

**State of California
AIR RESOURCES BOARD**

Executive Order G-23-294-001

CARB Approval of the STAXbox system used to control emissions from container vessels for compliance with the Control Measure for Ocean-Going Vessels At Berth

**STAX Engineering (STAX)
STAXbox**

WHEREAS August 27, 2020, the California Air Resource Board (CARB) adopted the Control Measure for Ocean-Going Vessels (OGV) At Berth, California Code of Regulations, sections 93130 - 93130.22 (2020 At Berth Regulation), which establishes requirements for ocean-going vessels at berth in a California port to reduce oxides of nitrogen (NO_x), diesel particulate matter (PM), and reactive organic gases (ROG) emissions from auxiliary engines;

WHEREAS section 93130.5 of the 2020 At Berth Regulation establishes requirements for an emission control strategy to qualify as a CARB Approved Emission Control Strategy (CAECS) that can be used to reduce emissions from ocean-going vessel auxiliary engines and applicable tanker auxiliary boilers while at berth in a California port;

WHEREAS no emission control strategy may be used to comply with the requirements of the 2020 At Berth Regulation unless CARB approves it as a CAECS;

WHEREAS the 2020 At Berth Regulation requires that the emission control strategy, if applicable for auxiliary engines, achieves emission rates of less than 2.8 grams per kilowatt hour (g/kW-hr) for NO_x, 0.03 g/kW-hr for PM 2.5, and 0.1 g/kW-hr for ROG demonstrated through testing conducted under a CARB approved Test Plan as specified in section 93130.5(d) of the 2020 At Berth Regulation;

WHEREAS for strategies approved after 2020, greenhouse gas (GHG) emissions from the strategy must be grid-neutral using the grid emission rate for the year that the technology is granted an Executive Order, as specified under section 93130.5(d);

WHEREAS the 2020 At Berth Regulation requires that the emission control strategy, if applicable for tanker auxiliary boilers, achieves emission rates less than 0.4 g/kW-hr for NO_x, 0.03 g/kW-hr for PM 2.5, and 0.02 g/kW-hr for ROG demonstrated through testing conducted under a CARB approved Test Plan as specified in section 93130.5(d);

WHEREAS STAX developed STAXbox, a barge-based capture and control system to reduce emissions from the auxiliary engines on an ocean-going vessel while at berth;

WHEREAS, STAXbox consists of the following components and subcomponents as specified in the Description of Control Strategy in "Test Plan: STAXbox Emissions Control System" (Test Plan dated February 28, 2023) including: an exhaust capture system using flexible ducting, and an emission control system comprising of a particulate filter and Selective Catalytic Reduction (SCR) unit to reduce NO_x, PM, and ROG;

WHEREAS STAX submitted their final Test Plan on February 28, 2023 using the STAXbox 1-1, and CARB issued STAX a Test Plan approval letter on April 10, 2023;

WHEREAS STAX submitted the "Emissions Measurement from Ocean Going Container Vessels Using a Capture and Control System" (Test Report) and "Application for CARB Approval of STAX Engineering's STAXBox Emissions Control System as a CARB Approved Emissions Control Strategy (CAECS)" (request for Executive Order) for the STAXbox, dated May 2, 2023;

WHEREAS CARB reviewed and evaluated the Test Report and request for Executive Order for the STAXbox Emissions Control System based on the requirements specified in the 2020 At Berth Regulation;

WHEREAS CARB found the submitted documents indicate STAXbox achieves the emission reductions and has GHG emissions that are grid neutral for 2023 as stated in the Test Report and required by the 2020 At Berth Regulation under section 93130.5(d) and issued EO G-23-294 approving the STAXbox 1-1 for use for compliance with the At Berth Regulation;

WHEREAS STAX manufactured additional equipment that is a duplicate of STAXbox 1-1 to be operated under the same approved operating conditions, and requested the duplicate be added to the Executive Order;

WHEREAS duplicate equipment can be added to an Executive Order when the equipment has been verified to be a duplicate, and the required in-use compliance testing is conducted with the in-use compliance test (including emissions) data submitted to CARB within 6 months or 30 vessel visits, whichever comes first;

WHEREAS duplicate equipment must be identical to the equipment described in STAX's Test Plan submitted on February 28, 2023;

WHEREAS the following in-use compliance tests must be conducted on duplicate equipment within 6 months or 30 vessel visits, whichever comes first after the date that the duplicate equipment is approved and added to the Executive Order. 1) Third-party source testing at one load point following the requirements of section 93130.5(g) with Relative Accuracy Test Audit (RATA) testing. 2) Third-party capture efficiency testing at one load point. 3) Durability testing on a minimum of 5 vessels and a minimum of 200 hours;

WHEREAS in-use compliance third-party source testing must be conducted for all pollutants listed in section 93130.5 (g) and all testing must follow the test methods specified in section 93130.5 (g) and in STAX's Test Plan submitted on February 28, 2023;

WHEREAS duplicate equipment will be removed from the Executive Order if the required testing is not submitted to CARB within 6 months or 30 vessel visits, whichever comes first;

WHEREAS duplicate equipment will be removed from the Executive Order if, after CARB evaluates the test data, CARB determines that the in-use compliance test data demonstrates the system achieves emission rates greater than those specified in section 93130.5(d);

WHEREAS during the in-use compliance period, all requirements of the Executive Order must be followed, including all malfunction reporting and recordkeeping requirements. Failure to comply with the requirements of the Executive Order, including section 93130.12, will cause the equipment to be removed from the Executive Order and the approved equipment list;

WHEREAS the Executive Officer finds it is appropriate to issue this Executive Order that identifies the operating conditions, recordkeeping, and monitoring requirements for STAX's use of the STAXbox to allow its use as a CAECS for compliance with the 2020 At Berth Regulation;

WHEREAS this approval does not constitute an air pollution or land use permit, nor does it relieve the responsibility of STAX or the end user to comply with all Federal, State, and local laws, rules, and regulations;

WHEREAS STAX is subject to the 2020 At Berth Regulation as a CAECS operator;

NOW, THEREFORE, IT IS ORDERED that the STAXbox is approved for use in demonstrating compliance with the 2020 At Berth Regulation as a CAECS, when used by STAX as intended and in accordance with the following terms and conditions, and in accordance with all other applicable requirements in the 2020 At Berth Regulation.

Approved STAXbox system(s) (approved equipment) and the vessel and engine types for which the STAXbox system(s) are approved to control can be found in Attachment 1 of this Executive Order.

APPROVED OPERATING CONDITIONS

Parameter	Value
Ocean-going vessel engine type	One auxiliary engine
Ocean-going vessel type	Container vessel
Ocean-going vessel fuel composition limitation	Marine distillate fuel meeting 0.1% sulfur content limit (0.1% sulfur marine gas oil (MGO) or marine diesel oil (MDO)), or R99/R100 renewable diesel fuels that meet the specifications of MGO/MDO
SCR inlet operating temperature range in degrees Fahrenheit (°F)	600 - 720°F
Ocean-going vessel engine maximum continuous rating (MCR) in kilowatts (kW)	3,500 kW
Ocean-going vessel allowable operating range (kW)	266 kW to 890 kW
Allowable exhaust flow rate in standard cubic feet per minute (scfm)	3,642 to 6,330 scfm of engine exhaust
Maximum engine exhaust temperature requirements	1,000°F

Parameter	Value
Static Pressure	Differential pressure between -2 to -20 inches of water across the diesel particulate filter
Other parameters that affect performance	1-2 inches of water back pressure at the capture system inlet
GRID Neutral Target - CA CO ₂ e state output emission rate from eGRID2021 in pounds per megawatt hour (lb/MWh)	480.5 lb/MWh
Maximum CAECS auxiliary generator operating load (kW)	320 kW
CAECS auxiliary generator renewable diesel carbon intensity limit in grams of carbon dioxide equivalent per megajoule of fuel (g CO ₂ e/MJ)	20.1 g CO ₂ e/MJ fuel
Maximum ammonia slip emissions in parts per million by volume, dry basis (ppmdv)	5 ppmdv averaged over 60 minutes

APPROVAL OF DUPLICATE EQUIPMENT

BE IT FURTHER ORDERED, STAX will conduct the required in-use compliance testing to verify compliance of duplicate equipment within six months or 30 vessel visits, whichever comes first for every new piece of equipment added to this Executive Order. The list of approved equipment can be found in Attachment 1 of this Executive Order.

OPERATIONAL REQUIREMENTS

BE IT FURTHER ORDERED, STAX will operate the STAXbox following the notification and operational requirements per sections 93130.12(b)(1) and 93130.12(b)(2):

1. At least seven calendar days before a vessel's arrival, the operator of the CAECS must coordinate in writing with the vessel operator and terminal operator for the use of the strategy and supply the vessel operator with information about the compatibility with the vessel and terminal of the CAECS.
2. During each visit, the operator of the CAECS shall:
 - a. Begin controlling emissions within two hours of vessel "Ready to Work";
 - b. Record inlet and outlet levels of emissions during the visit;
 - c. Continue controlling emissions until at least one hour before "Pilot on Board"; and
 - d. Ensure vessels are operating on CARB compliant distillate marine fuel.

MONITORING REQUIREMENTS

BE IT FURTHER ORDERED, for every 1,000 hours of operation (and at a minimum annually), STAX shall submit data to the Executive Officer from the continuous emission monitoring system (CEMS) for each visit the CAECS is operated, to verify that the emission reduction levels are maintained, paying the applicable Certification Fee for the At Berth Regulation (Division 3, Chapter 16, Article 7, sections 2913 and 2914) for each visit.

BE IT FURTHER ORDERED, the CEMS parameters submitted to the Executive Officer must follow the parameters and measurement methods listed in STAX's Test Plan submitted on February 28, 2023.

BE IT FURTHER ORDERED, within 30 days of a vessel departure, for every visit where STAXbox is used as a CAECS, STAX shall report to CARB visit information as required by section 93130.12(b)(3).

BE IT FURTHER ORDERED, within seven days of a vessel departure, STAX shall report to their vessel operator customers the information necessary for vessel operators to submit their visit information to CARB as required by section 93130.7(e)(4), including the following:

- 1) Emissions control start date and time
- 2) Emission control end date and time
- 3) Details on any delays or interruptions while controlling emissions and the times that emission reductions were uncontrolled during the visit.

BE IT FURTHER ORDERED, when vessel operators submit visit information to CARB as required by section 93130.7(e)(4), the vessel operator must also report the following information per the compliance instructions for section 93130.7(e)(4)(Q):

- 1) Total power generated by vessel's auxiliary engines while at berth in kW-h. Data must be recorded at a minimum once an hour.

BE IT FURTHER ORDERED, within seven days of a vessel departure, STAX shall report to their terminal operator customers the information necessary for terminal operators to submit their visit information to CARB as required by section 93130.9(d)(5), including the following:

- 1) Emissions control start date and time;
- 2) Emission control end date and time;
- 3) Details on any delays or interruptions while controlling emissions and the times that emission reductions were uncontrolled during the visit.

BE IT FURTHER ORDERED, STAX shall maintain the STAXbox in accordance with "Section 5. Maintenance" of STAX's Test Plan.

BE IT FURTHER ORDERED, the Executive Officer may request that the STAXbox be tested annually using the test methods specified in the 2020 At Berth Regulation 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 testing per section 93130.5(j) of the 2020 At Berth Regulation.

MALFUNCTION REPORTING AND RECORDKEEPING REQUIREMENTS

BE IT FURTHER ORDERED, STAX shall report within 24 hours to CARB, by electronic means, any malfunction that is expected to create emissions in excess of any applicable emissions limitation for a period greater than one hour and shall retain for five years all records pertaining to the malfunction pursuant to section 93130.12.

BE IT FURTHER ORDERED, a delay or interruption in emissions control caused by a malfunction is eligible for remediation for the hours of uncontrolled emissions only when CARB is notified by STAX according to the provisions of section 93130.12(c).

BE IT FURTHER ORDERED, STAX shall submit a corrective action report within seven calendar days after a malfunction has been corrected as pursuant to section 93130.12(d).

BE IT FURTHER ORDERED, records made pursuant to section 93130.12 shall be kept for a minimum of five years and STAX shall submit information to CARB according to section 93130.19.

BE IT FURTHER ORDERED, this approval is subject to the following conditions:

- STAX must submit documentation, within 30 days upon request, to CARB showing STAXbox is being maintained and the maintenance schedule in "Section 5. Maintenance" of STAX's Test Plan is being adhered to.
- STAX must keep records, including purchase receipts, for a minimum of five years, for renewable diesel purchases demonstrating the fuel used on the STAXbox complies with the Approved Operating Conditions in this Executive Order.
- STAX must communicate with the vessel operator and ensure the vessel is only operating one auxiliary engine while the STAXbox is controlling emissions.
- Delays or interruptions in emissions control caused by a malfunction, or when the operational requirements in section 93130.12(b)(2) are not met may result in enforcement actions and ultimately revocation of the EO unless the visits are made compliant through use of the Remediation Fund or with a Vessel Incident Event (VIE) or Terminal Incident Event (TIE).

DESIGN CHANGES AND EXTENSIONS

BE IT FURTHER ORDERED, no changes are permitted to STAXbox design, or approved operating parameters set forth in STAX's application, test plan, and this Executive Order and its appendices, unless CARB is notified in advance per section 93130.5(i)(2). Design changes include changes to any part of the STAXbox system including the exhaust capture hood, ducting, control equipment, and deployment platform. The changes must be approved in writing by the Executive Officer and any applicable Certification Fees for the At Berth Regulation (Division 3, Chapter 16, Article 7, sections 2913 and 2914) must be paid before the modifications may be used for compliance with the 2020 At Berth Regulation. The

Executive Officer may revoke this Executive Order if the STAXbox design or approved operating parameters are changed without prior notification and approval by the Executive Officer.

BE IT FURTHER ORDERED, this Executive Order shall have a duration of five years from the date G-23-294 was executed (December 4, 2023) unless it is revoked by CARB as set forth in section 93130.5(l). As specified in section 93130.5(i)(1), at least six months prior to the expiration of this Executive Order, STAX may apply for an extension by submitting an extension application to the Executive Officer asserting that the strategy has not changed and is still effective, following the requirements specified in section 93130.5(d) as provided in section 93130.5(i)(1) of the Control Measure, after paying any applicable Certification Fees for the At Berth Regulation (Division 3, Chapter 16, Article 7, sections 2913 and 2914).

BE IT FURTHER ORDERED, marketing of the STAXbox using any identification other than that shown in this Executive Order or marketing of the STAXbox for an application other than those listed in this Executive Order shall be prohibited unless prior approval is obtained from CARB.

BE IT FURTHER ORDERED, this Executive Order does not relieve STAX from complying with all other applicable regulations.

BE IT FURTHER ORDERED, this Executive Order may be revoked if the Executive Officer determines that STAXbox does not comply with any of the requirements in this Executive Order.

Executive Order EO G-23-294 is hereby superseded and is of no further force and effect.

Executed at Sacramento, California, this 15th day of July 2024.



Bonnie Soriano, Branch Chief
Freight Activity Branch
Transportation and Toxics Division

Attachment 1: Approved Equipment List

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Barge	STAXbox	Ocean-going Vessel Type	Ocean-going Vessel Engine Type	Capture Hood Type	In-Use Compliance Testing
Xcraft-1	STAXbox 1-1	Container vessel	One auxiliary engine	Flex duct	Original STAXbox system approved, and not a duplicate. No Requirement.
Xcraft-2	STAXbox 2-1	Container vessel	One auxiliary engine	Flex duct	Test data must be submitted to CARB within 30 vessel visits or by January 15, 2025, whichever comes first.