November 15th, 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 "Proposed Concepts for Commercial Harbor Craft in California." Starlight Marine Services, LLC (Starlight) has been actively engaged in the ship assist and tanker escort business of the maritime industry in California since 1998. We have grown to be a leading provider of assist and escort services providing quality service to major shipping lines and oil companies. Our growing fleet of harbor tugs routinely assist container, bulk, and petroleum tankers into and out of port. Our fleet of ship assist tugs are the best in the business, boasting competitive horsepower and green engines serving the LA/Long Beach, San Francisco/Oakland and PNW ports. We are privileged to do business in California and committed to be a proactive partner in the regulatory process with CARB.

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 a cleaner environment without doing irreparable damage to an industry that all American'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. Starlight has a long history of taking the lead on the environment implementing creative and technologically advanced solutions. We have spent tens of millions of dollars on clean air new builds and upgrades. 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.

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 second set of written comments on this rule, we've attached the previous letter 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 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. Starlight 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 or 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 predicator 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 $PM_{2.5}$ 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 $PM_{2.5}$ measured concentrations at monitoring stations in the South Coast to modeled concentrations at the nearest receptors.

$PM_{2.5}$ (mg/m^3) annual average	Average of all POCs (daily)	Average of 1hr	Closest Receptors (Modeled $PM_{2.5}$ mg/m^3, 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 $PM_{2.5}$ 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 Starlight 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 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.

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 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, Starlight 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, Starlight 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

Starlight 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. Starlight 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. Starlight 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. Starlight 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. Starlight looks forward to discussing the topics outlined in this letter with the CARB staff.

Sincerely,

Benjamin Ostroff
Manager of Harbor Operations
Starlight Marine Services, LLC.
Company Security Officer

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

Attachments

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

ENVIRONMENT
& HEALTH

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.[1] In general, the approach is similar, but many of the default inputs were substantially revised to lower overall emissions as shown in Figure 1.

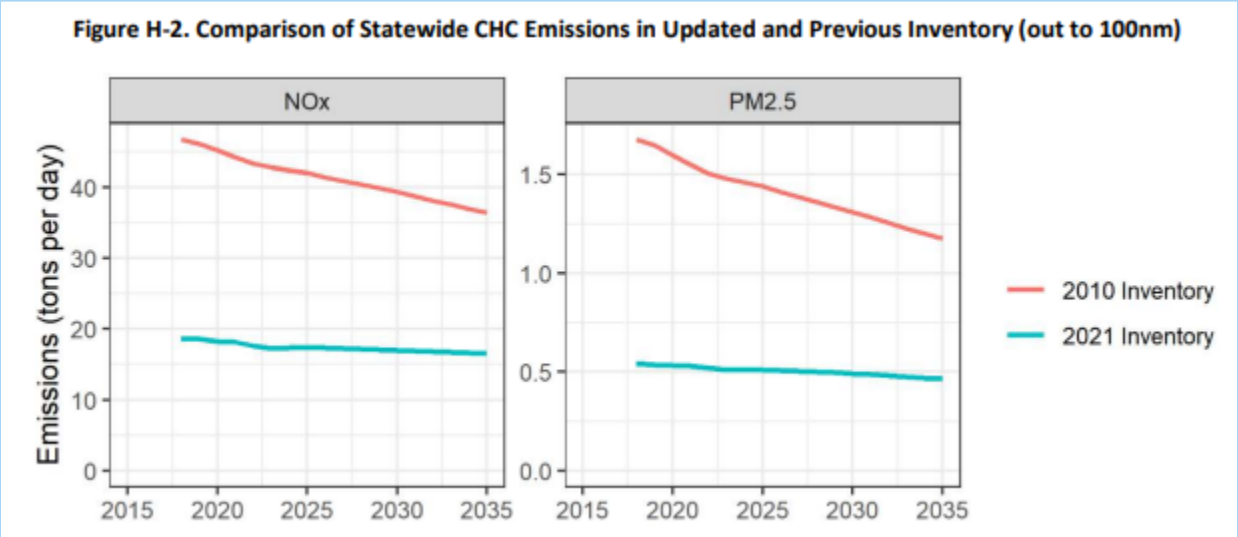

Figure 1. CARB commercial harbor craft emissions inventory comparison. (CARB 2021)

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

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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).

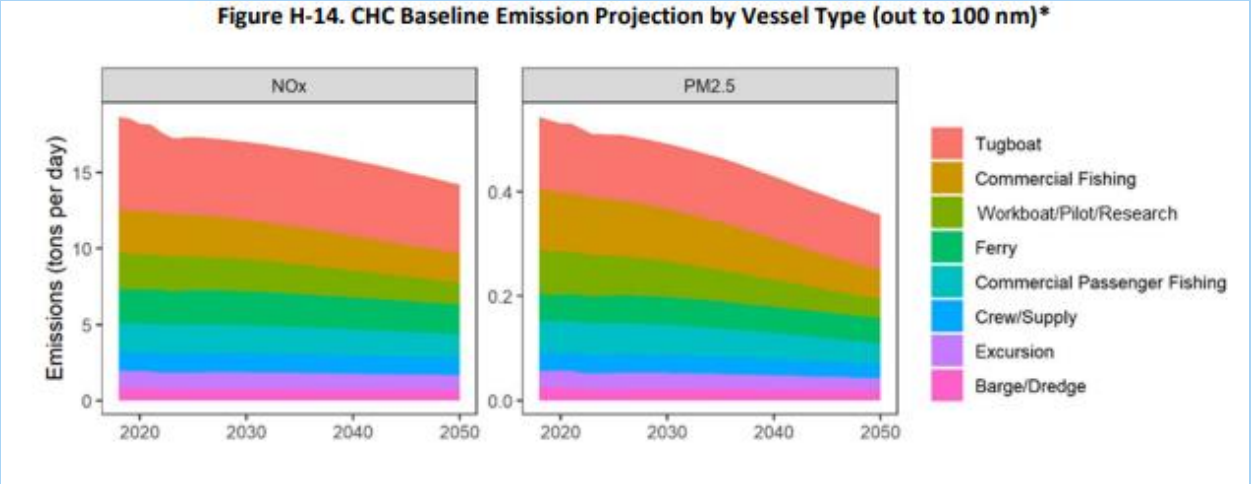

Figure 2. CARB commercial harbor craft emissions inventory by vessel type. (CARB 2021)

Alternative source of activity data includes AIS data that is publicly and freely available from a trusted source.[2] 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.

Emissions = Pop x Power x Activity (hrs) x Load Factor x (zhEF + DF x (Age/Life)) x 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[3] and PM correction is more significant for older engines)

[2] https://marinecadastre.gov/ais/
[3] 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[a]	11	19	2,466	14[a]	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
Combined Tug and Towboat	**177**	**229**	**1,936**	**200**	**1,350**	

[a] – 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[a]	8	4395	1	6[a]	6400	2, 3
Tugboat-Push/Tow	94	731	1	24	2700	0 – 3
Tugboat-Escort/Ship Assist	7	2450	2	61	3898	0 – 4
Combined Tug and Towboat	**109**			**91**		

[a] – 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[a]	1.36	0.020	0.92	0.019	0.85	0.020
Idle <0.1 knots	*4%*	*5%*				
Fraction within 24 nm	*87%*	*83%*				
Tugboat-Push/Tow	0.97	0.023	1.11	0.032	1.05	0.039
Idle <0.1 knots	*9%*	*15%*				
Fraction within 24 nm	*82%*	*85%*				
Tugboat-Escort/Ship Assist	2.04	0.041	2.31	0.057	2.31	0.057
Idle <0.1 knots	*17%*	*26%*				
Fraction within 24 nm	*99%*	*99%*				
Sum Tug and Towboats	**4.37**	**0.086**	**4.34**	**0.109**	**4.22**	**0.117**
CARB App. H (Estimated from Figure H-14)	**6.1**	**0.14**				
Relative to CARB Figure H-14	**72%**	**62%**	**71%**	**78%**	**69%**	**83%**

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)		**11**		**5.41**	**0.136**		
Average ATB (CARB)		**Ratio vs. Tier 1**		**0.78**	**1.14**		
Average ATB (AWO)		**6**		**4.15**	**0.063**		
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)		**105**		**5.80**	**0.173**		
Average Towboat (CARB)		**Ratio vs. Tier 1**		**0.83**	**1.44**		
Average Towboat (AWO)		**24**		**4.85**	**0.088**		
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)		**36**		**5.52**	**0.121**		
Average Tugboat (CARB)		**Ratio vs. Tier 2**		**1.09**	**1.35**		
Average Tugboat (AWO)		**61**		**5.09**	**0.104**		

- 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 $PM_{2.5}$. We also understand that ambient monitors will be measuring $PM_{2.5}$ 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 $PM_{2.5}$ 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 $PM_{2.5}$ 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 $PM_{2.5}$ measured concentrations at monitoring stations in the South Coast to modeled concentrations at the nearest receptors.

$PM_{2.5}$ (mg/m^3) annual average	**Average of all POCs (daily)**	**Average of 1hr**	**Closest Receptors (Modeled $PM_{2.5}$ mg/m^3, 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[4] 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 $(mg/kg\text{-}day)^{-1}$ or 3×10^{-4} per $\mu g/m^3$. 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[5]). An HEI study (HEI 1995[6]) 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[7] 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

[4] A 30 year residence time is considered to be a more realistic residence time period.
[5] 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)
[6] HEI. Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health· Effects. 1995. Diesel Exhaust New Scan.pdf (healtheffects.org)
[7] 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[8]), 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 $PM_{2.5}$ 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 $PM_{2.5}$ 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).

[8]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 NOx 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)[9] 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

[9] 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 $PM_{2.5}$, 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[10], Rhomberg *et al*. 2011[11]).

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 $PM_{2.5}$ 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)[12] found evidence for a $PM_{2.5}$ threshold at about 16 □g/m^3 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 $PM_{2.5}$

[10] 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

[11] 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

[12] 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[13]; Enstrom, 2005[14], Lipfert et al., 2006[15]). 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 $PM_{2.5}$, regardless of composition, is equally potent in causing health effects such as mortality. This is important because $PM_{2.5}$ 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[16]; Lippmann and Chen, 2009[17]; Kelly and Fussell, 2007[18]). 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[19]). 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 $PM_{2.5,}$ CARB applied a reduced-form methodology (IPT) to estimate additional health impacts for other air basins and from $PM_{2.5}$ 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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[13] 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

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

[15] 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

[16] 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.

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

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

[19] 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 $PM_{2.5}$. 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 that 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 "Proposed Concepts for Commercial Harbor Craft in California." Starlight Marine Services, LLC (Starlight) has been actively engaged in the ship assist and tanker escort business of the maritime industry in California since 1998. We have grown to be a leading provider of assist and escort services providing quality service to major shipping lines and oil companies. Our growing fleet of harbor tugs routinely assist container, bulk, and petroleum tankers into and out of port. Our fleet of ship assist tugs are the best in the business, boasting competitive horsepower and green engines serving the LA/Long Beach, San Francisco/Oakland and PNW ports. We are privileged to do business in California and committed to be a proactive partner in the regulatory process with CARB.

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 1st. 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 Starlight's principals have been associated with several highly technical rulemaking processes. Among these were the Escort Rules for San Francisco Bay and the Ports of Los Angeles and

Long Beach. The regulatory bodies involved included the United States Coast Guard and the California Office of Spill Prevention and Response. Private and industry partners in the process included including harbor and bar 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 CARBs 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. Starlight 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. Starlight 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 as Appendix A AWO's Comments submitted to CARB on 4/30/21. Starlight assisted AWO staff in the preparation of their comments and fully supports the observations and statements contained therein.

INACCURATE AND GROSSLY OVERINFLATED VESSEL POPULATION DATA

Starlight 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 Starlight 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 Starlight 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

Starlight 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.

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.

- 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, Starlight will be forced to spend tens of millions of dollars on unproven and potentially dangerous retrofits on vessels that have are in the process of or have only recently been repowered to meet the last iteration of the CHC regulations. 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

Starlight 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. Starlight 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. Starlight 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. Starlight urges CARB to adopt a more collaborative approach in advance of the 45-day formal rulemaking. Thoughtful and honest collaboration will benefit the state's economic and environmental health. Starlight looks forward to discussing the topics outlined in this letter with the CARB staff.

Sincerely,

Benjamin Ostroff
Manager of Harbor Operations
Starlight Marine Services, LLC.
Company Security Officer

Cc: Charles Costanzo, AWO's General Counsel and VP – Pacific Region