I. GENERAL

A. ACTION TAKEN IN THIS RULEMAKING

At its October 25, 2018, public hearing, the California Air Resources Board (CARB or Board) approved for adoption proposed amendments to California Code of Regulations, title 13, section 2235 and the associated test procedure. These regulations relate to the Board's requirements for motor vehicle fill pipes.

The Staff Report: Initial Statement of Reasons for Rulemaking (ISOR or Staff Report), released September 4, 2018, is incorporated by reference herein. The Staff Report contained a description of the rationale for the proposed amendments. On September 4, 2018, all references relied upon and identified in the staff report were made available to the public.

Staff's proposed amendments do the following:

1) Add a new performance standard for the leak rate at the fill pipe and nozzle interface, along with a bench test for measuring the leak rate.
2) Add and modify fill pipe head dimensional requirements, which apply only during a fill pipe head design change beginning in model year 2024.
3) Modify and make non-substantive changes to existing fill pipe provisions to improve clarity of the regulations.

Based on comments received during the 45-day comment period, the Board also directed staff to work further with industry to better clarify the new specifications and test procedure, and to consider any additional information on the proposed leak standard to see if an alternate standard is needed.

B. MANDATES AND FISCAL IMPACTS TO LOCAL GOVERNMENTS AND SCHOOL DISTRICTS

The Board has determined that this regulatory action will not result in a mandate to any local agency or school district, the costs of which are reimbursable by the State pursuant to Part 7 (commencing with section 17500), Division 4, Title 2 of the Government Code.
C. CONSIDERATION OF ALTERNATIVES

Staff is required to consider alternatives to the proposed amendments. As discussed in Chapter IX of the Staff Report, staff analyzed the following alternatives:

1) Apply the proposed dimensional changes to existing fill pipe designs;
2) Implement just the performance standard and bench test with no dimensional changes; and
3) No action.

For the reasons set forth in the Staff Report, in staff’s comments and responses at the hearing, and in this FSOR, the Board determined that no alternative considered by the agency would be more effective in carrying out the purpose for which the regulatory action was proposed, or would be as effective and less burdensome to affected private persons, or would be more cost-effective to affected private persons and equally effective in implementing the statutory policy or other provisions of law than the action taken by the Board. Please see Chapter IX in the Staff Report for a more detailed discussion of the alternatives.

II. MODIFICATIONS MADE TO THE ORIGINAL PROPOSAL

A. MODIFICATIONS APPROVED AT THE BOARD HEARING AND PROVIDED FOR IN THE 15-DAY COMMENT PERIOD

CARB released Notices of Public Availability of Modified Text and Availability of Additional Documents (15-Day Notices) on April 5, 2019, and April 24, 2019, which presented additional modifications to the regulatory text after consultation with stakeholders and notified the public of an additional document added to the regulatory record.¹

The following 15-day changes to Specifications for Fill Pipes and Openings of 2015 and Subsequent Model Motor Vehicle Fuel Tanks were made and are not separately discussed in the summary of comments and agency response in Chapter IV:

III. General Design Specifications

Subsection A.c: The 12-millimeter (mm) additional access zone depth had been inaccurately referred to as a “maximum” for the tapered access zone depth. “Maximum” was removed, but the 12 mm depth is maintained.

VIII. Test Procedure: Bench Leak Rate

Subsection A.a: The settings for the fill pipe height and pipe axis angle during the bench leak rate test were slightly adjusted to represent CARB’s bench test set-up. These settings also are representative of in-use vehicles.

Subsection B.a: The automotive industry provided bench leak test data showing that the resulting flow rate can vary depending on the length of the hose between the pressure gage and the nozzle boot. Therefore, to standardize the bench leak test and ensure consistent, repeatable results, language allowing vacuum and pressure/flow measurement to occur at different locations in the apparatus was removed.

Subsection E: To better standardize the bench leak test and ensure consistent results, language was changed to clearly indicate how to handle the two pre-existing holes in the nozzle boot during the bench leak test.

XII. Phase-in schedule

Subsection B: The phase-in for the bench leak test was changed to be based on projected volume of sales because manufacturing plans are usually developed prior to actual sales being known.

The following 15-day changes to the Application for Compliance with Fill Pipe Requirements were made and are not separately discussed in Chapter IV:

This form was changed to reflect the modified fill pipe face clearance dimension and other amendments to the dimensions in the fill pipe specifications.

B. UPDATE TO INFORMATION IN THE ISOR

In the original cost analysis, a retail price equivalent (RPE) multiplier of 1.46 was applied to adjust the cost to purchasers of California vehicles. The application of the multiplier to this case tends to exaggerate the regulatory cost because the proposal mark-up of $81,000 over the cost increase of $174,500 (i.e., $255,500 - 174,500) is most likely to be absorbed by manufacturers. Removing this RPE multiplier reduced the overall potential costs to California vehicle purchasers from $255,500 to $174,500 and the equivalent price increase per vehicle from 4 cents to 3 cents.

III. DOCUMENTS INCORPORATED BY REFERENCE

The regulation adopted by the Executive Officer incorporate by reference the following document:

Specifications for Fill Pipes And Openings of 2015 and Subsequent Model Motor Vehicle Fuel Tanks, last amended May 31, 2019

Furthermore, the incorporated specification procedure listed above adopted by the Executive Officer incorporate by reference the following document:

This incorporated document is referred to in the bench leak rate test procedure in section VIII of the fill pipe specifications.

These documents were incorporated by reference because it would be cumbersome, unduly expensive, and otherwise impractical to publish it in the California Code of Regulations. The documents are lengthy and a technical engineering document that would add unnecessary additional volume to the regulation. Distribution to all recipients of the California Code of Regulations is not needed because the interested audience for this document is limited to the technical staff at a portion of reporting facilities, most of whom are already familiar with this document. Also, the incorporated document was made available by CARB upon request during the rulemaking action and will continue to be available in the future. The documents are also available from college and public libraries.

IV. SUMMARY OF COMMENTS AND AGENCY RESPONSE

Written comments were received during the 45-day comment period in response to the October 25, 2018 public hearing notice, and written and oral comments were presented at the Board hearing. Listed below are the organizations and individuals that provided comments during the 45-day comment period:

<table>
<thead>
<tr>
<th>Commenter</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambrozaitis, Giedrius (10-09-2018)</td>
<td>Alliance of Automobile Manufacturers (Alliance)</td>
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<tr>
<td>Bui, Tin (10-22-2018)</td>
<td>American Honda Motor Co., Inc. (Honda)</td>
</tr>
<tr>
<td>Douglas, Steven (testimony at hearing)</td>
<td>Alliance of Automobile Manufacturers (Alliance)</td>
</tr>
<tr>
<td>Majewski, Ryan (10-19-2018)</td>
<td>Toyoda Gosei (TG)</td>
</tr>
<tr>
<td>Muskus, Amandine (10-22-2018)</td>
<td>Association of Global Automakers (Global)</td>
</tr>
<tr>
<td>Zitkovic, Michael (10-04-2018)</td>
<td>SAE Refueling Taskforce (SAE)</td>
</tr>
</tbody>
</table>

A. Comments of Support
1. Comment: Several comments expressed general support for amendments to fill pipe specifications. (Global/Alliance)

Agency Response: CARB appreciates support for staff’s recommended changes to the fill pipe specifications. The Board adopted the recommended changes to the regulation at its October 25, 2018 hearing.

B. Bench Test
2. Comment: Further analysis to determine if an agreeable acceptance criteria is needed. The safety factor needs further data, and vehicles with a 2.5 mm orifice meet the 0.5 vapor-to-liquid ratio (V/L). (SAE/Alliance/Honda)

Agency Response: Following the October Board hearing, the automotive industry provided bench leak test data showing that the resulting flow rate can vary depending on the length of the hose between the pressure gage and the nozzle boot. When the hose length used matches what CARB used for determining the bench leak standard, meeting the standard becomes more feasible than what
industry expected when they wrote these comments, addressing these commenters’ concern. As a result, staff added the lengths and diameters of the hoses CARB used to link the pressure and flow gages to the nozzle boot for its bench test rig to the procedure in the 15-Day Notice.

As described in Appendix C of the Staff Report, automakers performed testing with CARB at California gas stations, and found that fill pipes with a 2.5 mm orifice can still yield an appropriate V/L below 0.5. But, in setting the bench leak standard, staff adjusted the maximum allowable orifice size downward to 1.6 mm to include an additional safety buffer into the bench leak standard to account for the influence of a recirculation line, which may be present in-use but is not included in the bench leak test. The standard also buffers against degradation in in-use performance due to vehicle aging and variations in performance at different gas stations. Staff performed the bench leak test on a fill pipe with a 1.6 mm orifice and produced a leak rate of 2.5 standard liters per minute (SLPM), which was selected as the bench test standard.

3. **Comment:** A 4.0 SPLM should be used if further analysis cannot be completed. (Alliance)  

**Agency Response:** The bench test rate will remain 2.5 SLPM. See Agency Response to Comment #2.

4. **Comment:** A 4.0 SPLM should be used. CARB has not adequately explained why 2.5 SLPM is needed. Manufacturers provided data showing 4 SLPM is sufficient to achieve 0.5 V/L. (Honda)  

**Agency Response:** The bench test standard will remain 2.5 SLPM. See Agency Response to Comment #2.

### C. Bench Test Procedure: Details and Clarifications

5. **Comment:** CARB should provide a better nozzle description. (SAE/Alliance/TG)  

**Agency Response:** In response to the comment above, in the 15-day process CARB incorporated by reference Executive Order VR-202-X because it describes the proper vacuum-assist nozzle auto manufacturers are to use in the bench leak test.

6. **Comment:** Use a 3 kilogram (kg) weight instead of an actual refueling hose to eliminate variation in testing among different parties. TG’s study measured the weight applied by the refueling hose, which supports this 3 kg figure. (TG)  

**Agency Response:** CARB analyzed the automotive industry’s data on weight applied by the refueling hose, and concluded that a 1.5 kg weight would accurately represent the average hose weight and should not otherwise compromise the bench test. Therefore, an option for bench leak testing to attach a 1.5 kg weight to the nozzle instead of attaching a refueling hose was added as
a 15-day change. The option to use an actual fueling hose is maintained, since this was used in CARB’s analysis in establishing the bench test.

7. **Comment:** The pipe axis angle of 30 +/-2 degrees can conflict with ISO 13331 requirement of not less than 30 degrees. (Honda)

**Agency Response:** Included in CARB’s 15-Day Notice was an adjustment to the pipe axis angle to fall within 30-34 degrees for performing the bench test in order to better align the bench test pipe axis angle with ISO 13331, which is incorporated by reference in the fill pipe specifications.

8. **Comment:** The bench test should resemble the spitback—five tests on the same fill pipe instead of one test on five fill pipes. (Honda)

**Agency Response:** To provide flexibility while still maintaining an accurate verification, a 15-day change was made adjusting the test performance to more resemble the spitback test: one or more fill pipes with six test iterations instead of six fill pipes each individually tested. CARB believes this should still maintain accurate test verification while reducing the testing burden for manufacturers.

9. **Comment:** Use a standardized fixture to replace the nozzle for bench testing. (SAE/Alliance)

**Agency Response:** In order to perform the bench test using the assist vapor recovery nozzle as specified in the amendments, any leak paths in the nozzle must be sealed. In CARB’s experience, there was a leak path in the nozzle’s trigger plunger, which was sealed with epoxy prior to performing bench leak testing. CARB’s testing, referenced in Appendix C of the 45-Day Notice, shows that this nozzle provides repeatable results. A standardized nozzle test fixture was not available to reference at the time of this writing.

Since the CARB bench leak test procedure includes the option to comply using attestation, manufacturers will have the option to use alternate testing equipment than that specified in CARB’s procedure, so long as it yields an accurate result of whether their fill pipe meets the bench leak standard. This leaves open the possibility of using a standardized fixture, if such a fixture is developed in the future (for instance by an SAE taskforce).

10. **Comment:** The bench test procedure should be further developed in the future, so that it describes the apparatus and procedure at a higher level of detail, making the bench test more repeatable. Furthermore, this work should be done through the SAE taskforce and be reflected within a revised SAE J1140 document. (SAE)

**Agency Response:** In order to better standardize the bench leak test procedure and make it more repeatable, the lengths and diameters of the hoses CARB used to link the pressure and flow gages to the nozzle boot for its bench test rig were added to the procedure in the 15-Day Notice. At the time of this writing, J1140 does not contain more details as compared to CARB’s bench leak test procedure. Various details of the test are standardized in CARB’s procedure, with the intent of making
the procedure as repeatable as possible. Additionally, for reference purposes, the connector linking the hose to the nozzle boot in CARB’s bench test set-up (at location A in Figure C in the fill pipe specifications) has an internal diameter of 2 mm, and the “T” style connector linking the vacuum hose coming from the nozzle boot to the hose leading to the pressure gage (at location B in Figure C) has an internal diameter of 5 mm. CARB will continue working with the SAE taskforce to help ensure future changes to J1140’s bench leak test procedure compliment and can co-exist with CARB’s fill pipe specifications.

D. Definitions: Mention of Leaded Nozzle

11. **Comment:** References to leaded nozzles should be removed. (SAE/Alliance)

**Agency Response:** A 15-day change was made which removes references to leaded nozzles.

E. Dimensional Clarifications: Fill Pipe Sealing Surface

12. **Comment:** The maximum seal surface diameter should be 57.9mm. (SAE/Alliance/TG)

**Agency Response:** The standard fill pipe shape of SAE J1114, which is a common design specification, has a maximum outer diameter of the seal surface of 57.9 mm. To enable this standard fill pipe shape to meet CARB specifications, the maximum seal surface diameter was amended in a 15-day change to be 57.9mm for all fill pipes. This small adjustment from the original proposal is not expected to impact the ability of the nozzle to make a good seal with the fill pipe.

13. **Comment:** Remove the language concerning the diameter of the sealing surface that says "the convex portion shall have a maximum radius of 6 mm." This statement is unclear and precludes almost all capless designs. The convex callout in the past had to do with capped faces more with respect to fuel cap sealing rather than sealing with the nozzle.

**Agency Response:** After further discussion with the SAE taskforce, it became clear that this 6 mm dimension was creating unnecessary confusion, defeating the purpose for which it was originally added. As such, the “maximum radius of 6 mm” language was removed in a 15-day change.

14. **Comment:** Section III.D of the fill pipe specifications is not necessary if the maximum seal surface diameter is 57.9 mm and matches proposed drafts from the SAE Refueling Taskforce. (SAE/Alliance/TG)

**Agency Response:** In a 15-day change, Figure A was added and Subsection D was deleted to clarify which fill pipe drawing and specifications should be used when a manufacturer elects to use the SAE J1114 alternative filler pipe sealing surface shape. Figure A denotes Alternate Shape 2, which applies for 2024 and subsequent model year vehicles using SAE J1114’s alternative shape and that are changing their fill pipe head designs. This figure reflects the appropriate access zone and seal surface diameter in order to make a good seal with
California’s vapor recovery nozzles, and reflects the latest draft revisions to SAE J1114’s alternate shape developed by the SAE taskforce at the time of this writing.

15. **Comment:** CARB should maintain the existing planar definition for the fill pipe and nozzle interface and remove the portion of the new language, under the fill pipe sealing surface definition, indicating it is the portion of the fill pipe face “which could contact the 40 degree tapered zone,” as this would depict an angled sealing surface. (SAE/Alliance/TG)

**Agency Response:** The angled sealing surface concept is unnecessarily complicated. To simplify the definition of the fill pipe sealing surface and avoid depicting an angled sealing surface, a 15-day change was made removing this portion of the definition. The language in the specification is otherwise sufficient, which indicates that the sealing surface is the portion of the fill pipe face that would contact the vapor recovery boot.

**F. Dimensional Clarifications: Access Zone**

16. **Comment:** There needs to be a clarification on the 2.5 mm reference in the ISO 13331 Figure 5 cross section X. There are several interpretations of the 2.5 mm dimension, so clarity is needed. Interpreting the 2.5 mm dimension as a crush zone for the nozzle cushion is preferred. Additionally, if this interpretation is not recognized by CARB, the existing interpretation for ISO 13331 needs to be properly spelled out in the regulation for usage until the changes are phased in. (SAE/Alliance)

**Agency Response:** The fill pipe specifications incorporate ISO 13331 by reference. The 2.5 mm dimension pertains to the portion of the access zone in ISO 13331 that envelopes the tip of the fill pipe by 2.5 mm. Staff reached out to industry to inform CARB’s interpretation of this dimension and believes that this dimension is adequately characterized in the current specification. As such, no changes are proposed to this existing dimension. The latest draft of SAE J1140, at the time of this writing, further clarifies this 2.5 mm dimension and is shown in the drawing in Figure F1 below with minor adjustments to the language to add clarity.
Figure F1: Depiction of 2.5 mm portion of current access zone, access zone is depicted in yellow

17. Comment: Do not reference the access zone starting point to the fill pipe surface, which varies among different fill pipe designs. Instead, reference a “fixed” starting point, which would not vary when applying to different fill pipe designs. (SAE/Alliance/TG)

Agency Response: After further discussion in the SAE taskforce, staff realized that a fixed access zone as recommended in this comment would create a gap between the access zone and the fill pipe outer diameter, since different fill pipes vary in size. The additional access zone was re-worked in the SAE taskforce to more closely resemble the shape of the vapor recovery nozzle’s boot; this was integrated into the fill pipe specifications as a 15-day change. This new zone, shown in Figure B of the amended fill pipe specifications, captures that the front-most section, which terminates at the 12 mm depth boundary, would vary in shape depending upon the diameter of the fill pipe sealing surface, thus avoiding the gap between the access zone and outer diameter. In Figure B, the additional access zone is shown drawn around a capped style fill pipe for illustration purposes, but the entire access zone (additional access zone in Figure B and the remainder of the access zone found in ISO 13331) applies to all fill pipe types (bayonet, capped, capless, etc.).
18. **Comment:** CARB should adopt J1140 for describing the access zone. (SAE)

**Agency Response:** The content of the new additional access zone that CARB is adopting is very similar to what the SAE taskforce has developed so far for the draft J1140. Since the October Board hearing, CARB has worked with the SAE taskforce to clarify the access zone. At the time of CARB’s 15-Day Notices, the SAE J1140 revisions had not been finalized, and therefore J1140 could not be incorporated by reference.

**G. Dimensional Clarifications: Internal Locking Lip Depth**

19. **Comment:** The proposed locking lip depth should be changed from 4-11 mm to 4-12 mm to allow for stack-up conditions within the 100-degree swing of the nozzle on a SAE-recommended thread. (Alliance)

**Agency Response:** Analysis from the SAE taskforce of the J1114 thread indicates maximum stack-up results in a locking lip depth of 11 mm. Staff took this analysis into account and changed the proposal from 4-10 mm to 4-11 mm. As such, this dimension is not being changed to 4-12 mm.

**H. Terminology Clarifications**

20. **Comment:** The Alliance recommends using the same terminology for the proposed update. “Update”, “modification”, “supplement”, and “provisions” are used in different sections to describe the proposed update. (Alliance)

**Agency Response:** To be more consistent, a 15-day change included more consistent terminology. “Update” was replaced with “modify,” and “supplement” was replaced with “addition.”

21. **Comment:** For clarity, the Alliance suggests that outline callouts use the same format as the outline. (Alliance)

**Agency Response:** To improve clarity, outline callouts were changed to match the same format as the outline, which is Roman numerals, in a 15-day change.

22. **Comment:** Change “A minimum of five tests with each chose nozzle” to “A minimum of five tests with each chosen nozzle.” (Alliance)

**Agency Response:** To help clarify this language, a 15-day change was made which replaced “chose” with “chosen” in the sentence referenced by this comment.

23. **Comment:** The word “test” should be plural – “milliliter during the first five tests.” (Alliance)

**Agency Response:** To help clarify this language, a 15-day change was made replacing “test” with “tests” in the sentence referenced by this comment.
I. Comments Outside the Scope of the Rulemaking

24. Comment: A fill rate range is necessary for conducting testing. Honda recommends the same fill rate range as ORVR filling of 9.8 +/- 0.3 gal/min. (Honda)

Agency Response: This comment pertains to fill rate specifications for premature shut-off and spitback testing. The Board did not consider a proposal to change premature shut-off and spitback testing; therefore, this comment falls outside the scope of this rulemaking.

J. Nozzle Specification Comments:

25. Comment: Alliance included their comment on the proposed amendments for nozzle spout dimensions along with their comments for the proposed fill pipe amendments. Alliance recommended that CARB adjust the nozzle spout diameter range in CARB’s vapor recovery nozzle specifications to match the related the SAE specification. (Alliance)

Agency Response: In a parallel rulemaking at the October 25, 2018 Board meeting, the Board adopted amendments to nozzle spout dimensions to improve the compatibility and seal at the vehicle fill pipe and nozzle interface (“nozzle amendments”). The Alliance’s comments for nozzle specification amendments are addressed in the FSOR for the nozzle amendments, which is available at the CARB website: https://ww2.arb.ca.gov/rulemaking/2018/gas-station-nozzle-spout-dimensions-2018?utm_medium=email&utm_source=govdelivery

COMMENTS PRESENTED DURING THE FIRST POST-BOARD HEARING COMMENT PERIOD

Comments in this section responded to specific changes made available on April 5, 2019 through April 22, 2019.

During the first 15-day supplemental comment period, the Board received written comments from:

<table>
<thead>
<tr>
<th>Commenter</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Ambrozaitis, Giedrius (04-19-2019)</td>
<td>Alliance of Automobile Manufacturers (Alliance)</td>
</tr>
<tr>
<td>Zitkovic, Michael (04-19-2019)</td>
<td>SAE Refueling Taskforce (SAE)</td>
</tr>
</tbody>
</table>

A. Comments of Support

1. Comment: Commenters expressed support for the 15-day modifications to the fill pipe specifications. (SAE/Alliance)

Agency Response: CARB appreciates the support for staff’s 15-day changes to the fill pipe specifications.
COMMENTs PRESENTED DURING THE second POST BOARD HEARING COMMENT PERIOD

Comments in this section responded to specific changes made available on April 24, 2019 through May 9, 2019.

During the second 15-day supplemental comment period, the Board received a written comment from:

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<th>Commenter</th>
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<tr>
<td>Zitkovic, Michael (05-07-2019)</td>
<td>SAE Refueling Taskforce (SAE)</td>
</tr>
</tbody>
</table>

A. Comment of Support

1. Comment: General support for the second 15-day modifications to the fill pipe specifications. (SAE)

   Agency Response: CARB appreciates the support for staff’s second 15-day change.

V. Peer Review

Health and Safety Code Section 57004 sets forth requirements for peer review of identified portions of rulemakings proposed by entities within the California Environmental Protection Agency, including CARB. Specifically, the scientific basis or scientific portion of a proposed rule may be subject to this peer review process. Peer review is not required for these amendments to the fill pipe specification, because any changes to fill pipe designs manufacturers would make to meet the new specification could be made using currently available technology.