and ongoing maintenance required, but unfortunately also cannot use the existing CARB-approved alternative compliance option. In addition, although the draft rule did change the implementation date for non-frequent fliers to 2023, unlike fleets, that deferral did not give these global and transition cruises an option but to pull calls out of California. The cruise sector sets itineraries years in advance and the previously pending 2021 regulations already forced a reduction in the number of planned calls in 2021 and 2022 from "nonfrequent flier" ships.

Without clarity on the 2023 regulation sometime in the next year, these vessels will have the same result in 2023 and 2024. While the extension of the current regulation for the regulated fleet is helpful, losing the ability of non-frequent fliers to call on

California ports during this two-year extension would detrimentally impact these lines as well as prohibit many additional calls to California ports, specifically those transiting to and from Alaska. The more specialized world cruises and relocating cruise vessels may visit once every two to four years and only a few ports each visit, using entirely different cruise ships each time. This means that these vessels would be able to use these $2 million systems only 8-16 hours every one or two years.

2-15-7.2 A different flexible alternative is critical for these vessels to avoid displacing this trade that though fewer in overall numbers are still financially significant to impacted California ports that will lose additional calls. It is also important to note that the ISOR and SRIA do not properly analyze the possibility of future vessel diversions as well as those that have already occurred, and their economic impact.

CLIA SUPPORTS MOVING UP PORT AND TERMINAL PLAN DUE DATES SO THEY ARE IN PLACE PRIOR TO 2023, BUT ARE CONCERNED THAT THERE ARE NO DATES BY WHICH PLANNED INFRASTRUCTURE MUST BE IN PLACE

2-15-7.3 CLIA appreciates that the rule has been amended to require port and terminal plan due dates by December 1, 2021, before 2023. However, assurances should be included in the rule that shoreside shore power infrastructure will be available to meet the increased port calls required beginning in 2023.

CLIA REQUESTS THAT THE FOCUS OF THE INTERIM EVALUATION BE EXPANDED

2-15-7.4 The interim evaluation due now December of 2022 should be specifically expanded to address issues regarding rule implementation raised by stakeholders. As work on implementation continues, it will be critical to resolve issues, including incorporation of fleet averaging under Innovative Concepts or CARB Approved Emission Control Systems (CAECS), finalizing sufficient compliance pathways for non-frequent fliers, and addressing other issues identified in this letter, previous CLIA comments, and the Industry Coalition letters.

CLIA REQUESTS THAT LIABILITY BE CLARIFIED

2-15-7.5 By 2023, the liability provisions in the new rule should be clarified. The new proposed rule still requires joint and several liability for violating the control measure, which conflicts with specific liability/responsibility for ports, terminals, vessels and alternative compliance operators in other sections of the rule.

2-15-7.6 CLIA'S PREVIOUS COMMENTS STILL APPLY REGARDING UNRESOLVED CONCERNS WITH THE NEW PROPOSED RULE

There remain a number of comments previously submitted by CLIA that are unresolved with the new rule:

- the new rule remains extremely complex and doesn't work well for fleet-based companies - which has the potential to place vessels in compliance since 2014 in noncompliance;
- an alternative compliance option to shore power should be available for vessels that cannot use the only existing CARB-approved alternative compliance option;
- the remediation fund hourly amount of $12,000 per hour is punitive for cruise vessels and acts like a major penalty usually reserved for willful or intentional violations – in addition, a more reasonable per hour rate should also be considered as a compliance option for non-frequent fliers;
- a phase-in period should be allowed for low activity terminals suddenly being added to the rule based on activity;
- ongoing issues remain with the checklist, the timed connection requirement, and compliance decisions being made long after the vessel leaves port leaving vessels unsure of possible violations until after a California port visit.

Again, thank you for your consideration of these comments.

Sincerely,

Donald Brown
VP, Maritime Policy
Cruise Lines International Association

July 24, 2020

Richard Corey, Executive Officer
California Air Resources Board
1001 I Street
Sacramento, California 95814

Dear Mr. Corey:

On behalf of the California Association of Port Authorities (CAPA), I am writing to express the Association's appreciation for the work you and your staff have invested in the rule, and in particular our support for the changes made in the second 15-Day Notice. The current changes to the effective dates for compliance provide a more realistic timeline to develop terminal plans. Additionally, extending the Innovative Concepts pathway to 5 years provides a greater degree of certainty.

As you know, CAPA is comprised of eleven public seaports in California, including three of the largest container ports in the nation – Los Angeles, Long Beach and Oakland – as well as eight smaller ports situated along the coast from Humboldt to San Diego, and along inland waterways in West Sacramento and Stockton. CAPA and its members have a long history of working collaboratively with CARB on air emissions regulations, and we value that relationship. While CARB is aware of the economic disruption ports are currently experiencing due to the COVID-19 pandemic, CAPA remains concerned about the ability to meet the goals and deadlines of the proposed rule and the forecast assumptions used to develop the rule.

CAPA supports the use of the interim evaluation; however, we urge CARB to consider additional factors be added and the ability to alter the compliance deadlines based on the findings of the interim evaluation for all vessel types. CAPA urges the addition of the following provisions to the interim evaluation language:

2-15-8.1

- The interim evaluation scope is being expanded beyond a review of ro-ro and tanker vessels to also include an evaluation of control technologies for bulk, general cargo, and ocean-going vessels. The language authorizing staff to make recommendations to alter the deadlines for ro-ro and tankers should also be expanded to allow staff to recommend changes for all other vessels based on the findings in staff's review. We recommend the following sentence be amended as follows:

  If staff finds that the compliance deadlines for ~~ro-ro or tanker~~ vessels need to be ~~extended~~ adjusted forward or backward in time, the report will include recommendations to initiate staff's development of potential formal regulatory amendments.

2-15-8.2

- Given the current economic disruption and uncertain future, concerns have been raised about the accuracy of forecast assumptions used in the inventory of ocean-going vessels at-berth. As part of the interim evaluation requirement, language should be added specifically directing CARB staff to update and adjust the inventory based on the economic trends and data accumulated over the next two years.

2-15-8.3

- The interim evaluation language directs staff to evaluate information from ports and required terminal plans, and consider other public information such as engineering evaluations, logistical concerns, public engagement, and independent studies. The interim evaluation should be required to include an analysis of this information, and in particular, an evaluation of the economic health of a port to meet the implementation deadlines.

2-15-8.4

In addition, implementation of any regulation requires financial resources to invest in those improvements. The development and commercialization of these capture and control measures will be expensive, and state and local support is critical. CAPA urges CARB to continue its support to dedicate low carbon transportation funds for the development, demonstration, and commercialization of this technology.

Regardless of the current economic crisis, CAPA's members remain committed to the existing regulatory requirements and working with CARB on reducing emissions. While it will take time to determine if shipping practices are forever altered, or if this is a short-term adjustment, CAPA appreciates changes made during this process and urges CARB to adopt the changes outlined above.

Finally, the development of the expanded At-Berth Rule has been a long process that has involved numerous meetings with CARB staff, and the submission of formal comments, data, and reports. We look forward to reviewing staff's comments and responses to the material submitted as part of the rule making process.

If you have any questions or need additional information, please give me a call (916) 443-8891.

Sincerely,

Kelly Hitt
Interim-Executive Director
California Association of Port Authorities

PACIFIC MERCHANT SHIPPING ASSOCIATION

July 27, 2020

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Delivered via email to cotb@arb.ca.gov
https://www.arb.ca.gov/lispub/comm/bcsubform.php?listname=ogvatberth2019&comm_period=2

Subject: **OGV At Berth -- PMSA Comments on Second Supplemental 15-Day Notice**

On behalf of its ocean carrier and marine terminal operator member companies, the Pacific Merchant Shipping Association (PMSA) appreciates the opportunity to comment on the latest version of the proposed At Berth Regulation for Oceangoing Vessels. The second 15-Day Notice provides for changes to the regulatory structure of the proposed At Berth Regulation that address some of the concerns that PMSA has raised during rule development that result from the elimination of the current regulation and its replacement with an entirely new enforcement regime.

PMSA and its members are proud of our record of compliance with the current Vessel At Berth regulation and the significant emissions reductions that we have achieved from our operations. Changing the effective date for the existing regulated fleet from 2021 to 2023 in the proposed rule validates this success and will maintain the current regulation for two more years without any degradation in emissions controls. This is beneficial in that it will forestall unnecessary rule change impacts, provide regulatory and enforcement compliance continuity for the existing regulated fleet, and give all stakeholders and CARB an additional opportunity for making improvements to the proposed new measure. PMSA remains concerned that many of the issues that have been raised during this rulemaking have not yet been addressed or even responded to substantively, and we would respectfully request that the Board commit to taking this additional time to address these issues and concerns prior to the implementation of a new regulatory regime in 2023.

PMSA has been pleased to work with CARB staff for many years on the implementation and enforcement of the current regulation and on addressing the potential changes in this proposed measure. We incorporate herein by reference all of our previous comments, reports, and submissions during the informal rulemaking and formal rulemaking periods, including the technical evaluation work of third-party consultants regarding the proposed rule. We are also proud to work with a coalition of diverse cross-industry stakeholders who have been working to create a cost-effective and technologically feasible set of conditions for rule expansion for the past several years, including a comprehensive alternative proposal. PMSA continues to associate itself with the comments of the industry coalition consisting of CAPA, CLIA, PMSA, WSPA and WSC.

New Effective Date Provides an Opportunity

PMSA is concerned that the proposed rule cannot be successfully complied with by many fleets which have invested significant resources into a working shore power system and are plugging in at ports and terminals which are similarly equipped and compliant with the current regulation. These concerns are amplified given the realities and uncertainties present in the maritime industry. Therefore, the revised effective date of 2023, which allows for these fleets to continue to operate under current law, is appreciated. This date will allow PMSA and its members to continue to work with CARB staff to improve the rule structure without risking temporal non-compliance for shore power equipped vessels. In addition, serious concerns remain regarding the feasibility and true cost-effectiveness of controlling tanker and Ro/Ro vessels and this framework should provide benefits for those fleets as well.

US EPA Waiver Required for 2023 Implementation

CARB sought and was granted the waiver from USEPA for the existing At Berth regulations which implement emissions standards applicable to the running of auxiliary engines while at berth in California's ports. (76 FR 77515) This waiver was granted after previous auxiliary engine emissions standards were determined to be unenforceable by ARB without the prior issuance of a US EPA §209(e)(2) waiver and after objection to the waiver by PMSA. See *Pacific Merchant Shipping Association v. Goldstene,* 517 F.3d 1108 (9th Cir., 2008). The US EPA waiver process is one component of the Clean Air Act that ensures the preservation of the current and previously adopted regulatory structure in a uniform manner nationwide, as an alternative emissions standard over and above or in addition to a US EPA standard, and that the adoption or change to any existing uniform rule is completed in the best interests of the currently regulated vessel fleets, CARB, and the entire United States. More importantly, regulations for vessels at berth, including specifically any newly promulgated emissions standards, are legally unenforceable without the provision of a new waiver.

2-15-9.1 Now that CARB has set the effective date for changes to the existing At Berth Rule in 2023, it should clearly and affirmatively lay out its schedule for seeking an obtaining a new waiver for the new At Berth Regulation from the U.S. Environmental Protection Agency, or it should create a clear compliance pathway for currently regulated vessel fleets which is consistent with the existing waiver.

Proposed Rule's Joint & Several Liability and Indirect Source Approach is Unnecessary

An indirect source rule is a regulation which assigns a liability and responsibility to a facility to reduce indirect mobile source emissions which that facility does not control, when the mobile source can be directly regulated to reduce emissions through a traditional emissions standard, engine standard, or other in-use standard.

We are concerned that many of these hallmarks are present in the proposed control measure when they were successfully avoided in the current regulation. 2-15-9.2 Ports and marine terminals at present are responsible for the provision of shoreside power infrastructure and operational support and manning under the current rule, and that will not change under the proposed rule. These entities can be held accountable for such responsibilities, but they cannot be held liable for an emissions standard violation

by an off-road engine on a vessel over which they have no control. This proposal seeks to do just that by establishing a novel and unnecessary Joint & Several Liability measure for vessel emissions.

2-15-9.2 Assigning a vessel's emissions standard liability to a port or marine terminal must be avoided. The creation of third-party liability for vessel emissions for a marine terminal is just as misplaced as trying to hold a vessel operator responsible for the actions of a marine terminal operator once at berth. These should all be treated as independent bases of responsibility and given independent measures of reporting and review. PMSA has proposed multiple bases upon which these liabilities may be established and believes that continued investment in compliance can be maintained without the establishment of a new liability regime.

Projections and Analyses Must Be Revised

During the June 25th hearing, CARB staff acknowledged that the COVID-19 crisis has impacted existing and future cargo volumes in California ports. Staff also stated that the current crisis will have disparate effects across the maritime industry, with the timeline to recovery being long. Even before the current crisis, data was submitted demonstrating that the cargo and resulting emissions estimates were wrong. The crisis has amplified those misapplications and projections.

The derived data from the cargo forecasts has led to unreliable information presented in the updated emissions forecast. As stated in the letter on the first 15-Day Notice[1], cargo volumes in 2020 for the ports of Los Angeles and Long Beach will be at least 26% below the values contained CARB's data set. CARB staff has not addressed any of forecast issues raised in the prior letter.

2-15-9.3 More information continues to become available demonstrating the problems attendant to the existing CARB forecasts and inventories. PMSA recently released an analysis[2] that provides the most recent annual data on the loss of containerized trade market share experienced by U.S. West Coast ports, including Los Angeles, Long Beach, and Oakland in recent years. This analysis demonstrates the accelerating market share erosion of California ports. As a result, all dependent analyses, including rule emissions benefits, health benefits, CEQA review including the Statement of Overriding Considerations, and cost-effectiveness, will all be based on flawed data. CARB should re-evaluate baseline emissions, proposed emission reductions, health benefits, costs, and cost-effectiveness based on a revised forecast and assumptions.

Interim Evaluation

2-15-9.4 The text of the interim evaluation contained in the proposed regulation presupposes the feasibility of emission control technology for Ro/Ro vessels. The language should be clear that the interim evaluation will evaluate the feasibility of technology to control emissions successfully and cost-effectively from

[1] https://www.arb.ca.gov/lists/com-attach/137-ogvatberth2019-UzpXP1w5UnQCd1Im.pdf
[2] https://www.pmsaship.com/wp-content/uploads/2019/12/Briefing-Paper-Loss-of-Market-Share-at-U.S.-West-Coast-Ports.pdf

Ro/Ro vessels since there is no existing technology to reduce emissions in exhaust streams in a manner that can safely operate on tanker Ro/Ro vessels in operation. The technology which is currently in demonstration has a number of technical, safety, and operational constraints it must overcome. At the same time, any proposed system needs to also abide by Coast Guard, OSHA, and other regulatory requirements, while not being prohibitively expensive.

2-15-9.4 The interim evaluation should be clear that it will evaluate all considerations that would impact the success of new control technologies, including the configuration of Ro/Ro vessels, which make reaching the exhaust an engineering challenge. The only way to answer these questions is with a demonstration that must be completed before the interim evaluation is conducted. With a presentation date of December 2022, it is likely that the demonstration will not even be operating before CARB staff must prepare their evaluation and is not expected to be complete until long after the interim evaluation is complete. An interim evaluation that is not informed by a complete demonstration is mere speculation.

2-15-9.5 The interim evaluation should also address issues regarding rule implementation raised by PMSA and other maritime industry stakeholders over the next two years. As work on implementation continues, it will be critical to resolve issues, including the sufficiency of TIEs/VIEs, incorporation of fleet averaging under Innovative Concepts or CARB Approved Emission Control Systems (CAECS), sufficient compliance pathways for non-frequent fliers, and other issues identified in this letter.

Industry Grappling with the Effects of COVID-19

The scale of the current crisis is unprecedented. The World Trade Organization (WTO) has estimated that global trade could decline up to 32% this year.[3] As a result of this crisis, the analyses on which this rule is based are out of date and no longer valid. The ISOR analysis is predicated on strong growth assumptions based on a number of forecasts. Questions about those assumptions were raised prior to the current crisis. For example, the ISOR analysis assumes that from 2016 (the inventory base year) through 2020 container cargo at the ports of Long Beach and Los Angeles would grow 4.5% per year. Last year (before the current crisis), the two ports declined 3.3%. Since the crisis, the decline has accelerated, with year-over-year declines in January (-5.1%), February (-16.9%), March (-19.7%), April (-11.4%), May (-13.7%), and June (-10.3%). For the first six months of the year, the two ports are down 12.5% over the same period last year. Before even considering the rest of the year, the current crisis means the emissions inventory contained in the ISOR is wrong. That gap only grows if the rest of 2020 is forecast based on WTO projections. By the end of this year, the baseline forecast used in the ISOR will overestimate cargo volumes by between 26% and 62%.

2-15-9.6 The estimates of benefits, emissions estimates, costs, cost-effectiveness, and health impacts, which presume the rate of growth contained in the ISOR, are now no longer valid. Even if growth were to immediately resume at levels assumed in the ISOR, cargo volumes and resulting activity will likely be millions of containers off from the cargo volume estimate.

[3] https://www.wto.org/english/news_e/spra_e/spra303_e.htm

Innovative Concepts

2-15-9.7 PMSA appreciates proposed changes to the Innovative Concepts (IC) of the proposed regulation but believes that these changes remain insufficient. While increasing the term to five years does provide some additional certainty for select regulated parties to propose an innovative concept, it still fails to provide the long-term assurance necessary to make it a viable compliance pathway. A number of other changes should be considered to make the concept viable.

2-15-9.8
- A fleet averaging concept should be a defined path within the IC section. Fleet averaging, as a program whose parameters are known, should not be subject to unnecessary restrictions for new concepts. Given the known success of fleet averaging to reduce emissions, it is not necessary to create uncertainty by having a five-year term with extension subject to uncertain approval. In addition, concerns remain that at this time it is unknown how fleet averaging would be handled under the IC provisions and that CARB staff cannot describe or even assure that fleet averaging is consistent with all the requirements of the IC provisions.

2-15-9.9
- While IC must be "surplus" at the time of creation, CARB could revoke or decline to renew approval if the emission reduction became subject to regulation at a future date, or by any CARB-approved AB 617 Community Emission Reduction Plan. The IC section should be modified to allow IC reductions without this limitation.

2-15-9.10
- Limiting the location of IC emissions reductions only to "adjacent" communities and distances no greater than 3 nautical miles may have unintended consequences. Neither "adjacent" nor "community" are defined in the Proposed Regulation, so it is unclear how close an area would need to be in order to be deemed "adjacent," and where the boundaries of that area would end. The IC section should be modified to encourage any project (adjacent or not) that would benefit the port and terminal communities.

2-15-9.11
- The IC section sets a single, one-time deadline for submitting a proposal. This implies that ICs will not be considered after December 1, 2021. The deadline should be removed and replaced with a process for IC plan review at any date such plans are submitted in the future. In addition, if IC will be used to facilitate fleet averaging, the ability to use fleet averaging should be available beyond 2021. Fleets will encounter different circumstances over the life of this regulation that may allow them to comply with the proposed regulation versus making use of a fleet average approach. New fleets may want to enter the California market after the 2021 deadline and this ensures they will be forever precluded from using fleet averaging. The original rule contained a similar fixed date requirement for alternative technologies, CARB staff eventually were forced to revise that through the use of an "Advisory". As a result, we strongly recommend that IC applications be accepted continuously with the understanding that CARB needs a minimum lead time before an approved application becomes effective.

2-15-9.12 - The prohibition on public funding for ICs is too broad. Funding may come from different sources, including federal, other states, or other nations. In addition, such a prohibition would exclude demonstration projects. Fleets that are likely to engage in ICs, including fleet averaging, are also likely to participate in demonstration projects sought by CARB or other air quality agencies. Being innovative should not prohibit technology advancement.

2-15-9.13 - Revocation of the IC plan provides for a 30-day notice. This is likely to be inadequate for an ocean carrier to transition to original provisions of the rule. The risk of a 30-day transition at the uncertain end of a five-year program is enough to prevent an ocean carrier opting to implement an IC. The IC section should include a nine-month transition period upon revocation of an IC plan.

Fundamental Problems with Emissions Inventory Unresolved

2-15-9.14 Even before addressing the changes brought about by the COVID-19 crisis, the emissions inventory has not addressed known problems as described in previous industry stakeholder comment letters. The inventory overestimates growth, resulting in a significant overestimation of the proposed rule's emissions benefit. The inventory does not consider the emission reductions associated with Proposition 1B funding, requiring emission reductions of 90% under the existing rule – 10% more than the proposed rule. This results in the inappropriate attribution of emission reductions from existing requirements to the proposed rule. The emissions inventory also inappropriately caps emission reductions under the existing rule at 80%. Every vessel with a call greater than 15 hours will result in emission reductions greater than 80%. In San Pedro Bay, where calls greater than 100 hours are typical, emission reductions can exceed 97%. Section 93118.3(e)(4)(A) of the current regulation explicitly states that any vessel using grid power is assumed to reduce emissions 90%. Yet, no explanation or reason is given in the emissions inventory for capping emission reductions at 80%. The inventory must be updated to correct these issues.

CARB inventory staff have acknowledged these issues in a variety of phone calls and emails with stakeholders and have indicated that these issues will be resolved sometime this summer. That delay does a disservice to both the public and decisionmakers in understanding the benefits of the proposed rule changes.

Timed Connection Requirement

CARB staff has revised the one-hour limit on the connect and disconnect times for shore power to a two-hour connect time limit and one-hour disconnect time limit. While it is appreciated that the infeasibility of the one-hour requirement was acknowledged, a two-hour requirement is still arbitrary and capricious and not based on any evidence that it is safe or feasible. As we have said in previous letters, the existing rule permits multiple connection strategies, some of which will require more than one hour. 2-15-9.15 More importantly, the shore power connection process requires individual people to manhandle heavy, high-voltage equipment and energize that equipment – sometimes in adverse weather conditions. Under no

2-15-9.15 circumstances should that work be performed under a stopwatch. The two-hour requirement would likely be ineffective because any exceedance of the one-hour requirement would likely result in a safety exemption being sought, as having labor move faster handling high voltage equipment would be fundamentally unsafe.

CARB staff has still provided no basis on which it can be assumed that connection times can be consistently and safely accelerated. In fact, no data is available from CARB justifying the previous one-hour connection window or the new two-hour connection window.

VIEs/TIEs

2-15-9.16 PMSA is concerned that the number of Vessel Incident Events (VIEs) and Terminal Incident Events (TIEs) are insufficient to ensure rule compliance. An analysis prepared by Starcrest Consulting Group previously submitted, demonstrated that there are insufficient VIEs/TIEs available to ensure compliance for known issues identified by CARB. As discussed earlier, VIEs/TIEs will be needed for unknown and unexpected changes in trade, vessel deployments or equipment failures and maintenance. If VIEs/TIEs are not increased, CARB will penalize ocean carriers and terminals for already known and unavoidable circumstances.

2-15-9.17 **Previous Comments Continue to Be Unaddressed**

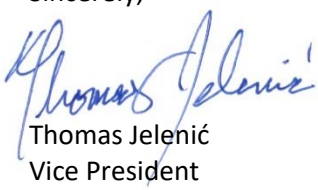
PMSA has submitted numerous letters under its own name and in cooperation with other maritime stakeholders[4]. Those comments are incorporated herein by reference. This includes numerous technical comments which have not been formally addressed or responses provided. We request that CARB staff review and respond to all industry comments before Board consideration of the proposed regulation. The rulemaking process should be an iterative process in order to develop a rule that achieves air quality goals in a manner that creates the least burden and at the lowest cost. The purposes of the informal rulemaking period should be to ensure stakeholders have an opportunity to lay out issues *and* have those issues responded to. Hundreds of pages of comments, data, and technical information have been provided to CARB, all of which are awaiting a response. An iterative rulemaking process can only exist if CARB staff *responds* to the data submitted by stakeholders during the process.

[4] https://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=ogvatberth2019

Conclusion

While the current form of the proposed rule remains problematic with a number of issues that will make full compliance unachievable at times, the fact that the effective date of the proposed rule has now been set for 2023 will allow all PMSA to continue to work with CARB staff to address these issues. PMSA looks forward to opportunity to continue to improve the proposed rule and ensure successful and full compliance can be achieved.

Sincerely,



Thomas Jelenić
Vice President

SAN PEDRO BAY PORTS

CLEAN AIR ACTION PLAN

July 26, 2020

Richard Corey
California Air Resources Board
Clerk's Office
1001 I Street
Sacramento, CA 95814
(*Submitted electronically to:*
https://www.arb.ca.gov/lispub/comm/bcsubform.php?listname=ogvatberth2019&comm_period=1)

Dear Mr. Corey:

SUBJECT: SECOND 15-DAY CHANGES TO THE PROPOSED CONTROL MEASURE FOR OCEAN-GOING VESSELS AT BERTH

The Port of Long Beach and Port of Los Angeles (Ports) appreciate this opportunity to provide comments on the California Air Resources Board (CARB) Second 15-Day Changes Package for the Proposed Control Measure for Ocean-Going Vessels at Berth released on July 10, 2020. This latest iteration of rulemaking reflects some of our ongoing discussions with CARB staff on the proposed rulemaking for over the past two years, and we very much appreciate your staff's willingness to engage on these issues.

We are facing an unprecedented public health crisis, which has and will continue to have significant adverse economic impacts on the maritime industry and the world at large. The Ports have experienced a 12.52% decline in cargo throughput over the first half of 2020, compounding the challenges we have experienced due to the global trade wars and the ongoing loss of market share. We will continue to closely monitor and evaluate economic developments, but anticipate these impacts will continue to reverberate throughout the industry for many years to come.

2-15-10.1 In light of this, we recommend that your Rule include a mechanism that allows for a timely reassessment of the regulation with greater flexibility in the event that economic conditions warrant it. For example, as regulatory requirements go into effect, the Ports suggest that "check-ins" or other types of assessment steps can occur that will allow the various stakeholders to be a part of the implementation process, and assure that the steps envisioned can be implemented.

After reviewing the Second 15-Day Changes for the At Berth Regulation, the Ports offer the following comments.

Port of LONG BEACH
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Port of Long Beach | Environmental Planning
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562.283.7100

THE PORT OF LOS ANGELES
Port of Los Angeles | Environmental Management
425 S. Palos Verdes Street | San Pedro, CA 90731
310.732.3675

The San Pedro Bay Ports Clean Air Action Plan was developed with the participation and cooperation of the staff of the US Environmental Protection Agency, California Air Resources Board and the South Coast Air Quality Management District.

- While the 2025 implementation timeline for Roll-On/Roll-Off ships (RoRos) is better than the previous proposal for 2024, as articulated in the Ports previous joint letter from April 29, 2020, the Ports remain concerned that this industry will not be able to develop, commercialize, and widely deploy the required technology within this timeframe. Respectfully, the Ports still support the previously requested a timeline for RoRo implementation of 2027.

2-15-10.2

- Development of tanker vessel emission capture and control technology is nascent. We believe the 2025 timeline is infeasible, and a deadline of 2029 will be necessary. The hurdles to overcome the safety challenges associated with the tanker vessels are significant, and a hazard assessment must be conducted. We understand you plan to release a $10 million solicitation to fund development, testing, and certification of this technology. According to your webinar hosted on July 15, you anticipate the selected project demonstration to conclude by 2025. This does not leave any time for production, purchase, and implementation of the remaining eight systems required in the San Pedro Bay according to your agency's Berth Analysis.

2-15-10.3

- The steep cost of this regulation - $2.23 billion - will have a substantial impact on the industry. The combined impact of the global trade wars, COVID-19, and implementation of more stringent regulatory requirements will likely result in additional cargo diversion, and consequently, excess emissions at non-California ports. Declining harbor revenues, lack of available cap-and-trade revenues, and competing funding needs for reduction of emissions from other sources have decreased the availability resources for implementation of this measure. The Ports ask that you appropriate significant funding during this time to make this rulemaking successful while ensuring our California ports remain competitive. Previously, the Ports requested at least $200 million to support technology advancement and deployment. We reiterate this request, and ask that these dollars be appropriated to both RoRos and tankers statewide.

2-15-10.4

Lastly, we would like to highlight a new issue regarding the Interim Evaluation language:

- The Interim Evaluation, to be published by December 2022, is going to be critical in defining progress the industry will have made towards achieving the requirements of the new At Berth Regulation. A significant amount of data will need to come from ports, terminal operators, vessel operators, and any grant funded demonstration projects. It is unclear in the new regulatory language whether or not industry data will be accepted. We request that the development of the recommendations from this Interim Evaluation be based upon data provided by those organizations impacted directly, and the process for including data is transparent.

2-15-10.5

We thank you and your staff for your recommendations to their Board on June 25, 2020, and we thank your Board for recognizing the uncertain and unprecedented challenges the port industry faces today. While we agree we need the emission reductions from vessels at berth in order to move the needle on public health and clean air for our communities, we do continue to diverge on the level of effort it will take, the cost, and the time needed for successful implementation of this measure. The Ports are committed to working closely with your staff on developing the Proposed Control Measure for Ocean-Going Vessels at Berth and look forward to ongoing dialogue on these issues.

Please feel free to reach out to Morgan Caswell, Port of Long Beach Manager of Air Quality Practices at (562) 283-7138 or via email at morgan.caswell@polb.com or Teresa Pisano, Port of Los Angeles Marine Environmental Supervisor at (310) 732-3057 or via email at tpisano@portla.org, with any specific questions.

Sincerely,

EUGENE SEROKA
Executive Director
Port of Los Angeles

MARIO CORDERO
Executive Director
Port of Long Beach

cc: Bonnie Soriano, CARB (via email Bonnie.Soriano@arb.ca.gov)
Angela Csondes, CARB (via email Angela.Csondes@arb.ca.gov)
Nicole Light, CARB (via email Nicole.Light@arb.ca.gov)

PORT OF OAKLAND

July 27, 2020

Ms. Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on Second Notice of Public Availability of Modified Text and Availability of Additional Documents and Information

Dear Ms. Csondes:

The Port of Oakland (Port) appreciates this opportunity to comment on the Proposed Control Measure for Ocean-Going Vessels At Berth (Proposed Control Measure). The Port notes that this is its seventh (7th) comment letter on the topic. The Port has not received written responses to any of its previous comments and has concerns about this rulemaking process. Given that several of the Port's outstanding questions are substantive, the Air Resources Board members are being asked to vote on the regulation before our technical and feasibility concerns have been addressed and answered. As a result, this process risks becoming a "check the box" exercise rather than a meaningful exchange leading to an improved regulation that will continue to meet our mutual objectives of reducing emissions from seaport sources.

Briefly, the Port must reiterate the following comments:

- The Port of Oakland has no feasible Alternative Compliance Method
- The foundational analysis for the Proposed Control Measure is flawed
- The complex TIE/VIE regime is ripe for conflict
- The current at-berth regulation is successful and should be maintained for containerships

Before offering details for the items above, the Port would like to acknowledge several recent changes that have moved the Proposed Control Measure in a positive direction. These include allowing containerships to stay under the 2007 At-Berth Regulation until 2023, extending the Innovative Concepts timeframe to five years, and providing a process to request additional

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TIEs/VIEs to accommodate anticipated growth in vessel calls. The Port appreciates these changes and notes that some of them are partially responsive to concerns the Port has raised.

The Port has No Feasible Alternative Compliance Method

2-15-11.1 According to CARB's own analysis, the Port of Oakland has no feasible alternative compliance method at three out of four of its terminals (representing 83% of the Port's call volume). This means that carriers that might choose to rely on a barge-mounted bonnet system for compliance at the San Pedro Bay Ports will not have a compliance option in Oakland, where the only feasible compliance method is shore power. This puts the Port of Oakland at a substantial disadvantage, especially as compared to alternative gateways outside California in Tacoma, Seattle, Vancouver, and Prince Rupert, for example. Diverting cargo to distant seaports can lead to increased emissions, undermining the purpose of the regulation.

2-15-11.2 We still need to understand how ARB staff will address these practical concerns about creating an alternative compliance method that is infeasible for the overwhelming majority of ship operations at the Port of Oakland, given the major negative impacts that could result (decreased Port competitiveness, loss of market share, diverted cargo, increased emissions, etc). This is a matter than needs to be addressed before the Board considers the adoption of the Proposed Control Measure.

The Foundational Analysis for the Proposed Control Measure is Flawed

The analysis that serves as the foundation for this rule both underestimates the efficacy of the current At-Berth Regulation *and* overstates the benefit of the Proposed Control Measure. The discrepancies listed below need to be addressed prior to approval of the Proposed Control Measure.

CARB staff appear to be unwilling to modify certain data that underpin the benefits of this rule if they are in conflict with a desired outcome. CARB staff have acknowledged that there are significant discrepancies between data assumptions and actual observed practices that could impact the analysis, but there has been little-to-no follow through to correct theses data gaps.

2-15-11.3 We are concerned that a refusal to incorporate Oakland's 2016 baseline data or to officially update the expected cargo growth rate for Oakland or to remove the incorrect 80% cap on the benefit of the current regulation, will produce a distorted result that justifies a changed rule for containerships based on faulty assumptions.

2-15-11.4

a. The emissions benefit calculation caps the benefit of the current regulation at 80%. This is incorrect because it ignores demonstrated overcompliance due to 1) the provision requiring every vessel capable of plugging in to do so, 2) the long call durations at the San Pedro Bay Ports resulting in ~96% emission reductions, 3) the fact that some infrequent callers are plugging in even though they are not required to do so, and 4) the required 90% compliance rate for shore power systems that received grant funding.

   The artificial 80% benefit cap is not even internally consistent within CARB's own documents. According to page 22 of the 2007 regulation (text copied in below),

CARB assumes 90% reductions for any ship that plugs in. Why does the analysis cap the benefit of the 2007 regulation at 80%?

> (4) Control Factors
>
> (A) The emissions from vessels using grid power in lieu of the vessel's auxiliary engines when the vessels are at berth are presumed to be reduced by 90 percent.

b. CARB's 2016 baseline data for shore power operations in Oakland are neither reliable nor reflective of actual usage. Comparing summaries by vessel class size to the Port of Oakland's own data (used for billing and subject to audit), the values are off by up to 40% in critical areas. Port staff discussed this problem with CARB staff and showed them the comparison during a phone call on January 15, 2020. CARB staff offered to investigate the issue and spot check some data points to try to understand it better. To date, nothing has happened. Port staff have continued to raise this issue, but it remains unaddressed and unresolved. The baseline data are critical for accurately evaluating any future benefits of the Proposed Control Measure, so this needs to be addressed.

2-15-11.5

c. As recognized by CARB staff, the assumed growth rate for the Port Oakland is too high and does not comport with any recent or anticipated cargo trends. The inventory assumes an unreasonably aggressive 5% compounded annual growth rate for the Port of Oakland. CARB staff agreed it should be lowered to 2.2% to be in line with the recently finalized Bay Area Seaport Forecast (by Tioga Group for the San Francisco Bay Conservation and Development Commission, dated May 22, 2020). CARB staff said they would address this in summer 2020, but that does not seem to have happened and does not appear to be scheduled before the Board votes on this item. This is also a critical factor that, if left unaddressed, would artificially inflate any future emissions from OGV operations in Oakland and overstate the benefit of the Proposed Control Measure.

2-15-11.6

The Port suggests that CARB staff resolve all three of these issues *before* a vote is taken on the Proposed Control Measure. These adjustments may change the outcome of the cost-benefit analysis, and hence the need for containerships to be placed under the Proposed Control Measure.

The Port has kept meticulous shore power records and would be happy to share information and provide reliable data sets to CARB.

The complex TIE/VIE regime is ripe for conflict

2-15-11.7

The Port is concerned about the Proposed Control Measure's potential to create conflict and disputes rather than collaboration among terminal operators, vessel operators and the local seaport. The Port has expressed this concern to CARB in previous correspondence. Given the Port's extensive experience working with our marine terminal operators and shipping lines on compliance with the At-Berth regulation, it is curious that CARB staff would not be receptive to

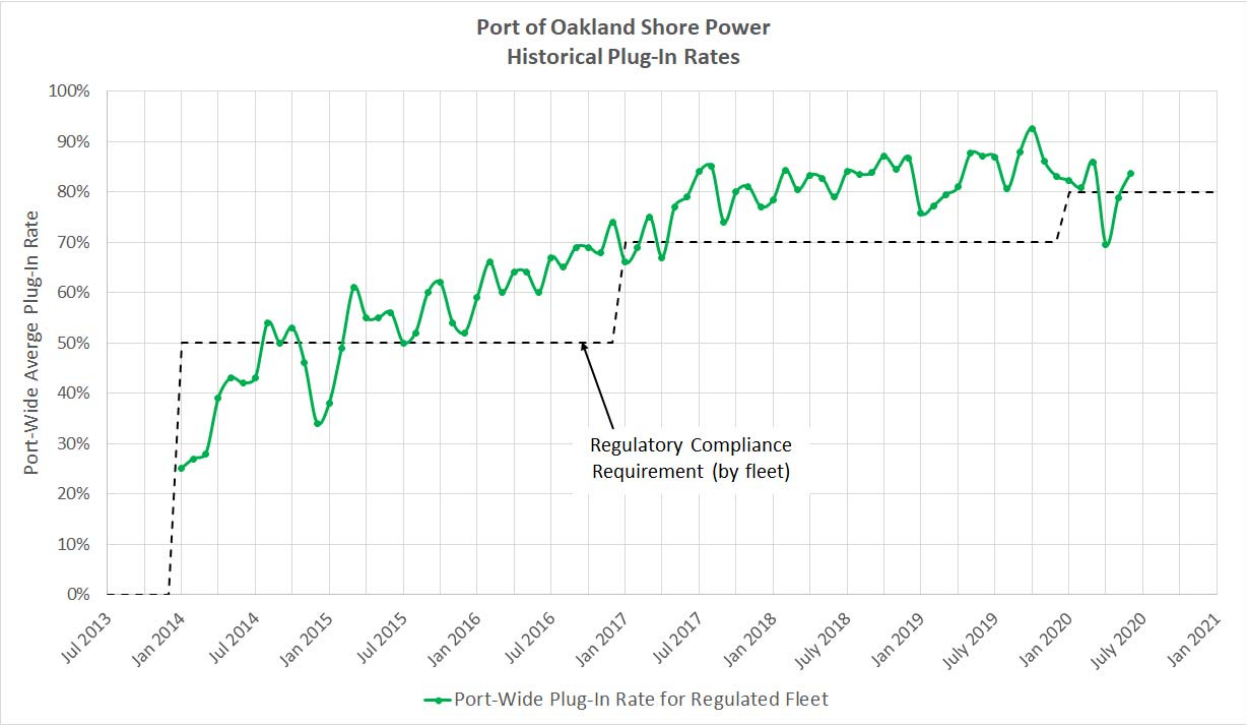
the Port's know-how and operational concerns. Specifically, the Port is very concerned about the complex regime of TIEs and VIEs and the interplay with fleets that choose the Innovative Concepts route. For example, a terminal operator that has expended its TIE budget for the year would be incentivized to give more favorable berth assignments to ships on the TIE/VIE regime over ships on the fleet averaging regime. There are many foreseeable scenarios where a missed plug-in is not clearly the fault of the vessel owner or the terminal operator. How will CARB staff navigate these grey areas?

2-15-11.7

The Port recommends that CARB maintain the framework of the existing At-Berth Regulation for containerships.

The Current At-Berth Regulation is Successful and Should be Maintained for Containerships

The current At-Berth Regulation has proven to be successful for containerships. The graph below shows the Port of Oakland's shore power plug-in rate since 2014 for the regulated fleet.[1] This graph underscores the effectiveness of the current At-Berth Regulation.



Clearly, ships coming to the Port of Oakland consistently over-perform in terms of the required regulatory compliance plug-in rates. The temporary decline in plug-ins in Spring 2020 was due to the Port's inability to perform vessel commissioning due to COVID-19, however the Port fully expects the plug-in percentages to rise since the Port resumed commissioning in May 2020.

CARB staff have given presentations indicating that the Innovative Concepts provision will allow for regulated vessel fleets to use fleet averaging methods to comply with the Proposed

[1] Steamships and infrequent callers not subject to the current regulation are not included in this graph.

Control Measure. However, that is not explicitly stated in the regulation language. The provision for fleet averaging to be used as an Innovative Concept must be included in the language of the regulation to give carriers certainty. Otherwise, CARB staff could change their mind about its acceptability. Further, the Innovative Concept rule has one single application deadline, December 1, 2021. Does that mean that fleets entering the California market in 2022 are not allowed to use fleet averaging? What about fleets that start using the TIE/VIE regime but then wish to switch to fleet averaging, would that be allowed? CARB needs to include certainty about fleet averaging, and a mechanism to allow it after December 1, 2021.

2-15.11.8

2-15-11.9

The Innovative Concept provision is a step in the right direction. But for simplicity's sake, if the current regime is already acceptable as an Innovative Concept, why not let the current regime stay in place? Why force the carriers to re-apply every five years for a proven method that is already working? The application process with public review is burdensome, the five-year limit injects uncertainty, and the one-time application deadline is an unfair barrier for future fleets.

2-15-11.10

The Port of Oakland recommends that CARB maintain the framework of the existing At-Berth Regulation for containerships. California's container shipping industry has successfully coalesced around this existing regulation, is complying well with the regulation and is achieving the desired compliance levels and air quality reduction outcomes.

Closing

Lastly, the Port of Oakland reiterates that today's July 27, 2020, letter is the Port's seventh (7th) letter to CARB providing comments and expressing concerns about the Proposed Control Measure. The Port has expended considerable time and personnel resources combing through the proposed regulation and raising substantive concerns about many different aspects of the rule as well as the data upon which it is based.

To date, CARB staff have not provided written responses to the questions and comments posed in the Port of Oakland's first six letters. The Port has attached the previous six letters to today's letter, and specifically requests detailed responses to each of the questions raised in all the Port's letters. The Port believes that CARB's expressed intention to provide meaningful stakeholder engagement requires timely, substantive written responses to questions and comments made by the Port of Oakland and other stakeholders.

The Port of Oakland is fully engaged and committed to reducing at-berth emissions and increasing shore power usage. The Port firmly believes that California's container terminals can achieve the desired outcomes of the Proposed Control Measure without getting mired in an unnecessarily complicated new regulation that is analytically flawed and presents the potential for conflict among seaports, terminal operators and vessel owners and operators.

The Port of Oakland looks forward to working with CARB on the emissions inventory and associated analyses. Please contact Ms. Tracy Fidell, P.E., Port Associate Environmental Planner/Scientist at tfidell@portoakland.com with any follow-up questions and responses.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

CC:

Kristi McKenney, Chief Operating Officer
Michele Heffes, Port Attorney
Bryan Brandes, Maritime Director
Matthew Davis, Director of Governmental Affairs

Attachments (Prior letters to CARB):

1) June 25, 2020 Port letter to CARB re: Comments for CARB Board Meeting on June 25, 2020, Agenda Item 20-6-4: Public Meeting to Hear an Informational Update on Control Measure for Ocean-Going Vessels at Berth

2) May 1, 2020 Port letter to CARB re: Comments on March 26, 2020 Notice of Availability of Modified Text for Proposed Control Measure for Ocean-Going Vessels at Berth (15-day changes)

3) December 2, 2019 Port letter to CARB re: Comments on October 15, 2019, Draft Proposed Control Measure for Ocean-Going Vessels at Berth and Supporting Documents

4) June 10, 2019 Port letter to CARB re: Comments on May 10, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents

5) February 15, 2019 Port letter to CARB re: Comments on *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

6) January 31, 2019 Port letter to CARB re: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

PORT OF OAKLAND

Duplicate see Hearing comment Letter 10

June 25, 2020

Ms. Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments for CARB Board Meeting on June 25, 2020, Agenda Item 20-6-4: Public Meeting to Hear an Informational Update on Control Measure for Ocean-Going Vessels At Berth

Dear Ms. Csondes:

The Port of Oakland (Port) appreciates the opportunity to comment on the Proposed Control Measure for Ocean-Going Vessels At Berth (Proposed Control Measure). The Port understands that the California Air Resources Board (CARB) is planning for the Proposed Control Measure to replace the current Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (current At-Berth Regulation), with the goal of having the new rule in place in 2021.

Briefly, the Port has the following comments:

- The current at-berth regulation is successful and should be maintained for containerships
- The Port of Oakland has no feasible Alternative Compliance Method
- The foundational analysis for the Proposed Control Measure is flawed
- TIEs vs. VIEs create a potential for conflict

Before giving detailed comments on the regulation, the Port questions whether CARB's timeline for implementing the Proposed Control Measure is still appropriate and feasible. As CARB is aware, California and U.S. seaports and goods movement industry stakeholders are responding to an unprecedented global economic and public health crisis. The maritime industry, which includes California and U.S. seaports, is included within the transportation critical infrastructure sector defined by the Department of Homeland Security. The maritime industry, operating under extraordinarily challenging public health, safety and financial conditions due to the COVID-19

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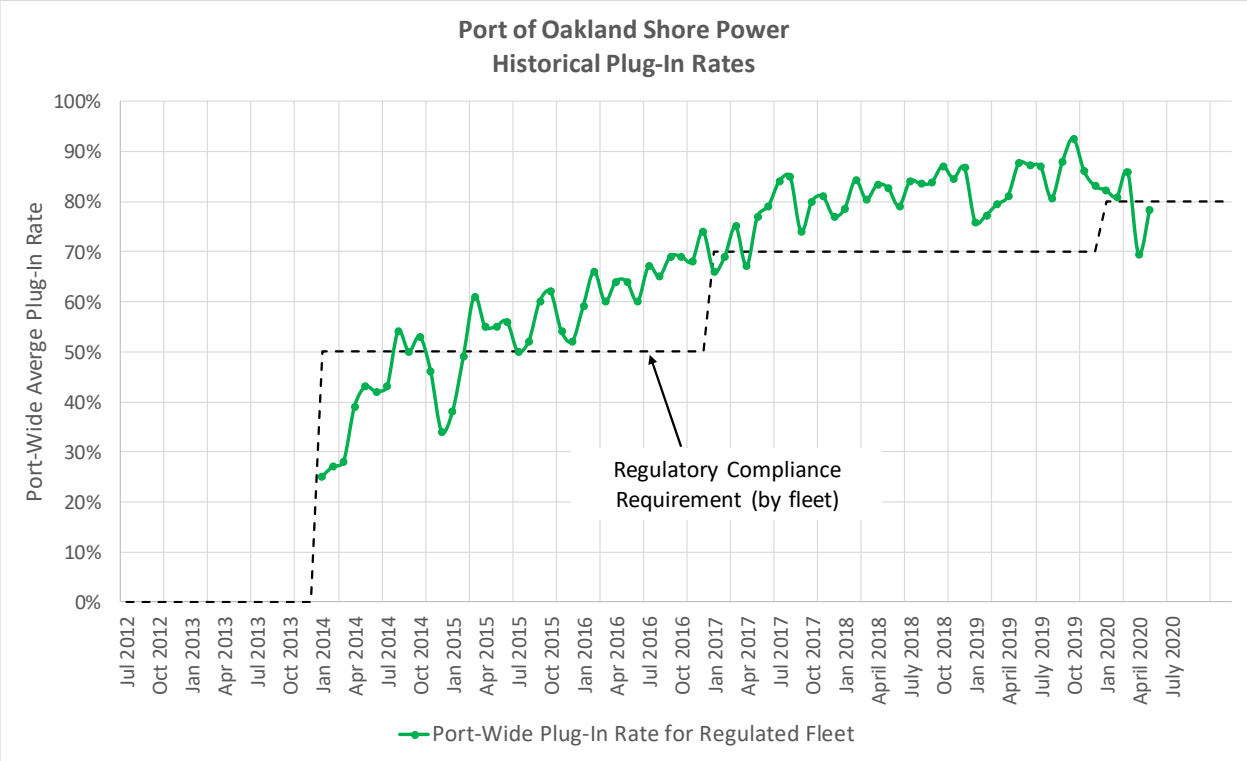
pandemic, has swiftly reprioritized and reallocated scarce personnel and financial resources to ensure the continuity of essential supply chain services to the public, communities, businesses and local, state and federal government agencies around the United States. It seems problematic and inattentive to these challenges for CARB to require California seaports, terminal operators, and shipping companies to divert their limited resources and attention to this rulemaking process and subsequent requirements when lives and jobs are at risk. We respectfully request that CARB place the rulemaking process on "pause" to allow the maritime industry to focus its resources and attention on the performance of its critical supply chain functions and services in response to the COVID-19 pandemic. CARB could use this time to refine the analysis that serves as the foundation for the Proposed Control Measure

The Current At-Berth Regulation is Successful and Should be Maintained for Containerships

The current At-Berth Regulation has proven to be successful for containerships. The graph below shows the Port of Oakland's shore power plug-in rate since 2014 for the regulated fleet.[1] This graph underscores the effectiveness of the current At-Berth Regulation.



It is clear that ships coming to the Port of Oakland consistently over-perform in terms of the required regulatory compliance plug-in rates. The decline in plug-ins in April 2020 was due to

[1] Steamships and infrequent callers not subject to the current regulation are not included in this graph.

the Port's inability to perform vessel commissioning due to COVID-19, however the Port fully expects the plug-in percentages to rise since that the Port resumed commissioning in May 2020.

The Innovative Concepts provision provides a pathway "for regulated vessel fleets to continue using fleet averaging methods to comply with the Proposed Regulation." If the current regime is already acceptable as an Innovative Concept, why not let the current regime stay in place? Why force the carriers to re-apply every three years for a proven method that is already working? The application process with public review is burdensome and the three-year limit injects uncertainty.

The Port of Oakland recommends that CARB maintain the framework of the existing At-Berth Regulation for containerships. California's container shipping industry has successfully coalesced around this existing regulation, is complying well with the regulation and is achieving the desired compliance levels and air quality reduction outcomes.

The Port has No Feasible Alternative Compliance Method

According to CARB's own analysis, the Port of Oakland has no feasible alternative compliance method at three out of four of its terminals (representing 83% of the Port's call volume). This means that carriers relying on a barge-mounted bonnet system for compliance at the San Pedro Bay Ports will not be able to call Oakland, where the only feasible compliance method is shore power. This puts the Port of Oakland at a substantial competitive and operational disadvantage, especially as compared to its competitor ports outside California in Tacoma, Seattle, Vancouver, and Prince Rupert. Diverting cargo to distant seaports leads to increased emissions, undermining the purpose of the regulation.

The Foundational Analysis for the Proposed Control Measure is Flawed

The analysis that serves as the foundation for this rule both underestimates the efficacy of the current At-Berth Regulation *and* overstates the benefit of the Proposed Control Measure. The discrepancies listed below need to be addressed.

a. The emissions benefit calculation caps the benefit of the current regulation at 80%. This is incorrect because it ignores demonstrated overcompliance due to 1) the provision requiring every vessel capable of plugging in to do so, 2) the long call durations at the San Pedro Bay Ports resulting in ~96% emission reductions, and 3) the fact that some infrequent callers are plugging in even though they are not required to do so.

b. CARB's 2016 baseline data do not seem reliable. Comparing summaries by vessel class size to the Port of Oakland's own data (used for billing and subject to audit), the values are off by up to 40% in critical areas.

c. As recognized by CARB staff, the assumed growth rate for the Port Oakland is too high. The inventory assumes a 5% compounded annual growth rate (CAGR) for the Port of Oakland, which CARB staff have agreed should be lowered to 2.2% to be in line with the recently finalized Bay Area Seaport Forecast (by Tioga Group for the San Francisco Bay Conservation and Development Commission, dated May 22,

2020). Considering the current COVID-19 crisis and the related documented decline in cargo throughput at California seaports, the 5% CAGR is highly speculative and unreliable at best and should not serve as the analytical basis to estimate projected emissions reductions and cost-effectiveness of the Proposed Control Measure.

CARB inventory staff have acknowledged these issues in a many phone calls and emails to Port of Oakland staff. CARB staff members have said that they will address these issues in Summer 2020, which is too late to make the required adjustments or revisions under the proposed rulemaking and adoption schedule.

The Port suggests that CARB take the time available now during the COVID-19 crisis to reassess its baseline data, compliance assumptions, and inventory calculations. The Port has kept meticulous shore power records and would be happy to share information and provide reliable data sets to CARB.

TIEs vs. VIEs and the Potential for Conflict

The Port is concerned about the Proposed Control Measure's potential to create conflict and failure rather than collaboration among terminal operators, vessel operators and a local seaport. The Port of Oakland has expressed this concern in previous correspondence (i.e., letters submitted in the public record) to CARB. Specifically, the Port is very concerned that the proposed complex regime of TIEs and VIEs will lead to disputes, rather than collaboration, among terminal operators, vessel operators, and a local seaport. It is doubtful whether CARB enforcement staff possesses the necessary dispute resolution expertise to referee the foreseeable conflicts. Again, the Port of Oakland recommends that CARB maintain the framework of the existing At-Berth Regulation in place for containerships.

Closing

Lastly, the Port of Oakland notes that today's June 25, 2020, letter is the Port's sixth (6th) letter to CARB providing comments and expressing concerns regarding the Proposed Control Measure. (See attachments to this letter, below.) The Port has expended considerable time and personnel resources combing through the proposed regulation and raising substantive concerns and questions about many different details of the proposed regulation and the data upon which it is based.

To date, CARB staff <u>have not provided</u> written responses to the questions and comments posed in the Port of Oakland's first five letters. The Port has attached the previous five letters to today's letter, and specifically requests detailed responses to each of the questions raised in all the Port's letters. The Port believes that CARB's expressed intention to provide meaningful stakeholder engagement requires that CARB timely and diligently provide substantive written responses to questions raised and comments made by the Port of Oakland and other stakeholders.

The Port of Oakland is fully engaged and committed to reducing at-berth emissions and increasing shore power usage. The Port firmly believes that California seaports can achieve the desired outcomes of the existing shore power rule without getting mired in an unnecessarily complicated new regulation that is analytically flawed and presents the potential for conflict among seaports, terminal operators and vessel owners and operators.

The Port of Oakland looks forward to working with CARB on the emissions inventory and associated analyses. Please contact Ms. Tracy Fidell, P.E., Port Associate Environmental Planner/Scientist at tfidell@portoakland.com with any follow-up questions and responses.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

CC:

Kristi McKenney, Chief Operating Officer
Michele Heffes, Port Attorney
Bryan Brandes, Maritime Director
Matthew Davis, Director of Governmental Affairs

Attachments (Prior letters to CARB):

1) May 1, 2020 Port letter to CARB re: Comments on March 26, 2020 Notice of Availability of Modified Text for Proposed Control Measure for Ocean-Going Vessels at Berth (15-day changes)

2) December 2, 2019 Port letter to CARB re: Comments on October 15, 2019, Draft Proposed Control Measure for Ocean-Going Vessels at Berth and Supporting Documents

3) June 10, 2019 Port letter to CARB re: Comments on May 10, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents

4) February 15, 2019 Port letter to CARB re: Comments on *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

5) January 31, 2019 Port letter to CARB re: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

PORT OF OAKLAND

Duplicate see 15-1 comment Letter 48

May 1, 2020

Ms. Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on March 26, 2020 Notice of Availability of Modified Text for Proposed Control Measure for Ocean-Going Vessels at Berth (15-day changes)

Dear Ms. Csondes:

The Port of Oakland (Port) appreciates the opportunity to comment on the rulemaking materials posted March 26, 2020, for the Proposed Control Measure for Ocean-Going Vessels At Berth (Proposed Control Measure). The Port understands that the California Air Resources Board (CARB) is planning for the Proposed Control Measure to replace the current Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (current At-Berth Regulation), with the goal of having the new rule in place in 2021.

The Port of Oakland has a very successful shore power program, underscoring the effectiveness of the current At-Berth Regulation. In 2018, 83% of regulated vessel calls[1] at the Port of Oakland drew shore power, surpassing the regulatory requirement of 70% compliance. The plug-in rates at the Port of Oakland are increasing as more carriers retrofit their vessels for shore power. In 2019, the success rate for the regulated fleet was 84% and year to date for 2020, the rate is tracking at 83%. Once safety exemptions are taken into consideration, compliance is much higher, surpassing 90% at some berths.

Before listing comments on the regulation, the Port questions whether CARB's timeline for implementing the Proposed Control Measure is still appropriate and feasible. As CARB is aware, California and U.S. seaports and goods movement industry stakeholders are responding to an unprecedented global economic and public health crisis. The maritime industry, which

[1] Steamships and infrequent callers (<25 calls/year) are exempt from the current regulation.

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includes California and U.S. seaports, is included within the transportation critical infrastructure sector defined by the Department of Homeland Security. The maritime industry, operating under extraordinarily challenging public health, safety and financial conditions due to the COVID-19 pandemic, has swiftly reprioritized and reallocated scarce personnel and financial resources to ensure the continuity of essential supply chain services to the public, communities, businesses and local, state and federal government agencies around the United States. It seems problematic and inattentive to these challenges for CARB to require California seaports, terminal operators, and shipping companies to divert their limited resources and attention to this rulemaking process when lives and jobs are at risk, especially since many of the proposed measures are not due to take effect for several years. We respectfully request that CARB place the rulemaking process on "pause" to allow the maritime industry to focus its resources and attention on the performance of its critical supply chain functions and services in response to the COVID-19 pandemic.

Specific Comments and Questions on the Proposed Control Measure

1. One of the Port of Oakland's main concerns about the Proposed Control Measure is its potential to create conflict and failure rather than collaboration among terminal operators, vessel operators and a local seaport. The Port of Oakland has expressed this concern in previous correspondence to CARB (see attachments to this letter, below). Specifically, the proposed complex regime of TIEs and VIEs has the potential to lead to disputes, rather than collaboration, among terminal operators, vessel operators, and a local seaport. Similarly, the proposed requirement for each port to prepare a "Port plan" and agree upon a "division of responsibilities" between terminal operators and the local seaport adds another potential arena of conflict for each port and its terminal tenants. It is doubtful whether CARB enforcement staff possess the necessary dispute resolution expertise to referee the foreseeable conflicts. The Port of Oakland recommends that CARB maintain the framework of the existing At-Berth Regulation in place for containerships. California's container shipping industry has successfully coalesced around this existing regulation and has demonstrated consistent overcompliance with the rule.
2. According to the 15-day changes, the Innovative Concepts provision provides a pathway "for regulated vessel fleets to continue using fleet averaging methods to comply with the Proposed Regulation." If the current regime is already acceptable as an Innovative Concept, why not let the current regime stay in place? Why force the carriers to re-apply every three years for a proven method that is already working? The Port suggests that CARB allow current fleet averaging methods to stay in place for all carriers who desire it without the need to constantly re-apply every three years. The shipping industry thrives on certainty.
3. According to CARB's own analysis, the Port of Oakland has no feasible alternative compliance method at three out of four of its terminals (representing 83% of the Port's call volume). This means that carriers relying on a barge-mounted bonnet system for compliance at the San Pedro Bay Ports (SPBP) will not be able to call Oakland, where the only feasible compliance method is shore power. This puts the Port of Oakland at a real disadvantage, especially as compared to its competitor ports in Tacoma, Seattle, Vancouver, and Prince Rupert. Diverting cargo to distant seaports only serves to increase emissions, undermining the purpose of the regulation.

4. The inventory that serves as the foundation for this rule is flawed. It underestimates the efficacy of the current regulation and overstates the benefit of the Proposed Control Measure. The discrepancies listed below invalidate the conclusions of CARB's analysis.

    a. CARB's 2016 baseline data do not seem reliable. Comparing summaries by vessel class size to the Port of Oakland's own data (used for billing and subject to audit), the values are off by up to 40% in critical areas.

    b. The inventory calculation caps the benefit of the current regulation at 80%, which disregards current overcompliance primarily due to 1) the provision requiring every vessel capable of plugging in to do so, 2) the long call durations at the SPBP resulting in ~96% emission reductions, and 3) the fact that some infrequent callers are in fact plugging in even though they are not required to do so.

    c. As recognized by CARB staff, the assumed growth rate for the Port Oakland is too high. The inventory assumes a 5% compounded annual growth rate (CAGR) for the Port of Oakland, which CARB staff have agreed should be lowered to 2.2%. Considering the current COVID-19 crisis and the related documented decline in cargo throughput at California seaports, it is evident that the 5% CAGR is speculative at best and should not serve as the analytical basis to estimate projected emissions reductions and cost-effectiveness of the Proposed Control Measure.

    CARB inventory staff have acknowledged these issues in a variety of phone calls and emails to Port of Oakland staff. CARB staff members have said that they will address these issues in Summer 2020, which is obviously too late to make the required adjustments or revisions under the proposed rulemaking and adoption schedule.

    The Port suggests that CARB take the time available now during the COVID-19 crisis to reassess its baseline data, compliance assumptions, and inventory calculations. The Port has kept meticulous shore power records and would be happy to share information and provide reliable data sets to CARB.

5. Lastly, the Port of Oakland notes that today's May 1, 2020, letter is the Port's fifth letter to CARB providing comments and expressing concerns regarding the Proposed Control Measure. (See attachments to this letter, below.) The Port has expended considerable time and personnel resources combing through the proposed regulation and raising substantive concerns and questions about many different details of the proposed regulation and the data upon which it is based. To date, CARB staff have not provided written responses to the questions and comments posed in the Port of Oakland's first four letters. The Port has attached the previous four letters to today's letter, and specifically requests detailed responses to each of the questions raised in all the Port's letters. The Port believes that CARB's intention to provide meaningful stakeholder engagement requires that CARB timely and diligently provide substantive written responses to questions raised and comments made by the Port of Oakland and other stakeholders.

Closing

The Port of Oakland appreciate the opportunity to review the 15-day changes to the Proposed Control Measure. As the Port of Oakland's maritime air quality policies and plans – Maritime

Air Quality Improvement Plan (2009) and Seaport Air Quality 2020 and Beyond Plan (2019) – emissions inventories, and shore power records and data show, among other policies and documents, the Port of Oakland is fully engaged and committed to reducing at-berth emissions and increasing shore-power usage. However, the Port believes that California seaports can achieve the desired outcomes of the existing shore power rule without getting mired in an unnecessarily complicated new regulation that is analytically flawed and presents the potential for conflict among seaports, terminal operators and vessel owners and operators.

The Port of Oakland looks forward to working with CARB on the emissions inventory and associated analyses. Please contact Tracy Fidell, P.E., Port Associate Environmental Planner/Scientist at tfidell@portoakland.com with any follow-up questions and responses.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

CC:

Kristi McKenney, Chief Operating Officer
Michele Heffes, Port Attorney
John Driscoll, Maritime Director
Matthew Davis, Director of Governmental Affairs

Attachments (Prior letters to CARB):

1) June 10, 2019 Port letter to CARB re: Comments on May 10, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents

2) January 15, 2019 Port letter to CARB re: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

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4) December 2, 2019 Port letter to CARB re: Comments on October 15, 2019, Draft Proposed Control Measure for Ocean-Going Vessels at Berth and Supporting Documents

June 10, 2019

Duplicate see 45-day comment letter 17

Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on May 10, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents

Dear Ms. Csondes:

The Port of Oakland ("Port") appreciates the opportunity to comment on the rulemaking materials posted May 10, 2019, for the Proposed Control Measure for Ocean-Going Vessels At Berth ("Proposed Control Measure"). The Port understands that the California Air Resources Board ("CARB") is planning for the Proposed Control Measure to replace the current Airborne Toxic Control Measure ("ATCM") for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (the "At-Berth Regulation"), with the goal of taking the Proposed Control Measure to the CARB Governing Board in December 2019. On May 10, 2019, CARB posted the revised text of the Proposed Control Measure, and provided, as supporting documents, the presentation from the May 14 and May 16, 2019 public workshops, Cost Inputs and Assumptions in PDF format, and Cost Estimates in Excel format.

The Port supports CARB's ongoing efforts to reduce emissions from ocean-going vessels ("OGVs") at berth and is working diligently to maximize the number of vessel visits using shore power. Port staff work collaboratively with shipping lines to provide education and resources about the shore power program. Port staff also track shore power usage in real time, collecting detailed information from marine terminal operators. The Port posts shore power usage statistics, reasons for equipped vessels not plugging in, and cost information on our shore power website: https://www.oaklandseaport.com/development-programs/shore-power/. In 2018, 75% of all calls to the Port drew shore power.

Public comments on the Proposed Control Measure are due to CARB June 10, 2019. Port staff understand CARB will then finalize the regulatory language and prepare an Initial Statement of

Reasons ("ISOR") to release on October 18, 2019, with public comment on the ISOR closing on December 2, 2019. The CARB Governing Board is scheduled to hear the Proposed Control Measure on December 5, 2019. Do CARB staff intend to respond to public comment on the ISOR? Three days does not leave time for meaningful CARB response to public comment or public review of subsequent changes to the Proposed Control Measure. Port staff suggest a minimum of 14 days for CARB staff to review and respond to public comment, and for the public to review any changes, before the Proposed Control Measure can be heard.

The Proposed Control Measure includes the concept of an Incident Exemption, which is new since CARB published its draft Proposed Control Measure in August 2018. Vessel fleets would be granted Vessel Incident Exemptions (VIEs) and terminals would be granted Terminal Incident Exemptions (TIEs). Starting in 2021 for container ships and terminals, VIEs and TIEs would be granted at levels of 5% of the previous calendar year's calls. CARB stated at the May 14, 2019, public workshop that the expected plug-in level for the container fleet is 90% in 2021.

Port staff submit the following comments and questions, divided into the topic areas of the draft regulatory text of the Proposed Control Measure, the presentation from the May 14, 2019 and May 16, 2019 public workshops, and the Cost Inputs and Assumptions in PDF format.

Comments and Questions on the Draft Regulatory Text of the Proposed Control Measure

1. Port staff request clarification on the definition of "necessary infrastructure…that will enable a terminal to comply with this Control Measure" in Section 93130.10(b) of the Proposed Control Measure and what, in this context, "subject to verification by [CARB] enforcement staff" means. From Table XI Berth and Terminal Counts, Anticipated Infrastructure Needs, and Unique Vessels of the CARB Cost Inputs and Assumptions in PDF format, it appears that CARB believes that three new shore power vaults "would be installed in response to the Draft Regulation [Proposed Control Measure]…" at the Port. Accordingly Port staff request documentation supporting CARB staff's berth-by-berth infrastructure analysis and determination that three new shore power vaults would be required at the Port in response to the Proposed Control Measure.

2. Regarding the Terminal and Port Plans required for Container terminals in Section 93130.11 of the Proposed Control Measure, the deadline of June 1, 2020 does not allow for sufficient time after the anticipated adoption of the Proposed Control Measure for ports and terminals to submit plans. Port staff object to the text in Section 93130.11(a) that "[a]s an alternative, Ports may submit plans for their terminal operators." Ports should not be expected to submit plans for terminal operators. In addition, the statement in Section 93130.10(b) of the Proposed Control Measure that "Ports should use terminal plans as [the] basis for developing port plans" seems to indicate that the deadline for Port Plans should be adjusted to come after the deadline for Terminal Plans.

3. The definition of "Fleet" in Section 93130.2(b)(22) of the Proposed Control Measure does not explain how fleets will be established. What will CARB require at the beginning

of each compliance year to establish fleets? Will this be part of the online Freight Regulations Reporting System ("FRRS") mentioned in the presentation from the May 14, 2019 and May 16, 2019 public workshops?

Port staff request an initial accommodation for new fleets entering the California market. New entrants should be given an opportunity to estimate the coming year's ship calls and estimate the number of VIEs to be awarded for the coming year.

The definition of Fleet and the requirements for VIEs also need to be responsive to changes in the shipping industry, for example when businesses merge or alliances change. Likewise, CARB should clarify what provisions will accommodate changes in the terminal industry, such as new terminals or changes in ownership, in the allocation of TIEs.

4. Port staff have two comments regarding vessel commissioning. Port staff request that vessel commissioning events that do not successfully connect to shore power as discussed in Section 93130.7(f)(2) of the Proposed Control Measure be considered eligible for exceptions under the regulation. The commissioning attempt shows that the goal was to reduce emissions through shore power and as such an Exception should be available to operators in this situation. Port staff conduct each vessel commissioning (with the exception of those at the Matson Terminal) to ensure the safety of the vessel, terminal, and workforce. Vessel commissioning is an invaluable safety procedure and should not be penalized under the Proposed Control Measure.

   Port staff request that the definition of "Vessel Commissioning" in Section 93130.2(b)(61) of the Proposed Control Measure be expanded to include the case in which the port authority is the commissioning agent, as is the case at the Port of Oakland. Likewise, in Section 93130.7(d)(1) ("If applicable, commission vessel as required by terminal operator"), Section 93130.8(a)(4) ("It is the terminal operator's responsibility to commission vessels equipped with shore power"), and Section 93130.8(d)(1) ("If applicable, commission vessel for use of shore power"), the commissioning requirement should be determined by the port authority or the terminal operator.

5. The reduction in VIEs and TIEs for Container, Reefer, and Passenger vessels from 5% each to 3% each discussed in Sections 93130.7(g)(1)(A)(ii) and 93130.8(h)(1)(A)(ii) of the Proposed Control Measure serves to increase the usage of the Remediation Fund [Section 93130.12(a)] in and after 2023. Port staff request further information from CARB on when and where the Remediation Fund will be deployed, given that CARB anticipates zero-emissions regulation on trucks, transport refrigeration units, forklifts, and cargo-handling equipment in the time frame of enhanced usage of the Remediation Fund, making those categories ineligible for incentive-funded emissions reductions.

6. The allotted VIEs and TIEs for vessels other than Container, Reefer, and Passenger vessels in Sections 93130.7(g)(1)(A) and 93130.8(h)(1)(A) of the Proposed Control Measure reduce from 5% to 3% after only one year. Port staff note that at the advent of the ATCM, the requirement was 50% of all calls in the first year. An initial expectation of 90% usage does not accommodate the fact that the Proposed Control Measure is the first-of-its-kind requirement for Ro-Ro and Tanker vessels in the world, and the technologies and equipment required do not exist at this time and have not been tested.

7. Regarding the Remediation Fund described in Section 93130.12 of the Proposed Control Measure, what is the procedure and timeline for CARB to approve a public entity to manage the funds generated at the Port?

8. Port staff request clarification from CARB of what constitutes a failure to achieve "full emission reductions" as referenced in Section 93130.12(a)(3) of the Proposed Control Measure, regarding when the Remediation Fund may be used.

9. In response to the suggestion in Section 93130.8(a)(2) of the Proposed Control Measure that a terminal operator should be responsible to interrupt a vessel call to shift the vessel to a berth with shore power if no berth was previously available, Port staff request CARB prepare and share an analysis of harbor craft emissions associated with such a shift at each port. Second to OGV, harbor craft are the second-highest emitting sources of emissions in the Port's 2017 Emissions Inventory. Given the short duration of the average vessel call to the Port, the suggestion to call additional harbor craft to reduce the remaining hours of an OGV call's auxiliary emissions could lead to increased overall emissions.

10. Likewise, Port staff question if the suggestion in Section 93130.8(a)(3) of the Proposed Control Measure that a terminal operator should be responsible to provide an alternative CARB-approved emission control strategy if a commissioned shore power vessel is berthed such that it cannot connect to shore power is necessary. CARB's own analysis in the Cost Inputs and Assumptions in PDF format, Table XI, declares that no barge-based capture and control system is anticipated for the Port.

11. Port staff note that the "power meter readings at the time of shore power connection and disconnection" requested in Section 93130.8(e)(2)(C) of the Proposed Control Measure are typically not available within 7 calendar days of a vessel's departure, as anticipated by CARB. Power meter readings at the Port are typically available at the close of the calendar month and not sooner.

12. In Section 93130.1 of the Proposed Control Measure, the stated intent of the Proposed Control Measure is "to ensure that operators of ocean-going vessels reduce emissions using a California Air Resources Board (CARB) approved emission control strategy to reduce PM, NOx, and ROG emissions at berth without increasing overall GHG emissions from this Control Measure…" How will CARB monitor GHG emissions after

implementation of the Proposed Control Measure and what is the GHG emissions baseline?

Comments and Questions on the presentation from the May 14, 2019 and May 16, 2019 public workshops

13. On Slide 4 of the presentation for the May 14, 2019 and May 16, 2019, public workshops, CARB staff show OGV at-berth emissions for the entire state. Port staff request to see these emissions totals further tabulated both by port or marine terminal and by vessel type. This is especially important as, per Section 93130.7(g)(2) of the Proposed Control Measure, VIEs are specific to the Fleet-Port pairing they are granted to.

14. On Slides 5 and 29 of the presentation for the May 14, 2019 and May 16, 2019 public workshops, CARB staff show a table of cost effectiveness for this rulemaking. The Port provides specific comments on the cost estimates below. Port staff request to see the total cost estimates and cost effectiveness estimates further tabulated both by port and by vessel type.

Comments and Questions on the Cost Inputs and Assumptions in PDF format

15. In Table V. Auxiliary Engine Effective Power Values, CARB states that it is relying on "the same power values cited in Table 7 of the emission inventory methodology https://ww3.arb.ca.gov/msei/ordiesel/draft2019ogvinv.pdf. Values used in cost analysis for container/reefer and tanker vessels are calculated as one kW-average per vessel type, weighted by average vessel kW at each port/terminal and vessel visits to each port/terminal."

    As noted in the Port's February 15, 2019 letter to CARB regarding the emissions inventory, the emissions inventory relies on the assumption that container vessel effective power is a function of vessel size bin. Will this assumption in the emissions inventory be modified to align with the cost estimate?

16. In Table VI. Duration of Emission Control at Berth, CARB shows that it is estimating statewide emissions reductions based on average duration of emission control at berth per vessel visit. The Port requests an emissions and cost analysis specific to each port or marine terminal and each vessel type. The stated average Container/Reefer duration of emission control at berth of 38.8 hours is about twice the average time for shore power connections at the Port. The difference between Port data and the average shows that the statewide average is not meaningful for the Port, and the conclusions of the averaging analysis may not apply to the Port.

17. Table VIII. Electricity and Fuel Cost Inputs and the associated Cost Estimates in Excel format show that CARB expects 100% of any Low Carbon Fuel Standard ("LCFS") credits would be reinvested into shore power. It is not guaranteed that the credits would

all be reinvested into shore power. What assumptions did CARB staff make in projecting the LCFS credit value through 2032?

18. Related to the duration of emission control at berth in Table VI, Port staff would like to reiterate that shore power usage at the Port is billed based on hours of use, not kWh drawn. This affects the assumptions in Table VIII. Electricity and Fuel Cost Inputs, as well. While the cost of Pacific Gas & Electric electricity is relevant to the Matson Terminal and the overall discussion of electricity costs, the Port is the utility serving shore power at all but the Matson Terminal.

19. The growth assumptions in Table IX. Growth Factors overestimate actual TEU growth for the Port between 2016 and 2018 and continue to use a 3.9% compound annual TEU growth rate between 2018 and 2032. Port staff request that in addition to this high estimate of TEU growth, CARB prepare an estimate of emissions using a realistic growth estimate. For reference, the Port's CAGR between 2008 and 2018 was 0.4%. Port staff understand that the growth estimates CARB is using for emissions and costs for the Port will align with the vessel fleet projections (such as larger vessels each year) that are being used for the Ports of Long Beach and Los Angeles.

20. Port staff note that the cost of compliance with the existing At-Berth Regulation is high and requires frequent vessel retrofits. In 2018, the Port commissioned or re-commissioned nearly 100 vessels, or about 25% of the ever-commissioned vessel list. The ongoing costs of retrofitting vessels when the line rotation changes, maintaining vessel equipment, and commissioning vessels with the current At-Berth Regulation apply equally to comply with the Proposed Control Measure and should be included in the cost estimates as they are real and necessary costs of compliance with the Proposed Control Measure. The Proposed Control Measure is not additive and incremental to the At-Berth Regulation, but rather a replacement and as such the entire cost to comply with the Proposed Control Measure needs to be factored into the cost effectiveness.

Closing

Port staff appreciate the opportunity to review the Proposed Control Measure and attend the public workshop on May 14, 2019. We look forward to working with CARB on refinements to improve the Proposed Control Measure, emissions inventory, and associated analyses.

Please contact Catherine Mukai, P.E., Port Associate Environmental Planner/Scientist at cmukai@portoakland.com with any follow-up questions.

Sincerely,

Colleen Liang, Port Environmental Supervisor, for
Richard Sinkoff
Director of Environmental Programs and Planning

Enclosures: January 15, 2019 Port letter to ARB re: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

February 15, 2019 Port letter to ARB re: Comments on *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

PORT OF OAKLAND

February 15, 2019

Duplicate see 45-day comment letter 17

Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

Dear Ms. Csondes:

The Port of Oakland ("Port") appreciates the opportunity to comment on the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* posted January 15, 2019, for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor ("Proposed Control Measure"). The Port understands that the California Air Resources Board ("CARB") is planning for the Proposed Control Measure to replace the current Airborne Toxic Control Measure ("ATCM") for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (the "At-Berth Regulation"), with the goal of taking the Proposed Control Measure to the CARB Governing Board in December 2019. CARB posted the text of the Proposed Control Measure on August 31, 2018. The *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* was prepared in support of the Proposed Control Measure.

The Port supports CARB's ongoing efforts to reduce emissions from ocean-going vessels ("OGVs") at berth and is working diligently to maximize the number of vessel visits using shore power. Port staff work collaboratively with shipping lines to provide education and resources about the shore power program. Port staff also track shore power usage in real time, collecting detailed information from marine terminal operators and posting that information on the Port's website for public information purposes.[1]

[1] https://www.oaklandseaport.com/development-programs/shore-power/

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The *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* document includes emissions from California ports and CARB-defined Marine Terminal Complexes ("MTCs"). The emissions for 2016 are tabulated in Appendix B, while emissions for other years are only represented graphically in figures in the document and in tables published by CARB on November 9, 2018.

Comments on the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* are due to CARB February 15, 2019. CARB will then host a public workshop to discuss the emissions on February 26, 2019. After that, Port staff anticipate the need for a revised emissions inventory for the Proposed Control Measure that responds to public comments. The Port provides wharfinger information to CARB annually as required by grant funding obligations. In addition, Port staff request that CARB staff work with the Port to refine assumptions made in the emissions estimates.

Given the scheduling of the public workshop after the public comment period has closed, this letter includes comments and questions that may best be addressed in the workshop. Thus, the Port is providing a list of comments and questions on the draft emissions inventory and topics for discussion at the February 26 public workshop.

Comments and Questions on the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results*

1. Why was 2016 selected as the baseline calendar year for the emissions inventory? Does CARB plan to conduct in-depth emissions inventories for 2017 and 2018?

2. Table 4 of the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* shows vessel visit counts to California ports and MTCs in 2016 only. However, current trends are for fewer calls by larger vessels for a given amount of containerized cargo. The discussion on page 25 of the draft clarifies that "vessel practice changes" are not considered, even as the total number of calls is dropping in real time. Since 2013, total annual calls to the Port have been decreasing. Container cargo throughput is thus decoupled from vessel call activity. CARB should expand the vessel growth forecasting for the baseline scenario to include the effects of larger vessels and fewer calls for the same amount of containerized cargo.

3. Table 7 of the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* relies on the assumption that for all ports and MTCs, container vessel effective power will match that of the Ports of Los Angeles and Long Beach in 2016. The effective power does not appear to be a function of vessel size bin, so the level of detail with which the effective power is classified by CARB-defined size bin is not appropriate. In addition, given the variation between data from the Port of Los Angeles and the Port of Long Beach within the same CARB-defined size bin, the data may not be meaningful when averaged by CARB-defined size bin. CARB should use an average effective power for container vessels regardless of size.

4. The growth rates in the Freight Analysis Framework ("FAF") for ports and MTCs outside of the San Pedro Bay are at odds with current trends. The FAF assumption for container cargo at the Port of Oakland is a 5% year-over-year growth rate between 2016 and 2020. Actual growth rates between 2016 and 2018 have not kept pace, with current Oakland planning documents estimating about half the FAF compound annual growth rate.[2] CARB should adjust the FAF growth forecasting for the baseline scenario to align with actual trends.

5. Page 27 of the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* discusses statistical significance in the context of the emission forecasting. If CARB staff have conducted an uncertainties analysis, it should be included in the methodology and results document.

6. Table 15 of the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* does not treat all ports and vessel types equally when assuming "Projected 2020 and Later Time on Shorepower," without justifying the differences. For instance, CARB assumes container vessels at the Port of Hueneme spend 80% of their time on shore power after 2020, while CARB assumes at the Ports of Los Angeles and Long Beach container vessels spend only 65% of their time on shore power. Impossibly, CARB-defined size bins 7, 9, and 12 container vessels at the Port of Oakland are assumed to spend 100% of their time at berth on shore power.[3] Port staff request further justification for and synchronization of the assumptions for "Projected 2020 and Later Time on Shorepower."

7. In the discussion of the "static age distribution model" versus a survival and turnover model, CARB staff do not consider the abnormally high number of OGV keels laid in 2015. How did CARB decide that the spike in keels laid in 2015 was not material to estimating NOx emissions through 2050?

8. CARB should revise its assumption that sulfur content in fuel is 0.1% based on the results of enforcement analyses of in-use fuel sulfur. The sulfur content of in-use fuel as sampled by the CARB enforcement team in calendar years 2017 and 2018 is lower than 0.1% by 30% and almost 50%, respectively, presenting information that actual emissions are lower than those estimated by CARB. (As stated on page 12, information from CARB's enforcement team is already used to determine reduced emissions from reduced engine activity time.)

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[2] https://www.portofoakland.com/community/environmental-stewardship/maritime-air-quality-improvement-plan/

[3] Vessels arriving at berth need time to tie lines and lower gangways before they can connect shore power and likewise vessels need time to disconnect from shore power when leaving the berth. With these bookends on each vessel call, a vessel cannot be plugged into shore power for 100% of the time at berth.

9. CARB should elaborate in the text on the Particulate Matter ("PM") emission factor for Marine Gas Oil ("MGO") at 0.1% sulfur. The 2007 Initial Statement of Reasons for At-Berth Regulation rulemaking used a value of 0.25 g/kW-hr for 0.1% S MGO. The *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* uses a PM emission factor of 0.18 g/kW-hr for the same fuel. The root source for OGV auxiliary engine emission factors is stated in both cases as the 2002 Entec study, with no description of why two different values of PM emission factors are used for the same fuel.

10. Please add References to the Table of Contents and to the document (Sources of emission factor information are only included at the end of Appendix A).

11. On page 42, should the last sentence read "it excludes emissions from boilers," not "it excludes emissions from auxiliary engines"?

Closing

Port staff look forward to working with CARB to support the updated emissions inventories referred to in the *Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results* after the workshop on February 26.

Please contact Catherine Mukai, P.E., Port Associate Environmental Planner/Scientist at cmukai@portoakland.com with any follow-up questions.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

PORT OF OAKLAND

January 31, 2019

Duplicate see 45-day comment letter 17

Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

Dear Ms. Csondes:

The Port of Oakland ("Port") appreciates the opportunity to comment on the Preliminary Draft HRA posted November 5, 2018, for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor ("Proposed Control Measure"). The Port understands that the California Air Resources Board ("CARB") is planning for the Proposed Control Measure to replace the current Airborne Toxic Control Measure ("ATCM") for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (the "At-Berth Regulation"), with the goal of taking the Proposed Control Measure to the CARB Governing Board in December 2019. CARB posted the text of the Proposed Control Measure on August 31, 2018. The November 5, 2018, Preliminary Draft HRA and associated air dispersion modeling files that CARB released December 14, 2018, were prepared in support of the Proposed Control Measure.

The Preliminary Health Analyses document contains two types of assessment, 1) an HRA using air dispersion modeling and impacts estimation guidance from the California Environmental Protection Agency Office of Environmental Health Hazard Assessment ("OEHHA") and 2) an Incidents per Ton ("IPT") analysis.

The Port supports CARB's ongoing efforts to reduce emissions from ocean-going vessels ("OGV") at berth and is working diligently to maximize the number of vessel visits using shore power. Port staff work collaboratively with shipping lines to provide education and resources about the shore power program. Port staff also track shore power usage in real time, collecting

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detailed information from marine terminal operators and posting that information on the Port's web site for public information purposes.[1]

The key input to the Preliminary Draft HRA is the estimated emissions from vessels at berth, which are not yet final. Emissions estimates need to be final and the Preliminary Draft HRA updated before the Preliminary Draft HRA results can be used.

CARB conducted two HRAs addressing only the Ports of Long Beach and Los Angeles together and the Richmond Complex. CARB's use of AERMOD and the 2015 OEHHA Risk Assessment Guidelines for HRAs represents current best practices. However, the robustness of the findings is limited by the emissions estimates. Emissions estimates are typically completed before the HRA but in this case are open for public comment and discussion through the end of February 2019, at which point they may be refined.

The air dispersion model AERMOD, which CARB selected for the Preliminary Draft HRA is the preferred model from the US Environmental Protection Agency. Required inputs to AERMOD include meteorological data, emissions information for each pollutant considered, and exhaust parameters for release points. Of these inputs, the estimated emissions are key, since emissions have a direct linear relationship with the estimated ambient concentrations and health impacts from each source.

On November 5, 2018, CARB posted the Preliminary Draft HRA. CARB then posted a hard-coded spreadsheet of "Draft At Berth Emissions Estimates" used in the Preliminary Draft HRA on November 9, 2018, and air dispersion modeling files in mid-December with a public comment period for the Preliminary Draft HRA closing January 31, 2019.

CARB also posted the "Draft: 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results"—for the emissions that were entered into the Preliminary Draft HRA—on January 16, 2019, with a separate public comment period for the emissions methodology and results closing February 16, 2019.

Without greater understanding of the emissions used as data inputs to the air dispersion model and risk estimation calculations, the utility of the Preliminary Draft HRA is limited. Port staff are reviewing the emissions methodology released on January 16, 2019, and are comparing it with the spreadsheet posted November 9, 2018. Port staff look forward to discussing the emissions with CARB staff at the public workshop CARB scheduled for February 26, 2019. After that, Port staff anticipate the need for a revised HRA for the Proposed Control Measure that relies on emissions that have been reviewed and understood by all parties.

The AERMOD input and output files and risk estimation databases CARB provided on December 14, 2018, appear to carry out the methodology discussed in the Draft Preliminary HRA, but further review is not warranted until emissions are finalized. In addition to the

[1] https://www.oaklandseaport.com/development-programs/shore-power/

wharfinger information provided by the Port to CARB annually as required by grant funding obligations, Port staff are happy to work with CARB staff to refine assumptions made in the emissions estimates.

The role of the Preliminary Draft HRA posted November 5, 2018, in rulemaking for the Proposed Control Measure is not clear.

The Proposed Control Measure is not an ATCM, in fact its stated purpose is to reduce NOx, PM, and GHG but not the toxic air contaminant DPM—which is the focus of the Preliminary Draft HRA. The inclusion of an HRA for any of the ports in California is therefore not a fundamental driver of the Proposed Control Measure (leaving the CARB Governing Board direction, Mobile Source Strategy, and Sustainable Freight Action Plan as drivers). Thus, any reductions in risk shown in the Preliminary Draft HRA are purely informational. Indeed, CARB's elimination of the At-Berth Regulation ATCM by focusing on a Proposed Control Measure for NOx and PM but not DPM seems to imply that no further risk reductions are required.

The Preliminary Health Analyses report announces that the risk reductions of the Proposed Control Measure are "significant," a term defined in the California Environmental Quality Act ("CEQA") and used in CARB's Certified Regulatory Program, but not defined in the CARB rulemaking process. While CARB staff present the percentage of reduction in risk of the Proposed Control Measure over the current At-Berth Regulation, the total residual risk should be compared to that of other source categories to prioritize the need for the Proposed Control Measure.

Health impacts from Criteria Air Pollutants are managed through SIP Planning, which does not require a new Proposed Control Measure for the container fleet.

$PM_{2.5}$ is a criteria air pollutant, not a toxic air contaminant, and the California Ambient Air Quality Standards ("CAAQS") and National Ambient Air Quality Standards ("NAAQS") are the appropriate health-protective standards for $PM_{2.5}$. Regional ambient air concentrations of $PM_{2.5}$ are managed to levels below the CAAQS and NAAQS through SIP planning. Even so, CARB's Mobile Source Strategy calls for an evaluation of emissions reductions from currently unregulated fleets, not the already regulated container fleet which calls Oakland. Thus, SIP planning for $PM_{2.5}$ attainment does not mandate an amended At-Berth Regulation to reduce statewide emissions through an "every vessel, every visit" control strategy like CARB staff have proposed.

The Incidents Per Ton ("IPT") methodology presented for $PM_{2.5}$, a criteria air pollutant, is not a cost effectiveness metric.

The IPT methodology provides information on health effects assuming ambient $PM_{2.5}$ concentration is the sole contributor to adverse health effects, with a direct linear relationship. The IPT methodology is not, however, part of a cost-effectiveness evaluation. CARB released a "Preliminary Cost Information" document in August 2018 as part of this rulemaking effort,

which relies on the same assumptions as the emissions inventory (which, as discussed above, may need refinement). The preliminary costs data evaluated total costs of the Proposed Control Measure, but not cost effectiveness of proposed measures calculated in terms of cost per ton of emissions removed. CARB has also not yet prepared a socio-economic impact analysis of the proposed rule.

Closing

Port staff are interested in working with CARB to improve the current ATCM focused on DPM to allow for 100% compliance. We look forward to seeing enhanced supporting documentation for the CARB emissions estimates and a revised HRA and cost effectiveness analysis once the emissions are updated.

Please contact Catherine Mukai, P.E., Port Associate Environmental Planner/Scientist at cmukai@portoakland.com with any follow-up questions.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

PORT OF OAKLAND

December 2, 2019

Duplicate see 45-day comment letter 17

Angela Csondes
Manager, Marine Strategies Section
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812-2815
Submitted Via Electronic Comment Log

Subject: Comments on October 15, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents

Dear Ms. Csondes:

The Port of Oakland ("Port") appreciates the opportunity to comment on the rulemaking materials posted October 15, 2019, for the Proposed Control Measure for Ocean-Going Vessels At Berth ("Proposed Control Measure"). The Port understands that the California Air Resources Board ("CARB") plans to replace the current Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-Going Vessels At Berth in a California Port (the current "At-Berth Regulation") with the Proposed Control Measure, with the goal of taking the Proposed Control Measure to the CARB Governing Board on December 5, 2019 at a special meeting to be held in West Oakland. The Port understands that the CARB Governing Board will not vote on the Proposed Control Measure on December 5, 2019, and that comments are due December 9, 2019.

The Port fully supports CARB's efforts to reduce emissions from ocean-going vessels at berth and is working diligently to maximize the number of vessel visits using shore power. Port staff work collaboratively with shipping lines to provide education and resources about the shore power program. Port staff track shore power usage in real time, collecting detailed information from marine terminal operators. The Port regularly posts up-to-date shore power usage statistics, reasons for vessels not plugging in, and cost information on the Port's shore power website: https://www.oaklandseaport.com/development-programs/shore-power/.

In 2018, 75% of all vessel calls at the Port of Oakland drew shore power (the number for all vessel calls includes steamships and "infrequent callers" which are both exempt from the current At-Berth Regulation), which surpassed the regulatory requirement of 70% compliance. The plug-in rates at the Port of Oakland continue to increase. For example, in October 2019, 100% of vessels

that were equipped with shore power plugged in and 83% of all vessel calls plugged in. This was the third time in 2019 and the second consecutive month where shore power plug-in rates were above 80%. For 2019, the year-to-date average, including October 2019, was 76%.

The Port has commented on previous drafts of the Proposed Control Measure and various supporting documents, and those previous comment letters are enclosed with this comment letter. The Port appreciates CARB's consideration of its past comments and sets forth its new and continuing comments and concerns below.

Comments on Emissions Inventory

The Port has reviewed Appendix H: 2019 Update to Inventory for Ocean-Going Vessels at Berth: Methodology and Results. This inventory is extremely important, as it lays the foundation for the need for, and cost-effectiveness of, the Proposed Control Measure.

The Port appreciates all the hard work that went into the inventory, and the willingness of CARB staff to attempt to explain their methodology. At the same time, Port staff (along with other public seaport authorities and shipping partners that operate in the State) have struggled to understand the inventory results and implications for both Oakland and the State as a whole. Based on the collective feedback that has been received from stakeholders, CARB staff continues to revisit the baseline and forecasted emissions assumptions with updated calculations and results even as this Proposed Control Measure is being put before the CARB Governing Board. In other words, the methodology and analysis upon which the Proposed Control Measure is based, are still in flux.

To highlight just one particularly notable example, the 2020 estimated total hours at berth divided by typical call durations by vessel size indicate that there will be 2,580 calls for the Port of Oakland in 2020, which is a dramatic departure and increase (a deviation of over 40%) from observed operational realities and shipping trends. For context, the Port of Oakland had 1,175 calls in the first 10 months of 2019, 1,543 calls in 2018, and 1,598 calls in 2017. The same calculation applied to CARB values for the Ports of Los Angeles and Long Beach predicts 2,405 calls in 2020, which means Oakland would see 175 more calls than the Ports of Los Angeles and Long Beach combined. Such an order of magnitude difference has implications for evaluating the effectiveness and potential impact of the Proposed Control Measure and any marginal benefits that could be achieved by it.

Port staff compared the 2016 baseline values used by CARB in the inventory to 2016 actual values recorded at the Port. It appears that CARB's 2016 values for total time at berth are about 8% higher than actual, and that CARB's estimates for average power by ship size (which were derived from values at the ports of Los Angeles and Long Beach) are about 9% higher than actual for Oakland. Additionally, it seems that CARB has underestimated the total activity for the regulated fleet in 2016 by about 11%, which makes it appear that the Proposed Control Measure overestimates projected reductions. These over- and under-estimates do not balance out. In fact, they lead to further discrepancies which are compounded by CARB's assumed 21.5% growth rate which is applied equally across all vessel size bins. The Port understands that this growth rate was

developed from the Federal Highway Administration's Freight Analysis Framework and requests that CARB explain how this growth rate applies to hours at berth, cargo volumes, emissions, ship calls, and cost.

The Port appreciates CARB staff's recent acknowledgment that the cargo growth rate for Oakland needs to be adjusted. Port staff and CARB staff have had multiple discussions about the growth rate issue, and the Port understands that CARB will consider instead the Oakland-specific cargo forecast commissioned by the Bay Conservation and Development Commission ("BCDC")[1]. This will lower the forecasted annual growth rate for Oakland from ~4.6% to a more realistic, but still high, forecast of 2.2%. For reference, the Port's historical compounded annual growth rate from fiscal year 2008 to fiscal year 2018 was 0.4%.[2]

We look forward to evaluating the results and implications of these revised forecasts when the technical work is presented at a future date by CARB staff. The Port seeks assurance that no CARB vote will proceed until the emission reduction estimates reflect more realistic growth rates, for example as provided in the BCDC report.

The Port appreciates CARB staff's willingness to apply an "efficiency factor" that acknowledges efficiency gains produced by moving more cargo on fewer, larger ships. One point of caution is that the layering of percentages makes it extremely difficult to follow the logic and relate CARB's forecasted activity and emissions to any real-world metrics. Small errors and invalid assumptions with an initial set of data points can be magnified as these results are extrapolated into later forecast years, which lead to unrealistic and unreliable conclusions The Port understands the complexity of the task, but a regulation as important and expensive as the one being proposed needs to be based on data that can be fact-checked, and must include forecasts that are grounded in factual operational data.

As an alternative, the Port of Oakland prefers and requests that CARB re-evaluate the inventory using 2016 baseline values provided by the Port and a Port-specific growth forecast. The Port further requests that the forecast activity levels be related to ship calls, which can be readily understood by all ports, regulatory agency staff as well as by the public. This would be consistent with how the Port tracks shore power usage and compliance. Lastly, and most importantly, the Port asks that these changes be made and the inventory fully peer-reviewed before the CARB Governing Board contemplates further action on the Proposed Control Measure.

Broad Concerns about the Proposed Control Measure

The Port is extremely concerned that the Proposed Control Measure adds a substantial additional regulatory burden and cost to carriers and terminals that are already achieving high levels of plug-ins and emissions reductions. As the Port has discussed with CARB previously along with other California seaports, CARB could achieve more cost-effective emissions reductions from other source categories. In fact, during a conference call with CARB staff on Friday, November 22,

[1] BCDC is currently amending its Seaport Plan for the San Francisco Bay Area.
[2] From Budget and Finance report at May 23, 2019 Port Board Meeting (File ID 098-19), slide 6.

2019, the Port joined its sister ports in proposing potentially preferred emissions reductions project alternatives based upon readily available specific equipment replacements, which will result in a significant reduction of emissions.

A second broad concern is that the Port of Oakland would be disadvantaged under the Proposed Control Measure because it does not have the option of a CARB approved emission control strategy ("CAECS") other than shore power. As CARB itself found, the Port of Oakland cannot use a barge-based capture and control ("C+C") method at three of its four terminals "due to concerns expressed from SF Bar Pilots about wave interaction from passing vessels and channel space and navigational constraints." (See Appendix E: *Berth Analysis*.) The three terminals cited in CARB's Appendix E (Everport, Matson, and OICT) account for over 83% of the Port's call volume.

To elaborate, the potential negative impact to the Port and its carriers, tenants, and the community from the Proposed Control Measure is foreseeable. It is well established that almost every vessel calling Oakland also calls the ports of Los Angeles and Long Beach. Unlike Oakland, the ports of Los Angeles and Long Beach can use a barge-based C+C strategy. What will happen if carriers rely on a barge for compliance at the ports of Los Angeles and Long Beach, and then come to Oakland where a barge is not possible? The Port is very concerned that carriers may bypass Oakland if the Proposed Control Measure is enacted as currently written. Oakland has no feasible C+C alternative[3], which could put the Port of Oakland at a serious competitive disadvantage.

To address the fact that a barge-based C+C will not work in Oakland, the Port requests that CARB grant Oakland exemptions corresponding to the number of calls that rely on barge-based C+C in Southern California.

As a third concern, the Port understands that the Proposed Control Measure anticipates other emission control strategies such as a land-based C+C system. However, the Port is concerned that landside emissions control approaches were never contemplated for use in the container fleets, have not been analyzed by CARB staff for use in the container shipping trades, and by CARB's own analysis can result in an increase in greenhouse gas emissions[4], which would seem to be an unacceptable outcome given the purpose and intent of this rulemaking.

The Port's fourth concern is the introduction of shared responsibility which potentially creates conflict among vessels, terminals, and ports (see Table 5 of Proposed Control Measure) where none now exists. Upon the adoption of the initial At-Berth Regulation, CARB rightly acknowledged that in a global shipping environment it was not reasonable to expect that every vessel in every fleet would be equipped to receive shore power, hence the creation of fleet compliance averages and an exemption for infrequent callers. The Port has seen that its diligent involvement with carriers and terminals has resulted in a continuous positive trajectory in shore power usage.

[3] Appendix E of the ISOR, page 12
[4] Appendix C-1 of the SRIA, page 15

The Proposed Control Measure continues the acknowledgement that there will be instances when ships cannot plug in, due to circumstances on the vessel or at the terminal, hence the inclusion of alternative compliance options and a complex regime of Terminal Incident Events ("TIEs") and Vessel Incident Events ("VIEs"). The Port understands the goal of the TIE and VIE regime, but it creates more problems such as record-keeping and dispute resolution, than it solves. The Proposed Control Measure has no clear grievance or dispute resolution process when conflicts arise

Specific Comments on Proposed Control Measure

1. Regarding the Terminal and Port Plans required for Container terminals in Section 93130.14, the deadline of July 1, 2021 is confusing because the Compliance Start Date listed in Section 93130.7(b) is shown as January 1, 2021. Shouldn't the Plans and associated 90-day review window be completed prior to requiring compliance?

   Port staff object to the text in Section 93130.14(a) that "[a]s an alternative, Ports may submit plans for their terminal operators." Ports should not be expected to submit plans for terminal operators. In addition, the statement in Section 93130.14(b)(1) that "Ports should use terminal plans as [the] basis for developing port plans" seems to indicate that the deadline for Port Plans should be adjusted to come after the deadline for Terminal Plans.

2. The definition of "Fleet" in Section 93130.2(b)(29) does not explain how fleets will be established. What will CARB require at the beginning of each compliance year to establish fleets? How will this work?

   The proposed regulation does not address how or whether VIEs will be granted for new fleets entering the California market, or for fleets that expand. New entrants should be allowed to estimate their annual ship calls and be granted the associated number of VIEs for the coming year. Otherwise, this is a barrier to entry for new fleets because they will be granted zero VIEs in their very first year of operation. This puts California ports at a competitive disadvantage compared to ports in Oregon, Washington, Canada, Mexico, and on the U.S. Gulf and East Coast.

   The definition of Fleet and the requirements for VIEs also need to be responsive to changes in the shipping industry, for example when businesses merge or alliances change. It is not clear whether VIEs will be granted on a port-specific or State-wide basis. It is also not clear how disagreements will be resolved on whether a specific instance should use a TIE or a VIE. Will CARB adjudicate these?

3. The Port is glad to see that Vessel Commissioning is specifically exempt from the rule, as listed in visit exception Section 93130.8(c). However, the Port notes that it should not be limited to only the first visit, and should not matter whether the commissioning was successful. What happens if the commissioning was not successful? The Port of Oakland requires that vessels be re-commissioned if they have not been in Oakland for over a year. Further, the same vessel might need commissioning on both port side and starboard side. For these reasons, the same ship might require multiple commissioning trips.

Port staff request that vessel commissioning events that do not successfully connect to shore power as discussed in Section 93130.8(c) be eligible for exceptions under the regulation without the use of a VIE. The commissioning attempt shows that the goal was to reduce emissions through shore power and as such should be an exception in this situation. Port staff conduct each vessel commissioning (with the exception of those at Berths 61-6 [5] to ensure the safety of the vessel, terminal, and workforce. Vessel commissioning is an invaluable safety procedure and should not be penalized under the Proposed Control Measure.

The Port requests that the definition of "Vessel Commissioning" in Section 93130.2(b)(76) of the Proposed Control Measure be expanded to include the port authority as the commissioning agent, as is the case at the Port of Oakland. The same language is found in Section 93130.7(e)(2) ("Ensure the vessel is commissioned as required by terminal operator"), Section 93130.8(c)(2) ("The terminal requires that the vessel be recommissioned"), and Section 93130.9(a)(2) "The terminal operator is responsible for commissioning vessels equipped with shore power."). The commissioning requirement should be determined by the port authority or the terminal operator.

4. The Port requests that the definition of "Ready to Work" in Section 93130.2(b)(55) be expanded to include "Auxiliary Marine Power (AMP) container has been loaded on the ship and is in position, if applicable." This is crucial for the requirement in Section 93130.9(d)(2)(D) that the vessel be plugged in "within 1 hour of vessel "Ready to Work"." Many of the ships that call at the Port of Oakland rely on an AMP container to connect to shore power. The AMP container is often domiciled at the terminal and needs to be loaded onto the vessel by a ship-to-shore crane prior to plugging in. Some of the major carriers calling in Oakland rely on an AMP container to use shore power [MOL, NYK, K-Line (the ONE Alliance), Hyundai, and APL]. A vessel is not ready to plug in until the AMP container is in position.

   Likewise, the Port requests that the disconnection requirement in Section 93130.9(d)(2)(E) be re-written to accommodate certain situations where the AMP container has been removed from the ship prior to the pilot boarding.

5. The Port appreciates the increase in TIEs to 15% for the first four years of the regulation as listed in Table 3 of Section 93130.11. The Port requests that the number of TIEs and VIEs be rounded *up* to the nearest whole number instead of rounding to the nearest whole number for instances where the number of TIEs or VIEs is calculated at a fraction of ship call as stated in Section 9310.11(a)(2). Any fractional call should be counted as a whole call. For example, if a carrier made 49 calls to a California port in 2019, the VIE calculation

[5] The Port does not commission vessels at the Matson Terminal because these shore power vaults were installed by the former tenant, APL. The current terminal operator has assumed responsibility for these vaults.

would award 2.45 VIEs at the 5% level. This should be rounded up to three, not down to two.

6. Regarding the Remediation Fund described in Section 93130.15 of the Proposed Control Measure, what is the procedure and timeline for CARB to approve a public entity to manage the funds generated at the Port? What happens if no Remediation Fund administrator is established per Section 93130.15(a)? Does that mean the Remediation Fund would not be an option?

7. Port staff request further information from CARB on when and where the Remediation Fund will be deployed. Given that CARB anticipates zero-emissions regulation on trucks, transport refrigeration units, forklifts, and cargo-handling equipment in the time frame of enhanced usage of the Remediation Fund, would those categories be ineligible for incentive-funded emissions reductions?

8. Port staff note that the power meter readings required in Section 93130.9(d)(2)(C) and (F) and Section 93130.9(d)(3)(I) are not available until the close of each calendar month. This means that it will often not be possible to report the power usage within seven calendar days of a vessel's departure, as required in the Proposed Control Measure.

9. In Section 93130.1 of the Proposed Control Measure, the stated intent of the Proposed Control Measure is "to reduce oxides of nitrogen (NOx), reactive organic gases (ROG), particulate matter (PM), diesel particulate matter (DPM), and greenhouse gas (GHG) emissions from ocean-going vessels while docked at berth at California ports." How will CARB monitor GHG emissions after implementation of the Proposed Control Measure? What is the GHG emissions baseline?

10. The Port requests that maintenance events of landside shore power equipment be included in Section 93130.9(f) along with "construction or repair" so that maintenance events also have the option of using a TIE.

11. The Port requests that the Proposed Control Measure include an exemption for liquified natural gas (LNG) powered vessels. This would have the desired effect of incentivizing cleaner ships, which would provide significant emission reductions throughout the ship's voyage, not just the small fraction of time while the ship is at berth in California.

Conclusion

In conclusion, the Port of Oakland is fully committed to reducing emissions, and is proud of the results achieved with its industry and regulatory partners. In fact, the Port is unaware of any other port authority in the world that plugs in as many container vessels on an annual basis as the Port of Oakland. The partnership and collaboration with CARB, the Bay Area Air Quality Management District, and the Port's shipping and marine terminal customers have been a key to the success of

this program. The Port believes that these efforts can be used a model for other states and nations who might seek to reduce localized emission from ships at berth.

Port staff appreciate the opportunity to review and comment on the Proposed Control Measure and attend the public workshop on December 5, 2019. We look forward to continuing to work with CARB towards improving shore power effectiveness, emissions inventories, and associated analyses and to collaborate together to achieve cost-effective and feasible air quality improvements to protect public health.

Please contact Ms. Tracy Fidell, P.E., Port Associate Environmental Planner/Scientist at tfidell@portoakland.com with any follow-up questions.

Sincerely,

Richard Sinkoff
Director of Environmental Programs and Planning

Enclosures:

1) June 10, 2019 Port letter to ARB re: Comments on May 10, 2019, Draft Proposed Control Measure for Ocean-Going Vessels At Berth and Supporting Documents
2) February 15, 2019 Port letter to ARB re: Comments on Draft 2018/2019 Update to Inventory for Ocean-Going Vessels: Methodology and Results for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor
3) January 31, 2019 Port letter to ARB re: Comments on Preliminary Draft Health Risk Assessment ("HRA") for the Proposed Control Measure for Ocean-Going Vessels At Berth and At Anchor

CC:

Danny Wan, Executive Director
Michele Heffes, Acting Port Attorney
Matt Davis, Director of Government Affairs
Delphine Prevost, Manager Maritime Administration and Finance
Diane Heinze, Environmental Assessment Supervisor

Comment Log Display

Below is the comment you selected to display.
Comment 12 for To Consider Proposed Control Measure for Ocean-Going Vessels At Berth (ogvatberth2019) - 15-2.

First Name: Jesse N
Last Name: Marquez
Email Address: jnm4ej@yahoo.com
Affiliation: Coalition For A Safe Environment

Subject: Public Comments Submission
Comment:

Re: Public Comments Submission In Opposition To Specific Proposed Amendments
And Requests To Correct And Include Additional Information

Dear CARB Board Members:

The Coalition For A Safe Environment and et all signatory organizations submit these joint public comments on the Proposed Control Measure for Ocean-Going Vessels At Berth Rule Amendments.

We represent a broad base coalition of port community organizations in California and we object to the significant last minute and unacceptable changes to the Proposed Control Measure for Ocean-Going Vessels At Berth Rule. Many of the changes are delays in implementation or compliance which have significant impacts on public health, the environment and climate change. Hundreds of innocent residents and children will die prematurely and hospitalized with the new delays in implementation and compliance. This is an act of Environmental Racism. 2-15-12.1

CARB Staff has continuously failed to include 99% of all EJ Community recommendations, requests, information omissions, needed corrections and definitions that have been submitted in writing during the public comment periods. This is an act of Environmental Racism.

We request that you not approve the Proposed Control Measure for Ocean-Going Vessels At Berth Rule as presented by CARB Staff until the final At Berth Rule includes information corrections, information omissions, additional assessments information, recommendations and requests by the organization in these public comments. CARB Staff ignored 99% of all our concerns, document errors, information omissions, recommendations and requests.

See attached complete public comments.

Respectfully submitted,

Jesse N Marquez
Executive Director
Coalition For A Safe Environment

Attachment: www.arb.ca.gov/lists/com-attach/185-ogvatberth2019-AmFTM1U1BSVSMVMM.pdf

Original File Name: CFASE et al CARB At Berth Rule Public Comments Final 7-27-2020 PDF.pdf

Date and Time Comment Was Submitted: 2020-07-27 20:09:23

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Duplicate Letter see comments that were presented at the Board Hearing #6

Coalition For A Safe Environment
California Kids IAQ
Community Dreams
EMERGE
American Legion Post # 6
Wilmington Improvement Network
San Pedro & Peninsula Homeowners Coalition
NAACP- San Pedro-Wilmington Branch # 1069
California Communities Against Toxics
California Safe Schools
Del Amo Action Committee
Action Now
St. Philomena Social Justice Ministry
Comite Pro Uno
350 South Bay Los Angeles
Frack Free LA County
West Long Beach Association
Philippine Action Group for the Environment
Carson Environmental Commission Member

July 27, 2020

California Air Resources Board
Clerks Office
1001 I Street
Sacramento, CA 95814
916-322-5594
http://www.arb.ca.gov/lispub/comm/bclist.php

Su: CARB Second Public Availability of Modified Text & Availability of Additional Documents and/or Information
Proposed Control Measure for Ocean-Going Vessels At Berth

Re: Public Comments Submission In Opposition To Specific Proposed Amendments And Requests To Correct And Include Additional Information

Dear CARB Board Members:

The Coalition For A Safe Environment and et all signatory organizations submit these joint public comments on the Proposed Control Measure for Ocean-Going Vessels At Berth Rule Amendments.

We represent a broad base coalition of port community organizations in California and we object to the significant last minute and unacceptable changes to the Proposed Control Measure for Ocean-Going Vessels At Berth Rule. Many of the changes are delays in implementation or compliance which have significant impacts on public health, the environment and climate change.

Hundreds of innocent residents and children will die prematurely and hospitalized with the new delays in implementation and compliance. This is an act of Environmental Racism.

CARB Staff has continuously failed to include 99% of all EJ Community recommendations, requests, information omissions, needed corrections and definitions that have been submitted in writing during the public comment periods. This is an act of Environmental Racism.

We request that you not approve the Proposed Control Measure for Ocean-Going Vessels At Berth Rule as presented by CARB Staff until the final At Berth Rule includes information corrections, information omissions, additional assessments information, recommendations and requests by the organization in these public comments. CARB Staff ignored 99% of all our concerns, document errors, information omissions, recommendations and requests.

INTRODUCTION

Ocean-Going Vessels commonly known as ships are one of the largest sources of air pollution at ports. Each ship releases 2-4 tons of air pollution daily while docked at a port terminal. Ships burn the dirtiest petroleum fossil fuel product called Bunker Fuel which is actually a thick liquid oil fuel. Ship emissions come from three sources: Main Engines, Auxiliary Engines and Boilers.

The current At Berth Rule requires that ships must use Electric Shorepower or an Equivalent Alternative Ship Emissions Capture and Treatment Technology. The At Berth Rule does not currently apply to all categories of ships.

Ships today are all not complying with the existing At Berth Regulation especially when there is an unexpected interference such as a union labor agreement strike, port terminal failure to hire sufficient truck drivers to unload cargo, port terminals failure to have sufficient chassis to pick up containers and currently the excuse of the Coronavirus pandemic to intentionally not unload product. CARB Staff has not provided information as to the number of ships currently not in compliance with the At Berth Rule. During this time of the Coronavirus there have been over 30 ships outside of the harbor breakwater at-anchor at the Ports of Los Angeles and Long Beach.

CARB has continuously failed to protect public health and to enforce the law and existing regulations. Environmental Justice Communities are the most vulnerable populations and most disproportionately impacted. CARB continuously bends over backwards to support ports, big box retailers and the shipping industry by manipulating the At Berth Rule to allow ship category exemptions, unreasonable and unjustified reporting and compliance extension deadlines. This is once again an act of Environmental Racism.

We support California's transition to Zero Emission Freight Transportation and Emission Capture and Treatment Technologies. We cannot meet California's air quality standards and reduce our public health crisis with weak regulations, long implementation dates, no technology certification protocols, allowing mitigation measures that by-pass compliance asap and allowing ship exemptions.

We support AB 32 the Global Warming Solutions Act for the reduction of greenhouse gases as soon as possible. CARB continues to delay the earliest implementation of all feasible mitigation measures in the ports and petroleum industries the two largest polluters in the state of California.

Electric Shorepower

Every major port in California is required to have at least one terminal that offers Electric Shorepower. Ships must be retrofitted to be able to plug into Electric Shorepower and most ships have not been retrofitted or because of the design cannot be retrofitted. Some port terminals only offer shorepower on one end or location of a terminal so cannot be used on all ships.

Ship Emissions Capture, Control & Treatment Technology

There is an current existing and CARB Executive Order approved technology that is using basic vacuum cleaner technology to suck-in ship emissions from ship exhaust pipes and then processes these ship air pollution emissions with a series of filters so that clean emissions are released into the atmosphere. Ship Emissions Capture, Control & Treatment Technology can be built on-dock at a terminal, on a barge which can be maneuvered alongside a ship or on a barge near a ship at-anchor.

The AMECS-Advanced Maritime Emissions Control System was the first Ship Emissions Capture, Control & Treatment Technology to be invented by ACTI/AEG and is approved by a CARB Executive Order that complies with the At Berth Rule. ACTI/AEG owns eight US Technology Patents and is the only company to have built both an on-dock system at a terminal that works and an on-barge system tested At-Berth and At Anchor.

Electric Shorepower vs Ship Emissions Capture, Control & Treatment Technology

Electric Shorepower can only stop and prevent about 50% of ship emissions because shorepower can only connect to the Main Engines Exhaust Pipes. Toxic air pollution is still being released into the atmosphere untreated from Auxiliary Boilers. Boilers are used to heat a ship and crude oil in tanker ships. Ships were not designed to allow extra-large cables and supporting equipment etc. to be added later. Ship Emissions Capture, Control & Treatment Technology can capture and treat 99% of emissions and therefore are more effective than shorepower. A large vacuum hose attached to an extendable articulated arm is connected to the Main Engine, Auxiliary Engines and Boilers exhaust pipes.

ISSUES

1. **Inadequate Public Comment Period Time & Request For 30 Day Extension Of The Public Comment Period**

   CARB added 16 new documents under the title of Additional Reference Documents of which the majority have no specific relevance or contribute no significant value of

information. It is impossible for a member of the public to read over 4,000 pages of new information.

CARB should have devoted its time in counting the number of ships at all California ports currently not complying with the At Berth Rule.

CARB should have devoted its time calculating the toxic emissions ships were illegally releasing when not complying with the At Berth Rule.

CARB should have devoted its time in estimating the public health, environmental and greenhouse gas impacts and costs from these illegal emissions.

CARB's Staff continuing reference to meeting the two year regulation amendment and adoption deadline would not be critical if CARB Staff had not completely rewritten the At Bert Rule in the last 5 months and concentrating in delaying the amendment process for five years.

2. **The Majority Of New Proposed Revisions Are Attempts By CARB Management and Staff To Support The Private Shipping Industry Making Maximum Profits And To Delay Implementation, A Continuing Historical Example of Environmental Racism**

The Environmental Justice Community and Public have already seen CARB Management and Staff delay the At Berth Rule Amendments 5 years with no justification. Public Health in Disadvantaged Communities and Significant Reductions of Toxic Ship Emissions and Greenhouse Gases continues to be a low priority to CARB.

AB 617 Port Communities have already identified ship pollution as a priority reduction requirement in their CERP's (Community Emissions Reduction Plans). CARB has NO LEGAL AUTHORITY to grant any exemptions or extensions of time that it cannot legally validate.

The Environmental Justice Community and Public only requested 4 basic changes:

Commented [J1]:

- That the regulation include all categories of ships with no exemptions
- That the regulation be adopted asap
- That there be no extensions of dates or time to comply with Rule requirements
- That CARB create a standardized industry technology certification protocol

3. **Major Amendments Were Made That Were Not Requested by EJ Organizations, The Public & CARB Board Members**

CARB management and staff made amendments that were not requested by the EJ Community or the Public nor were they directed by CARB Board members during the public hearings.

CARB management and staff illegally accepted public comment from the shipping industry after the public comment deadline of May 1, 2020 and incorporated some of the shipping industries requests into the current proposal. The purpose of this CARB Informational Hearing is to try to cover up this illegal action by the CARB staff. The public was not allowed or advised they could continue to submit additional public comment.

The majority of Environmental Justice Community and Public Comments that were submitted were not included in the current Amendments.

4. We Want CARB Approved Ship Emissions Control Technology Certification Requirement No Strategy

We want to replace the current CARB inappropriate technology approval process of using an Executive Order and want an industry standardized CARB Approved Ship Emissions Control Technology Certification Requirement. EO's allow personal bias, industry and political influence to interfere and approve less qualified companies which is occurring now.

We want no discretionary Executive Officer approval. A technology Applicant either passes or fails a CARB Approved Ship Emissions Control Technology Certification Protocol and Requirements.

A Strategy is only a Goal as clearly stated in all Dictionaries. A Strategy is not a requirement, condition or control measure. We want clearly defined and certified Ship Emissions Technology Control Certification Requirement and Mitigation Measures.

We want all references to CARB Approved Emission Control Strategy (CAECS), emission control strategy, innovative concept and innovative concept compliance terminology to be replaced throughout the regulation with CARB Certified Approved Ship Emissions Control Technology.

The regulation states that, "To receive CARB approval, a person must demonstrate that the emission controls strategy achieves emission ….. The word person must be replaced with "Technology."

Current Available Technologies:

A. On-Dock Ship Electric Shorepower
B. On-Dock Stationary Emissions Capture, Control & Treatment Technology (AMECS)
C. At-Dock At Anchor Ship Barge Emissions Capture, Control & Treatment Technology (AMECS). Ship is docked but the barge is alongside the ship.
D. At-Anchor Ship Barge Emissions Capture, Control & Treatment Technology (AMECS) Ship is not docked but anchored in the harbor.

Available In 2020:

A. At-Dock Tanker Ship SPUD Barge Emissions Capture, Control & Treatment Technology (AMECS)
B. At-Anchor Tanker Ship SPUD Barge Emissions Capture, Control & Treatment Technology (AMECS)

Future Potential Technologies:

A. At-Anchor Ship Barge Zero Emissions Electric Fuel Cell Power
B. Ship On-Board Emissions Capture, Control & Treatment Technology

5. We Want A CARB Ship Emissions Control Technology Certification Protocol and Procedures

We are not here to play games or here to allow CARB to continue to obfuscate its responsibilities of failing to establish badly needed standardized shipping industry Technology Certification Requirements, Compliance Protocols and Testing Procedures.

We additionally request that CARB include in the Certification Requirements that the manufacturer and/or seller provide evidence of ownership of technology patents or permission to use Emissions, Capture, Control and Treatment Technologies. CARB has issued an EO's to a company that does not own the patents or rights for its technologies and allowed that they also be awarded CARB grant subcontracts.

The regulation requires a manufacturer to provide a Warranty but Carb Staff is currently waiving those requirements and allowing a company to continue to operate out of compliance and in violation of a CARB Executive Order and CARB Subcontract requirements. i.e. Port of Los Angeles Green OMNI Terminal Project - Clean Air Engineering-Maritime, Inc. Marine Exhaust Treatment System (METS-1) and ShoreKat System.

6. We Want All Ports & Terminals To Have Specific Compliance Requirements In The Regulation

CARB staff has created unacceptable non-compliance schemes such as TIE's and VIE's for Ports and Terminals to avoid planning their ship compliance needs in advance, budgeting funds in advance, ordering adequate equipment in advance, building electric utility infrastructure in advance and purchasing sufficient equipment in advance.

Ships are required to file an Inward Forwarding Manifest with the U.S. Customs and the average ship travel time to the US is 10 days. So Ports and Terminals know in advance when a ship will arrive.

Reference: 19 CFR § 4.7a - Inward manifest; information required; alternative forms

(xv) Date of departure from foreign, as reflected in the vessel log (this element relates to the departure of the vessel from the foreign port with respect to which the advance cargo declaration is filed (see § 4.7(b)(2) or § 4.7(b)(4)); the time frame for reporting this data element will be either:

(A) No later than 24 hours after departure from the foreign port of lading, for those vessels that will arrive in the United States more than 24 hours after sailing from that foreign port;

The Ports and Terminal Operators can list 99% of all possible worst case scenarios and prepare emergency back-up contingency plans today now.

These are CARB Management and Staff elaborate schemes to allow ships to continue to maximize their profits, pollute our air and waters and allow significant Public Health Impacts to continue in our communities.

7. Applicability Shall Refer To A CARB Ship Emissions Control Technology Certification Protocol/Procedure

We do not except the meaningless CARB staff proposed CARB Approved Emissions Control Strategy. We want a CARB Ship Emissions Control Technology Certification Program, Protocols and Procedures to be referenced.

We want all responsible parties, the ports, terminal operators, ships and third party testing companies to be held jointly and severally liable for violating this Control Measure. We do not accept Staffs wording of “may be held Liable.” Again another CARB staff attempt to minimize enforcement in EJ Port Communities.

8. We Want No Ship Category Exemptions For Dry Bulk, Break Bulk Or General Cargo Ships

CARB staff was directed by CARB Board Members at the December CARB Meeting to include Dry Bulk, Break Bulk and General Cargo Ships but staff has failed to include them in Table 1. CARB was presented an engineering firms data in December showing the significant amount of emissions of Dry Bulk, Break Bulk and General Cargo Ships and staff has not provided any evidence or data to validate an exemption.

The following Table 22 illustrates that Bulk Ships are a significant Emissions Source and what the immediate benefits would be under the amended At-Berth Rule.

Evaluation of the Advanced Maritime Emissions Control System (AMECS)

AMECS Demonstration at the Port of Long Beach, California

Table 22. Emissions Reduced per Vessel

Vessel Type	PM[1] ton/yr	NOx ton/yr	VOC ton/yr	TOTAL[2] ton/yr	SOx[3] ton/yr
Auto Carrier	135.8	72.7	2.4	210.9	70.2
Bulk	42.3	22.9	0.8	65.9	21.6
Container Ship	242.0	135.0	4.5	381.5	117.4
General Cargo	34.7	17.2	0.6	52.5	19.8
Passenger	386.7	197.4	6.2	590.3	164.9
Reefer	194.8	106.8	3.6	305.2	97.3
Roll-on/Roll-off	102.7	61.1	2.0	165.8	44.5
Tanker	237.2	74.4	2.8	314.4	197.0

[1] Moyer weighting factor of 20 was applied to the PM emissions reduced.
[2] Total emissions only include PM, NOx, and VOC for cost effectiveness calculations.
[3] SOx emissions reduced is provided in this table for informational purposes only.

Examples where Tables exclude Break Bulk Ships:

Table 1: Compliance Start Dates by Vessel Type	
January 1, 2021	Container and refrigerated cargo vessels
January 1, 2021	Passenger vessels
January 1, 2024~~2025~~	Roll-on roll-off vessels
January 1, 2025~~2027~~	Tanker vessels that visit the ports of Los Angeles or Long Beach
January 1, 2027~~2029~~	All remaining tanker vessels

A. Container Ships
C. Tanker Ships
D. Dry Bulk Carrier Ships
E. General Cargo Ships
F. RORO-Roll-On Roll-Off Ships
G. Passenger-Cruise Ships

CARB staff also did not include Dry Bulk, Break Bulk and General Cargo Ships in Terminal Plans. Reference: Section 93130.14. Terminal and Port Plans and Interim Evaluation

CARB staff also did not include Dry Bulk, Break Bulk and General Cargo Ships in Table 4: Remediation Fund Hourly Amount.

Table 4: Remediation Fund Hourly Amount		
Vessel Type	Hourly Remediation Payment Beginning in 2021*	
	Normal Rate	Tier III Rate
Container, Reefer, Ro-ro	$1,900	$1,100
Tanker with electric pumps	$1,600	$1,000
Tanker with steam driven pumps	$3,400	$2,700
Passenger vessels with capacity under 1,500 combined passengers and crew	$5,300	$3,200
Passenger vessels with capacity of 1,500 or more combined passengers and crew	$12,000	$7,100

CARB staff also did not include Dry Bulk, Break Bulk and General Cargo Ships in Table 5: Innovative Concept Application Due Date.

Table 5: Innovative Concept Application Due Date	
Vessel Type	Due Date
Container/ Reefer	July 1, 2021
Passenger	July 1, 2021
Ro-ro	December 1, 2021
LA/LB Tankers	December 1, 2021
Other Tankers	December 1, 2021

9. We Want Ship Emissions Compliance At All Ship Locations

A. At-Dock
B. At-Anchor In Port Waters
C. At- Anchor Outside Of Break Water
D. At-Anchor In California Coastal Waters

10. We Do Not Want CAPCOA To Be A Remediation Fund Administrator, CARB Has This Responsibility Or A Qualified Mitigation Non-Profit Foundation

We do not want CAPCOA or an Air District to be a Remediation Fund Administrator and we do not approve of the use of an unenforceable and unappealable Memorandum of Understanding or "similar agreement". We want a legal signed contract between all parties.

CAPCOA and Air districts have not supported EJ Communities Proposals, Requests, Recommendations, Appeals and Lawsuits 90%+ of the time in the past.

The Harbor Community Benefit Foundation in San Pedro in Southern California and the Rose Foundation in Oakland in Northern California are qualified to administer this Remediation Fund.

11. We Want No Extension Of Originally Proposed Dates Or Times Compliance Requirements

CARB staff has proposed numerous date and time extensions which are not necessary.

12. We Want CARB To Establish Minimum At Berth Rule Port Responsibilities Information Requirements

We do not want to wait for Ports to take 2-3 years to develop their responsibilities. We want CARB to hold 2-3 public hearings within 6 months to develop preliminary Port Responsibilities. They can be fine-tuned by ports who may have some special circumstances.

13. We Want No At Berth Rule Interim Requirements

Any and all requirements must be mandatory and clearly defined. We want no waivers, variances and extensions for non-certified technology. There can be an approved Pilot Project or Test Demonstration in preparation for final CARB Certification.

14. We Want The At Bert Rule To Include MARPOL ANNEX VI & XIII Engine Requirements & For Ships To Provide Certificate Information

International Air Pollution Prevention Certificate (IAPPC)

Engine International Air Pollution Prevention Certificate (EIAPPC)

15. We Want The AT Bert Rule To Include The U.S. EPA North American and U.S. Caribbean Sea Emissions Control Areas Penalty Policy for Violations by Ships of the Sulfur in Fuel Standard and Related Provisions

The regulation fails to reference and include all international IMO ship mandatory requirements and penalties. We request that CARB research and include all applicable IMO requirements for inclusion in this regulation.

16. **We Want PM Emissions Standards & Compliance Data In Addition To Opacity Requirements**

There is no definition of Opacity and Opacity Requirements. It essentially means how dark is the black smoke that you see and the volume. You cannot see or see clearly the smoke in the rain, on a foggy day and at night.

Opacity Requirements require a person to take a class and having opacity charts/scales to look at or to confirm an observation. So there is some personal opinion and best judgement allowed

We want to include CARB PM Standards and Testing Requirements included in the regulation.

17. **We Do Not Want To Expand Use Of Vessel and Terminal Incident Events (VIE's and TIE's) To New & Growing Vessel Fleets & Terminals**

All Ports, Terminal Operating and Shipping Industry have known and will know all new AT Berth Rule Requirements. All Ports and Terminal Operators have had a minimum of five years to prepare for the expansion of the At Berth Rule.

CARB staff has created acceptable non-compliance schemes such as TIE's and VIE's for Ports and Terminals to avoid planning their ship compliance needs in advance, budgeting funds in advance, ordering adequate equipment in advance, building electric utility infrastructure in advance and purchasing sufficient equipment in advance.

These are CARB Management and Staff elaborate schemes to allow ships to continue to maximize their profits, pollute our air and waters and allow significant Public Health Impacts to continue in our communities.

99% of all possible worst case scenarios are already known, can be listed and can be prepared for now, so there is no excuse to not be ready with back-up emergency power, additional emissions control and treatment technologies and including complete shut-down protocols.

All required ship forms, documentation and report requirements already exist, are on-line and there will only be a few changes and updates. 90%+ of all ship forms, documentation and reports can be prepared in advance before arrival at a port.

18. **CARB's Reference To A Second Qualified Ship Emissions Capture & Control Technology Company Is A Fraud & Example of CARB Management Discrimination Against A Superior Minority Owned Technology Company**

19. **The Definitions Of Words Has Words That Are Not Defined In The Definitions**

As one example: The definition of Anchorage includes the words “moor” and “California waters,” but there are no definitions of these words.

The average person does not know what the word moor means and does not know how far out in the ocean is the California water boundary.

CARBS failure to include all important word definitions is an attempt to deceive the public as to how far outside a breakwater the At Bert Rule applies. Ports do not want any responsibility to acknowledge, identify, quantify and mitigate ship emissions outside the port. During the Covid-19 Pandemic and other events such as the Ports of Los Angeles and Long Beach ILWU union strikes and ports failures to assure that Terminal Operators had sufficient truck drivers and container chassis resulted in over 30 ships being “At-Anchorage or At-Anchor” outside the breakwater. Ships did not plug-in or use alternative ship emission control, capture and treatment technology so 100’s of tons of ship air pollution went unmitigated and public health was negatively impacted. CARB, the AQMD’s and Ports took no corrective or remedial action whatsoever.

The term At Anchor is used more often than At Anchorage and should also be included in the definitions.

We want the requirement and definition of Certification to be included in the definitions.

20. CARB Staff Has To Stop Making Up Definitions That Confuse The Public & Use Governmental Agency Or Industry Definitions

CARB staff needs to clean-up definitions. There are numerous errors and omissions.

There is no definition for IMO and does reference all the mandatory worldwide ship requirements that are applicable in this At Berth Rule.

The rule defines Remediation Fund but has no definition of Remediation.

There is a Tanker Boiler definition but fails to state that all ships have and use Boilers. Tanker Ship Boilers are also the largest source of emissions.

There is a Utility definition that is not correct or accurate. One accurate definition of Electric Utility is: An electric utility is a company in the electric power industry that engages in electricity generation and distribution of electricity for sale generally in a regulated market. Where does staff get the word “any person engaged in…?

We want a review of all word definitions and all words contained in this regulation.

21. CARB Staff has Proposed No Enforcement, Penalties And Fines Section

We want a chapter or section that clearly outlines and describes CARB's Enforcement, Penalties And Fine Responsibilities.

For additional information the primary contact is Jesse N Marquez for these public comments.

Respectfully Submitted,

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The Port of Hueneme
Oxnard Harbor District

Foreign Trade Zone #205
WORLD TRADE CENTER® OXNARD

July 27, 2020

Heather Arias
California Air Resources Board
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Submitted Electronically

Comments on CARB Proposed At-Berth Regulation

Dear Ms. Arias:

On behalf of the Port of Hueneme (Port) we are submitting this comment letter on this final 15 Day version of the At Berth Regulation Draft. We appreciate the opportunity to comment on this draft regulation.

Our most important current comment is that we encourage CARB to ensure that the interim assessment be as robust as possible and consider compliance progress on a Port by Port, or terminal by terminal basis, as substantial differences in financial resources and physical characteristics will result in differing abilities to meet compliance deadlines. This is particularly critical during this pandemic and the hoped for, eventual economic recovery. As has been mentioned before, the assumptions of estimated vessel activity growth and subsequent increases in emissions will likely prove to have been overestimated for the smaller ports, which are going to struggle the most to fund and install the needed infrastructure to comply with the new rule without help from the State or Federal government. 2-15-13.1

Ports and terminals including the Port are going to need to invest millions of dollars into new infrastructure at a time when the economic vitality of the shipping industry is the most at risk. The Port has already begun preparation for the implementation of this new rule but it is critical to recognize the amount of detailed work that has to be completed before the Port can even get to the point of ordering new infrastructure equipment. All of this work has substantial costs and takes a great deal of time, particularly in today's world of socially distant work and online meetings. But the point is that operating the equipment required by the new rule is not as simple as paying for it, installing it and flipping a switch. To ensure that it works and that no one is harmed, Ports and terminals must very carefully plan and assess for this future. All of this work is done considering that to our knowledge no shoreside emissions capture system has ever been utilized to control the emissions of a RORO vessel. Therefore all of this effort is moving toward a completely new paradigm in ship emissions control.

To be able to comply with this new regulation, the Port's and terminals must assess all of the following which require substantial expense and time: 2-15-13.2

1. Engineering: How much do systems like the emissions capture systems which will be required for RORO ships weigh? How will they be moved around the dockside? How large are these systems? Where can they be placed adjacent to a ship that is actively unloading cargo? Are the dock adjacent to the ship and any wharves over which it must travel strong enough to support the existing loads of cargo and equipment but also these emissions capture systems which are extremely heavy in their current iterations? How will these capture systems be physically connected to the vessels at berth? How will they be powered and refueled? Where will that power supply be located? Can this system be connected or the connection maintained when there are high winds or storms?
2. Financial: How much does the system cost? How does the Port gather the funds needed to pay for the emissions capture system in time for compliance requirements? How much will this system cost to operate per hour? How are those costs distributed? How much infrastructure is needed to power and move the system? We want to reiterate that the Port hope that the Board understands that at Hueneme it will not be "large multinational companies" paying for the infrastructure upgrades required for compliance, it will be the Port alone doing so.
3. Operations: How and where do you position an emissions capture system to not block cargo operations or pose a safety risk? When does the system need to be started prior to beginning operation? Will the positioning of the system to be ready once the vessel is made fast prevent access to bollards or other wharf features needed to safely secure a vessel to the berth? Will noise from the operation of the system prevent communication adjacent to the vessel side while it is berthed?
4. Safety: Can an emissions capture system safely operate adjacent to a RORO ship? Will vessel crew or labor have to work underneath or within the fall zone of the capture hose and nozzle and supporting crane? Within what wind speeds are these systems safe to operate? Will shoreside capture systems prevent safe securing of a vessel to the berth, such as blocking access to or compromising positioning of breast or spring lines? All of these considerations are critical to safely implementing an emissions capture system at the Port.

Additional questions which remain:

- Can bonnet systems be powered by Tier IV diesel generators? Will they be required to capture carbon emissions?
- If bonnet systems have to operate in zero emissions mode, the Port will need to work with our electrical utility to upgrade the service to the Port. This electrical service upgrade is of the magnitude of having a projected cost of $40-60 million and taking 4-6 years to complete.
- Are projects installing infrastructure for compliance with this rule ineligible for public grant funds?
- How will compliance for seasonal vessel calls be handled under the new regulation? If a seasonal produce line only visits California ports three months of the year, would they be eligible for vessel incident exemptions?

The Port is committed to maintaining its critical role of being the economic engine for the region while growing its leadership in the path to a future of zero emission, sustainable goods movement. The Port envisions an equitable future in which economic opportunities and a clean, decarbonized environment are accessible locally and which both provide and give back to future generations.

Sincerely,

Giles Pettifor,
Environmental Manager

Duplicate Letter see 15-day comment letter #55

Previously Submitted Comments

On behalf of the Port of Hueneme we are submitting this comment letter on this final 15 Day version of the At Berth Regulation Draft. We appreciate the opportunity to comment on this draft regulation and encourage the California Air Resources Board (CARB) to consider delaying the implementation of these proposed changes as the hypothetical growth in future emissions is no longer possible given the current global economic depression.

Corona Virus Pandemic

It is imperative that CARB appreciate how serious the dire economic situation that is developing internationally will affect California's citizens and their ability to do basic things like pay rent and put on their family's table. With record unemployment and the wheels of trade grinding to a sudden stop an unprecedented downturn is beginning which will reverberate through our economy for many months to come. California's ports and their cargo movements partners are already struggling to continue the essential jobs of moving goods and essential equipment like fresh foods and medical equipment, and are witnessing ongoing decreases in vessel calls.

At the present time it is impossible for us to forecast the full impacts associated with this global pandemic, however based on the current status of unemployment filings within the U.S. (more than 26 million in 6 weeks), the level of small business stimulus already exhausted at the National level ($365 billion), it is clear that the US economy whose circulatory system is goods movement is in the early stages of a massive economic depression. Initial estimates based on the current data available are estimating that this downturn will be the most severe since the great depression of nearly 100 years ago.

CARB has long argued that the expansion of the current At Berth rule is required due to the growth in emissions over the next decade from unregulated vessel calls. CARB forecasted that significant increase emissions will result from growth in vessel calls to the California ports. The COVID pandemic is going to significantly curtail ship calls to the ports of California for several years at a minimum. Therefore this spike of emissions this rule seeks to curtail will not be occurring. As this forecasted increase is emissions is no longer going to occur as vessel calls will be falling the projected health impacts will not happen and therefore the health benefits claimed in the Initial Statement of Reasons (ISOR) also will not occur. However if it continues to be implemented as planned regardless of the current situation the costs will remain and may likely increase due to the difficulty of working and planning during the pandemic.

If this rule change goes forward with no emissions to curtail but still forces ports and terminals to invest hundreds of millions of dollars in infrastructure that will not be utilized, CARB is going to be putting a huge economic handicap on the California ports and putting the entire State and its economy at a significant competitive disadvantage just as the economy is trying to recover post-COVID. Raising the cost of doing business in the State at the time when all ports nationwide are scrambling to get business is the opposite of how to help the California economy and families recover from this economic devastation. This is indisputable, and those impacts will likely be felt the most greatly at the State's smaller ports including Hueneme.

Hueneme Specific Situation:
While ports statewide will see reductions of vessel calls and impacts, of greatest concern locally is the Port and its impacts. The auto cargo moving through the Port generates nearly 60% of the Port's annual revenue.

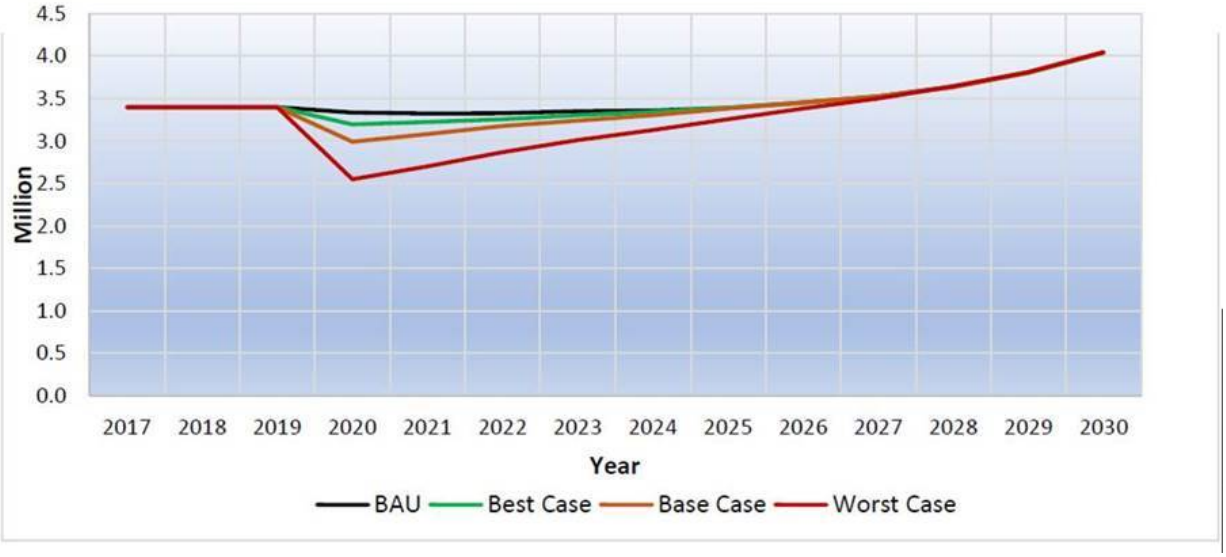
Facts about Hueneme and Auto related trade:

- 85% of our imported value annually is cars
- 33% of our imported tonnage annually is cars
- 40% of our exported value annually is cars
- 17% of our exported tonnage annually is cars

Forecasts for the global auto industry predict as much as a 20% decrease in sales from 2019 in 2020. In addition, 6 of the Port's top 10 partners by value of trade have shut down automotive production due to COVID-19 prevention. Also, 60% of our trading partners by value (cars) have shut down their automotive production plants to prevent virus spread. This link shows the numbers and countries we do business with, top commodity by value for import and export at the Port of Hueneme is cars.
https://www.ustradenumbers.com/port/port-hueneme-calif/

- Best Case - A fall in volume in 2020 of **0.14m** units (**-4.1**% from BAU, **-6%** from 2019)
- Base Case - A fall in volume in 2020 of **0.34m** units (**-10.2**% from BAU, **-12%** from 2019)
- Worst Case - A fall in volume in 2020 of **0.78m** units (**-23.5**% from BAU, **-25%** from 2019)

Figure 5.1 Rest of North America Automotive Sales Volume Forecast BAU Under 3 Scenarios 2017-2030 (units)



So in review the growth of emissions is going to happen, the health impacts will not thus result, and thus it will be impossible to achieve the economic benefits of mitigating those impacts, and yet the costs remain and may increase. Instituting a regulation with all of the costs and none of the benefits is in short, poor public policy making. Unfortunately at this time this regulation change cannot be justified.

It is also imperative that regulators fully appreciate the ongoing challenges of operating a heavily utilized shorepower system. The Port has been endeavoring since its installation to make available to its customers a fully functional array of shorepower vaults to facilitate their compliance and enable the incredible emissions reductions made possible by the current regulations. Nearly six years after the implementation of this regulation, the ports around the State continue to struggle to meet the requirements of this regulation in its current form. The lead times in acquiring parts, availability of qualified vendors to conduct repairs or maintenance all continue to be challenges which can lead to unavailability of shorepower vaults sometimes for weeks on end. For example, the Port just two weeks ago had the annual preventative maintenance completed on its six vaults by the qualified electrical contractor. Less than two weeks later several of the vaults have been plagued by outages with no clear source of faults. These systems are complicated, expensive and dangerous to operate. However, that being said the Port is fully committed to continuing the operation of these systems

Duplicate See 45-Day Comment Letter 53

We write today to provide comment on the proposed rewrite of the Control Measure for Ocean-Going Vessels At Berth regulation. This is letter presents the Port of Hueneme's (Port) updated comments on status of California Air Resources Board's (CARB) new proposed At Berth Regulations. In light of our extensive comments which are reproduced below unchanged from our 2017 and 2019 comments, we will update CARB with briefer commentary herein which is largely based upon the information and discussion conducted at the recent CARB Board meeting on December 5, 2019.

- The Port would first like to state unequivocally that it is in full support of regulating the emissions from Ocean Going Vessels (OGV) and has partnered with CARB and our local air district to achieve substantial emission reduction progress since the implementation of the first At Berth regulation. Thanks to the combination of the clean fuel rules and the current At Berth regulation **the Port has seen as greater than 84% reduction in the emission of diesel particulate matter from OGV at berth in the Port since 2008**.

- The Port believes that this rule rewrite has the potential to achieve further emissions reductions from OGV, however in order to ensure that the Port can continue its role as the engine which drives substantial regional economic activity, enabling employment of more than 15,000 people, these proposed revisions must be conducted in a manner which pursue the most cost effective reductions in emissions. For the Port, CARB is seeking to apply requirements for further emissions reductions which would be nearly completely reliant upon a technology that is not currently commercially available and is not yet approved for use by CARB. This alternative control system (ACT) will likely be a system which captures emissions from OGV and physically or chemically removes the pollutants from the exhaust gases. These systems are large, heavy, and technically complicated in their design and operation. The implementation of one of these systems at the Port will take substantial resources and time. **This is not to imply that the Port is in opposition to the use of an ACT system for emissions reductions in any way!** However as a steward of public funds the Port does not take lightly the responsibility of investing in a yet unproven technology which may have a cost equivalent to a third of its annual revenue.

- The CARB Board seemed during the December 5th meeting to favor moving the date of compliance for requiring an ACT for Roll On Roll Off (RORO) vessels from 2025 to 2023. At the present time the Port presumes that the State of California will require that the ACT system operate as a zero emission system which will require it to be powered by electrical power. Current barge based emissions capture systems use diesel fuel and produce significant emissions through the use of heavy machinery and generators to power the emissions filter process. Presently the Port is nearly at the maximum of its available electrical power ceiling as it seeks to continue the implementation of zero emission technologies on Port. Adding additional power load to the Port will require additional power supply from its utility provider Southern California Edison (SCE). SCE has notified the Port that the regional circuitry upgrades needed to supply the Port with additional power will be of such scale as to take three to five years to complete and cost $30-50 million dollars. This utility upgrade would preclude the Port from being able to operate a zero emissions ACT by 2023.

- As noted, the annual revenue of the Port is approximately $16-18 million dollars annually. It is estimated that additional shoreside power capacity at the Port would cost approximately $20 million dollars. An ACT system for the Port is estimated to cost $5-7 million dollars.

Additionally, the Port has only six major customers which move cargo through the Port enabling those 15,000 jobs. As noted in previous comment letters, some of the communities surrounding the Port are State designated disadvantaged communities and the Port takes seriously its role of providing the types of jobs which can enable individuals to reach ladders of opportunity. Port related jobs can bring families out of poverty and are increasingly uncommon in the state of growing economic disparity in Ventura County and the State in general. The loss of a single customer would have major economic implications to the surrounding region as each direct Port job has a multiplier creating an additional five to six jobs in the community.

- During the meeting on the 5th, many in the audience and the Commissioners stated that it would be "large multinational corporations" who would be forced to pay for these regulations and therefore the impact would be minimal amongst the "billions" which these corporations make in profits. Unfortunately, the reality is that most of the cost of these regulations will be carried by the State's ports. Goods movement is a global system of connectivity which is structured to move goods from their location of manufacture to their location of consumption. The "large multinational corporations" involved in this process have a growing amount of choice when it comes to choosing a path through this supply chain and the ports of California are not their only choice for offloading their goods. Ports in the Gulf of Mexico and in other states along the Pacific Coast can be significantly cheaper. Rates of cargo diversion away from California will increase as California ports raise their rates to help fund the needed infrastructure improvements required by these new regulations. California ports will continue to lose market share and employment opportunities for local citizens, especially in areas already suffering from a lack of middle class jobs as the costs of doing business in California continues to increase. Additionally, the local demand for goods shipped from overseas will not diminish and that market will continue to demand fast cheap shipping for a plethora of goods from fresh produce to consumer goods. These goods will still have to reach consumers in California and when shipped into out of State ports will be trucked back into local stores and warehouses resulting in significant net increases in emissions of toxic pollutants and greenhouse gases.

- As part of its conversations with CARB over the last two years of the development of this proposed regulation, the Port has sought to make clear to the CARB staff how unique the characteristics of the Port are, and how these characteristics directly impact how it would comply with the proposed regulation. Due to our size and physical constraints solutions that work for ports like Los Angeles or Oakland are typically not well suited for application at Hueneme. However, the Port sought to show CARB that we are in full support of their goals to further reduce emissions from the Port. Thus, in an effort to help ensure that currently uncaptured emissions originating from the at berth time of the currently unregulated fleet could be reduced in the most cost effective way, the Port put together a list of potential projects which could achieve significant emissions reductions in the near term future and potentially at a lower cost. These "alternatives" were brought forward in a good faith effort to show the potential for in-lieu emissions reductions which could be financed in part by those customers of the Port in the unregulated fleets. Following months of collaborative communication with CARB staff, it was unexpected to the Port that the discussion at the December 5th meeting centered around these projects in no way being undertaken in lieu of the new requirements and could be required in the interim when direct compliance was infeasible on the short term. Thus it appears that CARB intends to require the Port and its customers operating RORO vessels be required to implement

the alternative projects which the Port proposed on an earlier timeline and not in lieu of any of the requirements of the proposed regulations. As noted by some of the audience members the operation of a modern seaport berth is a highly technical, dangerous, and expensive ballet of many players all of whom play a part in successfully moving cargo safely and efficiently. In applying new regulations into this system, the "devil is in the details," as noted by several CARB Board members during the meeting on the 5th. As implied by Board members during this meeting, if CARB were to propose a scheme in which the alternative projects proposed by the Port were to be required as a short term compliance step, any such regulation would have to ensure that it was procedurally and legally sound, scientifically valid, and equitable to those parties subject to the rule.

- In closing the Port wishes to reiterate again, that it is fully on-board with further reducing emissions from its operations and has multiple efforts underway at present including:
    - Writing in conjunction with the Ventura County Air Pollution Control District, its own clean air plan which will assess a brand new emission inventory for all Port activities and operations; and
    - Has just installed the first reference grade air quality monitors at a local elementary school which once running and calibrated will provide current air quality information to the local community; and
    - Writing a Port wide electrifical master plan which will help to guide the extensive engineering analyses and future scenario assessment needed to continue the Port on its plans toward zero emissions; and
    - In 2020 installing infrastructure including switchgear, transformers, conduit and plugs to plug in a new generation of zero emission electric cargo handling equipment at the Port, and
    - Will be operating in conjunction with partners, an electric hybrid mobile harbor crane as well as a zero emissions hydrogen fuel cell Class 8 heavy duty truck prototype, and the first electric terminal trucks within the next two years.

The Port is committed to maintaining its critical role of being the economic engine for the region while growing its leadership in the path to a future of zero emission, sustainable goods movement. The Port envisions an equitable future in which economic opportunities and a clean, decarbonized environment are accessible locally and which both provide and give back to future generations.

Sincerely,

Giles Pettifor,
Environmental Manager

Duplicate See 45-Day Comment Letter 53

Spring 2019 Comments:
Our comments on the current process include:

- It is imperative that CARB identify the potential for real and profound economic impacts (especially at smaller, niche ports) as well as increased state-wide emissions, (from the diversion of cargo to out of state ports) which may result from increased costs associated with the proposed regulation. Without a cost benefit analysis on a port by port basis the real impact of these changes cannot be ascertained. The Port wishes to document its request prior to **CARB's moving forward that the regulation process must include the completion of a full cost benefit analysis at each of the subject ports**! These costs should be made clear in comparison against the quantity of emissions that will be reduced at each individual port subject to the new regulations.
- **CARB needs to identify the quantified emission reductions it is seeking to achieve via the implementation of the new regulations**. This targeted volume reduction should then be applied to the modelled emissions of each port, on a port by port basis to determine what is the scientifically calculated emission reduction goal. Bringing verified, valid emissions data into the analyses for this regulatory process will ensure that the cost benefit analysis, which must accompany this effort, is as accurate as possible. The emissions of each port are different as well as the basin status and these characteristics should be reflected in CARB's analyses.
- CARB estimates of **port emissions for each port subject to the regulations should be scientifically valid, using the best available science and valid methodologies** that both CARB and the subject ports concur are valid. CARB's reduction target should be applied to the agreed upon inventory emissions amount to ensure fair calculation of responsibility.
- The **costs of proposed emissions reductions should be grounded in emissions costs generated for other similar State programs** such as the Carl Moyer technology retrofit program.
- Many ports statewide, including the Port, are investing in developing air quality plans specifically tailored to their own emissions inventory, physical and logistical characteristics of their cargo and waterfront setting, as well as their own community inputs and resource availability. These **local plans should be recognized when appropriate as real alternatives to the regulations and are avenues to emission reduction opportunities not currently contemplated by CARB as they are quantifying strategies to meet emission reduction goals**.

Duplicate See 45-Day Comment Letter 53

As follows the original fall of 2017 Comment Letter from the Port to CARB:

I. Introduction

The Port of Hueneme (Port) would like to thank the California Air Resources Board (CARB) for this opportunity to provide formal comments on the proposed amendments to the existing At Berth Regulations. The Port enjoys a long history of working cooperatively with both CARB and the Ventura County Air Pollution Control District (APCD) and looks forward to continuing these productive relationships to ensure success in future emission reduction programs.

Our collective efforts realized the installation of shoreside power vault and substation systems to enable the plug in of regulated refrigerated vessel fleets. At the forefront of new and innovative technologies, California leads not only the nation, but the world with shoreside capabilities. In leading the world with clean technology, we become the first to learn how to tackle the challenges inevitable with new technologies. This comment letter puts forth recommendations to address those challenges and respectfully requests that getting the first phase of the regulations perfected be the main purpose of the at-berth regulation amendments.

In the workshops of August 28 and September 7, 2017, CARB presented the concept of expanding its regulatory authority to new fleets, a concept which need thoughtful consideration, particularly as we continue to iron out the challenges with existing systems under the current regulations. As a partner in sustainable economic development, we urge CARB to consider the potential of very real impacts to local economies and pursue a cost-benefit analysis of the socio-economic impacts of the proposed amendments prior to promulgation of regulations mandating requirements on all vessel calls. Further, the true air quality benefit to a given air quality basin coupled with the actual costs of the expanded amendments needs to be fully understood to ensure the enactment of sound public policy consistent with the Governor's Executive Order B-32-15[1] which calls for transitions to zero emission, efficiency and increased competitiveness.

The Port appreciates the challenge CARB faces in drafting these regulations with a level of detail and forethought which accounts for the inherent complexities of the global maritime industry as well as the unique characteristics of California's ports and in a way which does not place an undue burden on these ports and put them at a competitive disadvantage. Working together we can find a solution that meets our mutual goals. The following comments provide important data and strategies to best inform future policy and regulation specific to the Port of Hueneme. The ultimate goal being to find a tangible pathway forward to achieve ambitious air quality improvements while supporting the economic backbone of socioeconomically distressed communities.

II. Environmental Profile

Port of Hueneme's Environmental Framework

Located at nexus of vibrant coastal communities, precious coastal wetlands, and Pacific Ocean pathways to our global trade partners, the Port takes very seriously its stewardship of the environment. As part of

[1] http://dot.ca.gov/hq/tpp/offices/ogm/cs_freight_action_plan/main.html

this responsibility the Port focuses particularly on its surrounding communities of Oxnard and Port Hueneme, its commissioning jurisdictions. The Port exists to serve these communities as an economic center providing employment, tax revenue and trade benefits for local citizens. The Port also strives to minimize potential impacts to these communities as it is nestled in adjacent to homes, schools and businesses. Due to the proximity of these sensitive receptors, air quality is of particular interest to the Port, and the Port works every day to take steps to minimize impacts to air quality. In an effort to demonstrate the seriousness with which the Port takes these duties of protecting the environment, the Port adopted an Environmental Management Framework (EMF) in 2012. The EMF outlines the strategic efforts the Port will undertake to protect the environment, and covers eight environmental elements including:

1. Community engagement
2. Sustainability
3. Air Quality
4. Water Quality
5. Soil and sediment
6. Marine resources
7. Energy management
8. Climate change adaptation

Since adopting this proactive agenda of sustainability, the Port has pursued the integration of the elements of the EMF into its daily operations as well as long term planning. Progress has been made every year since, and in 2016 the Port became the first port in California to be certified by Green Marine, the preeminent third party environmental certification organization for marine facilities. The Port is fully committed to making environmental progress in every way that it can as it grows and changes with the global economy.

While the Port moves forward with the implementation of its EMF, it must work to expend its limited resources in a manner that balances maintenance of critical Port infrastructure with investments in new equipment and technology which help the Port to comply with regulations and improve environmental performance. For this reason, the Port is continually looking for solutions that are both cost efficient and effective for the Port's characteristics, its operations and the local community.

The Port is unique in many ways that set it apart from both the large Ports of Los Angeles/Long Beach (LA/LB) and other smaller ports like San Diego or Stockton. As the Port was constructed with private funds in the 1930's it is not a California State Tidelands Port, which gives the Port more control over its operations, more accountability directly to its commissioning communities and the ability to operate more nimbly. The Port operates on 120 dockside acres and while this is smaller than other ports, the Port is very efficient with its limited space and constantly strives to use every bit of it as efficiently as possible.

III. Port Hueneme's Air Quality Basin and Port Emissions

RECOMMENDATION: Apply the attainment status of Ventura County air basin to any regulation impacting the Port and consider the emissions data and growth rates specific to the Port as opposed to that of the LA/LB air basin or the Ports of LA/LB.

Air quality regulation respective to a port or similar emission source should begin with a very simple analysis with two major local components:

1. Basin Status - Historical and current air quality within the basin in which the port operates.
2. Emissions - Current and estimated future quantity and quality of the port's emissions.

When beginning with these two components, it becomes clear how different the Port is from LA/LB.

1. Basin Status

It is not just the Port's physical setting and operations which are different from nearby LA/LB, the air quality within its surrounding basin is also very different. Table 1 presents the projected dates of attainment with National Ambient Air Quality Standards (NAAQS) for the air basins surrounding both the Port and LA/LB. The ozone standards are shown as this pollutant has the potential to exacerbate respiratory illness symptoms in sensitive populations including children and the elderly and those with inflammatory airways or asthma, and is of particular concern for community health activists.

	Attainment Date	
Ozone Standard	VC Basin	LA Basin
2008 - 8hr.	2020	2032
2015 - 8hr.	2026	2037

Table 1 Comparison Dates of NAAQS Attainment for Ventura County and Los Angeles Air Basins

Table 1 makes clear that the air quality within the air basin around the Port is now and will continue to be substantially better than that of LA/LB. The air quality within Ventura County has steadily improved during the last twenty five years even while the County's population has grown by more than 30% during that time period as clearly shown in Figure 1. Despite this growth in population, Figure 2 shows that the average ozone concentrations within the County have decreased over time, driving the reductions in days over the NAAQS metric that are shown in Figure 1.

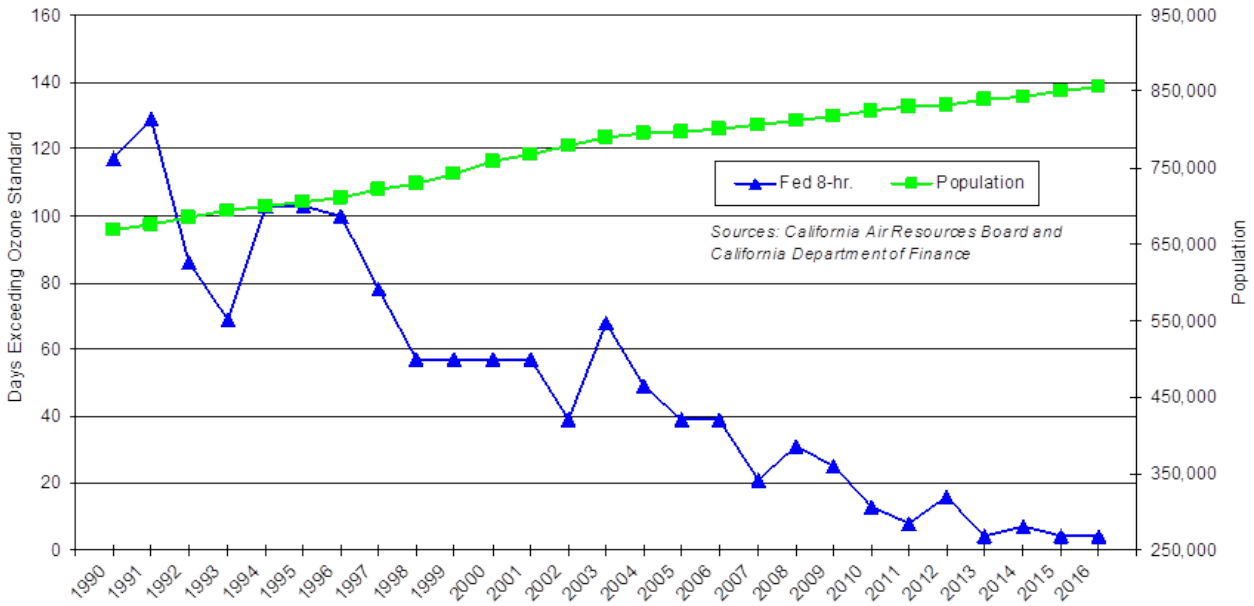


Figure 1 Ventura County Days Over Federal Ozone Standard vs. Population Growth.

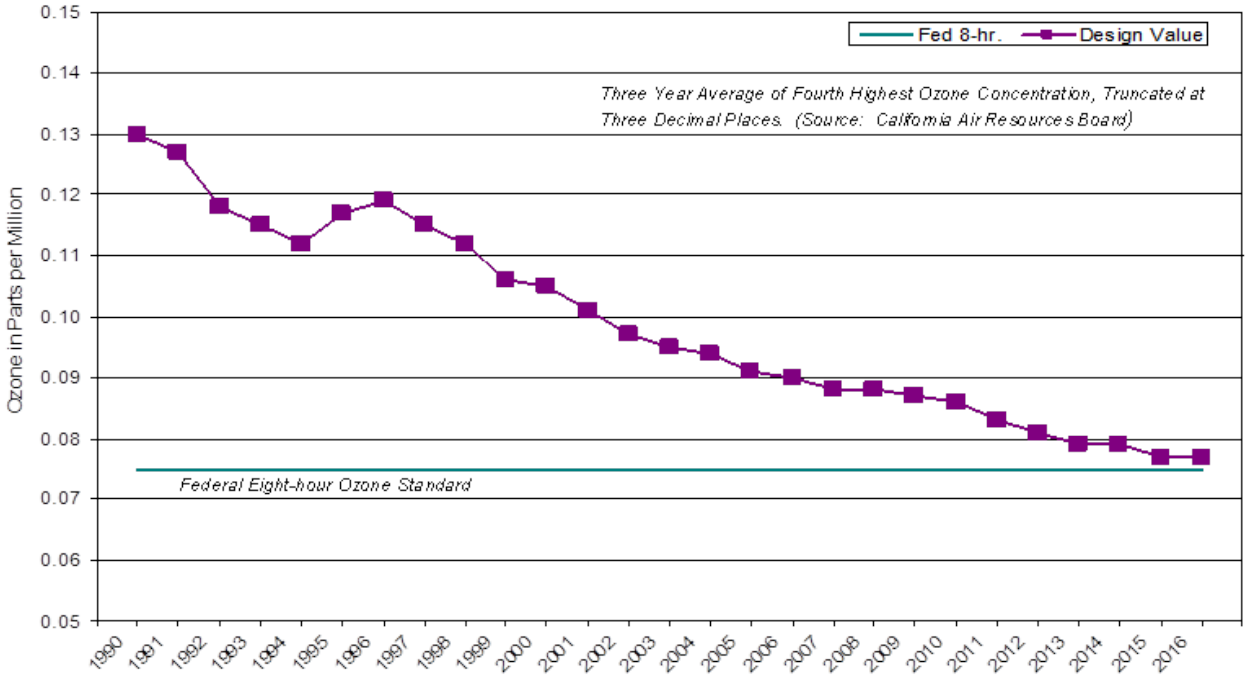


Figure 2 Ventura County 8-Hour Ozone Values

2. Emissions

OGV Emissions

Not only is the Ventura County air quality substantially better than that of the LA basin, a great deal of the air pollution within the air basins of Ventura County come from emissions from ocean going vessel (OGV) traffic offshore that is bound for LA/LB. The air basin over Ventura County extends three nautical miles offshore and is called the South Central Coast (SCC) Basin, while the basin which extends from three to one hundred nautical miles offshore is called the Outer Continental Shelf (OCS) Basin. CARB calculates attainment status for the SCC Basin using a photochemical model which incorporates emissions from both basins, meaning that transitory OGV emissions from LA/LB bound vessels in the OCS directly impact air quality in the SCC. When the pollutant quantities emitted by OGVs in both basins are analyzed, it becomes clear how much of a negative contribution is made by the OCS OGV, passing inside of the Channel Islands, as the majority of trans-Pacific traffic does, in transit to LA/LB.

Table 2 shows the estimated pollution contribution from OGV in both the SCC and OCS basins, while Figure 3 uses these numbers to clearly show how much greater the OCS portion is than that of the SCC basin, where the Port is located and represents a considerably low contribution to the problem.

		2020		2035	
	Basin	ROG	NO_x	ROG	NO_x
OGV Emissions*	SCC	0.04	**0.84**	0.06	**1.07**
	OCS	0.86	**12.54**	1.6	**9.63**

Table 2. Emissions from Ocean Going Vessels within Ventura County SCC and OCS Basins[2]

[2] Ventura County Air Pollution Control District. *Final 2016 Air Quality Management Plan*. 2016

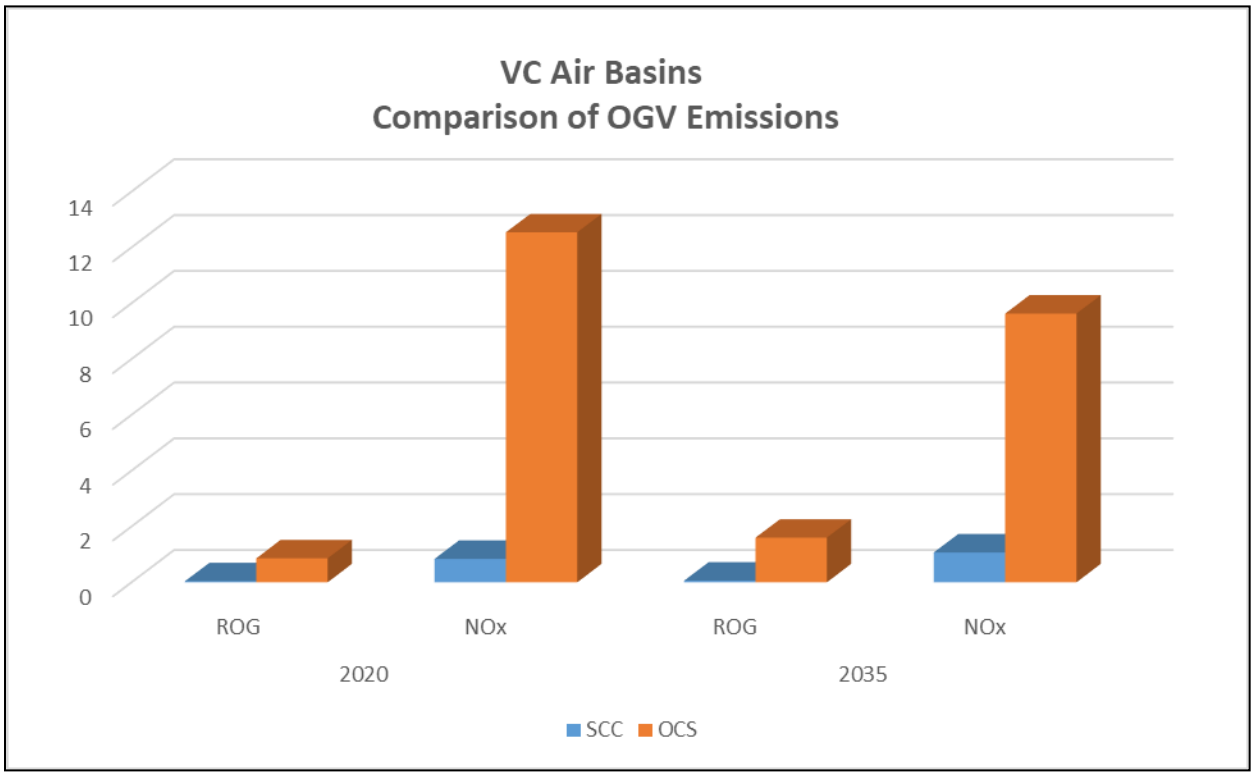


Figure 3. Emissions from Ocean Going Vessels within Ventura County SCC and OCS Basins

These numbers make it clear that Ventura County is coming from a very different place with regards to ambient air pollution levels. Essentially, the Ventura County basin's status quo is so much lower than LA/LB that it does not make sense to apply the same assumptions about emission related impacts for the Port. This point is extremely important to the proposed regulation amendments.

CARB's ongoing emission inventory analysis makes assumptions about growth rates of OGV business at California ports. CARB is applying estimated growth in OGV traffic in various vessel classes to calculate growth in emissions, rationalized by the assumption that more OGV activity means more engine use, which equates to proportional increases in emissions. During this process, the ports were lumped into regions for simplified assessments. The Port was thus included in the same region as LA/LB. Consequently, the growth rate of a significantly larger port complex with extremely different growth estimates was used in the emissions calculations as a surrogate for the Port. Due to a number of reasons, including the size constraints of the Port's berths and shore-side area, the growth rates of LA/LB are in no way accurate for the Port, and would grossly overestimate the anticipated growth of the Port and its future emissions. This would in turn overestimate the potential for impact on local air quality and potential for human health effects. The inaccurate growth numbers CARB used for the Port were: an increase in refrigerated carriers by almost 44% and roll-on roll-off vessels of over 80% by 2025. The Port has calculated as part of its own business planning a more modest growth rate of approximately 30% over 30 years. The emissions associated with this growth forecast should be applied to any policy impacting the Port.

Criteria Pollutant Emissions

Within the air basin of Ventura County, the Port is a fairly small contributor of pollutants as evidenced in Table *3*. The Port's emissions of all of the assessed criteria pollutants, except NO_x, contribute less than one percent of the Ventura County SCC air basin's totals! The Port has worked in the last decade to implement operational changes and new technologies to reduce emissions, such as the addition of shore power, and through investments in efficiencies to reduce delays in cargo movement. In comparison to the Port's 2008 emissions, and despite an increase in vessel calls and goods throughput, the Port has seen a reduction in nearly all of assessed criteria pollutants including carbon dioxide, VOCs, particulate matter and SO_x.

Port of Hueneme Compared to Port of LA, VCAPCD, SCAQMD Emissions						
Criteria Pollutants	**VOC tons/day**	**CO tons/day**	**NO_x tons/day**	**PM 10 tons/ day**	**PM 2.5 tons/day**	**SO_x tons/ day**
Port of Hueneme Total	0.05	0.2	1.6	0.02	0.01	0.01
Total VCAPCD Emissions	45	169.5	60	29.1	10.5	17.0
Port of Los Angeles	1.1	5.2	22	0.4	0.4	0.4
SCAQMD Total Emissions	640	2,735	673	346	127	70
Port of Hueneme % of VCAPCD	0.1%	0.1%	2.7%	0.06%	0.1%	0.1%
Port of LA % of SCAQMD	0.2%	0.2%	3.2%	0.12%	0.3%	0.5%

Table 3. Port Hueneme Emissions Contribution to VCAPCD Totals[3]

[3] VCAPCD emissions data obtained from California Air Resources Board. 2015. https://www.arb.ca.gov/app/emsinv/emssumcat_query.php?F_YR=2015&F_DIV=-4&F_SEASON=A&SP=2009&F_AREA=DIS&F_DIS=VEN. (accessed September 2017).

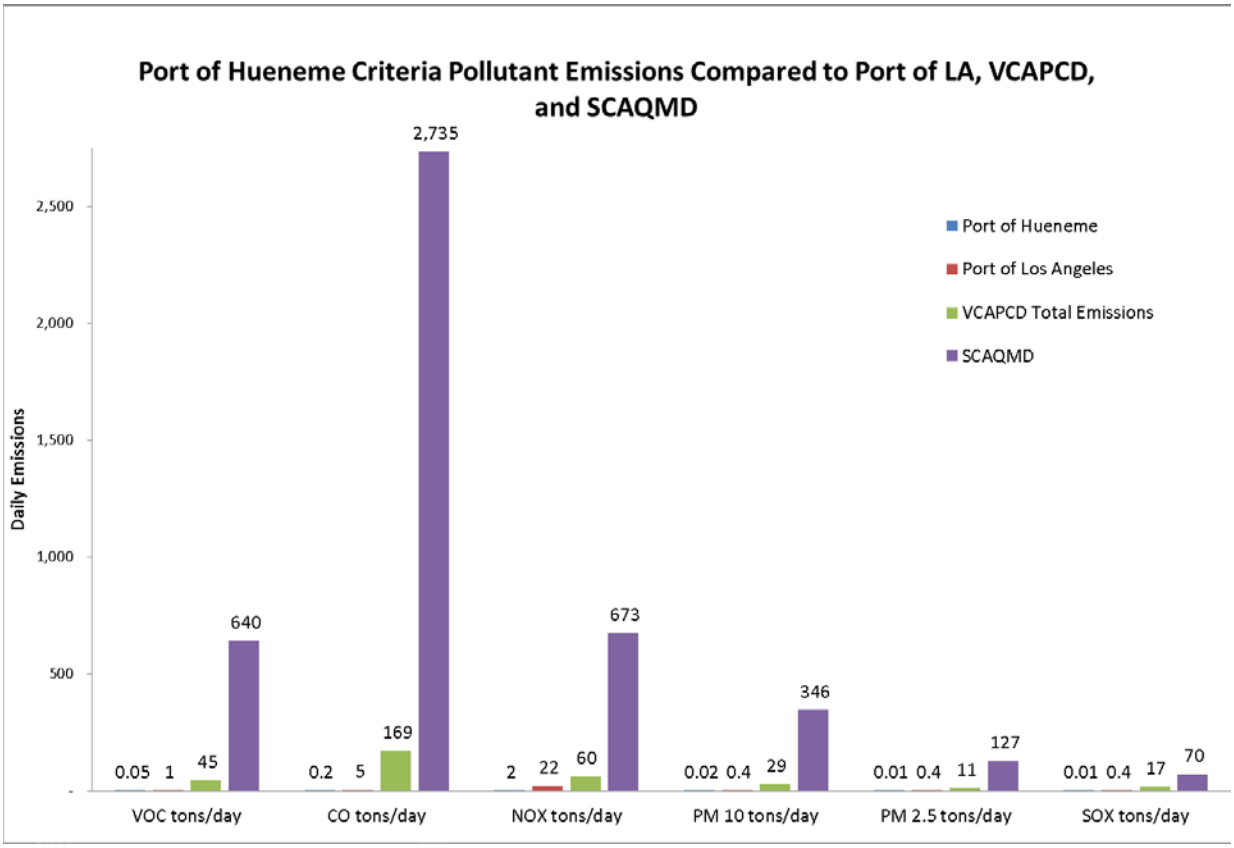


Figure 4. Emissions Comparison of Port of Hueneme to VCAPCD, Port of LA, and SCAQMD[4]

IV. Economic Profile

RECOMMENDATION: Perform a robust cost-benefit analysis to understand the impacts of the proposed Amendments to the At-Berth Regulations to both the economy and the environment for the various business segments proposed to be regulated.

State of the Local Economy and the Importance of the Port

The Port is one of the most productive and efficient commercial trade gateways for niche cargo on the West Coast. The Port is governed by five locally elected Port Commissioners from the communities of Oxnard and Port Hueneme. The Port moves $9 billion in goods each year and consistently ranks among the top ten U.S. ports for automobiles and fresh produce. Port operations support the community by bringing $1.5 billion in economic activity and creating 13,633 trade-related jobs. Trade through the Port

[4] California Environmental Protection Agency Air Resources Board. 2015 Estimated Annual Average Emissions: South Coast AQMD https://www.arb.ca.gov/app/emsinv/emseic1_query.php (accessed September 2017).
South Coast Air Quality Management District. Final 2016 Air Quality Management Plan 2017 http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/final2016aqmp.pdf?sfvrsn=15 (accessed September 2017).

generates more than $93 million in direct and related state and local taxes, which fund vital community services.

As shown in Table 4, the median household income in Oxnard is $54,524 and $49,627 in Port Hueneme. Both Oxnard and Port Hueneme median household incomes are lower than Ventura County's $71,451. Oxnard median household income is lower than the state of California and Port Hueneme median household income is also lower than California's level of $58,916. Port Hueneme's per capita income is 33 percent less than Ventura County and Oxnard's per capita income is even less than the county per capita income, measuring at 42 percent less.

	California	Ventura County	Oxnard	Port Hueneme
Income: 2014B				
Average Household Income	$87,744	$99,452	$74,377	$64,251
Median Household Income	$58,916	$71,451	$54,524	$49,627
Per Capita Income	$30,268	$32,724	$18,921	$21,889
Avg Income Growth 2000-2010	33.0%	31.1%	26.6%	30.9%
Avg Income Growth 2014B-2019	15.3%	14.0%	14.9%	13.8%

Table 4. Median Household Income & Per Capita Income (2014)[5]

Poverty and Misery Index

The measure is an index known as the "Misery Index," which is made up of eight socioeconomic indicators, applied to 11 areas (called Neighborhood for Learning or NfLs) in Ventura County. The eight indicators are: the poverty rate among children age 5 and under; the percentage of women-led households with children 5 and younger who are below the poverty line; the percentage of adults 25 and older without a high school diploma; the percentage of people who speak English "less than very well"; the portion of schoolchildren eligible for subsidized lunches; the portion of students classified as English learners; and the percentage of students who tested at "below proficient" for math and language arts. The percentages are added together and weighted equally for the index.

As seen in Table 5, this index illustrates the deep socioeconomic divides in Ventura County. At one end of the spectrum is Oak Park, where more than 98 percent of the adult population has a high school diploma, and not a single child under the age of 6 lived below the poverty line in 2011. Oak Park's score on the index the sum of the percentages on eight different risk measures — was 37.2, less than one-third the score of the next area, the Conejo Valley. In Oxnard, El Rio and Port Hueneme the total index was more than 10 times as high as Oak Park. In El Rio, for example, 45.9 percent of households led by a woman, with children 5 or younger, were living in poverty.

[5] 2015, Easy Analytic Software,Inc.(EASI®) All Rights Reserved, Alteryx, Inc.

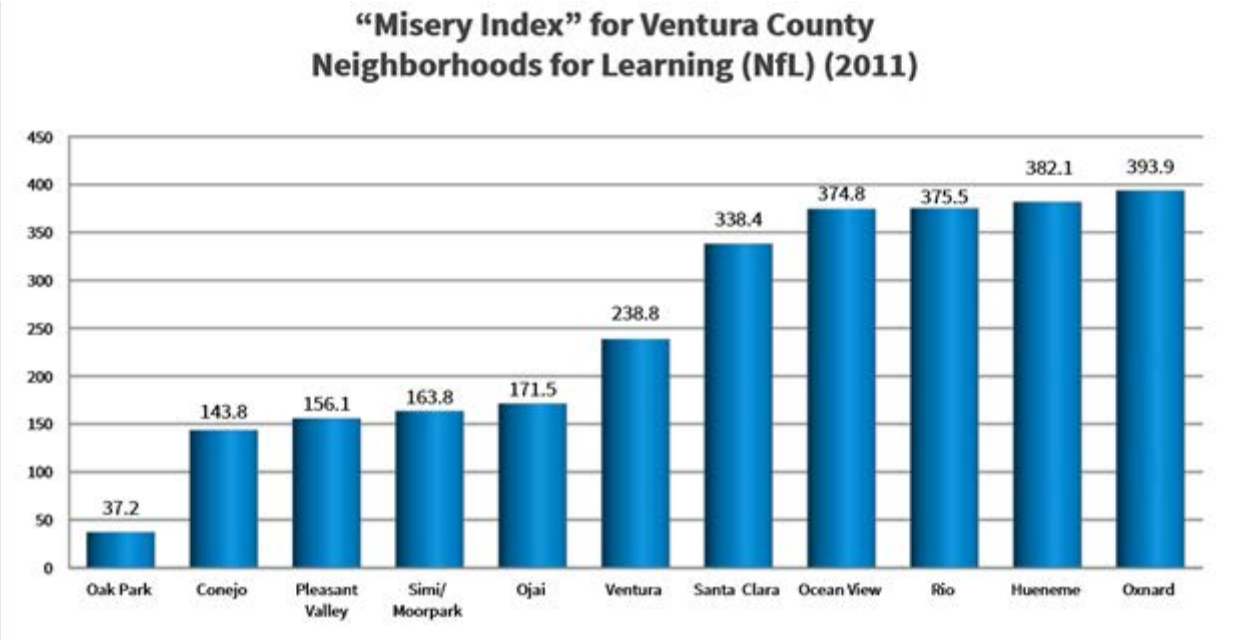


Table 5. Misery Index for Ventura County (2011)[6]

Business Environment and Challenges of At Berth Regulations

Automotive Category

Cargo throughput at the Port is dominated by two product lines, fresh fruit and automobiles. While demand and business for fresh fruit is fairly constant, the demand for automobiles is much more elastic and subject to broader global economic influences. The American public will likely purchase a banana in good economic times and bad, yet that is not the case with automobiles. In general, automobile transportation is a competitive business in which margins are small and competition is significant between carriers and amongst ports seeking to attract new business. In addition, many global carrier companies have large fleets of roll on roll off (RORO) vessels which travel on global routes that frequently change following the demand for specific product. For example, a global shipping company that has a significant presence in the Port and globally operates a fleet of approximately 120 RORO vessels, may only have half of their fleet call at the Port on an average year. Often, one vessel will call on the Port once a year, or once every two to five years. Due to the high costs to retrofit even a single vessel, this company would be very unlikely to retrofit all sixty vessels in order to comply with the proposed amendments. Thus, two choices would remain: the Port could purchase an emissions capture system for use by this company, or they could choose to move some portion of their automobile business to ports outside of California. The emission capture system would likely have to be a shore-side system as the Port does not have the space to be able to operate a barge mounted system and continue normal vessel operations. Yet, no shore-side systems are available as of yet, nor are any approved for use by CARB. This is an uncertain option to base compliance plans upon.

[6] VCCA 2015 State of the Region Ventura County Report

If shipping lines chose to pursue the retrofit of a few vessels, they would become the only ones capable of calling at California ports. However, this places the company at a disadvantage globally by having the entire state of California only serviceable by a specific set of vessels and not others. This is problematic for air quality as well, as the shipping lines will have to operate inefficiently. When vessels are not being used efficiently it results in greater emissions and high costs to the consumer. Logistically, many shipping lines will begin to look to the Pacific Northwest and Gulf ports to import their automobiles. Once imported, they will simply place them on trucks or rail and send them to California. The demand is in California, and they will find the cheapest way to get the automobiles here. Furthermore, this option leads to much more air pollution, the very consequence CARB is working so diligently to reduce.

John Martin, a nationally recognized maritime economist, conducted a study on the economic impact of the Port of Hueneme. He concluded that the Port is responsible for over 13,633 jobs, and $1.5 billion in economic activity for the region. The study also highlighted the Port's $93 million annual contribution to state and local taxes. If our customers decide to ship to other states, these jobs, economic activity, and tax revenues will be lost. Being located in a disadvantaged community where the city of Oxnard has a 24% poverty rate, higher than the state's average, makes the economic opportunity of the Port paramount to the citizens of this region. The Port not only provides jobs, but family sustaining jobs.

The Port's customers are not exempt from property taxes because they purchase property off Port. This means that all those imports and exports are generating the $93 million that is then reinvested in the schools, fire, police, healthcare, social services, and even our local AQMD. The Port services three automobile shipping lines. For just one of those to relocate means a loss of one third of the jobs, economic impact, and tax revenues over night. The Martin study found that the At Berth amendments as analyzed could have the potential impact on the local economy of the loss of:

- More than 2,700 jobs; and
- $300 million in economic activity annually; and
- More than $200 million in salaries and local consumption; and
- $25 million in of State and local taxes

In addition, to these socioeconomic impacts, business leakage from the Port to the Pacific Northwest ports, would have a substantial environmental costs as well. Emissions from the automobiles being delivered to distant markets like Los Angeles and Phoenix are accounted for with a U.S. Department of Transportation emission ton monetization rate. The emissions and subsequent costs resulting from vehicles being driven the increased distances to vehicle markets which are beyond that of delivery from the Port would be a cost of the proposed amendments and are shown in Table 6.

	Truck Miles		Ton Miles Penalty		Emissions Cost
	Portland to:	Huneme to:	Mileage Penalty	Ton Miles	Annual
San Francisco	645	364	281	21,053,236	$1,462,071
Los Angeles	975	70	905	225,140,993	$15,635,232
Seattle	171	1147	-976	-10,791,163	-$749,407
Portland	0	975	-975	-10,852,054	-$753,636
Denver	1252	1079	173	1,906,395	$132,392
Phoenix	1345	444	901	36,290,883	$2,520,271
Salt Lake City	775	752	23	258,967	$17,984
LasVegas,NV	982	325	657	14,125,214	$980,945
Total Emissions Cost					**$19,245,853**

Table 6. Total Emissions Costs for Vehicle Deliveries Resulting from Business Leakage from Port of Hueneme

The Martin Study identifies the worst-case scenario, but the true global nature of the Ro-Ro fleets would make the carriers very reluctant to retrofit their vessels when alternatives just up the coast and in Mexico and Canada exist. The competitive threat is very real. The extent to which the regulations could cause such leakage merits further evaluation and study for both the economic and environmental impacts before regulations are promulgated.

Break Bulk Project Cargo Category

Another important business segment to the Port is break bulk project cargo which contributes about 4% of the Port's revenue. This business line is extremely important to the Port's overall competitiveness and the thousands of jobs it supports. 100% requirement to reach zero emission for this vessel type call, would cause the industry to virtually disappear. These vessels make one time calls to ports to load and unload special cargoes, and may never return for another call at the Port. By way of example the largest crane in the world from Arizona, came to Hueneme for a one time move to China. These types of pieces frequently move through the Port on a different vessel on each occasion. A retrofit would not be justified in the eyes of an ocean carrier for a single voyage, thus potentially eliminating this business segment at the Port.

To best understand the implications of the proposed amendments, all business types at the Port need to be evaluated and the opportunity costs understood, again calling the need for a cost-benefit analysis to inform the draft regulations.

Tanker Business Category

The Port operates a distribution hub for liquid fertilizer product which is an essential tool for the massive agricultural industry of Ventura County. This $2 billion industry relies of timely delivery of fertilizer which is delivered to the Port by tanker vessel currently service by the Champion Tankers line. Champion operates about 20 tankers globally approximately six of which may visit the Port annually. This vessel category is subject to many of the same global economic challenges as any other ocean carrier and thus would reflect the same business challenges in justifying an expensive vessel retrofit or the risks of developing a fleet of captured California-only tankers.

V. Proposed Elements for Inclusion in At Berth Amendments

The Port is providing these comments not out of any effort to avoid regulation or doing its part to improve air quality in the region. The Port is fully committed to making progress to reduce emissions at the Port in a manner that is effective in addressing the pollutants which are most problematic in the surrounding areas and cost effective in reducing those emissions. It is clear to the Port that a one size fits all compliance pathway will not be effective in fairly applying emission reductions across the ports of California. Furthermore, smaller ports like Hueneme and its surrounding communities which rely on the Port for employment, will carry a much greater burden and are more at risk of serious negative economic consequences if the proposed amendments move forward without specific accommodations for smaller ports including Hueneme.

For these reasons, the Port would like to propose the following solutions to integrating a more equitable and realistic approach into the proposed amendments.

Alternative 1: Fix Current At-Berth Regulations
Under this alternative the Port recommends that the proposed amendments be shelved until the problems effecting the current regulations are solved. Presently under the existing At Berth regulations, several problems impact compliance attainment for vessels and fleet owners, and the Port believes that air quality would best be served by fixing these challenges before adding significant increases in the breadth of these regulations and thus compounding the level of regulatory complexity and compliance challenges by orders of magnitude. The current three hour plug in rule for shore power seems to be an arbitrary number which is difficult under even the best circumstances for a vessel to comply with. In numerous instances small delays or unforeseen events result in connections taking more than three hours, and missing the mark eliminates any incentive for continuing the attempted connection and thus negates potential emissions reductions. A sliding scale of compliance could be contemplated in which the duration at berth under shore power would be applied to a compliance total. A second confounding factor is the limited availability of technology vendors capable of providing support, system service and spare parts for shore power systems. Currently one company services all of the shore power systems in the State with one electrical engineer, this scenario leads to significant delays in servicing shore power equipment which results in vessel calls operating off of ship power and resulting emissions. It is challenging to not envision a situation in which these same types of problems will plague the emission reduction technologies which are currently being touted as significant solutions to reducing emissions from vessels including bonnet capture systems or similar technologies with the proposed amendments.

Alternative 2: Delayed Application of Requirements and Development of Local Air Plans
Under this scenario, smaller ports would fall subject to the proposed amendments after a set period of time such as ten years. During this intervening period, smaller ports would continue to be subject to the current At-Berth regulations. During this time, larger ports would be working with industry to develop and refine emissions control technologies including bonnet capture equipment and on-board scrubbers to such a degree that initial problems typical of any new technology could be worked out before they are required in all ports. Presently there are already problems with getting the resources needed from technology vendors to support ports with shore-side power systems in need of repair, and it is easy to envision a similar situation occurring with bonnet capture systems in the future. By implementing a delay for small ports, owners of vessel fleets visiting smaller ports would have time to assess new technologies and make informed decisions about retrofitting their fleets with new emission control technologies. In addition, smaller ports would have time to pursue the additional funds needed to invest in emission control technologies such as bonnet capture systems.

In addition, CARB had requested from the Port and its customers estimates of a specific cost point, a "tipping point" at which the burden on complying with the proposed amendments would drive business to leave the Port and move to a less expensive port such as Portland, Tacoma or the Gulf Coast. In discussion with customers of the Port, it has become clear that they are uncomfortable disclosing or even discussing such a cost due to the sensitive nature of disclosing strategic business planning with such detailed proprietary financial information, particularly in the highly competitive business segment of global vehicle shipping. However, one benefit of delaying the application of the proposed amendments to the smaller ports would be that in the interim time market forces would reach equilibrium between vendors of new control technologies and vessel owners and port authorities and make more clear how the increased regulatory costs of the At Berth amendments translate into increased operational costs and a resulting loss of business to other regions with lower compliance costs. This approach creates the opportunity to quantifiably measure leakage without impacting the most vulnerable ports. Delayed implementation would also enable ports time during which to begin coordination with local air pollution control agencies on developing local solutions.

Alternative 3 - Regional Targets and Solutions

Under this scenario, ports would be allowed to achieve compliance with the proposed amendments through the implementation of a locally developed plan which would achieve reductions in air pollutants equivalent to those of the proposed At-Berth amendments but through other efforts. A large percentage of the emission reductions, such as 75%, would have to take place at the port or adjacent port owned properties so that the benefits of these plans would be felt in the immediate communities around the ports which are most impacted by their emissions. These plans would be tailored specifically to a port's surrounding air basin, including NAAQS attainment dates, and its community needs and problem pollutants. These plans would be developed in partnership with their local Air Pollution Control District or Air Quality Management District with final approval from CARB.

The Port has begun the collaborative development process of a more comprehensive air quality plan that the Port is calling its Port of Hueneme Reducing Emissions and Supporting Health Plan (PHRESH Plan). The PHRESH Plan will be focused on developing Port specific strategies for reducing air pollutant emissions within the Port's direct operations or financial control. The PHRESH Plan will be tailored to the Port's features, equipment and operations and will assess a range of feasible reduction methodologies and source control technologies which could be implemented. The focus will be on achieving the most cost-effective solutions that provide the greatest amount of feasible reductions.

Additional Specific Comments on Proposed Amendments to the At Berth Regulations

Comment #1:
The Port strongly encourage CARB to conduct a socioeconomic assessment of the proposed amendments incorporating a full cost-benefit analysis due to the potential impacts of the concepts currently being discussed. As outlined above, the Port cannot emphasize enough the potential of economic harm which could result from the loss of small numbers of customers at the State's smaller ports.

Comment #2:
The Port frequently receives military cargo for the U.S. military which arrives on civilian vessels. The Port requests that CARB clarify if this situation would result in the vessel being exempt from the regulations due to the nature of its cargo.

Comments #3:
Some vessel lines are already developing and launching new vessels which call at the Port which incorporate onboard emissions controls technologies. The Port requests that CARB clarify whether this type of vessel will be exempted from the regulations or be grandfathered in.

Comments #4:
The Port requests clarification on the size of tanker vessels which will be subject to the regulations.

Comment #5:
There was discussion during the workshop of requiring ports to report vessel data to CARB under a new, streamlined reporting regimen. The Port requests clarification of this change and notes that altering the nature of the relationship between the Port and its clients could negatively influence it especially when regulatory compliance documentation is involved.

Comment #6:
The Port's customers encourage CARB making available grant funding or other incentive to offset the significant labor costs associated with shore power connections, which can total over $5,000 per call and at times exceed the cost of electricity used during the call.

We greatly appreciate the opportunity to provide these comments, and we look forward to working with CARB further on this important regulatory action. Please contact us if you have any questions or comments regarding this letter or its contents.

Sincerely,

Christina Birdsey,
Chief Operating Officer,
Port of Hueneme

From:	shingo.mizutani@nykgroup.com
To:	ARB Clerk of the Board; ARB Helpline; Light Densberger, Nicole@ARB; ARB (PIO) Public Information Office; ARB Public Records Access Request
Cc:	jack.duesler@nykgroup.com; takashi.capt.ito@nykgroup.com
Subject:	Question for At berth regulation - exhaust gaas measurement of Diesel generator engine
Date:	Monday, July 27, 2020 7:59:49 PM

To: California Air Resources Board
Fm: Mizutani/NYK LINE Tokyo
Date: July 28, 2020

Dear Sirs,

With reference to captioned, it would be appreciated if you could reply with explanation for my question below.

2-15-14.1 1. We suppose it is required that CO2E from control strategy must be grid-neutral in case the control strategy is external additional system.
In case of gas-fueled engine, there is no additional control system and we try to meet the regulation by the performance of engine alone,
therefore we suppose it is not necessary to consider grid-neutral, is it correct?

2-15-14.2 2. Since SCR system is not used as control strategy for our DF(LNG) engine,
we guess there is no point measuring ammonia because there is no factor to generate ammonia in exhaust gas.
Is it necessary to measure ammonia?

2-15-14.3 3. Is Engine load settings on testing(measurement of Gas of Diesel Generator engine) approved on 100%, 75%, 50%, 25% and 10% ? , and is it evaluated NOx, PM2.5 and ROG (g/kWh) shall be weighted averaged values calculated based on D2-test cycle (as well as IMO' NOx Technical Code)?

2-15-14.4 4. Is it considered that such CARB approved test is required for all engines one by one even if they are the same type of engine ? Or, is it considered that CARB will allow exemption of test of same type engine as previously tested engine ?

Best Regards,
****
Shingo Mizutani
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Automotive Quality Control Group
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****

Catherine H. Reheis-Boyd
President

July 27, 2020

Clerk of the Board
California Air Resources Board
1001 I Street
Sacramento, California 95814

sent via e-mail to: http://www.arb.ca.gov/lispub/comm/bclist.php

Re: WSPA Comments on Second "15-Day Changes" to CARB Proposed Control Measure for Ocean-Going Vessels at Berth

To the Clerk of the Board:

This letter supplements comments previously submitted by the Western States Petroleum Association ("WSPA") on the California Air Resources Board's ("CARB") Proposed Control Measure for Ocean-Going Vessels at Berth ("Proposed Regulation") and its various amendments since its original release on October 15, 2019. WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas and other energy supplies in California and four other western states.

WSPA is providing these comments in specific response to the Second 15-Day Changes, and as part of a continuing effort to provide feedback on the Proposed Regulation. We incorporate our previous comments submitted on February 15, 2019; March 29, 2019; May 30, 2019; June 14, 2019; August 15, 2019; December 3, 2019; March 6, 2020; and May 1, 2020 by reference herein.

I. Summary of Concerns with Second 15-Day Changes

2-15-15.1
- The Second 15-Day Changes propose to extend the compliance start dates for container vessels, refrigerated cargo vessels, passenger vessels and roll-on roll-off ("ro-ro") vessels, but arbitrarily exclude tankers from any compliance schedule relief – based on an incorrect and unsupported claim that the tanker industry has "recovered" from the pandemic. The Second 15-Day Changes must be further revised to provide the lead time necessary for industry to recover from the nation's current severe economic recession and to conduct the feasibility studies necessary to ensure that new international safety standards are adequately considered, and that tankers are not put at unacceptable risk of explosion or other serious threats to safety.

2-15-15.2
- The proposed extension of the maximum "Innovative Concepts" compliance period from three years to five years in the Second 15-Day Changes fails to make "Innovative Concepts" a viable compliance alternative for tanker terminals.

2-15-15.3
- The proposed changes to the "interim evaluation" provisions fail to provide for the feasibility study critically needed for tankers before the Proposed Regulation is adopted.

2-15-15.4
- The Second 15-Day Changes assume no changes to projected emissions and economic activity in the face of the pandemic, relying instead on increasingly unrealistic and outdated assumptions about future business levels, emissions and potential environmental benefits of the amendments.

2-15-15.5

- A draft report for a CARB-commissioned study on real-world tanker emissions – "Emissions Evaluation of a Large Capacity Auxiliary Boiler on a Modern Tankers," dated March 2020 – was made available to WSPA for the first time in early July. The results indicate that Staff's tanker NOx emissions factor overstates the actual real-world factor by ***233***% and overstates the actual tanker PM2.5 emission factor by ***2,288%***. Despite these significant inaccuracies in Staff's assumptions, Staff have not accounted for the findings of this study in the Second 15-Day Changes.

II. Adjustments in Compliance Start Years for Regulated Vessels Should Not Arbitrarily Exclude Tanker Vessels

The Second 15-Day Changes propose adjusting the compliance start dates from 2021 to 2023 for container vessels, refrigerated cargo vessels, and passenger vessels, and from 2024 to 2025 for ro-ro vessels. *See* Proposed 17 C.C.R. § 93130.7(b). Staff noted that these proposed changes were made "in order to give registered entities additional time to prepare for compliance in light of the current economic downturn." CARB Second Notice of Public Availability of Modified Text and Availability of Additional Documents and/or Information ("Second Notice"), p. 9.

Staff's claims about "past recession events" do not appear to be supported by actual evidence in the record, nor is it clear what data justify Staff's assertions about the predicted future "recovery" of tanker vessel visits. Staff provide no evidence in the supporting materials for the Second 15-Day Changes to justify not also affording tanker vessels additional time for compliance. Indeed, in the Second Notice, Staff concede that all of the regulated vessel categories are seeing emissions reductions due to the serious reduction in economic activity and vessel visits attributable to the pandemic, and that all categories will take years "to recover to pre-recession visit levels." Second Notice, p. 18.

2-15-15.6

The only indication given as to why tankers are being treated differently came in Staff's slide presentation to the Board on June 25, 2020, during which Staff claimed that "we're already starting to see increases in crude imports in May and June, and demand is expected to continue recovering as more people resume normal daily operations. *See* Transcript of CARB Videoconference Meeting, June 25, 2020 ("Transcript"), p. 329:18-23. But Staff have yet to present the data on which they purport to rely, making it impossible to assess the veracity or accuracy of their statements. Moreover, since the June Board meeting, the resurgence of COVID-19 cases in California has prompted the re-imposition of strict state and local responsive measures, including widespread business closures. Under these circumstances, people are not resuming normal daily operations now or any time soon, and demand cannot be expected to continue recovering.

The available data show that, contrary to Staff's claim, the tanker industry is suffering significantly from the economic collapse right along with other vessel categories. Energy Information Administration ("EIA") data through April 2020 show that PADD 5 crude imports, which are dominated by California, have fallen 46% since December 2019. *See* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRIMP51&f=M. Furthermore, California Energy Commission data show that, compared to 2019 inputs during the same timeframe, California refinery crude inputs were down between 25 and 30 percent during May and June 2020, and down by 32% as of July 17.[1] As the graphs in Tab 2 show, though they are not as low in July 2020 as they were in early May 2020, week to week U.S. crude imports and

[1] CA Energy Commission Weekly Fuels Watch Report, accessed July 23, 2020 at https://ww2.energy.ca.gov/almanac/petroleum_data/fuels_watch/index_cms.html (attached at Tab 1).

exports in 2020 are still far below averages seen in 2019.[2] Total monthly visits of foreign tankers into Southern California ports and terminals went from 35 total visits in January 2020 to just 23 in May and in June 2020, a drop of 34.3%. These same tanker visits as of mid-July were at only 13, tracking for another very low month in July.[3] These data translate to significant reductions in tanker traffic not accounted for in Staff's tanker traffic projections or emissions totals, and stand in direct conflict to Staff's suggestion that the tanker industry is somehow "recovered" from the COVID-19 downturn.

But even if crude imports *were* seeing minor increases at times in May and June 2020, levels of recent activity do nothing to make at-berth capture and control feasible or safe for tanker vessels in the timetables provided in the Proposed Regulation. As we and others have explained in detail in numerous prior comments, the types of emissions capture and control equipment that would be required for tankers in the current Proposed Regulation still have not been proven safe and feasible in real-world operations with tankers at marine terminals. This makes both the original 2027/2029 compliance dates, and the accelerated 2025/2027 compliance deadlines from the First 15-Day Changes, unrealistic and potentially dangerous to attempt to meet, even if eventually determined to be feasible sometime in the future. Indeed, CARB heard undisputed public testimony at the June Board meeting that failing to follow stringent safety measures in managing gases in tanker cargo spaces at berth can lead to catastrophic explosion and loss of human life, as it has in prior real-world incidents. *See* Transcript, pp. 364-365 (testimony of Capt. Saul Stashower). This issue *alone* warrants giving ports and terminals additional time to conduct necessary feasibility studies in order to determine whether and how at-berth capture and control could be accomplished without risking people's safety.

2-15-15.7 The safety concerns associated with tankers – and the critical need to fully understand and account for them in *any* regulation impacting tankers – are further underlined in the new Sixth Edition of the International Safety Guide for Tankers and Terminals ("ISGOTT"), published in June 2020. *See* "International Safety Guide for Tankers and Terminals," International Chamber of Shipping, *et al.* (6th ed. 2020) (attached at Tab 4). The ISGOTT is "widely recognised as the definitive best practice guidance on tanker safety and pollution prevention" (ISGOTT, p. iii), and compliance with ISGOTT measures is mandated under several California statutes and regulations. *See* California Building Code (Title 24, C.C.R.), Ch. 31F (Marine Oil Terminal Engineering and Maintenance Standards ("MOTEMS") requiring marine oil terminals to meet various ISGOTT standards); 2 C.C.R. §§ 2340(c)(29), 2355(a) (State Lands Commission safety requirements for tanker operations to meet specified ISGOTT provisions). The latest ISGOTT now contains a new Chapter 8 with guidelines on due diligence steps that are to be taken before technologies not yet adopted in the tanker and terminal sector are applied to tankers. Among these diligence steps are directions to review a proposed technology's interface with the vessel's existing systems and processes, preparation of formal risk and impact assessment plans, a study of hazards presented by the new technology, evaluation of consistency with other industry and classification society standards, and analyses of tanker and terminal personnel safety. *See* ISGOTT, Ch. 8 (Tab 4). ISGOTT Chapter 8 highlights the critical need to assess alternative and emerging technology to ensure that its introduction does not negatively impact tanker and marine

[2] *See* U.S. Energy Information Administration, Weekly U.S. Imports of Crude Oil and Weekly U.S. Exports of Crude Oil, Jan-Jul. 2020 (available at https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrimp51&f=m) (attached at Tab 2).
[3] July 2020, Marine Exchange of Southern California, "Major Ship Types By Count; 1-15 July 2020" (attached at Tab 3).

oil terminal safety. These important ISGOTT guidelines reinforce the safety concerns that we have documented throughout this rulemaking process.

2-15-15.7 In adhering to the ISGOTT guidance, tanker operators also rely on direction, guidance and approvals for regulatory and standards compliance from classification societies like the American Bureau of Shipping (ABS), a "recognized organization" by the United States Coast Guard and International Maritime Organization (IMO), and member of the International Association of Classification Societies (IACS) with consultative status at the IMO. The ABS has issued a guidance document relating to the numerous steps required to assess feasibility of any new technology on marine vessels before the technology can be adopted for real-world use, including engineering evaluations, risk assessments, engineering designs, creation of a manufacturing plan and quality assurance requirements, functional and model testing, prototype validation, systems integration testing, and ABS review. *See* ABS, "Guidance Notes on Qualifying New Technologies" (April 2017) (attached at Tab 5) ("ABS Guidance"). These safety, risk and other assessments cannot be short-cut or postponed for a later day. As the ABS Guidance points out, "[t]he qualification activities within each stage employ risk assessments and engineering evaluations that build upon each other in order to determine if the new technology provides acceptable levels of safety in line with current offshore and marine industry practice." In other words, we cannot simply skip to the "operational stage" without first completing the first stages in the ABS Guidance – *i.e.*, feasibility, concept verification, prototype validation and systems integration.

2-15-15.7 The record contains no indication that Staff have even reviewed the requirements of the ISGOTT or the ABS Guidance in preparing the Proposed Regulation, let alone evaluated whether the Proposed Regulation meets the due diligence and risk assessment requirements of the ISGOTT. Again, additional time should be provided in the compliance schedule for tankers, as it has for other classes of vessels, in order to allow Staff the time necessary to ensure that the Proposed Regulation takes the new ISGOTT guidelines and the ABS Guidance into consideration. These guidance materials also constitute new information that CARB must take into account in the analysis of hazard impacts in the Final Environmental Assessment for the Proposed Regulation.

In light of the catastrophic economy-wide impacts of the pandemic, and given the many serious safety concerns that the Proposed Regulation continues to raise for the tanker category, it would be arbitrary and capricious for CARB to adopt changes granting additional time for compliance for all other regulated marine vessel classes "in light of the current economic downturn," but not for tankers. Building in this extra time is crucial to ensuring that CARB does not rush to force impracticable and potentially dangerous requirements on tankers, terminals and ports.

III. The Extension of the Maximum "Innovative Concepts" Compliance Period from Three to Five Years Does Not Make It a Viable Compliance Alternative

The Second 15-Day Changes also propose extending the time during which an "innovative concept" may be used for compliance from a maximum of three years to a maximum of five years. *See* Proposed 17 C.C.R. §§ 93130.2(b)(21), 93130.17(a)(7). Staff remarked in the Second Notice that the proposed change is intended "to allow more certainty to innovative concept projects to be used for compliance under the Control Measure." Second Notice, p. 14.

As we and others have explained in prior comments, the proposed "Innovative Concepts" provisions do not provide the true compliance alternative stakeholders requested – *i.e.*, a compliance option ***in lieu of*** the currently unworkable requirement to install and operate yet-unproven at-berth capture and control systems. At best, an "Innovative Concept" would provide

a temporary ***additional*** compliance obligation for stakeholders who choose the option, and after a defined maximum period of time, stakeholders *still* would be required to meet the requirement to install a capture and control system or provide shore power.

2-15-15.8 Changing this maximum time from three to five years does not address the core problems with the "Innovative Concepts" provisions. Most fundamentally, the Second 15-Day Changes fail to provide any relief from the running deadlines to install at-berth shore power or capture and control systems. Once one or more five-year "Innovative Concept" periods come to an end without CARB renewal (or during such a period if CARB decides to revoke an "Innovative Concept"), stakeholders then would become ***immediately*** subject to the default 2027/2025 deadlines to install a capture and control system. Far from providing more incentive to tanker terminals to choose the "Innovative Concept" option, a five-year project period would actually provide ***less*** incentive by increasing the amount of lost investment from funding the Innovative Concept over five years, while leaving the stakeholder with little or no time to install capture and control by the now-accelerated default regulatory deadlines.

IV. The Second 15-Day Changes to the Interim Evaluation Provisions Do Not Substitute for a Proper Feasibility Study

The Second 15-Day Changes also propose that in the envisioned "interim evaluation" of available control technologies and infrastructure for tankers and ro-ro vessels, CARB Staff will not only review "potential requirements for control technologies for use with bulk and general cargo vessels, and for ocean-going vessels at anchor," but now also the "control technologies" themselves. *See* Proposed 17 C.C.R. § 93130.14(d). Staff notes that "[t]his change clarifies that CARB will focus on what technologies are available, and will consider potential requirements for these specific vessel categories (rather than requirements for the control technologies themselves)." Second Notice, p. 14.

2-15-15.9 The proposed changes to subsection 93130.14(d) do not make the "interim evaluation" an adequate substitute for an actual tanker feasibility study done prior to adopting the Proposed Regulation. As discussed above, Chapter 8 of the June 2020 ISGOTT update provides that all aspects of a proposed technology's feasibility and safety – including hazards analyses, workability of the proposed interface with existing vessel systems, consistency with classification society and industry standards, and potential risks to tanker and shore-side personnel – must be reviewed ***before*** implementing the proposed technology, not ***after***. *See* ISGOTT, Ch. 8 (Tab 4).

Throughout this entire rulemaking, WSPA has been urging Staff to conduct a feasibility study concerning the viability and safety of installing capture and control systems for use with tankers, and to assess the results of this study before imposing requirements on tanker vessels. Yet, as currently proposed in the Second 15-Day Changes, section 93130.14(d) would require Staff to publish its report on tanker control technology by December 1, 2022 – nearly two years after portions of this Regulation become effective and a year after tanker terminals are required to submit terminal plans describing how they will comply with the Proposed Regulation.

The Second 15-Day Changes do not remedy the problem by directing that Staff evaluate both the "potential requirements" for control technologies and the "control technologies" themselves. We agree that these are critically important questions for determining whether and how tanker terminals can safely and feasibly comply with the Proposed Regulation. But they need to be answered ***before*** imposing mandatory compliance deadlines on stakeholders, not two years ***later***.

V. The Second 15-Day Changes Fail to Account for the Massive Economic Disruptions and Changes in Projected Emissions Attributable to COVID-19

In the Second 15-Day Changes, while Staff finally acknowledge the existence of the coronavirus pandemic, they believe it merits no changes at all to predictions of future economic and vessel activity, likely future emissions, or anticipated health outcomes. According to Staff, "[b]ecause the current circumstances are unique from past recession events, CARB staff expect there may be a reduction in emissions to continue over the next few years from reduced vessel visit activity but outcomes are unknown. Therefore we did not make changes to our inputs or methodologies at this time."[4] Second Notice, p. 18.

2-15-15.10 California law prohibits Staff from simply assuming away the most serious national economic calamity since the Great Depression. The Health and Safety Code authorizes CARB to adopt regulations only after finding that they are necessary, technologically feasible, and cost effective given the information made available to CARB Staff. Cal. Health & Safety Code §§ 39602.5(a), 43013(a). California Government Code Section 11346.3(c) further requires the Standardized Regulatory Impact Analysis (SRIA) in this rulemaking to conduct a full analysis of the potential of the Proposed Regulation to impact the creation or elimination of jobs, business, investment and innovation in the California economy, along with an accurate assessment of the health, safety and welfare benefits of the regulation. Cal. Gov. Code § 11346.3(c)(1).

Deciding that the most significant reduction of economic activity in a generation should result in ***zero*** change to Staff's pre-pandemic economic and emission assumptions defies logic and is plainly arbitrary and capricious. It allows this rulemaking to proceed on now increasingly inaccurate and unreliable projections of future tanker and other vessel activity in California's ports and terminals over the next several years. By refusing to account for reduced vessel activity in the future, Staff are choosing to rely on considerably overstated future emissions projections, leading to unrealistically high potential health impacts and, in turn, overstated promises of health benefits. Also, as discussed below, Staff's failure to disclose recent empirical data on tanker emissions has resulted in even further exaggerated and inaccurate projections for future tanker emissions.

A slower national and California economy over the next several years will very likely lead to reduced vessel trips and growth of vessel traffic over that period. Fewer vessel trips at California ports and terminals will mean lower at-berth emissions. At the very least, this could substantially change Staff's estimates of the potential health benefits of this measure (likely lower) and the cost-effectiveness of the Proposed Regulation (likely much less cost-effective). Staff are not entitled to ignore these impacts.

The public is not well-served when CARB Staff indulge exaggerated or unrealistic projections of future emissions. As the Legislature has pointed out, "[i]naccurate [emissions] inventories that do not reflect the actual emissions into the air can lead to misdirected air quality control measures, resulting in delayed attainment of standards and unnecessary and significant costs." *See* Cal. Health & Safety Code § 39607.3(d). Just because future "[o]utcomes are unknown" does not give
2-15-15.10 CARB Staff permission to ignore them entirely. It is CARB's legal duty to accurately and fairly assess what impacts the coronavirus pandemic will have on future economic activity and vessel trips at California ports and terminals. Only then can CARB understand the true future emissions

[4] Notably, Staff found "past recession events" instructive when granting all vessel classes but tankers relaxed compliance schedules, but apparently of no guidance whatsoever in requiring changes to assumptions of future vessel activity, emissions or health outcome assumptions. *See* Second Notice, p. 18.

impacts of vessel traffic, and therefore, the potential impacts of the proposed measures on health and the actual cost-effectiveness of the Proposed Regulation.

2-15-15.11 **VI. Staff Have Failed to Consider Making Changes to Tanker Emission Assumptions Considering the Compelling Results of a CARB-Commissioned Independent Study on Real-World Tanker Emissions**

The Second 15-Day Changes fail to account for, or even acknowledge, a 2019 study commissioned by CARB on in-service tanker emissions – a study that shows a drastically lower emission factor for tankers than the factor on which Staff are currently relying. In 2019, CARB commissioned engineers at the University of California, Riverside, Bourns College of Engineering Center for Environmental Research and Technology ("CE-CERT") to conduct a study to evaluate real-world emissions from a modern tanker ship auxiliary boiler in the process of offloading fuel at berth. *See* Miller, W. et al., "Emissions Evaluation of a Large Capacity Auxiliary Boiler on a Modern Tanker," Draft Final Report, March 2020 (attached at Tab 6) ("CE-CERT Report"). CE-CERT conducted testing of the boiler in October 2019. The draft report, which is dated March 2020, was only made available to WSPA in early July 2020.

In our February 2019 comment letter on the Proposed Regulation, we expressed concern that the emission factors being used for tanker vessels "do not provide an accurate characterization of the emissions resultant from engines and boilers aboard a modern fleet" and specifically that the "stagnant PM emission factor is of particular concern." Staff was and still is using a 0.151 g/kWh PM2.5 emission factor and a 1.995 g/kWh NOx emission factor for tanker boilers in its emissions inventory for the Proposed Regulation. These emission factors are based on a 2002 report from Entec compiling data on vessels that were over 20 years old at that time, few of which are still in operation today.[5] Critically, Entec's boiler emissions factors were derived from boilers using heavy No. 6 fuel oil – ***not*** the cleaner burning, low sulfur distillate fuels CARB has mandated since 2008. *See* Entec Report, Ch. 2, p. 16 ("Emission factor measurement data relating to gas turbines and steam turbines are scarce in comparison to diesel engines and thus a greater uncertainty is associated with these factors. For steam turbines, all recent marine emission inventory studies have relied on US data from the early 1980s (US EPA, 1985 and Scott Environmental Technology Inc., 1981). Since no new data has been found in the literature and steam engines are in general being phased out, the same emission factors are proposed here.") The old NOx and PM2.5 emissions factors for heavy fuel oil are significantly higher than those for the low sulfur distillate fuels burned in tankers today.

Based on empirical observation, the CE-CERT Report observed tanker boiler PM2.5 emissions of 0.022 g/kg-fuel, which (using Staff's specific fuel consumption figure) converts to a PM2.5 emission factor of 0.0066 g/kWh.[6] ***This empirically-derived emission factor is 96% lower than the tanker PM2.5 emission factor still being used in Staff's assumptions***.

While it appears results on metals emissions still have yet to be added to the report due to COVID-19 related delays, its PM and NOx data appear to be complete and are directly relevant to the proposed regulation of tanker terminals in this rulemaking. Not only were the CE-CERT Report's

[5] *See* "Quantification of emissions from ships associated with ship movements between ports in the European Community," Entec UK Limited, Final Report (July 2002), Ch. 2 ("Entec Report") (available at https://ec.europa.eu/environment/air/pdf/chapter2_ship_emissions.pdf).
[6] The emissions factors derived here from the CE-CERT Report were derived using the same approach as the emissions factors calculated by Starcrest for CARB, in order to ensure the numbers cited herein can be meaningfully compared with the numbers used by CARB Staff.

conclusions based on empirical data from an actual in-service tanker vessel, they also are significantly instructive as to the broader tanker fleet calling at California ports and terminals. PM2.5 emissions from modern boilers are far less than those reflected in Staff's outdated PM2.5 emission factor largely due to changes in the type of fuel used and significant improvements to tanker boiler designs over 40 years. WSPA understands that CE-CERT discussed these findings with a representative from the boiler manufacturer (Alpha Laval) and was told that the improved nozzle designs used in current marine auxiliary boilers and the use of distillate fuel markedly reduced PM2.5 emissions due to less fouling and finer droplets.

If the CE-CERT Report's empirically derived emission factor were used in Staff's emissions estimates for tankers, the projected share of statewide ocean-going vessel ("OGV") PM2.5 emissions attributable to tanker vessels would fall from 50% to 20%. Yet at the June 25 Board hearing, Staff's slide presentation continued to misrepresent tankers' share of overall OGV PM2.5 emissions as 50%. At the June 25 hearing, Staff repeatedly cited this 50% number as an important basis for not adjusting compliance timelines or other requirements in the Proposed Regulation for tanker vessels.

Similarly, the CE-CERT Report observed real-world tanker boiler NOx emissions to be 0.858 g/kWh, which is *57% smaller* than the obsolete 1.995 g/kWh factor used by CARB that is based on the 40-year-old study. As with PM2.5, CARB is greatly overestimating the NOx emissions associated with tankers, and thus inflating the associated health benefits. The table below summarizes the differences in the emissions factors measured by the CE-CERT and those used by CARB.

Source	NOx (g/kWh)	PM2.5 (g/kWh)
CE-CERT	0.858	0.0066
CARB	1.995	0.151
Staff Emissions Overstated By	233%	2,288%

The CE-CERT Report establishes that Staff's NOx and PM2.5 assumptions incorrectly overstate actual tanker auxiliary boiler emissions, overstating actual NOx by 233% and overstating actual PM2.5 by a whopping ***2,288%***. Thus, the results of the CE-CERT Report must be assessed and incorporated into this rulemaking, and Staff's grossly overestimated PM2.5 and NOx emission factors must be corrected.

Also, the CE-CERT Report leads to potential questions about the validity of other Staff assumptions regarding tanker emissions and the resulting projections of health impacts. Together with refining its estimates of future economic and vessel activity as discussed above, Staff must incorporate these new emissions assumptions (and any other corrected emissions assumptions) into their overall analysis of anticipated future emissions levels, cost effectiveness calculations, and other variables dependent on the tanker emissions estimates.

Regardless of what conclusions are to be drawn from the Report, Staff has a legal duty to disclose and discuss the Report's findings. If Staff believe it is necessary to await a final version of the Report or solicit additional vessel testing before addressing the new emission data in this rulemaking, Staff should delay finalizing the Proposed Regulation.

* * *

WSPA stands ready and willing to assist Staff in doing the hard work necessary to complete a feasibility study, so that we may determine whether at-berth capture and control for tankers can be accomplished safely and in accord with the newest international tanker standards. ***But if this work is not properly completed, lives will be put at risk***. We remain deeply concerned that Staff have now submitted two revisions of the Proposed Regulation without adequate consideration of the significant health and safety issues posed, and without building in the time necessary for a feasibility study for tankers. This study must be done before imposing compliance mandates on ports and terminals, not years later. In the meantime, Staff cannot pretend that an unprecedented worldwide pandemic will have *no* impact on future economic activity or emissions. Staff must take the time needed to assess the serious economic impacts of COVID-19 and what it will mean in terms of true future emissions from OGVs. Stakeholders and the public deserve to have this rulemaking informed by a full and fair evaluation of the facts as they stand today, not as Staff might have understood them a year ago.

Sincerely,

Attachments

Western States Petroleum Association
Comments on Second 15-Day Changes to At Berth Regulation

List of Attachments

	Tab	Document
2-15-15.12	1	California Energy Commission Weekly Fuels Watch Report, accessed July 23, 2020, https://ww2.energy.ca.gov/almanac/petroleum_data/fuels_watch/index_cms.html
2-15-15.13	2	U.S. Energy Information Administration, Weekly U.S. Imports of Crude Oil and Weekly U.S. Exports of Crude Oil, Jan-Jul. 2020, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrimp51&f=m)
2-15-15.14	3	Marine Exchange of Southern California, "Major Ship Types By Count; 1-15 July 2020" (July 2020)
2-15-15.15	4	International Chamber of Shipping, *et al.*, "International Safety Guide for Tankers and Terminals," (6th ed. 2020)
2-15-15.16	5	ABS, "Guidance Notes on Qualifying New Technologies" (April 2017)
2-15-15.17	6	Miller, W. *et al.*, "Emissions Evaluation of a Large Capacity Auxiliary Boiler on a Modern Tanker," Draft Final Report (March 2020)

2-15-15-.12

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	05/08/2020	05/01/2020	Percent Change	One Year Ago	Percent Change

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	05/15/2020	05/08/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	7,890	7,472	5.6%	11,355	-30.5%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	05/22/2020	05/15/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	7,857	7,890	-0.4%	11,302	-30.5%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	05/29/2020	05/22/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	7,730	7,857	-1.6%	12,168	-36.5%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	06/05/2020	05/29/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	8,088	7,730	4.6%	12,306	-34.3%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	06/12/2020	06/05/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	8,304	8,088	2.7%	11,500	-27.8%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	06/19/2020	06/12/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	8,413	8,304	1.3%	11,671	-27.9%

California Energy Commission Weekly Fuels Watch Report

These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

Production Type	06/26/2020	06/19/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	8,698	8,413	3.4%	11,710	-25.7%

California Energy Commission Weekly Fuels Watch Report

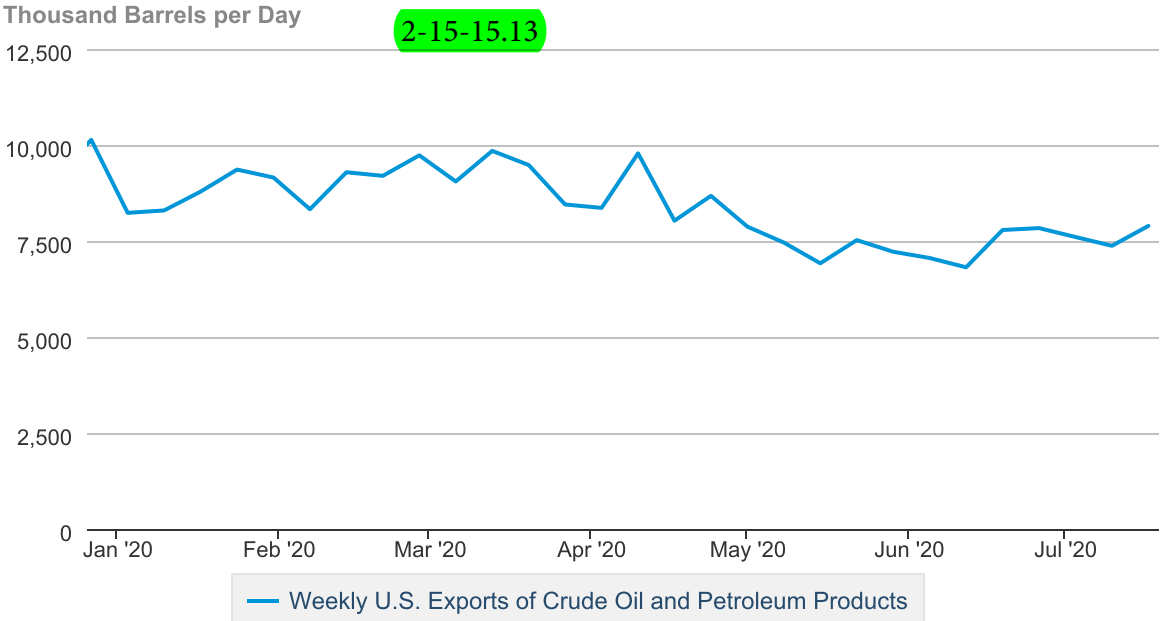
These numbers are based on reports from California refineries, and are subject to refinery revision and Energy Commission verification.

California Weekly Refinery Production and Stocks Levels (Thousands of Barrels)

Refinery Input

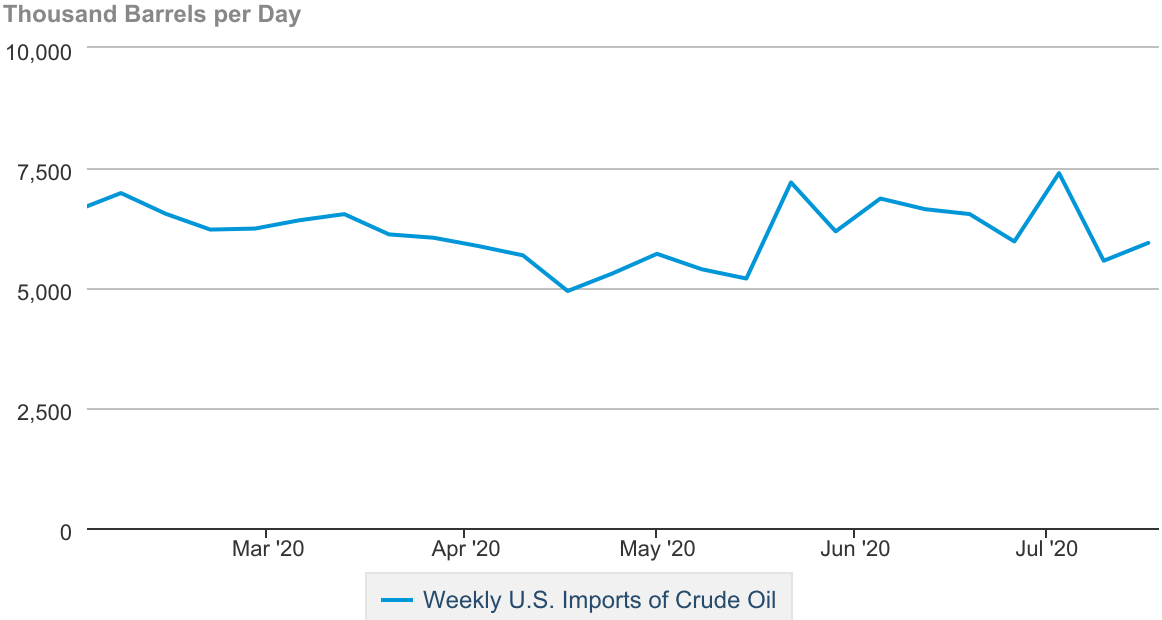
Production Type	07/17/2020	07/10/2020	Percent Change	One Year Ago	Percent Change
Crude Oil	8,293	8,597	-3.5%	12,189	-32%

Weekly U.S. Exports of Crude Oil and Petroleum Products



Source: U.S. Energy Information Administration

Weekly U.S. Imports of Crude Oil



Source: U.S. Energy Information Administration

Major Ship Types by Count
1-15 July 2020

2-15-15.14

15-Jul-20											Day of Current Month					
2020	2020	2020	2020	2020	2020	**2020**		Days in 2018-2019			**15**			Container ships per day average 2018 - 2019		
January	February	March	April	May	June	**July**		730	**Ships per day by type**					5.67		
Actual Ship Count								**Ships per day Ship Count**								
Actual	Actual	Actual	Actual	Actual	Actual	**Actual**	**Type of Ship**	**2018-2019 Average**	January	February	March	April	May	**June**	July	**Type of Ship**
35	33	34	35	23	23	**13**	**Foreign Tankers**	1.4	1.1	1.1	1.1	1.2	0.7	**0.8**	**0.9**	**Foreign Tankers**
172	135	145	156	132	153	**86**	**Container Ships**	**Color-coding is relative to 2018-2019 average**								**Container Ships**
5.5	4.7	4.7	5.20	4.4	5.1	**5.7**	**Container Ships per day**	5.7	5.5	4.7	4.7	5.2	4.3	**5.1**	**5.7**	**Container Ships per day**
16	18	22	14	9	6	**3**	**Vehicle Ships**	0.6	0.5	0.6	0.7	0.5	0.3	**0.2**	**0.2**	**Vehicle Ships**
40	31	21	0	0	0	**0**	**Passenger Ships**	1.0	1.3	1.1	0.7	0.0	0.0	**0.0**	**0.0**	**Passenger Ships**
19	15	24	18	10	21	**9**	**Bulk Carriers**	0.7	0.6	0.5	0.8	0.6	0.3	**0.7**	**0.6**	**Bulk Carriers**
6	16	10	1	20	16	**3**	**General Cargo**	0.5	0.2	0.6	0.3	0.0	0.6	**0.5**	**0.2**	**General Cargo**
58	47	50	94	42	37	**23**	**Bunkers Only**	1.2	1.9	1.6	1.6	3.1	1.4	**1.2**	**1.5**	**Bunkers Only**
411	344	371	394	294	305	**163**	**Total**									
13.3	11.9	12.0	13.1	9.5	10.2	**10.9**	**Ships/day**	12.5	13.3	11.9	12.0	13.1	9.5	**10.2**	**10.9**	**Ships/day**

2-15-15.15

ISGOTT

International Safety Guide for Oil Tankers and Terminals

Sixth Edition

International Chamber of Shipping
Shaping the Future of Shipping

OCIMF

1970 50 2020

IAPH
International Association of Ports and Harbors

First Published 1978, Second Edition 1984, Third Edition 1988, Third Edition Revised 1991, Fourth Edition 1996, Fifth Edition 2006, Sixth Edition 2020

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The International Chamber of Shipping (ICS) is the principal international trade association for the shipping industry, representing shipowners and operators in all sectors and trades.

ICS membership comprises national shipowners' associations in Asia, Europe and the Americas whose member shipping companies operate over 80% of the world's merchant tonnage.

Established in 1921, ICS is concerned with all technical, legal, employment affairs and policy issues that may affect international shipping. It represents shipowners with the various intergovernmental regulatory bodies that impact on shipping, including the International Maritime Organization (IMO).

ICS also develops best practices and guidance, including a wide range of publications and free resources that are used by ship operators globally.

Founded in 1970, the Oil Companies International Marine Forum (OCIMF) is a voluntary association of oil companies having an interest in the shipment and terminalling of crude oil, oil products, petrochemicals and gas, and includes companies engaged in offshore marine operations supporting oil and gas exploration, development and production.

Our vision is a global marine industry that causes no harm to people or the environment.

Our mission is to lead the global marine industry in the promotion of safe and environmentally responsible transportation of crude oil, oil products, petrochemicals and gas, and to drive the same values in the management of related offshore marine operations. We do this by developing best practices in the design, construction and safe operation of tankers, barges and offshore vessels and their interfaces with terminals and considering human factors in everything we do.

Founded in 1955, the International Association of Ports and Harbors (IAPH) is a non-profit-making global alliance of 170 ports and 140 port-related organisations covering 90 countries. Its member ports handle more than 60 percent of global maritime trade and around 80 percent of world container traffic. IAPH has consultative NGO status with several United Nations agencies. In 2018, IAPH established the World Ports Sustainability Program (WPSP). Guided by the 17 UN Sustainable Development Goals, it aims to unite sustainability efforts of ports worldwide, encouraging international cooperation between all partners involved in the maritime supply chain. WPSP (sustainableworldports.org) covers five main areas of collaboration: energy transition, resilient infrastructure, safety and security, community outreach and governance.

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Foreword

I am very pleased to introduce the revised Sixth Edition of the *International Safety Guide for Oil Tankers and Terminals*, or *ISGOTT* as it is generally known throughout the global tanker industry and amongst the Member States of the UN International Maritime Organization (IMO).

ISGOTT, first published in 1978, is now widely recognised as the definitive best practice guidance on tanker safety and pollution prevention, and is a perfect example of the good cooperation that exists between the IMO and the shipping industry the Organization regulates. The authors of this major publication – the International Chamber of Shipping (ICS), the Oil Companies International Marine Forum (OCIMF) and the International Association of Ports and Harbors (IAPH) – all enjoy consultative status with the IMO and contribute significantly to its work through their active participation at IMO meetings.

I believe that a reason why *ISGOTT* has endured, and is so highly regarded, is the vital complementary role it plays in working alongside the comprehensive framework of global shipping regulation that has been adopted by the IMO to help ensure safe and pollution-free ship operations.

Global maritime regulations, enforced by Flag States, are vital for ensuring that all ships, regardless of flag, can operate safely and efficiently wherever in the world they are trading. However, further detailed guidance on best operational practice is leveraged from the vast experience of industry professionals. Industry publications such as *ISGOTT* are therefore crucial for ensuring that the aims and objectives of IMO instruments, such as the MARPOL and SOLAS Conventions, are achieved in real life.

The safety record and the environmental performance of the tanker industry has improved substantially since the adoption by the IMO of its many Conventions and Codes. This impressive improvement in performance has not been delivered by regulation alone. It is a testimony to the good practices deployed, and constantly refined, by the industry itself and the dedication and huge professionalism of the seafarers and other personnel it employs.

This firm commitment by the industry to continuous improvement is a concept fully embraced by the IMO's ISM Code, and I believe this is clearly demonstrated by the industry's ongoing efforts to keep *ISGOTT* updated.

I fully support the industry-wide collaboration that has made this new edition of *ISGOTT* possible. This is crucial to ensuring that the maritime industry will not only contribute to maintaining and further improving its excellent safety record and reducing its environmental impact, but will also bring us ever closer to the ultimate goal of zero accidents.

Kitack Lim
Secretary-General
International Maritime Organization

Introduction to the Sixth Edition

Effective management of health, safety and environmental protection is critical to the tanker and terminal industry and the *International Safety Guide for Oil Tankers and Terminals (ISGOTT)* has become the standard reference on the safe operation of oil tankers and the terminals they serve.

ISGOTT was first published in 1978 by combining the contents of the *Tanker Safety Guide (Petroleum)* published by the International Chamber of Shipping (ICS) and the *International Oil Tanker and Terminal Safety Guide* published on behalf of the Oil Companies International Marine Forum (OCIMF). This revision of *ISGOTT* updates and replaces the prior Fifth Edition that was published in 2006 and has been reviewed by OCIMF and ICS together with the International Association of Ports and Harbors (IAPH). In addition, support has also been provided by other industry associations including the International Association of Independent Tanker Owners (INTERTANKO), the Society of International Gas Tanker and Terminal Operators (SIGTTO) and the Society for Gas as a Marine Fuel (SGMF), as well as specialists in topics such as human factors.

Through the combined effort of multidisciplinary subject matter experts from these industry leading organisations, this publication has been enhanced to ensure that it continues to reflect current best practice and legislation and, as a result, will maintain its position as a definitive reference for the safe operation of oil tankers and the marine terminals they visit.

This Sixth Edition encompasses the latest thinking on a range of topical issues including gas detection, the toxicity and the toxic effects of petroleum products (including benzene and hydrogen sulphide), the generation of static electricity and stray currents, fire protection and the growing use of mobile electronic technology.

In addition, the opportunity was taken to include new topics or to significantly reappraise topics previously covered that have undergone a shift in emphasis since the Fifth Edition. These include:

- Enclosed space entry.
- Human factors.
- Safety Management Systems (SMSs), including complementary tools and processes such as permits to work, risk assessment, Lock-out/Tag-out (LO/TO), Stop Work Authority (SWA) and their linkage to the underlying principles of the *International Safety Management (ISM) Code*.
- Marine terminal administration and the critical importance of the tanker/terminal interface.
- Alternative and emerging technologies.
- Bunkering operations, including the use of alternative fuels such as Liquefied Natural Gas (LNG).
- Cargo inspectors.
- Alignment with OCIMF's recently revised *Mooring Equipment Guidelines*.
- Maritime security and linkage to both the *International Ship and Port Facility Security (ISPS) Code* and industry's maritime security *Best Management Practices (BMP)*.

The Ship/Shore Safety and Bunkering Operations Checklists have also been completely revised to reflect changes in the understanding of the impact of human factors in their effective use. The importance of ensuring that individual and joint responsibilities for the tanker and the terminal are clearly communicated before arrival, as well as when alongside, is central to this objective.

The Sixth Edition of *ISGOTT* retains the four section format of:

Part 1 General Information
Part 2 Tanker Information
Part 3 Marine Terminal Information
Part 4 Ship/Shore (Tanker/Terminal) Interface

Care has been taken to ensure that where the guidance given in previous editions is still relevant and accurate, any amendments, changes or deletions have only enhanced the content and not diminished the ethos of ensuring the health, safety and environmental protection of those who use the guide.

The authors believe that *ISGOTT Sixth Edition* continues to provide the best technical guidance on oil tanker and terminal operations. All operators are urged to ensure that the recommendations in this guide are not only read and fully understood, but are also followed through their SMSs and procedures.

Purpose and Scope

The primary purpose of the *International Safety Guide for Oil Tankers and Terminals (ISGOTT)* is to provide operational advice to assist personnel directly involved in tanker and terminal operations. It makes recommendations for tanker and terminal personnel on the safe carriage and handling of crude oil and petroleum products on tankers and at terminals. It does not, however, provide a definitive description of how tanker and terminal operations are conducted.

To achieve its purpose *ISGOTT* provides guidance on, and examples of, certain aspects of tanker and terminal operations and how they may be managed. Effective management of risk demands SMSs, processes and controls and procedures that can quickly adapt to change. Therefore, the guidance given is, in many cases, intentionally non-prescriptive and alternative procedures may be adopted by operators in the management of their operations. These alternative procedures may exceed the recommendations contained in this guide and are strongly encouraged where they will further enhance the safety objective.

When adopting alternative procedures, operators should follow a risk-based management process that incorporates systems for identifying and assessing the risks and for demonstrating how they are safely managed. Guidance in the Sixth Edition is aimed at further assisting operators of tankers and marine terminals in these principles of safe management. For shipboard operations, this course of action must satisfy the requirements of the ISM Code.

In all cases, the advice given in *ISGOTT* is subject to any international, national or local regulations that may be applicable and is intended only to complement or strengthen those requirements. Companies responsible for the operation of tankers and terminals should ensure that they are aware of any such requirements and ensure full compliance.

It is recommended that a copy of *ISGOTT* is kept and used on board every tanker and in every marine terminal to provide advice on operational procedures and the shared responsibility for operations at the ship/shore interface.

Certain subjects are dealt with in greater detail in other publications issued by the IMO, ICS or OCIMF or by other maritime industry organisations. Where this is the case, an appropriate reference is made and a list of these publications is given in the bibliography.

It is not the purpose of the guide to make recommendations on design or construction of tankers. Information on these matters may be obtained from national authorities and from authorised bodies such as Classification Societies. Similarly, the guide does not attempt to deal with certain other safety related matters, e.g. navigation, helicopter operations and shipyard safety, although some aspects are inevitably touched upon.

It should also be noted that the scope of *ISGOTT* relates only to cargoes of crude oil and petroleum products that are carried in oil tankers, chemical tankers, gas carriers and combination carriers certified for the carriage of petroleum products. Therefore, it does not cover the carriage of chemicals or liquefied gases other than in the context of where they may be used on board oil tankers, e.g. LNG as a marine fuel. The carriage of chemicals and gases as cargo are the subject of other industry guides.

Industry guidance such as *ISGOTT* is based on the best knowledge and information available to the authors. Irrespective of this and the subject matter, or how strong and important the information provided, the industry is not in a position to mandate its own advice. For this reason, industry guidance in *ISGOTT* is characterised by the word 'should'. IMO regulations implemented by national administrations are legally enforceable and, therefore, when *ISGOTT* references such regulations or their implications the term used is 'must'.

Finally, the guide is not intended to encompass offshore facilities such as Floating Production Storage and Offloading Units (FPSOs) and Floating Storage Units (FSUs); operators of such units may, however, wish to consider the guidance given to the extent that good tanker practice is equally applicable to their operations.

Comments and suggestions for improvement are always welcome for possible inclusion in future editions. They may be addressed to any of the three sponsoring organisations as follows:

International Chamber of Shipping
38 St Mary Axe
London
EC3A 8BH
United Kingdom
web: www.ics-shipping.org

Oil Companies International Marine Forum
29 Queen Anne's Gate
London
SW1H 9BU
United Kingdom
web: www.ocimf.org

International Association of Ports and Harbors
7th Floor
South Tower New Pier Takeshiba
1-16-1 Kaigan
Minato-ku
Tokyo 105-0022
Japan
web: www.iaphworldports.org

CHAPTER 8

Alternative and Emerging Technologies

This chapter describes how alternative and emerging technologies can be assessed to make sure they do not affect safety on tankers and terminals. The due diligence process can be used in the tanker's SMS and safety manuals on the terminal. For more detail on alternative and emerging mooring technologies, see OCIMF's *Mooring Equipment Guidelines*.

8.1 Definition

Alternative technologies are technologies that have a documented track record in another sector but are not yet adopted in the tanker and terminal sector.

Emerging technologies are technologies that do not have a documented track record in any sector but could be developed in the future to improve the safety and the efficiency of the tanker and terminal sector.

In both cases, no known best practice would exist for the tanker and terminal sectors.

8.2 Examples

At the time of publication, the following alternative or emerging technologies exist:

- Marine Autonomous Surface Ships (MASS).
- Autonomous Underwater Vehicles (AUV).
- Marine mobile technology, e.g. intrinsically safe electronic tablets and telephones.
- Aerial drones.
- Robotic crawlers.
- Cold ironing.
- Methanol bunkering.
- Hydrogen fuel cell management.
- Electric cell propulsion power supply.

The list is not exhaustive. This guide does not endorse or oppose the listed technologies, but they may be considered for use following a structured due diligence and formal risk assessment process.

8.3 Due diligence process

8.3.1 Evaluation

Before considering the adoption of an alternative or emerging technology, a preliminary design review should be completed to evaluate the:

- General description and its equivalency to existing technologies.
- Functional description and its equivalency to existing technologies.
- Interface with existing technologies.
- Interface with existing systems and operational processes.
- Preliminary documentation, design drawings, general arrangements, product specifications and applicable codes and standards.
- Detailed formal safety and operational risk assessment plans, including assessments of human factors.
- Any additional design basis documentation.
- Consistency with other industry reference materials, e.g. the World Association for Waterborne Transport Infrastructure (PIANC) or the International Association of Classification Societies (IACS).

8.3.2 Impact

The tanker and terminal should complete an impact assessment before agreeing to use an alternative or emerging technology at the marine interface. This process should be documented and ensure that both parties have assessed and understood the risks of using the alternative or emerging technology.

If either the tanker or terminal is unable to complete the impact assessment, they should tell the other party what technology is being used and share any relevant documentation to support its use, e.g. the risk assessment and evaluation reports of design and product specifications.

If the alternative or emerging technology only affects the tanker or the terminal, the above exchange does not need to happen unless a general understanding would be useful.

8.3.3 Equivalency

Equivalency should be demonstrated through detailed data analysis of engineering or design studies, prototype and/or on-site testing and experience. Compare the data analysis of the alternative or emerging technology with the existing technology it is replacing or being used alongside.

Equivalency should show that the alternative or emerging technology is at least as good as the existing technology in delivering:

- The safety of tanker and terminal personnel.
- The assurance that the risks continue to be effectively managed.
- Suitable margins of safety that include the probability and consequence of system failure.
- Operational effectiveness and integrity.
- Compliance with applicable regulations, standards and recommended industry guidance and best practices.

8.3.4 Formal safety risk assessments

Formal, documented and detailed safety risk assessments should be carried out to understand the risks of using alternative or emerging technologies. It is recommended that personnel conducting these risk assessments:

- Are experienced in the methods of risk assessment being used.
- Have a detailed working knowledge of the alternative or emerging technology, the equivalent existing technology and industry best practices.

Classification Societies, marine consultants or other organisations may provide an independent formal safety risk assessment or guidance on how to effectively evaluate alternative and emerging technologies.

The IMO also provides guidance to administrations for approving alternatives and equivalents in MSC.1/Circ.1455 *Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments.*

Factors to consider in a formal safety risk assessment of an alternative or emerging technology include:

- Hazards associated with the alternative or emerging technology and/or its equivalency.
- Safeguards incorporated into the design of the alternative or emerging technology, including measures to ensure the safety of personnel.
- Human factors and any risk reducing benefits from adopting the alternative or emerging technology.
- Risk modelling to identify frequencies and potential consequences of hazards.
- Risks related to the local conditions and locally required operations.
- Issues that may require further detailed analysis and testing/evaluation.
- Issues that may require special attention with respect to operations, inspection and maintenance, including personnel, equipment and systems redundancy.
- How the alternative or emerging technology works under different environmental conditions, e.g. air temperature, marine spray or ice.

8.3.5 Stakeholder engagement

The number and type of stakeholders involved in evaluating an alternative or emerging technology will depend on its impact and the complexity of its implementation.

Stakeholder mapping is recommended for identifying stakeholders who are important to the evaluation and success of the alternative or emerging technologies.

12-15-15.16

GUIDANCE NOTES ON

QUALIFYING NEW TECHNOLOGIES

APRIL 2017

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

ABS Plaza
16855 Northchase Drive
Houston, TX 77060 USA

Foreword

The marine and offshore industries regularly develop new technologies that have no service history in the proposed application or environment. Often, governing industry codes and regulations do not develop at the same pace as technology. These new technologies have little or no precedent and may be so different from existing designs that the requirements contained in class Rules may not be directly applicable.

These Guidance Notes describe the ABS approach for qualification of new technologies to confirm their ability to perform intended functions in accordance with defined performance requirements. This document also provides details regarding the required submittals and the key interaction points with ABS during the new technology development to benefit from ABS involvement as a trusted advisor.

A systems engineering approach to qualification is introduced in this document that allows for systematic and consistent evaluation of new technologies as they mature from a concept through confirmation of operational integrity in their intended applications. The approach is divided into a five stage process that is aligned with the typical product development phases of a new technology:

- Feasibility Stage
- Concept Verification Stage
- Prototype Validation Stage
- System Integration Stage
- Operational Stage

Completion of qualification activities within each stage of the new technology qualification process results in a Statement of Maturity issued to the client attesting to the maturity level of the new technology. Upon completion of the Prototype Validation Stage, the new technology may be "Type Approved" under the ABS Type Approval Program to limit repeated evaluation of identical designs for eligible products. During the Prototype Validation Stage, if all the engineering evaluations have been completed, a Product Design Assessment (PDA) can be issued prior to further consideration for ABS Type Approval.

The integration of the new technology qualification process with the Novel Concept Class Approval process (as presented within the ABS *Guidance Notes on Review and Approval of Novel Concepts*) provides end users of the qualified technologies with the added benefit that the transition from new technology qualification to Class Approval will be seamless. It provides regulatory agencies with the confidence that all hazards associated with the introduction of the new technology to the market has been systematically identified and mitigated. It is to be noted that when applying these Guidance Notes for certification or classification purposes in conjunction with Novel Concept Class Approval process, the primary driver for classification acceptance will be safety even though there may be additional functional requirements (e.g., reliability) defined by the client.

These Guidance Notes become effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of these Guidance Notes is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.

Terms of Use

GUIDANCE NOTES ON

QUALIFYING NEW TECHNOLOGIES

CONTENTS

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SECTION 1 Introduction

1 Overview

These Guidance Notes describe the ABS approach for qualification of new technologies to confirm their ability to perform intended functions in accordance with defined performance requirements. They also provide details of the required submittals, the ABS review process and the key interaction points with ABS during the new technology development.

This document introduces a systems engineering approach to qualification that allows for systematic and consistent evaluation of new technologies as it matures from a concept through confirmation of operational integrity in its intended application. The approach is divided into a multi-stage process that is aligned with the typical product development phases of a new technology. The qualification activities within each stage employ risk assessments and engineering evaluations that build upon each other in order to determine if the new technology provides acceptable levels of safety in line with current offshore and marine industry practice. The qualification efforts by all stakeholders including the vendor, system integrator and end-user at each stage are recognized and captured within a new technology qualification plan (NTQP). Completion of qualification activities as identified within each stage of the NTQP results in a Statement of Maturity being issued by ABS attesting to the maturity level of the new technology.

The process is also compatible with approaches based on technology readiness levels (TRLs), (e.g. API RP 17N/Q, ISO 16290/NASA, and US DoD); and can be tailored to projects that require the use of multiple pathways to qualification. The comparison of ABS Qualification Stages with industry TRLs can be found in Appendix 2.

It is to be noted that when applying these Guidance Notes for certification or classification purposes in conjunction with Novel Concept Class Approval process, the primary driver for classification acceptance will be safety even though there may be additional functional requirements (e.g., reliability) defined by the client.

3 Background

The marine and offshore industries regularly develop new technologies that have no service history in the proposed application or environment. Often, governing industry codes and regulations do not develop at the same pace. These new technologies have little or no precedent and may be so different from existing designs that the requirements contained in class Rules may not be directly applicable.

Marine vessels and offshore units which contain new technological features or designs that are not currently governed by Rules, Guides and existing industry standards may still be qualified and/or approved by ABS through the process described in these Guidance Notes. This qualification is on the basis that the Rules, Guides, and existing industry standards, insofar as applicable, have been complied with, and that special consideration through appropriate risk assessments and engineering evaluations has been given to the new features through the application of these Guidance Notes.

These Guidance Notes are structured to provide a general procedure for vendors/system integrators/end-users to guide them through the process of obtaining Statements of Maturity attesting to the maturity level of new technologies. The process can be applied to technologies seeking qualification independent of class approval or installation on ABS classed assets.

The integration of the new technology qualification process and the Novel Concept Class Approval process provides end users of the qualified technologies with the added benefit that the transition from new technology qualification to Class Approval will be seamless. It provides regulatory agencies with the confidence that hazards associated with the introduction of the new technology has been systematically identified and mitigated.

5 Application

These Guidance Notes are in general applicable to all new technologies for offshore units and marine vessels that do not follow typical Rules, Guides, or industry codes or standards. This document provides guidance to parties seeking recognition for the maturity level of a proposed new technology.

A new technology for the purpose of these Guidance Notes is defined as any design (material, component, equipment or system), process or procedure which does not have prior in-service experience, and/or any classification rules, statutory regulations or industry standards that are directly applicable. It is possible to categorize the type of "novelty" in one of four categories:

i) Existing design/process/procedures challenging the present boundaries/envelope of current offshore or marine applications

ii) Existing design/process/procedures in new or novel applications

iii) New or novel design/process/procedures in existing applications.

iv) New or novel design/process/procedures in new or novel applications

An asset such as a marine vessel or an offshore unit becomes a novel concept if the incorporation of any new technology(ies) appreciably alters its service scope, functional capability, and/or risk profile. Novel concepts are typically presented to ABS for review and class approval following the process in the ABS *Guidance Notes on Review and Approval of Novel Concepts (Novel Concept Guidance Notes).*

The New Technology Qualification (NTQ) process could be applicable in the following cases:

i) To qualify new technology that may need to be classed or certified at a later date

ii) To simultaneously qualify new technology identified while seeking class approval for a novel concept

iii) To qualify a new technology independent of the need to be classed or certified

If the proposed new technology is intended for incorporation on an asset to be classed by ABS, then it is recommended that the new technology complete up to and including the System Integration Stage of the New Technology Qualification (NTQ) process. In other cases, the level of maturity to which the new technology may be qualified depends on the client's request. New technology qualification could be requested from ABS at any level of indenture as desired such as component, sub-system or system level.

The process is designed to accommodate cases where multiple vendors, system integrators, and/or end-users need to work together to qualify a combination of new technologies. In such cases, it is important for the teams to work together to integrate technologies as early as possible in order to optimize the process. Even though these Guidance Notes are primarily intended for the qualification of new technologies, the approach could also be applied to qualify existing technologies.

7 New Technology Qualification Process

The NTQ process confirms the ability of a new technology to perform its intended functions in accordance with defined performance requirements. The process starts with a comprehensive description of the technology to be qualified, followed by a screening of the technology to reveal the new or novel features that the qualification should focus on.

The process is divided into five sequential stages that progressively qualify the technology from feasible to operational stages as requested. The five qualification stages are:

i) Feasibility Stage

ii) Concept Verification Stage

iii) Prototype Validation Stage

iv) System Integration Stage

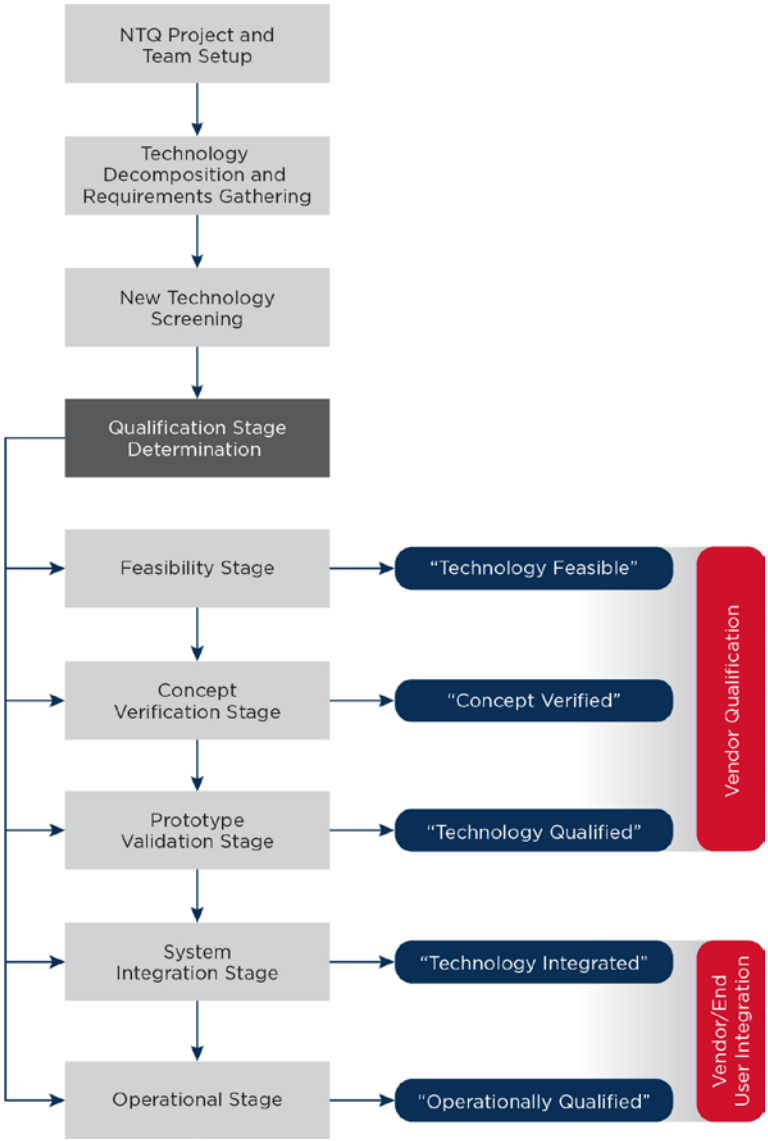
v) Operational Stage

Qualification activities outlined in the New Technology Qualification Plan (NTQP), are to be performed within each stage and should be defined at the end of the previous stage as agreed between the client and ABS. The qualification activities are based on the information available depending on the maturity level and based on the findings and knowledge gained in the previous stages completed. Typically, there are two main sets of activities within each stage, namely, engineering evaluations and risk assessments.

Upon completion of each of the five stages, a Statement of Maturity will be issued to the vendor(s) and the technology can progress to the next stage of maturity. It is envisioned that some vendors may have developed technologies to a level beyond the Feasibility Stage prior to contacting ABS for this qualification service. In such cases, ABS would perform an assessment of the current stage of technology development and endorse the technology with the applicable Statement of Maturity based on this assessment. The technology qualification can then proceed starting at that stage and continuing to the subsequent stages. Additionally, the new technology qualification process can be stopped at any stage, and restarted at an agreed upon time.

Section 1, Figure 1 provides a basic overview of the process along with the Statements of Maturity issued. Further guidance on each topic and deliverables that are to be submitted to ABS for review can be found in later Sections.

FIGURE 1
New Technology Qualification Process



9 ABS Type Approval Program

New technologies that have completed the Prototype Validation Stage of the NTQ process or have been "Technology Qualified", and can be consistently manufactured to the same design and specification may be "Type Approved" under the ABS Type Approval Program. During the Prototype Validation Stage, if all the engineering evaluations have been completed, a Product Design Assessment (PDA) can be issued prior to further consideration for ABS Type Approval. The ABS Type Approval Program is a voluntary option for the demonstration of compliance of a system or product with the defined performance requirements as derived from Rules, Guides, or other recognized standards. It may be applied at the request of the vendor or manufacturer. The suitability of the ABS Type Approval Program for the proposed new technology will be determined on a case-by-case basis.

Specific requirements and details regarding the ABS Type Approval Program can be found in 1-1-4/7.7 and Appendix 1-1-A3 of the ABS *Rules for Conditions of Classification (Part 1).*

11 Definitions

As Low As Reasonably Practicable (ALARP). Refers to a level of risk that is neither negligibly low nor intolerably high, for which further investment of resources for risk reduction is not justifiable. Risk should be reduced to ALARP level considering the cost effectiveness of the risk control options.

Approval. Confirmation that the plans, reports or documents submitted to ABS have been reviewed for compliance with one or more of the required Rules, Guides, standards or other criteria acceptable to ABS.

Availability. Ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided (ISO 14224).

Boundary. Interface between an item and its surroundings (ISO 14224).

Client. The vendor, OEM, manufacturer, asset owner/operator of the new technology or novel concept, representing any party or parties that have a stake or interest in the design or third party groups working under or for these entities.

Consequence. The measure of the outcome of an event occurrence in terms of people affected, property damaged, outage time, dollars lost or any other chosen parameter usually expressed in terms of consequence per event or consequence amount per unit of time, typically per year.

Controls. The measures taken to prevent hazards from causing undesirable events. Controls can be physical (e.g., safety shutdowns, redundant controls, added conservatism in design, etc.), procedural (e.g., operating procedures, routine inspection requirements, etc.) and can also address human factors (employee selection, training, supervision).

Critical Assumption. An assumption that if found not true will change the conclusions of the study that used such assumption.

Engineering Evaluations. Various engineering analysis tools and testing that may be used to support new technology qualification activities. Typical examples include but not limited to the following: Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), Functional and Performance Testing, Model Testing, System Integration Testing, etc.

Failure. The loss of the ability to perform the intended function.

Failure Causes. Circumstances associated with design, manufacture, installation, use and maintenance that have led to a failure (ISO 14224).

Failure Mechanism. A physical or chemical process resulting in a form of damage which will ultimately lead to failure.

Failure Mode. The specific manner of failure that the failure mechanism produces.

Functional Specification. Document that describes the features, characteristics, process conditions, boundaries and exclusions defining the performance and use requirements of the product, process or service (ISO 13880).

Frequency. The occurrence of a potential event per unit of time, typically expressed as events per year.

Global Effects. Total effect an identified failure has on the operation, function or status of the installation or vessel and end effects on safety and the environment.

Hazards. Conditions that exist which may potentially lead to an undesirable event.

Indenture Level. The level of subdivision of an item from the point of view of maintenance action (ISO 14224).

Item. Any part, component, device, subsystem, functional unit, equipment or system that can be individually considered (ISO 14224).

Local Effects. Impacts that an identified failure mode has on the operation or function of the item under consideration or adjacent systems.

Maintainability. Ability of an item under given conditions of use, to be retained in, or restored to, a state in which it can perform a required function, when maintenance is performed under given conditions and using stated procedures and resources (ISO 14224).

Manufacturing Assessment (MA). An inspection of the product during manufacture, an assessment of the quality control system and manufacturing processes that must be satisfactorily completed if the manufacturer wants a product to be labeled "Type Approved" under the ABS Type Approval Program.

Manufacturing Plan. Document setting out the specific manufacturing practices, technical resources and sequences of activities relevant to the production of a particular product including any specified acceptance criteria at each stage (ISO 13880).

Product Design Assessment (PDA). Technical evaluation of a product for potential use on ABS-classed assets. The process involves ABS Engineers verifying product compliance with manufacturers' specifications, applicable ABS Rules and national or international standards.

Quality Assurance and Quality Control. Typical quality plans and related processes for controlling quality during production.

Qualification. The process of confirming, by examination and provision of evidence, that equipment meets specified requirements for the intended use (API RP 17N).

Qualification Activities. Usually in the form of risk assessments, engineering evaluations, and testing that is required to be performed in order to mature the new technology to the next stage.

Qualification Plan. A document containing the qualification activities listed to mature the new technology to the next qualification stage. This is submitted as a New Technology Qualification Plan (NTQP) report.

Redundancy. Existence of more than one means for performing a required function of an item (ISO 14224).

Reliability. Ability of an item to perform a required function under given conditions for a given time interval (ISO 14224).

Risk. The product of the frequency with which an event is anticipated to occur and the consequence of the event's outcome.

Risk Profile. Description of any set of risks (ISO 31000).

Technical Specification. Document that defines technical requirements to be fulfilled by the product, process or service in order to comply with the functional specification (ISO 13880).

Type Approval. A voluntary ABS Program for product certification that is used to demonstrate a product manufacturer's conformance to the Rules or other recognized standards. The Product Design Assessment (PDA) and Manufacturing Assessment (MA) together result in a Type Approval or a "Type Approved" product.

Validation. The process of evaluating a production unit (or full scale prototype) to determine whether it meets the expectations of the customer and other stakeholders as shown through performance of a test, analysis, inspection, or demonstration.

Verification. The process of evaluating a system to determine whether the product of a given development stage satisfy the approved requirements and can be performed at different stages in the product life cycle by test, analysis, demonstration, or inspection.

13 Abbreviations

ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute Recommended Practice
CFD	Computational Fluid Dynamics
FEA	Finite Element Analysis
FMECA	Failure Mode Effects and Criticality Analysis
FTA	Fault Tree Analysis
HAZOP	Hazard and Operability
HAZID	Hazard Identification
HFE	Human Factors Engineering
ITP	Inspection Test Plan
MA	Manufacturing Assessment
MTBF	Mean Time Between Failure
NTQ	New Technology Qualification
NTQP	New Technology Qualification Plan
PDA	Product Design Assessment
PFD	Process Flow Diagram
P&ID	Piping and Instrumentation Diagram
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RAM	Reliability, Availability and Maintainability
RBD	Reliability Block Diagram
SRDD	Systems Requirements and Description Document
SIT	Systems Integration Test
US DoD	United States Department of Defense

SECTION 2 Getting Started

1 New Technology Qualification Project and Team Setup

Once the client (vendor/system integrator/end-user) requests qualification of a technology using these Guidance Notes, a project kick-off meeting is scheduled. At this meeting, the client presents to ABS a brief overview of their proposed technology along with their expectations, any ongoing qualification activities (if initiated) and project timelines. ABS will advise the client if new technology qualification is the most appropriate path for proceeding and recommend next steps.

The kick-off meeting is followed by the establishment of a new technology qualification team. An important factor for a successful technology qualification is the composition of the qualification team. The qualification process involves the interaction of two teams: the vendor or client team (design team) and the ABS-designated review team.

For each NTQ project, depending on the complexity of the proposed new technology, ABS may establish a special multidisciplinary review team comprised of ABS staff members. The composition of the team will depend on the technical areas involved in the project as well as the physical location of the client's engineering and testing facilities. This will help the client benefit from technical review and comment from our subject matter experts throughout the qualification process. One of the members will be the designated NTQ project lead to act at as the client's main point of contact throughout the NTQ process. All ABS team members will be covered under the confidentiality/non-disclosure agreement that is typically signed between ABS and clients for this type of qualification services.

It is encouraged whenever possible to include ABS, system integrators and end users of the new technology early in the qualification process. This will facilitate the identification and alignment of requirements early in the design process avoiding costly design modifications later. If applicable, input from regulatory agencies (including flag Administration) will also help align the qualification activities with requirements or other expectations.

3 New Technology Decomposition and Requirements Gathering

3.1 Introduction

The NTQ process follows a systems engineering approach to qualifying new technology. This approach focuses on the following elements:

- Defining goals of the new technology
- Identifying the functional requirements to meet the goals
- Identifying the performance requirements for the functional requirements
- Performing qualification activities to verify and validate the performance requirements

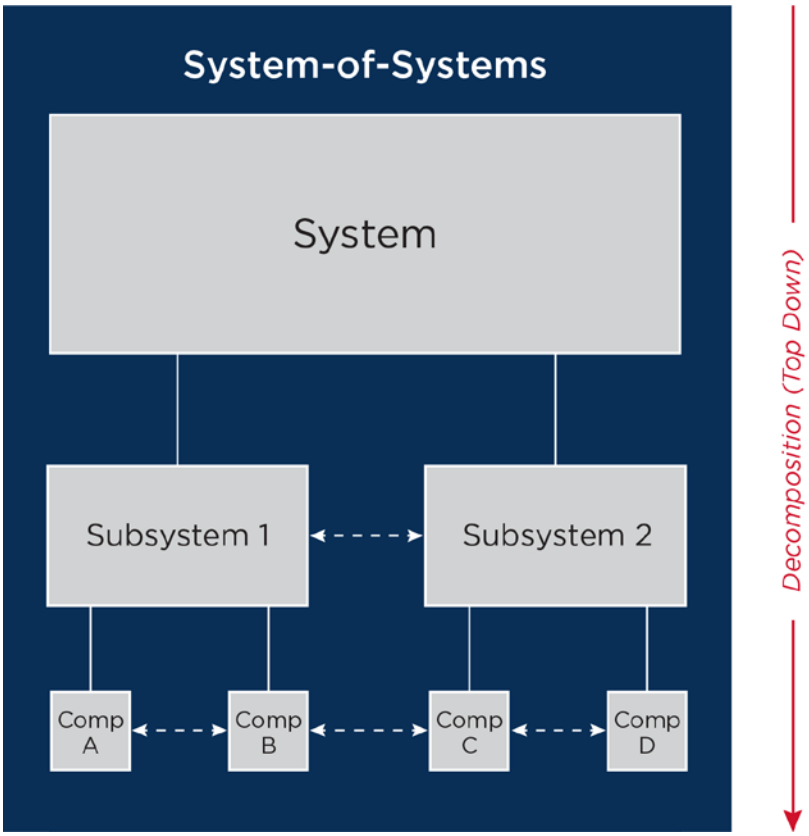
The qualification process starts with a top-down system decomposition, wherein the system is divided into subsystems, which are further broken down into components. This decomposition process is used in order to achieve the following:

- Mapping functional requirements of the system to item(s) (e.g., subsystems or components) identifying ownership of a specific functional requirement,
- Mapping functional requirements to specific performance requirements,
- Confirming that all defined functional requirements can be addressed by configurable items,
- Identifying new technology items prior to determining if qualification is needed and what interactions between items need to be considered.

Depending on the type of item for which the client is seeking qualification, the NTQ process can be tailored. This is applied by considering the different categories of new technology as defined in Subsection 1/5 and understanding what exactly has changed to focus qualification efforts.

The maximum maturity level of the system is based on the individual qualification of each item(s). For example, the overall maturity level of the system is equal or lower than that of the subsystems, which are equal or lower than that of the individual components. The decomposition, system hierarchy and interactions between all items are depicted in Section 2, Figure 1.

FIGURE 1
New Technology System Hierarchy



The item for which new technology qualification is desired could be at any level of indenture within the system hierarchy. System-of-Systems (SoS) refers to the larger system with which integration of the new technology could occur. This SoS could be another system or an asset such as a marine vessel or an offshore unit. The asset becomes a novel concept if the incorporation of any new technology(ies) appreciably alters its service scope, functional capability, and/or risk profile.

3.3 New Technology System Requirements and Description Document

Properly defining a new technology is a critical aspect of NTQ. For this purpose, a system requirements and description document (SRDD) should be developed for the new technology and maintained throughout the NTQ process. This document defines and sets the baseline requirements for the new technology and may be derived from functional and technical specifications. The requirements will be defined for each level within the system hierarchy as applicable. As the design matures through development and more knowledge is gained through qualification, these requirements may be subject to change. The SRDD will need to be updated accordingly.

3.3.1 Defining System Requirements

3.3.1(a) Goals. The goals defined for the new technology should identify the high-level scope, objectives, or requirements that the new technology needs to meet. Goals may be derived from client's needs, mission, measures of effectiveness, environmental or application constraints, program/policy decisions and/or requirements derived from tailored specifications or standards.

3.3.1(b) Functional Requirements. Functional requirements define each function that the system is required to perform. The functional requirements should be mapped to specific items that will perform the function and typically includes a description of the function to be performed, the environment within which the function should be performed, the conditions under which the system should start the function and the conditions under which the system should terminate the function.

3.3.1(c) Performance Requirements. The performance requirements define how well each functional requirement should be accomplished, and the set of performance metrics including identification of critical performance parameters. The performance requirements can be defined qualitatively at early design stages and progressively more quantitatively during subsequent stages of technology maturation. In case where performance requirements are not defined because of the novelty of the technology, the requirements should be extrapolated from existing Rules, Guides, and/or other industry standards. Any relevant requirements from regulatory agencies or Flag Administration should be also considered. The performance criteria is the acceptance criteria against which the results of each qualification activity is evaluated.

The requirements should be defined according to NATO AVT-092 "Qualification by Analysis" and/or ISO 13879 "Petroleum and natural gas industries – Content and drafting of a functional specification". The aspects to consider for inclusion while defining functional requirements and related performance requirements may vary depending on the new technology to be qualified but typical considerations include:

3.3.1(d) Design Conditions. The system design conditions describe all applicable loading requirements under the environmental and operating conditions. This should include, but not be limited to, the natural environment (e.g., temperature and chemical exposure), the induced environment (e.g., vibration and noise), electromagnetic signal environment, and threats. Typical loading and design conditions to be considered include, but are not limited to, the following:

- Pressure and temperature induced loads and fluctuations
- Static and dynamic loads
- Fatigue and fracture effects
- Wear and vibration effects
- Material degradation and associated loss from damage mechanisms
- Accidental loads (as applicable)

3.3.1(e) System Interface Requirements. The system interface requirements define all internal and external physical and functional interfaces (e.g., mechanical, electrical, etc.) relevant to the new technology. Interfaces among system elements should also include interfaces with the human element. The system interface definition confirms that various elements of the system can functionally and physically interact with each other and with all external systems they connect to or communicate with. A graphic description of the interfaces can be used when appropriate for clarity.

3.3.1(f) Human System Integration Requirements. Human factors play an important role for the system to work safely and effectively in achieving required functions and goals, and should be considered throughout the design life of the new technology. Human factors requirements (ergonomics) define the characteristics of human system interaction in terms of usability, safety, human reliability, performance, effectiveness, efficiency, maintainability, and health. It is important that human factors be considered during early design stages.

Human Factors Engineering (HFE) is a specialized engineering discipline that integrates human behavioral and physical capabilities and limitations with traditional engineering disciplines to produce a human-system interaction that maximizes the best of both, allowing both the human and system to work together in achieving functional and performance requirements.

The focus of HFE is the design of the human-system interface. This includes interfaces between personnel and the hardware, software, and physical environments associated with systems. It also involves the interfaces between personnel, individual tasks, and the overall work system (e.g., its structure, management, policies, and procedures). A good starting point is defining usability requirements which identify user needs and expectations. Usability requirements define the appropriate allocation of functions between users and the technology as well as the measurable effectiveness, efficiency, and satisfaction criteria in specific contexts of use.

During the design process, specific areas, stations, or equipment arrangement that would require concentrated human engineering attention should be defined. Any special requirements, such as constraints on allocation of functions to personnel and communications and personnel/equipment interactions, should be specified. Successful application of HFE depends on a proper process of conducting the appropriate activities in the various stages of the development lifecycle of the system.

Further guidance on Human Factors Engineering can be found in the following references:

- ABS *Guide for Ergonomic Notations*
- ABS *Guidance Notes on the Implementation of Human Factors Engineering into the Design of Offshore Installations*
- ABS *Guidance Notes on the Application of Ergonomics to Marine Systems*
- ABS *Guidance Notes on Ergonomic Design of Navigation Bridges*
- *Standard Human Engineering Program Requirements for Ships and Marine Systems, Equipment and Facilities, Standard 1337. American Society of Testing and Materials (ASTM) (2010)*
- *Common Requirements, Architectural Components & Equipment (C-CR-002). Norwegian Oil Industry Association and the Federation of Norwegian Engineering Industries (NORSOK). (1996)*
- *Working Environment (S-002). Norwegian Oil Industry Association and the Federation of Norwegian Engineering Industries (NORSOK). (2004)*

3.3.1(g) Maintainability. Specify the quantitative maintainability requirements that apply to maintenance in the planned maintenance and support environment. Examples are as follows (ISO 29148):

- Time (e.g., mean and maximum downtime, reaction time, turnaround time, mean and maximum times to repair, mean time between maintenance actions)
- Rate (e.g., maintenance staff hours per specific maintenance action, operational ready rate, maintenance time per operating hour, frequency of preventative maintenance)
- Maintenance complexity (e.g., number of people and skill levels, variety of support equipment, removing/replacing/repairing components)
- Maintenance action indices (e.g., maintenance costs per operating hour, staff hours per overhaul)
- Accessibility to components within systems and to parts within components

3.3.1(h) Reliability. Reliability describes the ability of a system or component to function under stated conditions for a specified period of time. Reliability requirements determine the robustness, consequences of, and redundancy of the system. Reliability requirements are best stated as quantitative probability statements that are measurable by test or analysis, such as the mean time between failures (MTBF) and the maximum acceptable probability of the failure during a given time period.

3.3.1(i) Safety and Environment. Safety and environmental requirements applicable to eliminating or minimizing hazards related to people, environment, and asset.

3.3.1(j) System Life Cycle Sustainment. The system life cycle sustainment requirements include activities that relate to sustaining the quality or integrity of the system. Typical requirements include, but are not limited to, support, sparing, sourcing and supply, provisioning, technical documentation, personnel support training for all modes of operation (e.g., installation, hook-up, commissioning, and decommissioning) throughout the life cycle of the system. These requirements should be updated as needed in order to sustain performance.

3.3.1(k) Data Management and System Security. For data-intensive systems, the management of information should be defined. The information management requirements should define the information the system receives, stores, generates and exports as well as the backup of the information.

System security requirements define both the surrounding environment (i.e., location) of the system and the operational security requirements. For example, to protect the system from accidental or malicious access, use, or destruction, some protection methods (e.g., access limitations, use of passwords, or the restriction of communications between some areas of the system) can be used. For control systems that govern multiple critical aspects of the assets, insights should be provided for operations, maintenance and support of cyber-enabled systems, to improve security in those systems.

The ABS CyberSafety™ program addresses cyber-enabled systems protection in an extended set of engineering processes that emphasizes human and systems safety. For further guidance on this program refer to the following documents:

- ABS *Guidance Notes on Application of Cybersecurity Principles to Marine and Offshore Operations – ABS CyberSafety™ Volume 1*
- ABS *Guide for Cybersecurity Implementation for the Marine and Offshore Operations – ABS CyberSafety™ Volume 2*
- ABS *Guidance Notes on Data Integrity for Marine and Offshore Operations – ABS CyberSafety™ Volume 3*
- ABS *Guide for Software Systems Verification – ABS CyberSafety™ Volume 4*
- ABS *Guidance Notes on Software Provider Conformity Program – ABS CyberSafety™ Volume 5*

3.3.2 System Description

The SRDD is also to include a detailed technology description. This involves additional documentation that could help provide evidence or demonstrate the ability of the technology to meet defined system requirements. The description of the technology typically includes the following:

i) Equipment list

ii) Comparison with existing similar technologies

iii) Lessons learned from similar technologies

iv) Possible applicable standards, codes, or industry practices

v) Relevant engineering documents as applicable:

- Piping and Instrumentation Diagrams (P&IDs)
- Heat and material balances
- Block diagrams
- Design schematics
- General arrangements
- Material specifications including material properties
- Design analysis methodology and related reports
- Installation analysis
- Test reports

vi) Control and safety system details

vii) Operational, maintenance, and inspection strategies

viii) New or unproven manufacturing, assembly, transit, storage, installation, hook-up, testing, commissioning, and decommissioning details

ix) Quality, health, safety, and environmental philosophies

The SRDD needs to be submitted for ABS review. The SRDD is not intended to be a single consolidated document but a design review package that compiles the relevant documents.

It is recognized that the requirements definition and the supporting description documentation is developed throughout the NTQ process. The submittal only needs to include the information available based on the design maturity of the new technology.

5 New Technology Screening

Once the technology has been described, a systematic screening process is needed in order to identify the new or novel elements, characteristics, or environment for which qualification is needed. The decomposed system should be reviewed to identify which of those items are considered new technology, as defined in Subsection 1/5, and which ones are not. The level of effort involved in qualification increases from categories *i)* through *iv)*. Items that are not considered new technology could follow the conventional ABS certification process.

For new technology items, it is useful to identify whether similar technology exists and whether relevant Rules, Guides, and/or standards apply wholly or partially for this technology. Identifying the new technology items provides a basis for reducing the qualification scope to only those items that need to be addressed through the NTQ process. The vendors could perform the screening process independently or in a workshop setting with ABS, which will help support/guide the process. Section 2, Table 1 below, is a sample table that can be used for a systematic screening.

TABLE 1
Systematic Screening Table

Item	*Description*	*Similar Technology Exists?*	*Relevant Rules, Guides, or Industry Standards for This or Similar Technology?*	*New Technology (Yes/No)*	*New Technology Category (i, ii, iii, iv)*	*Notes*
1		Technology 1, Technology 2…	Standard 1 (partially) Standard 2 (No)…	Yes	*i*	
2		No	Standard 1 (partially) Standard 2 (partially)…	Yes	*iii*	
3		This technology exists	N/A	No	N/A	

Columns:

Description: Description of elements of the new technology item(s) (e.g., subsystems)

Similar Technology Exists?: Identify whether similar technologies exist, for example, technologies in other industries (e.g., onshore, aerospace, etc.). If existing technology exists, list them in this column.

Relevant Standards for This or Similar Technology: List of any standards applicable to the new technology with short explanation about applicability.

New Technology (Yes/No): Decide which technologies are new and which are not.

New Technology Category: As defined in Subsection 1/5:

i) Existing technology challenging current boundary/envelope

ii) Existing technology in new applications

iii) New technology in existing applications

iv) New technology in new applications

Notes: Other information or justification relevant to the screening process (e.g., conditions for applicability of standards, recommendations for qualification, etc.).

The systematic screening results and supporting information is to be submitted for ABS review.

7 New Technology Stage Determination

Based on the results from the new technology screening process and review of the SRDD, ABS and the client will agree on a maturity level determination. An appropriate qualification stage will be assigned to proceed, with qualification activities. A detailed questionnaire for determining the technology maturity level and qualification stage can be found in Appendix 3.

A more mature design could result in the ability to start at a later qualification stage, thus minimizing the level of effort and time it takes to complete qualification of the new technology. Once credit has been given to the design maturity and the appropriate qualification stage is determined, the client can proceed through the qualification process outlined in the following Sections:

- Feasibility Stage (Section 3)
- Concept Verification Stage (Section 4)
- Prototype Validation Stage (Section 5)
- System Integration Stage (Section 6)
- Operational Stage (Section7)

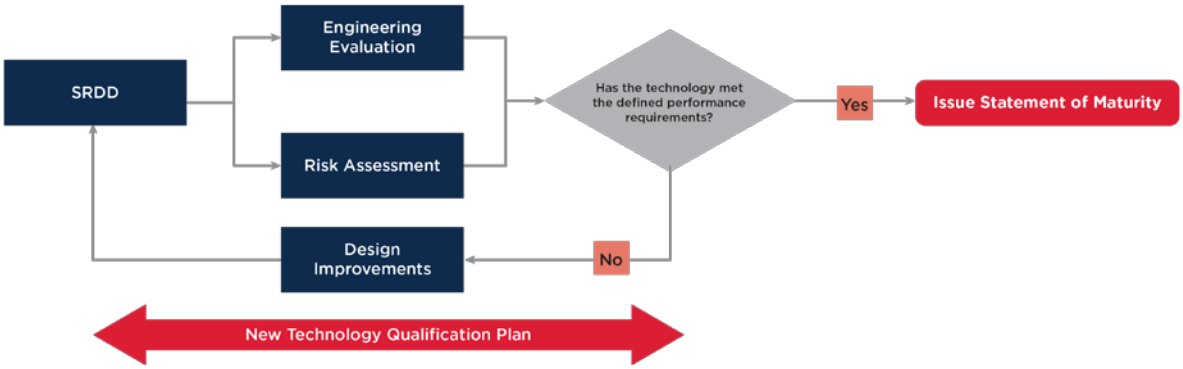
9 New Technology Qualification Plan and Activities

The New Technology Qualification Plan (NTQP) defines a roadmap for progressing the new technology through the appropriate qualification stages. The objective of the NTQP is to provide a summary of qualification activities that need to be performed at each stage in order to demonstrate the ability of the new technology to meet the requirements specified in the SRDD.

The initial NTQP should be developed based on the findings in the screening process in Subsection 2/5. The NTQP for each subsequent stage is updated based on the findings from the previous stage activities and discussions between the client and ABS. A NTQP template is provided in Appendix 4.

Qualification within each stage is comprised of a set of iterative activities that include engineering evaluations and risk assessments to verify new technology design. Results of these activities could lead to design improvements or modifications to the requirements specified in the SRDD. All design improvements and/or modifications should be documented in the NTQP with necessary technical justification. Section 2, Figure 2 summarizes the iterative NTQP activities.

FIGURE 2
New Technology Qualification Stage Iterative Process



9.1 Risk Assessment Requirements

As stated in Subsection 2/9, a risk assessment is to be prepared and submitted to ABS for review.

For a new technology requesting qualification through the NTQ process, a risk assessment is to be performed/updated at each stage as applicable. The risk assessment within the NTQ process will vary from qualitative to quantitative depending on the maturity level and information available at that stage. The primary objective of the risk assessment is to identify technical risks and uncertainties associated with the proposed design and document all foreseeable hazards, their causes, consequences, and potential risk control measures considering the new technology in its proposed application and operating environment. All possible interfaces, and known integrations are to be evaluated as part of this assessment.

All risk assessments performed must consider the following areas:

i) Personnel safety

ii) Asset protection

iii) Environmental protection

It is recommended that the risk assessment be carried out by a multidisciplinary team that includes the design team (vendor) and the end-user. ABS' participation in the risk assessment is also recommended. Appendix 2 of the ABS *Guide for Risk Evaluations for the Classification of Marine-Related Facilities* provides an overview of how to assemble an appropriate risk assessment team.

Prior to performing the risk assessment, a risk assessment plan should be prepared and submitted to ABS for review. The risk assessment plan should include the following information:

i) Scope of the Assessment

a) Description of the proposed new technology including physical and operational boundaries

b) Intended service application of the new technology

ii) Assessment Team

a) Subject matter experts/participants/risk analysts, including their background and areas of expertise

iii) Assessment Preparation

a) All available new technology information (e.g., design basis, drawings, procedures, etc.),

b) Proposed risk assessment method (e.g., FMECA)

c) Proposed risk assessment criteria for evaluation (e.g., risk matrix)

After the risk assessment has been completed, a report that includes the following information should be submitted to ABS for review:

i) Scope

a) Description of the proposed new technology including physical and operational boundaries

b) Intended service application of the new technology

ii) Risk Assumptions and Data References

iii) Supporting Engineering Documents

a) Technical drawings

iv) Risk Assessment Worksheets (Hazard Register) that

a) Identifies hazards associated with the new technology in its current boundary conditions (application and operating environment),

b) Identifies scenarios associated with each identified hazard,

c) Identifies causes of the hazardous scenario,

d) Identifies consequences of the hazardous scenario,

e) Identifies existing risk control measures for each hazardous scenario,

f) Estimates the likelihood (frequency) and the severity of the consequence,

g) Evaluates the risk of the hazardous scenario by measuring it against the acceptable risk criteria agreed upon by the analysis team,

h) Identifies and evaluates the need for any recommendations to lower the risk to acceptable levels (design improvements through risk control measures)

v) Conclusions and Recommendations

a) Action items and/or recommendations

Further guidance on developing basic and detailed risk assessment plans can be found in Section 5 and Section 6, respectively of the ABS *Guide for Risk Evaluations for the Classification of Marine-Related Facilities.*

It is recognized that each new technology may be unique in terms of design, operating environment, and application, therefore it is difficult to provide precise guidance on which risk assessment techniques should be used in a given situation. Therefore the selection of risk assessment methodology should be considered on a case-by-case basis and discussed with ABS prior to performing a risk assessment. Some typical recommended risk assessment techniques and their common uses can be found in Section 2, Table 2.

TABLE 2
Recommended Risk Assessment Techniques

Type of Study	*Description*	*Common Uses*
HAZID	A method to rapidly identify hazards, assess potential consequences, and evaluate existing safeguards of the system. Methods draw upon a highly experienced multi-disciplinary team using a structured brainstorming technique to assess applicability of potential hazards.	• Used for all types of systems and processes.
FHA	A functional hazard assessment (FHA) is used to identify and assess the functional failures of a system or subsystem.	• Used for all types of systems and processes.
FMEA (Failure Mode and Effects Analysis)	An FMEA is a reasoning approach best suited to reviews of mechanical and electrical hardware systems. The FMEA technique (1) considers how the failure modes of each system component can result in system performance problems and (2) makes sure the proper safeguards are in place. A quantitative version of FMEA is known as failure modes, effects and criticality analysis (FMECA).	• A design FMEA/FMECA can be used for reviews of mechanical and electrical systems (e.g., fire suppression systems, vessel steering and propulsion systems) to identify design related failures. • A process FMEA is often used to identify failures while performing steps within a given process or procedure (e.g., manufacturing, assembly).
Hazard and Operability (HAZOP) analysis	The HAZOP analysis technique uses special guide words for (1) suggesting departures from design intents for sections of systems and (2) making sure that the proper safeguards are in place to help prevent system performance problems.	• Used for finding safety hazards and operability problems in continuous process systems, especially fluid and thermal systems. It can also be used to review procedures and other sequential or batch operations.

Further guidance on risk assessments techniques can be found in the following references:

- ABS *Guidance Notes on Risk Assessment Applications for the Marine and Offshore Oil and Gas Industries*
- ABS *Guidance Notes on Failure Mode and Effects Analysis (FMEA) for Classification*
- *Petroleum and Natural Gas Industries – Offshore Production Facilities – Guidelines on Tools and Techniques for Hazard Identification and Risk Assessment, ISO 17776*
- *Risk Management – Risk Assessment Techniques, ISO 31010*
- *Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment, SAE ARP 4761*

9.3 Engineering Evaluation

Engineering evaluations are used to verify and validate that the new technology is capable of performing acceptably with respect to intent and overall safety according to the requirements of each stage. This is achieved gradually for each qualification stage through specific qualification activities as the technology matures and can be found in the NTQP. The types of activities for engineering evaluation are:

i) *Review Engineering Design Requirements.* As the technology matures, and more detailed design information becomes available, the functional and performance requirements are reviewed/updated as needed.

ii) *Technical Analyses and Simulations.* Engineering design analyses and simulations are used to verify the technology at the earlier qualification stages

iii) *Validation Testing.* Functional, model testing, and prototype testing are used to verify that the new technology satisfies all the specified functional and performance requirements.

iv) *Interface Analyses.* Interface analyses of the technology with existing systems are required and system integration testing is needed in order to fully understand all interactions between the new technology and surrounding systems, including people and the environment.

v) *Verification of Operability.* Operational testing and the collection of test data are required to verify the new technology satisfy the operational requirements.

vi) *Verification of Inspectability and Maintainability.* The various components of the new technology must be reviewed to confirm that they can be monitored, inspected and maintained in a manner consistent with existing practice.

vii) *Quality Assurance and Quality Control (QA/QC) Program.* Establish and maintain an effective quality control procedure(s) and quality acceptance criteria at each stage in accordance with recognized industry standard.

9.5 Design Improvements

Based on the results of the engineering evaluation and risk assessment activities, design improvements may be necessary to enhance reliability and safety of the design. The opportunities to improve safety could be through changes or modifications that make the design inherently safer or implementation of appropriate risk control measures. Example design changes include, material changes, reconfiguration, redundancy, and loading requirements.

Any design improvements that are identified and determined necessary as part of further refinement of the new technology is to be re-evaluated against the functional and performance requirements outlined in SRDD. The updated qualification activities should aim to meet these new requirements. Design improvements should be tracked in the NTQP.

The following sections should be considered when improving the design of any new technology.

9.5.1 Hierarchy of Risk Control Measures

Inherently safe design exists in something as a permanent and inseparable element. In other words, the risk control measures in place are “built in”, not “added on”. Identification of measures to control risks identified throughout the qualification process can be summarized in the following list:

i) *Elimination or Substitution.* Elimination of the design element, or the hazard associated with it should always be the first consideration. Careful evaluation may indicate that the functional requirements may be accomplished by another design element.

ii) *Engineering.* Engineering controls are mechanical or physical features added to the equipment, systems, subsystems, and/or components in order to remove or control the hazard, either by initial design specifications or by applying methods of substitution, minimization, isolation, or ventilation.

iii) *Administrative.* Administrative controls rely more actively on human action and behavior. Examples of administrative controls include written operating procedures, maintenance and inspection strategies, checklists, safety meetings, alarms, signs, training of personnel.

iv) *Personal Protective Equipment.* Personal protective equipment (PPE) creates a barrier between the person wearing the PPE and the hazard associated with the job. PPE such as hearing protection, protective clothing, safety glasses, respirators, gloves, welding aprons, and hardhats are methods of controlling hazards.

In general, inherently safe design is more of a philosophical way of thinking rather than a specific set of tools or methods. For example, a hazard might be considered “safe” because it has specific risk reducing measures in place. Inherently safe design asks the question, “can it be safer?”

The goals of inherently safe design can be summarized by the following:

- Fewer and smaller hazards
- Fewer causes that initiate hazardous events
- Reduced severity and consequences (e.g. fatalities, lost time incidents, asset damage, etc.)
- More effective management of residual risk

The inherently safe design approach to achieve goals of safer design should consider elimination or substitution to significantly reduce hazards. The following questions should be asked when considering the design of new technologies with hazardous potential:

1. Can the hazard be eliminated by design improvements?
2. If not, then can the magnitude of the hazard be reduced?
3. Do the alternative designs identified in question 1 and 2 increase the magnitude of other hazards or present new hazards?
4. What other risk control measures (engineering or administrative) are required to manage hazards that remain?

An inherently safe design approach to design improvements is recommended in order to eliminate design elements that are limiting the new technology from meeting defined functional and performance criteria. This philosophy should shift focus on improving design by implementing elimination, substitution, or engineering risk control measures.

9.5.2 Management of Change

Design improvements are inevitable during the course of technology design and development and are integral to the process, especially during the early design phases. These improvements can potentially have an impact on risk, and on previously performed qualification activities during the NTQ process. For this reason, it is important that clients establish an appropriate Management of Change (MoC) program. It is recommended that a MoC program be developed to confirm that design improvements are reviewed in a responsible manner by appropriate personnel.

A MoC program is a combination of policies and procedures used to evaluate the potential impacts of a proposed design improvement so that it does not result in unacceptable risks. Developing an effective MoC strategy requires establishing, documenting, and successfully implementing formal policies to evaluate and manage both temporary and permanent modifications including equipment, materials, procedures and conditions.

The techniques used to evaluate the improvement, the people available for review, the time frames for reviewing and implementing the improvement will differ between the design phases. During the early phases, there may be many design improvements, but there will be fewer records to update than if the improvement occurs at a later stage. Tools such as software simulations and preliminary risk analysis can prove extremely valuable when determining design improvements at early stages and are less labor intensive than in later stages.

An effective MoC program requires preparation beyond defining and documenting a policy to outline the system. The following factors are important to successful implementation of a MoC program:

i) Clear roles and responsibilities

ii) Appropriate organizational preparation

iii) A written MoC program manual that includes MoC forms

iv) Pilot roll-out before the full-scale deployment, training of affected personnel, and

v) Close attention when integrating MoC with existing programs.

The following references provide more details on Management of Change processes:

- ABS *Guidance Notes on Management of Change for the Marine and Offshore Industries*
- *API RP 750, Management of Process Hazards, American Petroleum Institute, Washington, DC, 1990*
- *API RP 75, Recommended Practice for Development of a Safety and Environmental Management*
- *Program for Offshore Operations and Facilities, American Petroleum Institute, Washington, DC, 2004*
- *Guidelines for Management of Change for Process Safety, Center for Chemical Process Safety CCPS, 2008*

SECTION 3 Feasibility Stage

1 Introduction

A new technology considered for qualification in the Feasibility stage is at an early concept maturity level, where basic research and development activities to identify engineering principles are complete; and a concept formulated along with its functional requirements. A high-level design analysis is performed to verify the concept in the intended application and that the overall proposed level of safety is comparable to those established in Rules, Guides, other recognized industry standards and recommended practices.

In cases where multiple concepts are submitted for ABS review, the overall objective is to work with ABS to identify a concept that proves most feasible for the application with respect to safety and reliability.

3 Qualification Activities

3.1 Engineering Evaluation

The engineering evaluation at the Feasibility Stage involves a high-level design verification of the proposed concept. All goals, functional requirements, and performance requirements submitted as part of the SRDD in 2/3.3 are reviewed along with any available high-level engineering design analysis to verify that the proposed concept is feasible.

3.3 Risk Assessment

A high-level risk assessment should be carried out during this stage to identify any preliminary technical risks and uncertainties associated with the proposed concept. The risk assessment should focus on documenting all foreseeable hazards, their causes, consequences, and potential risk control measures considering the new technology in its proposed application and operating environment. Additionally, all possible interfaces and known integrations should be considered. This risk assessment should set the basis for any subsequent qualitative/quantitative assessments that may need to be performed to completely understand the new technology's risk profile. Subsequent assessments may be in the form of additional engineering evaluation or risk assessments.

The results of the risk assessment should be documented and tracked in a hazard register for assessment and implementation in future qualification stages. The primary function of the hazard register should be to demonstrate that hazards and appropriate risk control measures have been identified. Recommendations for additional risk assessments and engineering evaluations are to be documented and submitted as part of the NTQP.

An appropriate risk assessment technique should be selected for this high-level risk assessment and submitted to ABS for review in the form of a risk assessment plan as discussed in 2/9.1. The engineering evaluation documents that support the risk assessment should be available and at an appropriate level of maturity before the risk assessment is performed. The following high-level risk assessment techniques are recommended as options for identifying preliminary technical risks:

i) HAZID identifying possible hazards, events, and outcomes related to the impact on personnel, asset, environmental, and reputation

ii) Functional FMEA identifying possible failure modes, effects (local and global), causes, and preliminary safeguards including all interfaces (i.e. system to system, system to subsystem, etc.)

iii) Functional Hazard Analysis (FHA) identifying system/sub-system functions and hazards associated with those functional failures

A risk assessment report including the hazard register should be prepared. The risk assessment report and the NTQP should be submitted to ABS for review.

There may be specific cases where the information available at this maturity level is limited and a risk assessment technique may not be possible. This scenario will be treated on a case-by-case basis, and ABS will recommend an alternative approach as needed to meet the new technology Feasibility Stage requirement.

5 Summary of Submittals

The following qualification activities along with future activities for the Concept Verification Stage should be highlighted in the NTQP and submitted to ABS for review:

5.1 Engineering Evaluation

i) SRDD

- Design basis, functional specification and/or technical specification of the new technology
- System and function architecture details such as functional flow block diagram
- Design details such as basic engineering drawings and engineering principles associated with further development
- Design analysis methodology and any available preliminary results
- Details regarding physical and functional interface requirements (mechanical, hydraulic, electronic, optical, software, human, etc.)
- Applicable design references, codes, standards and guidelines, and technical justification for any proposed deviations (may be identified independently or during the new technology screening process)
- Lessons learned, references and examples of comparable designs

5.3 Risk Assessment

i) Risk assessment plan in accordance with 2/9.1

ii) The appropriate risk assessment report identified in 3/3.3

iii) Hazard Register complete with an action tracking system

7 Feasibility Stage Completion: Technology Feasible

Once the above deliverables have been submitted to ABS for review and all specified performance requirements have been verified, then a Statement of Maturity will be issued stating that the technology is feasible. The technology is now ready to proceed to the Concept Verification Stage.

SECTION 4 Concept Verification Stage

1 Introduction

The second stage of the NTQ process is the Concept Verification Stage. The new technology is verified as performing its functions in accordance with defined performance requirements. This is accomplished by performing more detailed engineering studies and physical (or virtual) model testing. Reliability testing of select items may be performed. The operating conditions and the relevant environment are further refined. The functional and performance requirements outlined in the SRDD are re-evaluated, verified, and updated (as needed). The interfaces between configurations are verified against functional and performance requirements.

In addition, the production strategy is developed in the form of a preliminary manufacturing plan. A design risk assessment is carried out to identify technical risks related to design failures. Risk assessments from the Feasibility Stage are reviewed and updated (as needed) based on the design development in this stage.

3 Qualification Plan Activities

3.1 Engineering Evaluation

3.1.1 Engineering Design Review

At the Concept Verification Stage, the concept is confirmed and the engineering design is performed to verify that the functionality and performance of the new technology can be satisfied. The subsystem and component level requirements following the systems engineering approach should be defined if not specified at the Feasibility Stage. The objective is to define complete and consistent requirements that an item should have and confirm that the design correctly and completely captures each specification in the system requirements.

The performance requirements should state how the technology will perform its function and how the system requirements will be met. The performance requirements are to be established and should be detailed enough that the technology can be evaluated against the expected performance criteria. In addition, the requirements for the integration of subsystems and components into system prototypes should be defined. The overall configuration of the system should be provided and a preliminary interface analysis should be performed to verify the interfaces between configurations.

Design constraints should be identified and incorporated into the system requirements and design documentation. At this stage, the system requirements should be stated in quantitative measures that can be verified by subsequent numerical or analytical models and model tests. The overall system requirements defined at the Feasibility Stage should be reviewed to confirm continued relevance. Any change should be reviewed and documented with technical justification.

A preliminary manufacturing plan should be developed and should include the manufacturing methods and processes, the facilities, the production schedule, and the quality assurance requirements. The materials used in the system should be determined and reviewed during the qualification process. The technology design documentation is to be submitted for ABS review.

3.1.2 Functional and Model Testing

Tests are an essential part of the NTQ process and they can demonstrate the performance of the new technology. The types of tests required depend on the novelty of technology itself and pre-existing experience with similar concepts.

Functional and model tests are used to verify the functionality of the system and its ability to meet the defined functional requirements. Testing is to be performed in the technologies anticipated environment and operating conditions. The objectives of the functional testing are to verify that the system meets the performance and reliability requirements, as well as to verify the results obtained from the analytical models. The functional testing should consider and address the critical failure modes identified during the risk assessments.

For the new materials or those that can have a significant effect on the performance of the system, destructive or non-destructive testing should be used to identify the relevant failure modes and mechanisms or to explore the critical parameters and their effects. The same raw materials or components stated in the material specification for the actual product should be used in the tests. For materials that will degrade over time, materials degradation testing should be performed. Accelerated testing methods may be used to test the lifetime performance of the materials in a shorter time. Additionally, reliability testing for select items may be required.

Before performing any testing, a test plan should be developed and submitted to ABS. The test plan should document the test setup and strategy that will be used to verify that a product meets its design specifications and other requirements. The specific test plans should include the assumptions and constraints, input data, test procedures, expected test results, the parameters to be measured, instrumentation system specifications, and the acceptance criteria for evaluating results. For certain tests, it may be required for an ABS Surveyor to witness the testing activities to verify that it meets performance requirements and confirm the presence of an effective quality control program. Further guidance on function and model testing can be found in references [10], [11], [12] and [13] listed in Appendix 1.

3.3 Risk Assessment

The objective of the risk assessment in this stage is to identify technical risks associated with the new technology design to the lowest level of indenture as practicable. The updated concept level design engineering documentation from the Feasibility Stage and the additional engineering documents developed in this stage serve as input to the risk assessment. This design risk assessment should take into account the following:

- Any design modifications from the Feasibility Stage
- Updated functional and performance requirements
- Updated configurations
- Possible interfaces and integrations
- All potential failure modes, failure causes and failure mechanisms in all expected operational modes and life cycle stages
- The effectiveness of existing risk control measures and the need for any additional or more reliable measures
- Closing out any action items (qualification activities) as agreed in the Feasibility Stage

Based on the findings of this risk assessment, additional qualification activities in the form of risk assessments or engineering evaluation may be required to further assist in identifying and assessing the full potential ranges of failure causes, failure mechanisms, consequences and any related uncertainties. These additional studies may be coarse, detailed, or a combination depending on the objective of the study. The results of the risk assessment should be documented and tracked in a hazard register for assessment and implementation in future qualification stages. The resulting qualification activities should be documented within the NTQP. A risk assessment report including the hazard register should be prepared. The risk assessment report and the NTQP should be submitted to ABS for review.

A risk assessment technique that is appropriate for reviewing the new technology design should be selected and submitted as part of the risk assessment plan to ABS. Potential design related failure events in all anticipated operational modes should be evaluated. Typically, for hardware or mechanical systems, a Failure Mode Effects and Criticality Analysis (FMECA) is recommended. The FMECA performed can help evaluate failure modes and corresponding failure causes, failure mechanisms, and the local and global effects of failure. It also includes a criticality analysis which is used to estimate the probability of failure and the severity of the associated consequence. The probability can be qualitative if lacking historical quantifiable data, but quantitative probabilities are preferred. The method of assigning criticality should be included within the risk assessment plan and agreed by ABS prior to the study. Results from the FMECA should be relayed back to the design process of the new technology to facilitate any design improvements or FMEA verification activities. Further guidance on FMECA and related verification activities can be found in the ABS *Guidance Notes on Failure Mode and Effects Analysis for Classification.*

The following risk assessments verifying all technical risks are to be performed and submitted to ABS for review.

i) Design risk assessment (e.g., FMECA) as described above.

ii) Update Feasibility Stage risk assessments as needed based on updated design documentation.

iii) Perform any additional risk assessments identified while verifying the design and/or updating previous risk assessments.

If reliability, availability and maintainability (RAM) targets are defined as part of the functional requirements then a preliminary system RAM analysis should be carried out in this stage. System modeling techniques such as reliability block diagrams (RBD), fault tree analysis (FTA), Markov state diagrams or other established methods should be used to demonstrate the ability of the system to meet the defined performance requirements. The FMECA serves as input to the system reliability models along with the other engineering documentation developed at this stage. A RAM analysis should be prepared and submitted for ABS review. The data sources used, their applicability and any related assumptions should be documented within this report.

5 Summary of Submittals

The following qualification activities along with future activities to be addressed in the Prototype Validation Stage should be highlighted in the NTQP and submitted to ABS for review:

5.1 Engineering Evaluation

i) SRDD

a) Documents that describe the concept verification design requirements

b) Design documents that include but not limited to the configuration, drawings, PFD/P&ID, analytical models, etc.

c) Functional and model test plans, test data (as requested), and test results

ii) Preliminary manufacturing plan

5.3 Risk Assessment

i) Updated risk assessments from the Feasibility Stage (as applicable)

ii) Updated Hazard Register with updated action items closed out

iii) Preliminary design risk assessment (e.g., FMECA) report

iv) Preliminary system RAM analysis report (as applicable)

7 Concept Verification Stage Completion: Concept Verified

Once the above have been submitted to ABS for review and all specified performance requirements have been verified, then a Statement of Maturity will be issued stating that the concept has been verified. The technology is now ready to proceed to the Prototype Validation Stage.

SECTION 5 Prototype Validation Stage

1 Introduction

The third stage of the NTQ process is the Prototype Validation Stage. New technology that has matured to this stage has previously completed conceptual functional, performance, and reliability testing in nonspecific environments. The main objective in this stage is to validate with a prototype what was verified in the Concept Verification Stage.

During this stage, the technology is further developed to the point where a prototype or full scale production unit can be manufactured. All engineering studies and design risk assessments are completed and the design is refined to the detailed design. Engineering documents such as detailed drawings, product specifications, manufacturing plan and qualification test procedures are all fully developed. A preliminary system-of-systems interface analyses may be performed and system integration testing plan developed. Process risk assessments may be carried out (as needed) to evaluate relevant procedures and further refine them.

A prototype or full scale production unit is manufactured and all necessary qualification testing is carried out to validate the design. After completing this stage, the new technology has demonstrated that it can perform within the established performance requirements in a simulated or actual environment for an extended period of time.

3 Qualification Plan Activities

3.1 Engineering Evaluation

3.1.1 Engineering Design Review

At the Prototype Validation Stage, the engineering design is to confirm that the overall system, down to the lowest component level, has satisfied all system requirements. The performance requirements a technology must meet should be finalized and measurable. In addition, the requirements for system integration, installation, commissioning, operation, maintainability, and decommissioning should be established.

At this point the system has reached the necessary level of maturity to start fabricating, integrating, and testing. Changes in the requirements defined for any items during the previous stages should be reviewed and documented with technical justification.

At this stage, all design analyses and configuration definitions are completed and all design decisions that are outstanding are to be finalized. It is noted that there may be a need to revisit certain analytical and other relevant studies based on results of the prototype test. Detailed drawings including all dimensional requirements, process and instrument details, safety features and ancillary systems are completed as applicable. For load bearing components, all relevant loading and the uncertainty in that loading are analyzed. For process and electrical systems, all associated potential system failure/breakdowns and their associated failure frequencies (if applicable), as well as the consequence and impact on the system from each failure are identified.

In addition, all information (e.g., drawing and data) required for the production of the system are to be finalized. The actual performance of the new technology should be evaluated during prototype testing and compared against existing designs if available. The aforementioned design engineering documents are to be submitted to ABS for review. A preliminary system-of-systems interface analyses and system integration testing plan may be developed at this stage and submitted to ABS for review before the System Integration Stage.

3.1.2 Prototype Testing

Prototype testing is intended to prove that the interactions between the systems/subsystems/ components under relevant loading and environmental operating conditions can perform reliably as intended. Prototype tests can identify potential failure modes and mechanisms as well as the critical parameters, especially when operational experience in relevant environments is limited or unknown.

Prototype testing can be used to verify the analytical models and the assumptions made during the engineering design process. A test plan which details test techniques, test limits, expected test data, quality assurance requirements should be developed and submitted to ABS for review before prototype testing. Calibration of measuring devices is to be current with manufacturer's quality management system. Calibrations should be traceable to a recognized national standard (e.g., NIST, ANSI, etc.).

For certain new technologies, it may be very difficult to perform prototype testing in the actual environment. In this case, virtual prototype testing in a simulated environment can be performed. However, the virtual prototype testing must be reviewed by ABS to assess that the simulated environments are commensurate with expected operational practices. Analysis tools, such as finite element analysis (FEA) and computation fluid dynamics (CFD), and other methods used should be qualified for application. The prototype testing documents should include inputs, assumptions, boundary conditions, the computational models and appropriately conditioned/reported test results. Prototype test results should be documented and analyzed to determine whether the prototype satisfies specified functional and performance requirements in its actual environment. A prototype test report is to be submitted to ABS for review. Further guidance on prototype testing can be found in references [10], [12], [13] and [14] listed in Appendix 1.

3.1.3 Manufacturing

A manufacturing plan should be finalized that includes the manufacturing methods and processes, the facilities, the production schedule, and quality assurance requirements. Quality assurance of the manufacturing process should confirm that the product meets the required specifications. The manufacturing plan should be submitted to ABS for review. Further guidance on developing a manufacturing plan can be found in references [15], [16] and [34] listed in Appendix 1.

3.1.4 ABS Survey

Survey during the manufacturing process and prototype testing may be required. The vendor should submit an Inspection Test Plan (ITP) to ABS for review. The ITP should define witness points and hold points as agreed between the vendor and ABS. The ABS Surveyor should witness the manufacturing process and prototype testing to verify that proper manufacturing and prototype testing processes are followed and it meets the quality assurance requirements.

3.3 Risk Assessment

The main objective of the risk assessments performed in the Prototype Validation Stage is to validate the final design of the new technology. The design risk assessment (e.g., hardware design FMECA) from the Concept Verification Stage should be reviewed and updated to evaluate changes made to the design and/or other aspects of the new technology description. Changes made to one part of the design or new technology design requirements could have the potential to introduce new technical risks to other previously evaluated parts. The results of other qualification activities in this stage may also serve as input to the updated design risk assessment. Follow-on qualification activities determined from the results of the updated design risk assessment should be included within the NTQP.

For certain new technologies with high consequence severity levels upon failure, if not already addressed by other risk assessments, ABS may recommend that an additional process risk assessment (e.g., process FMECA or HAZOP) is performed. The objective of this risk assessment is to evaluate the potential failures that could occur during specific steps as listed within the procedures. This process risk assessment typically evaluates procedures related to manufacturing (as defined within the final manufacturing plan), testing (prototype and systems integration), installation/integration, commissioning, operations and decommissioning. A risk assessment technique that is appropriate for reviewing these procedures should be selected and

submitted as part of the risk assessment plan to ABS for review. Typically, a process FMECA or HAZOP study is recommended. It is recognized that the scope of this risk assessment depends on the availability of relevant procedures. All interfaces should also be considered when performing this assessment. The recommendations from the study should be used by the engineering design team and the operations team to determine any design improvements or procedural changes necessary before finalizing the design and manufacturing.

Based on the findings of the final design risk assessment and process risk assessment (if applicable), a re-evaluation of all previous risk assessments should be considered. All previous risk assessments should be reviewed against any newly identified failure modes or hazards. Changes made to the design due to findings in these risk assessments should also be checked against the final functional and performance requirements.

Finally, all identified technical risks from the Prototype Validation Stage and risk assessments from previous stages should be appropriately managed through any necessary design improvements. All corresponding action items should be closed in order for the new technology to complete this stage of the NTQ process.

The following final design level risk assessments verifying all technical risks are to be performed and submitted to ABS for review:

i) Final design risk assessment (e.g., design FMECA)

ii) Final process risk assessment (e.g., process FMECA or HAZOP) if applicable

iii) Update all previous risk assessments as needed based on updated final design level documentation

iv) Final hazard register based on the final design with all actions items closed out

If applicable, the preliminary RAM analysis should be re-evaluated and finalized. The final RAM analysis report should be submitted for ABS review.

5 Summary of Submittals

The following qualification activities along with future activities for the System Integration Stage should be highlighted in the NTQP and submitted to ABS for review:

5.1 Engineering Evaluation

i) SRDD

- Review engineering documents that describe the component requirements and the interaction between components, subsystems, and the overall system if applicable.
- Detailed design documents including detailed drawings, product specifications, process and instrument details, detailed calculations, etc.
- Prototype test plans, test data (as requested), and test results summarized in a report.
- Additional qualification testing, data, and results identified in the design risk assessment (e.g., FMECA).

ii) Inspection Test Plan (ITP)

iii) Detailed manufacturing plan.

5.3 Risk Assessment

i) The final updated risk assessment reports from the Concept Verification Stage (as applicable).

ii) The final design risk assessment (e.g., FMECA) report.

iii) The process risk assessment (e.g., process FMECA) report (as applicable).

iv) The final system RAM analysis report (as applicable).

v) Final hazard register with all action items closed out.

7 Prototype Stage Completion: Technology Qualified

Once the above deliverables have been submitted to ABS for review and all specified performance requirements have been verified, then a Statement of Maturity will be issued stating that the technology has been qualified. The technology is now ready to proceed to the System Integration Stage.

9 ABS Type Approval Program

Upon completion of the Prototype Validation Stage of the NTQ process, the new technologies that are consistently manufactured to the same design and specification may be Type Approved under the ABS Type Approval Program to limit repeated evaluation of identical designs. During the Prototype Validation Stage, if all the engineering evaluations have been completed, a PDA can be issued prior to further consideration for ABS Type Approval.

SECTION 6 Systems Integration Stage

1 Introduction

The fourth stage of the NTQ process is the Systems Integration Stage. In this stage, discussions between the vendor and end-user are held to understand the compatibility of the technology with final operating system and operating environment. An interface analysis is performed to confirm the compatibility of the item. The technical risks during operations that have not been addressed during previous risk assessments are evaluated and relevant reports updated. All necessary risk control measures are implemented.

The "Technology Qualified" item is then integrated (by installation) with the final intended operating system. All functional and performance requirements of the integrated system as outlined in the SRDD are validated through testing before (or during) commissioning. Plans for in-service survey, inspection, monitoring, sampling and testing (as applicable) are determined.

3 Qualification Plan Activities

3.1 Engineering Evaluation

3.1.1 System Interface and Integration Requirement

At this stage the overall technology goals and requirements may remain unchanged. However, specific requirements for system-of-systems functionality and interfaces should be finalized. In addition, the detailed operational performance parameters should be defined and operational procedures should be developed. System interface and integration requirements are to be submitted to ABS for review.

3.1.2 Interface Analysis

It should be analyzed that the addition or incorporation of the new technology does not negatively affect the integrity of the surrounding systems and components. All necessary functional and physical interfaces (e.g., mechanical, electrical, environment, data, human, etc.) and other systems should be reviewed and verified that the new technology does not adversely affect those systems. At this stage, the interfaces should be specified in quantitative limiting values, such as interface loads, forcing functions, and dynamic conditions. The use of tables, figures, or drawings is recommended as appropriate. The vendor/end-user should provide detailed interface control methods or other engineering solutions so that the new technology is compatible with the integrated systems. The complete interface analysis and necessary engineering solutions are to be submitted to ABS for review.

3.1.3 System Integration Testing (SIT)

The operational prototype is built and integrated into the final system. Full interface and function test programs are performed in the intended (or closely simulated) environment. The impact of the new technology on the performance and integrity of other systems as well as the impact of other systems on the new technology itself should be addressed. An initial operational test and evaluation should be performed to assess the operational effectiveness and suitability in the intended environment. The operational test must demonstrate that the operational aspects associated with placing the application in a marine or offshore environment are commensurate with typical operational practice for these facilities. Changes to the technology design or operational procedures may be necessary to address any issues encountered during operational testing. A test plan which details test techniques, test limits, expected test data, quality assurance requirements should be developed and submitted to ABS for review before the system integration testing. All test procedures and test results are to be summarized in a report and submitted to ABS for review.

3.1.4 ABS Survey

Survey during the system integration testing may be required as agreed upon in the system integration test plan. ABS Surveyor will witness the system integration testing to verify that proper testing processes are followed and it meets the quality assurance requirements based on the witness points as agreed between the vendor/end-user and ABS.

An In-Service Inspection Plan (ISIP) to address in-service survey, inspection, monitoring, sampling and testing (as applicable) during operations should be submitted for ABS review.

3.3 Risk Assessment

The main objective of the risk assessments performed in the System Integration Stage is to evaluate any technical risks resulting from system integration and operations that have not been previously evaluated as part of the design risk assessment, process risk assessments or other risk assessments in the previous stages. The end-user should manage any additional/residual risks identified through appropriate risk control measures.

An appropriate risk assessment technique should be selected and submitted as part of the risk assessment plan to ABS for review. The use of a process FMECA, HAZOP or HAZID are recommended. The scope of this risk assessment typically includes installation, SIT, commissioning, operations and decommissioning. The assessment should consider all interfaces between the validated prototype and the connected system (system-of-systems). Follow on qualification activities may be determined from the results of the risk assessment such as engineering evaluation, testing, design improvements or procedure changes. These activities should be addressed within the NTQP. All risk control measures should be implemented and any outstanding action items from the risk assessment closed before proceeding with system integration testing and commissioning.

The need for updates to any previously submitted risk assessments or RAM analysis should be evaluated and addressed as appropriate. Updated risk assessment reports including hazard registers, RAM analysis (if applicable) and the NTQP should be submitted for ABS review.

5 Summary of Submittals

The following qualification activities along with future activities for the Operational Stage should be highlighted in the NTQP and submitted to ABS for review:

5.1 Engineering Evaluation

i) SRDD

- All documents that describe requirements for system-of-systems functionality and interfaces.
- All documents that describe detailed operational procedures and performance parameters.
- System integration test plans, test data, and test results summarized in a report.
- Plans for in-service survey, inspection, monitoring, sampling and testing (as applicable) during operations or ISIP.

5.3 Risk Assessment

i) Updated risk assessment reports from the previous stages (as applicable)

ii) Other applicable technical safety studies (e.g., RAM).

7 System Integration Stage Completion: Technology Integrated

Once the above deliverables have been submitted to ABS for review and all specified performance requirements have been verified, then a Statement of Maturity will be issued stating that the technology is integrated. The technology is now ready to proceed to the Operational Stage.

SECTION 7 Operational Stage

1 Introduction

The last stage of the new technology qualification process is the Operational Stage. New technology categorized as "Operationally Qualified" denotes that it has been integrated into the final system and has been operating successfully in service in the relevant operational environment.

Once the technology has been qualified at the Prototype Stage, it must be confirmed that the knowledge gained by the engineering and risk assessment tests and studies is fed into the operational stage, in order to monitor prior assumptions and predictions through in-service field verification. In other words, the first implementation of any new technology should be treated as a first time application to some extent. This Section will outline the necessary activities that must be completed and the information to be supplied to ABS during this stage. It is recommended that the qualification process involves members with operational background in this stage of the project. These members should become familiar with the results of all the previous qualification stages, if they had not participated from the start of the qualification process.

At this stage, the operational objectives, operating environment and the performance requirements established during design are reviewed and applied to define goals for in-service operation. Following successful operation and performance achievement of the goals in the actual operational environment, the technology can be granted a Statement of Maturity.

The activities of the Operational Stage are as follows:

i) Implementation of in-service survey, inspection, monitoring, sampling and testing plans

ii) Collection and analysis of reliability, availability, maintainability (RAM analysis) and other operational performance data as needed

iii) Comparison of operational data above with previously specified performance requirements, goals and criteria

iv) Performance of root cause analyses for any observed failure and using feedback to introduce modifications for improvement

v) Comparison of observed parameters with any critical assumptions made during the previous qualification stages and updating calculations as necessary

It is to be noted that when applying these Guidance Notes for classification or certification purposes, the primary driver for classification acceptance will be safety even though there may be additional functional requirements (e.g., reliability, ability to perform as per operational design specification) defined by the client.

3 Qualification Plan Activities

The need and extent of special in-service qualification requirements are dependent upon the justifications and risk assessment results during the design and qualification process. System requirements have been started to be defined in the Feasibility Stage of qualification, and they have been updated in later stages as the design evolved. Such requirements have to be translated into specific and quantifiable performance requirements to be attained during operations. Additionally, any critical assumptions made in the risk assessment and engineering evaluations during the four previous qualification stages should be monitored to confirm that operational experience does not disprove them. Taking all the above into consideration, the vendor and/or end-user together with ABS should outline the necessary elements of in-service survey, inspection, monitoring, sampling and testing needed to gain confidence in the real world application of the new technology.

These special requirements can be integrated in the end-user's Asset Integrity Management program. Advanced inspection and maintenance approaches like Reliability Centered Maintenance (RCM) and Risk Based Inspection (RBI) are appropriate strategies to follow since they are based on reliability and risk goals. Data collection and management are very important activities to consider for the in-service qualification stage.

The amount of operational history that is sufficient to verify performance requirements during operations depends on several factors, including actual equipment run time, failure rate and exposure time to failure. Therefore, the time to reach the "Operationally Qualified" status for the proposed new technology will be determined on a case-by-case basis.

All records related to the inspection, monitoring, sampling and testing of the new technology as established by the agreed-upon operational qualification plan or ISIP should be kept and made available for review upon request by ABS at any time. These records will be reviewed periodically to establish the scope and content of the required surveys that should be carried out by ABS.

The following references contain additional guidance for in-service monitoring, sampling, testing and inspection plans:

- ABS *Guidance Notes on Equipment Condition Monitoring Techniques*
- ABS *Guidance Notes on Reliability-Centered Maintenance*
- ABS *Guide for Surveys Using Risk-Based Inspection for the Offshore Industry*
- ABS *Guidance Notes on the Investigation of Marine Incidents*
- ABS *Guide for Hull Condition Monitoring Systems*
- ABS *Guide for Hull Inspection and Maintenance Program*
- ABS *Guide for Building and Classing Subsea Pipeline Systems*
- API RP 17N *Recommended Practice Subsea Production System Reliability, Technical and Integrity Management*

5 Summary of Submittals

The output of this stage is a report reviewing the operational data collected, and demonstrating how the specified performance requirements and criteria have been met.

The following items are typical submittals that ABS would expect to receive annually in order to conduct an Operational Stage audit:

- Summary report of results of the inspection, monitoring, sampling and qualification testing activities
- Failure data analysis of critical components
- Non-conformance reports and corrective actions taken.

Note: In case of a non-conformance report for a critical component, ABS should be notified as soon as practical.

7 Operational Stage Completion: Operationally Qualified

Once the operational experience of the new technology has proven to be successful (i.e., according to the expected performance, for a satisfactory amount of time in the actual operating environment, and meeting criteria acceptable by ABS), then a Statement of Maturity stating the operational qualification of the technology will be issued.

APPENDIX 1 References

1. API RP 17N Recommended Practice Subsea Production System Reliability, Technical and Integrity Management. American Petroleum Institute, 2009.
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5. ISO 13879. Petroleum and natural gas industries -- Content and drafting of a functional specification. International Organization for Standardization, 1999.
6. ABS *Guidance Notes on Risk Assessment Applications for the Marine and Offshore Oil and Gas Industries*. Houston, TX.
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10. Department of Defense Test & Evaluation Management Guide, December, 2012.
11. ISO 17025. General requirements for the competence of testing and calibration laboratories. International Organization for Standardization, 2005.
12. Military Handbook 781A (MIL-HDBK-781A), Handbook for reliability test methods, plans, and environments for engineering, development qualification, and production, 2015.
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APPENDIX 2 Comparison of ABS Qualification Stages with Industry TRLs

1 Introduction

Technology Readiness Levels (TRLs) are a method of estimating the maturity level of new technology. There are a wide variety of scales in industry based on the ISO 16290 standard. This standard uses a numerical scale one through nine, with nine representing the most mature. The American Petroleum Institute (API) uses a scale ranging from zero to seven. Although the definitions of these levels differ slightly (space systems vs oil and gas), the fundamental philosophy remains the same. ABS has developed a stage gate process compatible with the wide range of TRLs (API, US DoD, ISO 16290). However, the numbers levels presented have now been replaced by a series of qualification stages. Comparison of the ABS definition and the industry TRLs are provided in the table below.

TABLE 1
ABS Qualification Stages Comparison with Various Industry TRLs

ABS Qualification Stage	*API RP 17N/Q TRLs*	*US DoD TRLs*	*ISO 16290 TRLs*
Feasibility Stage	0	1	1
	1	2	2
Concept Verification Stage	2	3	3
		4	4
Prototype Validation Stage	3	5	5
	4	6	6
System Integration Stage	5	7	7
	6	8	8
Operational Stage	7	9	9

APPENDIX 3 New Technology Stage Determination

1 Introduction

In order to estimate the current qualification stage of a proposed a new technology, the following table should be used. These questions serve as general guidance to understand the design maturity of the technology based on completed qualification activities and hence determine the corresponding qualification stage. The client's design team, ABS, and other identified stakeholders should agree upon the qualification stage identified. All supporting documentation justifying affirmative answers are to be submitted to ABS for review. Negative answers will be reviewed on a case-by-case basis in order to determine applicability of the question to the technology.

Qualification Stage	*Item #*	*Question*	*Yes/No/NA*	*Evidence to support?*
Feasibility Stage	1	Has what is specifically new and/or unique about the concept been clearly identified?		
	2	Has what specifically needs qualification been defined?		
	3	Have potential applications been identified?		
	4	Have fundamental objectives and requirements (e.g., RAM) for the identified application been identified?		
	5	Have basic functionality and durability of the technology been analyzed?		
	6	Have basic principles been observed and reported?		
	7	Have lessons learned from similar technology been reviewed and documented?		
	8	Have basic design calculations been performed?		
	9	Have conceptual research and development been completed?		
	10	Has a preliminary list of reliability drivers been prepared?		
	11	Has a preliminary fitness assessment (physical interfaces, human etc.) been performed?		
	12	Can engineering drawings (basic configurations, interfaces, and/or PFD's or flow charts) and calculations be submitted for review?		
	13	Have any early stage risk assessment and mitigation studies been performed and documented?		
Concept Verification Stage	14	Has the concept functionality been demonstrated by physical models or "mock-ups"?		
	15	Have laboratory scale material testing and degradation mechanisms been performed?		
	16	Have all conceptual design engineering studies been completed?		
	17	Have preliminary function/performance/reliability engineering studies been completed?		
	18	Have reliability drivers been confirmed?		
	19	Is there documentation that RAM requirements can likely be met?		
	20	Has durability been confirmed by testing or calculation?		
	21	Has a viable manufacturing or fabrication scheme been documented?		
	22	Has preliminary qualitative design risk analysis (e.g., FMECA) been documented?		
	23	Have the initial risk assessments been reviewed/updated to identify any additional technical risks?		

Qualification Stage	*Item #*	*Question*	*Yes/No/NA*	*Evidence to support?*
Prototype Validation Stage	24	Have all items in the manufacturing of the technology been specified?		
	25	Has the manufacturing and assembly process been accepted?		
	26	Has a prototype or full scale production unit been manufactured?		
	27	Has the manufacturing and assembly defects been removed by stress screening?		
	28	Has the technology passed basic functionality testing of prototype (physical or virtual) or full scale product to demonstrate fitness and function capability in a simulated or actual operating environment?		
	29	Has a performance data collection system been established and properly documented?		
	30	Has the technology passed performance, durability, and accelerated life tests?		
	31	Is the degradation of function/performance within expected acceptable limits?		
	32	Has the technology passed system reliability analyses?		
	33	Has the operating/destruct limits been established or confirmed?		
	34	Has the degradation limits and rates been established or confirmed?		
	35	Has the required in-service monitoring needs and means been identified?		
	36	Has a process risk assessment (e.g., process FMECA) been performed and documented (if applicable)?		
	37	Has the final design risk assessment (e.g., FMECA) been completed for all life cycle modes (including assembly, transit, storage, installation, hook-up, commissioning, operation, decommissioning) for all interface permutations and properly documented?		
	38	Have the residual risk and uncertainty been estimated and properly documented?		
	39	Has the reliability study been updated and properly documented?		
System Integration Stage	40	Has the design risk assessment (e.g., FMECA, HAZOP) considering full system interfaces been updated and properly documented?		
	41	Have all other technical risks been identified/addressed and properly documented?		
	42	Has the technology been deployed into a full prototype and fully integrated with the intended system?		
	43	Has the function/performance when connected/integrated into a wider system been fully tested?		
	44	Have all mechanical, hydraulic, optical, electronic, software, etc. and human interfaces been fully addressed and documented?		
	45	Have all system integration requirements been confirmed?		
	46	Has installation/hook-up/testing/commissioning with a wider system been completed as per specifications?		
	47	Is there a data collection system in place to document performance and reliability?		
	48	Has a detailed in-service inspection/monitoring/sampling plan been defined and properly documented?		
	49	Can inspection/monitoring/sampling functionality be validated?		
Operational Stage	50	Has the technology demonstrated acceptable reliability and availability in the targeted operating environment?		
	51	Has the in-field service monitoring, sampling, and inspection plan been successfully implemented?		
	52	Has reliability and integrity performance data been properly collected, analyzed, and documented?		
	53	Have any underperforming components of the technology been identified?		
	54	If so, then has there been any reliability improvements for failed or underperforming components?		

Qualification Stage	*Item #*	*Question*	*Yes/No/NA*	*Evidence to support?*
Operational Stage (continued)	55	Has there been any performance feedback from projects or suppliers?		
	56	Have any unexpected aspects (e.g., interdependencies or influences on performance) or safety concerns been observed?		
	57	Has the technology been reliable for at least one survey (or maintenance or planned replacement) cycle or agreed upon time period as indicated in the SRDD or in-service inspection plan (ISIP)?		
	58	Has the design risk assessment (e.g., FMECA) been updated with in-service performance data?		
	59	Has the system reliability assessment been updated and properly documented?		

APPENDIX 4 New Technology Qualification Plan (NTQP) Template

1 Introduction

The New Technology Qualification Plan (NTQP) should be a high level document that tracks the maturity level and status of qualification activities. These activities help verify and validate the new technology's ability to qualify all desired NTQ stages. The document is not meant to be a collection of engineering reports, methodologies, test data, or plans. The NTQP is to be updated throughout qualification process.

The following sections provide a recommended template for submitting an NTQP as part of the new technology qualification process.

3 New Technology Qualification Plan (NTQP) Template

Executive Summary

1.0 Introduction

- Summarize the project objectives.
- Provide an overview of the new technology and its application.
- Describe current status of design and qualification activities.
- Provide key points of contact.

2.0 New Technology Screening and Stage Determination

2.1 System Requirements Overview

- Summarize defined system goals, functional and performance requirements (with reference to appropriate SRDD document(s)).

2.2 New Technology Screening

- Summarize the new technology screening results.

2.3 New Technology Stage Determination

- Summarize the results of the new technology stage determination process.

3.0 New Technology Qualification Activities

- For each new technology item being qualified, list all qualification activities including the following details for each activity
  - Summarize the qualification activity (scope, objective and method)
  - Performance Requirement and its source.
  - Identify the stage in which this qualification activity was determined.
  - Provide reference to appropriate engineering evaluation report or risk assessment report (include corresponding hazard register nodes) from which this activity was determined.
  - Scheduled Timelines (start/finish).

- Provide reference to appropriate engineering evaluation or risk assessment reports that documents the results of the qualification activity.
- Comments from the Client & ABS

4.0 References

Appendices:

Appendix 1 Summary of Previous Qualification Activities

List all previously completed qualification activities prior to NTQ process with references to appropriate reports.

2-15-15-.17

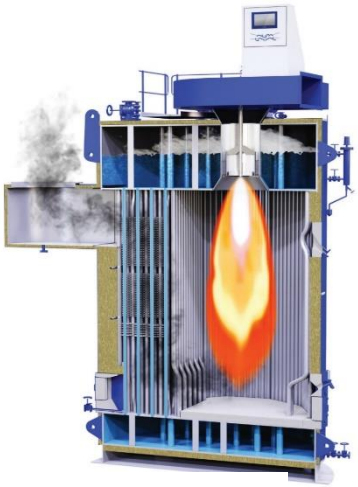
Emissions Evaluation of a Large Capacity Auxiliary Boiler on a Modern Tanker

Draft Final Report

Prepared for

California Air Resources Board
CARB

March, 2020



Source Alpha Laval

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Disclaimer

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Acronyms and Abbreviations

σ…… .....standard deviation
BC .....black carbon
CARB.....California Air Resources Board
CE-CERT.....College of Engineering-Center for Environmental Research and Technology (University of California, Riverside)
CFR.....Code of Federal Regulations
cm/s.....centimeters per second
CO.....carbon monoxide
COV .....coefficient of variation
CO_2.....carbon dioxide
DF .....dilution factor
eBC .....equivalent black carbon
EC .....elemental carbon defined by thermal optical methods
EPA.....United States Environmental Protection Agency
IMO.....International Maritime Organization
ISO .....International Organization for Standardization
kPa.....kilo Pascal
lpm .....liters per minute
ULSFO.....low sulfur heavy fuel oil
MGO .....marine gas oil
MFC .....mass flow controller
ms.....milliseconds
MSS.....Micro Soot Sensor
NIOSH .....National Institute of Occupational Safety and Health 5040 protocol
NIST.....National Institute for Standards and Technology
NO_x .....nitrogen oxides
OC.....organic carbon defined by thermal optical methods
o.d.....outer diameter
OEM.....original equipment manufacturer
PM.....particulate matter
$PM_{2.5}$ .....fine particles less than 2.5 µm (50% cut diameter)
PTFE .....polytetrafluoroethylene
QC.....quality control
SRL .....sample reporting limit
scfm.....standard cubic feet per minute
S .....sulfur
SO_2.....sulfur dioxide
SO_x.....sulfur oxide
UCR .....University of California at Riverside
Stdev. .....Standard deviation one sigma

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Executive Summary

Introduction: More than ten years have passed since emissions were measured from the large auxiliary boiler on a Suezmax tanker while it unloaded about one million barrels of crude. Modern vessels use newer boiler designs so it is of interest to measure their emissions. The Alpha Laval unit is an Aalborg OL large capacity auxiliary boiler with a super heater, representative of a modern boiler for tankers. Alpha Laval is a market share leader so data from this unit should provide an important perspective on the emissions from widely-used tanker boilers with the latest technology advances. Further, ships operating within California waters now use low-sulfur distillate fuels so results from this test will show the combined effects of a modern boiler design and the cleaner California fuels.

Methods: The test methods utilized International Organization for Standardization (ISO) 8178-4 sampling protocols. The boiler was evaluated at one load representative of normal operation. The emissions measured were regulated gaseous, speciated hydrocarbons C2-C12, aldehydes and ketones, metals, particulate matter mass less 2.5 um ($PM_{2.5}$), and PM composition which included elemental and organic carbon (EC and OC) PM. Other methods and practices, sampling dilution, and calculations such as dry to wet correction, followed ISO and Code of Federal Regulations (CFR) recommendations.

***Objectives*:** The primary aim of this work is to study the in-use emissions from a modern tanker boiler utilizing California approved MGO low sulfur fuel.

Results gaseous: The boiler carbon dioxide (CO_2) emissions were 3026 g/kg-fuel which is similar to previous testing of a modern auxiliary boiler on a container vessel suggesting the results are representative of a properly operated boiler. The nitrogen oxide (NO_x) emissions averaged 2.86 ± 0.18, carbon monoxide (CO) 0.06 ± 0.064, and sulfur dioxide (SO_2) 0.94 g/kg-fuel. The NO_x emissions were slightly higher, with-in 50%, to previous testing of a modern container vessel auxiliary boiler tested on low sulfur MGO and ULSFO fuels, but over two times lower (2.2) than the emissions on a tanker vessel auxiliary boiler tested on high sulfur HFO fuel.

Results PM: The $PM_{2.5}$ emissions were 0.022 ± 0.004 g/kg-fuel and were slightly lower compared to previous testing of a modern auxiliary boiler tested on low sulfur MGO and ultra-low sulfur fuel oil (ULSFO) fuels, but over 100 times lower (131) than the PM emissions on a boiler tested on high sulfur heavy fuel oil (HFO). The equivalent black carbon (eBC) emissions were 0.0012±0.0004 g/kg-fuel and were about the same for a previous modern boiler tested, but about 120 times lower than the EC emission reported for an older boiler tested on a tanker. The PM compostion is mostly organic (68%) and about 1.5% elemental carbon.

Results Toxics: The boiler emissions for Formaldehyde, Acetaldehyde and Acrolein were 0.401, 0.376, and 1.749 mg/kg-fuel. These results compare well with the modern boiler operating on MGO fuel test from a container vessel. Modern boilers operating on MGO fuels appear to have lower Acetaldehyde and Acetone emissions compared to older boiler tested on HFO fuels. The PAMS measurements were at the detection limit of the measurement method and thus, could not be compared properly to the previous testing on an older boiler tested on a high sulfur HFO fuel. These results are useful for updating the model with "less than" type of values. The metals emissions were… Waiting on data.

Summary: Modern boilers operating on MGO fuels have lower NO_x and total PM mass compared to older boilers operating on high sulfur fuels. These results show the benefit of modern boilers operating on low sulfur MGO fuels.

1 Background

1.1 Marine Boiler Emissions

More than ten years have passed since emissions were measured from a large boiler on a Suezmax tanker while it unloaded about one million barrels of crude. Results of that project were peer reviewed and published (Agrawal et al 2008). The results were an all-inclusive set of regulated and nonregulated emissions factors for criteria pollutants (carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter (PM) mass), a greenhouse gas (carbon dioxide (CO_2)), speciated hydrocarbons needed for human health risk assessments, and a detailed analysis of the PM into its primary constituents (ions, elements, organic, and elemental carbon (EC and OC)). Details on the heavy fuel oil (HFO) and boiler design are found in the publication.

Modern vessels use newer boiler designs so it is of interest to measure their emissions. The boiler tested in this project was an Alpha Laval Aalborg OL large capacity auxiliary boiler with a super heater. Alpha Laval is a market share leader so data from this unit should provide an important perspective on the emissions from widely-used auxiliary boilers with the latest technology advances. Further ships operating within California waters now use low-sulfur distillate fuels so results from this test will show the combined effects of a modern boiler design and the cleaner California fuels.

Marine boilers, called auxiliary boilers, are used for supplying steam and hot water for non-propulsion uses such as fuel heating, galley, cabin space heating, and to drive steam turbines on tankers that offload petroleum crude oil in ports. Boilers can range in size where for container vessels and bulk carriers they tend to be smaller than the ones on a tanker vessel. The boiler tested in this research had a fuel consumption and exhaust flow rate ten times larger than the container vessel auxiliary boiler. Thus, tanker boiler emissions are a of importance to the California Air Resources Board (CARB) to estimate their environmental impacts.

1.2 Objective

The objective of this research is to evaluate the emissions from a modern auxiliary boiler on a tanker ship while it offloads fuel with-in a port in Northern California where the main engine is off. The testing followed the same protocol as used in the earlier study with one exception, the method used for measuring the nonregulated air toxics. Following the same protocol of the earlier study will allow a direct comparison of emissions and provide information on the changes in emissions over time.

2 Approach

This section outlines the in-use emissions testing approach for the modern boiler on a xx-class tanker vessel. This section describes the test article (boiler, fuel, and load point), sampling approach (sample location, sample discussions, and test protocol), measurements (gaseous and PM measurement methods, toxic sampling approach), calculations (exhaust flow determination), and a discussion of the assumptions used in the data analysis. The test article sections cover design details of the boiler operation. The sampling approach describes where the samples were collected from the exhaust, any impact this location may have on the measurement, and the test protocol. The measurements section describes the measurement methods for the gaseous, PM (mass and composition), and toxics samples. The corrections and assumption section provide a discussion on the data and analysis used in this report.

2.1 Test article

The boiler, fuel, and test matrix are described in this section.

2.1.1 Boiler

The boiler tested is an Alpha Laval's large capacity auxiliary boiler (2xAalborg OL 50,000 kg/h) installed on a tanker vessel. This boiler design includes a super heater unit, 2xAalborg XW-S with a steam rating of 50,000kg/h. The boiler operation is automatically controlled. A diagram is presented in Figure 2-1 and the OL model specifications are provided in Table 2-1.

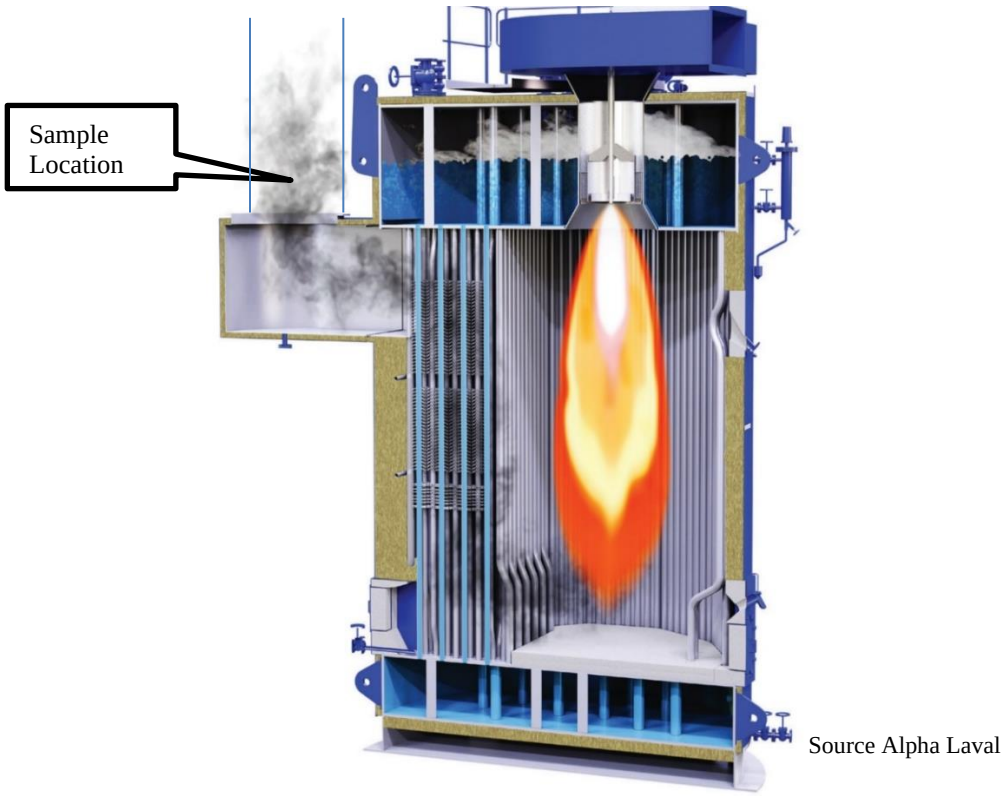


Figure 2-1 Design diagram of large frame boiler series

The test unit represents one of the larger boilers made by Alpha Laval. According to Alpha Laval's brochure, the unit tested, rated at 50,000kg/h steam capacity, is a boiler near the highest level of steam production that is commercially offered. This suggests the boiler emissions will be of interest to regulators since it is one of the higher emission rate boilers in mass/time for this type of tanker activity.

Table 2-1 List of Alpha Laval large frame boilers, 50,000 kg/h tested)

Steam capacity	Design pressure	Thermal output at 100% MCR	Height K (incl. retraction of burner lance)	Diameter D (incl. insulation)	Hight H	Width B	Boiler dry weight*)	Boiler operation weight
kg/h	bar(g)	kW	mm	mm	mm	mm	ton	ton
12,500	9	8,800	8,610	2,670	6,310	4,070	16.4	23.3
16,000	9	11,300	8,810	3,070	6,310	4,320	20.5	29.6
20,000	9 / 18	14,100	8,940	3,220	6,460	4,595	24.5 / 28.5	35.5 / 39.2
25,000	18	17,600	10,050	3,320	7,310	4,800	30.3	41.5
30,000	18	21,200	10,360	3,570	7,510	5,200	35.1	48.2
35,000	18	24,700	10,300	3,870	7,360	5,600	40.4	55.8
40,000	18	28,200	10,880	3,870	7,760	5,625	42.6	58.4
45,000	18	31,800	10,870	4,270	7,710	6,125	49.3	68.6
55,000	18	38,800	11,050	4,520	7,760	6,600	56.6	78.5

Source Alpha Laval

2.1.2 Test fuels

A standard low sulfur marine gas oil (MGO) fuel was used during this testing. The fuel complies with the CARB's Fuel Rule for Ocean-Going Vessels, which allows either an MGO or a marine diesel oil (MDO) at or below 0.1% sulfur (S). A fuel sample was taken, and the results show the fuel sulfur was less than 0.1% (S = 0.045% following D4294 and X-ray methods, see Appendix D). The test fuel had a carbon weight fraction of 0.8682 and a hydrogen weight fraction of 0.1286, See Appendix D for analysis report.

2.1.3 Test matrix

Typically, a test matrix includes a range of loads, but boilers operation tends to be constant load with periods of on/off control to maintain steam pressure. The fuel oil flow in the boiler is relatively constant while the boiler produces the highest steam rate for the turbine pump needs during land-based transfers (as tested during this project). As the land-based tanks reach their capacity, the boiler fuel rate slows slightly to accommodate a switch-over in the storage tanks.

Figure 2-2 shows the steam rate and fuel consumption for a different, but similarly sized auxiliary marine boiler made by Mitsubishi. The 50,000 kg/h Mitsubishi steam rate boiler shows a maximum fuel oil consumption of 3,787 kg/hr. If we assume the maximum consumption between manufacturers is similar, we can estimate the load on the boiler tested as a percentage of maximum. The measured fuel consumption during this testing was 2,400 kg/hr, suggesting the boiler was operated at an estimated 65% of its maximum design load.

The crew suggested the boiler could be operated at this "65%" state and also at a slightly lower steam rate. As such, there was a desire to test these two load points, but due to time limitations, however, we only had time to test the higher 65% load condition and not the lower load condition. The data in this report represents the 65% load case at a fuel consumption rate of 2,400 kg/hr.

Boiler type		MAC -20B	MAC -25B	MAC -30B	MAC -35B	MAC -40B	MAC -45B	MAC -50B	MAC -55B
Evaporation	kg/h	~ 20,000	~ 25,000	~ 30,000	~ 35,000	~ 40,000	~ 45,000	~ 50,000	~ 55,000
Boiler design pressure	MPa	1.77							
Working steam pressure	MPa	1.57							
Steam temperature	℃	*Saturated temperature to 280							
Boiler efficiency (LHV base)	%	80.5				82.5			
Feed water temperature	℃	60							
Air temperature	℃	38							
Number of burners	-	1							
Fuel oil consumption	kg/h	1,552	1,940	2,328	2,716	3,029	3,407	3,787	4,165

Figure 2-2 Heat loads and fuel rates for other boilers

(source Mitsubishi Heavy Ind.)[1]

2.2 Sampling approach

This section provides a discussion of the sample locations (PM representativeness and accessibility), and the test protocol (methods of sampling).

2.2.1 Sample locations

Sampling utilized UCR's partial dilution tunnel system, as outlined in ISO 8178-1, with a direct connection to the exhaust sample, see Appendix A for more details. Several points of access to the exhaust were identified during a site visit months before the testing campaign. The recommended location identified was near the top of the boiler stack where a cross-plume smoke meter was installed. The plume smoke meter was disconnected during testing and reinstalled afterwards, see Figure 2-4 and Figure 2-5. This location is free of bends and is a good location for sampling.

Figure 2-3 Platform space available for equipment (smoke meter shown)

[1] https://www.mhi-mme.com/products/boilerturbine/auxiliary_boilers.html#tab03_2 Auxiliary boiler project specifications.

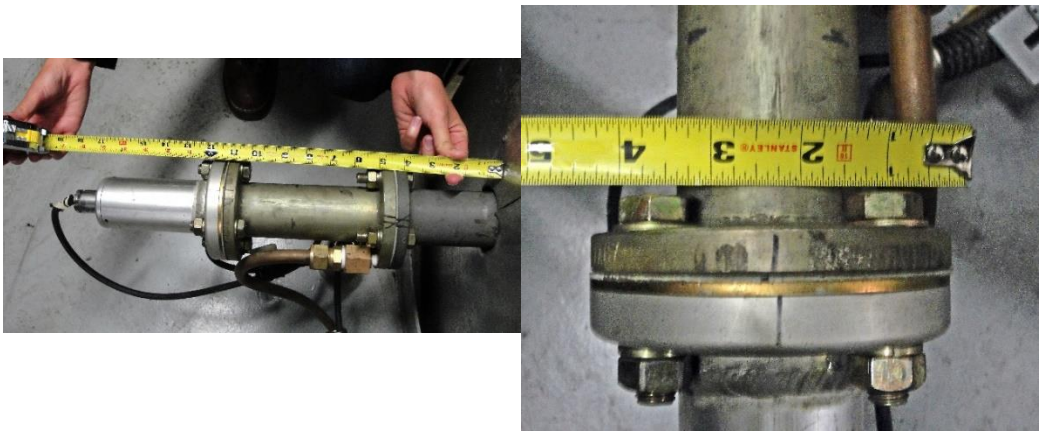


Figure 2-4 Dimensions for probe length and flange size

There were no sample ports prior to the heat exchanging surfaces where one can measure the boiler emissions directly, as can be seen by the boiler layout shown in Figure 2-1. UCR, therefore, utilized the cross-plume smoke meter sample location as the only practical sample location. The length of the sample probe needed to be 12 inches to access a well-mixed exhaust sample using good engineering judgment (which is 10% inside the wall of the exhaust stack where the flow is well mixed). The dimensions show the probe design should be 12 inches, see Figure 2-4 and Figure 2-5.

The dilution tunnel length with the installed cyclone was interfering with the vessel stack to the left in the figure shown below, see Figure 2-5. The tunnel would fit with the cyclone removed. Since this was the only suitable sample location the cyclone had to be removed in order to collect any samples from the boiler. The impact of this decision is provided in Section 2.5.

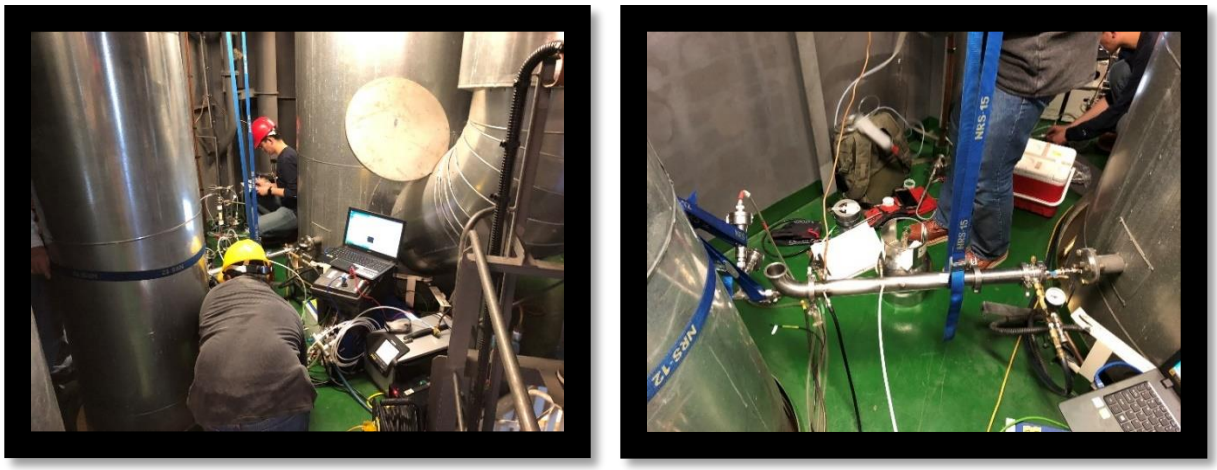


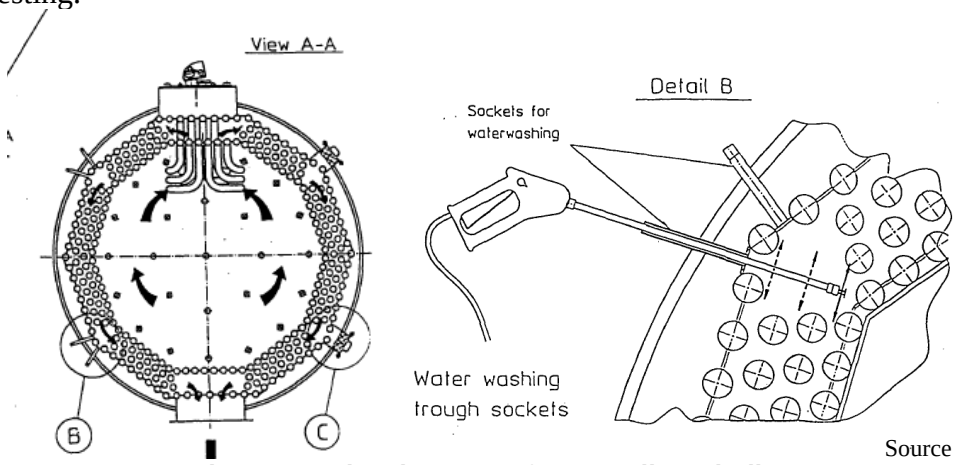
Figure 2-5 Boiler tunnel setup: thermopile probe removed for sampling

2.2.2 PM fouling discussion

Sampling after a heat exchanging surfaces, like a boiler, can be a source for PM adsorption and desorption because these surfaces heat and cool in the presence of PM where thermophoretic loss/accumulation (Hind 2nd Edition 1999) can be significant. During boiler-on conditions, the hot

boiler exhaust gas heats the cool boiler tubes and PM can adsorb on the surfaces. As the tube surfaces can get hot, PM may start to desorb. Then, during periods of boiler-off condition (reduced water heating), the heat exchanger surfaces will cool until the next cycle. The adsorption and desorption of PM on a boiler surface can be described by thermophoretic loss models in Hind (2nd Edition 1999). When PM is adsorbed onto the surface, stack PM emission factors can be underestimated over short periods of time (measured in hours). This suggests the location for the sample probe is important to try and be before the surfaces and the condition of the boiler cleaning is important.

The boiler heat exchanger surfaces do include cleaning recommendations of the heat exchanger surfaces. According to the Aalborg manual, the boiler cleaning is performed by routine air blasts and occasional water blasts. The rate of cleaning varies with the quality of the fuel and the indications from the installed smoke meter. The water blasts are performed when boiler performance declines. There are several access ports for these water blast ports, see Figure 2-6. According to discussions with the crew the boiler was in a clean state, thus suitable for our emission testing.



Source Alpha Laval

Figure 2-6 Cleaning setup for an Aalborg boiler

2.2.3 Test protocol

The boiler load was operated for more than 30 minutes at the highest power possible to warm the engine and stabilize emissions. Repeats of the same load are performed prior to changing loads (i.e. mode 1, 1, 1 change load, mode 2, 2, 2 load change…). Based on experience testing OGVs, repeating test points with this approach is needed to manage the time it takes between different load points and to prevent issues when navigating in areas with speed restriction. For this testing, however, only one load point was performed so there were not conditions to wait for. In general, at each steady state test mode, the protocol requires the following:

- Allow the gaseous emissions to stabilize before measurement at each test mode (minimum 10 minutes as per ISO). This was possible on the ME and AE tests, but due to strict time constraints on the boiler this guide was not followed, but emissions were stable regardless.
- Measure gaseous and PM concentrations for at least 3 minutes and no longer than 30 minutes (such that approximately 500µg of filter mass is collected at a minimum dilution ratio of 4:1). For the boiler tests the filter weights averaged 100 ug even with long sampling times of 40 minutes.

- Measure direct stack exhaust mass flow rate via EPA Method 2. Additionally, UCR recorded the fuel consumption of the boiler using discussions with vessel crew.
- Calculate emission factors from the measured pollutant concentration data and calculated mass flow rates.

2.3 Measurements

Like other marine tests, the measurement of exhaust concentrations followed the CARB[2] and IMO[3] protocols, see Appendix A for an in-depth description of UCR's marine sampling system. A dilution tunnel is connected directly to the exhaust stack without the need for a transfer line. The flow in the dilution system eliminates water condensation in the dilution tunnel and sampling systems and maintains the temperature of the diluted exhaust gas at <52°C before the filters.

An overview of UCR's partial dilution system is shown in Figure 2-7. Raw exhaust gas is transferred from the exhaust pipe (EP) through a sampling probe (SP) and the transfer tube (TT) to a dilution tunnel (DT) due to the negative pressure created by the venturi (VN) in DT. The gas flow rate through the TT depends on the momentum exchange at the venturi zone and is therefore affected by the absolute temperature of the gas at the exit of TT. UCR's marine testing is directly connected to the stack so to minimize PM losses. The dilution ratio targeted and verified for this testing project was 10:1 and the actual dilution ratio was 7:1.

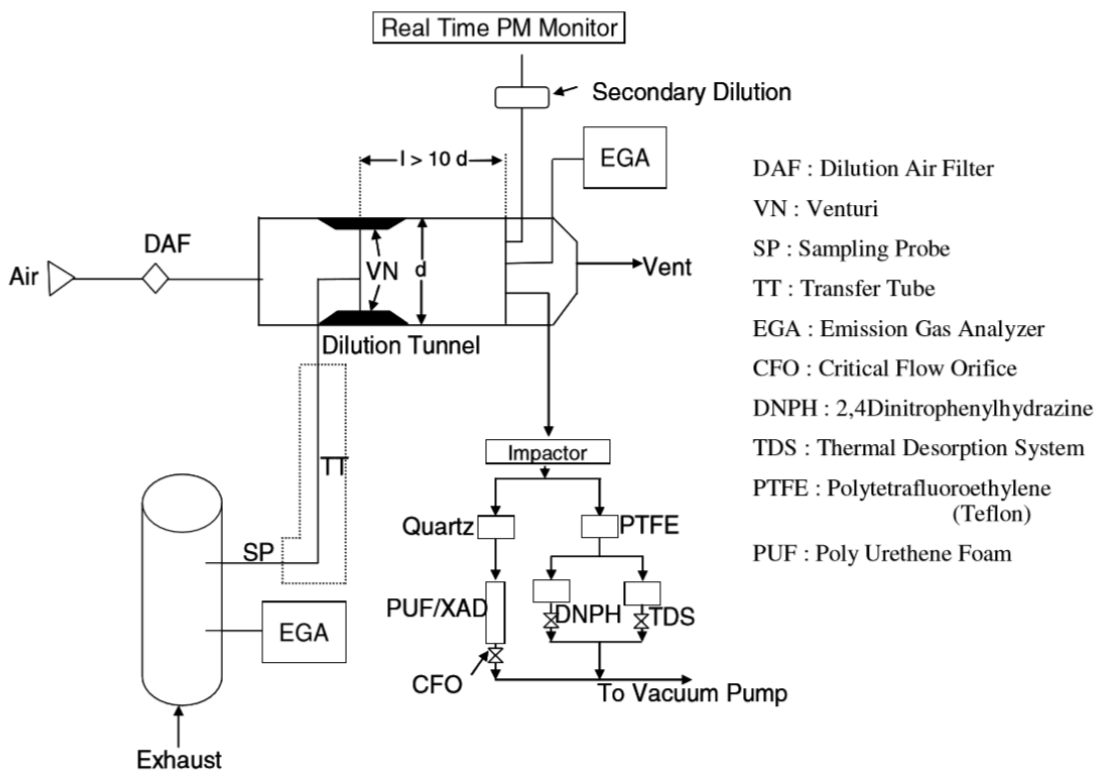


Figure 2-7 Sample schematic utilized

[2] California Air Resources Board, *Recommended Emissions Testing Guidelines for Ocean-going Vessels*, https://www.arb.ca.gov/ports/marinevess/documents/emissiontest/OGV%20Test%20Guidelines.pdf, (2012)

[3] ISO 8178-1 Reciprocating internal combustion engines - Exhaust emission measurement - Part 1: *Test-bed measurement of gaseous and particulate exhaust emissions*

[1] For this testing the TDS and PUF were not utilized and Suma canisters were collected from the secondary dilution system. Additionally, raw Suma canister grab samples were collected and analyzed.

ISO cautions that the advantages of partial flow dilution systems can be a source of sampling problems such as: losing particulates in the transfer tube, failing to take a representative sample from the engine exhaust and inaccurately determining the dilution ratio. UCR includes standard methods for each marine application to ensure these concerns are managed properly.

2.3.1 Gaseous and PM emissions

Best recommended practices for OGV exhaust gas measurements follow 40 CFR Part 1065 for PM measurements with specific details following ISO 8178-1 for dilution and exhaust gas sampling. The measurement approach is summarized here, with more details available in Appendix A.

Gaseous: The concentrations of gases in the diluted exhaust tunnel was measured with a Horiba PG-350. Nitrogen Oxides (NO_x) utilize a heated chemiluminescence detector (HCLD), carbon monoxide (CO) and sulfur dioxide (SO_2) utilize non-dispersive infrared absorption (NDIR) with cross flow modulation, and oxygen (O_2) utilize a zirconium oxide sensor. Major features of the PG-350 include a built-in sample conditioning system (5 deg C) with sample pumps, data storage on a flash drive, integrated mist and particle filters, and a thermoelectric cooler. The performance of the PG-350 was tested and verified under the U.S. EPA and ETV programs.

Gaseous concentrations were measured directly from the dilution tunnel and from raw exhaust during dilution ratio verification. Dry-to-wet corrections were performed using calculated water concentration from the exhaust and the dilution tunnel.

Table 2-2 Summary of Emissions Measured by UCR

Species Sampled			
NDIR CO	NDIR CO_2	CLD NO_x	Photoacoustic eBC
NDIR SO_2	Total **$PM_{2.5}$** Gravimetric method	PM EC/OC NIOSH method	

Particulate Matter (PM) mass: UCR's PM measurements use a partial flow dilution system that was developed based on the ISO 8178-1 protocol, detailed information is provided in Appendix A. Total PM mass less than 2.5 um diameter ($PM_{2.5}$) is measured from the diluted exhaust gas according to the Code of Federal Regulations (CFR) 40 CFR Part 1065. UCR utilizes 47 mm 2um pore Teflon filters (Whatman Teflo) weighed offline with UCR's UPX2 Mettler Toledo micro balance (0.1 ug resolution) in a temperature, humidity, and particle-controlled environment. The microbalance is operated following the weighing procedures of the CFR. Before and after collection, the filters are conditioned for a minimum of 24 hours in an environmentally controlled room (RH = 45%, T = 21 C, 9.5 C dew point) and weighed daily until two consecutive weight measurements were within 3µg.

PM Composition: The project measured PM composition which comprises elemental carbon (EC) and organic carbon (OC). OC/EC analysis was performed on samples collected on 2500 QAT-UP Tissuquartz Pall (Ann Arbor, MI) 47 mm filters that are preconditioned at 600°C for 5 h. A 1.5 cm2 punch is cut out from the quartz filter and analyzed with a Sunset Laboratory (Forest Grove, OR) Thermal/Optical Carbon Aerosol Analyzer according to the NIOSH 5040 reference method. The PM composition filters were sampled from UCR dilution tunnel at a targeted flow rate of 15 slpm.

Metals: The metal analysis has not been performed at this time. It will be performed on the Teflon PM samples using X-Ray Fluorescence (XRF) from an offline analytical method. The filters were first weighed then will be sent out for XRF analysis. The method offers analysis of elements (Na through Pb) represented by 38 elements. XRF is an EPA approved, non-destructive analytical method (IO-3.3) wherein a filter is bombarded with X-ray energy. The subsequent excitement of electrons can be measured when the electrons fall back to their valence state, releasing energy in the process. Each element has a "fingerprint" of energy discharges which are measured to determine the quantity of each element.

Equivalent black carbon (eBC). Bond et al (2013) provided a definition of black carbon (BC) measurement methods as they relate to characterizing climate impacts. The photoacoustic measurement method is considered to be an equivalent BC method (denoted as eBC), the NIOSH thermal optical method is an apparent elemental carbon measure of BC (denoted as EC), single particle soot photometers such as the laser-induced incandescence measure the refractory nature of BC (denoted as rBC), and particle soot absorption photometers such as the Aethalometer and MAAP instruments measure the equivalent BC (denoted as eBC). The instrument utilized for BC measurements in this study was UCR's in-house photoacoustic real-time analyzer (AVL MSS-483) which represents the eBC measurement method as defined by Bond and is utilized here for consistency. The photoacoustic measurement method is a reliable and robust measurement for quantifying marine BC where the PM fractions vary significantly and have been shown to impact the EC measurement method (Bond et al 2013 and Johnson et al 2016). The photoacoustic measurement was sampled from the same dilution tunnel used for the gravimetric and NIOSH filter samples.

2.3.2 Toxics

CARB utilizes speciation estimates from boiler emissions that are used in the emission inventory and air quality models. These models are lacking toxic data from marine boilers. As such, additional toxic samples were utilized for the boiler tests. These included aldehydes and ketones, speciated hydrocarbons, and metals. All the toxic samples were collected from the dilution tunnel as shown in Figure 2-7. Additionally, two speciated hydrocarbon samplers were collected directly from the raw stack to improve measurement sensitivity.

Total Gaseous Non-Methane Organics (TGNMO) concentrations are often measured using a total hydrocarbon analyzer with a field ionization detector (FID). However, these devices have a flame and are not usually allowed on a tanker vessel. For this project diluted exhaust samples were collected in SUMMA® canisters, equipped with flow controllers and subsequently analyzed for TGNMO at Atmospheric Analysis and Consulting (AAC) an off-site laboratory.

PAMS AAC also analyzed the SUMMA canisters for VOC's and BTX to process the total PAMS impact of the speciated HCs. They used the TO-12/PAMS method which provides the data for VOCs including light toxics (BTX and butadiene) and the PAMS profile needed for air quality modeling. With this method, the analysis provides concentrations of the following hydrocarbons.

Ethylene	3-Methylpentane	Styrene
Acetylene	1-Hexane	O-Xylene
Ethane	N-Hexane	N-Nonane
Propylene	Methylcyclopentane	Isopropylbenzene
Propane	2,4-Dimethylpentane	N-Propylbenzene
Isobutane	Benzene	M-Ethyltoluene
1-Butane	Cyclohexane	P-Ethyltoluene
N-Butane	2-Methylhexane	1,3,5-Trimethylbenzene
Trans-2-Butene	2,3-Dimethylpentane	O-Ethyltoluene
Cis-2-Butene	3-Methylhexane	1,2,4-Trimethylbenzene
Isopentane	2,2,4-Trimethylpentane	N-Decane
1-Pentane	N-Heptane	1,2,3-Trimethylbenzene
N-Pentane	Methylcyclohexane	M-Diethylbenzene
Isoprene	2,3,4-Trimethylpentane	P-Diethylbenzene
Trans-2-Pentene	Toluene	N-Undecane
Cis-2-Pentene	2-Methylheptane	N-Dodecane
2,2-Dimbutane	3-Methylheptane	
Cyclopentane	N-Octane	
2,3-Dimenthylbutane	Ethylbenzene	
2-Methylpentane	M/P-Xylenes	

Note in the earlier tanker measurement project, VOC adsorbed molecules starting about C_4 (butadiene) through C_{12} were collected on a multi-bed carbon bed composed of molecular sieve, activated charcoal, and carbotrap resin. The VOC included toxics such as 1,3 butadiene; benzene; toluene; ethylbenzene and xylenes. This method was not used during this testing campaign.

Aldehydes and ketones: Carbonyls (aldehydes and ketones) were collected on 2,4-dinitrophenylhydrazine (DNPH) coated silica cartridges (Waters Corp., Milford, MA) behind the Teflon filter. A critical flow orifice was used to control the 1.0 LPM flow through the cartridge. Sampled cartridges were sealed and stored at a cold temperature and later extracted using 5 mL of acetonitrile with the liquid then injected into Agilent 1100 series high performance liquid chromatograph (HPLC) equipped with a diode array detector. The HPLC column was similar to a 5µm Deltabond AK resolution (200cm x 4.6mm ID) with upstream guard column. The HPLC sample injection, and operating conditions are set up according to the specifications of the SAE 930142 HP protocol (Siegl, W et al 1993). The DNPH samples were collected from the dilution tunnel. Due to time limitations and sample difficulties only one valid sample was collected.

Metals: The metal analysis was performed on the Teflon PM samples using X-Ray Fluorescence (XRF) from an offline analytical method utilizing the same Teflon filters used to determine the

$PM_{2.5}$ mass. The filters were first weighed then sent out for XRF analysis. The method offers analysis of elements (Na through Pb) represented by 38 elements. XRF is an EPA approved, non-destructive analytical method (IO-3.3) wherein a filter is bombarded with X-ray energy. The subsequent excitement of electrons can be measured when the electrons fall back to their valence state, releasing energy in the process. Each element has a "fingerprint" of energy discharges which are measured to determine the quantity of each element.

2.3.3 Exhaust flow

The calculated emission factor requires the measurement of the engines exhaust flow rate. The exhaust gas flow can be determined by the following methods:

1. Direct Measurement Method (**utilized**)
2. Carbon Balance Method (not available, lacking measured fuel consumption**)**
3. Air and Fuel Measurement Method (not available)
4. Air Pump method (not possible on boilers only engines)

Although there are four accepted methods for measuring flow rate, the direct measurement approach was most suitable for boiler testing. Direct exhaust flow measurement is complex and requires long straight sections which is not typically available on OGVs exhaust systems. Thus, direct measurement has not been a preferred method at UCR for engine exhaust flow, where fuel flow measurement has been utilized. For this boiler, there was a suitable straight section for good exhaust flow direct measurement. Thus, direct flow measurement (#1) was utilized for accurate emissions calculations.

The direct measurement system utilized in this project was a type S Pitot tube is used to measure the differential pressure between the counter-flow (static pressure) and parallel-flow (dynamic pressure) directions. This method follows EPA Method 2, see Section 2.4.2 and Appendix E for details.

2.3.4 Boiler

The boiler output was not available for recording and only a single mode was utilized given the short time frame allowed on the vessel. The boiler was operated under normal usage conditions in a high load operation maintaining bulk fuel temperature. It is estimated based on the recorded fuel rate that the boiler load was around 65% of its total capacity.

2.4 Calculations

The calculations are described in this section.

2.4.1 Emission factors

The emissions were collected at the one mode in triplicate to allow for the determination of confidence intervals for the reported means. The triplicate measurements were performed by collecting three samples (i.e. triple or three repeated measurements) at each load point for all the species of interest (gaseous continuous and integrated PM samples). The result is based on the measured mass flow in the exhaust stack, the measured concentration of species, divided by the fuel rate calculated by the carbon balance method utilizing the MGO fuel as specified in Section 2.1.2. An overall single emission factor representing the boiler was determined by dividing the

integrated mass of emissions (g/hr) by the integrated fuel rate (kg-fuel/hr) to get an emission factor of g/kg-fuel for each species presented.

2.4.2 Exhaust flow

The exhaust flow calculation follows EPA Method 2 which utilizes a type S Pitot tube is used to measure the differential pressure between the counter-flow (static pressure) and parallel-flow (dynamic pressure) directions, see Figure 2-8. Velocity is calculated using Bernoulli's principle, which states that the pressure in a stream of fluid is reduced as the speed of the flow is increased. The velocity calculation is based off of the temperature, molecular weight of the exhaust gas, static pressure, dynamic pressure, and relative humidity. Measurement of the differential pressure and temperature were repeated at the sampling site several times at different depths inside the duct, including the near side of the duct, in the middle of the duct, and the far side of the duct, see Appendix E for detailed exhaust flow calculation.

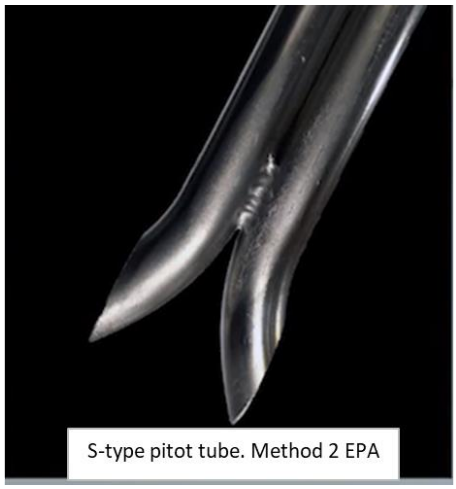


Figure 2-8 S-type pitot tube for EPA Method 2

2.5 Corrections and assumptions

Ship testing is very complex where space and time are limited, and setup is from instruments which were transported in boxes to the test site and setup. As such, it is expected not everything will go according to plan, but most data on ships is of value since it is hard to come by.

This section was added to discuss three issues that occurred while testing the boiler. These issues may impact the emissions where this section provides context to the quality of the reported data.

2.5.1 Emissions stability

There was a small stability issue that occurred at the start of sampling that may impact the gaseous emissions slightly and the eBC more significantly. The stability issue can be seen by the slight increase in CO_2 and NO_x concentration for the first hour of testing, see Figure 2-9 between 10:30 and 11:30 (note this was after 1-2 hours of boiler stabilizing). The change in NO_x concentration is small (1 ppm NO_x) and larger for CO_2 (1.5% CO_2), but the Test 1 MSS soot measurement (eBC) is five times higher than the steady state measured soot measurement of Test 2, see the grey trace in Figure 2-9. It is not clear what happened between 10:30 and 11:30, but it seems there was a slight change in fuel usage (CO_2 change) and unstable eBC emission (BC desorption, fueling, or other). There was also an impact in the PM filters as can be seen by the color of the

filters, see Figure 2-10. The first filter, Test #1, was darker then Test #2 and #3 supporting what was visible with the real time MSS soot sensor. The overall PM filter mass, however, did not change significantly, as discussed in the next sub section.

Previous testing on a container vessel modern boiler showed that soot concentration (eBC method) was very stable and averaged about 0.01 mg/m3 during the 8 hours of sampling over three separate days. This would suggest the more representative eBC value is the one between 11:50 and 12:10 for test 1. As such, a re-analysis of the real time data was performed to collect the data for the stable time segment. A re-analysis of the gaseous emissions was also collected for this time period. The original sample durations are shown by orange circles and bars, the modified time segments are denoted by the green circles, see Figure 2-10. The results presented in this are based on the analysis during the green circles. The details of the original and modified data are provided in Appendix F.

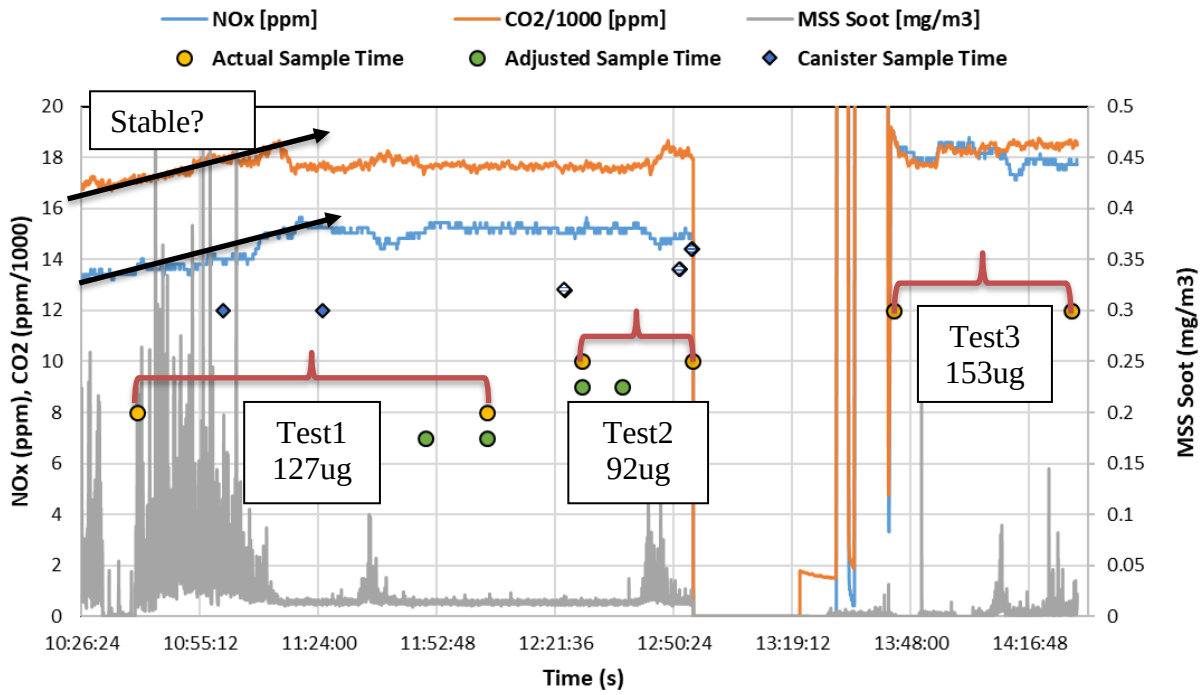


Figure 2-9 Real time emissions for tests 1, 2, and 3

[1] Orange circles are the original sample times for PM filters, The blue triangles are the stop and stop of the SUMA canisters, green are the revised sample averaging times for the eBC and gaseous emissions.

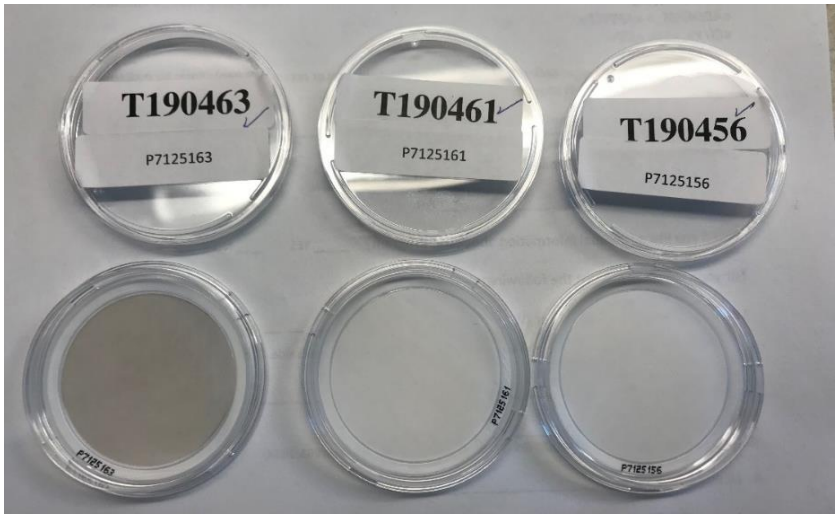


Figure 2-10 Sample filters Test 1, 2, and 3

[1] The filter weights were 127, 153, and 92 ug from left to right.

2.5.2 Filter spotting

During the dilution tunnel installation, the PM cyclone would not fit due to space limitations so it had to be removed, see discussion in Section 2.2.1. Cyclones were introduced into PM samplers to prevent collecting wall accumulated particles, debris in the exhaust, and other objects not emitting directly from the combustion process. Typically, a properly sampled PM filter would not show visible spotting. The spotting on these filters cannot be seen easily with-out some type of magnification, see Figure 2-10 vs Figure 2-11. The mass impact due to the spotting is believed to be small because less than 5% of the total mass is soot and the spotting would likely be soot based accumulation particles. Additionally, the PM mass for the darker filter is less than the PM mass for the other two filters showing that the color of the filter isn't what is causing the higher PM filter weights.

The results for the PM mass filters are presented "as is" where these values maybe be artificially high by 5% due to the filter # 1 eBC instability and the PM spotting. Also, these PM mass emission rates are similar to the recent boiler UCR tested on a container ship and these PM mass emission rates are much lower than a similar crude tanker tested in 2008 (Agrawal et al 2008), so the data is of value to report.

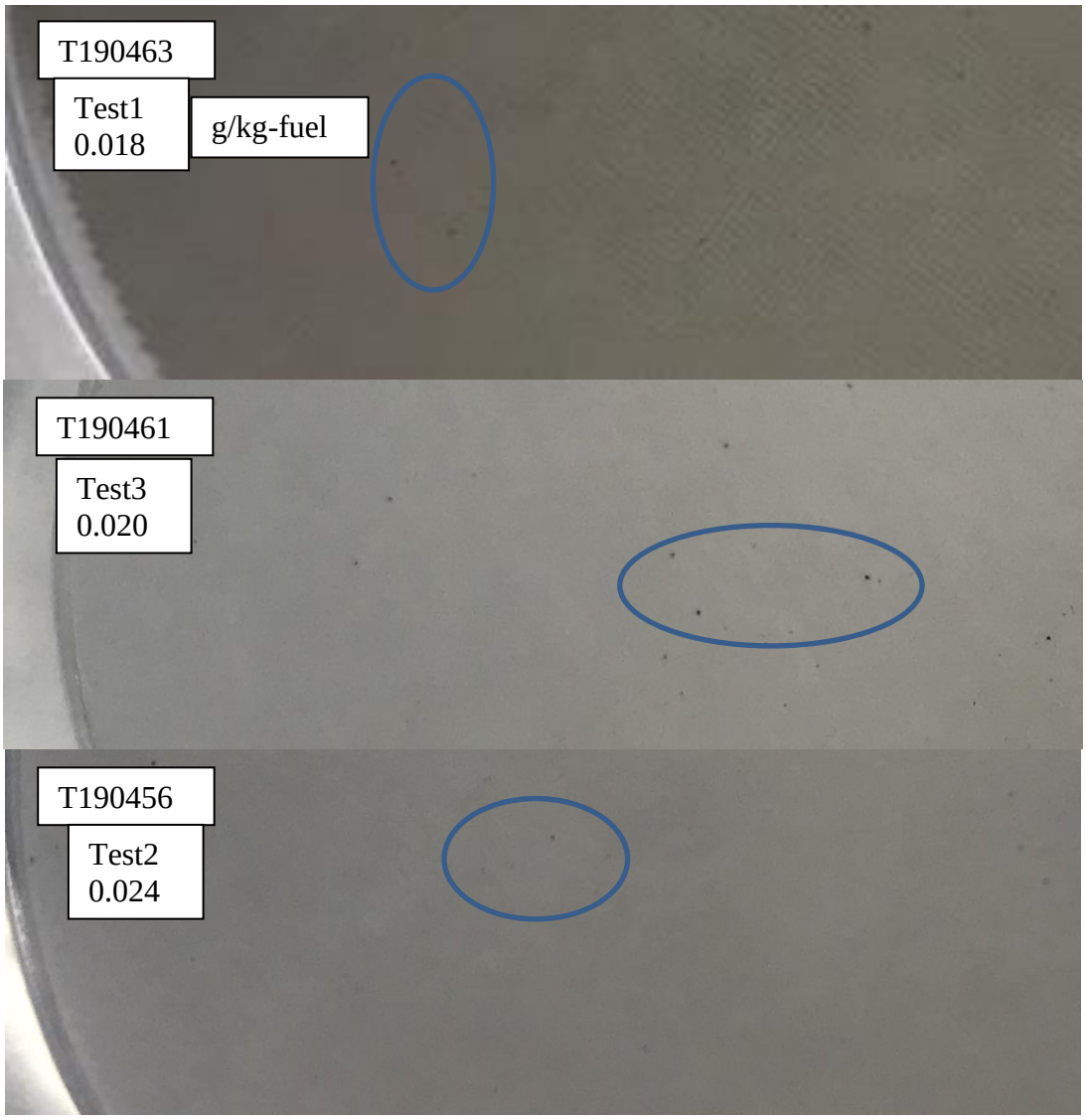


Figure 2-11 Filter spotting for tests 1, 2, and 3 (most observed spotting)

2.5.3 Toxics

SUMA canisters samplers were collected from the dilution tunnel between 11:01 and 12:24 and from the raw exhaust after 12:50, see Table 2-3. The dilute samples resulted in detectable quantities of C2-C4 analytes, but for the raw, undiluted samples, all the analyte responses below C5 were below the Sample Reporting Limit (SRL), see Table 2-4. The EPA 3C analysis showed 1.5% CO2 in the dilute measurement and 10.5% CO2 in the raw stack sample, suggesting the samplers were labeled and analyzed correctly. This suggests there may be a contamination in the dilution air utilized for the dilute BTEX samples.

The raw samples were used in the report analysis and this finding doesn't impact to overall discussion. Future BTEX samples will consider this impact on our sampling system especially when testing for lighter HC fuels.

Table 2-3 Summary of BETX sampling locations

BTEX				
Start Time	Dur	Flow	ID	Comment
hh:mm	min	slpm		
11:01	24	0.5	BTX6123	Dil tunnel
12:24	28	0.5	BTX6121	Dil tunnel
12:52	3	-	BTX6124	Raw stack grab
12:55	3	-	BTX6126	Raw stack grab

Table 2-4 Summary of BTEX concentrations C2-C4 dilute vs stack discussion

Analyte	MM		Diulte		Stack	
			#1	#2	#3	#4
Ethylene	28.1	C2H4	<SRL	<SRL	<SRL	<SRL
Acetylene	26.0	C2H2	1.88	<SRL	<SRL	<SRL
Ethane	30.1	C2H6	3.32	3.12	<SRL	<SRL
Propylene	42.1	C3H6	<SRL	<SRL	<SRL	<SRL
Propane	44.1	C3H8	16.1	9.16	<SRL	<SRL
Isobutane	58.1	C4H10	7.14	10.5	<SRL	<SRL
1-Butene	56.1	C4H8	<SRL	<SRL	<SRL	<SRL
1,3-Butadiene	54.1	C4H6	<SRL	<SRL	<SRL	<SRL
n-Butane	58.1	C4H10	2.24	3.44	<SRL	<SRL

3 Results

The emission results for the Alfa Laval auxiliary boiler installed on a tanker are described in this section. The results are based on the operation of the boiler under in-use conditions during fuel off-load in a Northern California port. The estimated load condition is 65%. There were some data corrections performed and these corrections are explained in Section 2.5. This section presents the results of the final data set, where all data points are available in Appendix F.

The result section is divided into three sub sections gaseous, PM (PM mass and composition and BC), and toxics. All error bars and standard deviations (stdev) presented are based on one sigma (σ) uncertainty.

3.1 Gaseous

The gaseous emissions include NO_x, CO, CO_2, and SO_2. The SO_2 emissions were both measured and calculated where the calculated values are used in this report. The gaseous emissions are shown in Table 3-1 (averages), Table 3-3 (stdev) and Figure 3-1. The boiler $fsCO_2$ emissions were 3026 g/kg-fuel. This is similar (with-in 2%) to previous testing of a modern auxiliary boiler on a container vessel. The close agreement suggests both boiler tests were performed under similar conditions.

The fuel specific (fs) NO_x emissions averaged 2.86 ± 0.18, CO 0.06 ± 0.064, and SO_2 0.94 g/kg-fuel. The $fsNO_x$ emissions were slightly higher, with-in 50%, to previous testing of a modern container vessel auxiliary boiler tested on low sulfur MGO and ULSFO fuels (0.038 S and 0.089 S respectively) (Johnson et al 2019), but over two times lower (2.2) than the emissions on a tanker vessel auxiliary boiler tested on high sulfur HFO fuel (2.85% S) (Agrawal et al 2008). The CO emissions were 6.9 times lower than the boiler operating on HFO fuel. The boiler SO_2 emissions were lower for the low sulfur fuel compared to a high sulfur HFO fuels, lower by a factor of 58 (Agrawal et al 2008). The main difference is a result of the sulfur weight fraction in the fuel.

Table 3-1 Summary of Emissions Measured by UCR (ave)

Boiler	Carb. FC	Units	Average Species					
Load	kg/hr		NOx	CO	CO2	calc. SO2	PM2.5	PM_eBC
65%	2460.4	g/hr	7051.0	154.7	7445560	2321.0	53.7	2.9
65%	2460.4	g/kg-fuel	2.86	0.064	3026.1	0.943	0.022	0.0012

Table 3-2 Summary of Emissions Measured by UCR (stdev)

Boiler	Carb. FC	Units	Stdev Species					
Load	kg/hr		NOx	CO	CO2	calc. SO2	PM2.5	PM_eBC
65%	2460.410	g/hr	0.261	0.063	0.434	0.000	0.004	0.0028
65%	2460.410	g/kg-fuel	0.175	0.055	0.162	0.050	0.004	0.0004

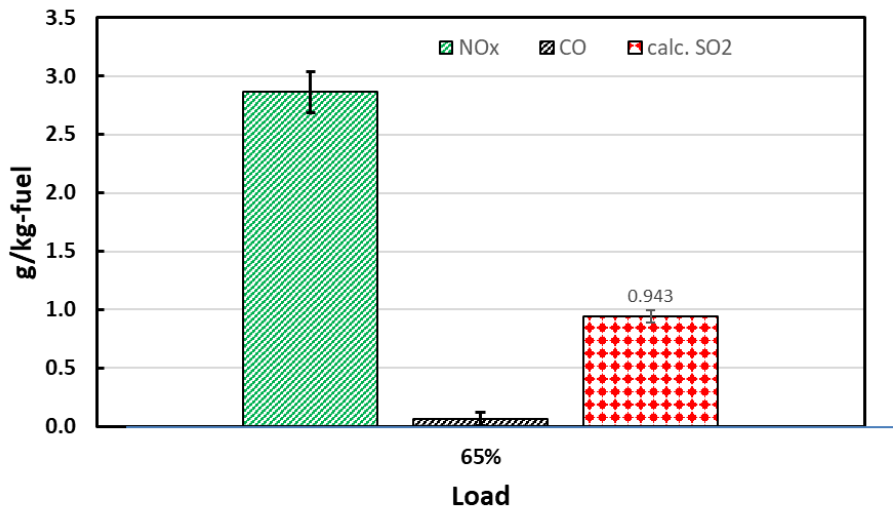


Figure 3-1 NOx, CO, and SO2 boiler emissions (g/kg-fuel)

[1] SO2 is calculated from sulfur in the fuel and fuel usage.

3.2 PM

The PM emissions are organized by PM mass, PM composition (EC, OC, Sulfate), and equivalent BC (eBC), see Section 2.3 for a description of the PM measurement method and definitions.

The $PM_{2.5}$ mass and eBC emissions for the boiler are show in Table 3-1 and Figure 3-2. The average $PM_{2.5}$ emissions were 0.022 ± 0.004 g/kg-fuel and the eBC emissions were 0.0012±0.0004 g/kg-fuel. The $PM_{2.5}$ emissions were slightly lower, with-in 50%, to previous testing of a modern auxiliary boiler tested on low sulfur MGO and ULSFO fuels (Johnson et al 2019), but over 100 times lower (131) than the PM emissions on a boiler tested on high sulfur HFO fuel, (Agrawal et al 2008).

The boiler eBC emissions were higher (70%) than the previous testing of a modern boiler (Johnson et al 2018), but the soot concentration in the stack was similar and near the detection limits of the measurement method. This suggests the difference between the eBC emissions from the two modern boilers may be a result of detection limits. eBC emissions were not measured with a micro soot sensor during the 2008 tanker testing, but NIOSH EC mass was measured. The boiler eBC emissions was 120 times lower than the EC emission reported for the tanker operating on high sulfur fuels (Agrawal et al 2008). Johnson has shown the EC measurement method at ratios of EC/OC < 5%, like in Agrawal's study, are less accurate (Johnson et al 2016), thus it is not clear the benefit of the eBC or EC measurement difference between the modern and older boilers.

The speciated PM (EC, OC, and Sulfate) emissions are shown in Table 3-3 and Figure 3-2. The PM_EC was 0.56 mg/kg-fuel and the OC_PM was 21 mg/kg-fuel. The fraction of EC compared to the sum of EC+OC is 2.2% suggesting the EC fraction is low for the boiler emissions and OC fractions are larger. The sulfate PM is still being analyzed, but can be estimated from the fuel sulfur level. This is estimated at 11 mg/kg-fuel for a fuel sulfur level of 0. 0483%. With the estimated sulfur the PM composition is calculated to be approximately 68.5% organic, 30% sulfate, and 1.5% elemental.

Table 3-3 Summary of PM composition measured by UCR (ave)

Boiler	Carb. FC	Units	Average Species					
Load	kg/hr		PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor
65%	2460.4	g/hr	1.400	51.218	-	79.356	61.461	89.599
65%	2460.4	g/kg-fuel	0.00056	0.021	-	0.032	0.025	0.036

[1] PM_S is represented as hydrated sulfate ions (H20SO46.55H20), PM_TC is the sum of PM_EC+PM_OC+PM_S, PM_OCcor = 1.2*PM_OC to correct for the hydrogen bonding estimate, and PM_TCcor = PM_EC+PM_OCcor_PM_S and should represent the total PM mass and, thus, be comparable to $PM_{2.5}$

Table 3-4 Summary of of PM composition measured by UCR (stdev)

Boiler	Carb. FC	Units	Stdev Species					
Load	kg/hr		PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor
65%	2460.4	g/hr	0.001	0.007	-	0.006	0.008	0.008
65%	2460.4	g/kg-fuel	0.00032	0.004	-	0.003	0.004	0.004

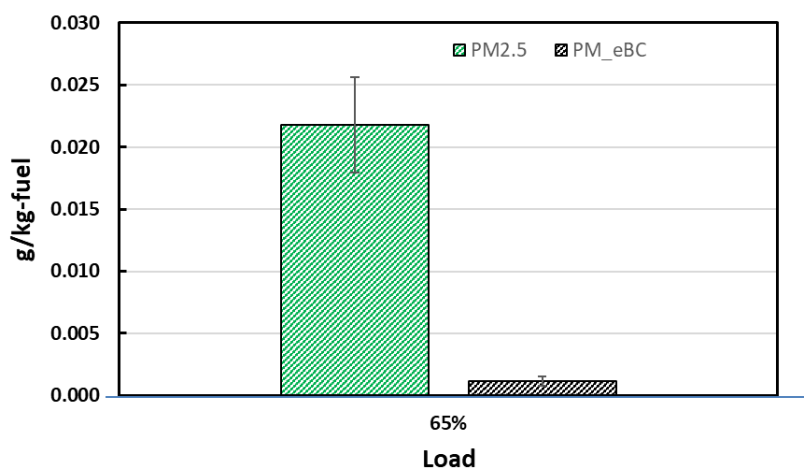


Figure 3-2 $PM_{2.5}$ and eBC emissions (g/kg fuel)

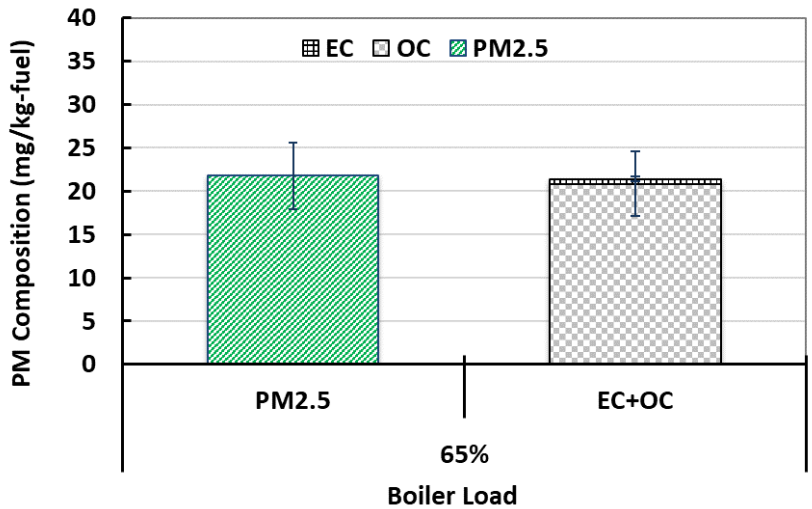


Figure 3-3 $PM_{2.5}$ and eBC emissions (mg/kg fuel)

3.3 Toxics

Toxics measurements were collected for the boiler tests. These include aldehydes and ketones, speciated hydrocarbons, and metals.

Aldehydes and ketones: The aldehydes and ketones are presented in Table 3-5. Only Formaldehyde, Acetaldehyde and Acrolein were analyzed, other species were not reported. The boiler emissions for Formaldehyde, Acetaldehyde and Acrolein were 0.401, 0.376, and 1.749 mg/kg-fuel. These results compare well with the modern boiler operating on MGO fuel from a container vessel. Both modern boilers operating on MGO fuel (container and tanker) emission results showed lower Formaldehyde emissions compared to the container boiler emissions when operating on low sulfur HFO fuel. Additionally, modern boilers operating on MGO fuels appear to have lower Acetaldehyde and Acetone emissions compared to the boiler tested by Agrawal (Agrawal et al 2008).

Table 3-5 Average Aldehydes and ketone emissions by fuel by test load.

Fuel	Load	Fuel Use kg/hr	Units	Formaldehyde			Acetaldehyde			Acrolein		
MGO	65%	2460	mg/hr	976.6	±	-	917.0	±	-	4263.1	±	-
MGO	65%	2460	mg/kg-fuel	0.401	±	-	0.376	±	-	1.749	±	-

[1] Statistical student t.test was not performed due to only one sample collected. Expected uncertainty from other replicate tests from boilers is ± 15%.

BTEX speciated hydrocarbons: The total PAMS, TNMHC, and selected species are presented in Table 3-6. The total PAMS were low and just above the Sample Report Limit (SRL) at 2 ppb and the total NMHC were 249 ppb on average. On a mass basis, the total PAMS and TNMHC were 0.0033 and 0.516 mg/kg-fuel, see Table 3-7. Other selected speciated HCs (C4-C8) are shown in Table 3-7 which were all below the SRL where the values reported represent an upper limit to their measurement this is why they are reported with the "<" sign. The speciated HCs (C4-C8) are higher during this modern boiler test compared to those reported by Agrawal (Agrawal et al 2008). One reason for the higher emissions in this testing may be due to different

sample detection limits between the laboratories. The full report of speciated HCs (C2-C12) is provided in Appendix F. Also, during the previous study, PAHs were collected which were not collected in this study so that comparison is not available.

Table 3-6 EPA 3C, total PAMS, and TNMHC results, raw stack

Analyte	Stack EPA 3C		
	#1	#2	Ave
Dilution Factor	1.97	1.79	1.88
H2	<2.0%	<1.8%	<1.8%
Ar/O2	7.5%	7.5%	7.5%
N2	82.0%	82.0%	82.0%
CO	<0.2%	<0.2%	<0.2%
CO2	10.4%	10.5%	10.5%
CH4	<0.2%	<0.2%	<0.2%
1,3 Butadiene (ppbC)	<SRL	<SRL	<SRL
Total PAMS (ppbC)	1.99	2.04	2.02
TNMHC (ppbC)	309	189	249

Table 3-7 Selected speciated hydrocarbons (C4-C8) mg/kg-hr

Analyte	Conc. ppb	mg/kg-fuel
1,3-Butadiene	<SRL	< 0.00907
Benzene	<SRL	< 0.00874
Toluene	<SRL	< 0.00883
m/p-Xylenes	<SRL	< 0.00891
Ethylbenzene	<SRL	< 0.00891
o-Xylene	<SRL	< 0.00891
Total PAMS	2.02	0.00332
TNMHC	249.0	0.516

[1] Total PAMS and TNMHC utilized propane for molar mass. For other species see Appendix F for the full list

Metals: The metal results for the boiler at 65% load are shown in Table 3-8 and Table 3-9. The full list of metal results can be found in Appendix F. These are in progress. AQMD agreed to perform this once the quarantine is lifted.

Table 3-8 Average selected metals with 1 σ error bars, 1 of 2

Fuel	Units	Mg			AL			Si			P			S		
MGO	mg/hr	-	±	-	-	±	-	-	±	-	-	±	-	-	±	-
MGO	mg/kg-fuel	-	±	-	-	±	-	-	±	-	-	±	-	-	±	-

Table 3-9 Average selected metals with 1 σ error bars, 2 of 2.

Fuel	Units	Cl			V			FE			NI		
MGO	mg/hr	-	±	-	-	±	-	-	±	-	-	±	-
MGO	mg/kg-fuel	-	±	-	-	±	-	-	±	-	-	±	-

4 Summary

Emissions measurements were made on from a modern auxiliary boiler on a tanker ship while it offloads fuel with-in a port in Northern California where the main engine was off. The auxiliary boiler was operated on MGO fuel and operated at an estimated 65% load. Emissions were measured following ISO and CFR methods for gaseous, and PM (total mass, elemental, and organic carbon species, sulfated PM). Boiler sampling also include toxics to help the CARB update its boiler emissions inventory. Dilution ratios and filter temperatures, as specified in 1065, were met during this testing.

A summary of the results for the testing is as follows:

- The emissions were slightly unstable at the start of testing, but were found to be stable for the segments analyzed. The reported data set is representative of valid measurements suggesting the results are representative of a properly operating boiler.
- The boiler fuel flow rate was meausred at 2460 kg/hr utilizing direct measurment of exhaust flow and carbon balance from emissions species. This agrees well with the reported fuel rate that ranged from 2268 to 2722 kg/hr according to the Chief. The corresponding exhaust flow at the 2460 kg/hr fuel rate was 35,639 m3/hr.
- The boiler fuel specific (fs) CO_2 emissions were 3026 g/kg-fuel. This is similar to previous testing of a modern auxiliary boiler on a container vessel.
- The boiler $fsNO_x$ emissions averaged 2.86 ± 0.18, CO 0.06 ± 0.064, and SO_2 0.94 g/kg-fuel. The $fsNO_x$ emissions were slightly higher, with-in 50%, to previous testing of a modern container vessel auxiliary boiler tested on low sulfur MGO and ULSFO fuels, but over two times lower (2.2) than the emissions on a tanker vessel auxiliary boiler tested on high sulfur HFO fuel. The CO emissions were 6.9 times lower than the boiler operating on HFO fuel.
- The boiler $fsSO_2$ emissions were lower for the low sulfur fuel compared to a high sulfur HFO fuels by a factor of 58
- $fsPM_{2.5}$ emissions were 0.022 ± 0.004 g/kg-fuel and were slightly lower to previous testing of a modern auxiliary boiler tested on low sulfur MGO and ULSFO fuels, but over 100 times lower (131) than the PM emissions on a boiler tested on high sulfur HFO fuel. The main difference between boiler PM emissions on low and high sulfur fuels is the sulfur content of the fuel.
- The fs_eBC emissions were 0.0012±0.0004 g/kg-fuel and were about the same for a previous modern boiler tested, but about 120 times lower than the fsEC emission reported for an older boiler tested on a tanker. The methods were not the same and there may be questions for this large difference.
- The fsPM composition (EC, OC, and Sulfate) were 0.56, 21, and 11 mg/kg-fuel respectively. The sulfute PM emissions were calculated and will be udpated with measured values once the state shut down has been lifted.
- The metals emissions were… Waiting on the analysis due to the state shut down.

- The boiler emissions for Formaldehyde, Acetaldehyde and Acrolein were 0.401, 0.376, and 1.749 mg/kg-fuel. These results compare well with the modern boiler operating on MGO fuel test from a container vessel. Modern boilers operating on MGO fuels appear to have lower Acetaldehyde and Acetone emissions compared to older boiler tested on HFO fuels.
- The total speciated HCs (C2-C12) PAMS and TNMHC were 0.0033 and 0.516 mg/kg-fuel. The PAMS measurements were at the detection limit of the measurement method and thus, could not be compared properly to the previous testing on an older boiler tested on a high sulfur HFO fuel.

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Appendix A – Sample Collection Methods

ISO 8178-1[4] and ISO 8178-2[5] specify the measurement and evaluation methods for gaseous and particulate exhaust emissions when combined with combinations of engine load and speed provided in ISO 8178- *4: Test cycles for different engine applications*. The emission results represent the mass rate of emissions per unit of work accomplished. Specific emission factors are based on brake power measured at the crankshaft, the engine being equipped only with the standard auxiliaries necessary for its operation. Per ISO, auxiliary losses are <5 % of the maximum observed power. IMO ship pollution rules and measurement methods are contained in the "International Convention on the Prevention of Pollution from Ships", known as MARPOL 73/78[6], and sets limits on NO_x and SO_x emissions from ship exhausts. The intent of this protocol was to conform as closely as practical to both the ISO and IMO standards.

Gaseous and Particulate Emissions

A properly designed sampling system is essential for accurate collection of a representative sample from the exhaust and subsequent analysis. ISO points out that particulate must be collected in either a full flow or partial flow dilution system and UCR chose the partial flow dilution system as shown in Figure A-1.

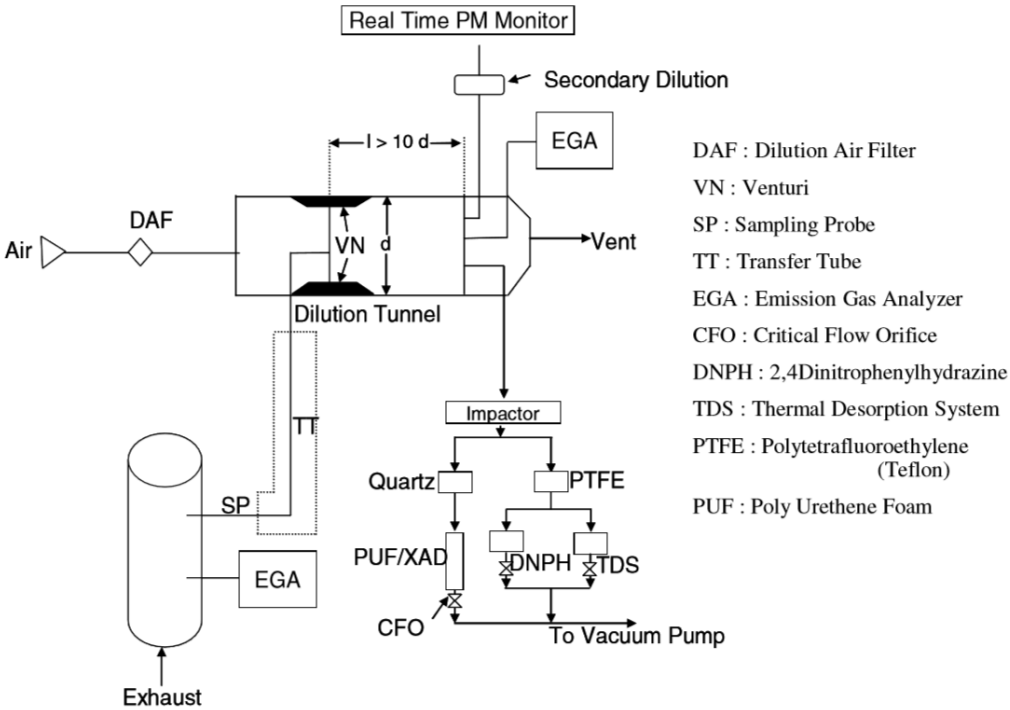

Figure A-1 Partial Flow Dilution System

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[4] International Standards Organization, IS0 8178-1, *Reciprocating internal combustion engines - Exhaust emission measurement -Part 1: Test-bed measurement of gaseous particulate exhaust emissions,* First edition 1996-08-l5

[5] International Standards Organization, IS0 8178-2, *Reciprocating internal combustion engines - Exhaust emission measurement -Part 2: Measurement of gaseous and particulate exhaust emissions at site,* First edition 1996-08-l5

[6] International Maritime Organization, *Annex VI of MARPOL 73/78 "Regulations for the Prevention of Air Pollution from Ships and NOx Technical Code*".

The flow in the dilution system eliminates water condensation in the dilution tunnel and sampling systems and maintains the temperature of the diluted exhaust gas at <52°C before the filters. ISO cautions that the advantages of partial flow dilution systems can be lost to potential problems such as: losing particulates in the transfer tube, failing to take a representative sample from the engine exhaust and inaccurately determining the dilution ratio.

An overview of UCR's partial dilution system is shown in Figure A-1. Raw exhaust gas is transferred from the exhaust pipe (EP) through a sampling probe (SP) and the transfer tube (TT) to a dilution tunnel (DT) due to the negative pressure created by the venturi (VN) in DT. The gas flow rate through TT depends on the momentum exchange at the venturi zone and is therefore affected by the absolute temperature of the gas at the exit of TT. Consequently, the exhaust split for a given tunnel flow rate is not constant, and the dilution ratio at low load is slightly lower than at high load. More detail on the key components is provided in Table A-1.

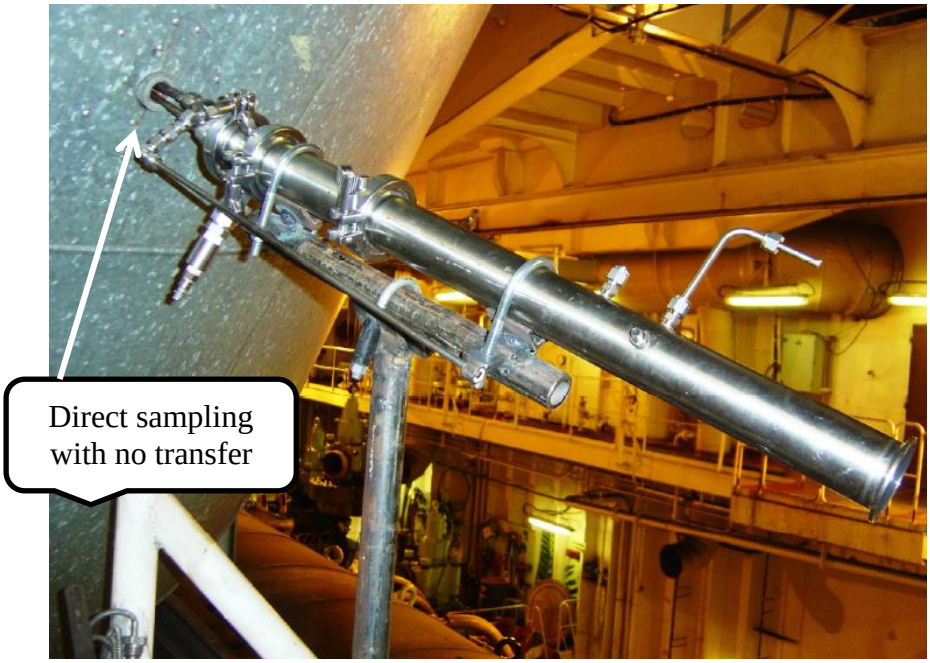

Figure A-2 measurement layout on an engine exhaust stack

Dilution Air System

40 CFR Part 1065 recommends dilution air to be 20 to 30°C and ISO recommends 25 ±5°C. Both also recommend using filtered and charcoal scrubbed air to eliminate background hydrocarbons. The dilution air may be dehumidified. The system can be described as follows: The pressure is reduced to around 40 psig, a liquid knock-out vessel, desiccant to remove moisture with silica gel containing an indicator, hydrocarbon removal with activated charcoal, and a HEPA filter for the fine aerosols that might be present in the supply air. The silica gel and activated carbon are changed for each field campaign. Figure A-3 shows the field processing unit in its transport case. In the field the case is used as a framework for supporting the unit.

Table A-1 Components of a Sampling System: ISO Criteria & UCR Design

Section	Selected ISO and IMO Criteria	UCR Design
Exhaust Pipe (EP)	In the sampling section, the gas velocity is > 10 m/s, except at idle, and bends are minimized to reduce inertial deposition of PM. Sample collection of 10 pipe diameters of straight pipe upstream is recommended and performed where possible. For some tight configurations use good engineering judgment.	UCR follows the ISO recommendation, when practical.
Sampling Probe (SP) -	The minimum inside diameter is 4 mm and the probe is an open tube facing upstream on the exhaust pipe centerline. No IMO code.	UCR uses a stainless steel tube with diameter of 8mm placed near the center line.
Transfer Tube (TT)	• As short as possible and < 5 m in length; • Equal to/greater than probe diameter & < 25 mm diameter; • TTs insulated. For TTs > 1m, heat wall temperature to a minimum of 250°C or set for < 5% thermophoretic losses of PM.	UCR uses a transfer tube of 0.15 m (6 inches). Additionally the sample tube insertion length varies with stack diameter, but typically penetrates at least 10%, but not more than 50% of the stack diameter.
Dilution Tunnel (DT)	• shall be of a sufficient length to cause complete mixing of the exhaust and dilution air under turbulent flow conditions; • shall be at least 75 mm inside diameter (ID) for the fractional sampling type, constructed of stainless steel with a thickness of > 1.5 mm.	UCR uses fractional sampling; stainless steel tunnel has an ID of 50mm and thickness of 1.5mm.
Venturi (VN) --	The pressure drop across the venturi in the DT creates suction at the exit of the transfer tube TT and the gas flow rate through TT is basically proportional to the flow rate of the dilution air and pressure drop.	Venturi proprietary design provided by MAN B&W; provides turbulent mixing.
Exhaust Gas Analyzers (EGA)	One or several analyzers may be used to determine the concentrations. Calibration and accuracy for the analyzers are like those for measuring the gaseous emissions.	UCR uses a 5-gas analyzer meeting IMO/ISO specs

Figure A-3 Field Processing Unit for Purifying Dilution Air in Carrying Case

Calculating the Dilution Ratio

According to ISO 8178, "it is essential that the dilution ratio be determined very accurately" for a partial flow dilution system such as what UCR uses. The dilution ratio is simply calculated from measured gas concentrations of CO_2 and/or NO_x in the raw exhaust gas, the diluted exhaust gas and the dilution air. UCR has found it useful to independently determine the dilution ratio from both CO_2 and NO_x and compare the values to ensure that they are within ±10%. UCR's experience indicates the independently determined dilution ratios are usually within 5%. At systematic deviations within this range, the measured dilution ratio can be corrected, using the calculated dilution ratio. According to ISO, dilution air is set to obtain a maximum filter face temperature of <52°C and the dilution ratio shall be > 4.

Dilution System Integrity Check

ISO describes the necessity of measuring all flows accurately with traceable methods and provides a path and metric to quantifying the leakage in the analyzer circuits. UCR has adopted the leakage test and its metrics as a check for the dilution system. According to ISO the maximum allowable leakage rate on the vacuum side shall be 0.5 % of the in-use flow rate for the portion of the system being checked. Such a low leakage rate allows confidence in the integrity of the partial flow system and its dilution tunnel. Experience has taught UCR that the flow rate selected should be the lowest rate in the system under test.

Measuring the Gaseous Emissions: CO, CO_2, NO_x, O_2, SO_2

Measurement of the concentration of the main gaseous constituents is one of the key activities in measuring emission factors. This section covers the ISO/IMO protocols used by UCR. For SO_2, ISO/CFR recommends that the concentration of SO_2 is calculated based on the fact that 97.75% of the fuel sulfur is converted to SO_2 (40 CFR Part 1065). UCR agrees with this recommendation and the enclosed SO2 reported emissions are calculated from fuel sulfur levels.

Measuring Gaseous Emissions: ISO & IMO Criteria

ISO specifies that either one or two sampling probes located in close proximity in the raw gas can be used and the sample split for different analyzers. However, in no case can condensation of exhaust components, including water and sulfuric acid, occur at any point of the analytical system. ISO specifies the analytical instruments for determining the gaseous concentration in either raw or diluted exhaust gases.

- Non-dispersive infrared analyzer (NDIR) for the measurement of carbon monoxide and carbon dioxide;
- Heated chemiluminescent detector (HCLD) or equivalent for measurement of nitrogen oxides;
- Paramagnetic detector (PMD) or equivalent for measurement of oxygen.

ISO states the range of the analyzers shall accurately cover the anticipated concentration of the gases and recorded values between 15% and 100% of full scale. A calibration curve with five points is specified. However, with modern electronic recording devices, like a computer, ISO allows the range to be expanded with additional calibrations. ISO details instructions for establishing a calibration curve below 15%. In general, calibration curves must be < ±2 % of each calibration point and be < ±1 % of full scale zero.

ISO outlines their verification method. Each operating range is checked prior to analysis by using a zero gas and a span gas whose nominal value is more than 80 % of full scale of the measuring range. If, for the two points considered, the value found does not differ by more than ±4 % of full scale from the declared reference value, the adjustment parameters may be modified. If >4%, a new calibration curve is needed.

ISO, IMO, and CFR specify the operation of the HCLD. The efficiency of the converter used for the conversion of NO_2 into NO is tested prior to each calibration of the NO_x analyzer. 40 CFR Part 1065 requires 95% and recommends 98%. The efficiency of the converter shall be >95 % and will be evaluated prior to testing.

ISO requires measurement of the effects of exhaust gases on the measured values of CO, CO_2, NO_x, and O_2. Interference can either be positive or negative. Positive interference occurs in NDIR and PMD instruments where the interfering gas gives rise to the same effect as the gas being measured, but to a lesser degree. Negative interference occurs in NDIR instruments due to the interfering gas broadening the absorption band of the measured gas, and in HCLD instruments due to the interfering gas quenching the radiation. Interference checks are recommended prior to an analyzer's initial use and after major service intervals.

Measuring Gaseous Emissions: UCR Design

The concentrations of CO, CO_2, NO_x and O_2 in the raw exhaust and in the dilution tunnel are measured with a Horiba PG-250 portable multi-gas analyzer. The PG-250 simultaneously measures five separate gas components with methods recommended by the ISO/IMO and USEPA. The signal output of the instrument is connected to a laptop computer through an RS-232C interface to continuously record measured values. Major features include a built-in sample

conditioning system with sample pump, filters, and a thermoelectric cooler. The performance of the PG-250 was tested and verified under the U.S. EPA ETV program.

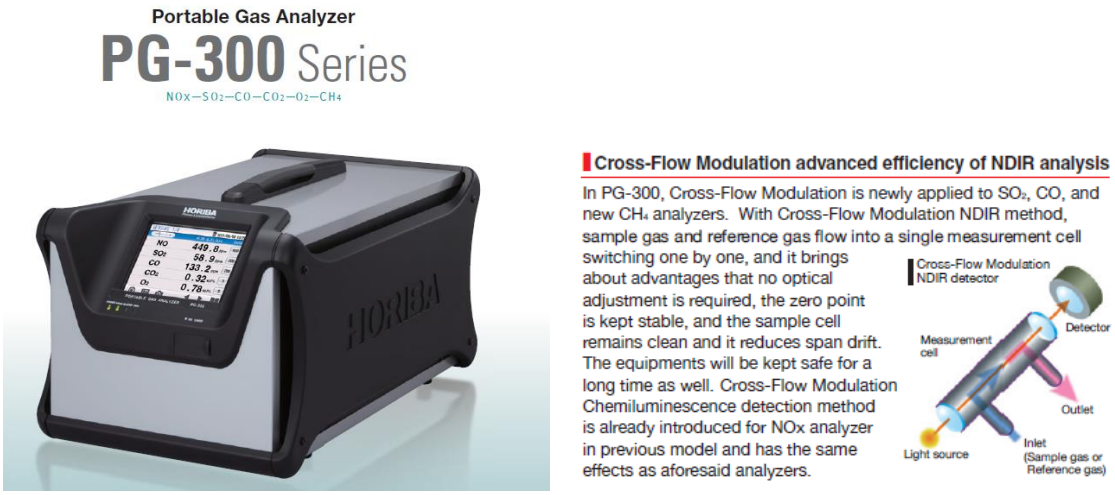

Figure A-4 Gas analyzer setup with measurement cell description

Details of the gases and the ranges for the Horiba instrument are shown in Table A-2. Note that the Horiba instrument measures sulfur oxides (SO_2); however, UCR follows the protocol in ISO which recommends calculation of the SO_2 level from the sulfur content of the fuel as the direct measurement for SO_2 is less precise than calculation. When an exhaust gas scrubber is present, UCR recommends measuring the SO_2 concentration after the scrubber since the fuel calculation approach will not be accurate due to scrubber SO_2 removal performance expectations.

Table A-2 Detector Method and Concentration Ranges for Monitor

Component	Detector	Ranges
Nitrogen Oxides (NOx)	Heated Chemiluminescence Detector (HCLD)	0-25, 50, 100, 250, 500, 1000, & 2500 ppmv
Carbon Monoxide (CO)	Non dispersive Infrared Absorption (NDIR). Cross flow modulation	0-200, 500, 1000, 2000, & 5000 ppmv
Carbon Dioxide (CO_2)	Non dispersive Infrared Absorption (NDIR)	0-5, 10, & 20 vol%
Sulfur Dioxide (SO_2)	Non dispersive Infrared Absorption (NDIR). Cross flow modulation	0-200, 500, 1000, & 3000 ppmv
Oxygen	Zirconium oxide sensor	0-5, 10, & 25 vol%

For quality control, UCR carries out analyzer checks with calibration gases both before and after each test to check for drift. Because the instrument measures the concentration of five gases, the calibration gases are a blend of several gases (super-blend) made to within 1% specifications. Experience has shown that the drift is within manufacturer specifications of ±1% full scale per day shown in Table A-3. The PG-250 meets the analyzer specifications in ISO 8178-1 Section 7.4 for repeatability, accuracy, noise, span drift, zero drift and gas drying.

Table A-3 Quality Specifications for the Horiba PG-250

Repeatability	±0.5% F.S. (NO_x: </= 100ppm range CO: </= 1,000ppm range) ±1.0% F. S.
Linearity	±2.0% F.S.
Drift	±1.0% F. S./day (SO2: ±2.0% F.S./day)

Replacement parts

Replacement part intervals assume 8 hours of operation per day. Replacement interval may be more frequent depending on measurement gas conditions and use conditions.

[Consumable Items]

Name	Replace Every (general guideline)	Notes
Mist catcher	3 months	MC-025
Scrubber	3 months	For reference line
Air filter element	2 weeks	For reference line

[Replacement Parts]

Name	Replace Every (general guideline)	Notes
Pump	1 year	Replace when broken
NOx converter catalyst	1 year	For NOx analyzer*
Zero gas purifier unit catalyst	1 year	*
Ozone generator	1 year	For NOx analyzer*
Deozonizer	1 year	For NOx analyzer*
CR2032 battery	5 years	For clock backup
Galvanic O_2 cell	1 year	Replace when broken*

* Differs depending on model

Figure A-4b Gas analyzer replacement parts and maintenance

Measuring the Particulate Matter (PM) Emissions

ISO 8178-1 defines particulates as any material collected on a specified filter medium after diluting exhaust gases with clean, filtered air at a temperature of ≤ 52ºC (40 CFR Part 1065 is 47±5 °C), as measured at a point immediately upstream of the PM filter. The particulate consists of primarily carbon, condensed hydrocarbons, sulfates, associated water, and ash. Measuring particulates requires a dilution system and UCR selected a partial flow dilution system. The dilution system design completely eliminates water condensation in the dilution/sampling systems and maintains the temperature of the diluted exhaust gas at < 52°C immediately upstream of the filter holders (and is typically below 47°C also). IMO does not offer a protocol for measuring PM and thus a combination of ISO and CFR practices are adopted. A comparison of the ISO and UCR practices for sampling PM is shown in Table A-4.

Table A-4 Measuring Particulate by ISO and UCR Methods

	ISO	UCR
Dilution tunnel	Either full or partial flow	Partial flow
Tunnel & sampling system	Electrically conductive	Same
Pretreatment	None	Cyclone, removes >2.5µm
Filter material	PTFE coated glass fiber	Teflon (TFE)
Filter size, mm	47 (37mm stain diameter)	Same
Number of filters in series	Two	One
Number of filters in parallel	Only single filter	Two; 1 TFE & 1 Quartz
Number of filters per mode	Single or multiple	Single is typical unless looking at artifacts
Filter face temp. °C	≤ 52	Same
Filter face velocity, cm/sec	35 to 80.	~33
Pressure drop, kPa	For test <25	Same
Filter loading, µg	>500	500-1,000 + water w/sulfate, post PM control ~ 100
Weighing chamber	22±3°C & RH= 45%± 8	22±1 °C & dewpoint of 9.5 °C±1°C (typically < ±0.6°C)
Analytical balance, LDL µg	10	LDL = 3 and resolution 0.1
Flow measurement	Traceable method	Same
Flow calibration, months	< 3months	Every campaign

Sulfur content. According to ISO, particulates measured using IS0 8178 are "conclusively proven" to be effective for fuel sulfur levels up to 0.8%. UCR is often faced with measuring PM for fuels with sulfur content exceeding 0.8% and has adopted the 40 CFR Part 1065 sampling methodologies as no other method is prescribed for fuels with a higher sulfur content.

Calculating Exhaust Flow Rates

The calculated emission factor requires the measurement of the engine's exhaust flow rate. The exhaust gas flow can be determined by the following methods:

1. Direct Measurement Method
2. Carbon Balance Method
3. Air and Fuel Measurement Method
4. Air Pump method

Method 1: Direct Measurement of exhaust
Actual exhaust mass flow rate can be determined from the exhaust velocity, cross sectional area of the stack, and moisture and pressure measurements. The direct measurement method is a difficult technique, and precautions must be taken to minimize measurement errors. Details of the direct measurement method are provided in ISO 5167-1.

Method 2(a)-Carbon Balance
Carbon Balance is used to calculate the exhaust mass flow based on the measurement of fuel consumption and the exhaust gas concentrations with regard to the fuel characteristics. The method given is only valid for fuels without oxygen and nitrogen content, based on procedures used for EPA and ECE calculations. Detailed calculation steps of the Carbon Balance method are provided in annex A of ISO 8178-1. Basically: In…lbs fuel/time * wt% carbon * 44/12 → input of grams CO2 per time Out… vol % CO2 * (grams exhaust/time * 1/density exhaust) → exhaust CO2 per time
Note that the density = (mole wt*P)/(R* Temp) where P, T are at the analyzer conditions. For highly diluted exhaust, M ~ of the atmosphere.

Method 2(b)-Universal Carbon/Oxygen balance
The Universal Carbon/Oxygen Balance is used for the calculation of the exhaust mass flow. This method can be used when the fuel consumption is measurable and the fuel composition and the concentration of the exhaust components are known. It is applicable for fuels containing H, C, S, 0, N in known proportions. Detailed calculation steps of Carbon/Oxygen Balance method is provided in annex A of ISO 8178-1.

Method 3-Air and Fuel Measurement Method
This involves measurement of the air flow and the fuel flow. The calculation of the exhaust gas flow is provided in Section 7.2 of ISO 8178-1.

Method 4-Air Pump Method
Exhaust flow rate is calculated by assuming the engine is an air pump, meaning that the exhaust flow is equal to the intake air flow. The flow rate is determined from the overall engine displacement, and rpm; corrected for temperature and pressure of the inlet air and pumping efficiency. In the case of turbocharged engines, this is the boost pressure and intake manifold temperature. This method should not be used for diesel engines equipped with additional air input for cylinder exhaust discharge, called purge or scavenger air, unless the additional flow rate is known or can be determined.

Added Comments about UCR's Measurement of PM
In the field UCR uses a raw particulate sampling probe fitted close to and upstream of the raw gaseous sample probe and directs the PM sample to the dilution tunnel. There are two gas streams leaving the dilution tunnel; the major flow vented outside the tunnel and the minor flow directed

to a cyclone separator, sized to remove particles >2.5um. The line leaving the cyclone separator is split into two lines; each line has a 47 mm Gelman filter holder. One holder collects PM on a Teflon filter and the other collects PM on a quartz filter. UCR simultaneously collects PM on Teflon and quartz filters at each operating mode and analyzes the quartz filters utilizing the NIOSH or IMPROVE methods. UCR recommends the IMPROVE method over the NIOSH.

Briefly, total PM is collected on Pall Gelman (Ann Arbor, MI) 47 mm Teflon filters and weighed using a Mettler Toledo UMX2 microbalance with a 0.1 ug resolution. Before and after collection, the filters are conditioned for 24 hours in an environmentally controlled room (22±1 °C and dewpoint of 9.5 °C) and weighed daily until two consecutive weight measurements are within 3 µg or 2%. It is important to note that the simultaneous collection of PM on quartz and Teflo™ filters provides a comparative check of PM mass measured by two independent methods for measuring PM mass.

Sulfur in the fuel produces SO_2 in the combustion process and some of the SO_2 becomes SO_3 in the exhaust and subsequently produces $H_2SO4 \bullet 6H_2O$ which is collected on the Teflon filter paper. After the final weights for the particulate laden Teflon filters have been determined a portion of the filter is punched out, extracted with High Performance Liquid Chromatography grade water and isopropyl alcohol and analyzed for sulfate ions by ion chromatography.

Measuring Real-Time Particulate Matter (PM) Emissions-DustTrak 8520

In addition to the filter-based PM mass measurements, UCR uses a Nephelometer (TSI DustTrak 8520) for continuous measurements of steady-state and transient data. The DustTrak is a portable, battery-operated laser photometer that gives real-time digital readout and has a built-in data logger. It measures light scattered (90 degree light scattering at 780nm near-infrared) by aerosol introduced into a sample chamber and displays the measured mass density in units of mg/m^3. As scattering per unit mass is a strong function of particle size and refractive index of the particle size distributions and as refractive indices in diesel exhaust strongly depend on the particular engine and operating condition, some question the accuracy of PM mass measurements. However, UCR always references the DustTrak results to filter based measurements and this approach has shown that mass scattering efficiencies for both on-road diesel exhaust and ambient fine particles have values around $3m^2/g$.

Figure A-5 Picture of TSI DustTrak

Measuring Non-Regulated Gaseous Emissions

Neither ISO nor IMO provide a protocol for sampling and analyzing non-regulated emissions. UCR uses peer reviewed methods adapted to their PM dilution tunnel. The methods rely on added media to selectively collect hydrocarbons and PM fractions during the sampling process for

subsequent off-line analysis. A secondary dilution is constructed to capture real time PM this same tunnel was used for DNPH and Canister samples. In addition, UCR collected raw grab samples of the

Appendix B – Quality Control

Pre-test calibrations
Prior to departing from UCR all systems will be verified and cleaned for the testing campaign. This included all instruments used during this testing project. Sample filters are checked and replaced if necessary.

On-site calibrations
Pre- and post-test calibrations were performed on the gaseous analyzer using NIST traceable calibration bottles. Dilution ratio was monitored and verified at least twice each test day. Leak checks were performed for the total $PM_{2.5}$ system prior testing for each setup.

Post-test and data validation
Post-test evaluation includes verifying consistent dilution ratios between points and data is compared to other test conditions that are similar.

The figure below (Figure B-1) is an example of a chain of custody form. This is the form used to track filter weights from the test to the laboratory. One form for the filter weights, BTEX, and EC/OC. This is just an example of media tracking that is used.

Figure B-2 is an example of UCR certified calibration bottles used for testing. Prior to using a new bottle the old one is verified with the new one as bottles can incorrect in their stated value. It is rare, but can happen.

CE-CERT
College of Engineering: Center for Environmental Research and Technology

Analytical Laboratory
University of California, Riverside
Data Results For TEFLON Filters

Project Name: Original AEP River Operations - Kentuck | **Project Fund #:**
PI/Contact: Wayne Miller | **Send Results: Nick Gysel**

Sample ID	**Serial ID**	Date Received	Initial Weight (mg/filter)	Final Weight (mg/filter)	**NET Weight (mg/filter)**	Initials	COMMENTS
AT120473	n/a	2/x/2013	191.2060	192.6972	1.4912	MV	
AT120474	n/a	2/x/2013	189.2139	191.2111	1.9972	MV	
AT120475	n/a	2/x/2013	194.4568	196.2289	1.7721	MV	
AT120476	n/a	2/x/2013	190.1723	191.7284	1.5561	MV	
AT120477	n/a	2/x/2013	153.2872	154.4464	1.1592	MV	
AT120478	n/a	2/x/2013	187.4435	188.9519	1.5084	MV	
AT120479	n/a	2/x/2013	182.9071	184.0064	1.0993	MV	
AT120481	n/a	2/x/2013	178.7453	179.3674	0.6221	MV	
AT120482	n/a	2/x/2013	165.5829	166.2499	0.6670	MV	

Figure B-1 Sample chain of custody form example

CERTIFICATE OF ANALYSIS
Primary Standard

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Carbon dioxide	**12 %**	**11.76 %**	**L**	**± 1%**
Carbon monoxide	**500 ppm**	**501 ppm**	**L**	**± 1%**
Nitric oxide	**2000 ppm**	**1929 ppm**	**U**	**± 1%**
Propane	**500 ppm**	**515 ppm**	**Q**	**± 1%**
Nitrogen	**balance**	**balance**		

Analytical Instruments: **Horiba Instruments Inc.~VIA-510~NDIR~Non-dispersive Infrared**
Thermo Environmental~42i~Nitric Oxide Analyzer~Chemiluminescence
Horiba Instruments Inc.~FIA-510~THC- Total Hydrocarbon Analyzer~FID - Flame Ionization Detector

Cylinder Style: **AS**
Cylinder Pressure @70F: **2000 psig**
Cylinder Volume: **140 ft3**
Valve Outlet Connection: **CGA-660**
Cylinder No(s). **CC92665**
Comments: **[NOx] = 1947 ppm for reference only.**
All values not valid below 150 psig.

Filling Method: **Gravimetric**
Date of Fill: **10/31/2012**
Expiration Date: **11/06/2014**

Chas Manning (CMW)
Analyst: **Chas Manning**

Nelson Ma
Approved Signer: **Nelson Ma**

Figure B-2 One percent sample protocol gas analysis example

Appendix C –Test Assumptions

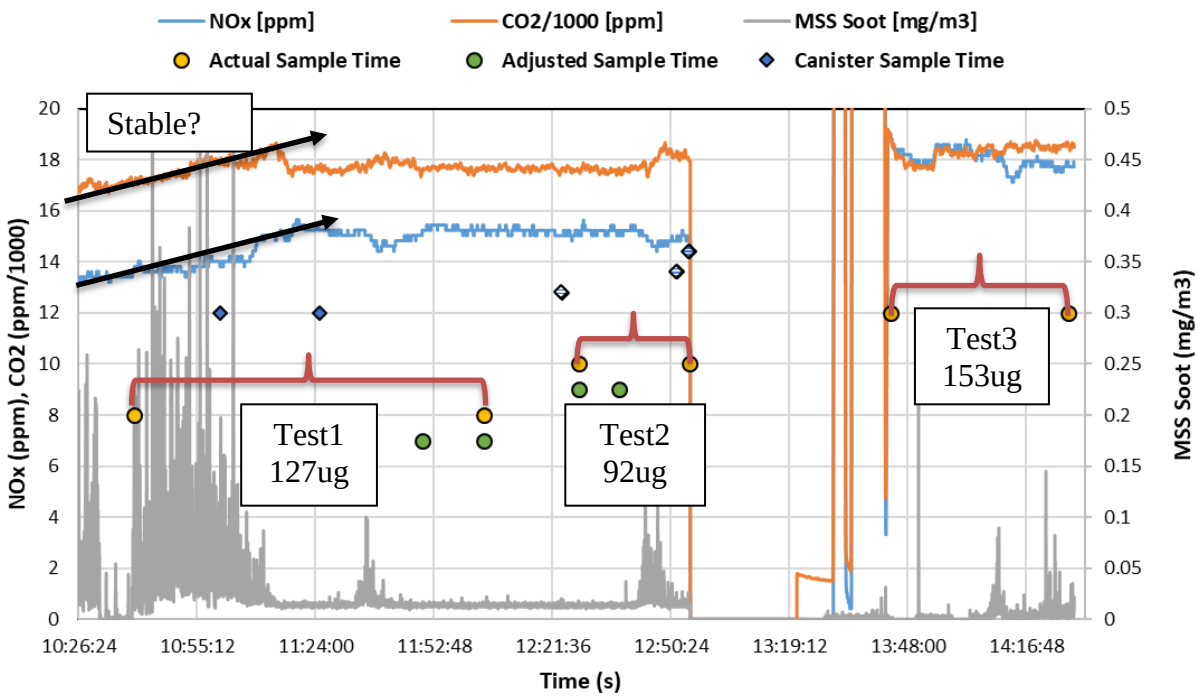

Figure C-1: Real Time Response for selected emissions species with test notes

Initial sample times were chosen based on previous projects and soot levels. Initial sampling was started as soon as possible with a total sample time of 75 minutes. During the second test, a power failure on the ship cut testing short for a total sample time of 27 minutes. The final test sample was started as soon as power was restored and lasted as long as possible for a total testing time of 43 minutes. The real time data shows that all sample times experienced unstable data trends. The first test experienced unstable CO2, NOx, and Soot data at the beginning of the test most likely due to the boiler not being fully warmed up. The second test experienced soot, NOx, and CO2 spikes toward the end of the test. The third test showed elevated levels of CO2 and NOx for unknown reasons.

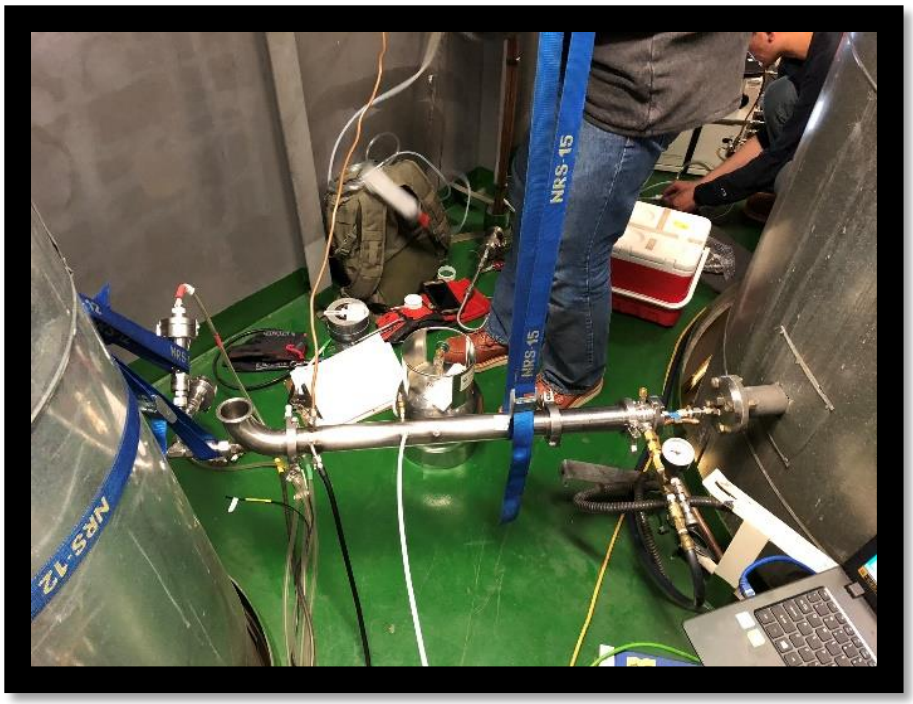

Figure C-2 Installation showing removal of cyclone.

Due to the unstable nature of all 3 test points, modified sampling times were used to capture stable data during the course of testing. PM results were averaged with the soot data from the original tests, and a weighting factor was used to calculate PM mass of the modified sample times.

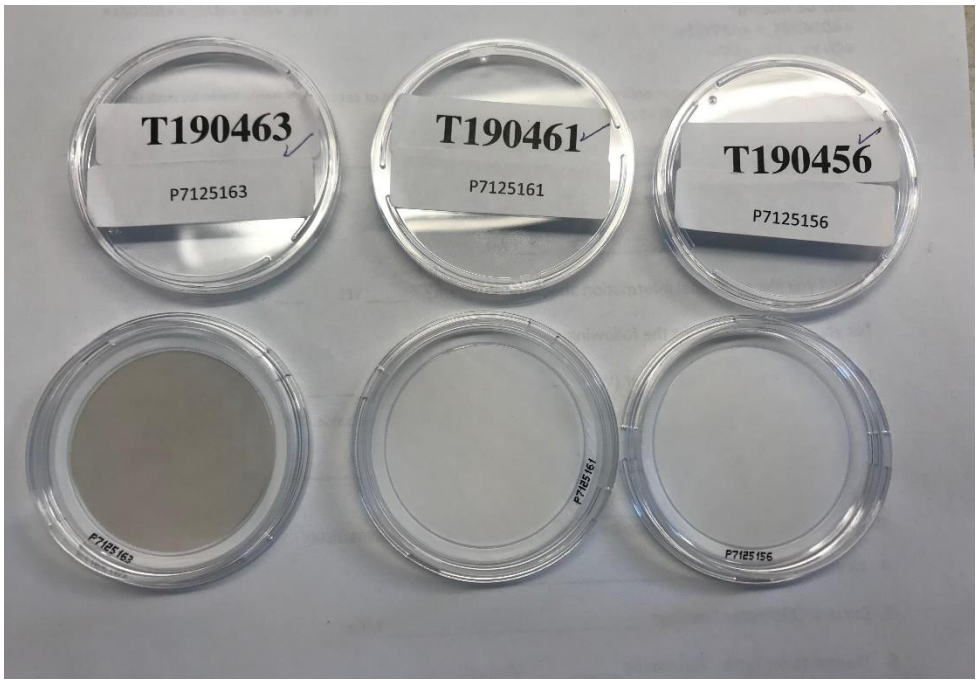

Figure C-3 Sample filters Test 1, 2, and 3

[1] The filter weights were 127, 153, and 92 ug from left to right.

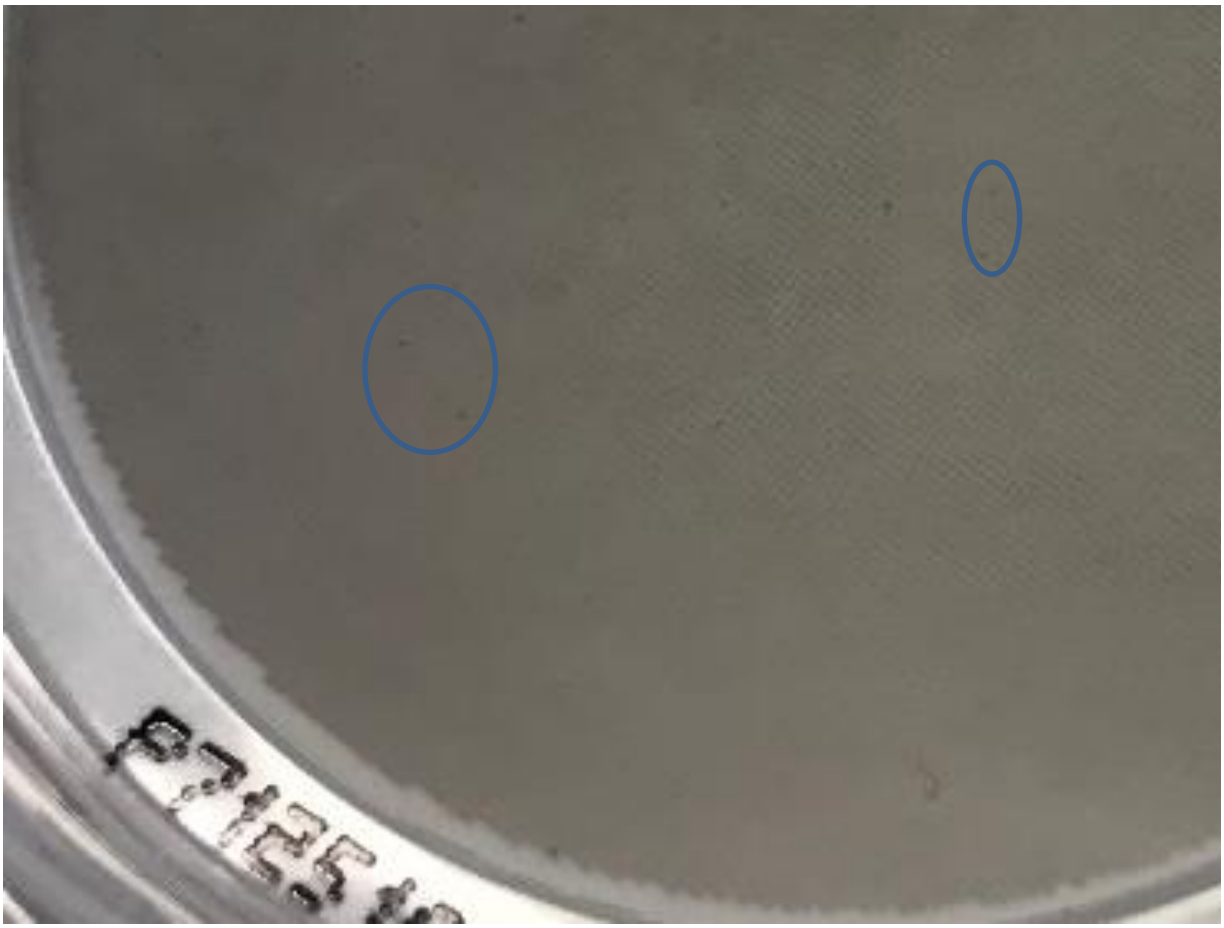

Figure C-4 Sample filter T190463 (medium spotting)

Figure C-5 Sample filter T190461 (heavy-ish spotting)

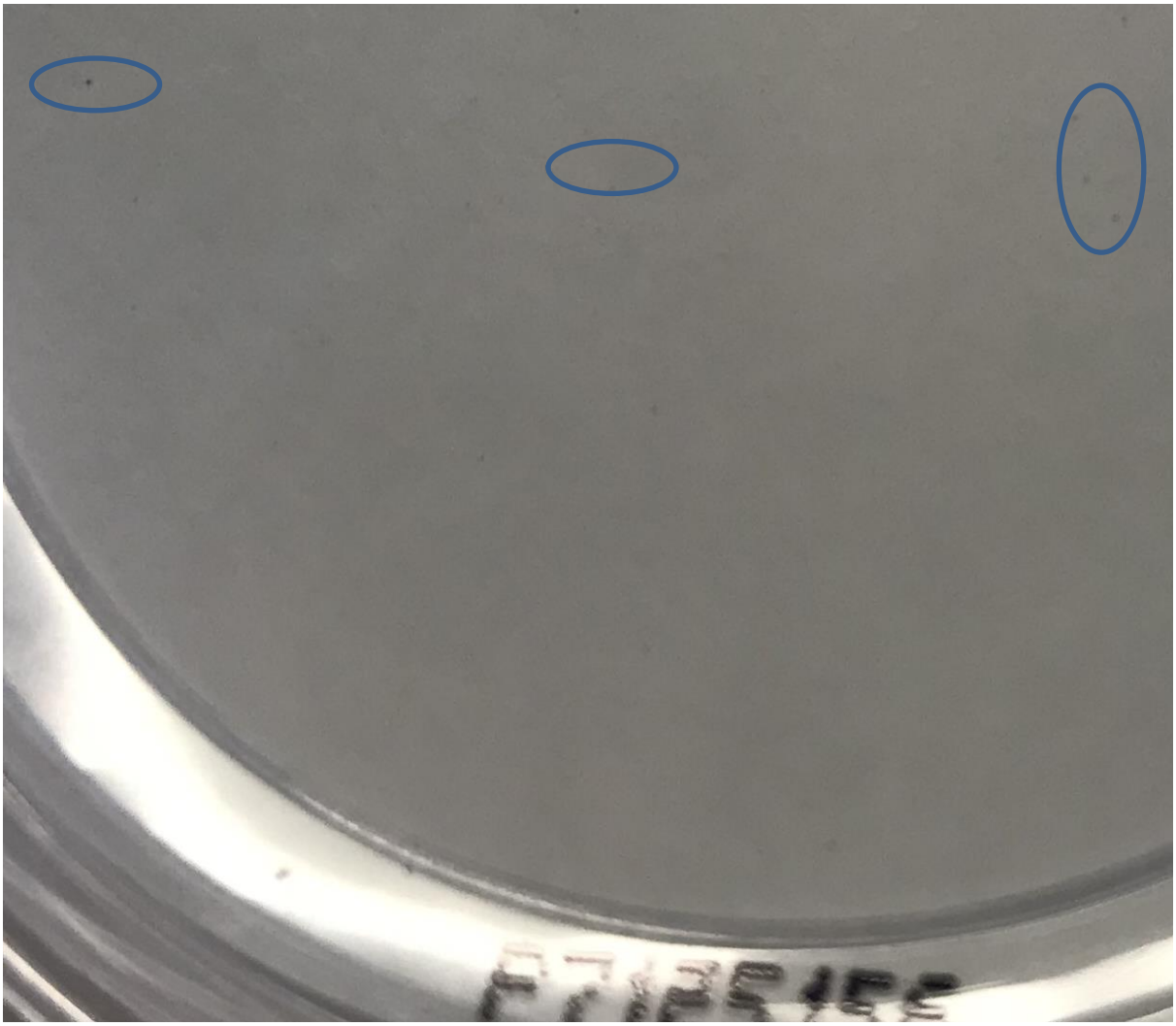

Figure C-5 Sample filter T190456 (light spotting)

Appendix D –Test Details and Data Records

This Appendix includes vessel and fuel records 1) Maintenance Records, 2) Fuel Analysis, and 3) Engine Screen Shots. These records were collected during testing.

- **Boiler records -** None provided or obtained due to the short amount of time for this testing.
- **Fuel analysis** A fuel sample was collected during our testing and sent out for analysis. The results are shown in the table below.
- **Speciated sample analysis forms.** A copy of the samples sent to the AAC and the methods utilized. Results are summarized in Appendix F.

Southwest Research Institute
6220 Culebra Road, San Antonio, TX

Test Results
Monday, January 27, 2020

Sample Description — SwRI Lab#: 51548

Test Result / Description	Units	Result, Information or Description	Rep#
SwRI Project Name		oddb	1
SwRI Lab Number		51548	1
SwRI SampleId		2193812	1
Date Sample was Received		1/15/2020 2:50:00 PM	1
SwRI Work Order Number		82758	1
SwRI Project Number		1.08.05.11.11831.01.001	1
Requested/Submitted by		bnelson	1
Sample Type		diesel	1

Client/Billing Information — SwRI Lab#: 51548

Test Result / Description	Units	Result, Information or Description	Rep#
Client Name		UNIVERSITY OF CALIFORNIA	1
Client Requestor		WAYNE MILLER	1
PO/TK Number		RT11003973	1
Primary Sponsor Code		UCR DIESEL	1

D5291 Determination of Carbon, Hydrogen — SwRI Lab#: 51548

Test Result / Description	Units	Result, Information or Description	Rep#
Carbon Content	wt%	86.82	1
Hydrogen Content	wt%	12.86	1

D4294 Sulfur by Energy-Dispersive X-Ray Flourescence — SwRI Lab#: 51548

Test Result / Description	Units	Result, Information or Description	Rep#
Sulfur by X-Ray ppm	ppm	454	1
D4294 Sulfur by Energy-Dispersive XRF	Mass %	0.045	1

Atmospheric Analysis & Consulting, Inc.

CLIENT : UC Riverside
PROJECT NAME : UCR
AAC PROJECT NO. : 191896
REPORT DATE : 11/12/2019

On November 4, 2019, Atmospheric Analysis & Consulting, Inc. received four (4) Six-Liter Summa Canisters for Fixed Gases analysis by EPA 3C. Upon receipt, the samples were assigned unique Laboratory ID numbers as follows:

Client ID	Lab No.	Return Pressure (mmHg)
10:1 Dilute w/ CFO	191896-3083	723.0
10:1 Dilute Grab Sample	191896-3084	622.0
Raw Grab Sample 1252	191896-3085	519.4
Raw Grab Sample 1257	191896-3086	565.6

This analysis is performed in accordance with AAC's Quality Manual. For detailed information pertaining to specific EPA, NCASI, ASTM and SCAQMD accreditations (Methods & Analytes), please visit our website at www.aaclab.com.

I certify that this data is technically accurate, complete, and in compliance with the terms and conditions of the contract. No problems were encountered during receiving, preparation, and/or analysis of these samples.

The Technical Director or his/her designee, as verified by the following signature, has authorized release of the data contained in this hardcopy report.

If you have any questions or require further explanation of data results, please contact the undersigned.

Sucha Parmar, Ph.D.
Technical Director

Laboratory Analysis Report

CLIENT : University of California, Riverside
PROJECT NO : 191896
UNITS : ppbC

DATE RECEIVED : 11/04/2019
DATE REPORTED : 11/08/2019

HYDROCARBONS (C1-C12) SPECIATED

Client ID	Raw Grab Sample			Sample Reporting Limit (SRL) (MRLxDF's)	Raw Grab Sample			Sample Reporting Limit (SRL) (MRLxDF's)	Method Reporting Limit (MRL)
AAC ID	191896-3085				191896-3086				
Date Sampled	10/24/2019				10/24/2019				
Date Analyzed	11/07/2019				11/07/2019				
Can Dilution Factor	1.97				1.79				
	Result	Qualifier	Analysis DF		Result	Qualifier	Analysis DF		
Ethylene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Acetylene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Ethane	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Propylene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Propane	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Isobutane	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
1-Butene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
1,3-Butadiene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
n-Butane	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
trans-2-Butene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
cis-2-Butene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
Isopentane	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
1-Pentene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
n-Pentane	<SRL	U	1.0	1.97	2.04		1.0	1.79	1.0
Isoprene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0
trans-2-Pentene	<SRL	U	1.0	1.97	<SRL	U	1.0	1.79	1.0

Appendix E –Exhaust Flow

The calculation follows EPA Method 2 which utilizes a type S Pitot tube is used to measure the differential pressure between the counter-flow (static pressure) and parallel-flow (dynamic pressure) directions. Velocity is calculated using Bernoulli's principle, which states that the pressure in a stream of fluid is reduced as the speed of the flow is increased. The velocity calculation is based off of the temperature, molecular weight of the exhaust gas, static pressure, dynamic pressure, and relative humidity. Measurement of the differential pressure and temperature were repeated at the sampling site several times at different depths inside the duct, including the near side of the duct, in the middle of the duct, and the far side of the duct. The equation below is from the EPA Method 2 documents Equation 2-7 and 2-8.

$$V_s = K_p\, C_p \left[\frac{\sum_{i=1}^{n} \sqrt{\Delta p_i}}{n} \right] \sqrt{\frac{T_{s(abavg)}}{P_s\ M_s}} \qquad .Q = 3600(1 - B_{ws}) v_s A \left[\frac{T_{std} P_s}{T_{s(abavg)} P_{std}} \right]$$

Where:

- A = Cross-sectional area of stack, m2 (ft2).
- Bws = Water vapor in the gas stream
- Cp = Pitot tube coefficient, dimensionless.
- K = 0.127 mm H2O (metric units). 0.005 in. H2O (English units).
- Kp = Velocity equation constant.
- Ms = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).
- n = Total number of traverse points.
- Pg = Stack static pressure, mm Hg (in. Hg).
- Ps = Absolute stack pressure (Pbar + Pg), mm Hg (in. Hg),
- Pstd = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
- Qsd = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).
- Ts(abavg) = Average absolute stack temperature, °K (°R).
- Ts = Stack temperature, °C ((°deg;F).
- Tstd = Standard absolute temperature, 293 °K (528 °R).
- Vs = Average stack gas velocity, m/sec (ft/sec).
- Δp = Velocity head of stack gas, mm H2O (in. H20).
- Δpi = Individual velocity head reading at traverse point "i", mm (in.) H2O.
- Δpstd = Velocity head measured by the standard pitot tube, cm (in.) H2O.
- Δps = Velocity head measured by the Type S pitot tube, cm (in.) H2O.

Table E-1 Summary of direct measurements from the pitot tube sampling

				Average Pitot DelP			Average Pitot Static P			
Stack Diam mm	Traverse Side B	Time Start (HH:MM)	Load	(inH20)	(mmH20)	(mmH20) ^0.5	(inH20)	(mmH20)	(mmH20) ^0.5	Temp (C)
1098.54	Full	8:16	High	0.11	2.90	1.70	0.40	10.11	0.74	223
1098.54	Mid	8:26	High	0.12	3.09	1.76	0.44	11.27	0.83	225
1098.54	Shallow	8:34	High	0.10	2.54	1.59	0.37	9.36	0.69	220

Appendix F –Raw Data and Analysis

The summary results in this Appendix include raw data used to generate the values in the report including outside laboratory results. The tables of data show the results for boiler for gaseous and PM emissions. The boiler toxic emissions are also listed below. The EC/OC results were sent to an outside laboratory and were analyzed using the NIOSH thermal optical method.

There were only three test points sampled during this testing. As discussed in Section 2.5, the data needed correction due to good engineering judgement that the full sample was not stable. The gray data represents the corrected data ("adjusted") and the non-gray data in Tables F-1 through F-3 are the original data samples so one can see the impact.

Table F-1 emissions data per test point for the original data and the "adjusted" data (gray).

Date	Project Name	Fuel	ATS	Location	Test Mode	Start Time	Sample Duration	DR	Boiler Load	Fuel Rate cacl OEM	Fuel Rate calc Meas	Fuel Rate Used Calcs	Exh Temp	Filter Temp	Stack Pres	Carb. Bal. Exh Flow I		Measured Meth2 Exh Flow II		Exh Flow Utilized
mm/dd/yyyy	name					hh:mm:ss	min	n/a	Name	kg/hr	kg/hr	kg/hr	C	C	mbar	(scfm)	(m3/hr)	(scfm)	(m3/hr)	m3/hr
10/24/2019	Tanker Boiler Test	MGO	n/a	original	1_1	10:40:00	40.3	7.0	65%	2494.8	2438.1	2438.1	221.8	41.5	0.75	17211	36467	16820	35639	35639
10/24/2019	Tanker Boiler Test	MGO	n/a	original	1_2	12:28:00	27.0	7.0	65%	2494.8	1982.4	1982.4	221.8	42.8	0.91	21167	44849	16820	35639	35639
10/24/2019	Tanker Boiler Test	MGO	n/a	original	1_3	13:44:00	43.0	7.0	65%	2494.8	2516.8	2516.8	221.8	43.6	0.53	16672	35327	16820	35639	35639
10/24/2019	Tanker Boiler Test	MGO	n/a	adjusted	1_1	11:50:00	15.0	7.0	65%	2494.8	2425.1	2425.1	221.8	41.5	0.75	17303	36663	16820	35639	35639
10/24/2019	Tanker Boiler Test	MGO	n/a	adjusted	1_2	12:28:00	10.0	7.0	65%	2494.8	2414.5	2414.5	221.8	42.8	0.91	17379	36824	16820	35639	35639
10/24/2019	Tanker Boiler Test	MGO	n/a	adjusted	1_3	14:08:52	15.0	7.0	65%	2494.8	2541.7	2541.7	221.8	43.6	0.53	16509	34981	16820	35639	35639

Table F-2 emissions data per test point for the original data and the "adjusted" data (gray). (g/hr basis)

Date	Test Group	ATS	Test	Start Time	Boiler Load	g/hr													FuelRate Carb.	SO2 calc	H20 Fraction	dil O2 Conc
mm/dd/yyyy	n/a	n/a	#	hh:mm:ss	%	NOx	CO	CO2	meas. SO_2	calc. SO_2	PM2.5	PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor	PM_eBC	(kg/hr)	g/hr	%	%
10/24/2019	original	n/a	1_1	10:40:00	65%	6,475	290.20	7,377,801	761.2	2,299.9	52.8	-	-	-	-	-	-	14.16	2,438	2299.9	1.3	18.6
10/24/2019	original	n/a	1_2	12:28:00	65%	5,368	191.00	5,997,762	1,565.0	1,870.1	58.3	-	-	-	-	-	-	4.30	1,982	1870.1	1.0	15.1
10/24/2019	original	n/a	1_3	13:44:00	65%	7,883	0.00	7,616,652	2,303.3	2,374.2	60.7	-	-	-	-	-	-	1.00	2,517	2374.2	1.3	18.6
10/24/2019	adjusted	n/a	1_1	11:50:00	65%	6,686	234.0	7,338,369	444.1	2,287.6	42.1	-	-	-	-	-	-	3.4	2,425	2287.6	1.3	17.7
10/24/2019	adjusted	n/a	1_2	12:28:00	65%	6,677	230.1	7,306,291	479.0	2,277.6	57.4	-	-	-	-	-	-	3.4	2,414	2277.6	1.3	17.7
10/24/2019	adjusted	n/a	1_3	14:08:52	65%	7,790	0.0	7,692,020	604.1	2,397.6	61.6	-	-	-	-	-	-	1.9	2,542	2397.6	1.3	17.7

Table F-3 emissions data per test point for the original data and the "adjusted" data (gray). (g/kg-hr basis)

Date	Fuel	ATS	Test	Start Time	Boiler Load	g/kg-fuel (kg/tonne-fuel)													Calculated Fuel Usag			NOx Cor.
mm/dd/yyyy	n/a	n/a	#	hh:mm:ss	%	NOx	CO	CO2	meas. SO_2	calc. SO_2	PM2.5	PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor	PM_eBC	Ship FC	Carb. FC	-	Kh
10/24/2019	original	n/a	1_1	10:40:00	65%	2.66	0.12	3026	0.312	0.943	0.022	-	-	-	-	-	-	0.0058	2494.8	2438	-	-
10/24/2019	original	n/a	1_2	12:28:00	65%	2.71	0.10	3025	0.789	0.943	0.029	-	-	-	-	-	-	0.0022	2494.8	1982	-	-
10/24/2019	original	n/a	1_3	13:44:00	65%	3.13	0.00	3026	0.915	0.943	0.024	-	-	-	-	-	-	0.0004	2494.8	2517	-	-
10/24/2019	adjusted	n/a	1_1	11:50:00	65%	2.76	0.10	3026	0.183	0.943	0.017	-	-	-	-	-	-	0.0014	2494.8	2425	-	-
10/24/2019	adjusted	n/a	1_2	12:28:00	65%	2.77	0.10	3026	0.198	0.943	0.024	-	-	-	-	-	-	0.0014	2494.8	2414	-	-
10/24/2019	adjusted	n/a	1_3	14:08:52	65%	3.06	0.00	3026	0.238	0.943	0.024	-	-	-	-	-	-	0.0007	2494.8	2542	-	-

Table F-4 Average for all gaseous and PM species (g/hr and g/kg-fuel)

		Average Species													Average Calculated Fuel Usag		
Units	Load	NOx	CO	CO2	meas. SO_2	calc. SO_2	PM2.5	PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor	PM_eBC	Ship FC	Carb. FC	-
g/hr	65%	7051	155	7445560	509.07	2320.96	53.70	_	_	_	_	_	_	2.89	2460	2320.96	
g/kg-fuel	65%	2.86	0.06	3026.1	0.21	0.94	0.02	-	-	-	-	-	-	0.0012	2495	2460.41	

Table F-5 Standard deviation (1 sigma) for all gaseous and PM species (g/hr and g/kg-fuel)

		Stdev Species													Average Calculated Fuel Usag		
Units	Load	NOx	CO	CO2	meas. SO_2	calc. SO_2	PM2.5	PM_EC	PM_OC	PM_S	PM_TC	PM_OCcor	PM_TCcor	PM_eBC	Ship FC	Carb. FC	-
g/hr	65%	0.26	0.06	0.43	0.32	0.00	0.00	-	-	-	-	-	-	0.0028	0.00	288.50	
g/kg-fuel	65%	0.18	0.06	0.16	0.03	0.00	0.00	-	-	-	-	-	-	0.0004	0.00	70.60	

Table F-6 Summary of results EPA 3C analysis and the selected speciated hydrocarbons

Analyte	Stack EPA 3C		
	#1	#2	Ave
Dilution Factor	1.97	1.79	1.88
H2	<2.0%	<1.8%	<1.8%
Ar/O2	7.5%	7.5%	7.5%
N2	82.0%	82.0%	82.0%
CO	<0.2%	<0.2%	<0.2%
CO2	10.4%	10.5%	10.5%
CH4	<0.2%	<0.2%	<0.2%
1,3 Butadiene (ppbC)	<SRL	<SRL	<SRL
Total PAMS (ppbC)	1.99	2.04	2.02
TNMHC (ppbC)	309	189	249

Table of selected speciated HCs

Analyte	Conc. ppb	mg/kg-fuel
1,3-Butadiene	<SRL	< 0.00907
Benzene	<SRL	< 0.00874
Toluene	<SRL	< 0.00883
m/p-Xylenes	<SRL	< 0.00891
Ethylbenzene	<SRL	< 0.00891
o-Xylene	<SRL	< 0.00891
Total PAMS	2.02	0.00332
TNMHC	249.0	0.516

Table F-7 Detail of the raw suma canister samples speciated HC (C2-C12) results. All values but two are below the detection limit (SRL)

Analyte	MM_C1	Formula	Raw (ppb)		mg/kg-fuel	Analyte	MM	Formula	Raw (ppb)		mg/kg-fuel
			ID#1	ID#2					ID#1	ID#2	
Ethylene	14.0	C2H4	<SRL	<SRL	< 0.00941						
Acetylene	13.0	C2H2	<SRL	<SRL	< 0.00874	3-Methylhexane	14.3	C7H16	<SRL	<SRL	< 0.00961
Ethane	15.0	C2H6	<SRL	<SRL	< 0.01009	2,2,4-Trimethylpentane	14.3	C8H18	<SRL	<SRL	< 0.00958
Propylene	14.0	C3H6	<SRL	<SRL	< 0.00941	n-Heptane	14.3	C7H16	<SRL	<SRL	< 0.00961
Propane	14.7	C3H8	<SRL	<SRL	< 0.00986	Methylcyclohexane	14.0	C7H14	<SRL	<SRL	< 0.00941
Isobutane	14.5	C4H10	<SRL	<SRL	< 0.00975	2,3,4-Trimethylpentane	14.3	C8H18	<SRL	<SRL	< 0.00958
1-Butene	14.0	C4H8	<SRL	<SRL	< 0.00941	Toluene	13.2	C7H8	<SRL	<SRL	< 0.00883
1,3-Butadiene	13.5	C4H6	<SRL	<SRL	< 0.00907	2-Methylheptane	14.3	C8H18	<SRL	<SRL	< 0.00958
n-Butane	14.5	C4H10	<SRL	<SRL	< 0.00975	3-Methylheptane	14.3	C8H18	<SRL	<SRL	< 0.00958
trans-2-Butene	14.0	C4H8	<SRL	<SRL	< 0.00941	n-Octane	14.3	C8H18	<SRL	<SRL	< 0.00958
cis-2-Pentane	14.0	C5H10	<SRL	<SRL	< 0.00941	Ethylbenzene	13.3	C8H10	<SRL	<SRL	< 0.00891
Isopentane	14.4	C5H12	<SRL	<SRL	< 0.00968	m/p-Xylenes	13.3	C8H10	<SRL	<SRL	< 0.00891
1-Pentene	14.0	C5H10	<SRL	<SRL	< 0.00941	Styrene	13.0	C8H8	<SRL	<SRL	< 0.00874
n-Pentane	14.4	C5H12	<SRL	2.04	0.00968	o-Xylene	13.3	C8H10	<SRL	<SRL	< 0.00891
Isoprene	13.6	C5H8	<SRL	<SRL	< 0.00914	Nonane	14.3	C9H20	1.99	<SRL	0.00966
trans-2-Pentene	14.0	C5H10	<SRL	<SRL	< 0.00941	Isopropylbenzene	13.4	C9H12	<SRL	<SRL	< 0.00896
cis-2-Pentene	14.0	C5H10	<SRL	<SRL	< 0.00941	.alpha.-Pinene	13.6	C10H16	<SRL	<SRL	< 0.00914
2,2-Dimethylbutane	14.4	C6H14	<SRL	<SRL	< 0.00964	n-Propylbenzene	13.4	C9H12	<SRL	<SRL	< 0.00896
Cyclopentane	14.0	C5H10	<SRL	<SRL	< 0.00941	m-Ethyltoluene	13.4	C9H12	<SRL	<SRL	< 0.00896
2,3-Dimethylbutane	14.4	C6H14	<SRL	<SRL	< 0.00964	p-Ethyltoluene	13.4	C9H12	<SRL	<SRL	< 0.00896
2-Methylpentane	14.4	C6H14	<SRL	<SRL	< 0.00964	1,3,5-Trimethylbenzene	13.4	C9H12	<SRL	<SRL	< 0.00896
3-Methylpentane	14.4	C6H14	<SRL	<SRL	< 0.00964	o-Ethyltoluene	13.4	C9H12	<SRL	<SRL	< 0.00896
1-Hexene	14.0	C6H12	<SRL	<SRL	< 0.00941	.beta.-Pinene	13.6	C10H16	<SRL	<SRL	< 0.00914
n-Hexane	14.4	C6H14	<SRL	<SRL	< 0.00964	1,2,4-Trimethylbenzene	13.4	C9H12	<SRL	<SRL	< 0.00896
Methylcyclopentane	14.0	C6H12	<SRL	<SRL	< 0.00941	n-Decane	14.2	C10H22	<SRL	<SRL	< 0.00955
2,4-Dimethylpentane	14.3	C7H16	<SRL	<SRL	< 0.00961	1,2,3-Trimethylbenzene	13.4	C9H12	<SRL	<SRL	< 0.00896
Benzene	13.0	C6H6	<SRL	<SRL	< 0.00874	m-Diethylbenzene	13.4	C10H14	<SRL	<SRL	< 0.00901
Cyclohexane	14.0	C6H12	<SRL	<SRL	< 0.00941	p-Diethylbenzene	13.4	C10H14	<SRL	<SRL	< 0.00901
2-Methylhexane	14.3	C7H16	<SRL	<SRL	< 0.00961	n-Undecane	14.2	C11H24	<SRL	<SRL	< 0.00954
2,3-Dimethylpentane	14.3	C7H16	<SRL	<SRL	< 0.00961	n-Dodecane	14.2	C12H26	<SRL	<SRL	< 0.00953
Total PAMS	14.70	C3H8	1.99	2.04	0.00332						
TNMHC	14.70	C3H8	309	189	0.516						

From: Janet Rogers
To: ARB Clerk of the Board
Subject: Additional Documents and/or Information for the Proposed Control Measure for Ocean-Going Vessels At Berth
Date: Monday, July 27, 2020 8:55:30 PM

As a resident of Downtown San Diego I am submitting additional public comment related to Ocean Going Vessels at Berth Rulemaking.

I am part of a group of downtown San Diego residents that has been in discussions with CARB Staff about this rule's impact on the 40,000 downtown residents living downwind of the cruise ship terminal.

2-15-16.1 I understand that CARB is diligently working to reduce emissions in California and I applaud your efforts. I look forward to the new rule going into effect for cruise ships January 1, 2023. I wish the rule was going into effect immediately, since every day these ships are not connected to shore power, they emit a huge amount of toxic fumes to foul the air downtown and make people sick. I strongly support requiring all cruise ships to connect to shore power, or equivalent, when at berth.

Eliminating the regulated and unregulated fleet designation for cruise ships and making each ship responsible for meeting environmental standards and obeying the rules will be a big improvement.

As with most rulemaking, I see areas for improvement. Every minute of reduced emissions really matters when you live so close to an extremely polluting industry, such as the cruise ship industry. The health and welfare of my loved ones, my friends and myself are significantly impacted by this industry.

2-15-16.2 I continue to be concerned about the time granted to connect and disconnect to shore power in the new rule.

Current standards allow the vessels to run their engines a total of 3 hours between tie down and leaving. CARB staff says this time period is too short since it is very hard to meet this standard.

The new rule still has a 3 hour window plus additional time to complete the READY TO WORK process. The rule establishes 2 hours to connect from READY TO WORK and 1 hour to disconnect from the time the Harbor Pilot boards the ship. We were told that a 2-hour connection time was requested by container ships, due to additional complications related to the containers.

I believe that cruise ships could have a shorter time to connect, and possibly disconnect, due to a comparatively simpler process than container ships. Yet this possibility is not considered in the proposed rule.

I believe that standards should be achievable and based on data. Unfortunately, CARB is setting these new standards without data to support the 2 hour and 1 hour rules.

There is no data to inform us how long it normally takes to get READY TO WORK, which involves readying the gangplank, and processes by both Coast Guard and Border Protection agents.

From earlier discussions with our Port Authority, it doesn't take 2 hours to connect to shore power once the cruise ship is READY TO WORK. As far as CARB knows, one hour from READY TO WORK is more than enough time for cruise ships to connect to shore power. The very limited data available suggests that two hours are not needed after READY TO WORK in order to connect cruise ships to shore power.

Every additional minute the people who live downtown are subjected to the toxic and harmful emissions from cruise ships is a minute too long.

I ask the CARB Board to consider:

1. Staff collecting Ready to Work data for cruise ships, on a random basis, to understand how long this normally takes.
2. Staff collecting connection times for cruise ships starting from Ready to Work, on a random basis, to understand how long this takes.
3. Staff should present this information in its 2022 interim evaluation and consider altering the rule if appropriate.
4. Staff should commission a time study to evaluate the times to connect and disconnect.
    - Is the READY TO WORK process handled efficiently?
    - Are the connect and disconnect processes being done efficiently?
    - Can the technologies be improved?
    - Can the labor processes be improved?
5. Staff should keep records of current connect and disconnect times and compare them to times after the implementation of the new rule. Allowing the ships time in excess of reasonable needs for the connect/disconnect process may result in longer times. This rule creates a big jump to 120 minutes after READY TO WORK for cruise ships, and people lose the incentive to complete the process quickly.
6. Staff could create incentives to shorten connect/disconnect times.
7. Adjust measurements so that averages remove outliers, like VIE and TIE, which skew results.
8. Use a wider range of statistical analysis, even something as easy as MODE, to find the normal breakpoints for a process.
9. More data collection, reporting and analysis can provide the tools CARB staff needs to reduce emissions.
10. Separate the cruise ship requirements from the container ships, since the process is not the same.
11. Consider making the cruise ship connection time 1 hour from READY TO WORK and adjust both the connect and disconnect times based on data from incentivized programs.

Please consider reducing the time cruise ships have to connect to or disconnect from shore power. I appreciate your efforts.

Sincerely,

Janet Rogers

From:	Pat Pressel
To:	ARB Clerk of the Board
Subject:	Subject: Second Notice: Additional Documents and/or Information for the Proposed Control Measure for Ocean-Going Vessels At Berth
Date:	Monday, July 27, 2020 9:44:15 PM

As a resident of Downtown San Diego I am submitting additional public comment related to Ocean Going Vessels at Berth Rulemaking.

I am part of a group of downtown San Diego residents that has been in discussions with CARB Staff about this rule's impact on the 40,000 downtown residents living downwind of the cruise ship terminal.

2-15-17.1 I understand that CARB is diligently working to reduce emissions in California and I applaud your efforts. I look forward to the new rule going into effect for cruise ships January 1, 2023. I wish the rule was going into effect immediately, since every day these ships are not connected to shore power, they emit a huge amount of toxic fumes to foul the air downtown and make people sick. I strongly support requiring all cruise ships to connect to shore power, or equivalent, when at berth.

Eliminating the regulated and unregulated fleet designation for cruise ships and making each ship responsible for meeting environmental standards and obeying the rules will be a big improvement.

As with most rulemaking, I see areas for improvement. Every minute of reduced emissions really matters when you live so close to an extremely polluting industry, such as the cruise ship industry. The health and welfare of my loved ones, my friends and myself are significantly impacted by this industry.

2-15-17.2 I continue to be concerned about the time granted to connect and disconnect to shore power in the new rule.

Current standards allow the vessels to run their engines a total of 3 hours between tie down and leaving. CARB staff says this time period is too short since it is very hard to meet this standard.

The new rule still has a 3 hour window plus additional time to complete the READY TO WORK process. The rule establishes 2 hours to connect from READY TO WORK and 1 hour to disconnect from the time the Harbor Pilot boards the ship. We were told that a 2-hour connection time was requested by container ships, due to additional complications related to the containers.

I believe that cruise ships could have a shorter time to connect, and possibly disconnect, due to a comparatively simpler process than container ships. Yet this possibility is not considered in the proposed rule.

I believe that standards should be achievable and based on data. Unfortunately, CARB is setting these new standards without data to support the 2 hour and 1 hour rules.

There is no data to inform us how long it normally takes to get READY TO WORK, which involves readying the gangplank, and processes by both Coast Guard and Border Protection agents.

From earlier discussions with our Port Authority, it doesn't take 2 hours to connect to shore power once the cruise ship is READY TO WORK. As far as CARB knows, one hour from READY TO WORK is more than enough time for cruise ships to connect to shore power. The very limited data available suggests that two hours are not needed after READY TO WORK in order to connect cruise ships to shore power.

Every additional minute the people who live downtown are subjected to the toxic and harmful emissions from cruise ships is a minute too long.

I ask the CARB Board to consider:

1. Staff collecting Ready to Work data for cruise ships, on a random basis, to understand how long this normally takes.
2. Staff collecting connection times for cruise ships starting from Ready to Work, on a random basis, to understand how long this takes.
3. Staff should present this information in its 2022 interim evaluation and consider altering the rule if appropriate.
4. Staff should commission a time study to evaluate the times to connect and disconnect.
    - Is the READY TO WORK process handled efficiently?
    - Are the connect and disconnect processes being done efficiently?
    - Can the technologies be improved?
    - Can the labor processes be improved?
5. Staff should keep records of current connect and disconnect times and compare them to times after the implementation of the new rule. Allowing the ships time in excess of reasonable needs for the connect/disconnect process may result in longer times. This rule creates a big jump to 120 minutes after READY TO WORK for cruise ships, and people lose the incentive to complete the process quickly.
6. Staff could create incentives to shorten connect/disconnect times.
7. Adjust measurements so that averages remove outliers, like VIE and TIE, which skew results.
8. Use a wider range of statistical analysis, even something as easy as MODE, to find the normal breakpoints for a process.
9. More data collection, reporting and analysis can provide the tools CARB staff needs to reduce emissions.
10. Separate the cruise ship requirements from the container ships, since the process is not the same.
11. Consider making the cruise ship connection time 1 hour from READY TO WORK and adjust both the connect and disconnect times based on data from incentivized programs.

Please consider reducing the time cruise ships have to connect to or disconnect from shore power. I appreciate your efforts.

Sincerely,

Pat Pressel

Pat92101@att.net

“Justice will not be served until those who are unaffected are as outraged as those who are" -
Benjamin Franklin

2-15-18.1

From: Bob Piskule
To: ARB Clerk of the Board
Subject: CARB rulings for cruise ships
Date: Monday, July 27, 2020 9:50:45 PM

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

I am part of the Embarcadero Coalition. I look forward to the new rule for cruise ships January 1,2023. I hope the Port Of San Diego puts in the 2nd power station for cruise ships sooner than latter. Los Angles all ready has two stations in use. Please keep improving are air quality in San Diego.

ROBERT PISKULE
rjp527@yahoo.com
619-300-5640

Sent from Mail for Windows 10

July 27, 2020

California Air Resources Board

1001 I Street,

Sacramento, California 95814

Via Electronic submittal

Re: PROPOSED CONTROL MEASURE FOR OCEAN-GOING VESSELS AT BERTH

The Coalition for Clean air submits these comments in support of the California Air Resources Board's proposed Control Measure for Ocean-Going Vessels ("OGVs") At Berth ("At Berth Regulation"). OGVs cause immense amounts of air pollution globally and particularly when in port when they are closest to people who live near, and work at, California's ports. OGVs are sources of both nitrogen oxide ("NOx") and particulate matter ("PM") emissions, both of which cause grave health impacts. Further, California is in non-attainment of NOx reduction goals under the federal Clean Air Act. Air Districts across the state are working to reduce NOx and other criteria pollutants from stationary sources. Moving OGVs from using diesel auxiliary engines, sources of both NOx and PM, in port to alternatives such as plugging into electrical power or using capture-and-control technology will reduce air pollution and improve public health. As a result, we urge the California Air Resources Board ("ARB") to adopt this regulation at its August meeting and move forward with its implementation as soon as possible.

I. Public Health Benefits of At Berth Regulation Are Obvious and Relevant

Our primary reason for supporting the At Berth regulation is to protect public health. As stated in the ARB Staff Report: Initial Statement of Reasons ("SOR," released October 15, 2019), OGV emissions include criteria pollutants, air toxic contaminants, and greenhouse gases. (SOR, ES-2; see also SOR p. I-10.) As stated above, one of the main pollutants from an OGV is NOx. Exposure to NOx can cause respiratory irritation, aggravation of respiratory diseases, especially asthma, causing coughing, wheezing and difficulty breathing, all of which can lead to emergency room visits and hospital admissions for those people affected. (Id.) Negative public health impacts from NOx emissions are a main reason we strongly support adoption of this regulation. "California's combination of unique geography and robust freight contributes to our state experiencing some of the worst air quality in the nation." (SOR, ES-4.)

Another harmful emission from OGV operations is particulate matter ("PM") that can be inhaled into upper airways and lungs, creating respiratory ailments leading to still more public health concerns. The current COVID-19 pandemic provides a sobering demonstration of the need to protect respiratory health: experts have found that exposure to particulate matter increases COVID-19 mortality. ("Exposure to air pollution and COVID-19 mortality in the United States," Xiao Wu MS, Rachel C. Nethery PhD, M. Benjamin Sabath MA, Danielle Braun PhD, Francesca Dominici PhD, Harvard T.H. Chan School of Public Health, Updated April 5, 2020.)

Exposure to PM 2.5 can increase premature mortality, hospital admissions for cardiopulmonary causes, acute and chronic bronchitis, asthma attacks, and respiratory symptoms. The health effects are of particular concern for sensitive groups such as infants, children, the elderly, and those with preexisting heart or lung disease. (SOR, ES-3; see also SOR p. V-15-19, and ARB, "Inhalable Particulate Matter and Health [PM2.5 and PM10]", August 10, 2017, https://ww3.arb.ca.gov/research/aags/common-pollutants/pm/pm.htm.)

Researchers at McGill University followed over a million adults in Toronto and Montreal and their medical records from 1991 to 2016. The studies found:

"New research has linked air pollution nanoparticles to brain cancer for the first time. The ultra-fine particles (UFPs) are produced by fuel burning, particularly in diesel vehicles, and higher exposures significantly increase people's chances of getting the deadly cancer. Previous work has shown that nanoparticles can get into the brain and that they can carry carcinogenic chemicals." (The Guardian, Air Pollution Nanoparticles Linked to Brain Cancer for First Time, November 13, 2019 https://www.theguardian.com/environment/2019/nov/13/air-pollution-particles-linked-to-brain-cancer-in-new-research.) The article further documented:

"The discovery of abundant toxic nanoparticles from air pollution in human brains was made in 2016. A comprehensive global review earlier in 2019 concluded that air pollution may be damaging every organ and virtually every cell in the human body. Toxic air has been linked to other effects on the brain, including huge reductions in intelligence, dementia and mental health problems in both adults and children. The World Health Organization says air pollution is a "silent public health emergency"." (Id.)

It is critical that we protect public health in areas near ports; most of which are "disadvantaged communities" and have suffered environmental injustices for years or even decades. These areas tend to be comprised of the working poor and people of color who contend daily with the various and cumulative pollution burdens of goods movement, such as proximity to heavy duty trucks, locomotives, cargo handling equipment and OGVs. (SOR p. II-1,2, p. V-9 and V-15; see also Office of Environmental Health Hazard Assessment, CalEnviroScreen 3.0, June 25, 2018, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30.)

The Proposed At Berth Regulation would improve on the existing At Berth Regulation by covering more OGVs and by lowering the visit threshold for determining which ports or terminals are encompassed by the rule. We are supportive of these changes, as they ensure that public health benefits accrue from all ships that visit a California port or independent marine terminal that exceeds 20 OGV visits annually. To continue to apply a regulation to fewer ships and ports would also continue to allow poor air quality to result from those ship visits. As a
2-15-19.1 result, we support the new Regulation whole-heartedly and urge the ARB to implement the regulation beginning on January 1, 2021.

II. Proposed At Berth Regulation Is a Cost Effective Way to Reduce Emissions and Protect Health

Although the total price tag of the At Berth Regulation appears high, when measured against the direct health benefits and the actual cost to the average consumer, it is clearly a worthy investment in a cleaner goods movement system and a healthier California populace.

The Proposed At Berth regulation will improve health benefits for all Californians and particularly communities directly impacted by port operations. Specifically, by 2032, the health benefits would total $2.32 billion from 237 fewer premature deaths, 75 fewer hospital admissions, and 122 fewer emergency room visits statewide, while total costs for all 4 entities to implement would total about $2.23 billion, while. In addition, potential cancer risks will be reduced by approximately 60%. (SOR VI-1,2.) From the Ports of Long Beach and Los Angeles alone—which are just two of the several ports and independent marine terminals expected to be affected by this rulemaking in California—about 2.4 million residents would have a reduced potential cancer risk from implementing the updated At Berth Regulation. (Id., see also p. V-15, p. III-7.)

The annual cost to the average individual consumer for these substantial health benefits is negligible.

III. The Proposed 15-Day Changes

2-15-19.2 A. Delayed Implementation Schedule for Ro-ros Is Unjustified. We oppose moving back the emissions control requirements for these vessels because it will result in greater emissions in 2024. At the June Board meeting, no convincing evidence was introduced to support the rollback; in fact, a persuasive case was made that the delay will prolong the suffering of communities in the San Diego area who are exposed to diesel fumes from ro-ros.

2-15-19.3 B. The Innovative Concept Provision Must Retain Safeguards, And Community Steering Committees Must Be Consulted. The innovative concept provision responds to the requests of the Western States Petroleum Association, Pacific Merchant Shipping Association and some ports. We welcome cost-effective alternative projects that achieve equivalent or greater emission reductions in the impacted communities at a lesser cost, but the provision must not become a loophole. Therefore, it is important that the alternatives reduce criteria pollutants at least as much as the controls would in the time frame needed to be in compliance, do not increase greenhouse gas emissions or increase emissions at other ports or terminals, provide additional reductions that would not have otherwise occurred, and do not use public funds. Furthermore, we agree that consideration of any innovative concepts should involve consulting with Community Steering Committees for AB 617 communities affected by at-berth emissions.

Respectfully submitted,

Bill Magavern

Policy Director

Coalition for Clean Air