BOARD MEETING DATE: March 4, 2022 AGENDA NO. 30

PROPOSAL: Determine That Proposed Amendments to Rule 1115 – Motor Vehicle Assembly Line Coating Operations, are Exempt from CEQA and Amend Rule 1115

SYNOPSIS: Rule 1115 - Motor Vehicle Assembly Line Coating Operations regulates VOC emissions from coatings and solvents used in operations conducted on motor vehicle assembly lines. Proposed Amended Rule 1115 will revise VOC emission limits consistent with VOC limits established under Reasonably Achievable Control Technology requirements. In addition, the proposed amendment will update definitions, recordkeeping, and testing requirements. This action is to adopt the Resolution: 1) Determining that the proposed amendments to Rule 1115 – Motor Vehicle Assembly Line Coating Operations, are exempt from the requirements of the California Environmental Quality Act, and 2) Amending Rule 1115 – Motor Vehicle Assembly Line Coating Operations.

COMMITTEE: Stationary Source, January 21, 2022, Reviewed

RECOMMENDED ACTIONS:
Adopt the attached Resolution:
1. Determining that the proposed amendments to Rule 1115 – Motor Vehicle Assembly Line Coating Operations, are exempt from the requirements of the California Environmental Quality Act; and
2. Amending Rule 1115 – Motor Vehicle Assembly Line Coating Operations.

Wayne Nastri
Executive Officer

SR:MK:MM:RC

**Background**

Rule 1115 – Motor Vehicle Assembly Line Coating Operations was adopted on March 2, 1979, with the purpose of reducing emissions of VOCs resulting from coating operations conducted on motor vehicle assembly lines during the manufacturing of new motor vehicles.

The federal Clean Air Act requires a Reasonably Available Control Technology (RACT) demonstration to ensure South Coast AQMD rules are equally as stringent as regulations under other air agencies in California and throughout the United States. U.S. EPA issued Control Techniques Guidelines (CTG) for Automobile and Light-Duty Truck Assembly Coatings that are more stringent than the VOC emission limits contained in the current South Coast AQMD Rule 1115. In addition, the VOC emission limits in Rule 1115 for several coating types are less stringent than those in the corresponding rules from other regulatory agencies. To fulfill RACT requirements, PAR 1115 will address these deficiencies.

**Public Process**
The development of PAR 1115 was conducted through a public process. A Public Workshop was held remotely on January 6, 2022. As part of this rulemaking process, staff had individual meetings with affected facilities and conducted site visits at facilities subject to this rule.

**Proposed Amendments**
PAR 1115 updates VOC limits for coatings used in automotive assembly line processes and for other miscellaneous materials used at motor vehicle assembly coating operations to comply with RACT requirements. The update incorporates VOC limits recommended in the U.S. EPA 2008 CTG, includes new terms and definitions, and updates existing terms per definitions contained in the 2008 CTG and other sources. In addition, recordkeeping and testing requirements are updated.

**Emission Reductions**
Although PAR 1115 proposes to lower the VOC emission limits for coatings used in the motor vehicle assembly line and includes VOC emission limits for miscellaneous materials used at motor vehicle assembly coating operations, there are no anticipated emissions reductions associated with this proposal. Existing coatings used at facilities subject to PAR 1115 have been determined to already be compliant with the proposed emission limits.

**Key Issue**
Throughout the rulemaking process, staff worked closely with stakeholders to address their comments and issues regarding the proposed emission standards, monitoring, and recordkeeping requirements.

On February 17, 2022, staff received a comment letter from a stakeholder requesting:
- Exemption for UV/EB/LED materials
- Inclusion of Energy Curable Materials definition
- Inclusion of thin film UV/EB/LED materials test method
- Exclusion of transfer efficiency requirements for UV/EB/LED materials

The requested changes are not necessary since UV/EB/LED materials may be used provided they meet the VOC emission limits in the proposed amended rule Since coatings and solvents are needed with a UV/EB/LED curing technology, exempting any process that use UV/EB/LED could result in higher VOC emissions if these materials do not meet VOC limits in the proposed amended rule and rules regulating clean-up solvents.

**California Environmental Quality Act**
Pursuant to the California Environmental Quality Act (CEQA) Guidelines Sections 15002(k) and 15061, the proposed project (PAR 1115) is exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3). A Notice of Exemption has been prepared pursuant to CEQA Guidelines Section 15062 and is included as Attachment H to this Board letter. If PAR 1115 is approved, the Notice of Exemption will be filed for posting with the county clerks of Los Angeles, Orange, Riverside, and San Bernardino counties, and with the State Clearinghouse of the Governor's Office of Planning and Research.

**Socioeconomic Analysis**
The proposed amendments to Rule 1115 do not impose any additional costs and do not result in any adverse socioeconomic impacts. As a result, no socioeconomic analysis is required under California Health and Safety Code Sections 40440.8 and 40728.5.

**AQMP and Legal Mandates**
Pursuant to Health & Safety Code Section 40460 (a), South Coast AQMD is required to adopt an Air Quality Management Plan (AQMP) to achieve and maintain the state and federal ambient air quality standards for the South Coast Air Basin. South Coast AQMD is required to adopt rules and regulations that carry out the objectives of the AQMP. In accordance with CAA requirements, PAR 1115 is updated to meet the EPA's 2008 CTG and to fulfill RACT requirements.

**Resource Impacts**
Existing staff resources are adequate to implement the proposed amendments.

**Attachments**
A. Summary of Proposal
B. Key Issues and Responses
C. Rule Development Process
D. Key Contacts List
E. Resolution
F. Proposed Amended Rule 1115
G. Final Staff Report
H. Notice of Exemption from CEQA
I. Board Presentation

# ATTACHMENT A

# SUMMARY OF PROPOSAL

| Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations |
| --- |
| *Definitions*<br>• Terms and definitions as contained in the U.S. EPA 2008 Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings and other source-specific rules are introduced or modified<br><br>*Emissions Limits*<br>• VOC emission limits are revised or included to meet the limits recommended in the U.S. EPA 2008 Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings<br>• Prohibition of coatings that contain cadmium or hexavalent chromium<br><br>*Transfer Efficiency*<br>• Specifies methods of coating application that meet minimum transfer efficiency standards<br><br>*Monitoring, Reporting, and Recordkeeping*<br>• Maintain daily records of operation time, quantity of product, and pollutant mass emission rates<br>• Maintain manufacturer specification sheets, safety data sheets, technical data sheets, or other air quality data sheets that contain the necessary information to determine compliance with the emission limits<br><br>*Exemptions*<br>• Removes exemption for trunk coatings, interior coatings, sealers, deadeners, and accent and stripe coatings |

## ATTACHMENT B

## KEY ISSUES AND RESPONSES

| Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations |
| --- |
| Throughout the rulemaking process, staff has worked closely with stakeholders from facilities and with various other stakeholders to address their comments and resolve any key issues. |
| On February 17, 2022, staff received a comment letter from a stakeholder requesting:<br>• Exemption for UV/EB/LED materials<br>• Inclusion of definition of Energy Curable Materials<br>• Inclusion of test method for thin film UV/EB/LED materials<br>• Exclusion from transfer efficiency requirements for UV/EB/LED materials<br><br>The requested changes are not necessary since UV/EB/LED materials are not precluded from being used to comply with rule. The requested changes are also outside the scope of the amendments to align the rule with the 2008 CTG. Finally, an exemption could result in potential backsliding and the EPA would need to approve. |

**ATTACHMENT C**
**RULE DEVELOPMENT PROCESS**

Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations


**Eleven (11) months spent in rule development.**

**One (1) Public Workshop.**

**One (1) Stationary Source Committee Meeting**

## ATTACHMENT D

## KEY CONTACTS LIST

Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations
(*listed alphabetically*)

- Amrep (Ontario)
- El Dorado National (Riverside)
- Fortress Resources, Royal Truck Bodies (Carson)
- Harbor Truck Bodies (Brea)
- Karma Automotive (Moreno Valley)
- Marathon Industries (Santa Clarita)
- Spartan Motors GTB (Montebello)
- TABC, Inc (Long Beach)
- Taylor Dunn Manufacturing (Anaheim)
- UniVersal Engineering (Alta Loma)

# Appendix A

# South Coast AQMD Advisory Groups

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# Technology Advancement Advisory Group[1]

| | |
|---|---|
| Dr. Matt Miyasato, Chair | South Coast AQMD |
| Don Anair | Union of Concerned Scientists |
| Chris Cannon | Port of Los Angeles |
| *Dr. Bill Robertson | California Air Resources Board |
| Dr. Michael Kleinman | University of California Irvine |
| Yuri Freedman | Southern California Gas Company |
| George Payba | Los Angeles Department of Water and Power |
| Phil Heirigs | Western States Petroleum Association |
| Vic La Rosa | Total Transportation Solutions Inc. |
| Tim Olson | California Energy Commission |
| David Pettit | Natural Resources Defense Council |
| Dr. Sunita Satyapal | Department of Energy |
| Heather Tomley | Port of Long Beach |
| Laura Renger | Southern California Edison |

*Newly appointed member

[1] Members as of February 18, 2022

# SB 98 Clean Fuels Advisory Group[2]

| | |
|---|---|
| Dr. Matt Miyasato, Chair | South Coast AQMD |
| Keith Brandis | Volvo Group |
| Dr. John Budroe | California Environmental Protection Agency, Office of Environmental Health Hazard Assessment |
| Dr. John Wall | Independent Consultant in Combustion Technology |
| Dr. Mark Duvall | Electric Power Research Institute |
| Dr. Mridul Gautam | West Virginia University, Adjunct Professor, & University of Nevada-Reno |
| Dr. Wayne Miller | University of California, Riverside, College of Engineering, Center for Environmental Research and Technology |
| Dr. Petros Ioannou | University of Southern California Director of the Center for Advanced Transportation Technologies |
| Dr. Scott Samuelsen | University of California, Irvine, Combustion Laboratory/National Fuel Cell Research Center |
| Dr. Robert Sawyer | Sawyer Associates |
| Dr. Andreas Truckenbrodt | Independent Consultant in Fuel Cell Technologies |
| *Ken Kelly | National Renewable Energy Laboratory |
| Dwight Robinson | Mortimer & Wallace, Inc. |

*Newly appointed member

[2] Members as of March 4, 2022

# Appendix B

# Open Clean Fuels Contracts as of January 1, 2022

**[This Page Intentionally Left Blank]**

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Electric / Hybrid Electric Technologies and Infrastructure | | | | | | |
| 14184 | Clean Fuel Connection, Inc. | DC Fast Charging Network Provider | 04/04/14 | 06/30/23 | 390,000 | 1,210,000 |
| 16081 | Broadband Telcom Power Inc | Provide EV Hardware and Control System at SCAQMD Headquarters Including Installation Support, Warranty and Networking | 04/27/16 | 04/26/22 | 367,425 | 689,850 |
| 17105 | BYD Motors Inc | Development and Demonstration of up to 25 Class 8 Battery Electric Drayage Trucks | 04/14/17 | 10/13/23 | 2,294,436 | 8,942,400 |
| 17207 | Peterbilt Motors | Development and Demonstration of up to 12 Class 8 Battery Electric Drayage Trucks | 04/07/17 | 10/06/23 | 2,342,436 | 11,082,340 |
| 17225 | Volvo Technology of America LLC | Development and Demonstration of up to 2 Class 8 Battery Electric Drayage Trucks | 06/09/17 | 03/31/22 | 1,741,184 | 11,065,938 |
| 17244 | Kenworth Truck Company | Development & Demonstration of four Class 8 CNG Hybrid Electric Drayage Trucks | 09/08/17 | 06/30/22 | 2,239,106 | 6,492,238 |
| 18129 | Electric Power Research Institute | Versatile Plug-In Auxilary Power System Demonstration | 06/28/18 | 04/30/23 | 125,000 | 273,000 |
| 18232 | Hyster-Yale Group Inc | Electric Top-Pick Development, Integration & Demonstration | 09/14/18 | 06/30/23 | 367,801 | 3,678,008 |
| 18277 | Velocity Vehicle Group DBA Los Angeles Truck Centers LLC | Southern California Advanced Sustainable Freight Demonstration | 09/07/18 | 03/06/22 | 582,305 | 4,198,000 |
| 18287 | Evgo Services LLC | Charging Station and Premises Agreement for Installation of One DCFC at SCAQMD Headquarters | 06/27/18 | 06/26/28 | 0 | 0 |
| 19166 | Phoenix Cars LLC dba Phoenix Motorcars | Battery Electric Shuttle Bus Replacement Project | 01/31/19 | 01/30/22 | 0 | 7,311,456 |
| 19182 | Los Angeles County | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 01/03/19 | 01/03/22 | 0 | 0 |
| 19183 | Southern California Public Power Authority (SCPPA) | Disburse Donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 01/10/19 | 01/10/22 | 0 | 0 |
| 19190 | Daimler Trucks North America LLC | Zero Emission Trucks and EV Infrastructure Project | 12/18/18 | 06/17/22 | 8,230,072 | 31,340,144 |
| 19202 | City of Compton | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 04/11/19 | 04/10/22 | 0 | 0 |
| 19250 | Baldemar Caraveo | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 03/06/19 | 03/06/22 | 0 | 0 |
| 19251 | Gary Brotz | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 03/27/19 | 03/26/22 | 0 | 0 |
| 19252 | Hui Min Li Chang | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 03/29/19 | 03/28/22 | 0 | 0 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Electric / Hybrid Electric Technologies and Infrastructure (cont'd) | | | | | | |
| 19253 | Jennifer Chin | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/19/19 | 04/18/22 | 0 | 0 |
| 19254 | Liping Huang | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/11/19 | 04/18/22 | 0 | 0 |
| 19255 | Ramona Manning | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/05/19 | 04/04/22 | 0 | 0 |
| 19256 | Tony Chu | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 04/04/19 | 04/03/22 | | 0 |
| 19278 | Volvo Group North America, LLC | Low Impact Green Heavy Transport Solutions (LIGHTS) - Develop and Demonstrate Zero Emissions Heavy-Duty Trucks, Freight Handling Equipment, EV Infrastructure and Renewable Energy | 04/17/19 | 06/30/22 | 4,000,000 | 92,345,863 |
| 19279 | Douglas Harold Boehm | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 03/29/19 | 03/28/22 | 0 | 0 |
| 19280 | Emile I. Guirguis | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/19/19 | 04/18/22 | 0 | 0 |
| 19281 | Helen Chi | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 03/27/19 | 03/26/22 | 0 | 0 |
| 19282 | Hosneara Ahmed | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/05/19 | 04/04/22 | 0 | 0 |
| 19283 | Hsuan Hu | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 03/27/19 | 03/26/22 | 0 | 0 |
| 19284 | Jyi Sy Chiu | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/05/19 | 04/04/22 | 0 | 0 |
| 19285 | Mercedes Manning | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/19/19 | 04/18/22 | 0 | 0 |
| 19286 | Monica Sii | Disburse donated Mercedes-Bens USA, LLC Electric Vehicle Chargers | 04/19/19 | 04/19/22 | 0 | 0 |
| 19287 | Quei-Wen P Yen | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 03/29/19 | 03/28/22 | 0 | 0 |
| 19288 | Rae Marie Johnson | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/05/19 | 04/04/22 | 0 | 0 |
| 19289 | Yilong Yang | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 04/09/19 | 04/08/22 | 0 | 0 |
| 19295 | Ivan Garcia | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 04/11/19 | 04/10/22 | 0 | 0 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Electric / Hybrid Electric Technologies and Infrastructure (cont'd) | | | | | | |
| 19296 | Jamei Kun | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 04/19/19 | 01/18/22 | 0 | 0 |
| 19297 | Laizheng Wei | Disburse donated Mercedes-Benz USA, LLC. Electric Vehicle Chargers | 04/19/19 | 04/18/22 | 0 | 0 |
| 19438 | Puente Hills Hyundai LLC | Lease Two 2019 Hyudai Kona EVs for Three Years | 06/06/19 | 06/05/22 | 61,156 | 61,156 |
| 20054 | Puente Hills Hyundai LLC | Lease One 2019 Hyundai Kona EV for Three Years | 08/23/19 | 08/22/22 | 29,640 | 29,640 |
| 20097 | Zeco Systems, Inc. DBA Greenlots | Operate, Maintain and Network the EV Chargers | 02/14/20 | 02/13/23 | 155,664 | 155,664 |
| 20124 | Volvo Technology of America LLC | Develop & Demonstrate Battery-Electric Excavator & Wheel Loader | 09/01/19 | 09/30/22 | 0 | 2,000,000 |
| 20125 | Roush Cleantech, LLC | Develop and Demonstrate Battery Electric Medium-Duty Truck | 03/19/20 | 03/18/22 | 937,500 | 3,200,000 |
| 20168 | OMNITRANS | Disburse donated Mercedes-Benz USA, LLC Electric Vehicle Chargers | 02/28/20 | 02/27/23 | 0 | 0 |
| 20296 | Daimler Trucks North America LLC | Deploy Zero Emission Electric Delivery Trucks | 05/27/21 | 12/31/24 | 0 | 12,310,000 |
| 21077 | Daimler Trucks North America LLC | Develop and Demonstrate up to 8 Heavy-Duty Battery Electric Trucks and Transportable Fast-Charging | 03/11/21 | 03/31/23 | 1,000,000 | 6,742,000 |
| 21153 | Volvo Group North America, LLC | Switch-On: Develop and Deploy Seventy Heavy-Duty Battery Electric Vehicles | 06/10/21 | 09/30/24 | 2,000,000 | 31,540,000 |
| Engine Systems and Technologies | | | | | | |
| 17353 | Odyne Systems, LLC | Develop and Demo Medium-Heavy Duty (Class 5-7) Plug-In Hybrid Electric Vehicles for Work Truck Applications | 06/09/17 | 02/28/22 | 900,000 | 6,955,281 |
| 18194 | CALSTART | Develop and Demonstrate Near-Zero Emission Opposed Piston Engine | 05/30/18 | 06/30/22 | 1,000,000 | 15,550,000 |
| 19439 | Cummins, Inc. | Natural Gas Engine and Vehicles Research and Development - Natural Gas Specific Combustion Design | 08/30/19 | 08/29/23 | 250,000 | 10,996,626 |
| 20092 | Southwest Research Institute | Natural Gas Engine and Vehicles Research and Development - Pent-Roof Medium Duty Natural Gas Engine | 10/14/20 | 04/13/24 | 475,000 | 6,000,000 |
| 20158 | University of California Riverside | OnBoard Nox and PM Measurement Method | 05/19/20 | 05/18/22 | 201,087 | 688,587 |
| 20199 | Agility Fuel Solutions LLC | Develop a Near-Zero Natural Gas and Propane Conversion System for On-Road Medium-Duty Vehicles | 07/01/21 | 06/30/22 | 453,500 | 1,834,000 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Engine Systems and Technologies (cont'd) | | | | | | |
| 20316 | US Hybrid | Natural Gas Engine & Vehicles Research & Development - Plug-In Hybrid CNG Drayage Truck (PHET) | 06/02/20 | 12/01/23 | 500,000 | 2,853,006 |
| Fuel / Emission Studies | | | | | | |
| 17276 | University of California Riverside, Ce-Cert | Development of ECO-ITS Strategies for Cargo Containers | 08/03/17 | 01/31/22 | 543,000 | 2,190,233 |
| 17286 | University of California Riverside | In-Use Emissions Testing and Fuel Usage Profile of On-Road Heavy-Duty Vehicles | 06/09/17 | 03/31/22 | 300,000 | 1,625,000 |
| 21103 | University of California Riverside | Perform Investigation Study of E15 Gasoline Fuel Effects | 03/09/21 | 06/08/22 | 200,000 | 1,300,000 |
| 21169 | West Virginia University Research Corp | Evaluation of Vehicle Maintenance Costs Between NG and Diesel Fueled On-Road Heavy-Duty Vehicles | 09/29/21 | 03/28/24 | 100,000 | 250,000 |
| Fueling Infrastructure and Deployment (NG / RNG) | | | | | | |
| 18336 | ABC Unified School District | FY2017-18 Alternative Fuel School Bus Replacement Program (3 CNG Buses) | 10/05/18 | 11/30/34 | 117,900 | 676,500 |
| 18337 | Alta Loma School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (2 CNG Buses) | 10/05/18 | 11/30/34 | 78,600 | 423,000 |
| 18344 | Bellflower Unified School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (1 CNG Bus) | 09/07/18 | 11/30/34 | 39,300 | 225,500 |
| 18346 | Chaffey Joint Union High School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (6 CNG Buses) | 10/05/18 | 11/30/34 | 235,800 | 1,269,000 |
| 18348 | Cypress School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (1 CNG Bus) | 09/07/18 | 11/30/34 | 39,300 | 211,500 |
| 18349 | Downey Unified School District | FY 2017-18 alternative Fuel School Bus Replacement Program (4 CNG Buses) | 09/14/18 | 11/30/36 | 157,200 | 902,000 |
| 18350 | Fountain Valley School District | FY2017-18 Alternative Fuel School Bus Replacement Program (1 CNG Bus) | 09/07/18 | 11/30/34 | 39,300 | 211,500 |
| 18351 | Fullerton Joint Union High School District | FY2017-18 Alternative Fuel School Bus Replacement Program (4 CNG Buses) | 10/05/18 | 11/30/34 | 157,200 | 846,000 |
| 18355 | Huntington Beach Union High School District | FY2017-18 Alternative Fuel School Bus Replacement Program (15 CNG Buses) | 10/05/18 | 11/30/34 | 589,500 | 3,382,500 |
| 18363 | Orange Unified School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (1 CNG Bus) | 09/14/18 | 11/30/34 | 39,300 | 225,500 |
| 18364 | Placentia-Yorba Linda Unified School District | FY2017-18 Alternative Fuel School Bus Replacement Program (6 CNG Buses) | 10/05/18 | 11/30/34 | 235,800 | 1,353,000 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Fueling Infrastructure and Deployment (NG / RNG) (cont'd) | | | | | | |
| 18365 | Pupil Transportation Cooperative | FY 2017-18 Alternative Fuel School Bus Replacement Program (5 CNG Buses) | 10/05/18 | 11/30/34 | 196,500 | 1,127,500 |
| 18367 | Rialto Unified School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (13 CNG Buses) | 10/05/18 | 11/30/34 | 510,900 | 2,931,500 |
| 18368 | Rim Of The World Unified School District | FY2017-18 Alternative Fuel School Bus Replacement Program (3 CNG Buses) | 10/05/18 | 11/30/34 | 513,600 | 676,500 |
| 18369 | Rowland Unified School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (3 CNG Buses & 1 Propane Bus) | 11/02/18 | 11/30/34 | 117,900 | 770,000 |
| 18374 | Upland Unified School District | FY 2017-18 Alternative Fuel School Bus Replacement Program (4 CNG Buses) | 10/12/18 | 11/30/34 | 157,200 | 902,000 |
| 20178 | Whittier Union High School District | FY 2017-18 Alternative Fuel School Bus Replacement Program | 02/21/20 | 11/30/34 | 196,500 | 1,052,500 |
| 21099 | CR & R, Inc. | Renewable Natural Gas Production and Vehicle Demonstration Project | 03/03/20 | 09/30/22 | 166,250 | 166,250 |
| 21140 | Inland Kenworth (US) Inc | SCAQMD Approved Participating Dealership in TRUCK TRADE DOWN PROGRAM | 01/07/21 | 12/31/23 | 0 | 0 |
| 21141 | Velocity Truck Centers | SCAQMD Approved Participating Dealership in TRUCK TRADE DOWN PROGRAM | 03/04/21 | 12/31/23 | 0 | 0 |
| 21142 | TEC of California, Inc. | SCAQMD Approved Participating Dealership in TRUCK TRADE DOWN PROGRAM | 04/15/21 | 12/31/23 | 0 | 0 |
| Hydrogen and Mobile Fuel Cell Technologies and Infrastructure | | | | | | |
| 15150 | Air Products and Chemicals, Inc. | Install/Upgrade Eight H2 Fueling Stations throughout SCAG (including SCAQMD's HQs H2 station) | 10/10/14 | 04/09/22 | 1,000,000 | 17,335,439 |
| 15366 | Engineering, Procurement & Construction, LLC. | Operate and Maitain Publicly Accessible Hydrogen Fueling Station at SCAQMD's Diamond Bar HQs | 10/10/14 | 04/09/22 | 0 | 0 |
| 15611 | Ontario CNG Station, Inc. | Installation of Ontario Renewable Hydrogen Fueling Station | 07/10/15 | 07/09/22 | 200,000 | 2,510,000 |
| 16025 | Center for Transportation and the Environment | Develop & Demonstrate Fuel Cell Hybrid Electric Medium-Duty Trucks | 02/05/16 | 11/30/23 | 980,000 | 7,014,050 |
| 17059 | CALSTART Inc | Develop and Demonstrate Fuel Cell Extended Range Powertrain for Parcel Delivery Trucks | 10/27/16 | 02/28/22 | 589,750 | 1,574,250 |
| 17312 | Cummins EP NA Inc | ZECT II - Develop Fuel Cell Range-Extended Drayage Truck | 11/20/17 | 05/30/24 | 125,995 | 2,093,146 |
| 18150 | California Department of Food and Agriculture | Conduct Hydrogen Station Site Evaluations for Hydrogen Station Equipment Performance | 06/28/18 | 02/27/22 | 100,000 | 805,000 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Hydrogen and Mobile Fuel Cell Technologies and Infrastructure (cont'd) | | | | | | |
| 19248 | Tustin Hyundai | Three Year Lease of 2019 Fuel Cell Hyundai Nexo | 03/07/19 | 03/06/22 | 25,193 | 25,193 |
| 19313 | Equilon Enterprises LLC DBA Shell Oil Products | Construct & Operate Renewable Hydrogen Refueling Station | 06/30/20 | 04/01/22 | 1,200,000 | 12,000,000 |
| 20033 | Port of Long Beach | Sustainable Terminals Accelerating Regional Transportation (START) Phase I | 06/04/21 | 04/30/22 | 500,000 | 102,964,064 |
| 20038 | University of California Irvine | Expansion of the UCI Hydrogen Refueling Station | 10/18/19 | 02/17/27 | 400,000 | 1,800,000 |
| 20169 | Port of Los Angeles | Develop & Demonstrate Near-Zero and Zero Emissions Vehicles and Equipment at the Ports | 06/28/21 | 11/30/22 | 1,000,000 | 83,548,872 |
| 20244 | Cummins Electrified Power NA Inc | Demonstrate Fuel Cell Range-Extended Drayage Trucks | 12/16/19 | 06/30/22 | 582,305 | 4,985,665 |
| 21313 | Sunline Transit Agency | Deployment of 5 Zero-Emission Fuel Cell Transit Buses | 08/27/21 | 09/30/25 | 204,921 | 6,761,125 |
| 21386 | National Renewable Energy Laboratory | CA Hydrogen Heavy-Duty Infrastructure Research Consortium H2@Scale Initiative | 09/03/21 | 09/02/23 | 25,000 | 1,171,000 |
| Stationary Sources - Clean Fuels | | | | | | |
| 21266 | University of California Irvine | Develop Model for Connected Network of Microgrids | 08/17/21 | 02/16/24 | 290,000 | 370,000 |
| Technology Assessments and Transfer / Outreach | | | | | | |
| 08210 | Sawyer Associates | Technical Assistance on Mobile Source Control Measures and Future Consultation on TAO Activities | 02/22/08 | 02/28/22 | 50,000 | 50,000 |
| 09252 | JWM Consulting Service | Technical Assistance with Review and Assessment of Advanced Technologies, Heavy-Duty Engines and Conventional and Alternative Fuels | 12/20/08 | 06/30/22 | 30,000 | 30,000 |
| 12376 | University of California Riverside | Technical Assistance with Alternative Fuels, Biofuels, Emissions Testing, and Zero-Emission Transportation Technology | 06/01/14 | 05/31/24 | 300,000 | 300,000 |
| 15380 | ICF Resources LLC | Technical Assistance with Goods Movement, Alternative Fuels and Zero-Emission Transportation Technologies | 12/12/14 | 12/11/22 | 30,000 | 30,000 |
| 16262 | University of California Davis | Support Sustainable Transportation Energy Pathways (STEPs) 2015-2018 Program | 01/05/18 | 01/04/22 | 240,000 | 5,520,000 |
| 17097 | Gladstein, Neandross & Associates LLC | Technical Assistance with Alt Fuels and Fueling Infrastructure, Emissions Analysis and On-Road Sources | 11/04/16 | 06/30/22 | 200,000 | 200,000 |

| Contract | Contractor | Project Title | Start Term | End Term | South Coast AQMD $ | Project Total $ |
|---|---|---|---|---|---|---|
| Technology Assessments and Transfer / Outreach (cont'd) | | | | | | |
| 19078 | Green Paradigm Consulting, Inc. | Technical Assistance with Alternative Fuels, Evs, Charging & Infrastructure and Renewable Energy | 09/07/18 | 09/30/24 | 200,000 | 857,236 |
| 19227 | Gladstein, Neandross & Associates LLC | Technical Assistance with Alternative Fuels & Fueling Infrastructure, Emissions Analysis & On-Road Sources | 02/01/19 | 01/31/22 | 300,000 | 300,000 |
| 19302 | Jerald Cole | Technical Assistance with Hydrogen Infrastructure and Related Projects | 04/24/19 | 04/23/23 | 50,0000 | 50,000 |
| 20085 | CALSTART Inc | Technical Assistance for Development & Demonstration of Infrastructure and Mobile Source Applications | 11/08/19 | 11/07/23 | 250,000 | 250,000 |
| 20163 | Gladstein, Neandross & Associates LLC | Technical Assistance with Implementation & Outreach Support for California VW Mitigation Trust Fund | 01/21/20 | 01/21/22 | 26,000 | 26,000 |
| 20265 | Eastern Research Group | Technical Assistance with Heavy-Duty Vehicle Emissions Testing, Analyses & Engine Development & Applications | 06/17/20 | 06/16/22 | 50,000 | 50,000 |
| 21260 | Fred Minassian | Technical Assistance with Incentive and Research and Development Programs | 04/13/21 | 10/12/22 | 75,000 | 75,000 |
| 22032 | Southern California Chinese American Environmental Protection Association | Cosponsor the 2021 Southern California Chinese-American Environmental Protection Association 30-Year Anniversary and Annual Convention | 08/20/21 | 05/31/22 | 1,500 | 20,000 |
| 22096 | AEE Solutions LLC | Technical Assistance with Heavy-Duty Vehicle Emission Testing, Test Methods and Analysis of Real-World Activity Data | 11/08/21 | 11/07/23 | 100,000 | 100,000 |

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# Appendix C

# Final Reports for 2021

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**South Coast AQMD Contract #17065** **December 2021**

# Installation Services for Installation of EV Chargers at South Coast AQMD Headquarters

**Contractor**
Clean Fuel Connection, Inc. (CFCI)

**Cosponsors**
South Coast AQMD

**Project Officer**
Patricia Kwon

## Background

Clean Fuel Connection, Inc. (CFCI) was chosen by a competitive RFP process for installation of ninety-two (92) Level 2 electric vehicle supply equipment (EVSE) at South Coast AQMD headquarters. Goss Engineering, Inc. was also hired through a competitive RFP process to provide required engineering services prior to the release of an RFP for installation of EV chargers, preparation of construction plans to obtain a permit from the City of Diamond Bar, and engineering services as required during the installation of EV chargers from October 2016 through December 2017.

## Project Objective

CFCI performed the installation services as outlined in the City of Diamond Bar's approved construction plans and line drawings. These installation services included six ADA accessible chargers for both the front lobby entrance and the side entrance closest to conference room GB which is commonly used for public meetings and workshops. These services included working with the hardware provider Broadband Telecom Power, Inc. (BTC), Goss Engineering, and the City of Diamond Bar for permitting approvals.

Additional services included obtaining electrical and trenching permits from the City of Diamond Bar, providing a phased construction plan for work to be performed in different areas of the parking lot to minimize disruption, and performing the final job walk with South Coast AQMD staff and CFCI based on completing items on the final punch list. This also included ensuring compliance with the State of California Governor's Office of Planning and Research and Division of the State Architect EVSE universal charging access guidelines, as well as the American with Disabilities Act accessibility requirements, SB 854 requirements for Public Works projects, and all applicable building, electrical and safety codes.

## Technology Description

Due to the wide range of cutting-edge alternative fuel technologies that are demonstrated at the South Coast AQMD headquarters facility, even a moderately large scale construction project impacting six areas of the parking lot including upgrade and replacement of three transformers and seven electrical panels, presents technical challenges. In addition, there was an inability to shut down power at the facility for even a short thirty-minute interval due to the need to have continuous power at the facility for Air Quality Management Plan modeling runs and laboratory analyses for resolving toxics issues at metal processing plants in Paramount. Due to the need to comply with South Coast AQMD's Rule 1470 (prohibiting use of a backup natural gas generator to provide power during routine maintenance), replacement of the transformer in the main electrical room took place with the power still on through a "hot connect" procedure.

## Status

CFCI played a critical role in the installation of 92 Level 2 EV charging ports at South Coast AQMD headquarters. Electrical upgrades and hardware installation occurred between October 2016 and April 2017, with minor construction tasks completed in December 2017. CFCI remained under a warranty and maintenance agreement until December 2021.


*Locations of EV charging stations installed at South Coast AQMD headquarters*

## Results

Coordination between Goss Engineering who developed the approved plans, hardware provider BTC, and the City of Diamond Bar Plan Check department enabled the construction project to be carried out successfully and with a minimum of delays despite technical challenges, delays in receiving equipment, and unprecedented heavy rainfall.

*EV charging stations under the solar carport*

EV charging transactions in December 2017 showed there were over 1,329 charging sessions dispensing 15,309 kWh of electricity for EV chargers serving South Coast AQMD staff, visitors, and the general public. These EV chargers continue to be utilized but to a lesser extent since the COVID pandemic closed South Coast AQMD facilities to the public in March 2020 and have not yet re-opened to the public.

## Benefits

This project showcases the benefits of providing Level 2 EV charging for staff, visitors, and the general public at a large workplace location. On average, South Coast AQMD staff have a twenty-mile one-way commute to work, with some staff having as much as a 45-mile one-way commute. Without workplace charging, staff would be unable to drive their EVs to work and make it home. This results in increased zero emission vehicle miles traveled, particularly during critical morning and evening commuting hours when congestion impacts are at their greatest.

## Project Costs

Installation services for this project totaled $805,219 and were within the budget for this project. Hardware and Greenlots EVSE networking software were provided under a separate BTC contract for $367,425. Engineering services to obtain City permits were provided under a separate contract with Goss Engineering for $50,000. Total costs for the EVSE installation were $1.2M.

## Commercialization and Applications

The utilization of engineering services to define the installation phase of the project and assist in providing calculations and revised plans to the City of Diamond Bar assisted greatly in allowing the installation to stay within budget and to be completed within the desired time frame. It is recommended that for the installation of workplace charging at large facilities such as South Coast AQMD headquarters that an engineering firm be available to provide the necessary technical assistance at key points during the project. In particular, the engineering services were critical to define the load of existing panels and ensure proper specifications and upsizing of transformers, panels, conduit, and wiring. This upsizing incorporated not only the planned installation of 92 EVSE but also anticipated future deployments of EV chargers that were likely to occur within the next 5-10 years to future proof the facility. This future proofing enabled staff to later serve as a site host for a new 50 kW DC fast charger with CHAdeMO and CCS1 connectors at the front lobby parking area to better serve EVs capable of fast charging. Another critical service was having an installation warranty with CFCI and a maintenance contract with hardware provider BTC and networking software provider Greenlots to address post installation EVSE issues.

**South Coast AQMD Contract #17316** **September 2021**

# Develop and Demonstrate 10 Zero-Emission Fuel Cell Electric Buses

## Contractor

Center for Transportation and the Environment (CTE)
Orange County Transportation Authority (OCTA)
New Flyer
Air Products
Trillium

## Cosponsors

California Air Resources Board (CARB)
South Coast AQMD

## Project Officer

Patricia Kwon

## Background

As part of the CARB-funded Fuel Cell Electric Bus Commercialization Consortium Project (FCEBCC), this project furthers the development of fuel cell technology for transit agencies nationwide. CTE partnered with Orange County Transportation Authority (OCTA) to incorporate ten (10) prototype fuel cell electric transit buses into daily operation, which reduces carbon emissions and air pollutants in the South Coast Air Quality Management District (South Coast AQMD).

## Project Objective

The purpose of the FCEBCC project was to help accelerate the commercialization of zero-emission buses. Besides working to reduce greenhouse gas emissions, strengthen the economy, and improve public health and the environment, this project was also intended to create a financial incentive for industries to invest in clean technologies and develop innovative ways to reduce pollution throught the cap-and-trade program.

## Technology Description

While battery-electric vehicle adoption has steadily increased, hydrogen fuel cell electric buses (FCEB) are also a necessary technology for the mass adoption of zero-emission technologies. FCEBs have an electric drive system that feature a traction motor powered by a battery. The energy supply for an FCEB is on board the bus, where hydrogen, stored in tanks, is converted to electricity using a fuel cell. The electricity from the fuel cell is used to recharge the batteries.

## Status

This project is complete and the final report is on file with the technical details of the project. The project did not encounter any fatal issues, although the project timeline was extended due to infrastructure deployment and bus delivery delays. The first bus was delivered to OCTA in September of 2018, the station was commissioned in January of 2020 and buses completed 40-hour testing in December of 2020.


*New Flyer Xcelsior XHE40 fuel cell bus at OCTA*

## Results

In the first year of deployment, the two fleets had an average fuel economy of 8.46 miles per kg, or roughly 9.56 miles per diesel gallon equivalent. This is about twice that of typical diesel and compressed natural gas (CNG) buses. **Figure 1** illustrates that the buses were able to offset a combined total of 413 Metric Tons CO2e compared to their respective baseline fleets (CNG for OCTA, diesel for AC Transit). The energy efficiency of the fuel cell buses was greater than 2x that of comparable CNG buses. However, perhaps the biggest obstacle to adoption of FCEBs seen as a result of this project is vehicle availability.

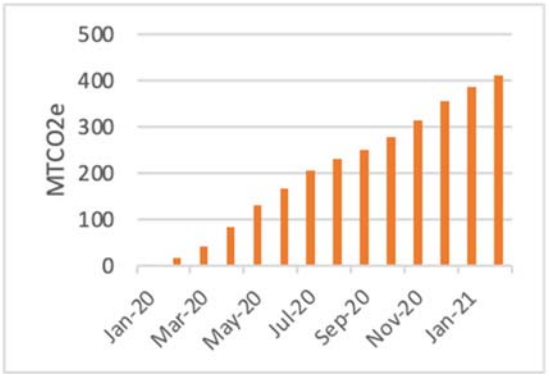


*Figure 1. Cumulative GHG Emission Reductions of FCEBs over first year of deployment, from February 09, 2020 through February 28, 2021.*

The average fleet availability through the first year of deployment was around 70%, with a maximum availability by month between the two fleets of 80%. Typical transit fleet operators target 85% vehicle availability in order to provide reliable service. As the technology matures and maintenance becomes more routine, FCEBs are expected to meet these targets.

## Benefits

A key challenge with the overall environmental impacts of fuel cell vehicles is the difficulty of sourcing hydrogen produced renewably. Despite this issue, the FCEBs were still able to provide environmental benefits by eliminating the release of key criteria pollutants such as nitrogen oxides (NOx), reactive organic gases (ROG), and particulate matter (PM10) compared to the agencies' baseline conventional diesel and CNG fleets. The expected annual emission reductions from the project application, and the actual realized reductions from the first year of deployment, are presented in the following table.

| | GHG (MTCO2e) | NOx (tons) | ROG (tons) | PM10 (tons) |
|---|---|---|---|---|
| *Expected* | *348* | *0.47* | *0.15* | *0.023* |
| Actual | 413 | 0.29 | 0.09 | 0.014 |

The expected emission reduction calculations assumed a general carbon intensity of the hydrogen fuel supply for California, while the actual calculations are based on the realized carbon intensity of fuel supply, which was significantly lower. The expected emission reduction calculations also assumed the FCEBs would travel the same number of miles as their baseline fleets. However, due to early maintenance issues, the buses did not meet the target mileage. The agencies expect the buses to meet their respective mileage targets as the maintenance becomes more routine.

Several other transit agencies in the South Coast Air Basin have also expressed interest in integrating fuel cell buses into their fleets including: Big Blue Bus, Foothill Transit, Long Beach Transit, OmniTrans, and SunLine Transit. Assuming these agencies are able to deploy 100 buses in total, replacing conventional diesel vehicles, this technology has the potential to reduce up to 73,450 MTCO2e in the South Coast Air Basin over the lifetime of the vehicles.

## Project Costs

The following table summarizes the project budget and actual expenditure.

| | | SCAQMD Share | Total |
|---|---|---|---|
| *Budget* | Buses | *$1,000,000* | *$13,338,000* |
| | Facility Upgrades | - | *$414,819* |
| | Station | - | *$5,486,895* |
| Actual | Buses | $1,000,000 | $12,978,382 |
| | Facility Upgrades | - | $989,377 |
| | Station | - | $5,403,097 |

## Commercialization and Applications

This project has already had an impact on the commercialization of FCEBs. There are two American original equipment manufacturers, New Flyer and ENC, that are Buy America compliant and these buses can therefore be purchased as part of other federal funding programs. New Flyer's XHE40 and XHE60 Xcelsior FCEBs also completed Altoona testing in early 2019, in parallel to this project, which made these buses eligible for purchase through federal, as well as California funding programs, which will only further their adoption. FCEB costs have also dropped steadily since 2004, when FCEB demo bus costs exceeded $3 million. OEM estimates for a 40-bus order are now around $1 million.

**South Coast AQMD Contract #18151** **December 2021**

# Develop & Demonstrate Battery Electric Switcher Locomotive

## Contractor

Rail Propulsion Systems

## Cosponsors

Coast Rail Services
South Coast AQMD
US Environmental Protection Agency (EPA)

## Project Officer

David Cook

## Background

Prior to the start of this project in 2018, there had been several attempts to develop and market battery-based hybrid or pure electric locomotives. Due primarily to the low energy density of the batteries used, new product reliability issues and poor cost benefit relative to the abundance of diesel locomotives available on the used market, these projects were unsuccessful in bringing a battery locomotive to market.

In 2017, following the implementation and subsequent EPA certification of the Blended Aftertreatment System (BATS) emissions reduction upgrade for existing passenger locomotives, Rail Propulsion Systems (RPS) proposed to South Coast AQMD a project for the design, development, and demonstration of a battery locomotive energy system. In 2018 South Coast AQMD notified RPS of available funding ($210,000) and RPS offered to provide the additional funds, access to the facilities, locomotive platform, and batteries required to support the project.

## Project Objective

The goal of this project was to utilize available funds from South Coast AQMD along with contributions from RPS to demonstrate and assess the viability of a battery locomotive conversion. Further, this project utilized existing "2nd life" batteries both for economic reasons and to assess viability for use of 2nd life batteries in certain applications as a deferment of, or an alternative to, costly and inefficient recycling of the batteries after being removed from first life services such as electric passenger vehicles. The project required RPS to design, develop and implement a large (300 kW-hr) battery system, power electronics, and related subsystems necessary to convert a diesel locomotive platform to a zero-emissions battery locomotive on a limited budget. Following the conversion, RPS was to assess and report on the performance of the battery locomotive followed by an option for additional in-service operation.

*Figure 1. The Simple Battery Switcher Locomotive*

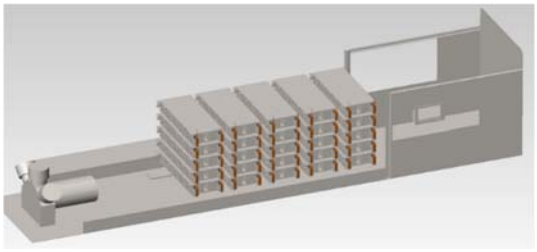

*Figure 2. Battery module cans in locomotive chassis*

## Technology Description

The RPS conversion package for the Simple Switcher project consists of an air cooled, modular, rack-based battery system, battery management, power electronics, motor driven cooling blowers and air compressor, and a lab view based locomotive control system. The

battery system contains approximately 300kW-hrs of second life Lithium-Ion batteries packaged into fifteen modules that could be individually removed and serviced or replaced. The battery management system consists of local monitoring units that measure the current, voltage and temperature of the batteries in a given module. This data is communicated to and monitored by a central controller unit that conveys data to the power electronics and locomotive control system to process fault indications and command power contactors to isolate specific modules if necessary. The power electronics receive inputs from the locomotive control system and battery management controller which are then processed to manage the flow of current from and too the battery system. The LabVIEW based locomotive controller receives command inputs from the operator control stand for throttle and direction and processes them into outputs to command the traction motor power contactors and the current input from the power electronics.

## Status

The Simple Switcher completed the performance test requirements of the project, successfully pulling trains of up to five loaded hopper cars in the railyard. Though the testing was successful, the operators on site assessed that, in its current configuration, the 1201 was not sufficient for daily in-service use. The compressed air system on the locomotive did not have sufficient capacity to support the flow and pressure requirements necessary to affectively charge and control the trainline braking system on consists of greater than five cars. Furthermore, the locomotive control system specified in this project was determined to be too simplistic and lacked the ruggedness and features necessary for daily switching use. These two items would need to be addressed through redesign or upgrades requiring additional funds beyond the scope of work of this contract.

## Results and Benefits

RPS successfully designed, manufactured and demonstrated that its battery locomotive conversion package is capable of powering a locomotive in place of a conventional internal combustion engine and generator package. The systems and related subsystems created in this project will be further improved and utilized on future RPS battery locomotives. An on-site charging station and related training for the operators were both successfully completed as well. Conversely, the budget constraints for this project did not allow for sufficient upgrade of other systems on the test locomotive resulting in a reduction in the amount of in-service testing that was ultimately conducted as part of the project. Primarily, a more robust compressed air system and a more capable locomotive control system are both required. As for the assessment of 2nd life batteries, the results of the testing found the project batteries to be sufficient in energy density and remaining cycle life to support the project locomotive. Ultimately, the labor involved with harvesting and repurposing the second life batteries may outway the perceived cost benefit when compared to sourcing new batteries of alternate compositions that have lower energy density but much higher cycle life performance. Ultimately, replacing diesel switcher locomotives with zero emissions alternatives has the potential to significantly reduce emissions and improve air quality in metropolitan areas particularly in EJ communities where most rail yards are located.

## Project Costs

| Participant | Funding |
|---|---|
| South Coast AQMD *(pass-thru from US EPA)* | $210,000 |
| Rail Propulsion Systems | $2,059,603 |
| **Total** | **$2,269,603** |

## Commercialization and Applications

The Simple Battery Switcher project provided a basis for requirements necessary to develop and market battery electric locomotives that would be acceptable to switching railyard operations and commuter rail service. Based on current battery and system development and manufacturing costs, it is estimated that battery switchers can be made available to the market for a retail cost of $4-6M and passenger locomotives for a cost of $12-15M for commuter applications. RPS is prepared to deliver battery switcher locomotives by early 2023 or sooner and battery commuter locomotives by 2025

**South Coast AQMD Contract #18397** **May 2021**

# Demonstrate Zero-Emission Cargo Handling Vehicle at Port of Long Beach

**Contractor**
City of Long Beach Harbor Department
Port of Long Beach (POLB)

**Cosponsors**
California Air Resources Board (CARB)
South Coast AQMD

**Project Officer**
Patricia Kwon

## Background

*C-PORT: The Commercialization of POLB Off-Road Technology (C-PORT) Demonstration* demonstrated the first zero-emission human-operated cargo-handling equipment (CHE) at the Port of Long Beach (POLB). C-PORT is focused on demonstrating zero emission battery electric yard tractors and top handlers since these represent 60% of the CHE utilized at the POLB. Utilizing battery electric yard tractors and top handlers would be a critical way to achieve the POLB's emission reduction goals as well as meeting the goals in the POLB's Clean Air Action Plan Update. The Clean Air Action Plan set a goal for zero emission CHE by 2030.

## Project Objective

C-PORT's objectives were to design, manufacture, and deploy three battery electric top handlers, one battery electric yard tractor, and one hydrogen fuel cell yard tractor across two port terminals with differing duty cycles; install sufficient infrastructure to support charging and operation of zero emission equipment in revenue service; and demonstrate the proposed equipment in revenue service for at least six months, collecting real-world data on equipment performance. The project also included important stakeholder and community engagement, workforce development and educational components.

## Technology Description

Three battery electric top handlers were manufactured as a collaboration between original equipment manufacturer (OEM) Taylor Machine Works, Inc., and the technology developer, BYD Motors, Inc. The battery-electric yard tractor was manufactured as a collaboration between Kalmar USA (OEM) and TransPower/Meritor, Inc. (technology developer). Each OEM provided its own 200kW proprietary charger at a one-to-one vehicle to charger ratio. The fuel cell yard tractor was manufactured as a collaboration between China National Heavy Duty Truck Group Co., Ltd. (OEM) and Loop Energy, Inc. (technology developer). Each of these vehicles represent the first zero emission technologies deployed from these OEMs. The fuel cell yard tractor was not demonstrated due to the lack of engineering documentation to fully address the POLB's safety and design concerns.


*Figure 1. Battery-Electric Kalmar Yard Tractor*

*Figure 2. Battery-Electric Taylor Top Handler*

## Status

C-PORT was a 38-month long project, commencing in June of 2018 and completed in August of 2021. A final report is on file with complete technical details.

## Results

The demonstration of battery electric top handlers and yard tractors was successfully completed. The battery electric yard tractor was able to meet the performance requirements at the Long Beach Container Terminal (LBCT). The battery electric top handlers were not able to meet the performance requirements for the long shifts at the SSA Marine Terminal at the POLB. However, the battery electric top handler deployed at the LBCT was suitable for the required work.

SSA Marine is a busy container terminal where the top handlers have a challenging duty-cycle and are required to operate two entire shifts. As such, operators found that due to the nature of the work and limitations around opportunity charging, the units did not maintain enough battery life to be comfortably used for the full two shifts. The greatest measured battery discharge (usage) during the demonstration was 91% during operations for 7.61 hours. The longest day for the tested SSA Marine diesel top handler was 12.43 hours. A full 29% of the days in which data was collected showed operations longer than 7.61 hours.

*Table 1. Daily averages for battery electric and diesel top handlers (top two) and yard tractor (bottom)*

| Daily Averages | Electric SSA Marine Top Handler #1 | Electric SSA Marine Top Handler #2 | LBCT Top Handler |
|---|---|---|---|
| Energy Use (kWh) | 382 | 301 | 63 |
| SOC Use (%) | 38 | 43 | 7 |
| Hourly Electricity Use Rate (kWh/hr) | 67 | 57 | 28 |
| Time Operational (Hours) | 5.2 | 4.7 | 2.6 |
| Speed (mph) | 3 | 2.5 | 0.5 |
| Distance (miles/day) | 18 | 13 | 1 |

| Daily Averages | SSA Marine Diesel Top Handler (a) | SSA Marine Diesel Top Handler (b) |
|---|---|---|
| Engine Load (%) | 41 | 22 |
| Engine Torque (%) | 27 | 41.3 |
| Time Operational (hours) | 5 | 4.8 |
| Speed (mph) | 1.6 | 1.4 |
| Distance (miles/day) | 7.4 | 8.5 |
| Fuel Consumption (gal/day) | 29 | 21.7 |

| | Electric Yard Tractor | Diesel Yard Tractor |
|---|---|---|
| Daily Averages | 95 kWh | 28% engine load |
| | 56% of SOC use | 57% engine torque |
| | 15 kWh/hr | 6.6 liters per hour of fuel per day |
| | 6 hours | 7 hours |
| | 8 mph | 5.5 mph |
| | 42 miles per day | 44 miles per day |

*Table 2. Greenhouse gas (GHG) and criteria pollutant emission reductions from the demonstration*

| | Net GHG Reductions based on the Demonstration Period | Estimated Avoided NOx Emissions | Estimated Avoided THC Emissions | Estimated Avoided PM Emissions |
|---|---|---|---|---|
| Units | MTCO2e | ton | ton | ton |
| SSA Top Handler 80367 | 49.0 | 0.32 | 0.00048 | 0.010 |
| SSA Top Handler 80368 | 44.3 | 0.28 | 0.00041 | 0.009 |
| LBCT Top Handler BYD | 17.4 | 0.09 | 0.00013 | 0.003 |
| LBCT Yard Tractor Kalmar | 11.1 | 0.03 | 0.00000 | 0.00000007 |
| **Total** | **121.7** | **0.72** | **0.00103** | **0.022** |

## Benefits

The project demonstrated that the vehicles were able to provide the expected operational benefits (GHG savings/operating hour). Based on the POLA & POLB 2019 Emission Inventories, deploying battery electric technologies across the entire fleet of yard tractors and top handlers would be equivalent to reducing annual emissions by 237,186 metric tons of $CO2_e$, 445.1 tons of $NO_x$, 85.8 tons of THC, and 7.2 tons of PM10.

## Project Costs

The total project cost was $7,784,086. The California Air Resources Board (CARB) awarded $5,339,820 through its Off-Road Advanced Technology Demonstration Project grant program. Of the required match funding, South Coast AQMD provided $350,000 and the balance of $2,184,266.74 was funded by the POLB.

## Commercialization and Applications

The project provided an important first step in full commercialization of these, and other battery electric CHE. Battery electric off-road vehicles, mobile equipment, and CHE are rapidly developing markets, and the knowledge gleaned from C-PORT will be applied to future products developed by Taylor and Kalmar.

Taylor has reported that the next generation of battery electric ZLC-996 series top handler will be a commercialized unit which will feature technology directly evolved from the precommercial C-PORT unit. Kalmar has reported that the information gleaned from C-PORT will be used to improve the next generation of battery electric yard tractors going into production in late 2022.

**South Coast AQMD Contract # 20248** **January 2021**

# Economic and Workforce Impact Analysis of Electric Revolution in Southern California

## Contractor

The Los Angeles County Economic Development Corporation

## Cosponsors

Southern California Edison
Southern California Association of Governments (SCAG)
Los Angeles County Metropolitan Transportation Authority (LA Metro)
Los Angeles Department of Water and Power
South Coast AQMD

## Project Officer

Seungbum Ha

## Background

The Energizing an Ecosystem: The Electric Mobility Revolution in Southern California (hereafter the LAEDC Electric Vehicle or EV report) was a collaboration between the LAEDC and five regional partners to analyze the electric vehicle ecosystem in the state of California as a whole and the five-county (Los Angeles, Orange, Ventura, San Bernardino and Riverside counties) Southern California region specifically. The purpose of this report was to build on existing LAEDC industry cluster development around electric mobility in addition to LAEDC research expertise in industry cluster and workforce analysis. This report was commissioned as of September 2019.

## Project Objective

The objective of this project was to define and assess the size and scope of the electric vehicle cluster in California from the perspective of firms and employment. The report was also to provide analysis of the scope of electric vehicle (EV) adoption thus far in the state; state and local goals and resources for adoption; the environmental concerns motivating adoption; and policies and programs that could be enacted to further the industrial and workforce development of the EV cluster in California.

## Technology Description


The final LAEDC Electric Vehicle report is divided into five sections followed by a conclusion.

The introductory stage qualitative sets the framework for a return of the automotive industry in California in the form of electric and alternative energy mobility. This section also includes a summary of the major finders of the report.

Section two of the report provides an asset mapping of all major firms in the state of California operating in the EV cluster. These firms were broken into three broad categories: passenger (light duty) vehicle companies; bus, truck, and tram companies; and charging and alternative fuel companies. Each category also included a summary of pertinent public and private initiatives and resources.

The third section focuses on the scope of EV deployment in the 5-county Southern California region, with an emphasis on City of Los Angeles and County of Los Angeles strategic plans for EV adoption and the environmental concerns the single out Southern California as a region for concentrated EV adoption and industry cluster development.

Section four provides a definition of the electric vehicle ecosystem across 17 industries as defined by the North American Industry Classification System (NAICS). Estimates and forecasts are given

for the electric vehicle cluster and for specific occupations in the cluster. Finally, consideration is given to jobs that might be lost as result of the EV cluster's growth.

The final section of the report recommends certain policies, such as new commissions, incentives, and data tools, to motivate the continued growth and success of the EV cluster in California.

## Status

This report was released publicly on March 4th, 2020, at the 2020 Veloz Forum in Sacramento, California.

## Results

Major Findings

| | | |
|---|---|---|
| New EVs to Reach 7 million by 2030 | | |
| Annual New Registrations | 565,300 | |
| Annual % Change | 25% | |
| EV Companies in California | | |
| Passenger Vehicle Companies | | |
| *Headquarters* | *13* | |
| *Design & Tech Studios* | *19* | |
| *Manufacturing* | *4* | |
| *R&D* | *6* | |
| Bus, Truck & Tram Companies | | |
| *Headquarters* | 16 | |
| *Other Offices* | 17 | |
| EV Charging and Alternative Energy Companies | | |
| *Headquarters* | 31 | |
| *Other Offices* | 6 | |
| EV Employment | 2018 | 2023f |
| California | 275,600 | 312,000 |
| SoCal | 119,200 | 152,200 |
| EV Wages | EV Jobs | Average |
| California | $91,300 | $68,500 |
| SoCal | $80,900 | $54,900 |

Estimates by LAEDC

## Benefits

This report is intended to enhance the understanding of the EV cluster in California by estimating the scope of business development in the cluster; the extent to which the cluster does and can provide for meaningful job creation; and advocating for policies and programs to enhance EV adoption and EV-related economic development. This report should aid both public and private sector actors as a data tool demonstrating the significance of the EV ecosystem as a catalyst for long-term economic growth. These anticipated benefits have not changed from the original inception and commencement of this project.

## Project Costs

*Project Costs by Funder*

| *Contributor* | *Amount* |
|---|---|
| *SoCal Edison* | *$35,000* |
| *LA Metro* | *$25,000* |
| *SCAQMD* | *$10,000* |
| *LA DWP* | *$25,000* |
| *SCAG* | *$25,000* |
| *Total* | *$120,000* |

Project Costs by Item

| Item | Task Description | Cost |
|---|---|---|
| Module 1 | EV industry landscape analysis | $16,500 |
| Module 2 | Regional EV supply, demand and externality assessment | $22,040 |
| Module 3 | Regional workforce impact analysis | $34,460 |
| Module 4 | EV Policy Analysis | $22,000 |
| Infographic printing (estimate) | | $500 |
| Copy editor | | $2,000 |
| Rpt design-(estimate) | | $7,500 |
| LAEDC Strategic Initiatives | | $15,000 |
| Total | | $120,000 |

## Commercialization and Applications

This report is the first of its kind in the state of California in that it takes a comprehensive look at the electric vehicle ecosystem from an industry and workforce standpoint. Most other reports analyze the scope of vehicle adoption and related incentives from a consumption standpoint. This report was created to be a public resource to all parties interested in electric vehicles as a unique industry cluster and who are invested in seeing this cluster grow not just to accomplish environmental policy aims but for economic development and job creation goals.

**South Coast AQMD Contract # 20122** **July 2021**

# Develop and Commercialize a Near-Zero Natural Gas Conversion System for On-Road Medium-Duty Vehicles

## Contractor
Landi Renzo USA Corporation (LRUSA)

## Cosponsors
South Coast AQMD
US Environmental Protection Agency (EPA)
California Air Resources Board (CARB)

## Project Officer
Joseph Lopat

## Background
Landi Renzo approached South Coast AQMD in August 2018 to discuss a potential partnership regarding the development of a near-zero emissions 7.3L compressed natural gas (CNG) engine for the automotive industry. Landi Renzo has significant experience in the field of emissions having been a manufacturer of ecological fuel systems and engines for nearly 70 years. Given the strong and growing interest in near-zero nitrogen oxide (NOx) emission engines for commercial use, there is a robust market potential for CNG engines for medium-duty vehicles. CNG is plentiful and can be sourced domestically as renewable natural gas (RNG) is a strong contributor in combating climate change. Based on previous studies it has been shown that fleets using CNG engines can meet air quality regulations more cost effectively.

## Project Objective
The objective of this project was to advance existing CNG engine and aftertreatment technologies to achieve engine NOx emission levels that are at least 90% lower than 2010 heavy-duty NOx emission standards. With this goal in mind, the objective was to modify a recently introduced 7.3-liter gasoline engine and demonstrate a 0.02 g/bhp-hr NOx CARB and EPA certified CNG engine for medium-duty vehicle applications. The initial plans involved changing controller software and utilizing the latest catalyst technology.

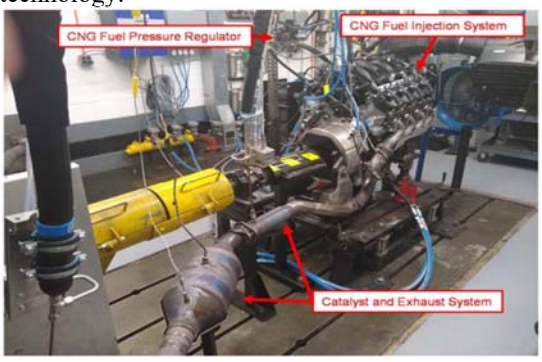


*Figure 1: LRUSA / Ford 7.3L CNG Engine on Dynamometer*

## Technology Description
The LRUSA CNG system consisted of a CNG fuel system containing a pressure regulator, engine feed lines, high pressure filter and supply, and fuel rail and injectors. All of these were installed on a Ford 7.3-liter engine within a Ford F-450 vehicle and a Ford E-450 vehicle. An original equipment manufacturer (OEM) specified catalyst and exhaust system was used. It was acknowledged that there were other potential projects of this nature that could involve modifications to the exhaust aftertreatment system.

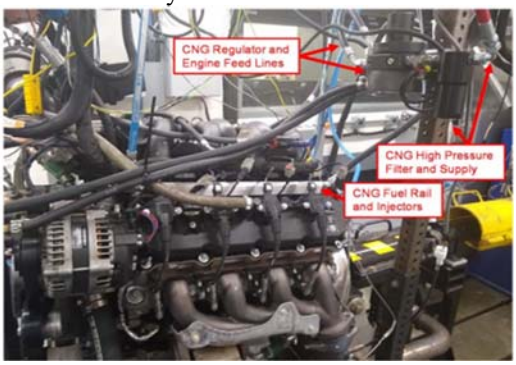


*Figure 2: Close up of LRUSA CNG Fuel System Components*

## Status

The LRUSA 7.3-liter CNG engine project completed all eight (8) tasks associated with a successful project per the South Coast AQMD contract. It should be noted that the ultra-low NOx goal of 0.02 g/bhp-hr was not achieved with the 7.3L engine's stock exhaust aftertreatment system. The certification results of 0.038 g/bhp-hr still resulted in achieving a lower NOx standard.

## Results and Benefits

In January 2020, Landi Renzo USA completed engine durability and OEM compliance testing of the Ford 7.3-liter CNG engine. The test satisfied the requirements specified by Ford in their Qualified Vehicle Modifier Bulletin Q185-R1 (Found at https://fordbbas.com/bulletins). Engine emissions development, emissions testing, and on-board diagnostics testing was completed per the test plan arranged with EPA in early February 2020. On March 25, 2020, the EPA issued LRUSA a Certificate of Conformity with the Clean Air Act for the Ford 7.3-liter CNG engine. In April 2020, the demonstration vehicle was completed and shipped to the Ford wind tunnel in Allen Park, MI to undergo chassis-level durability and OEM compliance testing. The vehicle was also reviewed and scored by Ford QVM staff to ensure that the design, build, and components meet or exceed the performance and quality standards set forth by the QVM program. After the OEM chassis-level testing was completed, the vehicle returned to California to continue on-road testing and development. Official CARB testing in our CFR 1065 compliant lab with CARB certification fuel was completed June 2020, and achieved NOx emissions of 0.038 g/bhp-hr. Despite all the delays caused by the Covid-19 pandemic, LRUSA received a conditional CARB EO November 17, 2020.

## Project Costs

| Participant | Funding |
|---|---|
| South Coast AQMD | $600,000 |
| Landi Renzo USA | $900,000 |
| **Total** | **$1,500,000** |

## Commercialization and Applications

Landi Renzo and Ford initially identified two possible development paths to meet the near-zero NOx target using either 7.3-liter chassis cert catalyst systems (used on lower gross vehicle weight rating chassis such as the MY2021 E-350) or pulling forward the production of Ford's catalyst system for an ultra-low NOx 7.3-liter gasoline engine for use in a Landi near-zero NOx system. Because of the time and resource constraints and the realities of working around the Covid-19 crisis, LRUSA was limited to utilizing the stock exhaust aftertreatment components for testing. LRUSA believes that with an improved aftertreatment system and further calibration development, a CNG system based on the 7.3-liter engine could achieve the goal of a near-zero NOx system. The Landi Renzo USA 7.3L CNG/RNG engine is currently the cleanest engine available for medium duty vehicles and allowed several fleets to meet their sustainability goals. These fleets include shuttle bus vehicles, food and beverage delivery trucks, general delivery vehicles etc. The Landi Renzo USA 7.3L engine covers a wide array of vocational vehicles that operate in high non-attainment areas, such as airports (e.g,. shuttle buses). This is particularly key as Landi Renzo exclusively supplies to the #1 bus dealer in the United States.

**SCAQMD Contract # 17352** **June 2021**

# Develop and Demonstrate Vessel Performance Management Software and Equipment

## Contractor

California State University Maritime Academy
SkySail GmBH
Krohne Messtechnik GmBH
Alliance Marine Inc.

## Cosponsors

Bay Area Air Quality Management District
South Coast AQMD
Cal State University Maritime Academy Maritime Administration

## Project Officer

Naveen Berry

## Background

This project, funded by the Bay Area Air Quality Management District (BAAQMD) and South Coast AQMD along with others, constituted much of the first phase of a proposed multi-year project to incorporate and evaluate emissions reduction strategies. The SkySail V-PER project was associated with the California State University Maritime Academy's (Cal Maritime) Golden Bear Research Center (GBRC) and centered on the 500-foot long United States Training Ship (USTS) Golden Bear.

## Project Objective

The V-PER performance management package, a novel marine monitoring system, focused on a decrease in exhaust emissions associated with decreased fuel consumption. The package was to be installed and qualitatively evaluated on the USTS Golden Bear by Cal State Maritime staff. This required associated upgrades be made to fuel sensors essential to the operation and evaluation of that equipment. Along with these upgrades, a baseline emissions qualitative profile for the vessel was developed and shared with sponsors. Though it is understood that the deliverable for this phase will be a qualitative evaluation, it is hoped that the work will lead to additional phases and a more lengthy quantitative assessment phase.

## Technology Description

The V-PER Performance Monitoring System receives input from various peripheral instruments and measurements i.e. fuel meters, anemometers, shaft torque, gyro compass, and engine/ship speed. The integration of the existing navigation, weather, and engineering data, combined with data from the new V-PER inertial measuring unit (IMU) are used to reflect real-time conditions experienced by the vessel such that the Master can make more informed decisions on economically and environmentally sound operations via course and speed selection or vessel trim.

## Status

The installation of commercially available marine monitoring equipment combined with standardized emissions testing practices resulted in a highly complex logistical process impacting the original performance period objective. The conceptual phase of securing extramural funding support occupied most of 2017. Additionally, challenges presented themselves in acquisitions, software installation and vessel logistics which consumed all of 2018 and much of 2019. Control system electronic communication issues were difficult to identify and address which caused a delay in the finalization of this project. Though functional, we anticipate full capability to be realized in the spring of 2020 with significant sea time usage by the summer of 2020 on our blue water cruise on the Training Ship Golden Bear.

*Picture of technology that has been supported with SCAQMD/Technology Advancement cosponsorship, if applicable. The picture, preferably a photograph, should clearly illustrate the technology. The size of the image should be about 3x3 to fit this two column format. The picture of the technology should be positioned on the front page*

## Results

Though the time frame for the project extended beyond what was originally anticipated, it is now

moving toward a successful conclusion. The project will continue with a longitudinal evaluation of SkySail V-PER along with additional assessments being made.

Location of the primary Human Machine Interface (HMI) for the SkySail V-PER in a central location adjacent to engine and navigational controls will provide the Master and Bridge personnel with convenient real-time feedback on propulsion responses to course and speed changes as well as adjustments to vessel loading (Figure 1).

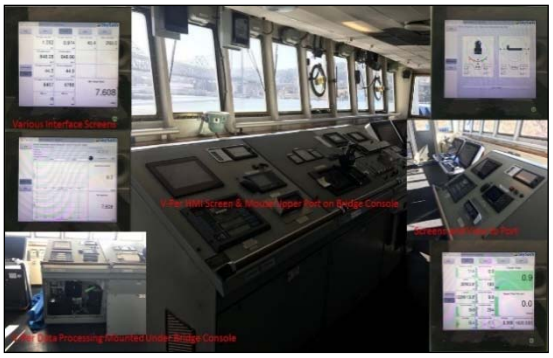

*Figure 1: V-PER Installed on Training Ship Golden Bear Bridge*

The HMI display is a clean and clear screen providing the viewer dimmable access to well laid out and intuitive pages. If there is any initial criticism of the provided display, it is that it is not a touch screen and requires a separate mouse or track-ball plus keyboard for input. Given current hardware technology and availability, this lack of a more cleanly integrated HMI component is somewhat surprising. Several of the intended users have expressed disappointment that a mouse and keyboard connection had to be provided on the console. Final assessment of this interface will be made after several more months of use through mid-2020.

Though the HMI provided an attractive, single-screen interface for the speed, wind direction, vessel trim and course, there was no added value given that all this data was available at nearly the same location on the bridge. As a monitoring tool, it is understood that further efforts would be required to gain engine and fuel data to fully realize the system potential.

All involved parties eagerly anticipate availability for the upcoming 2020 summer cruise in order to enhance vessel management in what is primarily an optimization effort. The Master and Chief Engineer, along with their crew must take port schedules, weather, fuel consumption and regulatory requirements into account in finding the best and safest path for delivering their cargos or completing a mission. These new tools and immediate feedback promise to greatly enhance that optimization capability.

## Benefits

The primary benefit of the V-PER will be the ability to accurately monitor and assess vessel conditions affecting fuel consumption and associated exhaust emissions. Location of the primary HMI for the SkySail V-PER in a central location adjacent to engine and navigational controls will provide the Master and Bridge personnel with convenient real-time feedback on propulsion responses to course and speed changes as well as adjustments to vessel loading. This real-time data, provided in a clear and easy-to-read format, will likely be an appreciated tool in the day-to-day voyage planning.

## Project Costs

The project costs totaled $135,230.14. Of this amount, South Coast AQMD and BAAQMD each paid $50,086. CSU Maritime Academy had a cost share of $35,058.14. The project came in at $2,194.14 over budget. This additional amount was cost shared by CSU Maritime Academy. The cost overage is a result of unexpected customs duties of $1,491.08, along with supplies and materials, and the associated overhead costs.

## Commercialization and Applications

The SkySail V-PER performance management software system and associated wind energy propulsion equipment are commercially available, but in limited use. The intent of this project was to demonstrate and evaluate the commercial advantages that might be achieved by shipowners and operators employing these and similar technologies. Our detailed benchmarking of significant installation challenges provided to our sponsors should be of significant value to entities interested in acquiring and utilizing performance management systems and will help inform commercial or market viability of the products. Further detailed quantitative assessments and results identifying reduced consumption and emissions results will ultimately determine the market competitiveness of this system.

**South Coast AQMD Contract #19208** **July 2021**

# Conduct Emission Study on Use of Alternative Diesel Blends in Off-Road Heavy-Duty Engines

## Contractor
University of California Riverside, Center for Environmental Research and Technology.

## Cosponsors
California Air Resources Board (CARB)
South Coast AQMD

## Project Officer
Joseph Lopat

## Background
On-road and off-road diesel engines have long been recognized as major sources of oxides of nitrogen (NOx), particulate matter (PM) and other toxic pollutants. The use of alternative diesel fuel formulations, such as renewable diesel will address California's efforts in reducing NOx and PM emissions from diesel engines and improve local and regional air quality. Although there are many studies characterizing combustion performance and emissions of renewable diesel and biodiesel, there is a lack of literature on the emissions characterization of renewable diesel-biodiesel blends. This is particularly true for blends in higher cetane diesel fuels, such as the California Air Resources Board (CARB) Ultra Low Sulfur Diesel (ULSD), which is the focus of CARB's Low Emission Diesel (LED) regulatory effort. There is also limited information available on the impacts of renewable diesel and renewable diesel blends in new technology diesel engines that are equipped with diesel particulate filters (DPFs) and selective catalytic reductors (SCR) or in off-road engines, where the benefits of renewable diesel fuel might be more long lasting due to their less stringent emissions standards over time. The characterization of toxic pollutants from these fuel blends is also limited and needs to be expanded.

## Project Objective
The goals of this study were to confirm and quantify the NOx, PM, ultrafine particles, and polycyclic aromatic hydrocarbons (PAHs) and their nitrated derivatives (nitro-PAHs) from the renewable diesel use in legacy off-road engines, as well as the potential benefits of renewable diesel in modern on-road engines with robust aftertreatment controls.

## Technology Description
For this program, 2 heavy-duty diesel engines were used, including a legacy off-road John Deere engine without aftertreatment controls and a modern on-road Cummins engine equipped with diesel oxidation catalyst (DOC), DPF, and SCR systems. The off-road engine is typically used for construction applications. The on-road Cummins engine was selected because Cummins represents a good share of the California diesel engine market in Class 7 or Class 8 trucks. The test fuels included a reference CARB ULSD, used as a baseline fuel, a neat 100 percent or 99 percent renewable diesel fuel (R100/R99), a blend of 65 percent renewable diesel and 35 percent biodiesel (R65/B35), and a blend of 50 percent renewable diesel and 50 percent biodiesel (R50/B50). Testing was performed using federal testing procedures (FTP), the non-road-tested cycle (NRTC), and steady state ramped modal cycles. For the John Deere engine, a 5-mode D2 ISO 8718 cycle was used.

## Status
This project was successfully completed in March 2021. Comprehensive data analysis for the toxic pollutants was completed in May 2021.

*Figure 1: John Deere off-road engine in testing lab*

## Results
Results showed important NOx reductions with renewable diesel for the off-road engine compared to CARB ULSD. The R65/B35 showed no statistically significant differences compared to the CARB ULSD for the D2 and for the NRTC. The R50/B50 showed statistically significant increases in NOx emissions for the D2 and NRTC compared to the CARB ULSD. For the on-road

Cummins engine, no statistically significant differences were seen between the CARB ULSD and R100 over either the FTP or ramped modal cycles (RMCs). R65/B35 and R50/B50 showed statistically significant increases in NOx compared to CARB ULSD. The use of renewable diesel will likely provide NOx emission benefits from older construction engines with no aftertreatment and will not adversely affect air quality and ozone formation from newer on-road engines.

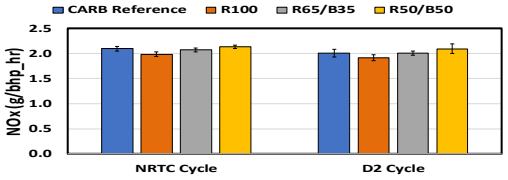


*Table 1:NOx emissions for the John Deere engine*

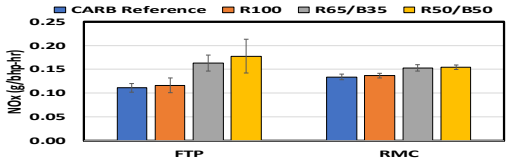


*Table 2: NOx emissions for the Cummins engine*

For the John Deere engine, PM emissions showed large reductions with R100 and the biodiesel blends. For the Cummins engine, PM mass emissions were found in very low levels due to the presence of DPF. Total and solid particle number emissions were generally lower for the biofuels compared to CARB ULSD. The biodiesel blends resulted in larger reductions of total and solid particle number emissions due to the oxygen content in the biodiesel molecule.

Formaldehyde and acetaldehyde were the predominant aldehydes in the tailpipe for both engines. Trends for lower carbonyl emissions were observed for the biofuels. Total gas- and particle-phase PAH emissions were significantly lower for the John Deere engine compared to the DOC/DPF-equipped engine. This finding suggests that modern heavy-duty diesel (HDD) engines equipped with robust aftertreatment controls will reduce the emissions exposures from toxic, mutagenic, and carcinogenic compounds that contribute to adverse health effects. For both engines, the use of biofuels showed reductions in particle- and gas-phase PAH emissions compared to CARB ULSD. These reductions were more pronounced with the higher biodiesel blends. Nitrated PAH emissions were seen in significantly lower levels than their parent PAHs. Nitrated PAH emissions showed mixed results with the biofuels with no consistent fuel trends. However, nitro-PAH concentrations for the DPF-equipped Cummins engine were relatively higher than those of the John Deere engine without aftertreatment controls. This phenomenon was due to the de-novo formation of nitro-PAHs inside the DPF system via nitration reactions of the parent PAHs, suggesting that DPF-equipped engines may form elevated emissions of the highly toxic and carcinogenic nitro-PAHs.

Overall, renewable diesel and its blends with biodiesel showed lower carcinogenic potential, as well as reduced ozone forming potential compared to CARB ULSD. Our findings suggest that these fuels can provide a strong pathway for emissions and emissions toxicity reductions from heavy-duty diesel applications in the South Coast Air Basin.

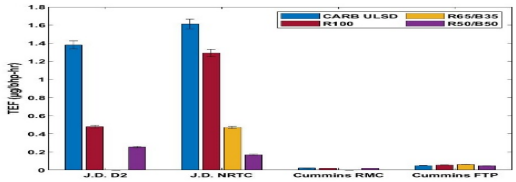


*Table 3: Total grams produced per brake HP per hour*

## Benefits

It is important to understand the emissions from current and older HDD engines with renewable diesel. Our findings suggest that these fuels can provide a strong pathway for emissions and emissions toxicity reductions from heavy-duty diesel applications in the South Coast Air Basin. This study provides a roadmap for the widespread use of these fuel formulations not only for on-road diesel engines, but also for off-road applications including construction, agricultural, marine, and locomotives. These fuels can also help achieve CARB LED standard and contribute to the Governor's diesel emissions reduction target for California.

## Project Costs

| | SCAQMD |
|---|---|
| Testing & Reporting | $261,000 |

## Commercialization and Applications

It is expected that liquid renewable diesel fuels will play a major role in heavy-duty transportation for in off-road diesel applications. Their use will likely provide emissions and air quality benefits and will likely reduce emissions toxicity and adverse health effect.

**South Coast AQMD Contract # 20058** **September 2021**

# Evaluate Meteorological Factors and Trends Contributing to Recent Poor Air Quality in the Basin


## Contractor

University of California, Riverside

## Cosponsors

South Coast AQMD

## Project Officer

Sang-Mi Lee


## Background

The South Coast Air Basin (SCAB) of California has achieved tremendous reductions in ozone and particulate matter (PM, particularly fine PM, or PM2.5) levels over the last decades but has recently experienced a leveling off of the reductions and even an uptick in ozone in 2016 and 2017. The immediate question is why? Also, how much of this uptick is related to meteorological factors versus a response to emissions changes from mobile and stationary sources?

## Project Objective

The main objective of this project was to find why the ambient ozone and PM2.5 levels in the South Coast Air Basin have plateaued in the past few years and to provide a robust understanding of the likely causes that led to the worsening of ozone and PM air quality in recent years. The results from the study will assist staff in better understanding the complex dynamics of air pollution and weather impacts and also help to develop more effective control strategies to improve air quality under changing climate conditions.

## Technology Description

The study employed long-term records of air quality data, emissions inventories and detailed meteorological information (from observations and models) to separate the contribution of meteorology and climate impacts from the effects of emission changes due to cleaner technologies and air quality agencies' regulations. The study also used satellite-derived data on trace species loadings (e.g., nitrogen dioxide (NO2), formaldehyde (HCHO) and ozone (O3)) in conjunction with modeling techniques, which include more traditional chemical transport modeling and meteorological detrending approaches, as well as "big-data" (e.g., machine learning) approaches.

## Status

The study was expected to be complete by September of 2021. A no-cost extension was granted to accommodate the setbacks in research progress due to the COVID pandemic. Progress reports have been periodically provided to South Coast AQMD, and most tasks have been completed. The final report is being finalized and will be provided to South Coast AQMD staff for final review.

## Results

Preliminary results show that temperature is the dominant parameter that drives ozone high concentrations. Four different approaches were used in this study. The linear regression models, chemical transport models, and machine learning techniques indicate that higher temperatures lead to higher ozone concentrations, and as a result, general global warming is increasing the potential for high ozone events. High temperatures are also generally accompanied with stagnation that promotes pollutant concentration buildup. Meteorological conditions during La Nina phenomenon also contribute to a higher concentration of ozone. The effect of meteorological conditions on PM2.5 concentration is more widely variable, as higher temperatures may lead to lowering ammonium nitrate concentrations while increasing other particulate matter components.

Using the four different approaches to accomplish the main objective provides a higher level of confidence in the findings of the study. Results are

consistent and complementary among the four approaches.

## Benefits

The project results provide a comprehensive analysis on the factors that lead to increasing ozone concentrations despite the decrease in ozone precursor emissions. While there are uncertainties associated with the use of any one of the analysis techniques employed in the study (regression modeling, chemical transport modeling, satellite observations, machine learning), results improve our understanding of why ozone may have increased in the past few years.

## Project Costs

The total cost of the study was $188,798. The first three quarterly reports were provided earlier in 2020, and payment for $113,277 was processed. The remaining $75,521 will be paid once the final report is submitted and approved.

## Commercialization and Applications

This report will be posted on South Coast AQMD's website and made available to the general public. Several organizations have already expressed high interest in learning the results and conclusions of the report. This report will help South Coast AQMD and the people living in the South Coast Air Basin to better understand ozone dynamics and the meteorological parameters that affects smog formation.

**South Coast AQMD Contract # 15635** **September 2021**

# ZECT II-Development and Demonstration of 1 Class 8 Fuel Cell Range Extended Electric Drayage Truck

## Contractor
Center for Transportation and the Environment (CTE)

## Cosponsors
US Department of Energy (DOE)
California Energy Commission (CEC)
Ports Technology Advancement Program (TAP)
South Coast AQMD

## Project Officer
Seungbum Ha

## Background
The Fuel Cell Technologies Office (FCTO) is a key component of the Department of Energy's (DOE) Energy Efficiency and Renewable Energy (EERE) portfolio. The FCTO aims to provide clean, safe, secure, affordable, and reliable energy from diverse domestic resources, providing the benefits of increased energy security and reduced criteria pollutants and greenhouse gas (GHG) emissions.

In April 2014, DOE released DE-FOA-0001106: Zero Emission Cargo Transport II (ZECT II) Demonstration. This funding opportunity sought "to focus on accelerating the introduction and penetration of Zero Emission Carbon Transportation II (ZECT II) technologies." The FOA defined ZECT technologies as, "those that produce zero emissions from the transport vehicle (or other equipment) which propels cargo for all or large portions of their duty cycle.".

South Coast AQMD wrote a proposal combining the DOE funding with funding from the California Energy Commission (CEC) and the Ports Technology Advancement Program (TAP). South Coast AQMD proposed to build and demonstrate trucks from three different teams as well as provide a single fueling infrastructure for all three teams. The Center for Transportation and the Environment (CTE) partnered with BAE Systems; Kenworth, a division of PACCAR; Total Transportation Services (TTSI); Ballard Power Systems; and World CNG to form one team for this project. The other two teams were led by Transpower and US Hybrid.

In February 2016, South Coast AQMD executed a contract with CTE to lead the team developing the Kenworth/BAE truck as well as the fueling infrastructure for all three teams.


*Figure 1: Zero Emission Electric Drayage Truck with Fuel Cell Range Extender*

## Project Objective
The goal of this project was to build a robust zero-emission, heavy-duty Class 8 drayage fuel cell truck that can effectively demonstrate reliable service transporting up to 80,000 lbs. on multiple service routes with differing duty cycles. The intent was to leverage the success of tier one technology companies experienced at building fuel cell, hybrid-electric propulsion systems for heavy-duty transit buses. Working in partnership with Kenworth, a leading heavy-duty truck original equipment manufacturer (OEM), the project engineered and built a prototype vehicle that was then demonstrated and evaluated over a 24-month deployment on regularly scheduled routes serving outlying communities off the I-710 freeway in Los Angeles. Performance and operations data collected during the demonstration phase will help identify the pathways and barriers to commercialization.

## Technology Description
The purpose of this project is to accelerate deployment of zero-emission cargo transport technologies that reduce harmful diesel emissions, petroleum consumption, and GHGs in surrounding communities along goods movement corridors. To achieve this purpose, the project team developed a zero-emission battery electric Class 8 drayage truck

with a hydrogen fuel cell range extender. This prototype truck then demonstrated its use in goods movement operations between the Ports of Los Angeles and Long Beach and the near-dock rail yards and warehouses.

To develop the initial truck prototype, the project team adapted a hybrid electric fuel cell propulsion system that is currently used for transit buses so that it was suitable for a Class 8 truck used in a drayage application. The power output of the electric drive train was two electric motors with 270 kW combined power output, comparable to a current Class 8 truck engine's power output. One absorption chiller (AC) traction motor was mounted on each rear drive axle, and the electric drive train was designed to be fully redundant. The vehicle operates using 100 kWh Li-ion batteries, engaging the 85 kW (net) fuel cell system only when the batteries reach a specified state-of-charge (SOC). The hydrogen storage capacity is 30 kg (25 kg usable), which will provide approximately 112 miles of range between refueling.

## Status

The team achieved the primary goal of the project, which was to make significant strides developing zero-emission technologies for heavy-duty Class 8 trucks that would accelerate the improvement of air quality in southern California transportation corridors.

## Results

Kenworth and BAE Systems collaborated to develop the preliminary vehicle design including mechanical layout and installation drawings. The preliminary design was based on the defined operational requirements as well as duty cycle information from a diesel-equivalent vehicle. To finalize the vehicle design, a combined critical design review and pre-production meeting was held at Kenworth Research and Development Center in Renton, WA.

*Figure 2: Overview of truck layout*

Air Products' mobile refueler performed consistently throughout the demonstration, but mobile fueling infrastructure adds cost, time, and risk that can only be justified for a small, temporary demonstration. An advantage for larger future deployments and for the heavy-duty vehicle market in general is investing in permanent on-site infrastructure. This will contribute to the cost-reduction goals achieved by mass deployment and shared resources. Expanding fueling infrastructure also guarantees the demand that hydrogen suppliers require to lower costs.

## Benefits

The specific design and development assessments and observations included the determination that the supply base is not yet ready for this technology. It was observed that the routing design is integral to the chassis layout, that there are currently too many connections (high voltage, low voltage, CAN, cooling, etc.), and that the high voltage interlocks are vital for functional safety. It was noted that minimizing to two voltages was difficult, cooling was a big challenge, and the battery management systems need self-diagnostics and auto-recovery. It was also determined that the power electronics firmware must become more automated, that human-machine-interface (HMI) is critical and that the procedures and infrastructure for vehicle testing are complex.

## Project Costs

The total project cost was $7,109,384. South Coast AQMD provided $821,198. An additional $3,554,691 was provided by the DOE. The CEC provided $2,400,000 and $283,495 was provided by the Port's TAP program. The contractor provided the remaining $50,000 as their cost share.

## Commercialization and Applications

Overall, the ZECT demonstration has laid the foundations for the commercialization of fuel cell electric heavy-duty trucks by successfully deploying the vehicle into TTSI's daily drayage operations. The lessons learned from demonstrating this prototype vehicle have informed improvements to both vehicle system design and manufacturing processes. By utilizing permanent on-site fueling infrastructure or existing public fueling infrastructure, increasing availability of off-the-shelf components, and achieving gains in efficiency of next generation technology, fuel cell electric trucks can enter the market at costs competitive with gasoline and diesel equivalents. The penetration of these zero-emission technologies into the heavy-duty market will maximize the impact to emissions reductions and help achieve local air quality targets on time.

**South Coast AQMD Contract #21336** **December 2021**

# Participate in California Fuel Cell Partnership for CY 2021

## Contractor
Frontier Energy Inc.

## Cosponsors
South Coast AQMD
Automakers, energy companies, local, state federal public agencies, technology companies, universities, transit agencies and others.

## Project Officer
Lisa Mirisola

## Background
Originally established with eight members in 1999, the California Fuel Cell Partnership (CaFCP) is a collaboration in which private and public entities are independent participants. It is not a joint venture, legal partnership, or unincorporated association. Therefore, each participant contracts with Frontier Energy (previously Bevilacqua-Knight, Inc./BKi) for their portion of CaFCP administration. South Coast AQMD joined the CaFCP in April 2000. The CaFCP currently includes 17 Champion members (executive board level), 9 Champion members (steering team level), and 44 associate members. The focus is on furthering commercialization of fuel cell vehicles, fueling infrastructure technologies and renewable and decarbonized hydrogen production.

## Project Objectives
The goals for 2021 included the following:
- Identify technology challenges and information gaps within the state's hydrogen station network, and work collaboratively with members to advance the market
- Coordinate and collaborate on approaches to achieving an initial 200 hydrogen stations expanding to a state-wide sustainable infrastructure network in California
- Identify new concepts and approaches to initiate exponential station network growth for light- and heavy-duty applications
- Communicate progress of fuel cell electric vehicles (FCEVs) and hydrogen to current and new stakeholder audiences
- Increase awareness and market participation of fuel cell electric trucks and buses, including supporting the deployment of pilot projects
- Coordinate nationally and internationally to share and align approaches

## Status
The members of the CaFCP intend to continue their cooperative efforts within California and have plans to expand activities in 2022 to advance the zero-emission vehicle (ZEV) technology benefits in-state and nationally. The final report covers the South Coast AQMD for 2021 membership. This contract was completed on schedule.


*Graphic 1 - CaFCP published its truck vision in August, calling for 200 stations serving 70,000 heavy-duty fuel cell electric trucks by 2035.*

## Technology Description
Many CaFCP members together or individually are operating fuel cell passenger cars, transit buses, drayage trucks and associated fueling infrastructure in California. Passenger cars include Honda's Clarity, Hyundai's Nexo and Toyota's second generation Mirai. Fuel cell bus operators include AC Transit, Sunline Transit, Orange County Transportation Authority and UC Irvine Student Transportation for a combined 46 buses, with 96 in the coming year or two, including Foothill Transit, Long Beach Transit, Golden Empire Transit, and others. More transit agencies are expected to adopt fuel cell buses over the next 5 to 10 years as they implement the Innovative Clean Transit regulation. Class 8 fuel cell drayage trucks include a Ballard powered BAE/Kenworth truck, the Hydrogenics fuel cell powered TransPower truck, Hyundai Xcient trucks and Toyota's Portal trucks.

## Results
Specific accomplishments include:
- Since 2015, more than 12,000 consumers and fleets have purchased or leased passenger FCEVs
- Transit agencies have 48 fuel cell electric buses in operation and more than 96 funded

- 48 plus light-duty retail hydrogen stations in operation in California and 124 in development; 4 bus stations in operation and 3 in early development, and 2 truck stations in operation, 2 in development and another 5 funded
- CaFCP staff and members continue to conduct targeted outreach and education throughout California and provide information to non-California requestors
- CaFCP operates and maintains the Station Operational Status System (SOSS) that the 40-plus open retail hydrogen stations use to report status. This data, in turn, feeds real-time information (address, availability, etc.) to fuel cell electric vehicle (FCEV) drivers through a CaFCP mobile website and other apps and systems. SOSS data also supports the new ZEV infrastructure credit in the Low Carbon Fuel Standard program
- CaFCP actively engages in medium- & heavy-duty FCEV codes & standards coordination, specifically through sponsoring SAE J2600 (fueling connection) for inclusion of high-flow H35 fueling geometry for fuel cell electric bus (FCEB) fueling and fueling protocol standard development
- Published a truck vision document in 2021 which calls for 200 stations serving 70,000 trucks by 2035. Early discussions are under way for an implementation road map for California and western states.

## Benefits

Compared to conventional vehicles, fuel cell vehicles offer zero smog-forming emissions, reduced water pollution from oil leaks, higher efficiency, and much quieter and smoother operation. When renewable fuels and electricity are used as a source for hydrogen, fuel cell vehicles also encourage greater energy diversity and lower greenhouse gas emissions ($CO_2$).

By combining efforts, the CaFCP can accelerate and improve the commercialization process for all categories of vehicles: passenger, bus, truck, etc. The members have a shared vision about the potential of fuel cells as a practical solution to many of California's environmental issues and similar issues around the world. The CaFCP provides a unique forum where infrastructure, technical and interface challenges can be identified early, discussed, and potentially resolved through cooperative efforts.

## Project Costs

Auto members provide vehicles along with the staff and facilities to support them. Energy members engage in fueling infrastructure activities, including hydrogen production. CaFCP's annual operating budget is about $1.4 million, and includes operating costs, program administration, joint studies and public outreach and education. All members make annual contributions towards the common budget with executive government members making an annual contribution of approximately $40,000. Some members contribute additional in-kind products and services to accelerate specific project and program activities.

## Commercialization and Applications

Research and scaling of technology by multiple entities will be needed to reduce the cost of fuel cells and improve fuel storage and infrastructure. CaFCP has played a vital role in demonstrating fuel cell vehicle reliability and durability, fueling infrastructure and storage options, and increasing public knowledge and acceptance of the vehicles and fueling.

CaFCP's goals relate to preparing for and supporting market launch through coordinated individual and collective effort. CaFCP members, individually or in groups:

- Prepare for larger-scale manufacturing, which encompasses cost reduction, supply chain and production
- Reduce costs of station equipment, increase supply of renewable hydrogen at lower cost, and develop new retail station approaches
- Support cost reduction through incentives and targeted research, development, and demonstration projects
- Continue research, development, and demonstration of advanced concepts in renewable and other low-carbon hydrogen
- Provide education and outreach to public and community stakeholders on the role of FCEVs and hydrogen in the evolution to electric drive

In 2022, the primary goals are the same as the 2021 goals listed above but have been shifting to be more inclusive of heavy-duty vehicle applications due to the adoption of regulations for transit bus fleets and heavy-duty trucks as well as the technology’s potential to significantly improve emissions in these applications.

**South Coast AQMD Contract #15618** **February 2021**

# Installation of Eight Hydrogen Stations in Various Cities

## Contractor
FirstElement Fuel, Inc.

## Cosponsors
California Energy Commission
South Coast AQMD

## Project Officer
Patricia Kwon

## Background
The California Energy Commission (CEC) issued solicitation PON-13-607 to provide funding opportunities under the ARFVT Program for projects which expand the network of publicly accessible hydrogen fueling stations to serve the current population of fuel cell vehicles (FCVs) and to also accommodate the planned large-scale roll-out of FCVs commencing between 2015 and 2016.

South Coast AQMD is a co-sponsor for this project.

## Project Objective
The objective of this project is to build and install eight public access hydrogen fueling stations in the cities of South Pasadena, Los Angeles (2 stations), Long Beach, Costa Mesa, La Canada Flintridge, Laguna Niguel and Lake Forest.

Six of the stations will have delivered hydrogen with 33% renewable content, and the remaining two stations will have 100% renewable hydrogen delivered. The fueling stations will be capable of delivering up to 100 kg of hydrogen per day nominal capacity, with a 35 kg per hour peak Type A fill. They will be designed to be easily expandable in the future. The stations will be able to fuel multiple vehicles back-to-back without delay to avoid congestion.

## Technology Description
Hydrogen fuel cell electric drive technology offers tremendous potential for the light-duty passenger vehicle market and medium- and heavy-duty truck and bus markets. These vehicles have zero tailpipe emissions, and the carbon footprint is nearly the same as plug-in electric vehicles.

The hydrogen stations installed under this contract must use a minimum average of 33% renewable hydrogen on a per kg basis through direct physical pathways (on-site or offsite production).

## Status
Seven out of eight public access hydrogen fueling stations have been installed and are currently in operation. The following table summarizes the completion dates along with key milestone dates of our project. Note that final reports are on file with complete technical details of the project.

| Station | Develop | Delivery | Testing | Completion |
|---|---|---|---|---|
| South Pasadena | 8/26/2016 | 1/17/2017 | 2/22/2017 | 4/10/2017 |
| Los Angeles (Hollywood) | 11/16/2015 | 3/28/2016 | 4/30/2016 | 11/10/2016 |
| Los Angeles (PDR) | 11/16/2015 | 4/12/2016 | 5/29/2016 | 8/18/2016 |
| Long Beach | 6/22/2015 | 9/9/2015 | 10/30/2015 | 2/22/2016 |
| Costa Mesa | 8/3/2015 | 10/13/2015 | 12/2/2015 | 1/21/2016 |
| La Canada Flintridge | 8/20/2015 | 10/14/2015 | 12/9/2015 | 1/25/2016 |
| Laguna Niguel | | | | |
| Lake Forest | 8/6/2015 | 10/14/2015 | 2/27/2016 | 3/18/2016 |

The location of the remaining one station (Laguna Niguel) was relocated and the CEC approved location for this station was not located within South Coast AQMD jurisdiction.

*Photo of installed Hydrogen Station at La Canada Flintridge. Source: FirstElement Fuel, Inc.*

## Results
Per California Senate Bill 1505, Environmental Standards for Hydrogen Production, at least one

third of the hydrogen sold by FirstElement's state funded hydrogen refueling stations will be produced from renewable sources. Hydrogen is supplied to the hydrogen fueling stations from Air Products' hydrogen production facilities in Wilmington/Carson, CA. Renewable biogas will be procured as feedstock for the facilities, resulting in delivered hydrogen product that meets the requirements of this PON and the 33.3% renewable hydrogen requirements of California SB 1505. Renewable hydrogen at 100% is achievable through the same supply pathway, however at a higher cost.

Air Products currently has a contract for sourcing of the renewable biogas that meets Public Resources Code Section 2574(b)(1). Air Products' biogas supply for this project is being sourced outside of California and transported to California with connection to a natural gas pipeline in the Western Electricity Coordinating Council (WECC) region that delivers gas into California.

As of July 1, 2019, FirstElement began purchasing and retiring attributes directly through a third party to better increase our renewable supply.

## Benefits

The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET) produced by Argonne National Laboratory was used to determine the energy sources and greenhouse gas emissions data presented in the table below. As shown, over two-thirds of the energy feedstock is renewable, very little petroleum is used, and the only tailpipe emissions are water compared to the myriad of pollutants emitted by the combustion of gasoline. The entire well-to-wheels process results in zero greenhouse gas emissions due to our procurement of very low carbon intensity biogas feedstock.

| Energy Sources | Zero Station (Gaseous Hydrogen) | Multi-Hose True Zero Station (Liquid Hydrogen) | Gasoline Vehicle |
|---|---|---|---|
| Petroleum | *5.20%* | *1.40%* | *75.50%* |
| Natural Gas | *16.70%* | *31.60%* | *18.90%* |
| Coal | *0.40%* | *0.50%* | *0.20%* |
| Renewable | *77.70%* | *66.80%* | *7.10%* |
| **Total GHGs** | *0 grams/mile* | *0 grams/mile* | *428 grams/mile* |
| **Tailpipe Emissions** | *Pure Water* | *Pure Water* | *VOC, CO, $NO_x$, $PM_{10}$, $PM_{2.5}$, $SO_x$, $CH_4$, $N_2O$* |

## Project Costs

The table below provides the summary of project costs for the program.

| Station | CEC | SCAQMD | Match |
|---|---|---|---|
| South Pasadena | 1,451,000 | 100,000 | 925,822 |
| Los Angeles (Hollywood) | 1,451,000 | 200,000 | 591,408 |
| Los Angeles (PDR) | 1,451,000 | 200,000 | 600,161 |
| Long Beach | 1,451,000 | 100,000 | 765,719 |
| Costa Mesa | 1,451,000 | 100,000 | 589,103 |
| La Canada Flintridge | 1,451,000 | 100,000 | 712,515 |
| Laguna Niguel | - | - | - |
| Lake Forest | 1,451,000 | 100,000 | 742,899 |
| **Total** | **$ 10,157,000** | **$ 900,000** | **$ 4,927,628** |

## Commercialization and Applications

By adding eight additional stations to the California Hydrogen Fueling Station Network, FirstElement has helped establish the infrastructure needed for the large scale roll out of Fuel Cell Vehicles. As of January 12, 2021, our stations, as part of the network of publicly accessible hydrogen fueling stations, served approximately 8,931 light-duty passenger fuel cell cars.

As this network expands, we see the continued roll out of this technology encouraging growth in the light-duty passenger markets as well as establishing the foundation for growth in the medium- and heavy-duty truck and bus markets.

**South Coast AQMD Contract #16251** **May 2021**

# Develop and Demonstrate Commercial Mobile Hydrogen Fueler

## Contractor
H2 Frontier Inc

## Cosponsors
California Energy Commission (CEC)
South Coast AQMD
US Hybrid
H2Frontier
Gas Technology Institute (GTI)

## Project Officer
Lisa Mirisola/Patricia Kwon

## Background
Automakers targeted a 2015 roll-out of hydrogen fuel cell vehicles (FCEV), making the availability of hydrogen fueling stations critically important. FCEVs play an important role in promoting the transition of the mobile transportation sector towards zero emission technologies. These new technologies are necessary to attain the federal criteria pollutant standards as well as the state greenhouse gas targets. California has the most extensive fleet of fuel cell vehicles in the nation, supported by the nation's largest network of hydrogen fueling stations. Even though additional stations are expected to become available over the next few years there is little or no redundancy in the network. Consequently, the impact of a station going out of service due to planned (or unplanned) maintenance can leave fuel cell vehicle owners without a convenient reliable source of fuel until the station comes back on-line.

## Project Objective
H2 Frontier Inc. proposed to design, fabricate, test, and deploy a fully operational, commercial mobile hydrogen fueler in response to the California Energy Commission's (CEC) recent Program Opportunity Notice 13-607 (Alternative and Renewable Fuel and Vehicle Technology Program, Subject Area-Hydrogen Refueling Infrastructure). The mobile fueler would be designed to provide back-up to stations during extended maintenance or upgrade and support fuel cell vehicle ride-and-drive events, while providing a fueling experience that would be similar to a full-scale station.

## Technology Description
The mobile fueler was not only intended to be a stand-alone station for remote filling but designed to provide the flexibility to integrate itself into stations that may have temporary dispensing issues. The design connects to the onsite hydrogen storage supply and can connect to existing hydrogen dispensers to fill onboard storage. Another design option to be explored on a case-by-case basis was the ability of the fueler to tow and connect to a secondary tube trailer to expand its capacity for any high demand locations thus helping to limit the need to remove it from the designated site to replenish on-board storage. The mobile hydrogen fueler would use renewable fuel when possible and would be deployed at hydrogen stations as needed.

Configured on board a medium-duty, Ford F550 truck platform, with hydrogen storage, compression, and dispensing capabilities, the mobile fueler was designed to be completely self-contained, with no need for external power, pre-cooling, or delivered hydrogen supplies. Additionally, the mobile fueler would have the capability to fill either 350 bar or 700 bar vehicle tanks while meeting U.S. DOT on-road vehicle requirements, along with the intent of SAE J2601 and SAE 2719 hydrogen fueling interface and hydrogen quality requirements and guidelines. The expected life of the equipment design was ten years, assuming 80% availability.

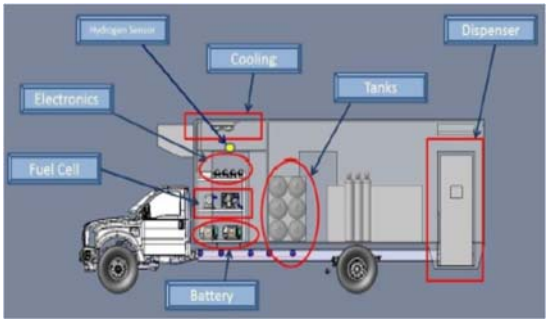


*Figure 1: Mobile Refueler Design Layout*

## Status

The first task was to design the system, prepare the platform and specify the specific equipment. This task was completed. However, the design did not conform to revised SAE J2601 and automakers would not approve their new fuel cell vehicles to fuel with the obsolete design.

H2Frontier exited the project, but the team with CEC Grant Agreement ARV-14-003 determined that it would be necessary for the refueler to comply with the SAE International J2601:2014 fueling protocol for it to serve the industry appropriately. SAE International J2601:2014 is a fueling standard that defines conditions, such as the required hydrogen pressure and temperature, for filling light-duty FCEVs. At that time, the team focused on securing the additional funding necessary to expand the project scope to comply with the advanced fueling protocol.

The project team investigated several opportunities to secure additional funding for the project. They held discussions with private companies with needs for mobile refueling solutions, and with state agencies that have mandates for acquiring and operating fuel cell electric vehicles. The project team also contacted private station operators and constructed several design iterations and plans to develop a path forward that would satisfy all entities associated with the project and related end use. Unfortunately, the project team was not able to acquire the additional funds during the project period and, without the necessary funding to provide a viable system to the industry, the project concluded when it reached the term end date without constructing and deploying a mobile hydrogen refueler.

GTI submitted the Final Report CEC-600-2021-006 to CEC April 2021.

*Figure 2: Base Truck Ford F650 with Custom Body*

## Benefits

In addition to criteria emission reductions, this project represented an investment in clean economical FCEV transportation to help meet California's climate goals.

## Project Costs

This project was not completed. The proposed total project costs to develop and deploy the commercial mobile hydrogen fueler were estimated at $1,665,654. The proposed project costs were broken down as follows:

| | CEC Funding | Partner Cost-Share |
|---|---|---|
| Gas Technology Institute | $224,677 | $15,064 |
| U.S. Hybrid | $400,000 | $375,913 |
| H2 Frontier, Inc. | $375,000 | 75,000 |
| South Coast AQMD | | 200,000 |
| **Totals** | **$999,677** | **$665,977** |

The first task was completed for $45,000. The remaining $155,000 of Clean Fuels funds from South Coast AQMD were de-obligated.

## Commercialization and Applications

New designs are being developed to address current fueling, safety and other standards.

**South Coast AQMD Contract #18158** **March 2021**

# California Hydrogen Infrastructure Research Consortium H2 @ Scale Initiative

## Contractor

Alliance for Sustainable Energy, LLC,
National Renewable Energy Laboratory (NREL)

## Cosponsors

US Department of Energy (DOE)
South Coast AQMD
California Air Resources Board (CARB)
California Energy Commission (CEC)
CA Go-Biz

## Project Officer

Lisa Mirisola

## Background

Many stakeholders are working on hydrogen and fuel cell products, markets, requirements, mandates, and policies. California has been leading the way for hydrogen infrastructure and fuel cell electric vehicle deployment. This leadership has advanced a hydrogen network that is not duplicated anywhere in the United States and is unique in the world for its focus on providing a retail fueling experience. The advancements have identified many lessons learned for hydrogen infrastructure development, deployment, and operation. Other interested states and countries are using California's experience as a model case, making success in California paramount to enabling market acceleration and uptake in the United States.

## Project Objective

California agencies identified tasks based on top research needs and priorities for the benefit of state and national efforts to deploy a hydrogen fueling infrastructure and has identified a need to leverage national laboratory research capabilities and staff to support these efforts. The consortium used these tasks as the first step in a strategic partnership, balancing near-term research needs with accelerating earlier-stage research into the market. Specific focus was placed on sharing and translating lessons learned to other jurisdictions, which is a priority in a partnership between state and federal agencies and laboratories.

## Technology Description

California agencies prioritized a certain set of tasks for the benefit of state and national efforts to deploy a hydrogen fueling infrastructure. The set of tasks focused on the near-term challenges for California hydrogen infrastructure development, deployment, and operation.

The set of tasks included hydrogen station data analysis, insights into medium and heavy-duty vehicles running on hydrogen, hydrogen contaminant detectors for use at hydrogen fueling stations, hydrogen nozzle freeze lock evaluation (component failure scenarios), hydrogen topics for integration into California energy management strategy, and a technical assistance project that analyzed liquid hydrogen modeling for a hydrogen station capacity tool.

## Status

The project was completed in April 2021. The final report is on file with complete technical details of all the project tasks.

For example, it was determined that understanding the conditions where nozzle freeze-lock occurs will help mitigate the issue in commercial hydrogen fueling stations. The observed trends can help station providers predict days when nozzle freeze-lock might occur and implement proactive countermeasures.


*Figure 1. Nozzle Freeze-lock Chamber and Atmosphere Generating Cart at NREL*

The medium/heavy-duty task was originally intended to analyze and report on retail and

experimental fueling of medium-/heavy-duty trucks, which were not operational in time for this project. The task was redirected towards a topical overview of medium/heavy duty truck fueling which resulted in a report and a presentation suitable for a webinar on April 7, 2021 that was shared with the California partners for their use as needed.

## Results

Results have been presented as part of DOE's Annual Merit Review 2018-2021, DOE H2@Scale Working Group, and at the 2019 Fuel Cell Seminar and Energy Exposition.

The markets for trucks and light duty vehicles complement each other with the larger number of light duty vehicles providing the possibility for many parts being produced thus bringing down the prices for components used in trucking, while the trucks use a lot of hydrogen fuel encouraging increased hydrogen production and bringing down the price of hydrogen for light duty vehicles.

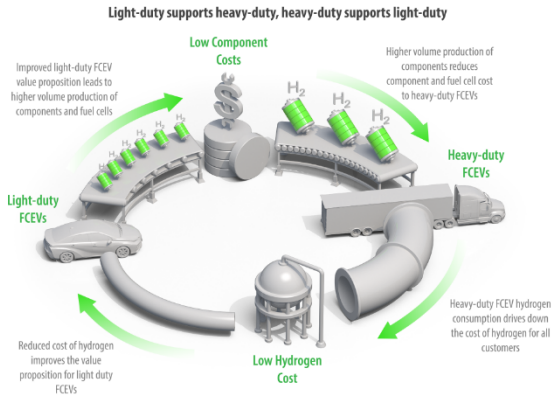


*Figure 2. Light-duty fuel cell vehicles support heavy-duty cell vehicles simultaneously reducing component costs and hydrogen fuel costs as fuel cell manufacturing and hydrogen production scale increases*

## Benefits

This consortium coordinates research efforts that support the DOE's and California's hydrogen goals and requirements, shares lessons learned with other states and stakeholders to inform implementation efforts outside of California, supports shifting the hydrogen infrastructure progress from a government push into a market pull, advances the station technology and operation to meet the next waves of vehicle demand, and leverages existing core capabilities and researchers at national labs.

## Project Costs

| Project Partner | Co-Funding |
|---|---|
| Fuel Cell Technologies Office | $700,000** |
| California Air Resources | $100,000 |
| California Energy Commission | $100,00 |
| South Coast AQMD | $100,000 |
| California Go-Biz | In kind |
| Total | $1,000,000 |

**subject to partial award, funding may be scale

The California Air Resources Board was unable to enter into a joint Cooperative Research and Development Agreement (CRADA), so CARB executed an individual CRADA with NREL for their portion.

## Commercialization and Applications

To provide a more comprehensive picture of when nozzle freeze-lock occurs, NREL recommends both repeated testing and evaluating multiple nozzle manufacturers. Statistical significance and trends could be further expanded upon. New heavy-duty high flow rate nozzles will also need testing. Testing with freeze mitigation technology, such as nitrogen purging, could help determine if mitigation strategies are effective.

Hydrogen contaminant detectors are not expected to meet all requirements of SAE J2719.

Follow-on tasks focusing on heavy-duty applications proposed to DOE for H2@Scale 2020 funding were approved and a new contract is under final review. Three new tasks have been set. The first new task is an HD Reference Station Design led by Sandia National Lab. The second task is an HD Station Test Device Design to analyze hydrogen fueling performance and the third task is the development of a HD Station Capacity Tool. A fourth task under a separate agreement, is an H2 Contaminant Detector Design focused on water vapor contaminant sensing at stations. This task was determined as necessary as more electrolysis stations are expected and there will be a need to ensure compatibility of hydrogen contaminant detector (HCD) pneumatic systems with regulated contaminants with validating HCDs in the field at a California station.

**South Coast AQMD Contract # 20108** **June 2021**

# Develop Optimal Operation Model for Renewable Electrolytic Fuel Production


## Contractor
University of California, Irvine

## Cosponsors
South Coast AQMD
California Energy Commission (CEC)
US Department of Energy (DOE)

## Project Officer
Seungbum Ha


## Background

There is a growing interest in the use of renewable electrolytic hydrogen (green hydrogen) and methane as substitutes for natural gas. In the case of pure hydrogen, the fuel would be used as a blend stock at fractions that may be as high as 20%. The allowable blend fraction for renewable synthetic methane (also referred to as synthetic natural gas or SNG) could be as high as 100%. Both fuels have the potential to change the pollutant emissions of combustion systems with NOx being the constituent of concern.

## Project Objective

The objective of the project was to assess the potential local and regional NOx emissions and air quality impacts of electrolytic fuel production systems injecting hydrogen or synthetic methane onto the natural gas grid.

## Technology Description

Electrolyzers use electric power to split water into hydrogen and oxygen through a catalytic electrochemical process. When the input electricity is renewable, the product hydrogen is a renewable fuel, also called green hydrogen. Green hydrogen (GH2) can be combined with biogenic CO2 to create methane in a process called methanation. The result is a renewable substitute for natural gas also referred to as synthetic natural gas (SNG). Both GH2 (up to a blend limit that may reach 20%) and SNG (potentially up to a blend limit of 100%) can be injected onto the natural gas grid to reduce the carbon intensity of system gas.

## Status

Three hypothetical electrolyzer projects were defined (size, location, electric supply sources). The (RoDEO) model developed and run by the National Renewable Energy Laboratory (NREL) was used to optimize the operating schedules of the electrolyzers to minimize hydrogen production cost based on the cost of input electricity. The result of this analysis confirmed the general feasibility of producing natural gas substitutes within the target price range and provided estimates of the quantities of produced fuel to be injected onto the natural gas grid.

## Results

Air quality analysis was conducted at the local and regional levels assuming hydrogen reaches the maximum allowed blend limit of 20% by volume to bound the impacts. Impacts were assessed based on NOx emissions impacts of hydrogen methane blends and methane-CO2 (SNG proxy) blends measured in parallel projects. SNG shows reduction in NOx formation for all burner types and so does not present an air quality concern. In contrast, some common burner types show reduced NOx formation with hydrogen blends and other burner types show increases. An inventory of burner types and replacement trends is needed to ensure that deployment of hydrogen blends for greenhouse gas (GHG) mitigation does not lead to upward pressure on secondary 8-hour ozone and PM2.5 levels in the South Coast Air Basin. The best and worst case 8-hour ozone results are shown below.

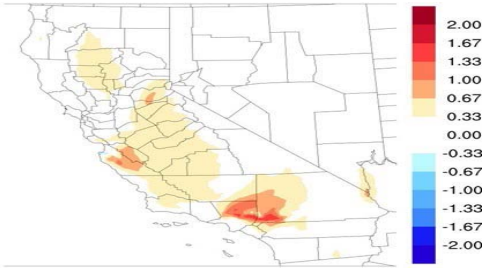


*Figure 1: Worst-case increase in summer average MD8H ozone (ppb) for 20% hydrogen blend on the gas grid*

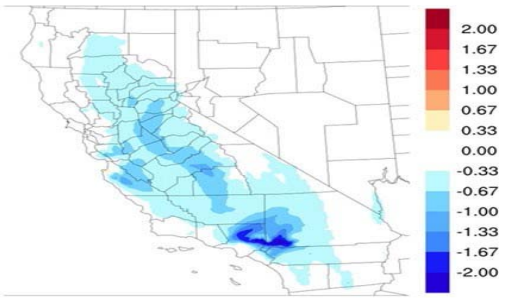


*Figure 2: Best-case decrease in summer average MD8H ozone (ppb) for 20% hydrogen blend on the gas grid*

## Benefits

The work shed light on the potential for upward pressure on NOx and secondary ozone and PM2.5 concentrations that could result from injecting hydrogen into the natural gas grid while also showing the reduced NOx is possible from hydrogen blends. Given the potential GHG benefits of green hydrogen, future technical and policy analysis should focus on ensuring that hydrogen deployment results in net negative emissions. This can be accomplished by design specifications for hydrogen-ready burners and combustors, aftertreatment requirements and deployment of non- combustion conversion devices such as fuel cells.

## Project Costs

The total planned project cost was $500,000 with $100,000 to be provided by South Coast AQMD and $400,000 from other related efforts funded by the California Energy Commission and the U.S. Department of Energy. The project was completed within the agreed budget.

## Commercialization and Applications

Introduction of zero and low-carbon fuels to decarbonize the fuel provided over the natural gas grid is a key strategy for achieving deep decarbonization. A growing number of national strategies including those of Canada, the United Kingdom and the European Union are embracing these solutions. The current U.S. Department of Energy Hydrogen Shot and the local green hydrogen initiative, HyDeal LA, demonstrate growing momentum for the deployment of these solutions driven in large part by rapidly declining costs of decarbonized gaseous fuel.

Proceedings are ongoing at the California Public Utilities Commission to establish regulatory frameworks for the introduction of hydrogen and synthetic methane on the gas grid as they have done for biomethane. Ensuring that the policies and regulations for deployment of these important resources fully considers air quality impact along with safety, reliability and GHG reductions is key to achieving an equitable energy transition. This project is important to establishing the foundations for the development of air quality policies to support a truly sustainable deployment of renewable hydrogen and methane.

# Appendix D

# Technology Status

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# Technology Status

For each of the core technologies discussed earlier in this report, staff considers numerous factors that influence the proposed allocation of funds, ranging from overall Environment & Health Benefits, Technology Maturity and Compatibility, and Cost, summarized in this technology status evaluation system.

Within the broad factors included above, staff has included sub-factors for each specific type of project that may be considered, as summarized below:

### Environment and Health Benefits

Criteria Pollutant Emission Reduction potential continues to receive the highest priority for projects that facilitate NOx reduction goals outlined in the 2016 AQMP. Technologies that provide co-benefits of Greenhouse Gas and Petroleum Reduction are also weighted favorably, considering the Clean Fuels Program leverages funds available through several state and federal programs, as well as overall health benefits in reducing exposure to Ozone and PM2.5, especially in disadvantaged communities.

### Technology Maturity & Compatibility

Numerous approaches have been used to evaluate technology maturity and risk that include an evaluation of potential uncertainty in real world operations. This approach can include numerous weighting factors based on the assessed importance of a particular technology. Some key metrics that are considered include Infrastructure Constructability, which evaluates the potential of fuel or energy for the technology and readiness of associated infrastructure, and Technology Readiness, which includes research and development of the technology and large scale deployments that consider ability for near-term implementation and operational compatibility for end users. These combined factors can provide an assessment for market readiness of the technology.

### Cost/Incentives

The long-term costs and performance of advanced technologies are highly uncertain, considering continued development of these technologies is likely to involve unforeseen changes in basic design and materials. Additionally, economic sustainability – or market driven – implementation of these technologies is another key factor for technology research, development, demonstration and deployment projects. In an effort to accelerate the demonstration and deployment, especially of pre-commercialization technologies, local, state and federal incentive programs are crucial, but may be underfunded to enable large scale deployments.

Staff has developed an approach to evaluating core technologies, especially some of the specific platforms and technologies discussed in the draft plan and annual report. The technology status evaluation below utilizes experience with implementing the Clean Fuels Program for numerous years, as well as understanding the current development and deployment of the technologies and associated infrastructure, and are based on the following measurement:

● Excellent ◓ Good ○ Satisfactory ◒ Poor • Unacceptable

The table below summarizes staff evaluation of the potential projects anticipated in the Plan Update, and technology developers, suppliers and other experts may differ in their approach to ranking these projects. For example, staff ranks Electric/Hybrid Technologies and Infrastructure as Excellent or Good for Criteria Pollutant and GHG/Petroleum Reduction, but Satisfactory to Excellent for Technology Maturity, Poor to Excellent for Compatibility, and Satisfactory to Unacceptable for Costs and Incentives to affect large scale deployment. It is further noted that the Clean Fuels Fund's primary focus remains on-road vehicles and fuels, and funds for off-road and stationary sources are limited.

This approach has been reviewed with the Clean Fuels and Technology Advancement Advisory Groups, as well as the Governing Board.

| Technologies & Proposed Solutions | Environment & Health | | | Technology Maturity & Compatibility | | | | Cost | |
|---|---|---|---|---|---|---|---|---|---|
| | Emissions Reduction | GHG/Petroleum Reduction | Health Benefits | Infrastructure Constructability | Technology Readiness | Near-Term Implementation/ Duty Cycle Fulfillment Capability | Operations Compatibility | Relative Cost & Economic Sustainability | Incentives Available |
| **Electric/Hybrid Technologies & Infrastructure** | | | | | | | | | |
| Plug-In Hybrid Heavy-Duty Trucks with Zero-Emission Range | ◓ | ○ | ◓ | ● | ○ | ◓ | ◓ | ◒ | ● |
| Heavy-Duty Zero-Emission Trucks | ● | ◓ | ● | ◓ | ○ | ◒ | ○ | ● | ◒ |
| Medium-Duty Zero-Emission Trucks | ◓ | ◓ | ● | ◓ | ○ | ○ | ◒ | ◒ | ◒ |
| Medium- and Heavy-Duty Zero-Emission Buses | ● | ◓ | ● | ◓ | ○ | ◒ | ○ | ◒ | ◒ |
| Light-Duty Zero-Emission Vehicles | ◓ | ◓ | ● | ◓ | ◓ | ◓ | ◓ | ○ | ◒ |
| Plug-In Hybrid Light-Duty Vehicles with Zero-Emission Range | ◓ | ○ | ◓ | ● | ● | ● | ● | ◒ | ● |
| Infrastructure | - | - | - | ◓ | ◓ | ◓ | ◓ | ◒ | ● |
| **Hydrogen & Fuel Cell Technologies & Infrastructure** | | | | | | | | | |
| Heavy-Duty Trucks | ● | ◓ | ◓ | ○ | ◓ | ○ | ◒ | ● | ● |
| Heavy-Duty Buses | ● | ◓ | ◓ | | ◓ | ◓ | ◓ | ● | ● |
| Off-road – Locomotive/Marine | ● | ◓ | ◓ | ○ | ○ | ◒ | ◒ | ● | ● |
| Light-Duty Vehicles | ● | ◓ | ◓ | | ◓ | ○ | ○ | ◒ | ◒ |
| Infrastructure – Production, Dispensing, Certification | - | - | - | ○ | ○ | ◒ | | ● | ◒ |
| **Engine Systems** | | | | | | | | | |
| Ultra-Low Emission Medium- and Heavy-Duty Renewable Diesel Vehicles | ◓ | ◓ | ◓ | ● | ○ | ● | ● | ◓ | ◒ |
| Renewable Gaseous and Alternative Fuel Ultra-Low Emission Medium- and Heavy-Duty Vehicles | ◓ | ◓ | ◓ | ● | ● | ● | ● | ◓ | ◒ |
| Ultra-Low Emission Off-Road Applications | ◓ | ◓ | ◓ | ◓ | ○ | ◓ | ● | ◓ | ◒ |
| **Fueling Infrastructure & Deployment** | | | | | | | | | |
| Production of Renewable Natural Gas – Biowaste/Feedstock | ◓ | ● | ◓ | ● | ◓ | ◓ | ◓ | ◒ | ◒ |
| Synthesis Gas to Renewable Natural Gas | ◓ | ● | ◓ | ● | ◓ | ◓ | ◓ | ○ | ○ |
| Expansion of Infrastructure/Stations/Equipment/RNG Transition | ◓ | ◓ | ◓ | ● | ◓ | ◓ | ◓ | ◓ | ○ |
| **Stationary Clean Fuel Technologies** | | | | | | | | | |
| Low-Emission Stationary & Control Technologies | ◓ | ◓ | ◓ | ◓ | ○ | ○ | ◓ | ○ | ◒ |
| Renewable Fuels for Stationary Technologies | ○ | ● | ◓ | ◓ | ○ | ○ | ○ | ○ | ◒ |
| Vehicle-to-Grid or Vehicle-to-Building/Storage | ● | ● | ◓ | ○ | ○ | ◒ | ○ | ◒ | ◒ |
| **Emission Control Technologies** | | | | | | | | | |
| Alternative/Renewable Liquid Fuels | ○ | ◓ | ◓ | ◓ | ● | ● | ● | ◓ | ○ |
| Advanced Aftertreatment Technologies | ◓ | ○ | ◓ | ○ | ○ | ◓ | ● | ◓ | ○ |
| Lower-Emitting Lubricant Technologies | ○ | ○ | ● | - | ◓ | ◓ | ◓ | ● | ○ |

● Excellent ◓ Good ○ Satisfactory ◒ Poor ● Unacceptable

# Appendix E

# List of Acronyms

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# LIST OF ACRONYMS

3B-MAW—3-bin moving average windows
AB—Assembly Bill
AC—absorption chiller
ACT – American Clean Truck regulation
ADA—American with Disabilities Act
AER—all-electric range
AFRC—air/fuel ratio control
AFVs—alternative fuel vehicles
AGL – Academy of Global Logistics
ALPR – automated license plate recognition
APCD—Air Pollution Control District
AQMD—Air Quality Management District
AQMP—Air Quality Management Plan
ARB—Air Resources Board
ARRA—American Recovery & Reinvestment Act
AWMA—Air & Waste Management Association
BACT—best available control technology
BATS – blended aftertreatment system
BEB—battery electric bus
BET – battery electric tractor
BET—battery electric truck
BEV—battery electric vehicle
BSNOx—brake specific NOx
BMEP – brake mean effective pressure
BMS—battery management system
CAP – Clean Air Protection
CAAP—Clean Air Action Plan
CAFR—Comprehensive Annual Financial Report
CaFCP—California Fuel Cell Partnership
CARB—California Air Resources Board
CATI—Clean Air Technology Initiative
CBD—Central Business District (cycle) - a Dyno test cycle for buses
CCF—California Clean Fuels
CCHP—combined cooling, heat and power
CCV—closed crankcase ventilation
CDA—cylinder deactivation
CDFA/DMS—California Department of Food &Agriculture/Division of Measurement Standards
CEC—California Energy Commission
CE-CERT—College of Engineering – Center for Environmental Research and Technology
CEMS—continuous emission monitoring system
CERP – Community Emission Reduction Plan
CEQA—The California Environmental Quality Act
CFCI—Clean Fuel Connection, Inc.
CFD—computational fluid dynamic
CHBC—California Hydrogen Business Council
CHE—cargo handling equipment
CMAQ—community multi-scale air quality
CNG—compressed natural gas
CNGVP—California Natural Gas Vehicle Partnership
$CO_2$—carbon dioxide
CO—carbon monoxide
ComZEV—Commercial Zero-Emission Vehicle
CPA—Certified Public Accountant
C-PORT – Commercialization of POLB Off-Road Technology
CPUC—California Public Utilities Commission
CRADA-Cooperative Research and Development Agreement
CRDS—cavity ring-down spectroscopy
CRT—continuously regenerating technology
CSC—city suburban cycle
CTE – Center for Transportation and the Environment
CVAG—Coachella Valley Association of Governments
CWI—Cummins Westport, Inc.
CY—calendar year
DAC – disadvantaged community
DC—direct connection
DC – direct current
DCFC—direct connection fast charger
DCM—dichloromethane
DEF—diesel exhaust fluid
DEG—diesel equivalent gallons
DERA – Diesel Emissions Reduction Act
DGE—diesel gallon equivalents
DF—deterioration factor
DME—dimethyl ether
DMS—Division of Measurement Standards
DMV—Department of Motor Vehicles
DOC—diesel oxidation catalysts
DOE—Department of Energy
DOT—Department of Transportation
DPF—diesel particulate filters
D-PMag – dual permanent magnet motor
DPT3—Local Drayage Port Truck (cycle) - where 3=local (whereas 2=near-dock, etc.)
DRC—Desert Resource Center
DRI—Desert Research Institute
ECM—emission control monitoring
EDD—electric drayage demonstration
EDTA—Electric Drive Transportation Association
EERE – Energy Efficiency and Renewable Energy
EGR—exhaust gas recirculation
EIA—Energy Information Administration

## LIST OF ACRONYMS (cont'd)

EIN—Energy Independence Now
EMFAC—Emission FACtors
EPRI—Electric Power Research Institute
E-rEV—extended-range electric vehicles
ESD—emergency shut down
ESS—energy storage system
EV—electric vehicle
EVSE—electric vehicle supply equipment
FCEB – fuel cell electric bus
FCET – fuel cell electric truck
FCEBCC - Fuel Cell Electric Bus Commercialization Consortium
FCEV – fuel cell electric vehicle
FCTO – Fuel Cell Technologies Office
FCV—fuel cell vehicle
FTA—Federal Transit Administration
FTP—federal test procedures
G2V—grid-to-vehicle
g/bhp-hr—grams per brake horsepower per hour
GC/MS—gas chromatography/mass spectrometry
GCW—gross combination weight
GCVW—gross container vehicle weight
GDI—gasoline direct injection
GGE—gasoline gallon equivalents
GGRF—Greenhouse Gas Reduction Relief Fund
GH2 – green hydrogen
GHG—greenhouse gas
GNA—Gladstein, Neandross & Associates, LLC
Go-Biz – Governor's Office of Business and Economic Development
GPCI – Green Paradigm Consulting, Inc.
GPU—gas processing unit
GREET- Greenhouse Gasses, Regulated Emissions and Energy Use in Transportation
GTI – Gas Technology Institute
GTL—gas to liquid
GVW – gross vehicle weight
GVWR—gross vehicle weight rating
H&SC—California Health and Safety Code
HCCI—Homogeneous Charge Combustion Ignition
HCD – hydrogen contaminant detector
HCHO - formaldehyde
HCNG—hydrogen-compressed natural gas (blend)
HD – heavy duty
HDD – heavy-duty diesel
HDDT—highway dynamometer driving schedule
HD-FTP—Heavy-Duty Federal Test Procedure
HD I/M – heavy-duty inspection and maintenance
HD-OBD—heavy-duty on-board diagnostics
HHDDT—heavy heavy-duty diesel truck schedule
HMI – Human Machine Interface
HPLC—high-performance liquid chromatography
HRSC – heat recovery steam cycle
HT—high throughput
HTFCs—high-temperature fuel cells
H2NIP—Hydrogen Network Investment Plan
HTPH—high throughput pretreatment and enzymatic hydrolysis
HyPPO—Hydrogen Progress, Priorities and Opportunities report
Hz—Hertz
ICE—internal combustion engine
ICEV—internal combustion engine vehicle
ICT – Innovative Clean Transit Regulation
ICU—inverter-charger unit
ICTC—Interstate Clean Transportation Corridor
ITS – intelligent transportation system
IVOC—intermediate volatility organic compound
JETSI - Joint Electric Truck Scaling Initiative
kg—kilogram
kWh – kilowatt-hour
LADOT—City of Los Angeles Dept. of Transportation
LADWP—Los Angeles Department of Water and Power
LAEDC – Los Angeles Economic Development Corporation
LA Metro – Los Angeles County Metropolitan Transportation Authority
LBCT – Long Beach Container Terminal
LCA—life cycle assessment
LCFS—Low Carbon Fuel Standard
LED – low emission diesel
LFP – lithium iron phosphate
Li—lithium ion
LIGHTS – Low Impact Green Heavy Transport Solutions
LIMS—Laboratory Information Management System
LLC—low load cycle
LLNL—Lawrence Livermore National Laboratory
LNG—liquefied natural gas
LO-SCR— light-off selective catalytic reduction
LPG—liquefied petroleum gas or propane
LRUSA – Landi Renzo USA Corporation
LSM—linear synchronous motor
LSV—low-speed vehicle
LUV—local-use vehicle
LVP—low vapor pressure
MATES—Multiple Air Toxics Exposure Study
MCE—multi cylinder engine

## LIST OF ACRONYMS (cont'd)

MCFC—molten carbonate fuel cells
MD—medium duty
MECA—Manufacturers of Emission Controls Association
MOA—Memorandum of Agreement
MOVES—Motor Vehicle Emission Simulator
MPa—MegaPascal
MPFI—Multi-Port Fuel Injection
MPG—miles per gallon
MPGde—miles per gallon diesel equivalent
MSRC—Mobile Source Air Pollution Reduction Review Committee
MSW—municipal solid wastes
MY—model year
MTA—Metropolitan Transportation Authority (Los Angeles County "Metro")
NAAQS—National Ambient Air Quality Standards
NAFA—National Association of Fleet Administrators
NAICS – North American Industry Classification System
NFPA—National Fire Protection Association
NCP—nonconformance penalty
NEV—neighborhood electric vehicles
NextSTEPS—Next Sustainable Transportation Energy Pathways
NG/NGV—natural gas/natural gas vehicle
NGO—non-governmental organization
NH3—ammonia
Nitro-PAHs – nitrated polycyclic aromatic hydrocarbons
NHTSA—Natural Highway Traffic Safety Administration
NMC – nickel manganese cobalt
NMHC—non-methane hydrocarbon
NO—nitrogen monoxide
$NO_2$—nitrogen dioxide
NO + $NO_2$—nitrous oxide
NOPA—Notice of Proposed Award
NOx—oxides of nitrogen
NRC—National Research Council
NREL—National Renewables Energy Laboratory
NRTC – non-road-tested cycle
NSPS—new source performance standard
NSR—new source review
NZ—near zero
NZE – near zero emission
O3 - ozone
OBD—on-board diagnostics
OCS—overhead catenary system
OCTA—Orange County Transit Authority
OEHHA—Office of Environmental Health Hazard Assessment
OEM—original equipment manufacturer
One-off—industry term for prototype or concept vehicle
PAH—polycyclic aromatic hydrocarbons
PbA—lead acid
PCM—powertrain control module
PEMFC—proton exchange membrane fuel cell
PEMS—portable emissions measurement system
PEV—plug-in electric vehicle
PFI – port fuel injection
PHET – plug in hybrid electric tractor
PHET—plug-in hybrid electric truck
PHEV—plug-in hybrid vehicle
PM—particulate matter
PM – permanent magnet
PM2.5—particulate matter ≤ 2.5 microns
PM10—particulate matter ≤ 10 microns
POH – Port of Hueneme
POLA – Port of Los Angeles
POLB – Port of Long Beach
PON – Program Opportunity Notice
POS—point of sale
ppm—parts per million
ppb—parts per billion
PSI—Power Solutions International
PTR-MS—proton transfer reaction-mass spectrometry
QVM – qualified vehicle modifiers
R&D – research and development
RD&D—research, development and demonstration
RDD&D (or RD3)—research, development, demonstration and deployment
REMD – roadside emissions monitoring device
RFA – Renewable Fuels Association
RFI – Request for Information
RFP—Request for Proposal
RFS—renewable fuel standards
RI—reactive intermediates
RMC – ramped modal cycle
RMC-SET— ramped modal cycle supplemental emissions test
RNG—renewable natural gas
ROG – reactive organic gases
RPS – Rail Propulsion Systems
RTP/SCS—Regional Transportation Plan/Sustainable Communities Strategy

## LIST OF ACRONYMS (cont'd)

S2S – Shore to Store
SAE—Society of Automotive Engineers
SB—Senate Bill
SCAB—South Coast Air Basin or "Basin"
SCAG – Southern California Association of Governments
SCAQMD—South Coast Air Quality Management District
SCFM—standard cubic feet per minute
SCE – single cylinder engine
SCE—Southern California Edison
SCE – Southern Counties Express
SCR—selective catalytic reduction
SCRT - Selective Catalytic Regenerating Technology
SCCRT - Selective Catalytic Continuously Regenerating Technology
SHR—steam hydrogasification reaction
SI—spark ignited
SI-EGR—spark-ignited, stoichiometric, cooled exhaust gas recirculation
SIP—State Implementation Plan
SJVAPCD—San Joaquin Valley Air Pollution Control District
SMR – steam methane reforming
SNG – synthetic natural gas
SOAs—secondary organic aerosols
SOC – state-of-charge
SoCalGas—Southern California Gas Company (A Sempra Energy Utility)
SOFC – solid oxide fuel cells
START – Sustainable Terminals Accelerating Regional Transportation
SULEV—super ultra-low emission vehicle
SUV—sports utility vehicle
SwRI – Southwest Research Institute
TAC – toxic air contaminants
TAO—Technology Advancement Office
TAP— (Ports') Technology Advancement Program
TC—total carbon
TCO – total cost of ownership
TEMS—transportable emissions measurement system
THC—total hydrocarbons
TLS – Toyota Logistics Services
TO—task order
tpd—tons per day
TRB—Transportation Research Board
TRL—technology readiness level
TSI—Three Squares, Inc.
TTSI—Total Transportation Services, Inc.
TWC—three-way catalyst
UCI – University of California, Irvine
UCR—University of California, Riverside
UCR/CE-CERT—UCR/College of Engineering/Center for Environmental Research & Technology
UCLA—University of California, Los Angeles
UDDS—urban dynamometer driving schedule
µg/m$^3$—microgram per cubic meter
ULEV—ultra low emission vehicle
ULSD – ultra low sulfur diesel
UPS—United Postal Service
U.S.—United States
U.S.EPA—United States Environmental Protection Agency
USTS – United States Training Ship
V2B—vehicle-to-building
V2G—vehicle-to-grid
V2G/B—vehicle-to-building functionality
VMT—vehicle miles traveled
VOC—volatile organic compounds
V-PER – vessel performance management package
VPP—virtual power plant
WAIRE - Warehouse Actions and Investments to Reduce Emissions Program
WGS – water gas shift
WVU—West Virginia University
ZANZEFF – Zero and Near Zero Emission Freight Facilities
ZE – zero emission
ZEB – zero-emission bus
ZECT—Zero Emission Cargo Transport
ZEDT – Zero Emission Drayage Truck
ZEV—zero emissions vehicle

**ATTACHMENT E**

**RESOLUTION NO. 22-____**

**A Resolution of the Governing Board of the South Coast Air Quality Management District (South Coast AQMD) determining that Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations, is exempt from the requirements of the California Environmental Quality Act (CEQA).**

**A Resolution of the South Coast AQMD Governing Board amending Rule 1115 Motor Vehicle Assembly Line Coating Operations.**

**WHEREAS**, the South Coast AQMD Governing Board finds and determines that Proposed Amended Rule 1115 is considered a "project" as defined by CEQA; and

**WHEREAS**, the South Coast AQMD has had its regulatory program certified pursuant to Public Resources Code Section 21080.5 and CEQA Guidelines Section 15251(l) and has conducted a CEQA review and analysis of Proposed Amended Rule 1115 pursuant to such program (South Coast AQMD Rule 110); and

**WHEREAS**, the South Coast AQMD Governing Board finds and determines after conducting a review of the proposed project in accordance with CEQA Guidelines Section 15002(k) – General Concepts, the three-step process for deciding which document to prepare for a project subject to CEQA, and CEQA Guidelines Section 15061 – Review for Exemption, procedures for determining if a project is exempt from CEQA, that Proposed Amended Rule 1115 is exempt from CEQA; and

**WHEREAS**, the South Coast AQMD Governing Board finds and determines that, it can be seen with certainty that there is no possibility that Proposed Amended Rule 1115 may have any significant effects on the environment, and is therefore exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3) – Common Sense Exemption; and

**WHEREAS**, the South Coast AQMD staff has prepared a Notice of Exemption for Proposed Amended Rule 1115 that is completed in compliance with CEQA Guidelines Section 15062 – Notice of Exemption; and

**WHEREAS**, Proposed Amended Rule 1115 and supporting documentation, including but not limited to, the Notice of Exemption, the Board Letter, and Final Staff Report, were presented to the South Coast AQMD Governing Board and the South Coast AQMD Governing Board has reviewed and considered this information, as well as has taken and considered staff testimony and public comment prior to approving the project; and

**WHEREAS**, the South Coast AQMD Governing Board finds and determines, taking into consideration the factors in Section (d)(4)(D) of the Governing Board Procedures (codified as Section 30.5(4)(D)(i) of the Administrative Code), that there were no modifications to Proposed Amended Rule 1115 since the Notice of Public Hearing was published; and

**WHEREAS**, Proposed Amended Rule 1115 will be submitted for inclusion into the State Implementation Plan; and

**WHEREAS**, Health and Safety Code Section 40727 requires that prior to adopting, amending or repealing a rule or regulation, the South Coast AQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing and in the Final Staff Report; and

**WHEREAS,** the South Coast AQMD Governing Board has determined that a need exists to amend Rule 1115 – Motor Vehicle Assembly Line Coating Operations to revise emission limits of volatile organic compounds for coatings used in the automotive assembly line processes and for other miscellaneous materials used at motor vehicle assembly coating operations to fulfill Reasonably Available Control Technology requirements; and

**WHEREAS**, the South Coast AQMD Governing Board obtains its authority to adopt, amend, or repeal rules and regulations from California Health and Safety Code Sections 39002, 39616, 40000, 40001, 40440, 40702, 40725 through 40728, 40920.6, and 41508, as well as the Clean Air Act; and

**WHEREAS**, the South Coast AQMD Governing Board finds that there is an ozone problem that Proposed Amended Rule 1115 will alleviate and will promote the attainment or maintenance of state or federal ambient air quality standards; and

**WHEREAS**, the South Coast AQMD Governing Board has determined that Proposed Amended Rule 1115 is written and displayed so that its meaning can be easily understood by persons directly affected by it; and

**WHEREAS**, the South Coast AQMD Governing Board has determined that Proposed Amended Rule 1115 is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations; and

**WHEREAS**, the South Coast AQMD Governing Board has determined that Proposed Amended Rule 1115 does not impose the same requirements as any existing state or federal regulations, and the proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD; and

**WHEREAS**, the South Coast AQMD Governing Board, in amending Rule 1115, references the following statute which the South Coast AQMD hereby implements, interprets or makes specific: California Health and Safety Code Sections 39002, 40001, 40702, 40440(a), and 40725 through 40728.5, and Clean Air Act Section 110; and

**WHEREAS**, Health and Safety Code Section 40727.2 requires the South Coast AQMD to prepare a written analysis of existing federal air pollution control requirements applicable to the same source type being regulated whenever it adopts, or amends a rule, and the South Coast AQMD's comparative analysis of Proposed Amended Rule 1115 is included in the Final Staff Report; and

**WHEREAS,** the South Coast AQMD Governing Board has determined that the Socioeconomic Impact Assessment is not required, pursuant to Health and Safety

Code Section 40440.8 or 40728.5, because Proposed Amended Rule 1115 will not have a significant impact on air quality or emissions limitations; and

**WHEREAS**, the South Coast AQMD staff conducted a public workshop on January 6, 2022 regarding Proposed Amended Rule 1115; and

**WHEREAS**, the public hearing has been properly noticed in accordance with all provisions of California Health and Safety Code Sections 40440.5 and 40725; and

**WHEREAS**, the South Coast AQMD Governing Board has held a public hearing in accordance with all provisions of law; and

**WHEREAS**, the South Coast AQMD specifies the Planning and Rules Manager of Rule 1115 as the custodian of the documents or other materials which constitute the record of proceedings upon which the adoption of these proposed amendments is based, which are located at the South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, California; and

**NOW, THEREFORE BE IT RESOLVED,** that the South Coast AQMD Governing Board does hereby determine, pursuant to the authority granted by law, that Proposed Amended Rule 1115 is exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3) – Common Sense Exemption. This information was presented to the South Coast AQMD Governing Board, whose members exercised their independent judgment and reviewed, considered and approved the information therein prior to acting on Proposed Amended Rule 1115; and

**BE IT FURTHER RESOLVED**, that the South Coast AQMD Governing Board does hereby adopt, pursuant to the authority granted by law, Proposed Amended Rule 1115 as set forth in the attached, and incorporated herein by reference; and

**BE IT FURTHER RESOLVED,** that the South Coast AQMD Governing Board requests that Proposed Amended Rule 1115 be submitted into the State Implementation Plan; and

**BE IT FURTHER RESOLVED,** that the Executive Officer is hereby directed to forward a copy of this Resolution and Proposed Amended Rule 1115 and supporting documentation to the California Air Resources Board for approval and subsequently submitted to the U.S. Environmental Protection Agency for inclusion into the State Implementation Plan.

DATE: _____ _____

CLERK OF THE BOARDS

(Adopted March 2, 1979)(Amended December 5, 1980)(Amended March 16, 1984)
(Amended March 2, 1990)(Amended August 2, 1991)(Amended March 6, 1992)
(Amended May 12, 1995)(Amended March 4, 2022)

# PROPOSED AMENDED RULE 1115 MOTOR VEHICLE ASSEMBLY LINE COATING OPERATIONS

(a) Purpose ~~and Applicability~~

The purpose of Rule 1115 is to reduce volatile organic compound (VOC) emissions that result from coating operations conducted on motor vehicle assembly lines. ~~This rule applies to all assembly line coating operations, conducted during the manufacturing of new motor vehicles.~~

(b) Applicability

The provisions of this rule shall apply to an owner or operator engaged in assembly line coating operations conducted during the manufacturing of new motor vehicles and other automotive parts that are coated during the vehicle assembly process as well as during associated solvent cleaning operations. This rule does not apply to activities subject to Rule 1151 – *Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations*.

(~~b~~c) Definitions

For the purpose of this rule, the following definitions shall apply:

(1) ADHESIVE means any chemical substance that is applied for the purpose of bonding two surfaces together other than by mechanical means.

(2) ANTIRUST COATING means a coating that is specifically labeled and formulated to be applied to a metal substrate to prevent the oxidation of the metal and not applied during the assembly line process.

(~~1~~3) APPLICATION LINE ~~is~~ means that portion of a motor vehicle assembly production line which applies surface coatings and other coatings to motor vehicle bodies, hoods, fenders, cargo boxes, doors, and grill opening panels.

(~~2~~4) ASSEMBLY LINE ~~is~~ means an arrangement of industrial equipment and workers in which the product passes from one specialized operation to another until complete, by either automatic or manual means.

(~~3~~5) BASECOAT ~~is~~ means a pigmented topcoat which is the first topcoat applied as part of a multistage topcoat system.

(~~4~~6) BASECOAT/CLEARCOAT (BC/CC) ~~is~~ means a topcoat consisting of a ~~base coat~~basecoat portion and a ~~clear coat~~clearcoat portion.

(7) BEDLINER means a multi-component coating applied to a cargo bed after the application of topcoat and outside of the topcoat operation to provide additional durability.

(~~5~~8) CAPTURE EFFICIENCY ~~is~~ means the percentage of volatile organic compounds used, emitted, evolved, or generated by the operation, that are collected and directed to an air pollution control device.

(9) CAVITY WAX means a coating applied into the cavities of the vehicle primarily for the purpose of enhancing corrosion protection.

(~~6~~10) CLEARCOAT ~~is~~ means a topcoat which contains no pigments or only transparent pigments and which is the final topcoat applied as part of a multistage topcoat system.

(~~7~~11) COATING ~~is~~ means a material which is applied to a surface in order to beautify and/or protect such surface.

(12) DEADENER means a coating applied to selected vehicle surfaces primarily for the purpose of reducing the sound of road noise in the passenger compartment.

(13) ELECTRODEPOSITION means a process of applying a protective, corrosion-resistant waterborne primer on exterior and interior surfaces that provides thorough coverage of recessed areas. It is a dip coating method that uses an electrical field to apply or deposit the conductive coating onto the part.~~ELECTROPHORETIC APPLIED PRIMER is an undercoat applied by dipping the component in a coating bath with an electrical potential difference between the component and the bath.~~

(~~9~~14) EXEMPT COMPOUNDS ~~are~~ means ~~any of the following compounds:~~ those compounds defined as Exempt Compounds in ~~as defined in~~ Rule 102 – *Definition of Terms*.

~~(A) Group I~~

~~trifluoromethane (HFC-23)~~

~~chlorodifluoromethane (HCFC-22)~~

~~dichlorotrifluoroethane (HCFC-123)~~

~~2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)~~

~~pentafluoroethane (HFC-125)~~

~~1,1,2,2-tetrafluoroethane (HFC-134)~~

~~tetrafluoroethane (HFC-134a)~~

~~dichlorofluoroethane (HCFC-141b)~~

~~chlorodifluoroethane (HCFC-142b)~~

~~1,1,1-trifluoroethane (HFC-143a)~~

~~1,1-difluoroethane (HFC-152a)~~

~~cyclic, branched, or linear, completely fluorinated alkanes;~~

~~cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;~~

~~cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and~~

~~sulfur-containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine~~

~~(B) Group II~~

~~methylene chloride~~

~~carbon tetrachloride~~

~~1,1,1-trichloroethane (methyl chloroform)~~

~~trichlorotrifluoroethane (CFC-113)~~

~~dichlorodifluoromethane (CFC-12)~~

~~trichlorofluoromethane (CFC-11)~~

~~dichlorotetrafluoroethane (CFC-114)~~

~~chloropentafluoroethane (CFC-115)~~

~~Use of Group II compounds may be restricted in the future because they are toxic, potentially toxic, or are upper-atmosphere ozone depleters, or cause other environmental impacts. By January 1, 1996, production of chlorofluorocarbons (CFC), 1,1,1-trichloroethane (methyl chloroform), and carbon tetrachloride will be phased out in accordance with the Code of Federal Regulation Title 40, Part 82 (December 10, 1993). Specifically, the District Board has established a policy to phase out chlorofluorocarbons (CFC) on or before 1997.~~

(~~10~~15) FINAL REPAIR ~~is~~ means the operations performed and coating(s) applied to completely-assembled motor vehicles, or to parts that are not yet on a completely assembled motor vehicle, to correct damage or imperfections in the coating.~~the final coating applied to correct topcoat imperfections prior to shipment.~~

(16) FLEXIBLE COATING means a coating applied to polyurethane or vinyl substrate to protect the substrate from damage or to repair the substrate.

(17) GASKET/GASKET SEALING MATERIAL means a fluid applied to coat a gasket or replace and perform the same function as a gasket. Automobile and

light-duty truck gasket/gasket sealing material includes room temperature vulcanization (RTV) seal material.

(18) GLASS BONDING PRIMER means a primer applied to the windshield or other glass, or to body openings, to prepare the glass or body opening for the application of glass bonding adhesives or the installation of adhesive bonded glass. Automotive and light-duty truck glass bonding primer includes glass bonding/cleaning primers that perform both functions (cleaning and priming of the windshield or other glass, or body openings) prior to the application of adhesive or the installation of adhesive bonded glass.

(19) HIGH-VOLUME, LOW-PRESSURE (HVLP) SPRAY EQUIPMENT means equipment used to apply materials by means of a spray gun which is designed to atomize 100 percent by air pressure only and intended to be operated, and which is operated, between 0.1 and 10.0 pounds per square inch gauge (psig) of air atomizing pressure measured dynamically at the center of the air cap and at the air horns and is capable of achieving a transfer efficiency of a minimum of 65%.

(20) LUBRICATING WAX/COMPOUND means a protective lubricating material applied to vehicle hubs and hinges.

(~~11~~21) METALLIC/IRIDESCENT TOPCOAT ~~is~~ means a topcoat which contains iridescent particles, composed of either metal as metallic particles or silicon as mica particles, in excess of 5 g/L (0.042 lb/gal) as applied, where such particles are visible in the dry film.

(~~12~~22) MIDCOAT ~~is~~ means a semi-transparent topcoat which is the middle topcoat applied as part of a three-stage topcoat system.

(~~13~~23) MOTOR VEHICLES ~~are~~ means any self-propelled vehicles, including, but not limited to, motorcycles, passenger cars, light-duty trucks and vans, medium-duty and heavy-duty vehicles as defined in Section 1900, Title 13, of the California ~~Administrative Code~~ Code of Regulations. Additional examples include, but are not limited to, automobiles, buses, golf carts, tanks, and armored personnel carriers.~~all passenger cars, light-duty trucks, medium-duty vehicles and heavy-duty vehicles as defined in Section 1900, Title 13, California Administrative Code.~~

(~~14~~24) MULTISTAGE TOPCOAT SYSTEM ~~is~~ means any basecoat/clearcoat topcoat system or any three-stage topcoat system, manufactured as a system, and used as specified by the manufacturer.

(~~15~~25) OVERALL CONTROL EFFICIENCY ~~is~~ means the efficiency of an emission control system at which an equivalent or greater level of VOC reduction will be achieved so that the VOC emissions resulting from the use of coatings subject to

this rule comply with the VOC emission limits established by the rule and includes consideration of both the capture efficiency and the efficiency of the control technology.~~the product of capture and control efficiencies.~~

(26) PLASTIC PART means a polymer-based component added or installed onto a motor vehicle during the manufacturing process. It does not include any adhesives used to attach a plastic part to a vehicle.

(~~16~~27) PRIMER ~~is any or all coatings beneath the topcoat~~means any coating applied prior to the applications of a topcoat for the purpose of corrosion resistance and/or adhesion of the topcoat.

~~(16) SPRAY PRIMER is any primer, except primer surfacer, that is applied by spraying.~~

(~~17~~28) PRIMER SURFACER ~~is~~ means an intermediate protective coating applied over the electrodeposition primer and under the topcoat. Primer-surfacer provides adhesion, protection, and appearance properties to the total finish. Primer-surfacer may also be called guide coat or surfacer. ~~a primer coat applied over an electrophoretically applied primer.~~

(29) PRIMER SURFACER OPERATIONS may include other coating(s) (e.g., anti-chip, lower-body anti-chip, chip-resistant edge primer, spot primer, blackout, deadener, interior color, basecoat replacement coating, etc.) that is (are) applied in the same spray booth(s).

(30) SEALER means a high viscosity material generally, but not always, applied in the paint shop after the body has received an electrodeposition primer coating and before the application of subsequent coatings (e.g., primer-surfacer). The primary purpose of an automotive sealer is to fill body joints completely so that there is no intrusion of water, gases or corrosive materials into the passenger area of the body compartment. Such materials are also referred to as sealant, sealant primer, or caulk.

(31) SOLIDS TURNOVER RATIO ($R_T$) means the ratio of total volume of coating solids that is added during electrodeposition in a calendar month divided by the total volume design capacity of the system.

(~~19~~32) SOLVENT CLEANING OPERATION ~~is~~ means the removal of loosely held uncured adhesives, uncured inks, uncured coatings, and contaminants which include, but are not limited to, dirt, soil, and grease from parts, products, tools, machinery, equipment, and general work areas. Each distinct method of cleaning in a cleaning process which consists of a series of cleaning methods shall constitute a separate solvent cleaning operation.

(~~20~~33) THREE-STAGE TOPCOAT SYSTEM ~~is~~ means a topcoat system composed of a basecoat portion, a midcoat portion, and a transparent clearcoat portion.

(~~21~~34) TOPCOAT ~~is~~means the final coating applied to provide the final color and/or a protective finish. The topcoat may be a monocoat color or basecoat/clearcoat system. In-line repair and two-tone are part of topcoat. ~~the final coating applied for the purpose of establishing the final color and/or protective surface. This includes all multistage topcoat systems, metallic/iridescent topcoats, and final repair coatings.~~

(~~22~~35) TRANSFER EFFICIENCY ~~is~~ means the ratio of the ~~weight (or~~ volume~~)~~ of coating solids adhering to an object to the total ~~weight (~~or volume~~)~~ of coating solids used in the application process expressed as a percentage.

(36) TRUNK INTERIOR COATING means a coating outside of the primer-surfacer and topcoat operations, applied to the trunk interior to provide chip protection.

(37) UNDERBODY COATING means a coating applied to the undercarriage or firewall to prevent corrosion and/or provide chip protection.

(38) VOC OF COATING LESS WATER AND LESS EXEMPT COMPOUNDS, OR REGULATORY VOC, means the weight of VOC per combined volume of VOC and coating solids and shall be calculated by the following equation:

$$\text{VOC OF COATING LESS WATER AND LESS EXEMPT COMPOUNDS (expressed in grams per liter or pounds per gallon)} = \frac{Wv - Ww - Wec}{Vm - Vw - Vec}$$

Where: Wv = Weight of volatile compounds

Ww = Weight of water

Wec = Weight of exempt compounds

Vm = Volume of material

Vw = Volume of water

Vec = Volume of exempt compounds

Weight is expressed in either grams or pounds.

Volume is expressed in either liters or gallons.

(39) VOC OF MATERIAL, OR ACTUAL VOC, means the weight of VOC per volume of material and shall be calculated by the following equation:

$$\text{VOC OF MATERIAL (expressed in grams per liter or pounds per gallon)} = \frac{Wv - Ww - Wec}{Vm}$$

Where: Wv = Weight of volatile compounds
Ww = Weight of water
Wec = Weight of exempt compounds
Vm = Volume of material

Weight is expressed in either grams or pounds.

Volume is expressed in either liters or gallons.

(40) VOC WEIGHT PER VOLUME OF SOLIDS DEPOSITED means the ratio of the VOC of material expressed in pounds per gallon (or grams per liter) to the amount of solids deposited during the application of a coating and shall be calculated by the following equation:

$$VOCdep = \frac{VOCmat}{TE \times V\%solid}$$

Where: VOCdep = VOC weight per volume of solids deposited
VOCmat = VOC of material
TE = Transfer efficiency (%)
V%solid = Volume percent of solids in the coating

(~~23~~4 1) VOLATILE ORGANIC COMPOUND (VOC) ~~is~~ means the same as defined in Rule 102 – *Definition of Terms* ~~any volatile compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate, and exempt compounds~~.

(42) WEATHERSTRIP ADHESIVE means an adhesive applied to weatherstripping materials for the purpose of bonding the weatherstrip material to the surface of the vehicle.

(43) WHEEL TOPCOAT APPLICATION means a process where a coating is applied to the rims of tires installed on a motor vehicle.

(~~e~~d) Requirements

(1) VOC Content of Coatings and VOC Emission Limits

~~(A)~~ ~~A~~An ~~person~~ owner or operator of a motor vehicle assembly line shall not apply ~~any electrophoretic primer, in any motor vehicle application line, which has a VOC content in excess of 145 grams per liter (1.2 lb/gal) of~~

~~coating, less water and less exempt compounds.~~a coating or miscellaneous material used at motor vehicle coating operations that has a VOC content in excess of the limits specified in Table 1 or Table 2 of this subdivision, except as provided in paragraph (d)(2).

~~(B) A person shall not apply any final repair coating, in any motor vehicle application line, which has a VOC content in excess of 580 grams per liter (4.8 lb/gal) of coating, less water and less exempt compounds.~~

~~(C) A person shall not apply any spray primer, primer surfacer and/or topcoat in any motor vehicle application line that result in VOC emissions in excess of 1.80 kilograms per liter (15.0 lb/gal) of applied solids.~~

**Table 1: VOC Emission Limits for Motor Vehicle Assembly Coating Operations**

<table>
<tr><th>Assembly Coating Process</th><th colspan="3">VOC Emission Limit</th></tr>
<tr><td rowspan="2">Electrodeposition Primer operations (including application area, spray/rinse stations, and curing oven)</td><td>Solids Turnover Ratio ($R_T$)≥0.16</td><td>$0.040 \leq R_T < 0.160$</td><td>$R_T < 0.040$</td></tr>
<tr><td>0.084 kg VOC per liter (0.7 lb/gal) of solids deposited</td><td>$0.084 \times 350^{0.160 - R_T}$ kg VOC per liter<br>($0.084 \times 350^{0.160 - R_T} \times 8.34$ lb/gal) of solids deposited</td><td>No VOC emission limit</td></tr>
<tr><td>Primer-Surfacer operations (including application area, flash off area, and oven)</td><td colspan="3" rowspan="3">1.44 kg VOC per liter (12.0 lb VOC/gal) of solids deposited</td></tr>
<tr><td>Topcoat operations (including application area, flash-off area, and oven)</td></tr>
<tr><td>Combined Primer-Surfacer and Topcoat operations</td></tr>
<tr><td>Final Repair operations</td><td colspan="3">0.580 kg VOC per liter (4.8 lb VOC/gal) of Coating less water and less exempt solvents</td></tr>
</table>

**Table 2: VOC Content Limits for Miscellaneous Materials Used in Motor Vehicle Assembly Coating Operations (Grams of VOC per Liter of Coating Less Water and Less Exempt Compounds, as Applied)**

| Material | VOC Emission Limit, as Applied grams per liter (lbs/gal) |
|---|---|
| Glass Bonding Primer | 900 (7.5) |
| Adhesive | 250 (2.1) |
| Cavity Wax | 650 (5.4) |
| Sealer | 650 (5.4) |
| Deadener | 650 (5.4) |
| Gasket/Gasket Sealing Material | 200 (1.7) |
| Underbody Coating | 650 (5.4) |
| Trunk Interior Coating | 650 (5.4) |
| Bedliner | 200 (1.7) |
| Weatherstrip Adhesive | 750 (6.3) |
| Lubricating Wax/Compound | 700 (5.8) |

(2) An ~~person~~ owner or operator may comply with the requirements of paragraph (~~c~~d)(1) by means of an Alternative Emission Control Plan pursuant to Rule 108 – *Alternative Emission Control Plans*.

(3) Approved Emission Control System

An ~~person~~ owner or operator may comply with the provisions of paragraph (~~c~~d)(1) by using an approved emission control system for reducing VOC emissions, consisting of collection and control devices, provided such emission control system is approved pursuant to Rule 203 – Permit to Operate, in writing

by the Executive Officer, for reducing emissions of VOC. The approved emission control system shall reduce the VOC emissions resulting from the use of coatings by an equivalent or greater level to that which would have been achieved by the provisions of paragraph (~~c~~d)(1).

The required efficiency of an emission control system at which an equivalent or greater level of VOC reduction will be achieved shall be calculated by the following equation:

$$C.E. = [\,1 - \{\, \frac{(VOC_{LWc})}{(VOC_{LWn,Max})} \times \frac{1 - (VOC_{LWn,Max}/D_{n,Max})}{1 - (VOC_{LWc}/D_c)} \,\}\,] \times 100$$

Where: C.E. = Overall Control Efficiency, percent

$VOC_{LWc}$ = VOC Limit of Rule 1115, less water and less exempt compounds, pursuant to subdivision (~~c~~d).

$VOC_{LWn,MAX}$ = Maximum VOC content of non-compliant coating used in conjunction with a control device, less water and exempt compounds.

$D_{n,MAX}$ = Density of solvent, reducer, or thinner contained in the non-compliant coating.

$D_c$ = Density of corresponding solvent, reducer, or thinner used in the compliant coating system = 880 g/L.

(4) Carcinogenic Materials

A person shall not manufacture motor vehicle assembly coatings for use in the South Coast AQMD in which nickel, cadmium or hexavalent chromium is introduced, used, or included as a pigment or as an agent to impart any property or characteristic to the motor vehicle assembly coatings during manufacturing, distribution, or use of the applicable motor vehicle assembly coatings.

(5) Transfer Efficiency

(A) An owner or operator of an assembly line coating operation shall not apply coatings to any motor vehicle or any associated parts or components to a motor vehicle on an assembly line except by the use of one of the following methods:

(i) electrostatic application, or

(ii) high-volume, low-pressure (HVLP) spray, or

(iii) brush, dip, or roller, or

(iv) spray gun application, provided the owner or operator demonstrates that the spray gun meets the HVLP definition in paragraph (c)(19) in design and use. A satisfactory demonstration must be based on the manufacturer's published technical material on the design of the spray gun and by a demonstration of the operation of the spray gun using an air pressure tip gauge from the manufacturer of the spray gun, or

(v) any such other automotive coating application methods as demonstrated, in accordance with the provisions of subparagraph (f)(2) capable of achieving equivalent or better transfer efficiency than the automotive coating application method listed in clause (d)(5)(A)(ii), provided written approval is obtained from the Executive Officer prior to use.

(B) An owner or operator shall not apply any automotive coating by any of the methods listed in subparagraph (d)(5)(A) unless the automotive coating is applied with properly operating equipment, operated according to procedures recommended by the manufacturer and in compliance with applicable permit conditions, if any.

(~~4~~6) Solvent Cleaning Operations; Storage and Disposal of VOC-containing Materials.

Solvent cleaning of application equipment, parts, products, tools, machinery, equipment, general work areas, and the storage and disposal of VOC-containing materials used in solvent cleaning operations shall be ~~carried out pursuant~~subject to Rule 1171 – ~~–~~*Solvent Cleaning Operations*.

(e) Recordkeeping

(1) Recordkeeping for VOC Emissions

An owner or operator shall maintain records of automotive coating usage pursuant to South Coast AQMD Rule 109 – *Recordkeeping for Volatile Organic Compound Emissions* to demonstrate compliance with the emission limits in subdivision (d), and shall at a minimum include the following information:

(A) Material name and manufacturer; and

(B) Current manufacturer specification sheets, safety data sheets, technical data sheets, or air quality data sheets, which list the actual VOC, regulatory VOC, and solids content, for each ready-to-spray automotive coating (based on the manufacturer's stated mix ratio), and automotive coating components.

(C) Current manufacturer specification sheets, safety data sheets, technical data sheets, or air quality data sheets, which list the actual VOC and regulatory VOC for Miscellaneous Materials Used at Motor Vehicle Assembly Coating Operations

(2) Recordkeeping for Emission Control Systems

An owner or operator using an emission control system shall maintain records, available upon request by the Executive Officer, of key system operating parameters which will demonstrate continuous operation and compliance of the emission control system during periods of VOC emission producing activities. "Key system operating parameters" are those parameters necessary to ensure or document compliance with paragraph (d)(3), including, but not limited to, temperatures, pressure drop, and air flow rates.

(~~e~~f) Methods of Analysis

(1) Determination of VOC and solids content

The VOC and solids content of materials subject to the provisions of the rule shall be determined by the following methods:

(A) United States Environmental Protection Agency ~~USEPA~~ Reference Method 24, ~~(~~[Code of Federal Regulations (CFR) Title 40, Part 60, Appendix A]~~)~~. The exempt compound content shall be determined by ~~SCAQMD~~South Coast AQMD Test Method 303 (Determination of Exempt Compounds) contained in the South Coast~~SCAQMD~~ AQMD ~~"~~*Laboratory Methods of Analysis for Enforcement Samples*~~"~~ manual or;

(B) South Coast ~~SCAQMD~~AQMD Test Method 304 [Determination of Volatile Organic Compounds (VOCs) in Various Materials] contained in the South Coast ~~SCAQMD~~AQMD ~~"~~*Laboratory Methods of Analysis for Enforcement Samples*~~"~~ manual~~.~~; or

(C) American Society of Testing and Materials (ASTM) Test D2369 – Standard Test Method for Volatile Content of Coatings.

(~~C~~D) Exempt Perfluorocarbon Compounds

The following classes of compounds:

cyclic, branched, or linear, completely fluorinated alkanes;

cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;

cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and

sulfur-containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine,

will be analyzed as exempt compounds for compliance with paragraph (c), only when manufacturers specify which individual compounds are used in the coating formulation. In addition, the manufacturers must identify the United States Environmental Protection Agency, California Air Resources Board, and the District approved test methods used to quantify the amount of each exempt compound.

~~(2) Determination of Compliance, Including Transfer Efficiency~~

~~Determination of compliance, including transfer efficiency, to verify compliance with subparagraph (c)(1)(C) shall be conducted as prescribed in EPA Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations, dated December 1988.~~

(2) Determination of Transfer Efficiency

The transfer efficiency of alternative automotive coating application methods, as defined by clause (d)(5)(A)(v), shall be determined in accordance with the South Coast AQMD method "Spray Equipment Transfer Efficiency Test Procedure for Equipment User, May 24, 1989," and South Coast AQMD "Guidelines for Demonstrating Equivalency With District Approved Transfer Efficiency Spray Gun September 26, 2002."

(3) Determination of Efficiency of Emission Control System

(A) The capture efficiency of the emissions control system as specified in paragraph (~~c~~d)(3) shall be determined by the procedures presented in the ~~USEPA~~U.S. EPA technical guidance document, "Guidelines for Determining Capture Efficiency, January 9, 1995." Notwithstanding the test methods specified by the Guidelines, any other method approved by the ~~USEPA~~U.S. EPA, the California Air Resources Board, and the South Coast ~~SCAQMD~~AQMD Executive Officer may be substituted.

(B) The efficiency of the control device of the emission control system as specified in paragraph (~~c~~d)(3) and the VO5C content in the control device exhaust gases, measured and calculated as carbon, shall be determined by the ~~USEPA~~U.S. EPA Test Methods 25, 25A, or South Coast ~~SCAQMD~~AQMD Method 25.1 (Determination of Total Gaseous Non-Methane

Organic Emissions as Carbon) as applicable. ~~USEPA~~U.S. EPA Test Method 18, or ARB Method 422 shall be used to determine emissions of exempt compounds.

(4) Multiple Test Methods

When more than one test method or set of methods are specified for any testing, a violation of any requirement of this rule established by any one of the specified test methods or set of test methods shall constitute a violation of the rule.

(g) Rule 442 Applicability

Any motor vehicle application line exempt from all or a portion of this rule shall comply with the provisions of Rule 442 – *Usage of Solvents*.

(~~f~~h) Exemptions

(~~1~~) The provisions of paragraph (~~c~~d)(1) of this rule shall not apply to the following manufacturing ~~operations~~uses:

(~~A~~) ~~Other coating operations not associated with applying body primer, and topcoat coatings to exterior sheet metal and body.~~

(~~B~~) ~~Use of:~~

(~~i~~1) Wheel Topcoat Application

(~~ii~~2) Antirust Coatings

(~~iii~~) ~~Trunk Coatings~~

(~~iv~~) ~~Interior Coatings~~

(~~iii~~3) Flexible Coatings

(~~vi~~) ~~Sealers and Deadeners~~

(~~iv~~4) Plastic Parts

(~~v~~) ~~Accent and Stripe Coatings~~

(~~h~~) ~~Recordkeeping Daily Record of Coating and Solvent Usage~~

~~Daily records of coating and solvent usage shall be maintained pursuant to Rule 109.~~

# SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

**Final Staff Report**
**Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations**

**March 2022**


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**SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT**

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WAYNE NASTRI

## BACKGROUND

Rule 1115 – Motor Vehicle Assembly Line Coating Operations was adopted on March 2, 1979, with the purpose of reducing emissions of volatile organic compounds (VOCs) that result from the coating operations conducted on motor vehicle assembly lines during the manufacturing of new motor vehicles.

In 2015, the United States Environmental Protection Agency (U.S. EPA) lowered the 8-hour Ozone National Ambient Air Quality Standard (NAAQS or Standard) to 70 parts per billion (ppb). The South Coast Air Basin (Basin) is classified as an "extreme" nonattainment area and the Coachella Valley located in Riverside County is classified as a "severe-15" nonattainment area with respect to the 2015 Ozone Standard. The Clean Air Act (CAA) requires that areas classified as moderate nonattainment or higher must develop and submit a demonstration that their current air pollution regulations and emission sources fulfill Reasonably Available Control Technology (RACT) requirements.

The RACT demonstration provides a comparison of the South Coast AQMD rules and regulations with the guidelines established by the U.S. EPA as well as with the existing regulations from other air agencies within California and throughout the United States. The purpose of the RACT demonstration is to review, and where applicable, update an agency's existing regulations to meet the current state of the science and emission controls.

In 2008, ~~The~~ the U.S. EPA issued Control Techniques Guidelines (CTG) for Automobile and Light-Duty Truck Assembly Coatings that are more stringent than the VOC emission limits contained in the current South Coast AQMD Rule 1115. In addition, the VOC emission limits in Rule 1115 for several coating types are less stringent than those in the corresponding rules from other regulatory agencies. To fulfill RACT requirements, Proposed Amended Rule (PAR) 1115 will address these deficiencies.

## REGULATORY HISTORY FOR RULE 1115

Since its adoption, Rule 1115 has been amended six times. The rule was last amended on May 12, 1995 to include provisions that:

- Added a purpose and applicability section
- Reduced VOC limits to be in line with CTG limits prepared by the U.S. EPA, that were applicable at the time
- Added the requirement to use U.S. EPA's ''Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operation''
- Added specification for U.S. EPA approved capture and control efficiency source test method
- Included recordkeeping requirement for emission control systems

## PUBLIC PROCESS

The development of PAR 1115 has been conducted through a public process. A Public Workshop was held on January 6, 2022, with the associated comment period closing on January 19, 2022. The purpose of the Public Workshop was to present the proposed rule to the public and to other stakeholders and to receive any comments related to the proposal. One public comment was received during the Public Workshop (see Appendix A).

## SUMMARY OF PROPOSAL

PAR 1115 will update the VOC limits for coatings used in automotive assembly line processes and for other miscellaneous materials used at motor vehicle assembly coating operations to comply with RACT requirements. The update will incorporate the VOC limits recommended in the U.S. EPA 2008 CTG for Automobile and Light-Duty Truck Assembly Coatings (2008 CTG). The update will also include new terms and definitions and will update existing terms per definitions contained in the 2008 CTG and other sources. In addition, recordkeeping and testing requirements will be updated.

## PROPOSED AMENDMENTS TO RULE 1115

Rule 1115 was last amended on May 12, 1995. As part of this current rulemaking effort, the rule will be amended to reflect the recommendations contained in the 2008 CTG, include new sections and definitions based on terms introduced by the 2008 CTG, and be revised for clarity.

Revised Purpose – Subdivision (a)

Previously, Rule 1115 combined the purpose and applicability of the rule into one subsection. Consistent with other source-specific rules, purpose and applicability will be separated into two distinct subdivisions. The purpose remains to reduce VOC emissions from motor vehicle assembly line coating operations.

New Applicability – Subdivision (b)

PAR 1115 adds a new subdivision describing the applicability of the rule. The provisions of the rule shall apply to an owner or operator engaged in assembly line coating operations conducted during the manufacturing of new motor vehicles and other automotive parts that are coated during the vehicle assembly process as well as during associated solvent cleaning operations. This rule does not apply to activities subject to Rule 1151 – Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations.

New and Modified Definitions – Subdivision (c)

PAR 1115 incorporates VOC limits recommended in the U.S. EPA 2008 CTG for Automobile and Light-Duty Truck Assembly Coatings. As such, several new terms are introduced and defined in this subdivision based on the terms and definitions contained in the 2008 CTG. The following terms and definitions are considered new to Rule 1115:

- Adhesive
- Bedliner
- Cavity Wax
- Deadener
- Gasket/Gasket Sealing Material
- Glass Bonding Primer
- Lubricating Wax/Compound
- Primer
- Primer Surfacer Operations
- Sealer
- Solids Turnover Ratio ($R_T$)
- Trunk Interior Coating
- Underbody Coating
- Weatherstrip Adhesive

In addition to incorporating new terms in subdivision (c), several other existing terms in Rule 1115 were updated based on the terms and definitions contained in the 2008 CTG. The following terms and definitions are updated and revised for Rule 1115:

- Electrodeposition (formerly Electrophoretic Applied Primer)
- Final Repair
- Primer Surfacer
- Topcoat

In addition to incorporating new and revised terms in subdivision (c) based on the 2008 CTG, several other existing terms were updated and revised to be consistent with definitions contained in other source-specific South Coast AQMD rules. The following terms were updated for Rule 1115 based on reference to definitions contained in South Coast AQMD Rule 1151:

- Exempt Compound
- High-Volume, Low-Pressure (HVLP) Spray Equipment
- Motor Vehicles
- VOC of Coating Less Water and Less Exempt Compounds, or Regulatory VOC
- VOC of Material, or Actual VOC
- Volatile Organic Compound

Lastly, PAR 1115 includes definitions for terms contained in the rule but that were not previously defined:

- Antirust Coating
- Flexible Coating

- Overall Control Efficiency
- Plastic Part
- VOC Weight Per Volume of Solids Deposited
- Wheel Topcoat Applications

Updated and New Requirements – Subdivision (d)

PAR 1115 will include new, and update existing, VOC limits as recommended in the 2008 CTG issued by the U.S. EPA for Automobile and Light-Duty Truck Assembly Coatings. When compared to the VOC emission limits recommended in the CTG, the VOC limits in Rule 1115 are less stringent except for coatings used for final repair activity – see Table 1. For example, for a spray primer, primer surfacer, or topcoat, Rule 1115 limits VOC emissions to 15.0 lb/gal of applied solids versus the 2008 CTG limits VOC emissions to 12.0 lb/gal. On the other hand, for final repair coatings, the VOC limits for Rule 1115 and the 2008 CTG are equivalent at 4.8 lb/gal of coating, less water and less exempt compounds.

**Table 1: Comparison of 2008 CTG Recommended VOC Emission Limits for Automobile and Light-Duty Truck Assembly Coatings and South Coast AQMD Rule 1115**

| **Assembly Coating Process** | **CTG Recommended VOC Emission Limit** | | | **Rule 1115 Limit** |
|---|---|---|---|---|
| Electrodeposition primer (EDP) operations (including application area, spray/rinse stations, and curing oven) | Solids turnover ratio ($R_T$)>0.16: | 0.040<$R_T$<0.160: | $R_T$<0.040: | No reference to turnover ratio |
| | 0.084 kg VOC/liter (0.7 lb/gal) coating solids applied | $0.084X350^{0.160-R_T}$ kg VOC/liter ($0.084x350^{0.160-R_T}$ x 8.34 lb/gal) coating solids applied | No VOC emission limit | 0.145 kg VOC/liter (1.2 lb/gal) of coating, less water and less exempt compounds |
| Primer-surfacer operations (including application area, flash-off area, and oven) | 1.44 kg of VOC/liter of deposited solids (12.0 lbs VOC/gal deposited solids) on a daily weighted average basis | | | 1.80 kg of VOC/liter of deposited solids (15.0 lbs VOC/gal deposited solids) |
| Topcoat operations (including application area, | 1.44 kg VOC/liter of deposited solids (12.0 lb VOC/gal deposited solids) on a daily weighted average basis | | | 1.80 kg of VOC/liter of deposited solids |

| | | |
|---|---|---|
| flash-off area, and oven) | | (15.0 lbs VOC/gal deposited solids) |
| Final repair operations | 0.58 kg VOC/liter (4.8 lb VOC/gallon of coating) less water and less exempt solvents on a daily weighted average basis or as an occurrence weighted average | 0.58 kg VOC/liter (4.8 lb VOC/gallon of coating) less water and less exempt solvents |
| Combined primer-surfacer and topcoat operations | 1.44 kg VOC/liter of deposited solids (12.0 lb VOC/gal deposited solids) on a daily weighted average basis | N/A |

In addition, the 2008 CTG provided VOC limits for other miscellaneous coatings and materials used at motor vehicle assembly lines. For these miscellaneous coatings and materials, Rule 1115 either did not have any limits or in some coatings' categories, provided an explicit exemption from any VOC limit. For example, the 2008 CTG had VOC limits for trunk coatings, interior coatings, sealers, and deadeners whereas Rule 1115 specifically exempted these coatings. Table 2 lists the U.S. EPA 2008 CTG recommended VOC content limits for miscellaneous materials used at motor vehicle assembly coating operations.

**Table 2: U.S. EPA 2008 Control Techniques Guidelines**
**VOC Content Limits for Miscellaneous Materials Used at Motor Vehicle Assembly Coating Operations**
**(Grams of VOC per Liter of Coating Less Water and Less Exempt Compounds, as Applied)**

| Material | VOC Emission Limit, as Applied, in grams per liter (pounds per gallon) |
|---|---|
| Glass Bonding Primer | 900 (7.5) |
| Adhesive | 250 (2.1) |
| Cavity Wax | 650 (5.4) |
| Sealer | 650 (5.4) |
| Deadener | 650 (5.4) |
| Gasket/Gasket Sealing Material | 200 (1.7) |
| Underbody Coating | 650 (5.4) |
| Trunk Interior Coating | 650 (5.4) |

| | |
|---|---|
| Bedliner | 200 (1.7) |
| Weatherstrip Adhesive | 750 (6.3) |
| Lubricating Wax/Compound | 700 (5.8) |

As part of its analysis, staff reviewed the VOC limits established in other air districts for coatings used in the automotive assembly process. Three air districts within California and three agencies from outside California were compared (see Appendix B).

- Bay Area Air Quality Management District (California)
- San Joaquin Valley Unified Air Pollution Control District (California)
- Antelope Valley Air Quality Management District (California)
- Texas Administrative Code
- Michigan Administrative Code
- Commonwealth of Pennsylvania Code

In general, the VOC requirements recommended for coatings used in automotive assembly line processes by the 2008 CTG are followed by the San Joaquin Valley Unified APCD, Antelope Valley AQMD, the Commonwealth of Pennsylvania, and the State of Texas. The San Joaquin Valley Unified APCD and the Antelope Valley AQMD also included VOC limits for other miscellaneous materials used at motor vehicle assembly coating operations, following the 2008 CTG recommendations.

To fulfill RACT requirements, Rule 1115 is being amended to meet the VOC limits recommended by the 2008 CTG. Comparing the current limits to the proposed amended rule, the VOC limits will be lowered from 15.0 pounds of VOC per gallon of deposited solids to 12.0 pounds of VOC per gallon of deposited solids for any spray primer, primer surfacer or topcoat in any vehicle application line. A new calculation for the VOC limit of material used in the electrodeposition process, in line with the 2008 CTG, is also added. This new calculation provides a variable approach based on the solids' turnover ratio as a method to account for the solids deposited during this process. PAR 1115 also includes previously unregulated coating categories such as trunk coatings, interior coatings, sealers, and deadeners, and adds categories consistent with the 2008 CTG.

To prevent emissions of nickel, cadmium or hexavalent chromium, paragraph (d)(4) is added to prohibit the manufacture of motor vehicle assembly coatings that use cadmium or hexavalent chromium as a pigment or as an agent to impart any property or characteristic to the coating. Currently, staff during site visits did not find or observe any facility, subject to Rule 1115, that uses coatings that contain cadmium or hexavalent chromium.

A new section is also added to clarify transfer efficiency and the methods of application. This section was incorporated from the provision contained in South Coast AQMD Rule 1151 – Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations, paragraph (d)(6). PAR 1115 includes subparagraph (d)(5)(B) which requires that any application method be conducted with equipment that is properly operated according to the procedures recommended by the manufacturer and in compliance with applicable permit conditions, if any. Because several of the proposed emissions limits for non-miscellaneous materials used at motor vehicle assembly coating operations rely on the amounts of applied solids, it is important that the equipment be operated properly to ensure the amount of VOC per gallon of solids deposited is accurately calculated. ~~The following example illustrates the issue.~~

The following example illustrates the issue of the transfer efficiency effect on the calculated lbs VOC per gallon of solid deposited. ~~For example~~In this example, a facility applies a topcoat using an HVLP spray gun. The topcoat has a VOC mass~~VOC of material~~ equal to 3.5 pounds of VOC per gallon of material and a volume percent of solids equal to 50%. Typically, a properly operated HVLP spray gun has a minimum transfer efficiency of 65%. If the spray gun, however, was not properly operated and only achieved an efficiency of 50%, then what should have been calculated as 10.8 pounds of VOC per gallon of solids deposited would be calculated as 14.0 pounds of VOC per gallon of solids deposited instead. See sample calculation below.

Formula to Calculate lb VOC per Gallon of Solid Deposited

$$VOC_{dep} = \frac{VOCmat}{TE \times V\%solid}$$

| | Case 1 | Case 2 |
|---|---|---|
| VOC of Material (VOCmat) (lbs/gal) | 3.5 | 3.5 |
| Solids Content (V%solid) (%) | 50 | 50 |
| Transfer Efficiency (TE) (%) | 65 | 50 |
| VOC Emitted ($VOC_{dep}$) (lb VOC/Gallon of Solid Deposited) | $= \frac{3.5}{(0.50 \times 0.65)}$<br>$= 10.8$ | $= \frac{3.5}{(0.50 \times 0.50)}$<br>$= 14.0$ |

Updated Recordkeeping – Subdivision (e)

PAR 1115 moves the recordkeeping section of the rule from subdivision (g) to subdivision (e) to align the format to current formatting of South Coast AQMD source-specific rules. In addition,

the recordkeeping requirements are updated to include provisions that are like those contained in South Coast AQMD Rule 1151.

Owners or operators are required to keep manufacturer specification sheets, safety data sheets, technical data sheets, or other air quality data sheets that contain the necessary information to determine compliance with the emission limits. For example, to calculate VOC per gallon of solids deposited, information on the VOC of material, transfer efficiency, and volume percent of solids in the coating is needed.

Modified Methods of Analysis – Subdivision (f)

The determination of VOC and solids content of a coating can be made using three different options~~, if needed~~. These are given as U.S. EPA Method 24, South Coast AQMD Test Method 304, or American Society of Testing and Materials (ASTM) D2369.

PAR 1115 also includes a section on the determination of transfer efficiency. If an operator uses an application method that is not through either electrostatic application, brush, dip, roller, HVLP, or HVLP-equivalent, but through an alternative method, then the operator of such equipment will have to show that the transfer efficiency meets at least HVLP equivalency. The HVLP transfer equivalency is considered to be a minimum of 65%.

Moved Rule 442 Applicability – Subdivision (g)

PAR 1115 moves the Rule 442 Applicability section of the rule from subdivision (d) to subdivision (g) to align the format to current formatting of South Coast AQMD source-specific rules.

Modified Exemptions – Subdivision (h)

PAR 1115, in line with the 2008 CTG, removes the exemption for trunk coatings, interior coatings, sealers and deadeners. In addition, the exemption for accent and stripe coatings is removed. Staff considers the use of accent and stripe coatings as subject to the VOC limitations of a basecoat, if applied during the assembly process.

## AFFECTED FACILITIES

Rule 1115 applies to facilities that operate motor vehicle assembly line coatings operations. Within the jurisdiction of the South Coast AQMD, staff identified nine facilities that are subject to Rule 1115:

- Amrep (Ontario)
- El Dorado National (Riverside)

- Fortress Resources, Royal Truck Bodies (Carson)
- Harbor Truck Bodies (Brea)
- Karma Automotive (Moreno Valley)
- Marathon Industries (Santa Clarita)
- Spartan Motors GTB (Montebello)
- TABC, Inc (Long Beach)
- Taylor Dunn Manufacturing (Anaheim)

As part of the rule development process, staff visited facilities affected by the proposed amendments. During the visits, staff audited the coatings used at the facilities. The audit consisted of observing what coatings were being used on site and reviewing the technical data sheets (TDSs) for coatings used in the assembly line process. Based on the information contained in the TDSs, staff assessed the reported VOC content of the coatings. In addition, staff observed the type of VOC control devices, if present, that were used by the facility. For example, staff noted that several facilities utilize regenerative thermal oxidizers to control VOC emissions from their process lines.

## EMISSION REDUCTIONS AND COST EFFECTIVENESS

Although PAR 1115 is proposing to lower the VOC emission limits for coatings used in the motor vehicle assembly line and to include VOC emission limits for miscellaneous materials used at motor vehicle assembly coating operations, there are no anticipated emissions reductions or costs associated with the proposal.

During site visits to facilities subject to PAR 1115, staff noted that operators were already using coatings that would meet the proposed VOC emission limits and using an equivalent HVLP or better transfer-efficient application method. ~~It was~~Staff also noted that compliant coatings were sold by different manufacturers. Thus, the coatings manufacturing industry can provide viable and compliant material without incurring additional production costs to comply with PAR 1115.

In addition to using coatings compliant with PAR 1115, staff noted that facilities that used high volumes of coatings had installed emissions control equipment. To reduce the overall amount of emissions emitted from the facility, several operators had installed thermal oxidizers or equivalent. Thermal oxidizers destroy VOC emissions through incineration and usually operate with a 90% or greater destruction efficiency. Thermal oxidizers therefore provide~~The net effect on the VOC content of a coating, through the use of thermal oxidizers, is~~ a significant reduction of VOC on a per gallon basis for a coating.

Finally, staff noted that coatings used by facilities do not contain cadmium or hexavalent chromium.

## CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Pursuant to the California Environmental Quality Act (CEQA) Guidelines Sections 15002(k) and 15061, the proposed project (PAR 1115) is exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3). A Notice of Exemption has been prepared pursuant to CEQA Guidelines Section 15062 and if PAR 1115 is approved, the Notice of Exemption will be filed for posting with the county clerks of Los Angeles, Orange, Riverside, and San Bernardino counties, and with the State Clearinghouse of the Governor's Office of Planning and Research.

## SOCIOECONOMIC ANALYSIS

The Proposed Amended Rule 1115 does not impose any additional costs to the affected facilities and does not result in any adverse socioeconomic impacts.

## DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

*Requirements to Make Findings*

California Health & Safety Code Section 40727 requires that prior to adopting, amending, or repealing a rule or regulation, the South Coast AQMD Governing Board make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing and in the staff report. In order to determine compliance with Sections 40727 and 40727.2, a written analysis is required comparing the proposed rule with existing regulations.

The draft findings are as follows:

*Necessity*

PAR 1115 is necessary to comply with the Clean Air Act, which requires areas subject to the Ozone National Ambient Air Quality Standard and classified as moderate nonattainment or higher to develop and submit a demonstration that their current air pollution regulations and emission sources fulfill the Reasonably Available Control Technology (RACT) requirements. The purpose of the RACT demonstration is to review and, where applicable, update an agency's existing regulations to meet the current state of the science and emission controls. Rule 1115 contains limits that are less stringent than those in the corresponding rules from other regulatory agencies. To fulfill RACT requirements, South Coast AQMD is amending Rule 1115 to address these deficiencies.

*Authority*

The South Coast AQMD obtains its authority to adopt, amend, or repeal rules and regulations pursuant to H&SC Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, 40920.6, and 41508.

*Clarity*

PAR 1115 is written or displayed so that its meaning can be easily understood by the persons directly affected by them.

*Consistency*

PAR 1115 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions or state or federal regulations.

*Non-Duplication*

PAR 1115 will not impose the same requirements as any existing state or federal regulations. The proposed amended rules are necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

*Reference*

In amending this rule, the following statutes which the South Coast AQMD hereby implements, interprets or makes specific are referenced: H&SC Sections 39002, 40001, 40406, 40702, and 40440(a).

## COMPARATIVE ANALYSIS

Under H&SC Section 40727.2, the South Coast AQMD is required to perform a comparative written analysis when adopting, amending, or repealing a rule or regulation. The comparative analysis is relative to existing federal requirements, existing or proposed South Coast AQMD rules and air pollution control requirements and guidelines which are applicable to motor vehicle assembly line coating operations. Because PAR 1115 does impose new or more stringent emissions limits or standard, and other air pollution control monitoring, reporting or recordkeeping requirements, a comparative analysis is required. The analysis is provided in Appendix B of this report.

## INCREMENTAL COST EFFECTIVENESS

California H&S Code Section 40920.6 requires an incremental cost-effectiveness analysis for BARCT rules or emission reduction strategies when there is more than one control option which would achieve the emission reduction objective of the proposed amendments, relative to ozone, CO, SOx, NOx, and their precursors. The proposed amendment will not trigger the need for control, as facilities are already meeting the limits, so there is no more stringent control option upon which an incremental cost-effectiveness would be calculated. Therefore, this provision does not apply to the proposed amendment.

## APPENDIX A

### PUBLIC COMMENTS RECEIVED AT THE PUBLIC WORKSHOP

1. During the PAR 1115 Public Workshop held on January 6, 2022, Thomas Kiang Lao, President and Senior Environmental Engineer for UniVersal Engineering requested clarification on the VOC limit for coatings used on an automobile console or dashboard which are made of plastic, composite, and metal as referenced in Table 2 of the proposed amended rule.

   **Response**: Consistent with the 2008 VOC limits as recommended in the U.S. EPA's 2008 CTG ~~issued by the U.S. EPA~~ for Automobile and Light-Duty Truck Assembly Coatings, staff did not include a specific category in PAR 1115 for coatings used on an automobile console or dashboard which are made of plastic, composite, and metal. Moreover, staff retained in paragraph (h)(4), an existing exemption from the provisions of the rule for coatings used on plastic parts. However, although this activity may not be regulated under PAR 1115, staff notes that South Coast AQMD Rule 1145 – Plastic, Rubber, Leather, and Glass Coatings regulates VOC emissions from the application of coatings to any plastic, rubber, leather, or glass product. Rule 1145 does not provide an exemption for automobile manufacturing activities and may apply for such activity.

No other public comments were received at the Public Workshop.

# APPENDIX B

| Table B-1: Comparison of Rules for Automobile Assembly Line Coatings in Other Regulatory Jurisdictions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **PAR 1115** | **U.S. EPA** | **Bay Area AQMD** | **San Joaquin Valley Unified APCD** | **Antelope Valley AQMD** | **State of Texas** | **State of Michigan** | **Commonwealth of Pennsylvania** |
| | Proposed Amended Rule | 2008 Control Technology Guidelines | Regulation 8 Rule 13 §8-13-302 | Rule 4602 | Rule 1151.1 | Texas Admin Code §115.453 (a)(3) | Mich Admin Code §R336.1610 Rule 610 | 25 Pa Code Chapter 129 §129.52e |
| **Assembly Coating Process** **VOC Emission Limits** | | | | | | | | |
| Electrodeposition primer (EDP) operations (including application area, spray/rinse stations, and curing oven) When solids turnover ratio ($R_T$)>0.16: | 0.7 pound per gallon (lb/gal) of coating solids applied | 0.7 pound per gallon (lb/gal) of coating solids applied | N/A | 0.7 pound per gallon (lb/gal) of coating solids applied | 0.7 pound per gallon (lb/gal) of coating solids applied | 0.7 pound per gallon (lb/gal) of coating solids applied | N/A | 0.7 pound per gallon (lb/gal) of coating solids applied |
| EDP operations (including application area, spray/rinse stations, and curing oven) When 0.040<$R_T$<0.160: | 0.084 x $350^{0.160-R_T}$ x 8.34 lb/gal of coating solids applied | 0.084 x $350^{0.160-R_T}$ x 8.34 lb/gal of coating solids applied | N/A | 0.084 x $350^{0.160-R_T}$ x 8.34 lb/gal of coating solids applied | 0.084 x $350^{0.160-R_T}$ x 8.34 lb/gal of coating solids applied | 0.7 x $350^{0.160-R_T}$ lb/gal of coating solids applied | N/A | 0.084 x $350^{0.160-R_T}$ x 8.34 lb/gal of coating solids applied |
| EDP operations (including application area, spray/rinse stations, and curing oven) When $R_T$<0.040: | No VOC limit | No VOC limit | N/A | No VOC limit | No VOC limit | No VOC limit | N/A | No VOC limit |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Prime Electrodeposition Process | N/A | N/A | 1.2 lb VOC/gal of coating (minus water as applied) | N/A | N/A | N/A | 1.2 lb VOC/gal of coating (minus water as applied) | N/A |
| Primer-surfacer operations (including application area, flash-off area, and oven) | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 15.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 14.9 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited |
| Topcoat operations (including application area, flash-off area, and oven) | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 15.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 14.9 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited |
| Final repair operations | 4.8 lb VOC/gal of coating (minus water and exempt solvent) | 4.8 lb VOC/gal of coating (minus water and exempt solvent) | 4.8 lb VOC/gal of coating (minus water) | 4.8 lb VOC/gal of coating (minus water and exempt solvent) | 4.8 lb VOC/gal of coating (minus water and exempt solvent) | 4.8 lb VOC/gal of coating (minus water and exempt solvent) | 4.82 lb VOC/gal of coating (minus water as applied) | 4.8 lb VOC/gal of coating (minus water and exempt solvent) |
| Combined primer-surfacer and topcoat operations | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | N/A | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | 12.0 lb VOC/gal of solids deposited | N/A | 12.0 lb VOC/gal of solids deposited |
| **Miscellaneous Materials Used in the Automotive Assembly Line Process**<br>**VOC Emission Limits**<br>Grams/liter (pounds/gallon) | | | | | | | | |
| Glass Bonding Primer | 900 (7.5) | 900 (7.5) | N/A | 900 (7.5) | 900 (7.5) | (7.51) | N/A | 900 (7.5) |
| Adhesive | 250 (2.1) | 250 (2.1) | N/A | 250 (2.1) | 250 (2.1) | (2.09) | N/A | 250 (2.1) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cavity Wax | 650 (5.4) | 650 (5.4) | N/A | 650 (5.4) | 650 (5.4) | (5.42) | N/A | 650 (5.4) |
| Sealer | 650 (5.4) | 650 (5.4) | N/A | 650 (5.4) | 650 (5.4) | (5.42) | N/A | 650 (5.4) |
| Deadener | 650 (5.4) | 650 (5.4) | N/A | 650 (5.4) | 650 (5.4) | (5.42) | N/A | 650 (5.4) |
| Gasket/Gasket Sealing Material | 200 (1.7) | 200 (1.7) | N/A | 200 (1.7) | 200 (1.7) | (1.67) | N/A | 200 (1.7) |
| Underbody Coating | 650 (5.4) | 650 (5.4) | N/A | 650 (5.4) | 650 (5.4) | (5.42) | N/A | 650 (5.4) |
| Trunk Interior Coating | 650 (5.4) | 650 (5.4) | N/A | 650 (5.4) | 650 (5.4) | (5.42) | N/A | 650 (5.4) |
| Bedliner | 200 (1.7) | 200 (1.7) | N/A | 200 (1.7) | 200 (1.7) | (1.67) | N/A | 200 (1.7) |
| Weatherstrip Adhesive | 750 (6.3) | 750 (6.3) | N/A | 750 (6.3) | 750 (6.3) | (6.26) | N/A | 750 (6.3) |
| Lubricating Wax/Compound | 700 (5.8) | 700 (5.8) | N/A | 700 (5.8) | 700 (5.8) | (5.84) | N/A | 700 (5.8) |
| **Determination of Transfer Efficiency** | | | | | | | | |
| | Transfer efficiency of alternative automotive coating application methods, determined in accordance with the South Coast AQMD method "Spray Equipment Transfer Efficiency Test Procedure for Equipment User, May 24, 1989," and South Coast AQMD | Determination of transfer efficiency shall be as prescribed in EPA "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations, dated December 1988." | Determination of transfer efficiency shall be as prescribed in EPA "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations, dated December 1988." | Any other coating application method which is demonstrated to the APCO to be capable of achieving at least 65 percent transfer efficiency. The transfer efficiency shall be determined in accordance with the SCAQMD method "Spray Equipment Transfer Efficiency Test | Transfer efficiency of alternative coating application methods determined in accordance with the SCAQMD method "Spray Equipment Transfer Efficiency Test Procedure for Equipment User," May 24, 1989 and SCAQMD "Guidelines for Demonstrating | The owner or operator shall demonstrate that either the application system being used is equivalent to the transfer efficiency of an HVLP spray or that the application system being used has a transfer efficiency of at least 65%. | Department approval of the transfer efficiency test method is required | Not specified |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | "Guidelines for Demonstrating Equivalency With District Approved Transfer Efficiency Spray Gun", September 26, 2002." | | | Procedure for Equipment User," May 24, 1989 | Equivalency With District Approved Transfer Efficiency Spray Gun", September 26, 2002. | | | |
| **Application Methods** | | | | | | | | |
| | Application by:<br>(i) Electrostatic application<br>(ii) HVLP spray equipment<br>(iii) Brush, dip, or roller<br>(iv) Satisfactory demon-stration of a spray gun meeting HVLP definition<br>(v) Approved HVLP equivalent | Not specified | Not specified | Application by:<br>(i) Brush, dip, or roller<br>(ii) Electrostatic application<br>(iii) EDP<br>(iv) Flow Coating<br>(v) Continuous Coating<br>(vi) HVLP spray equipment<br>(vii) Other coating method demon-strated to be capable of achieving 65% transfer efficiency | Application by:<br>(i) Brush, dip, or roller<br>(ii) Electrostatic application<br>(iii) Flow Coating<br>(iv) Continuous Coating<br>(v) HVLP spray equipment | Application by:<br>(1) Electrostatic application<br>(2) HVLP spray equipment<br>(3) Flow coat<br>(4) Roller coat<br>(5) Dip coat<br>(6) Brush<br>(7) Approved HVLP equivalent | Not specified | Not specified |
| **Record Keeping** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | An owner or operator shall maintain records of automotive coating usage pursuant to South Coast AQMD Rule 109 – Recordkeeping for Volatile Organic Compound Emissions to demonstrate compliance with the emission limits | Recommend that any State RACT Rules that allow for averaging include appropriate recordkeeping and reporting requirements. | The person shall maintain and have available during an inspection, a current list of coatings in use which provides all of the coating data necessary to evaluate compliance | The operator shall maintain records on a daily basis, and have available at all times, a current list of coatings in use which provides all of the coating data necessary to evaluate compliance per Sections 6.1.1, 6.1.2 and 6.2. | Maintain and have available during an inspection, a current list of Coatings and solvents in use which provides all of the Coating data necessary to evaluate compliance | Provides the VOC content of coatings may be determined by using analytical data from the MSDS, and if necessary the dilution solvent. Owner/operator may use data from the MSDS as a compliance alternative to testing. Relying on the MSDS is sufficient to ensure continuous compliance with the control requirements in §115.453 and extends option to owners and operators of all surface coating categories | A person who is responsible for the operation of a coating line that is subject to this rule shall obtain current information and keep records necessary for the determination of compliance with this rule | Not specified |

# APPENDIX C

## COMMENT LETTER RECEIVED ON 2/17/2022


February 17th, 2022

Mr. Michael Krause
South Coast Air Quality Management District
MKrause@aqmd.gov

Re: Public Comments Rule 1115—Motor Vehicle Assembly Line Coating Operations

RadTech is pleased to comment on the district's proposed amendments to Rule 1115. RadTech International is the trade association for the Ultraviolet/ Electron Beam/Light Emitting Diode (UV/EB/LED) industry. The organization represents over 800 members nationwide involved in a myriad of markets ranging from solar panel manufacturing to finger nail polish and the technology also plays a role in motor vehicle assembly line coating operations. 1-1

Unlike conventional inks and coatings, UV/EB/LED products do not evaporate. Instead, they are specifically formulated to react to energy. The nature of the process is such that virtually no Volatile Organic Compounds (VOCs) are generated. The materials are generally high viscosity and thus there are no regulatory concerns with generation of particulate matter from spraying. Additionally, UV/EB processes are **all-electric** and thus do not produce combustion contaminants such as NOx, SOx and Greenhouse Gases.

**Requested Proposed Rule Language Changes**

RadTech believes that Rule 1115 presents an opportunity for the district to achieve voluntary emission reductions above and beyond those presently required in the rule, through regulatory flexibility that will encourage conversion to UV/EB/LED. 1-2

**Request for Exemption**

Our materials are typically well below 50 grams/liter in VOC content which is minimal compared to the proposed limits. We respectfully request that UV/EB/LED materials be exempted from the rule requirements. An exemption would be an incentive for businesses to voluntarily choose UV/EB/LED technology resulting in additional emission reductions for the South Coast Basin. 1-3

Recordkeeping requirements are burdensome on businesses and in the case of UV/EB/LED operations, are not crucial because the materials are well below the rule limits. Exempting energy curable materials from overly prescriptive recordkeeping requirements will alleviate regulatory burdens on the SCAQMD's business community and benefit air quality. 1-4

**Definition**

We would very much appreciate the inclusion of a definition for energy curable materials in the rule. We propose a definition like the one in other SCAQMD rules (R1130, R1168):

1-5

*ENERGY CURABLE MATERIALS are single component reactive products that cure upon exposure to visible-light, ultraviolet light, or to an electron beam.*

**Test Method**

The Environmental Protection Agency and the SCAQMD have long recognized that EPA Method 24 is not suitable for thin film UV/EB/LED Materials. Consistent with other district rules, RadTech urges the inclusion of ASTM D7767-11 as suitable test method for UV/EB/LED products subject to Rule 1115. We propose the following language:

1-6

*The VOC content of thin film Energy Curable Adhesives and Sealants may be determined by manufacturers using ASTM Test Method 7767 Standard Test Method to Measure Volatiles from Radiation Curable Acrylate Monomers, Oligomers, and Blends and Thin Coatings Made from Them.*

**Transfer Efficiency**

UV/EB/LED products have higher viscosities than conventional solvent products. The rationale behind transfer efficiency requirements is to control VOC emissions that can take place during spraying operations. But, given the fact that UV/EB/LED materials do not have emissions like conventional solvent processes, facilities should not be required to the same level of regulation for transfer efficiency purposes. We urge an exemption for UV/EB/LED materials with viscosities of 650 centipoise or above, from the transfer efficiency requirements of the rule.

1-7

UV/EB materials not only meet, but far exceed any proposed rule requirements and any added flexibility to companies that choose these pollution preventive processes will encourage voluntary emission reductions thereby furthering the district's mission. We look forward to a productive rulemaking.

1-8

Sincerely,

Rita M. Loof

Director, Environmental Affairs

Response to Comment 1-1

During the rulemaking process for PAR 1115, staff visited multiple facilities subject to the rule. Staff did not observe UV/EB/LED technology in use during their visits. Staff would welcome the opportunity to contact operators of facilities engaged in motor vehicle assembly line coating operations that use the technology. Further research would be needed to ascertain viability of this technology for motor vehicle assembly lines, which is outside the scope and purpose of the current rule rulemaking effort.

Response to Comment 1-2

Thank you for your comment.

Response to Comment 1-3

Staff acknowledges the typically low VOC content of UV/EB/LED processes. Exemptions are included in rules for operations where there are challenges with complying with rule requirements. Materials cited in the comment letter that have a VOC content less than 50 grams/liter would be well below the proposed VOC limits in PAR 1115, therefore the addition of an exemption is not necessary. The current rule does not preclude UV/EB/LED materials from being used to comply with the rule. Further, staff does not see any incentive difference between a compliant process and an exempt process.

Response to Comment 1-4

Recordkeeping forms the basis to determine compliance with rules, including exemptions, and permit conditions. South Coast AQMD Rule 109 – Recordkeeping of Volatile Organic Compounds in Organic Material does include a limited exemption for any cleaning solvent subject to Rule 1171 – Solvent Cleaning Operations or Rule 1122 – Solvent Degreasers provided the material contains 50 grams of VOC per liter of material or less. Staff could consider an exemption for UV/EB/LED materials during the next amendment to Rule 109.

Response to Comment 1-5

South Coast AQMD rules do not typically include a defined term that is not referenced anywhere in the rule. As stated in response to comment 1-3, the current rule does not preclude UV/EB/LED materials to be used to comply with the rule, therefore, it is not listed in the rule and does not~~to~~ warrant a definition.

Response to Comment 1-6

ASTM Test Method 7767-11 determines the VOC content of the individual components of UV/EB/LED materials and can be used by manufacturers when they are estimating the VOC content of their fully formulated products. The method cannot be used to demonstrate compliance of a fully formulated (commercial) product as it is applied in the field. The South Coast AQMD laboratory cannot independently perform this analysis and have confidence that the results

accurately reflect the composition of the fully formulated product. ASTM Test Method 7767-11 can serve as a useful test that manufacturers can use to estimate the VOC content of their materials, and the rule does not preclude manufacturers of UV/EB/LED materials from using Test Method 7767-11. However, since this method cannot be used for compliance purposes, it is not listed under the test method compliance section in the rule.

Response to Comment 1-7

PAR 1115 provides multiple methods to demonstrate compliance to the transfer efficiency requirements in the proposed rule. To consider a change to the transfer efficiency requirements, staff would have to conduct considerable research into the impacts of the change and provide public process. Research would include visiting facilities that are using EV/EB/LED materials for motor vehicle assembly line coating operations, conferring with South Coast AQMD source test engineers, potentially conducting source tests, and holding further meetings with stakeholders. This request is outside the scope of this rule amendment.

Response to Comment 1-8

The current rulemaking effort was initiated with the purpose of updating the rule to meet Reasonable Available Control Technologies (RACT) requirements. In the future, staff welcomes the opportunity to work with the commentor to evaluate UV/EB/LED technology and its potential applicability to this industry.

**ATTACHMENT H**

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

**SUBJECT:** **NOTICE OF EXEMPTION FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT**

**PROJECT TITLE:** **PROPOSED AMENDED RULE 1115 – MOTOR VEHICLE ASSEMBLY LINE COATING OPERATIONS**

Pursuant to the California Environmental Quality Act (CEQA) Guidelines, the South Coast Air Quality Management District (South Coast AQMD), as Lead Agency, has prepared a Notice of Exemption pursuant to CEQA Guidelines Section 15062 – Notice of Exemption for the project identified above.

If the proposed project is approved, the Notice of Exemption will be filed for posting with the county clerks of Los Angeles, Orange, Riverside, and San Bernardino Counties. The Notice of Exemption will also be electronically filed with the State Clearinghouse of the Governor's Office of Planning and Research for posting on their CEQAnet Web Portal which may be accessed via the following weblink: https://ceqanet.opr.ca.gov/search/recent. In addition, the Notice of Exemption will be electronically posted on the South Coast AQMD's webpage which can be accessed via the following weblink: http://www.aqmd.gov/nav/about/public-notices/ceqa-notices/notices-of-exemption/noe---year-2022.

**NOTICE OF EXEMPTION FROM THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)**

| | | | |
|---|---|---|---|
| **To:** | County Clerks for the Counties of Los Angeles, Orange, Riverside and San Bernardino; and Governor's Office of Planning and Research – State Clearinghouse | **From:** | South Coast Air Quality Management District<br>21865 Copley Drive<br>Diamond Bar, CA 91765 |

**Project Title:** Proposed Amended Rule 1115 – Motor Vehicle Assembly Line Coating Operations

**Project Location:** The proposed project is located within the South Coast Air Quality Management District's (South Coast AQMD) jurisdiction, which includes the four-county South Coast Air Basin (all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino counties), and the Riverside County portion of the Salton Sea Air Basin and the non-Palo Verde, Riverside County portion of the Mojave Desert Air Basin.

**Description of Nature, Purpose, and Beneficiaries of Project**: Amendments to Rule 1115 are proposed that will update the volatile organic compound (VOC) emission limits for coatings used in automotive assembly line processes and for other miscellaneous materials used at motor vehicle assembly coating operations to comply with the United States Environmental Protection Agency's Reasonably Available Control Technology requirements and their recommended 2008 Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings. Other amendments are proposed that will: 1) separate the previously combined purpose and applicability subdivision into two parts; 2) revise the applicability requirements to include automotive parts that are coated during the vehicle assembly process as well as during associated solvent cleaning operations and exclude activities that would be subject to Rule 1151 - Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations; 3) add new and modify existing definitions of terms; 4) update recordkeeping requirements; 5) revise the methods of analysis to include an additional test method for determining VOC and solids content of coatings and to update the criteria for determining transfer efficiency; and 6) delete the exemptions for trunk coatings, interior coatings, sealers and deadeners, and accent and stripe coatings.

| **Public Agency Approving Project:** | **Agency Carrying Out Project:** |
|---|---|
| South Coast Air Quality Management District | South Coast Air Quality Management District |

**Exempt Status:** CEQA Guidelines Section 15061(b)(3) – Common Sense Exemption

**Reasons why project is exempt:** South Coast AQMD, as Lead Agency, has reviewed the proposed project pursuant to: 1) CEQA Guidelines Section 15002(k) – General Concepts, the three-step process for deciding which document to prepare for a project subject to CEQA; and 2) CEQA Guidelines Section 15061 – Review for Exemption, procedures for determining if a project is exempt from CEQA. Operators of all nine facilities subject to Rule 1115 are currently using coatings that comply with the proposed VOC emission limits and are applying these coatings using equivalent high-volume, low-pressure or other more transfer-efficient application method such that no physical modifications are expected to occur as a result of the proposed project. Thus, it can be seen with certainty that implementing the proposed project would not cause a significant adverse effect on the environment. Therefore, the proposed project is exempt from CEQA pursuant to CEQA Guidelines Section 15061(b)(3) – Common Sense Exemption.

**Date When Project Will Be Considered for Approval (subject to change):**
South Coast AQMD Governing Board Public Hearing: March 4, 2022

| **CEQA Contact Person:** | **Phone Number:** | **Email:** | **Fax:** |
|---|---|---|---|
| Kevin Ni | (909) 396-2462 | kni@aqmd.gov | (909) 396-3982 |
| **Rule Contact Person:** | **Phone Number:** | **Email:** | **Fax:** |
| Rodolfo Chacon | (909) 396-2726 | rchacon@aqmd.gov | (909) 396-3982 |

**Date Received for Filing:** _____ **Signature:** *(Signed and Dated Upon Board Approval)*

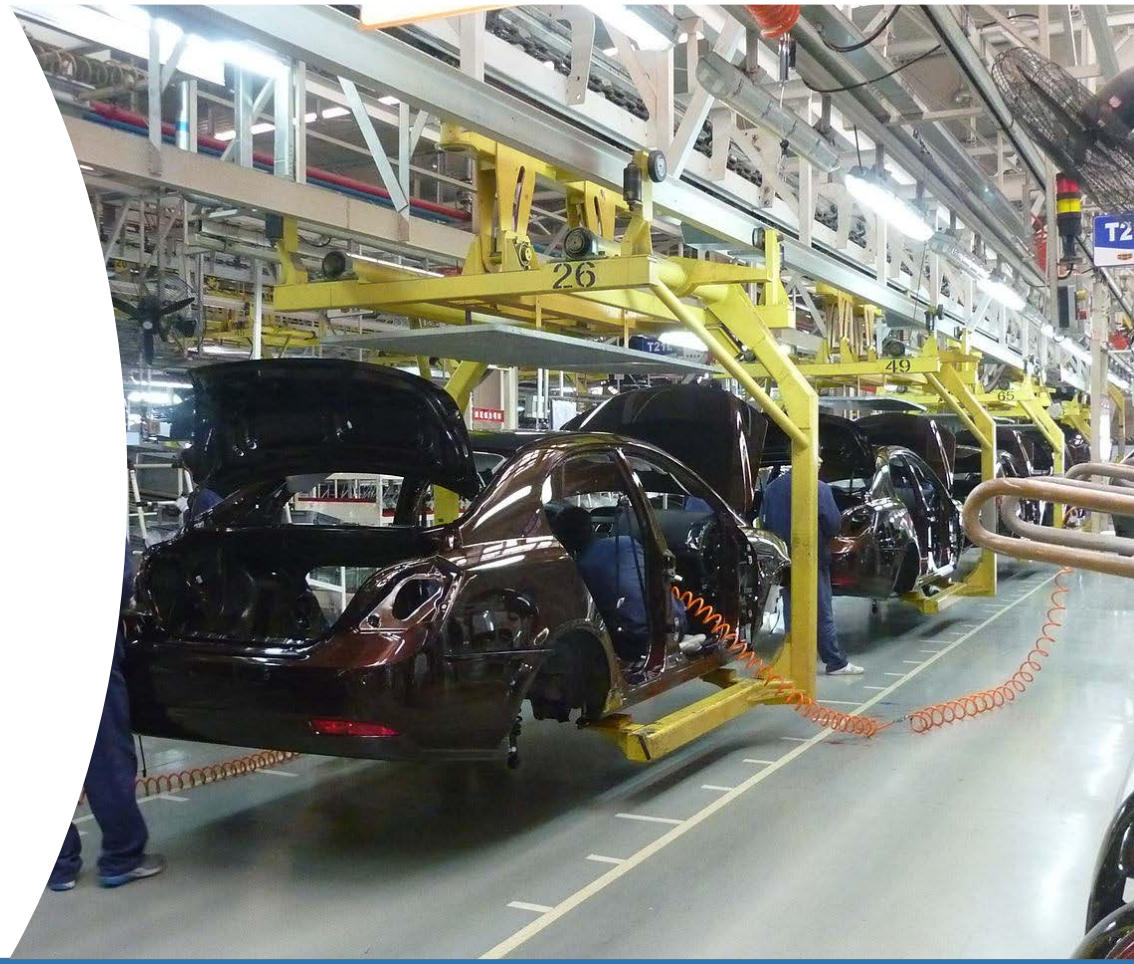
Barbara Radlein
Program Supervisor, CEQA
Planning, Rule Development, and Area Sources

ATTACHMENT I

# Proposed Amended Rule 1115 Motor Vehicle Assembly Line Coating Operations

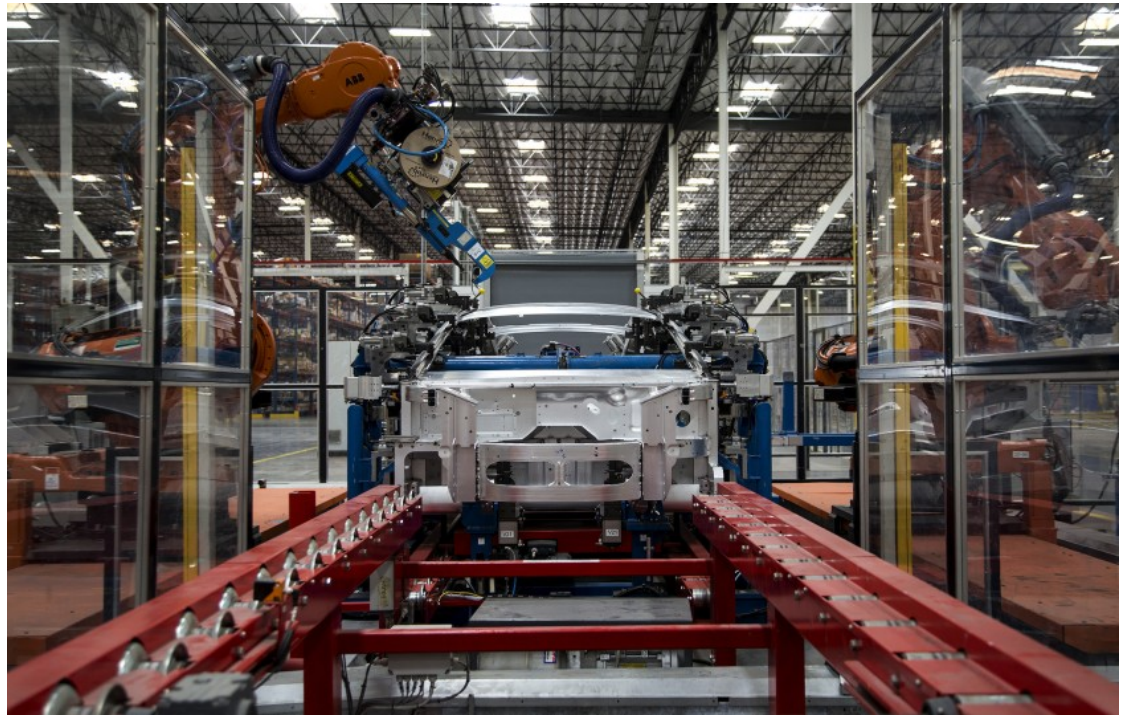
## Board Meeting

March 4, 2022



# Rule Background

- Rule 1115 applies to coatings used in assembly line operations (automatic and manual)
- Nine facilities subject to Rule 1115
- Rule last amended in 1995
- Rule amendment will address Reasonably Available Control Technology (RACT) deficiencies



# Proposed Rule Amendments

- Clean Air Act requires non-attainment areas to conduct RACT assessment
- RACT assessment compares existing South Coast AQMD rules with U.S. EPA guidelines and with similar regulations from other air agencies
- Rule 1115 identified as not meeting RACT
- Proposed rule amendments will:
  - Harmonize with U.S. EPA CTG VOC emission limits for coatings and miscellaneous materials
  - Add and update definitions
  - Clarify transfer efficiency requirements
  - Require records on-site for compliance determination
  - Eliminate exemptions that are no longer applicable

# Comparison of Proposed Changes

Changes VOC limits for:

- Electrodeposition primer
- Primer-surfacer and topcoat

Includes new VOC limits for:

- Combined primer-surfacer and topcoat
- Miscellaneous Materials

| Coating Category | Proposed Change |
|---|---|
| Electrodeposition primer (EDP) | General limit from 1.2 lb VOC/gal to 0.7 lb VOC/gal of deposited solids |
| Primer-surfacer and topcoat | Lowers limit from 15.0 lb VOC/gal of deposited solids to 12.0 lb VOC/gal of deposited solids |
| Combined primer-surfacer and topcoat | New limit - 12.0 lb VOC/gal of deposited solids |
| Miscellaneous Materials Categories | New limits incorporating 2008 U.S. EPA guidance |

- ➢ Other California air districts and other agencies across the country utilize these same limits
- ➢ Products available on the market and in use that meet these limits

# Anticipated Impacts

**Current Operations:**

- Use compliant coatings
- Utilize compliant application equipment (HVLP)
- Equipped with air pollution controls (thermal oxidizers) at higher volume facilities

**Impacts from Rule Amendment:**

- No additional costs expected
- No modifications that would cause a significant adverse effect on the environment
- No adverse socioeconomic impacts anticipated

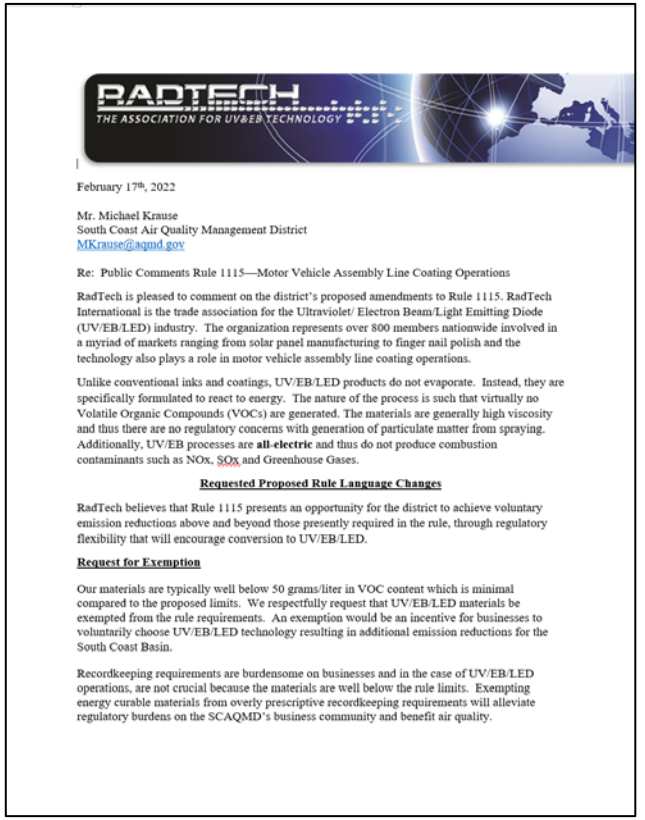
# Key Issue

On February 17th staff received comment letter requesting:

- Exemption for UV/EB/LED materials
- Inclusion of Energy Curable Materials definition
- Inclusion of thin film UV/EB/LED test methods
- Exclusion of transfer efficiency requirements for UV/EB/LED materials

UV/EB/LED materials may be used provided the coatings meet VOC emission limits in PAR 1115 and clean-up solvents meet requirements in existing rules

- Exemption could result in backsliding



RADTECH
THE ASSOCIATION FOR UV&EB TECHNOLOGY

February 17th, 2022

Mr. Michael Krause
South Coast Air Quality Management District
MKrause@aqmd.gov

Re: Public Comments Rule 1115—Motor Vehicle Assembly Line Coating Operations

RadTech is pleased to comment on the district's proposed amendments to Rule 1115. RadTech International is the trade association for the Ultraviolet/ Electron Beam/Light Emitting Diode (UV/EB/LED) industry. The organization represents over 800 members nationwide involved in a myriad of markets ranging from solar panel manufacturing to finger nail polish and the technology also plays a role in motor vehicle assembly line coating operations.

Unlike conventional inks and coatings, UV/EB/LED products do not evaporate. Instead, they are specifically formulated to react to energy. The nature of the process is such that virtually no Volatile Organic Compounds (VOCs) are generated. The materials are generally high viscosity and thus there are no regulatory concerns with generation of particulate matter from spraying. Additionally, UV/EB processes are **all-electric** and thus do not produce combustion contaminants such as NOx, SOx and Greenhouse Gases.

**Requested Proposed Rule Language Changes**

RadTech believes that Rule 1115 presents an opportunity for the district to achieve voluntary emission reductions above and beyond those presently required in the rule, through regulatory flexibility that will encourage conversion to UV/EB/LED.

**Request for Exemption**

Our materials are typically well below 50 grams/liter in VOC content which is minimal compared to the proposed limits. We respectfully request that UV/EB/LED materials be exempted from the rule requirements. An exemption would be an incentive for businesses to voluntarily choose UV/EB/LED technology resulting in additional emission reductions for the South Coast Basin.

Recordkeeping requirements are burdensome on businesses and in the case of UV/EB/LED operations, are not crucial because the materials are well below the rule limits. Exempting energy curable materials from overly prescriptive recordkeeping requirements will alleviate regulatory burdens on the SCAQMD's business community and benefit air quality.

# Staff Recommendation

Adopt resolution:

- Determining that PAR 1115 is exempt from the requirements of CEQA
- Amending Rule 1115