



November 15<sup>th</sup>, 2021

Mr. David C. Quiros  
Manager, Freight Technology Section  
Transportation and Toxics Division  
1001 "I" Street  
Sacramento, CA 95814

Re: Proposed Regulations for Commercial  
Harbor Craft in California

Dear Mr. Quiros:

We appreciate the opportunity to comment on the California Air Resources Board (CARB) proposed concepts for further reducing pollution from Commercial Harbor Craft (CHC). Foss Maritime Company (Foss) is a 132-year-old company that provides comprehensive marine transportation and logistical services throughout North America and the Hawaiian Islands. This includes ocean towing and project support in extreme environments throughout the world. Foss provides a wide range of engineering and technical support services from naval architecture and marine engineering to vessel design, construction, and repair. Foss is committed to reducing its carbon and emissions footprints and adhering to the principles of sustainability and safety in its operations. Foss has taken the lead in our industry to aggressively pursue opportunities to reduce emissions and work our environmental values into all our strategies.

It is our sincere desire to be a constructive participant in the rulemaking process and provide comments that will enable CARB to form meaningful regulations that promote the goal of cleaner air without doing irreparable damage to an industry that all Californian's rely on to deliver and support the delivery of their essential goods and services. At no time in our history has the fragility of the supply chain been so evident. That is not a reason to back away from our commitment to the environment, but a reason to pursue practical, science-based solutions. Foss has a long history of taking the lead on the environment implementing creative and technologically advanced solutions. We have spent well in excess of 100 million dollars on clean air new builds and upgrades. We built and operated the first two Hybrid tugs in the Los Angeles/Long Beach harbors. We built and operated the first fleet of double hull bunker barges in California to incorporate vapor collections systems, preventing the harmful release of hydrocarbons during loading operations. Over the last 20 years we have performed dozens of engine upgrades and clean-air rebuilds in advance of the regulatory requirements of the 2009 CHC rulemaking. In the last two years we have built and delivered four state-of-the-art 90 ton Tier 4 escort tugs to the California Market. Tugs, that under the proposed rules, will require significant modification just 7 years after being delivered.

We completed these projects in concert with many federal, state and port agencies. So, it is with a sense of frustration that we continue to be disappointed by CARB's failure to engage in a meaningful dialog with industry. This will be our third series of formal written comments on this rule, we've

attached the previous two for your reference, and we have yet to see CARB respond to any of our legitimate concerns as to the feasibility of the new rules, or the evidence that they are relying on false assumptions, unvalidated models and antiquated formulas to exaggerate the impact of harbor craft emissions. We believe that moving forward with the regulations as written, in light of the unaddressed and unacknowledged uncertainty of the CARB model's calculations regarding the health risk from CHC emissions is irresponsible. We urge CARB to stop pushing this clearly flawed and unsupported by science regulation and work in collaboration with the CHC industry and other impacted stakeholders to craft a regulation that makes a difference. One that:

- Develops rules that require those entering California must meet existing Best Available Technology Standard (BATS) at the time of entry or at the time construction began, whichever is first. (BATS defined as technology that is approved by both manufacturer and the regulator for use).
- Sets up a technical advisory committee of both industry and regulatory members to determine what is the BATS.
- Doesn't require adoption of unproven and unapproved technology (i.e. DPFs). Timelines should set adoption from the time of approval or production begins.
- Doesn't require those who in good faith upgraded or built new to comply with existing regulations, i.e. 2007/2009 CHC law, to upgrade prior to the life cycle of that investment (15 years for a rebuilt engines, 25 years for reengine/new construction) is realized.
- That exempt ATBs and Tugs in Ocean Transport from the CHC rules, simply because they are not harbor craft, and treating them as such is punitive and serves only to reduce the number of operators in the global supply chain.
- Establishes funding initiatives to promote the early adoption of new technologies and infrastructure that reduces emissions.

Such a framework would accelerate the reduction of emissions from CHC, by promoting real, cost-effective investment and the adoption of the best technology at the time. The currently proposed rule works against this by requiring constant incremental investment in technologies that are unproven and only offer marginal improvement at a very high cost. Capital that could be spent on the development of a zero-emission escort tug, will be spent, and arguably wasted, on industry trying to squeeze a non-existent diesel particulate filter (DPF) onto a vessel that it was not designed to receive it.

### **Comments on the Current Regulations**

In response to CARB's continued failure to address or even respond to these concerns, and in conjunction with our industry partners through our trade organization the American Waterways Operators (AWO) we have retained Ramboll, a third-party consulting engineering group, to conduct an independent assessment of the number of tug and towing vessels operating in California and to look at and comment on the Health Study section of the rulemaking packet. Their report to AWO can be found attached to AWO's official comments to this rulemaking. We believe the work and insight provided by Ramboll validates the concerns we have been asserting to CARB staff all along,

- CARB has misrelied a United States Coast Guard (USCG) database that has led them to the false conclusion that there is a 39% underreporting of CHC emissions to CARB. Ramboll data has shown us that for the tug and towing industry that number is only 2.3%.
- The unaddressed and unacknowledged uncertainty of the CARB model's calculations of the health risk created by harbor craft emissions overstates their impact on the public, likely far beyond just the improper inflation created by the overstated vessel inventory.

- CARB has arbitrarily and capriciously included or exempted classes of vessels. Specifically, the draft CHC rule exempts commercial fishing vessels because of certain operating criteria while not extending similar exemptions to ocean-going tugs and barges that meet the exact same criteria.
- The technical solutions offered by the rule are infeasible and overly prescriptive. They pick winners and losers in the commercial marketplace and fail to allow vessel operators to innovate and find creative solutions to achieve emission reduction targets. Foss supports CARB's goal of reducing emissions in California, but this rule would force operators down a technical path that is untested, unproven, and may not be the only avenue to achieve the desired emissions reductions.
- This rule puts living wage jobs and the lives of our mariners at risk. Attempting to install or operate unproven technology in the marine environment is filled with risk. Unlike trucks and off-road applications, our mariners cannot just pull over to the side of the road and call the fire department. *Unproven technology has no place in maritime applications.*

### **INACCURATE AND GROSSLY OVERINFLATED VESSEL POPULATION DATA**

The U.S. Coast Guard database used by CARB to determine the vessel population affected by the rule was designed to track the ownership and regulatory status of a vessel and provides no insight or information into where a vessel is operated. CARB's use of this database overstates the population of tug and towing vessels to reach the false conclusion that there is a significant number of vessels that are not reporting their engine hours to CARB.

We have shown ample evidence in previous comment letters and multiple meetings with CARB personnel to validate our position that emissions from vessels who have not reported their hours is only a fraction of the scaling factor CARB used to inflate the emission inventory. We have pointed out to CARB staff on these occasions that overcounting number of tug and towing vessels operating in California overinflates health risk assessment that is the justification for this rulemaking. We have explained the basis for the discrepancies and told the agency how it can obtain accurate data through the use of readily available AIS data that will show not only every vessel that enters CARB regulated waters, but when those vessels are actually underway. Inexplicably, CARB has done nothing to revise its figures or update its model. Indeed, at the CHC Workshop #4 held on March 16, 2021, CARB acknowledged that the agency was aware that its vessel counts did not accurately reflect the actual number of vessels in the applicable airshed, but informed attendees, without further explanation, that CARB would not be revising the vessel count numbers in the draft regulation. These technical and procedural errors jeopardize the entire basis for the regulation and subject it to heightened legal scrutiny.

For the purposes of this comment letter our trade organization, AWO, contracted with Ramboll, a third-party consulting engineering group, to conduct an independent assessment of the number of tug and towing vessels operating in California and the likely impact of emissions from those vessels. Using Automatic Identification System (AIS) data for 2019, Ramboll was able to account for every tug and towing vessel within California waters during that year. The AIS data affirms that CARB has significantly overcounted the size of California's tug and towing vessel fleet. Specifically, Ramboll found that 200 tug and towing vessels operated within a 100 nm of the California Coast, not the 229 tug and towing vessels estimated by CARB. Additionally, the CARB model assumes that non-reporting vessels operated with the same number of hours as reporting vessels. From the AIS data we can determine the number of hours when the vessels were moving, which when compared to hours reported to CARB, proved to be a reliable predictor of main engine hours. We were able to isolate the vessels CARB shows as having

filed reports from those vessels that have not. The non-reporting vessels averaged only 18% of the hours of the reporting vessels. This means that the total unreported hours are just 2.3% of the total reported hours, not the 29% that the CARB scaling factors estimated.

**Towing Vessel AIS Average Hours >.1 knot - Year 2019**

Vessel Type	Reporting Vessels	Non-Reporting Vessels	Non-Reporting as % of Reporting
ATBs	1,613	278	17%
Tugboat Push/Tow	1,022	300	29%
Tugboat SA	2,336	239	10%
Total of Tug Categories	1,637	291	18%
Reporting Vessels	177		
Non-Reporting Vessels	200		
% of Vessel's not reporting	12%		
% of Unreported Hours	2.3%		

Ramboll ran estimates based on these accurately captured tug and towing vessel hours and found that NOx and PM emissions were only 72% and 62%, respectively, of the figures the improperly inflated CARB’s model produced. We suspect a similar over estimation may exist with the other vessel categories of harbor craft and given that CARB’s assumption was that 39% of the CHC were not reporting, the potential for a massive overestimation of the impact of all harbor craft is possible.

**HEALTH STUDY CONCERNS**

Given the above-noted inflation of the tug and towing vessel fleet size and operating hours we expect that CARB’s assessment of harbor craft emissions is similarly skewed. In fact, Ramboll’s estimates based on updated vessel fleet size and operating hours indicates that CARB’s emissions are overstated. AWO also asked Ramboll to look at and comment on the Health Study section of the CARB rulemaking packet. Based on this assessment, Ramboll raised serious questions about the methodology CARB used both in its assessment of cumulative harbor craft emissions as well the resulting health effects. Most concerning to AWO is Ramboll’s observation that CARB has made no apparent effort to validate its air quality model with verifiable, real-world results. Ramboll conducted a preliminary analysis to validate the agency’s harbor craft- related exposure estimates by comparing the CARB modeled air concentrations at receptor points near Long Beach, Anaheim, Pico Rivera, and Los Angeles with the PM<sub>2.5</sub> concentrations measured at the sampling stations installed at these locations. Because the sampling stations are designed to capture emissions from all nearby sources, the agency’s modeled concentrations for harbor craft specifically would be expected to be within the range of the total measured emissions or, more likely, even lower. Below is the table of results from this exercise, extracted from the Ramboll report.

**Table 6. Comparison between annual average PM<sub>2.5</sub> measured concentrations at monitoring stations in the South Coast to modeled concentrations at the nearest receptors.**

PM <sub>2.5</sub> (mg/m <sup>3</sup> ) annual average	Average of all POCs (daily)	Average of 1hr	Closest Receptors (Modeled PM <sub>2.5</sub> mg/m <sup>3</sup> , Receptor #)			
Long Beach (North)	10.81	-	34.82 (1856)	35.68 (1857)	38.30 (1858)	34.15 (1855)
Long Beach (South)	12.82	14.56	51.57 (1874)	48.44 (1876)	59.88 (1900)	58.13 (1901)
Long Beach-Route 710 Near Road	13.87	15.02	24.01 (1825)	24.80 (1826)	22.29 (1827)	22.35 (1824)
Anaheim	11.05	13.62	15.30 (2602)	14.34 (2604)	16.13 (2601)	14.17 (2588)
Compton	13.24	-	18.05 (1683)	18.41 (1677)	18.96 (1685)	18.03 (1684)
Pico Rivera #2	12.49	-	8.41 (1458)	8.55 (1459)	9.04 (1457)	9.09 (1467)
Los Angeles-North Main Street	11.69	-	7.28 (530)	7.22 (491)		

The second column above shows the average annual PM<sub>2.5</sub> concentrations measured at the sampling stations listed on the left. Again, these figures show estimated PM concentrations from all sources in the area, including from cars and trucks, rail and harbor craft as well as other sources. They also reflect locations near the shoreline that are most likely to be impacted by harbor craft emissions. The four columns on the right show the CARB's modeled concentrations calculated at four locations nearest to each sampling station. As highlighted in the table, Ramboll found from this preliminary check of the data that CARB's modeled estimates are up to 4 times higher than actual measured concentrations of from all sources captured at sampling stations in the same general area. It makes no sense that the emissions just from harbor craft would be higher than the emissions captured in these areas from all possible sources. This raises serious questions about the legitimacy of CARB's model and what if any efforts CARB has made to validate it.

Ramboll and AWO made numerous requests for information from CARB staff that would help us understand the methodology the agency used to determine health impacts associated with harbor craft emissions. CARB staff were unable or unwilling to provide much of the necessary information, which has forced Ramboll to make more generalized observations about CARB's approach. Those observations are offered in detail in Section 2.2 of the attached report, but in short, (1) there is enormous uncertainty in the health effects data that CARB has presented calling into question the purported benefits of the proposed rulemaking; and (2) CARB has applied health effects analyses in an unconventional way and has failed to report its findings in a way that transparently acknowledges the lack of certainty inherent in their findings.

What we can say with certainty is that the health risks are overstated, if only by the overestimation of the vessel inventory and emissions, but in all likelihood to a much greater extent due to the unaddressed issues with the modeling itself. CARB's overstating the emissions from harbor craft is magnified in each step of the model, with each highly conservative assumption or input that is propagated throughout both risk assessments. Based on the comparison of the model output with actual PM levels at monitoring sites we have reason to believe that the errors in the model are overestimating the actual exposures to communities along the shoreline, and thus overestimating any potential benefits of the proposed CHC rules by a significant margin. This is too important a rulemaking to be based on a health study with so much unaddressed uncertainty. CARB needs to take the time to get this right.

To that end Foss urges CARB to:

- Develop an accurate vessel population data set using available means of gathering real-time vessel operating information and emission profiles. This should be done for all vessel categories.
- Validate the emission model to ensure inputs and results are realistic and accurately portray the impact of CHC emissions
- Amend the study utilizing the corrected data set to determine the industry specific impact and need for regulation.
- Redraft the Proposed Regulations in collaboration with the CHC industry and other stakeholders to reflect the conclusions of the new study, and the best path achieving our common goal of a cleaner and healthier environment.

***Moving forward with regulation without correcting errors in the underlying data set undermines the legitimacy of the regulatory process.***

### **CARB'S ARBITRARY AND CAPRICIOUS EXEMPTION OF SOME VESSELS VERUS OTHERS**

CARB's decision to exempt about 1,570 commercial fishing vessels (approximately 40% of the total CHC population) from the rule is arbitrary and capricious. This decision places 100% of the emission reduction burden of the CHC rule on 60% of the vessel population.

CARB's rationale for excluding these vessels applies to the tug and towing vessels that operate in coastal and international trade. Specifically:

- Small profit margins.
- Demonstrated lack of feasibility for Tier 4 repowers and retrofits;
- Competition with out of State and global markets; and,
- Tendency to conduct most of their operations far from the coast.

Ocean-going tugs and barges, either towed on a wire or rigidly connected through an ATB system, are directly analogous in their operation to commercial fishing vessels and share all four bases that led CARB to exempt commercial fishing vessels. AWO submitted information in April of 2020 showing that "repowering with EPA Tier 4 engines could be significant and cost prohibitive for some ship assist and escort tugs." Similar technical challenges exist for ocean-going tugs, barges, and ATBs. These vessels commonly operate in interstate commerce in competition with self-propelled vessels in out of state and global markets. Additionally, the tugboats and barges operating in these markets are required by law to be U.S.-flagged, -owned, -crewed, and -built. This rule would place U.S.-flagged towing vessels at a competitive disadvantage against self-propelled foreign-flagged vessels that are not covered by CARB's rule. Finally, AIS and Marine Exchange data reveals that these vessels conduct most of their operations far from the California coast, giving them a similar air emission profile in California as the exempted commercial fishing vessels.

CARB's decision to exempt 40% of CHC based on the exact conditions that apply to other non-exempt vessels is arbitrary and capricious and should be remedied in any final rule. In our comment letter from last year, attached to this letter, Foss offers draft language that could address this issue and separate vessels engaged in "ocean-going voyages" from the burdens on rules designed for "harbor craft".<sup>1</sup>

### **CARB'S PROPOSAL IS TECHNICALLY INFEASIBLE**

In its April 30, 2020 letter, AWO submitted an Engineering Review Summary performed by Jensen Naval Architects on the Marine Engineers of the Cal Maritime Tier 4 Feasibility study with which CARB supports its assertion that the proposed regulations are feasible for CHC operators. The Cal Maritime study evaluated four DPF retrofit scenarios for a single ship assist and escort tug. The Jensen Review Summary also demonstrates the feasibility of DPF retrofit using a comparable large towing vessel. While the Cal Maritime study projects a \$2.81 million per vessel cost, the Jensen study finds a larger cost impact – between \$3.7 and \$4.5 million – and makes some important points about the limitations of the Cal Maritime study:

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<sup>1</sup> Appendix B, "Concept I: Expanding Vessel Categories Subject to In-Use Requirements", Page 2, beginning at the 2<sup>nd</sup> Paragraph.

- This study of one large and spacious ship assist and escort tug is not representative of the diverse tug and towing vessel fleet.
- The Jensen Review Summary notes “the technical challenges of repowering with EPA Tier 4 engines could be significant and cost prohibitive for some ship assist and escort tugs.”
- The Jensen Review notes that size constraints on some tugs could entirely preclude the placement of aftertreatment systems required by CARB.

CARB’s proposal to combine Tier 3 or Tier 4 engines with DPF aftertreatment technology is unproven, unavailable, and technically infeasible. Size and weight constraints make re-powering and retrofit options impossible for many tug and towing vessels, but even if a vessel had the necessary space to accommodate this technology, there is no available DPF aftertreatment product on the market. The absence of commercially available technology has limited the guidance that engine manufacturers can provide about potential paths to compliance. Additionally, the absence of compliant technology makes planning future capital investment impossible. No matter how carefully a CHC operator has planned out the service life and maintenance schedule of a given vessel, the impact of this proposed rule with its unknowable compliance price-tag cannot be accounted for.

CARB must acknowledge that there is no available technology that currently meets both the performance standards of the proposed regulation and the propulsion needs of the regulated population of tug and towing vessels. CARB must provide realistic relief for vessels that cannot comply with its rules based on space or feasibility constraints. As the draft rule stands now, Foss will be forced to spend tens of millions of dollars on unproven and potentially dangerous retrofits on vessels that have only recently been repowered to meet the last iteration of the CHC regulations. In the most egregious case, Foss has vessels that have just been delivered or it will take delivery off that will be forced to be retrofitted just a few short years after they are first put into service. The financial waste caused by this proposal is staggering and raises the question of whether CARB is legally “taking” property from vessel operators by devaluing fully operational equipment that meets federal standards through state regulation.

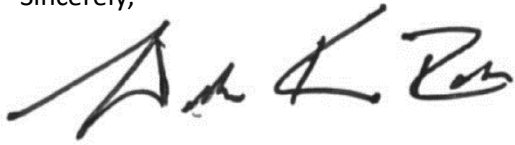
CARB must consider providing vessel operators a feasible path to reducing stack emissions from CHCs. This path must include less prescriptive means of achieving emission reductions and longer-lasting exemptions for vessels that cannot feasibly retrofit.

## **Conclusion**

Foss appreciates this opportunity to comment on CARB’s Proposed Concepts for Commercial Harbor Craft in California. It is our desire to continue our long and effective collaborative relationship with the State of California and CARB. However, in its current form this rulemaking represents a failure of collaboration between regulators and the regulated community. Foss does not understand how CARB can move forward with the rulemaking process without first addressing the glaring errors and misrepresentations that call into question the very legitimacy of the regulation. The erroneous data inflates the emissions generated by the tug and towing vessel fleet and in turn inflates the impact the fleet’s emissions have on the air quality and health of the residents of the regions in which we operate. Foss stands ready to work with CARB to address the errors in the vessel population data. We support a regulation that will fairly apply to all CHC based on their true area of operation and the impact they have on the air quality. Finally, we want a regulation that supports industry, finding feasible solutions to

reducing emissions in the harbors of California. Foss urges CARB to adopt a more collaborative approach and abandon this seriously flawed effort at rulemaking. Thoughtful and honest collaboration will benefit the State's economic and environmental health. Foss looks forward to discussing the topics outlined in this letter with the CARB staff.

Sincerely,

A handwritten signature in black ink, appearing to read "W. Roberts". The signature is fluid and cursive, with a large initial "W" and a stylized "R".

William Roberts  
President and Chief Operating Officer

cc: Jennifer A. Carpenter | President & CEO American Waterways Operators

Attachments

- Appendix A – Ramboll Report
- Appendix B – May 2021 Comment Letter to CARB
- Appendix C – April 2020 Comment Letter to CARB



# MEMORANDUM

Date: November 11, 2021

To: American Waterways Operators

From: Amnon Bar-Ilan, Christian Lindhjem, Sonja Sax

Subject: Ramboll Comments on the California Air Resources Board (CARB) Proposed Amendments to the Commercial Harbor Craft (CHC) Regulation

## 1. REVIEW OF HARBOR CRAFT EMISSIONS IMPACTS AND COMPARISON OF CALIFORNIA HARBOR CRAFT EMISSION INVENTORY

### 1.1 Introduction

The California Air Resources Board (CARB) air emissions inventory and proposed rule effectiveness are presented in Appendix H of the proposed regulation supporting documentation. This 2021 document updates CARB’s emission inventory methods from the 2007/2009 Commercial Harbor Craft (CHC) emission inventory methods.<sup>1</sup> In general, the approach is similar, but many of the default inputs were substantially revised to lower overall emissions as shown in Figure 1.

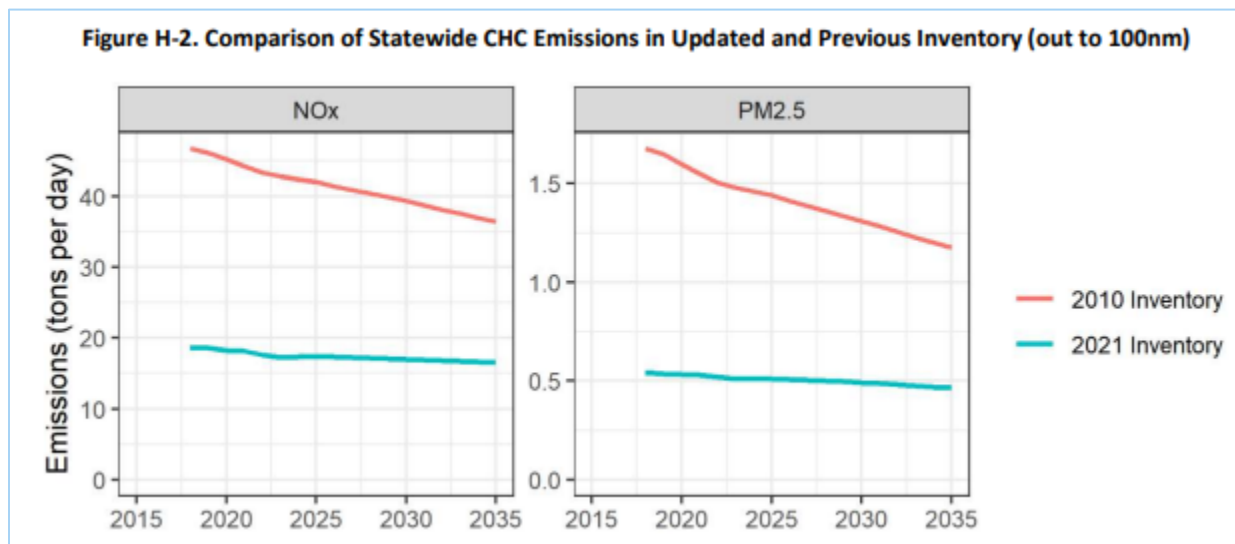


Figure 1. CARB commercial harbor craft emissions inventory comparison. (CARB 2021)

<sup>1</sup> <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-documentation-road>

CARB segregated the vessels by type (including vocation) shown in Figure 2. In this report, we focus on the Tugboat types, which include Tugboat-Escort/Ship Assist, Tugboat-Push/Tow, and Tugboat-Articulated Tug and Barge (ATB).

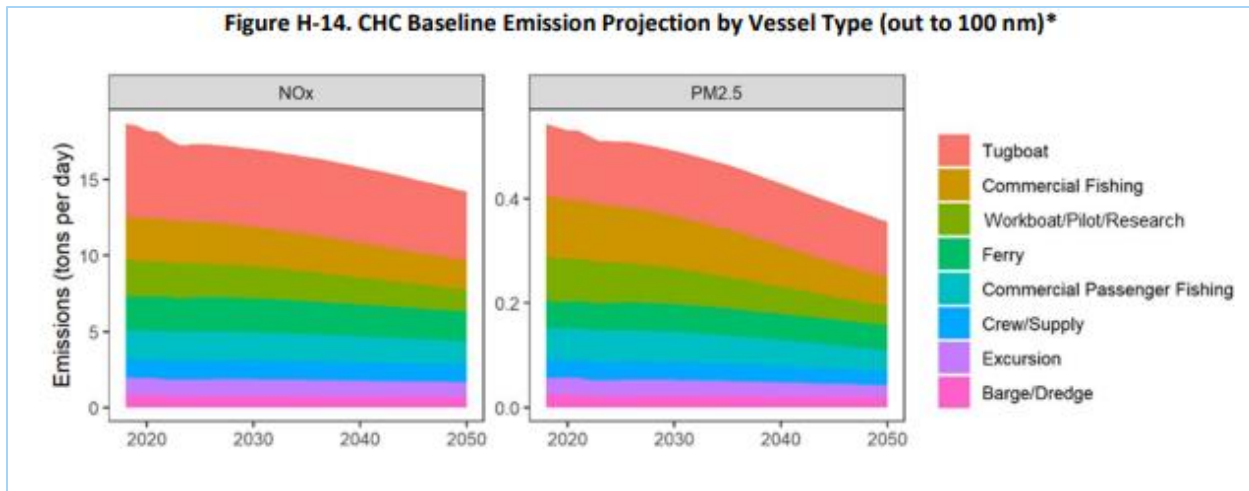


Figure 2. CARB commercial harbor craft emissions inventory by vessel type. (CARB 2021)

Alternative source of activity data includes AIS data that is publicly and freely available from a trusted source.<sup>2</sup> The AIS data identifies tug and towboats using vessel codes 31 for towboats and 52 for tugs and provide position, speed, and course. The AIS data identifies every vessel operating in US continental waters identified by MMSI for a given year.

Emissions estimates depend on input factors related to the vessel activity and engine characteristics. The AIS data provides the population and activity for all vessels operating in a defined domain. Emissions estimates also require that the new engine emission factors be identified by Tier level in Table H-5 of Appendix H of CARB (2021), age, and fuel correction.

$$\text{Emissions} = \text{Pop} \times \text{Power} \times \text{Activity (hrs)} \times \text{Load Factor} \times (\text{zhEF} + \text{DF} \times (\text{Age}/\text{Life})) \times \text{Fuel Correction}$$

- Pop – Population of vessels (activity input)
- Power – Engine power (activity input)
- Activity – Hours of engine operation (activity input)
- Load Factor – Average fraction of available power (CARB input estimate)
- zhEF – Emission factor when new (zero-hour) (CARB input estimate)
- DF – Deterioration factor (CARB input estimate)
- Age – Engine age (activity input)
- Life – Useful Life (CARB input estimate)
- Fuel Correction – In-use relative to engine certification fuel (CARB input estimate for 2011+ engines is 0.948 – NOx and 0.852 - PM<sup>3</sup> and PM correction is more significant for older engines)

<sup>2</sup> <https://marinecadastre.gov/ais/>

<sup>3</sup> <https://ww3.arb.ca.gov/msei/chc-appendix-b-emission-estimates-ver02-27-2012.pdf>

The vessel types average load factor estimates according to primary vocation for the range for tugs and towboats is shown in Table 1. Because of the difference in assumed load factor, it is important to appropriately characterize the activity that each vessel performs.

**Table 1. CARB Load Factor input by vessel type. (Table H-9, CARB 2021)**

Vessel Type	Load Factor	
	Main	Auxiliary
Tugboat-ATB	0.50	0.50
Tugboat-Push/Tow	0.33	0.37
Tugboat-Escort/Ship Assist	0.16	0.34

**1.2 Vessel and Emission Inventory and Comparison with CARB Estimates**

We used the AIS records to identify tug and towboats using vessel identification numbers 31 and 52, and American Waterways Operators (AWO) provided more detailed input for their vessel fleet including primary vocation, engine power, Tier level, and, in some cases, hours of operation in California waters. Table 2 shows the comparison of the vessel population found operating within 100 nm of the California coast during 2019. CARB (2021) reported that they identified the population of 177 tugs and towboats through the harbor craft reporting in Table H-3 and upwardly adjusted that inventory to account for unreported vessels through Coast Guard lists at California home ports. The AIS records find only 200 tug and towboats (23 vessels or about 13% more than reported by CARB) during 2019 compared with CARB’s estimate in Table H-3 of 229 vessels or 29 more than were reported in the AIS records.

**Table 2. Vessel population found in California waters <100 nm in 2019**

Vessel Type	CARB App. H			AIS Records		
	Table H-3	Adjusted Total Table H-3	Average Hours Table H-4	Population	Average Hours (>0.1 knots)	Average Hours (<0.1 knots)
Tugboat-ATB <sup>a</sup>	11	19	2,466	14 <sup>a</sup>	1,991	1,380
Tugboat-Push/Tow	108	147	1,550	118	817	1,216
Tugboat-Escort/Ship Assist	58	63	2,676	68	2,141	3,855
<b>Combined Tug and Towboat</b>	<b>177</b>	<b>229</b>	<b>1,936</b>	<b>200</b>	<b>1,350</b>	

<sup>a</sup> – AIS does not distinguish ATBs from Towboats; AWO identified six fleet vessels and eight others found in AIS records as ATB.

We used the AIS records to determine hours of operation for each tug and towboat operating in California waters out to 100nm during 2019. The average hours for AIS compared favorably with the CARB averages except for towboats where the operating hours about half that estimated by CARB. Total and average hours at less than 0.1 knots speed were considered to use no propulsion power, but auxiliary engines running at normal loads, though many tugs at their base will use shore power for auxiliary loads such as to keep the AIS transponders emitting a signal.

AWO supplied tier and power of the main and auxiliary engines for their members’ fleets as summarized in Table 3. For other tugs and towboats found in the AIS data, we used CARB default information with Tier 1 emissions rates to towboats (including ATB) and Tier 2 to tugboats to hours of operation. The AWO supplied fleets generally had higher installed power

than the CARB averages by vessel type, so using the CARB default for AIS extra (non-AWO) fleets leads to a conservative overestimate of emissions.

**Table 3. Vessel population and inputs use found in California waters <100 nm in 2019**

Vessel Type	CARB App. H Default Inputs			AWO Fleet		
	AIS Extra Population	Main Engines (hp)	Tier	AIS AWO Population	Main Engines (hp)	Tier
Tugboat-ATB <sup>a</sup>	8	4395	1	6 <sup>a</sup>	6400	2, 3
Tugboat-Push/Tow	94	731	1	24	2700	0 – 3
Tugboat-Escort/Ship Assist	7	2450	2	61	3898	0 – 4
<b>Combined Tug and Towboat</b>	<b>109</b>			<b>91</b>		

<sup>a</sup> – AIS does not distinguish ATBs from Towboats, AWO identified six vessels in AWO fleets and eight in AIS records as ATB.

The CARB default and AIS hours of operation were combined in the emissions to estimate tug and towboat emissions for 2019 as shown in Table 4. When applied, deterioration and fuel corrections primarily increase PM emissions relative to our baseline estimate. We also investigate the impact that fleet mix of engine Tier levels could have on average emissions rates primarily increasing PM emissions rates. The Tier levels for the AWO fraction of all vessels was provided, while CARB default fleet mix was used for the other tugs and towboats found in the AIS records.

**Table 4. Tug and towboat emissions in California waters <100 nm in 2019.**

Vessel Type	AIS Emissions Estimates		AIS (with deterioration, fuel correction)		AIS Additional Correction for Fleet Mix	
	NOx tpd	PM tpd	NOx tpd	PM tpd	NOx tpd	PM tpd
Tugboat-ATB <sup>a</sup>	1.36	0.020	0.92	0.019	0.85	0.020
<i>Idle &lt;0.1 knots</i>	4%	5%				
<i>Fraction within 24 nm</i>	87%	83%				
Tugboat-Push/Tow	0.97	0.023	1.11	0.032	1.05	0.039
<i>Idle &lt;0.1 knots</i>	9%	15%				
<i>Fraction within 24 nm</i>	82%	85%				
Tugboat-Escort/Ship Assist	2.04	0.041	2.31	0.057	2.31	0.057
<i>Idle &lt;0.1 knots</i>	17%	26%				
<i>Fraction within 24 nm</i>	99%	99%				
<b>Sum Tug and Towboats</b>	<b>4.37</b>	<b>0.086</b>	<b>4.34</b>	<b>0.109</b>	<b>4.22</b>	<b>0.117</b>
<b>CARB App. H (Estimated from Figure H-14)</b>	<b>6.1</b>	<b>0.14</b>				
<b>Relative to CARB Figure H-14</b>	<b>72%</b>	<b>62%</b>	<b>71%</b>	<b>78%</b>	<b>69%</b>	<b>83%</b>

**1.3 Assumptions**

- AIS data using a <0.1 knot cutoff to eliminate vessel activity when main (and often auxiliary) engines are at least low power or entirely off. The '<0.1knot' criteria best matched the propulsion engine time for tugboat (4% overestimate) and towboats and others identified in AWO fleets (4% underestimate).
  - Under <0.1 knot, the auxiliary engines were assumed to continue to be used to supply power for the AIS and other electrical demands. This is a known overestimate because many tugs plug into shore power while at base.
- Based on the CARB default model year, we used Tier 1 engines for towboats (both ATB and others) and Tier 2 for tugboat-Escort/Ship Assist.
  - CARB reported to have used a distribution of Tier levels; Andrew Daminao (CARB, email to Charles Constanzo, Friday, September 3, 2021 8:55 AM) provided a file 'Towing Vessel Inventory 2019' that provided information about the fleet mix by tier level.
  - Shown in Table 5 is a comparison of the impact on emissions that fleet mix could have compared with either Tier 1 or Tier 2. The small fraction of Tier 0 in the fleet has a significant impact (greater than 50% for DPM) on towboat emissions rates estimated and less but still significant on the tugboats.
  - AWO provide fleets' engines characteristics for 2019 that had generally higher Tier levels and averaged lower emissions levels than the fleets provided by CARB.

**Table 5. Fleet mix emissions impacts from CARB towing vessels file and AWO Submittals for 2019.**

Vocation	Tier	Count	AWO Count	Emission Factor by Tier (g/hp-hr)		CARB Tier 0, 1 Contribution	
				NOx	DPM	NOx	DPM
Tugboat-ATB	0	2	0	7.34	0.37	25%	49%
Tugboat-ATB	1	1	0	6.97	0.12	12%	8%
Tugboat-ATB	2	6	2	5.08	0.09		
Tugboat-ATB	3	2	4	3.69	0.05		
Tugboat-ATB	4	0	0	1.04	0.03		
Average ATB (CARB)		<b>11</b>		<b>5.41</b>	<b>0.136</b>		
Average ATB (CARB)		<b>Ratio vs. Tier 1</b>		<b>0.78</b>	<b>1.14</b>		
Average ATB (AWO)		<b>6</b>		<b>4.15</b>	<b>0.063</b>		
Tugboat-Push/Tow	0	32	1	7.34	0.37	39%	65%
Tugboat-Push/Tow	1	14	4	6.97	0.12	16%	9%
Tugboat-Push/Tow	2	42	8	5.08	0.09		
Tugboat-Push/Tow	3	17	11	3.69	0.05		
Tugboat-Push/Tow	4	0	0	1.04	0.03		
Average Towboat (CARB)		<b>105</b>		<b>5.80</b>	<b>0.173</b>		
Average Towboat (CARB)		<b>Ratio vs. Tier 1</b>		<b>0.83</b>	<b>1.44</b>		
Average Towboat (AWO)		<b>24</b>		<b>4.85</b>	<b>0.088</b>		
Tugboat-Escort/Ship Assist	0	4	5	7.34	0.37	15%	34%
Tugboat-Escort/Ship Assist	1	8	12	6.97	0.12	28%	22%
Tugboat-Escort/Ship Assist	2	18	22	5.08	0.09		
Tugboat-Escort/Ship Assist	3	6	21	3.69	0.05		
Tugboat-Escort/Ship Assist	4	0	1	1.04	0.03		
Average Tugboat (CARB)		<b>36</b>		<b>5.52</b>	<b>0.121</b>		
Average Tugboat (CARB)		<b>Ratio vs. Tier 2</b>		<b>1.09</b>	<b>1.35</b>		
Average Tugboat (AWO)		<b>61</b>		<b>5.09</b>	<b>0.104</b>		

- The deterioration of emissions due to age is a large uncertainty given that engines are regularly rebuilt and that historic regulations have encouraged engine rebuilds with emission upgrades to higher Tier levels.
  - CARB (2021) assumed that towboats would average a model year of 2003 (Table H-1), which in 2019 is 16 years old and past their useful life (Table H-8) of 14 years for main engines. This would increase NOx emission rates by 24% and PM by 77% for towboats.
  - CARB (2021) assumed that tugboats would average a model year of 2009 and be 10 years old in 2019. This would increase NOx emission rates by 15% and PM by 48% for towboats.

## 1.4 Conclusion

We demonstrated using publicly available AIS records that it is possible to accurately identify vessel activity spatially defined. Individual vessels are identifiable through MMSI numbers unique to the AIS transmitters along with their actual activity within California waters. Using the AIS data, CARB can more accurately identify the unreported vessels and not rely on a less reliable list of vessels by home port.

Overall, the number and emissions from tugs for both NOx and PM (including towboats) appear to have been overestimated in Appendix H. The emissions overestimate depends on several input variables, but engine emissions deterioration and fleet fraction, especially the remaining Tier 0 engines still in operation, have a significant effect on PM emissions rates.

## 2. COMMENTS ON THE HEALTH STUDY (APPENDIX G)

### 2.1 Health Risk Assessment for South Coast and Bay Area Air Basins

#### *CalPuff Modeling*

The CalPuff modeling conducted in support of the Proposed Amendments to the CHC Rulemaking involve a number of model inputs and assumptions as outlined in Appendix G. Ramboll reviewed the modelling methodology as well as supporting documentation provided by CARB.

A missing element of the modeling was any validation of the key model inputs as well as the model results. Because of the complex nature of the modeling, including a number of assumptions regarding the emissions inventory, spatial and temporal allocation of emissions, complex terrain and meteorology, it is paramount that CARB validate to the extent possible the model inputs and results.

With regards to model inputs, at the very least CARB should verify that the meteorological estimates used in the model compare to actual measured estimates from a relevant meteorological station. In addition, CARB used a single year of meteorological data and it would also be important to consider using more than one year in order to capture any variability in meteorological parameters that tend to vary from year to year.

With regards to model results, one important way to validate results includes comparing modeled results with measured values at monitor locations at or near the modeled receptor points. While we understand that the CARB is only considering contributions from CHCs in the form of diesel particulate matter, the modeling is used to estimate exposures to diesel

particulate matter and PM<sub>2.5</sub>. We also understand that ambient monitors will be measuring PM<sub>2.5</sub> from all sources. Therefore, we expect that modeled concentrations would be within the range of measured estimates or lower.

Ramboll conducted a check of how modeled PM concentrations compare to measured PM<sub>2.5</sub> concentrations for the South Coast Air Basin. Table 6 shows the results of the comparison between measured concentrations at monitoring sites in the South Coast Air Basin and nearby receptors.

As shown in Table 6, the results from this preliminary check of the data show that the modeled estimates are overestimating exposures as these estimates are up to 4 times higher than actual measured concentrations of PM<sub>2.5</sub> particularly in the most impacted regions (i.e., near the shoreline). Inland modeled estimates (which are expected to be less impacted by CHC emission) are closer to the measured concentrations although still exceed these concentrations for some receptors. This indicates that overall the modeled estimates are overestimating exposures. CARB should similarly verify the results for the Bay Area Air Basin.

An additional source of uncertainty is associated with scaling the concentrations for future years based on changes in emissions. Because the concentrations are not only based on the changes in emissions, but other key factors including meteorology, this introduces a significant amount of uncertainty, making the validation of model estimates even more critical. Also, because we believe that emissions are overstated this will contribute to even more uncertain exposure estimates based on simply scaling.

**Table 6. Comparison between annual average PM<sub>2.5</sub> measured concentrations at monitoring stations in the South Coast to modeled concentrations at the nearest receptors.**

PM <sub>2.5</sub> (mg/m <sup>3</sup> ) annual average	Average of all POCs (daily)	Average of 1hr	Closest Receptors (Modeled PM <sub>2.5</sub> mg/m <sup>3</sup> , Receptor #)			
Long Beach (North)	10.81	-	34.82 (1856)	35.68 (1857)	38.30 (1858)	34.15 (1855)
Long Beach (South)	12.82	14.56	51.57 (1874)	48.44 (1876)	59.88 (1900)	58.13 (1901)
Long Beach-Route 710 Near Road	13.87	15.02	24.01 (1825)	24.80 (1826)	22.29 (1827)	22.35 (1824)
Anaheim	11.05	13.62	15.30 (2602)	14.34 (2604)	16.13 (2601)	14.17 (2588)
Compton	13.24	-	18.05 (1683)	18.41 (1677)	18.96 (1685)	18.03 (1684)
Pico Rivera #2	12.49	-	8.41 (1458)	8.55 (1459)	9.04 (1457)	9.09 (1467)
Los Angeles-North Main Street	11.69	-	7.28 (530)	7.22 (491)		

**Cancer Health Risk Assessment**

The cancer risk assessment also relies on a number data inputs and assumptions, starting with the estimates from the CalPuff modeling. Many of the inputs and assumptions are considerably conservative as they are meant to be health protective and are screening-level analyses. It is important to note that screening level analyses are often followed by more targeted analyses with refined parameters that are more site-specific and/or based on more realistic parameters in order to yield more realistic risk results. Importantly, the numerous levels of

conservativeness in screening level analyses result in risk values that are often highly overestimated and do not necessarily reflect actual risks.

One key data input includes the exposure estimates, which are based on the CalPuff model inputs and a number of additional key assumptions. As noted above, based on Ramboll's check of the modeled DPM estimates, it is likely that these estimates are overestimating exposures, both due to overestimated emissions (see Section 1) contributing to overestimates of about least about 20-60%, in addition model assumptions that result in overestimates compared to measured estimates by as much as a factor of 4 (see comments above) at some receptor locations.

Exposure estimates are also based on updated methodology that also increases the risk estimates because of the application of high (95/80%) breathing rates and multiplicative factors for greater susceptibility in children. In addition, the risk assessment includes several conservative assumptions for estimating exposures including exposures across a residence time of 70 years<sup>4</sup> and assuming a person is home 24 hours a day over those 70 years. All of these conservative assumptions compound to generate highly inflated risks.

Another key input for the risk assessment is the use of a cancer potency factor (CPF). CARB relied on the estimate developed by OEHHA of  $1.1 \text{ (mg/kg-day)}^{-1}$  or  $3 \times 10^{-4}$  per  $\mu\text{g/m}^3$ . This cancer potency value, which represents a 95% upper confidence interval of the lifetime risk, is dated and overly conservative compared to more recent evaluations of the literature on which the cancer potency is based.

At the time of the development of the cancer potency EPA deemed the evidence to be too uncertain to use for cancer risk assessment (US EPA 1994<sup>5</sup>). An HEI study (HEI 1995<sup>6</sup>) found similar limitations associated with the studies that were the basis of the OEHHA value. These limitations included (1) questions about the quality and specificity of the exposure assessments for diesel exhaust, (2) a lack of quantitative estimates of exposure to allow derivation of an exposure-response function, and (3) lack of adequate data to account quantitatively for individual other factors that might also be associated with lung cancer, such as smoking. In 2002, EPA<sup>7</sup> again concluded that data were too uncertain for developing a cancer potency, but using more qualitative methods determined the risk to be in the range of  $10^{-5}$  to  $10^{-3}$ . Therefore, the risk could potentially be about 300 times lower than the OEHHA value.

Another important issue in extrapolating results from older epidemiology studies, as OEHHA did, is that diesel exhaust exposure in these studies is based on diesel exhaust composition that is very different compared to more contemporary diesel exhaust, and also quite different from marine vessel emissions (as these studies evaluated exposures in railroad workers and truck drivers). Specifically, because of the long latency period for lung cancer, epidemiology studies need to examine workers whose exposures started more than 20 years earlier. These particular studies are based on exposures from the 1950s and 1960s. However, the US EPA and CARB have progressively tightened standards for particulate emissions from diesel engines, including marine engines, resulting in the development of new technology diesel engines with significantly lower emissions and also likely different composition. Because these

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<sup>4</sup> A 30 year residence time is considered to be a more realistic residence time period.

<sup>5</sup> US EPA. Health Assessment Document for Diesel Emissions (External Review Draft, 1994) - Volume 1. U.S. Environmental Protection Agency, Washington, D.C., EPA/600/8-90/057Ba (NTIS PB95192092)

<sup>6</sup> HEI. Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects. 1995. [Diesel Exhaust New Scan.pdf \(healtheffects.org\)](http://www.healtheffects.org)

<sup>7</sup> U.S. EPA. Health Assessment Document for Diesel Engine Exhaust (Final 2002). U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC, EPA/600/8-90/057F, 2002



changes have resulted in not only quantitative reduction in mass emitted, but have also resulted in differences in the composition with respect to size and chemicals associated with the exhaust (e.g., Hesterberg et al. 2011<sup>8</sup>), the epidemiology studies based on old generation engines may not be applicable to current emission conditions.

Even if the epidemiology data were deemed robust enough for use in quantifying the cancer risks of DPM, the uncertainty suggests that cancer risks could be over 100 fold lower than estimates by CARB, which would bring the cancer risks into an acceptable range by US EPA and California standards (i.e.,  $10^{-6}$  to  $10^{-4}$ ) under the current regulations, without the need for application of the proposed regulations.

At a minimum, CARB should provide a more detailed discussion of the uncertainties noted in these comments and the impact on the estimated risks, which we note are likely highly inflated. The cumulative impact of application of multiple conservative assumptions needs to be acknowledged.

## 2.2 Regional PM<sub>2.5</sub> Mortality and Illness Analysis for California Air Basins

CARB used two different methods to estimate the impacts of the Proposed Amendments to the CHC Regulation on mortality and other health effects (hospital admissions for cardiovascular and respiratory diseases and emergency department visits for asthma). The first method relies on the modeled estimates for the two air basins (San Francisco Bay and South Coast) and the second method is a reduced form analysis that is applied to other air basins as well as to impacts from reductions in NOx.

While the CARB health analysis is based on standard methodology used by EPA to calculate health impacts, we were not able to check the results based on the data provided by CARB as many of the model inputs were missing. Also, even though the methods appear to be applied correctly, given what we were provided for review, the approach taken by CARB is unconventional. First, CARB is using two different methods to calculate health impacts, one based on modeled results and a second based on a reduced-form method with large simplifying assumptions. Both methods are subject to large uncertainties, but the reduced-form method has significantly more uncertainty.

Also, the way the CARB approaches the health analysis is also significantly different from the way EPA and others have conducted similar analyses (i.e., using BenMAP). CARB essentially is computing effects based on changes in PM<sub>2.5</sub> modeled estimates (or PM emission reductions) for each year starting in 2023 and up to 2038 between the current regulations and the proposed amendments. The impacts are summed across air basins for each year, and then summed across all years. To our knowledge, this type of cumulative assessment of health benefits across a long time period in the future has not been conducted previously using the methods CARB is using. We welcome other examples where this has been done.

The implications are that these impacts are cumulative over time. In addition, the impacts actually increase over the years (presumably as the difference in emissions or concentrations increase between current and proposed regulations).

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<sup>8</sup>Hesterberg, T. W., Long, C. M., Sax, S. N., Lapin, C. A., McClellan, R. O., Bunn, W. B., & Valberg, P. A. (2011). Particulate Matter in New Technology Diesel Exhaust (NTDE) is Quantitatively and Qualitatively Very Different from that Found in Traditional Diesel Exhaust (TDE). *Journal of the Air & Waste Management Association*, 61(9), 894–913.

The amount of uncertainty associated with this analysis is very large and propagated across all the steps in the risk assessment process including 1) emissions estimation, 2) modeling and scaling of PM concentrations (which rely on emission inputs), 3) deriving PM from diesel PM, 4) assumptions regarding conversion of NO<sub>x</sub> to PM, 5) application of health functions from epidemiology studies, and 6) estimation of baseline health statistics and population statistics for future years. The magnitude of the uncertainty and the impact on the direction of bias has not been evaluated by the CARB, but our analysis, based on available data, suggest that the magnitude is quite large (and larger than expressed by the 95% confidence intervals provided by CARB) and most likely are overstating the health benefits of the proposed amendments.

In light of the significant amount of uncertainty in the health analysis, we strongly suggest that CARB present the findings so that they are more transparent and in a way that acknowledges the level of uncertainty, as well as amount of confidence that can be placed on the results. For example, we don't think it is appropriate to present the combined results for the health analysis based on modeled data and those based on the IPT methodology, because the IPT results would tend to be much more uncertain and less reliable. Also, instead of presenting a total number of deaths as the sum across air basins and years, CARB should present results as a range on potential annual impacts for each air basin, separately. This again, with the acknowledgement that year to year there is uncertainty and the numbers could be more or less than estimated depending on many different model assumptions at every step in the risk assessment process.

Some of the key limitations and sources of uncertainty of these two methodologies for estimating the potential health impacts from the Proposed Amendments are discussed below.

### ***Analysis for the San Francisco Bay and South Coast***

As is the case for the cancer health risk assessment, the PM mortality and illness analysis relies on a number of model inputs and assumptions, many that are associated with significant uncertainty that tends to overstate the risks.

In interpreting the mortality and illness results, it is important to consider that the health impacts are based on a single population-based epidemiological study that infer statistical associations between health effects and air pollution exposures, but that cannot provide definite evidence of a cause and effect. This is because these studies have important limitations that preclude definite conclusions regarding a causal link between PM and mortality or illness, including uncertainty regarding the exposure estimates, the potential role of other pollutants or factors that might explain the effects, and evidence that there is likely a threshold below which health impacts are unlikely. In addition, the components of PM that may be associated with adverse health effects are yet unknown, but the analyses assume that all PM is equally toxic, making it a very conservative analysis.

The epidemiological studies that form the basis of the health study, including the mortality study by Krewski *et al.* (2009)<sup>9</sup> rely on data from central-site monitors to estimate personal exposures. This results in exposure measurement error because central-site monitors may not accurately capture population mobility, the uneven distribution of PM exposure attributable to local sources, pollution patterns that can be affected by terrain features and weather, and daily variations in PM concentrations or composition that may differ from variations experienced by

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<sup>9</sup> Krewski, D. et al., 2009. Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality Report. Health Effects Institute, 140 <https://www.healtheffects.org/system/files/Krewski140.pdf>

individuals. These factors can bias the results of an epidemiology analysis in either direction. The direction and magnitude of the bias depends on the type of measurement error. For PM<sub>2.5</sub>, however, because of the spatial variability of air pollutant concentrations the bias is likely to result in effects being overestimated (e.g., Goldman *et al.*, 2011<sup>10</sup>, Rhomberg *et al.* 2011<sup>11</sup>).

The bias associated with confounding effects is particularly difficult to address in epidemiology studies because it is challenging to account for all potential confounding factors. A confounder is a factor that is associated with both an exposure and an outcome, and may make it appear that the exposure is associated with (or caused) the outcome. In PM mortality studies there is evidence that co-pollutants can confound the PM mortality association, especially because many of the pollutants are strongly correlated, and disentangling the effects of any single pollutant (if any) is difficult. Even if potential confounders are accounted for in studies, there may still be issues of how well the confounding variables are measured and controlled for. For example, in the study by Krewski *et al.* (2009), which is used by CARB for the mortality estimates, data on potential confounders such as smoking and body mass index were determined at the beginning of the study for all participants, but were not re-evaluated over the follow up study period. Changes in these variables over time could alter confounding effects. The issue of confounding relates to both the assumption of causality, where another factor may actually be the causal agent, and to the magnitude of the association, where a co-factor may account for some of the observed risk. In either case, ignoring the effects of confounding results in overstated effects estimates.

Another source of uncertainty is the assumption of a log-linear response between exposure and health effects, without consideration for a threshold below which effects may not be measurable. The issue of a threshold for PM<sub>2.5</sub> is highly debated and can have significant implications for health impacts analyses as it requires consideration of current air pollution levels and calculating effects only for areas that exceed threshold levels. Without consideration of a threshold, effects of any change in air pollution below or above the threshold are assumed to impact health. Interestingly, although EPA traditionally does not consider thresholds in its cost-benefit analyses, the NAAQS itself is a health-based threshold level that EPA has developed based on evaluating the most current evidence of health effects. Most epidemiological studies do not indicate that a threshold exists, but these studies often do not have the statistical power to detect thresholds. Some studies that have employed different statistical methods have shown evidence of a threshold for PM-mortality effects. For example, Abrahamowicz *et al.* (2003)<sup>12</sup> found evidence for a PM<sub>2.5</sub> threshold at about 16 µg/m<sup>3</sup> below which mortality effects were not observed. Considering a threshold for PM effects would mean that effects would occur only when threshold levels of PM is exceeded.

Sensitivity analyses are often warranted using different health functions from different studies in order to evaluate the potential variability and/or uncertainty in health estimates. For example, some epidemiological studies have reported no mortality impacts from PM<sub>2.5</sub>

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<sup>10</sup> Goldman, GT; Mulholland, JA; Russell, AG; Strickland, MJ; Klein, M; Waller, LA; Tolbert, PE. 2011. "Impact of exposure measurement error in air pollution epidemiology: Effect of error type in time-series studies." *Environ. Health* 10 (1) :61. 211-5049

<sup>11</sup> Rhomberg, LR; Chandalia, JK; Long, CM; Goodman, JE. 2011. "Measurement error in environmental epidemiology and the shape of exposure-response curves." *Crit. Rev. Toxicol.* 41 (8) :651-671. 211-7617

<sup>12</sup> Abrahamowicz M, Schopflocher T, Leffondré K, du Berger R, Krewski D. Flexible modeling of exposure-response relationship between long-term average levels of particulate air pollution and mortality in the American Cancer Society study. *J Toxicol Environ Health A.* 2003 Aug 22-Oct 10;66(16-19):1625-54.

exposures (Beelen et al., 2009<sup>13</sup>; Enstrom, 2005<sup>14</sup>, Lipfert et al., 2006<sup>15</sup>). This means that if the BenMAP analyses used different concentration-response functions, the actual impacts may be very different from those reported in this analysis and could include a zero effect.

One additional important uncertainty stems from the assumption that all PM<sub>2.5</sub>, regardless of composition, is equally potent in causing health effects such as mortality. This is important because PM<sub>2.5</sub> varies significantly in composition depending on the source, and this is particularly important because the composition of particulate matter from diesel has also changed over time as a function of changes in both diesel fuel composition as well as the use of emission controls. Several reviews have evaluated the scientific evidence of health effects from specific particulate components (e.g., Rohr and Wyzga 2012<sup>16</sup>; Lippmann and Chen, 2009<sup>17</sup>; Kelly and Fussell, 2007<sup>18</sup>). These reviews indicate that the evidence is strongest for combustion-derived components of PM including elemental carbon (EC), organic carbon (OC) and various metals (e.g., nickel and vanadium), however, there is still no definitive data that points to any particular component of PM as being more toxic than other components. EPA also stated that results from various studies have shown the importance of considering particle size, composition, and particle source in determining the health impacts of PM (US EPA, 2009<sup>19</sup>). Further, EPA (2009) found that studies have reported that particles from industrial sources and from coal combustion appear to be the most significant contributors to PM-related mortality, consistent with the findings by Rohr and Wyzga (2012) and others. Therefore, by not considering the relative toxicity of PM components, BenMAP analyses are likely to be conservative.

### ***Analysis Using the IPT methodology for Other Air Basins (and NOx)***

In addition to the analysis conducted on modeled PM<sub>2.5</sub>, CARB applied a reduced-form methodology (IPT) to estimate additional health impacts for other air basins and from PM<sub>2.5</sub> derived from NOx emissions. These reduced-form analyses involve important simplifying assumptions that can greatly affect the reliability of the estimated health impacts.

The uncertainties described in the previous section also apply to the development of the IPT factors that are used to estimate the impacts for other air basins. Additional uncertainty is introduced when applying these IPT factors to the estimated emissions for this rulemaking. The IPT factors are based on a specific time period, and therefore important variability due to meteorological changes and or spatial differences are not accounted for. Most of these uncertainties were not discussed or considered by CARB. Importantly, a large majority of the assumptions and uncertainties likely result in overestimated benefits, particularly when considering the compounding effects of the uncertainties in the various modeling inputs, starting with the emissions estimates, on the final calculation.

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<sup>13</sup> Beelen, R; Hoek, G; van den Brandt, PA; Goldbohm, RA; Fischer, P; Schouten, LJ; Jerrett, M; Hughes, E; Armstrong, B; Brunekreef, B. 2008. "Long-term effects of traffic-related air pollution on mortality in a Dutch cohort (NLCS-AIR Study)." *Environ. Health Perspect.* 116 (2) :196-202

<sup>14</sup> Enstrom, JE. 2005. "Fine particulate air pollution and total mortality among elderly Californians, 1973-2002." *Inhal. Toxicol.* 17 (14) :803-816. 209-6826

<sup>15</sup> Lipfert, FW; Wyzga, RE; Baty, JD; Miller, JP. 2006. "Traffic density as a surrogate measure of environmental exposures in studies of air pollution health effects: Long-term mortality in a cohort of US veterans." *Atmos. Environ.* 40 (1) :154-169. 206-7558

<sup>16</sup> Rohr A.C., R.E. Wyzga, 2012. Attributing health effects to individual particulate matter constituents. *Atmos Environ.*, 62, 130-152. doi:10.1016/j.atmosenv.07.036.

<sup>17</sup> Lippmann, M., L.C. Chen, 2009. Health effects of concentrated ambient air particulate matter (CAPs) and its components. *Crit. Rev. Toxicol.*, 39, 865e913.

<sup>18</sup> Kelly, F.J., J.C. Fussell, 2007. Particulate Toxicity Ranking Report. Report Number 2/07. Environmental Research Group, Kings College, London.

<sup>19</sup> U.S. EPA. Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2009). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F, 2009

As noted previously, we don't believe it is appropriate for CARB to combine the results from this analysis with the analysis for the two air basins, for which modeled estimates are available. In addition, the estimated range of annual impacts for each air basin should be reported instead of summing the cumulative results across years.

### 2.3 Conclusions

The health risk assessments conducted by CARB are subject to a significant number of uncertainties that are propagated through the risk assessment steps and that we have shown to overestimate the health impacts. We first show that emissions estimates are inflated (see Section 1) and these estimates are inputs to the CalPuff modeling used to estimate exposures and risks for the Bay Area and South Coast Air Basins. We also note that CARB did not validate the model estimate against measured levels of PM<sub>2.5</sub>. Our preliminary analysis indicates that the modeled estimates are overestimating the measured levels for receptors near monitoring stations, particularly in highly impacted areas. Lastly, we highlight many of the risk assessment model assumptions that will also contribute to overstated health impacts in both the cancer risk assessment and the mortality and illness assessment.

Specifically, in the cancer risk assessment the use of highly conservative exposure assumptions (e.g., high breathing rates, 70 years of exposures 24 hours a day), application of sensitivity factors, and use of a highly conservative cancer slope factor all add up to highly inflated cancer risks. Similarly, in the mortality and illness analysis, risks are also likely to be overstated because of assumptions related to the choice of epidemiological study as the basis of the analysis, as well as the assumptions regarding the year to year changes in emissions across the air basins. Importantly, because the two methods used by CARB are associated with significantly different amount of uncertainty, the mortality and illness results should be presented as annual effects, and shown separately by air basin and by methodology, noting that results using the IPT approach will be more uncertain than those based on modeled results.

Overall, CARB needs to provide a more robust validation of modeled assumptions, a more thorough discussion of the underlying uncertainties and impact on the results, and a more transparent representation of the study results.



May 5th, 2020

Ms. Bonnie Soriano  
Chief, Freight Activity Branch  
Transportation and Toxics Division  
California Air Resources Board  
1001 "I" Street  
Sacramento, CA 95814

Re: AWO Comments relating to Proposed  
Amendments to the Regulations to Reduce  
Emissions from Diesel Engines On  
Commercial Harbor Craft Operated Within  
California Waters and 24 Nautical Miles of  
the California Baseline

Dear Ms. Soriano:

We appreciate the opportunity to comment on the California Air Resources Board (CARB) proposed concepts for further reducing pollution from Commercial Harbor Craft (CHC). Foss Maritime Company (Foss) is a 132-year-old company that provides comprehensive marine transportation and logistical services throughout North America and the Hawaiian Islands. This includes ocean towing and project support in extreme environments throughout the world. Foss's Pacific Northwest shipyard in Seattle, Washington offers a wide range of services from naval architecture and marine engineering to vessel design, construction, and repair. Foss is committed to reducing its carbon and emissions footprints and adhering to the principles of sustainability and safety in its operations. Foss has taken the lead in our industry to aggressively pursue opportunities to reduce emissions and work our environmental values into all our strategies.

It is our sincere desire to be a constructive participant in the rulemaking process and provide comments that will enable CARB to form meaningful regulations that promote the goal of cleaner air without doing irreparable damage to an industry that all Californian's rely on to deliver and support the delivery of their essential goods and services. We were disappointed by CARB's 16-day comment window, on a 113-page draft rule published on April 1<sup>st</sup>. These proposed rules involve highly technical subjects and the time allowed is not ample to both review the changes from the last draft, nor to prepare constructive comments to address what we believe are significant short-comings, errors, and misrepresentation of facts in the latest version. We did receive notice from Mr. David Quiros that CARB was granting an unpublished open-ended extension period. And while we feel this extension should have been formal and published, we trust that CARB is sincere, and are taking advantage of the opportunity by submitting the following comments for CARBs consideration and action.

Over the years Foss has been associated with several highly technical rulemaking processes. Among these were the Escort Rules for Prince William Sound, Puget Sound, San Francisco Bay and the Ports of

## Appendix B - May 2021 Comments

Los Angeles and Long Beach. The regulatory bodies involved included the United States Coast Guard, Washington Department of Ecology and California Office of Spill Prevention and Response. Private and industry partners in the process included including harbor and pilot associations, marine exchanges, shipping companies, harbor safety committees, tug and barge companies and other interested stakeholders. While at times the opinions of the regulators and regulated differed we were all guided by a commitment to get it right and to base our findings on accurate and verifiable data and sound scientific principles. The result was rules that have produced safer waterways, while allowing the commerce they regulate to continue to operate in a safe and efficient manner. The science behind the latest draft of the proposed CHC regulations has deviated from this proven path. We continue to be concerned by CARB's willingness to move forward with the rules without first addressing the known and significant errors in the foundational elements that they are based upon. These inaccuracies include:

- Errors in the vessel population data used by CARB, that drastically overstates the towing vessel population operating in CARB waters. Foss and AWO have repeatedly demonstrated to CARB staff that the U.S. Coast Guard vessel database, the foundation of all their vessel counts, has no information related to a vessel's utilization or location of operation. Further we have shared with CARB real-time sources of vessel operating data that could provide accurate usage data. Sources that showed:
  - Of the 219 towing vessels CARB used as operating in California, only 73 of those vessels were operated in California.
  - That the 219 vessels did not include vessels registered out of state, that were operating in California.
  - That CARB asserted, based on the false number of 219 towing vessels in their database, there was a 48% under-reporting of towing vessel emissions in California. Accurate real-time data refutes this claim and shows that any errors in reporting are likely insignificant.

It defies logic and scientific rigor that CARB is continuing to promote a regulation based on such an erroneous data set that has created incorrect and invalid conclusions.

- CARB has arbitrarily and capriciously included or exempted classes of vessels. Specifically, the draft CHC rule exempts commercial fishing vessels because of certain operating criteria while not extending similar exemptions ocean-going tugs and barges that meet the exact same criteria. These vessels trade in direct competition with self-propelled cargo and tank ships that are not covered by the CHC rule, putting them at a financial disadvantage.
- The technical solutions offered by the rule are infeasible and overly prescriptive. They pick winners and losers in the commercial marketplace and fail to allow vessel operators to innovate and find creative solutions to achieve emission reduction targets. Foss supports CARB's goal of reducing emissions in California, but this rule would force operators down a technical path that is untested, unproven, and may not be the only avenue to achieve the desired emissions reductions.

In support of our comments, we have included two additional letters, previously received by CARB. Attached as Appendix A is AWO's Comments submitted to CARB on 4/30/21. Foss assisted AWO staff in the preparation of their comments and fully supports the observations and statements contained therein. In Appendix B is the Foss comments on the rule submitted last year, dated 4/30/2020. As few if

any of these comments were directly addressed by CARB staff in either the revised draft of the rules or in the meetings leading up to their release, we urge CARB to reread these comments. We believe they offer a practical basis for renewed discussion and collaboration to create a rule set that will address the real challenge of emissions reductions and their true impact on health based in real data and the fair application of regulation.

## **INACCURATE AND GROSSLY OVERINFLATED VESSEL POPULATION DATA**

Foss directs you to the comments contained in the AWO comment letter in Appendix A. As the U.S. Coast Guard will attest, the database used by CARB to describe the population was designed to track the ownership and regulatory status of a vessel and does not provide any insight or information into where a vessel is operated. CARB staff has acknowledged this fact and yet continues to use the numbers in the database to justify the conclusions of the study and the proposed rules. These are not insignificant errors. The vessel count includes:

- 146 towing vessels that did not operate in CARB waters during the last three years.
- Excludes 69 towing vessels that were registered out of state but did operate in CARB waters.
- Includes 33 vessels that did not have a valid Certificate of Documentation, either having retired it or having it marked as “Not in Operation.” There is no evidence these vessels operated in CARB waters during the last three years.

Using real-time sources from the Marine Exchanges in both San Francisco and Los Angeles Long Beach, based on Automatic Identification System (AIS) and regulatory reporting requirements, we demonstrated the flaws in the vessel counts that CARB was using for towing vessels. Most importantly we clearly showed that there was no justification for CARB to inflate the towing vessel numbers by 48% for under reporting. AWO and Foss shared all our data with CARB in the spirit of full transparency and would welcome the opportunity to assist CARB in obtaining accurate vessel information. But we are confused and dismayed that while CARB openly acknowledged these errors in the CHC Workshop #4 held on March 16, 2021, they informed the attendees of the workshop that they would not be revising their vessel count numbers in the draft regulation.

To that end Foss joins with AWO to urge CARB to:

- Develop an accurate vessel population data set using available means of gathering real-time vessel operating information and emission profiles. This should be done for all vessel categories.
- Amend the study utilizing the corrected data set to determine the industry specific impact and need for regulation.
- Redraft the Proposed Regulations to reflect the conclusions of the new study.

Moving forward with regulation without correcting errors in the underlying data set will undermine the legitimacy of the regulatory process.

## **CARB’S ARBITRARY AND CAPRICIOUS EXEMPTION OF SOME VESSELS VERUS OTHERS**

Foss directs you to the comments from AWO, contained in Appendix A. CARB’s decision to exempt about 1,570 commercial fishing vessels (approximately 40% of the total CHC population) from the rule is



arbitrary and capricious. This decision places 100% of the emission reduction burden of the CHC rule on 60% of the vessel population.

CARB's rationale for excluding these vessels apply to the towing vessels that operate in coastal and international trade. Specifically:

- Small profit margins;
- Demonstrated lack of feasibility for Tier 4 repowers and retrofits;
- Competition with out of State and global markets; and,
- Tendency to conduct most of their operations far from the coast.

Ocean-going tugs and barges, either towed on a wire or rigidly connected through an ATB system, are directly analogous in their operation to commercial fishing vessels and share all four bases that led CARB to exempt commercial fishing vessels. AWO members have offered to confidentially share with CARB financial data that demonstrates the small profit margins in the towing industry. AWO submitted information in April of 2020 showing that "repowering with EPA Tier 4 engines could be significant and cost prohibitive for some ship assist and escort tugs." Similar technical challenges exist for ocean-going tugs, barges, and ATBs. These vessels commonly operate in interstate commerce in competition with self-propelled vessels in out of state and global markets. Additionally, the tugboats and barges operating in these markets are required by law to be U.S.-flagged, -owned, -crewed, and -built. This rule would place U.S.-flagged towing vessels at a competitive disadvantage against self-propelled foreign-flagged vessels that are not covered by CARB's rule. Finally, AIS and Marine Exchange data reveals that these vessels conduct most of their operations far from the California coast, giving them a similar air emission profile in California as the exempted commercial fishing vessels.

CARB's decision to exempt 40% of CHC based on the exact conditions that apply to other non-exempt vessels is arbitrary and capricious and should be addressed prior to formal rulemaking. In our comment letter from last year, found in Appendix B, Foss offers draft language that could address this issue and separate vessels engaged in "ocean-going voyages" from the burdens on rules designed for "harbor craft".<sup>1</sup>

## **CARB'S PROPOSAL IS TECHNICALLY INFEASIBLE**

In its April 30, 2020 letter, AWO submitted an Engineering Review Summary performed by Jensen Naval Architects on the Marine Engineers of the Cal Maritime Tier 4 Feasibility study with which CARB supports its assertion that the proposed regulations are feasible for CHC operators. The Cal Maritime study evaluated four DPF retrofit scenarios for a single ship assist and escort tug. The Jensen Review Summary also demonstrates the feasibility of DPF retrofit using a comparable large towing vessel. While the Cal Maritime study projects a \$2.81 million per vessel cost, the Jensen study finds a larger cost impact – between \$3.7 and \$4.5 million – and makes some important points about the limitations of the Cal Maritime study:

- This study of one large and spacious ship assists and escort tug is not representative of the diverse towing vessel fleet.

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<sup>1</sup> Appendix B, "Concept I: Expanding Vessel Categories Subject to In-Use Requirements", Page 2, beginning at the 2<sup>nd</sup> Paragraph.

- The Jensen Review Summary notes “the technical challenges of repowering with EPA Tier 4 engines could be significant and cost prohibitive for some ship assist and escort tugs.”
- The Jensen Review notes that size constraints on some tugs could entirely preclude the placement of aftertreatment systems required by CARB.

CARB’s proposal to combine Tier 3 or Tier 4 engines with DPF aftertreatment technology is unproven, unavailable, and technically infeasible. Size and weight constraints make re-powering and retrofit options impossible for many towing vessels, but even if a vessel had the necessary space to accommodate this technology, there is no available DPF aftertreatment product on the market. The absence of commercially available technology has limited the guidance that engine manufacturers can provide about potential paths to compliance. Additionally, the absence of compliant technology makes planning future capital investment impossible. No matter how carefully a CHC operator has planned out the service life and maintenance schedule of a given vessel, the impact of this proposed rule with its unknowable compliance price-tag cannot be accounted for.

CARB must acknowledge that there is no available technology that currently meets both the performance standards of the proposed regulation and the propulsion needs of the regulated population of towing vessels. CARB must provide realistic relief for vessels that cannot comply with its rules based on space or feasibility constraints. As the draft rule stands now, Foss will be forced to spend tens of millions of dollars on unproven and potentially dangerous retrofits on vessels that have only recently been repowered to meet the last iteration of the CHC regulations. In the most egregious case, Foss has vessels that have just been delivered or it will take delivery off that will be forced to be retrofitted just a few short years after they are first put into service. The financial waste caused by this proposal is staggering and raises the question of whether CARB is legally “taking” property from vessel operators by devaluing fully operational equipment that meets federal standards through state regulation.

CARB must consider providing vessel operators a feasible path to reducing stack emissions from CHCs. This path must include less prescriptive means of achieving emission reductions and longer-lasting exemptions for vessels that cannot feasibly retrofit.

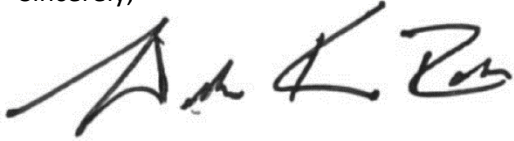
## **Conclusion**

Foss appreciates this opportunity to comment on CARB’s Proposed Concepts for Commercial Harbor Craft in California. It is our desire to continue our long and effective collaborative relationship with the State of California and CARB. However, in its current form this rulemaking represents a failure of collaboration between regulators and the regulated community. Foss does not understand how CARB can move forward with the rulemaking process without first addressing the glaring errors and misrepresentations that call into question the very legitimacy of the regulation. The erroneous data not only inflates the emissions generated by the towing vessel fleet and in turn the impact the fleet has on the air quality and health of the residents of the regions in which we operate. Foss stands ready to work with CARB to address the errors in the vessel population data. We support a regulation that will fairly apply to all CHC based on their true area of operation and the impact they have on the air quality. Finally, we want a regulation that supports industry finding feasible solutions to reducing emissions in the harbors of California. Foss urges CARB to adopt a more collaborative approach in advance of the 45-day

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formal rulemaking. Thoughtful and honest collaboration will benefit the state's economic and environmental health. Foss looks forward to discussing the topics outlined in this letter with the CARB staff.

Sincerely,

A handwritten signature in black ink, appearing to read "W. Roberts". The signature is fluid and cursive, with the first letter of each word being capitalized and prominent.

William Roberts  
President and Chief Operating Officer

cc: Charles Costanzo, AWO's General Counsel and VP - Pacific Region

# Appendix C - April 2020 Foss Comments

ALWAYS SAFE. ALWAYS READY.



April 30<sup>th</sup>, 2020

David C. Quiros  
Manager, Freight Technology Section  
Transportation and Toxics Division  
1001 "I" Street  
Sacramento, CA 95814

Re: Proposed Concepts for Commercial Harbor  
Craft in California

Dear Mr. Quiros:

We appreciate the opportunity to comment on the “Proposed Concepts for Commercial Harbor Craft in California.” Foss Maritime is a 131-year-old company that provides comprehensive marine transportation and logistical services from local harbor services throughout North America and the Hawaiian Islands. This includes ocean towing and project support in extreme environments throughout the world. Foss Maritime’s Pacific Northwest shipyard in Seattle, Washington offers a wide range of services from naval architecture and marine engineering to vessel design, construction, and repair. Foss is committed to reducing its carbon and emissions footprints and adhering to the principles of sustainability and safety in its operations. Foss has taken the lead in our industry to aggressively pursue opportunities to reduce emissions and work our environmental values into all our strategies.

It is our sincere desire to be a constructive participant in the rule making process and provide comments that will enable CARB to form meaningful regulations that promote the goal of cleaner air without doing irreparable damage to an industry that all Californian’s rely on to deliver and support the delivery of their essential goods and services. Our experience with the first Hybrid Tug technology deployed in California waters and the first conversion of a conventionally powered vessel to Hybrid technology makes us uniquely qualified to comment on the concepts proposed by CARB. Our comments follow the table of contents for your Proposed Concepts Commercial Harbor Craft (CHC) Regulations.

## **Concept I: Expanding Vessel Categories Subject to In-Use Requirements**

We want to be clear that we concur with CARB’s reasoning and support the exclusion of the commercial fishing vessels from the proposed regulations. However, we would ask CARB to consider that those same points can be made about other vessel categories that are included in the list of regulated CHC. Under the heading of Justification/Reasoning, CARB sites their reason for not including commercial fishing vessels, as: “the small profit margins in the industry, demonstrated lack of feasibility for Tier 4 repowers and retrofits , competition with out of state and global markets, and tendency to conduct the majority of their operations far from the coast.” All these points can be made regarding tank barges over 400 feet and 10,000 gross tons and the tugs that tow them. These vessels operate in stiff competition to both international tankers that are able to move supply to and from foreign ports, US ocean going tankers that are exempted and trucks and rail that while regulated by CARB present a much

higher emission profile per ton of cargo moved than their marine counterpart<sup>1</sup>. Further their routes are those of ocean-going vessels and not CHC, and we feel they should not be unduly burdened with regulations that don't apply to their competition.

*It is our belief that CARB should determine the applicability of the CHC rules based on the service the vessel is performing, rather than generic classification of the vessel. We would propose the following amendments:*

- *A vessel engaged in ocean voyage or a barge engaged in ocean voyage shall be exempt from the CHC rules. The following shall be the criteria for defining an ocean voyage exempt from regulation under the CHCRs.*
  - *A tug and loaded barge, whose arrival or departure is transporting a cargo with the destination outside of the load ports line of demarcation and beyond the 24nm control zone.*
  - *A lite tug and barge, whose arrival or departure is for the purpose of loading a cargo with a destination outside of the load ports line of demarcation and beyond the 24nm control zone.*
  - *Any moves or engine hours within the line of demarcation that is solely for the purpose of preparing for an ocean voyage as defined above.*

*So long as the vessels movements comply with the criteria above, they will not be required to comply with the CHCR, nor count any hours against the low-use operational requirements of the regulations.*

We believe adopting the service-based criteria above will ensure that barge moves that are clearly ocean voyages are not unduly burdened versus other modes of transportation that serve the same markets. This would also preserve the intent of the CHCRs to ensure that vessels performing services inside of the regulated control area are subject to the regulation.

## **Concept II. More Stringent In-Use Requirements**

Foss has a long history of working with CARB and other agencies to reduce the air emissions from our fleet ahead of regulatory requirements. This includes:

- Rebuilding existing engines with EPA compliant Tier 1, Tier 2 and Tier 3 kits.
- Re-powering vessels with new Tier 1, 2 and 3 engines.
- Building a new Hybrid powered ship assist tug, the CAROLYN DOROTHY.
- Converting an existing conventionally powered tug to a HYBRID powered tug, CAMPBELL FOSS.
- Adding Carbon Filtration to our bunker barge fleet to capture hydrocarbons during loading operations.
- Burning Ultra Low Sulfur Fuel Oil in advance of the regulatory requirement.
- Completing a Tier 4 Harbor Assist Tug in 2020 with three to follow in 2020/2021 replacing tugs that are tiering out due to the current CHCRs, but not done with their useful life.

Not counting the assistance funds from the Carl Moyer Program, CARB and federal grants Foss has made an investment in excess of \$50 million dollars to ensure our fleet remains among the greenest in operation.

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<sup>1</sup> All Figures adapted from Texas Transportation Institute, "A Modal Comparison of Domestic Freight Transportation Effects of the General Public: 2001-2014," January 2107, as reflected in the PricewaterhouseCoopers industry study.

# Appendix C - April 2020 Foss Comments

ALWAYS SAFE. ALWAYS READY.

Through all these projects we have learned many lessons about what works well and what does not. The key to every successful project is having a complete understanding of the technology we are working with, using proven components, taking the time to properly engineer and plan the project and being able to operate the vessel long enough after the modifications to offset the capital expense of the project. These lessons learned inform our comments below.

Marine Harbor Craft applications are unlike the shore-based power installations that CARB draws parallels in justifying the requirement for DPFs. Specifically stating that DPFs are “widely commercialized and proven technology on light-duty and heavy-duty equipment that has been used on-road, off-road and in port applications.” The evidence contradicts this comparison. Concern is that to date there has been little marine application of DPFs. The size of our engines and available space for installation makes a DPF installation extremely difficult. The back pressure created by a DPF on the exhaust system may exceed the tolerances of many of our existing or future engines to properly operate. Many, if not all our vessels currently have no OEM approved DPF available for the engines. Until one is available, and its characteristics defined, we cannot begin the process of determining if it is feasible to operate with a DPF.

The application of DPFs will also have to consider that the duty cycle of a marine vessel, is unlike that of on-road, off-road or port application equipment. As noted in CARB's proposed concepts “escort and harbor assist tugs have a highly variable duty cycles operating with relatively larger engines but lower average loads . . .” Additionally, our vessels also use their engines as the primary mode of braking and often maneuvering. Doing so requires the rapid acceleration and deceleration of the engines. Operators do not have the luxury of shore-based equipment that can maintain a much more moderate increase of power through multi-ratio transmissions and the gradual application of fuel. On vessels, power is often needed immediately to avoid collision, allision or losing propulsion. Overloading the propeller and stalling the engine is a real risk when maneuvering in tight quarters. For this reason, the manufacturer provided fuel curves must be very dynamic, considering the variable nature of the load requirements of the engines. This variable engine loading is exactly the situation that has caused many of the issues, including fire and premature failure, that other industries have experienced when they attempted to incorporate the use of DPFs.

The process of repowering or modifying the propulsion or power generation plants of a marine harbor craft takes years to plan, obtain regulatory approval and execute. The planning and engineering must begin years prior to commencing the work and even relatively simple changes must be evaluated against the impact to the vessel's stability, maneuverability, available space and watertight integrity. Each component's specifications, characteristics and operating parameters must be known far enough in advance to ensure a thorough design review and engineering process that can take place. Engineering can take from 3 to 9 months depending on the complexity of the project. Many projects will also require the approval from the vessel's Class Society or the USCG, which can add months to the timeline. It can then take an additional 3 to 6 months to identify a shipyard and negotiate a contract for the modifications. When you add this up, the process must begin years before the work is to be done, and the process can only begin when all the equipment that is to be used has been approved and accepted for the purpose.

The costs identified in the California Maritime Academy report do not reflect the entire financial impact of performing these modifications. With only a few tugs in our regional fleets, losing a single vessel has significant economic impact either in lost revenue or in the cost of sourcing a temporary replacement tug. While each situation is unique, a conservative cost would run well above \$5,000 per day. With a

conversion from Tier 2 to Tier 4 engines taking upwards of 2 months, the cost to the company will be 100's of thousands more than those captured in the CMA report. To minimize the downtime our engineering teams will generally begin the process years in advance, with work timed to ensure the modifications can be completed during one of the vessel's scheduled yard or other planned maintenance periods.

*With all these challenges in mind, we encourage CARB to consider modifying their proposed rules as follows:*

- *Expanding the implementation dates to better recognize the investment owners have already made to comply with previous regulation. We would ask CARB to adjust their implementation dates to allow any engine that is currently in compliance to be able to operate at least 20 years from the date it went into service without modification. For instance, Foss has a new vessel currently under construction that under the current proposal will be required to have DPFs installed by 2028, less than 8 years after it was built. A modification that was not foreseen during the design and planning stage of the vessel.*
- *Additionally, any engine modified to comply with the current regulation should be allowed 15 years at a minimum, from the date it was modified, before being compelled to comply with the new CHCR.*
- *Delay the implementation date for installation of a Diesel Particulate Filter (DPF) to 5 years after a model approved by both the manufacturer and appropriate regulatory authority is available. Only when the exact characteristics and specifications of a DPF are known can a company begin the engineering and planning necessary to determine if the project is feasible and then schedule a time to do the work.*
- *Tugs where it proves infeasible to install a Tier 4 engine and a DPF will be considered in compliance if they are Tier 2 or Tier 3, with a DPF.*
- *Company's should be afforded the ability to defer projects in one-year increments beyond the implementation date to avoid having to manage multiple projects in the same year.*

### **Concept III: More Stringent Requirements for New-Build Vessels**

New-Build construction allows us to overcome many of the hurdles present in the conversion of an existing vessel. However, new builds are not without their challenges. Most notably, a new build program is part of a company's long-term strategic plan, designed to meet their customers' needs and remaining competitive in the market. Vessel designs are completed years in advance, with the actual construction process taking more than a year to complete. Most build programs involve the delivery of multiple vessels allowing the owner to take advantage of the lower cost series construction and reduced operating costs associated with having a homogenous fleet. Common spare parts, similar repair procedures and common operating characteristics all helps to make an operation more efficient. Changing vessel plans in the middle of a build program can be costly and disruptive to the company's ability to successfully compete. As stated in the concept document, CARB's vision is that "New build vessels can be designed around the cleanest available equipment and present the best opportunity for cost-effectively reducing emissions from harbor craft in California." If owners are expected to meet this vision, we would ask that they be given the time necessary to incorporate the final rule into a well thought out build strategy.

*To do this we would encourage CARB to consider the following comments/recommendations to their proposed concepts:*

- *Set the implementation for the requirement to install a Diesel Particulate Filter (DPF) to 5 years after a model approved by both the manufacturer and appropriate regulatory authority is available. Only when the exact characteristics and specifications of a DPF are known can a company begin the engineering and planning necessary to determine if the project is feasible and then schedule the time to do the work.*
- *Any vessel completed before this point should be allowed to operate 15 years before being asked to re-engineer and add the DPF.*

#### **Concept IV: Mandates for Zero-Emission and Advanced Technologies**

As with Concept III, a technology change of this type will take time to plan and incorporate in existing vessel designs. To facilitate this process, we would ask CARB to consider the following comments:

- *Extend the phase in date to 5 years after the rule goes into effect. This will allow companies the time to properly transition their build programs to incorporate the new technology.*
- *Clarify the phase in date as the “Keel Laying Date”, defined in 46 CFR 30.10-37.*
- *Clarify the expectation. Currently the documents reference a specific technology employed by one tug company. There are many competing technologies that achieve the same effect. What will be the test for a compliant system?*
- *Can you clarify under the Zero-Emission Capable Hybrid, would a company be allowed to average the percent of power from zero-emission sources over 24 hours? In other words is it CARBs intent that at all times and in all modes you must be drawing 30% of your power from non-tailpipe emission sources, or just that 30% of the power you use over a period of time comes from non-tailpipe emission sources?*

#### **Concept V: Removing Exemptions for Under 50 horsepower**

Vessel’s carry several “portable” engines for a variety of purposes. These include trash and salvage pump motors for dewatering compartments and outboard motors for skiffs.

- *Can you clarify if it is CARBs intent to have these engines fall under the CHCR?*

#### **Concept VI: Requiring Replacement Vessels for Certain Vessel Categories**

Tug and Barge owners have in good faith built and designed vessels in compliance with federal, state and local laws and regulations. A jurisdiction should not be able to enact a new set of regulations that prevent an owner from realizing the benefit of their investment. We would ask CARB to consider the following comments:

- *As stated in our comments under Concept II we would ask that no vessel be required to modify an engine sooner than 20 years from the date it first went into service. If at that time an owner can prove both that the upgrade is not feasible and that it would present a financial hardship to meet the date an extension would be granted.*
- *As stated in our comments under Concept II any engine modified to comply with the current regulation be allowed 15 years at a minimum from the date it was modified, before being compelled to comply with the new CHCR. If at that time an owner can prove both that the upgrade is not feasible and that it would present a financial hardship to meet the date, an extension would be granted.*

#### **Concept VII: Compliance Extensions**

While we concur with the need for extensions as it is not only likely but almost certain that there are vessels within the current harbor craft fleet for which it will not be feasible, nor financially sustainable to



comply with the new regulations. The challenge will be in defining the very subjective terms of “feasible” and “financial hardship”. We offer the following comments.

The determination of what is or is not feasible often bleeds into what is or is not financially viable. In the CMA study they found that it was not feasible to retrofit a SCR and DPF on the representative ship assist tug. However, their conclusion was based on the amount of work that would have been needed to be done to modify the vessel to safely house the systems. Simply put, it would not be practical because the cost would far exceed the value of the modifications.

CARBs intent to assess financial hardship of complying with a regulation, based on the financial health of a company is fundamentally the wrong approach. The effect of such a methodology would be to potentially prop up companies that are struggling financially by allowing them to avoid regulation and gain an economic advantage over companies that are financially sound. Regulators should not be in the position of bailing out companies, but rather they should strive to create an equitable regulatory regime. We would argue that financial hardship should be measured in the impact on an assets ability to compete. If due to the vessel’s design or configuration the modification required to comply is so expensive that performing the modification would render the vessel too costly to be profitable then relief should be given in the form of an extension. In order to achieve an equitable measure of both the feasibility and hardship measure, we would ask you to consider the following revisions:

- *Modifications whose estimates, as verified by a yet to be determined third party or agency, exceeds the High Estimated Cost as offered in the CMA Report, and adjusted for inflation, would be granted an extension.*

This would provide a much simpler and more equitable approach to granting extensions and would be like the methodology used in the CMA study.

### **Concept VIII: Alternative Compliance Pathways**

We need a defined submittal plan, requirements and package to access and comment effectively on this concept. Under the existing regulations we petitioned CARB to recognize that the emission profile for the Hybrid Tug CAROLYN DOROTHY was already favorable to that of a vessel with the Tier Engines to which we were being required to upgrade. As explained to us, CARB was unable to look at emissions over time as the offset to point of time emissions.

- *Has CARB changed their position on this issue, and will they be willing to look at 24-hour profile versus a point of time approach?*

### **Concept X: Proposed Implementation Timeline**

- *See comments under Concept II & III*

### **Concept XI: Idling Limits and Shore Power Requirements**

Foss Maritime supports the idea of minimizing idle time as a way of reducing unnecessary emissions. Further we feel 15 minutes is adequate time to perform a proper start-up and shutdown, except where a watch change has occurred and the individual responsible for the machinery must ensure everything is running properly. We offer the following comments and questions.

- *Is our read that the initial daily startup allows for an additional 15 minutes, for 30 minutes total. If so, we would ask that the wording be changed to recognize that a watch change would constitute a new work period.*

- *We are concerned by the unintended consequences this might have on finding adequate lay berths. Unlike ferries we do not transit between two docks that are dedicated to our service. Outside of our home dock, we have arrangements with several facility owners to utilize their docks in between ship jobs and barge moves. Most of these locations do not currently have infrastructure to provide shore power connections, so while we can shutdown our main engines, we must still run our generators. We believe most of these operators will deny us the ability to dock, rather than make the investment in shore power or deal with the increased regulatory burden. There is simply not enough money in it for them to make that type of investment. This will force us to idle in the harbor between jobs or return across the harbor to our home dock increasing our fuel burn and emission output. We suggest CARB look at an incentive-based program for facilities to get credit for providing shore power infrastructure to the Harbor Craft vessels.*

## **Concept XII: Facility Infrastructure**

We have similar concerns about the requirements of this concept driving facilities away from providing moorage to Harbor Craft. We currently struggle to find suitable locations around the ports in California to moor our vessels. Most port operations are looking to maximize their waterfront space on cargo and other high revenue generating activities. While moorage for Harbor Craft is essential to the port economy, it is often lost on the individual facility operator. As mentioned in our comments under Concept XI, we worry this will drive more and more facility operators away from offering moorage.

## **Concept XIII: Reporting – Facilities**

As with Concept XI and XII the additional burden of reporting will likely have a negative impact on those facilities willing to rent or lease space to harbor craft. *Our recommendation is that negative impact on our CHC's ability to tie up and reduce emissions will offset any potential upside to CARB of finding potential non-reporters.*

## **Concept XIV: Reporting – Operators**

In general Foss Maritime does not take issue with the increase in reporting requirements, so long as it does not come with an unnecessary administrative burden. To that end we request CARB consider the comments below:

- *In developing the form for input, care should be taken to ensure data can be uploaded in batch or bulk form from a database or spreadsheet. We would be opposed to an annual reporting requirement that involved filling in the individual fields for each vessel in our fleet, creating hours of unnecessary work.*
- *We have concerns with the switch to engine model year, which does not reflect accurately how long the engine has been operated or how long the owner has had to recoup his investment. We would much prefer CARB use the initial in-service date as the baseline for determining any implementation dates for that engine.*
- *We believe CARB misunderstands the term Home Port. Home Port or Hailing Port as defined in the CFRs is "the name of the port from which a vessel hails, required by law to be painted on the stern of all documented vessels in the United States; the port in which the managing owner of the vessel lives, or which is nearest to his place of residence; the home port of a vessel." It is not intended to indicate where a vessel is being operated. CARB may want to ask that specific question.*

## **Concept XV: Vessel Identifiers**

We recognize that properly tracking vessels is a critical part of implementing any regulation. And while it is true . . . “There is currently no single identifier that can be used across all vessel types...” every vessel covered by the regulation will have either an Official Number, IMO Number or CF Number that will be unique. *Our recommendation is that vessels be required to provide CARB one of these numbers for tracking and those vessels that are not already required to display their chosen identification number, could be required under the regulation to do so.*

## **Concept XVI: Opacity Testing**

The proposed rule is unclear in the method of testing that will be used for Harbor Craft. As described earlier in our comments, Marine Harbor Craft have a highly variable duty cycle. Engines must be tuned such that they can successfully accelerate and decelerate to provide the vessel with the power, maneuverability and braking necessary to safely operate. The text of the Concept suggests that CARB would like to test during the transitional phase of our fuel map (accelerating or decelerating the engine) and not at steady state (i.e. at constant RPM under a consistent load) where the engines were designed to operate most efficiently. The result will be almost certainly some level of smokiness. Tuning the engine to get rid of this momentary smokiness will put the engine at risk of stalling or shutting down just when the operator needs an immediate response. To ensure the engines are tested in the manner that they are certified by the EPA we ask CARB to consider:

- *Any Opacity testing of marine equipment should be done at steady state, either prior to or post acceleration/deceleration.*
- *Testing should not be annual and serves no purpose other than to increase the operating cost and down time on the vessel. Like automobile emission testing it should be based on known risk factors such as age of the equipment and history. Propose once in the first 5 years to set a baseline, then every 5 years after that.*
- *Opacity testing should not be required for vessels qualifying under the low-use operating requirements.*

## **Concept XVII: Applicability and Exemptions**

No comments currently.

## **Concept XVIII: Compliance Fee**

Compliance with this new regulation will cost companies millions of dollars in upgrades. A fee on top will be an additional burden that will be shared by our shareholders, customers and the end consumer. We ask CARB to do everything possible to minimize the cost of administration, including reducing the frequency of reporting and opacity testing to minimum required to regulate the rule.

- *We would propose a fee based on the size of fleet and number of engines, with a cap. Suggest something about \$100 per year per engine, up to \$400 per vessel, with a cap of \$2,000 per company fleet.*
- *We would be opposed to any fee that was based on hours or activity as neither impacts the work required by CARB to regulate nor should it be there be a penalty for being busy.*

## Additional Comments

### Overstatement of CHC Air Emissions

Foss has serious concerns that CARB has relied on inaccurate information to justify the proposed regulatory concepts. We see no justification for upwardly scaling the CHC vessel population from the February 2019 reported figure of 1,928 vessels to align with a U.S. Coast Guard dataset showing 3,698 vessels. The misuse and misinterpretation of the data set has led to CARB artificially inflating California's vessel population and consequently the overstatement of air emissions from towing vessels in California.

While our examination of the data was hampered by our company's response to the COVID-19 crisis and CARB's unwillingness to extend the comment period, we can still safely conclude that there is no rationale for CARB making the conclusion that our industry is under-reporting in any significant way. We find the following flaws in CARB's use of the dataset and the conclusion they draw from the data.

- CARB is confusing Hailing Port with area of operation and counting vessels that do not operate in California as non-reporting vessels.
- CARB is counting vessels that are either not properly documented to operate or are no longer in commercial service because of their age.
- CARB failed to use readily available sources of vessel information to validate their assumptions.

All California harbor craft must maintain and provide extensive records of operation pursuant to 17 California Code of Regulations (CCR) § 93118.5. But CARB is asserting that nearly half of the harbor craft in California do not comply with reporting requirements – i.e. 1,928 CHC operators report their operations to CARB while U.S. Coast Guard data reflects an additional 1,770 vessels with hailing ports from California. CARB's incorrect starting assumption is that "hailing port" is synonymous with operating area and that 1,770 vessels are not only not reporting but are operating with hours that are equivalent to the industry average per vessel. A vessel is not required to set their hailing port as the area they operate in and hailing port is more often reflective of the owner's offices or state of legal presence. In truth towing vessels reporting to CARB have hailing ports in many states. This lack of rigor suggests that CARB is inflating the number of purported CHC vessels to demonstrate a greater risk to the airshed and to help justify the proposed concepts.

CARB's use of the Coast Guard dataset is also flawed because many vessels included in the dataset are not legally allowed to operate under current regulations. AWO discovered that at least 37 of the tank barges in the list are built before 1983 – most likely with single hulls and legally prohibited from carrying oil in U.S. waters. These vessels likely do not operate in California or anywhere else. Other vessels in the dataset lack Certificates of Documentation (COD) and therefore cannot legally operate in U.S. waters. All told, from the data that AWO members had extraordinarily little time to review, at least 69 out of 217 towing vessels included in the Coast Guard's data have either expired CODs or work outside California.

CARB references 244 as the number of towing sector vessels, excluding barges and tank vessels, within California (13 ATBs, 73 ship assist/escort tugs, and 158 near-shore/ocean-going vessels). Based on the

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above we know this number to be inaccurate. To find the facts our trade organization, AWO, obtained towing vessel population data from the Marine Exchange of Southern California and the San Francisco Marine Exchange, data clearinghouses for vessel activity throughout the state. This data included details on all tug escorts, assists, tank barge escort transit logs and an AIS search for active towing vessels in SF, SoCal, San Diego and Port Hueneme. This data showed that in the two-year time period a total of 142 vessels, classified as towing vessels by the USCG, were active in CARB regulated waters. This includes 13 ATB units that call these ports and more than 10 tug barge combinations that called less than 10 times in the two years, likely leaving them well below the 300 / 80-hour low operation limit. We concur with AWO's conclusion that CARB should also disclose its exact methodology for determining its vessel inventory and justify its decision to augment that inventory with misinterpreted Coast Guard data of questionable applicability.

## Conclusion

Foss appreciates the opportunity to comment on CARB's Proposed Concepts for Commercial Harbor Craft in California. We hope CARB will take note of both our concerns captured in our comments and our recommendations. It is our desire to continue our long and effective collaborative relationship with the State of California and CARB. The proposed concepts present a significant change in policy direction for CARB from incentive-driven emission control programs to prescriptive and mandatory emission control programs. We have proven over the years that the previous approach not only achieved the desired results in terms of emission reductions, but it also fostered successful technology innovations, well-managed industry costs, and substantive air quality improvements. As a final comment we would ask for CARB to relook at modeling what has worked in the past and propose an incentive-driven emission control program.

Sincerely,



William Roberts  
Chief Operating Officer

cc: Charles Costanzo, AWO's General Counsel and VP - Pacific Region