State of California
AIR RESOURCES BOARD

Executive Order G-22-479

Relating to CARB Approval of Control Efficiencies for Alternative Control Technologies used for Compliance with the Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-going Vessels At-Berth in a California Port

Clean Air Engineering-Maritime, Inc.
ShoreKat

WHEREAS, in 2007, the California Air Resources Board (CARB) has adopted the "Airborne Toxic Control Measure for Auxiliary Diesel Engines Operated on Ocean-going Vessels At-Berth in a California Port" (the "2007 ATCM;" title 17, California Code of Regulations, section 93118.3), which establishes requirements for ocean-going vessels that reduce oxides of nitrogen (NOx) and diesel particulate matter (PM) emissions;

WHEREAS, section 93118.3 (d)(2), 93118.3 (d)(3), and 93118.3 (e) of the 2007 ATCM establishes requirements for alternative control technologies that can be used to reduce emissions from certain ocean-going vessel auxiliary engines to comply with the 2007 ATCM while at berth in a California port;

WHEREAS, no alternative control technologies shall be used to comply with the requirements of the 2007 ATCM unless they fulfill the requirements specified in the 2007 ATCM;

WHEREAS the 2007 ATCM requires the control efficiency for alternative control technologies to be calculated based on an emission Test Protocol (or Test Plan) that is approved by the Executive Officer prior to conducting the emission measurements, and that emission measurements are conducted using the test methods specified in section 93118.3(e)(4)(B)(3);

WHEREAS, in 2020, the California Air Resources Board (CARB) adopted the "Control Measure for Ocean-Going Vessels At Berth" (the "2020 At Berth Regulation" or Regulation; title 17, California Code of Regulations, sections 93130 *et seq.*), which supersedes the ATCM effective January 1, 2023 and establishes new requirements for additional ocean-going vessels to reduce NOx and diesel PM emissions while at berth in a California port;

WHEREAS Clean Air Engineering-Maritime, Inc. (CAEM or the applicant) has developed a shore based capture and control system to treat emissions from auxiliary engines on ocean-going vessels called the ShoreKat;

WHEREAS, the ShoreKat consists of a direct connect capture duct, and an emission control unit manufactured by Tri-Mer Corporation of Owosso, MI that uses catalytic impregnated ceramic filters and aqueous ammonia injection to reduce emissions of NOx and PM with a diameter of 2.5 micrometers or less ($PM_{2.5}$);

WHEREAS, CAEM submitted their "Emission Test Protocol For Shore Based Capture and Control System to Treat Emissions from Auxiliary Engines" (Test Protocol) to CARB on January 12, 2018;

WHEREAS, on June 26, 2018, CARB approved CAEM's Test Protocol;

WHEREAS, CAEM submitted their "Test Report for Shore Based Capture and Control System to Treat Emissions from Auxiliary Engines" (Test Report) on March 31, 2022 and supplemental information submitted on May 6, 2022, June 6, 2022, July 1, 2022, and August 2, 2022;

WHEREAS, CARB reviewed and evaluated the Test Report for the ShoreKat based on the requirements specified in the 2007 ATCM;

WHEREAS, strategies issued an Executive Order under the 2007 ATCM, California Code of Regulations, title 17, section 93118(e)(4), may continue to operate under those terms until 2025 as an approved CARB Approved Emission Control Strategy (CAECS) before needing to apply for an extension, as specified in the 2020 At Berth Regulation, Section 93130.5(d)(3);

WHEREAS, the Executive Officer finds that testing was conducted on a smaller subset of vessel sizes than approved in the Test Protocol, and the operating conditions in the control efficiencies described below reflect the limited range of testing;

WHEREAS, the Executive Officer finds that additional vessel source testing will be necessary to extend the range of approved operating conditions or vessel types, and an extension application under Section 93130.5(i)(1) of the 2020 At Berth Regulation will also need to demonstrate that the system complies with the requirements of the Regulation as a CAECS, including meeting Reactive Organic Gas (ROG) and Grid Neutral requirements specified in the 2020 At Berth Regulation, Section 93130.5(d);

WHEREAS, the Executive Officer finds it is appropriate to approve the results of the emission measurements and to issue this Executive Order that identifies the approved control efficiencies, operating conditions, recordkeeping and monitoring requirements for the ShoreKat to allow its use for compliance with the 2007 ATCM;

WHEREAS, this approval does not constitute an air pollution permit or eliminate the responsibility of CAEM or the end user to comply with all federal, State, and local laws, rules, and regulations;

NOW, THEREFORE, IT IS ORDERED that the control efficiencies described below are approved under California Code of Regulations, title 17, section 93118(e)(4) of the 2007 ATCM for use in demonstrating compliance with the 2007 ATCM when the ShoreKat system is used as intended by CAEM, in accordance with the following terms and conditions, and in accordance with all other applicable requirements in the 2007 ATCM:

SYSTEM PARAMETERS

The equipment and system parameters will be consistent with the ShoreKat system described in the approved Test Protocol;

CONTROL EFFICIENCIES/EMISSIONS CALCULATIONS

1. Capture Efficiency of 90 percent,

2. $PM_{2.5}$ Control Efficiency of 78 percent,

3. NOx Control Efficiency of 83 percent,

4. Emissions Rate from the ShoreKat diesel generators during start-up and shutdown are uncontrolled, and estimated to be 0.33 pounds per hour NOx (Uncontrolled ShoreKat NOx Emission Rate) and 0.02 pounds per hour $PM_{2.5}$ (Uncontrolled ShoreKat $PM_{2.5}$ Emission Rate);

Provided the approved operating conditions are met, the emissions reduced by the ShoreKat shall be calculated for each visit as follows:

NOx reductions =

[(ShoreKat Capture Efficiency) x (ShoreKat NOx Control Efficiency) x (Vessel Auxiliary Engine NOx Emission Rate) x (Controlled Berthing Time) x (Power Requirement)] - [(Uncontrolled ShoreKat NOx Emission Rate) x (ShoreKat Start-up Time + ShoreKat Shutdown Time)]

$PM_{2.5}$ reductions =

[(ShoreKat Capture Efficiency) x (ShoreKat $PM_{2.5}$ Control Efficiency) x (Vessel Auxiliary Engine $PM_{2.5}$ Emission Rate) x (Controlled Berthing Time) x (Power Requirement)] - [(Uncontrolled ShoreKat $PM_{2.5}$ Emission Rate) x (ShoreKat Start-up Time + ShoreKat Shutdown Time)]

Where:

ShoreKat Capture Efficiency, NOx Control Efficiency and $PM_{2.5}$ Control Efficiency, Uncontrolled ShoreKat $PM_{2.5}$ Emission Rate, and Uncontrolled ShoreKat NOx Emission Rate are listed above,

NOx and $PM_{2.5}$ Emission Rates for the vessel auxiliary engine are determined pursuant to the 2007 ATCM, subsection 93118.3 (e)(3),

Controlled Berthing Time is the actual time each vessel's emissions were being reduced by the ShoreKat system,

ShoreKat Start-up Time is the actual time the ShoreKat system operated during start-up where emissions from the ShoreKat diesel generators were uncontrolled,

ShoreKat Shutdown Time is the actual time the ShoreKat system operated during shutdown, where emissions from the ShoreKat diesel generators were uncontrolled, and

Power Requirement is the electrical power requirement for each vessel as determined pursuant to the 2007 ATCM, subsection 93118.3 (e)(1)(C);

APPROVED OPERATING CONDITIONS

Parameter	Value
Ocean-going Vessel type	Bulk vessel
Ocean-going Vessel Engine type	One auxiliary engine
Fuel composition limitations	Marine distillate fuel with ≤ 0.1% sulfur content
Engine exhaust temperature requirements	350-700ºF
Other parameters that affect performance	Filter face velocity less than 0.03 m/s
Static Pressure	Differential pressure between -2 to -20 inches of water across the filter
Allowable operating range (kW)	<400 kW; only one auxiliary engine may be controlled per ShoreKat system
Exhaust flow rate that can be treated (standard cubic feet per minute (scfm)	2,500 to 3,500 scfm of engine exhaust
Maintenance Requirements	Per Section 5: Maintenance in CAEM's Test Protocol

The ammonia slip emissions through the ShoreKat shall not exceed 5 ppmdv, averaged over 60 minutes;

MONITORING REQUIREMENTS

CAEM shall submit summary data to the Executive Officer from the continuous emission monitoring system (CEMS), including emission levels of NOx, $PM_{2.5}$, ammonia, and capture efficiency, after every 1000 hours of operation, and at a minimum annually, to verify that the emission reduction levels are maintained;

CAEM shall maintain the ShoreKat system in accordance with Section 5: Maintenance in the Test Protocol;

CAEM shall continue to use the CEMS data collection methods specified in Section 7: Continuous Emissions Monitoring in the Test Protocol and summarized in Confidential Attachment A to this Executive Order unless prior approval from the Executive Officer is given;

The Executive Officer may request that the ShoreKat system be tested annually using the test methods specified in the 2007 ATCM to demonstrate the overall percentage of the emission reduction being achieved, and the results of such testing shall be provided to the Executive Officer within 30 days of the testing;

RECORDKEEPING AND REPORTING REQUIREMENTS

CAEM must notify any Fleet that uses the ShoreKat system for compliance with the 2007 ATCM or, after January 1, 2023, each vessel that uses the Shorekat System for compliance with the 2020 At Berth Regulation, that the fleet should keep the following records for a period of five years, in addition to the requirements of the 2007 ATCM, Sections 93118.3 (g)(1)(B) and (g)(2)(B) or of the 2020 At Berth

Regulation, Section 93130.5(k), and that these records shall be supplied to the Executive Officer within 30 days of a request from CARB staff, at the address provided in CARB staff's request:

1. Dates and times when the ShoreKat system initially ties to the vessel and subsequently when the ShoreKat system unties from the vessel,

2. Dates and times when the vessel auxiliary engines are connected to the ShoreKat system and emissions are being controlled, and subsequently when the auxiliary engine emissions stop being controlled by the ShoreKat system.

CAEM must keep the following records for a period of five years on the use of the ShoreKat system. These records shall be supplied to the Executive Officer within 30 days of a request from CARB staff at the address provided in CARB staff's request:

1. Record of each vessel that controlled auxiliary engine emissions with the ShoreKat system while the vessel was docked at berth:

    a. Name of vessel
    b. Port and terminal where vessel is at berth

2. Dates and times when the ShoreKat system initially ties to the vessel and subsequently when the ShoreKat system unties from the vessel.

3. Date and times when the vessel auxiliary engines are connected to the ShoreKat system and emissions are being controlled, and subsequently when the auxiliary engine emissions stop being controlled by the ShoreKat system.

4. CEMS data for each vessel visit where ShoreKat system is used to reduce emissions for compliance with the 2007 ATCM.

5. Date, time, and description of any equipment failure with the ShoreKat system that affected the ability of the vessel to control auxiliary engine emissions.

CAEM shall notify the Fleet, as defined in Section 93118.3 (c)(16) of the 2007 ATCM, within 5 business days after any visit where the reductions from ShoreKat system are less than the approved capture and control efficiencies in this Executive Order.

BE IT FURTHER ORDERED Executive Officer may request periodic emissions testing or other types of monitoring to verify the proper operation of the ShoreKat system and may modify the testing frequency as he/she deems appropriate.

BE IT FURTHER ORDERED, no changes are permitted to ShoreKat design or approved operating parameters unless CARB is notified in advance, and CARB evaluates the changes and determines that ShoreKat will continue to meet the capture and control efficiencies specified in this Executive Order. The changes must be approved in writing by the Executive Officer before the modified ShoreKat or modified operating parameters may be used for compliance with the 2007 ATCM. The Executive Officer may revoke this Executive Order if the ShoreKat system design or approved operating parameters are changed without prior notification and approval by the Executive Officer.

BE IT FURTHER ORDERED, this Executive Order shall be voided if the Executive Officer determines that the ShoreKat does not comply with any of the specifications in this Executive Order.

Executed at Sacramento, California, this 19th day of December 2022.

Steven S. Cliff, Ph.D.
Executive Officer

By:

Heather Arias, Chief
Transportation and Toxics Division