APPENDIX A

FINAL TECHNICAL SUPPORT DOCUMENT

Amendments to the New Engine Tier 4

Off-Road Compression-Ignition Regulations

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FINAL TECHNICAL SUPPORT DOCUMENT: TIER 4

Note: This appendix provides background information regarding the Tier 4 Off-Road Compression-Ignition Regulations and Test Procedures approved by the Air Resources Board on December 16, 2011, and with subsequent conforming modifications authorized under Resolution 11-41. Revisions to the original Appendix R, published on October 26, 2011, as part of the Staff Report: Initial Statement of Reasons, are meant solely to indicate the transition from a proposed document to a final document, and are indicated either by <u>underlined</u> type to indicate additions (except that some existing headings within the document were underlined originally for emphasis, and remain so, and thus do not constitute new language) or by ~~strikeout~~ to indicate deletions.

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Detailed Descriptions of ~~Proposed~~ Final Amendments: Tier 4 Off-Road CI Engines

I. DEFINITIONS

This section provides background on key terms that ~~staff is proposing for~~ have been incorporat~~ion~~ed or modif~~cation~~ed in to the California off-road diesel regulations and/or test procedures.

- 2011 and Later Test Procedures:

In keeping with the precedence for incorporating test procedures and defining a standardized abbreviation for them in the definition section §2421 of the off-road diesel regulation, ~~staff's proposal assigns~~ the updated test procedures titled "California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression Ignition Engines, Parts I-D, I-E, and I-F," have been assigned to new subparagraph (a)(4)(B) as the 2011 and Later Test Procedures. The previous version of the test procedures are relocated to new subparagraph (a)(4)(A), previously just (a)(4), and retitled to indicate model year-limited applicability through the 2010 model year (i.e., 2008-2010 Test Procedures).

- Constant Speed Engine:

~~Staff proposes to align with t~~The definition of a "constant speed engine" has been aligned with the federal definition of "constant speed engine/operation" in 40 CFR, part 1039.801. The new definition more accurately describes the normal operation of a constant speed engine, including a more realistic allowance for fluctuating engine speed under changing loads. The revised definition is appended to the existing definitions of "constant speed engine" in new subparagraph (a)(15)(C) with referenced applicability to 2011 and later model year engines,

- Date of Manufacture or Build Date:

The ~~proposal aligns with~~ definition of "date of manufacture" has been aligned with the federal definition of "date of manufacture" described in 40 CFR, part 1068.30 to standardize the assignment of engine build dates. Further, the use of the term in §2423(j)(1) of the regulation to characterize the type of power to be included on the emissions label for replacement engines necessitates the creation of a new definition for "Date of Manufacture" in §2421(a)(19). All subsequent definitions are renumbered to preserve alphabetical order.

- Carryover:

~~Staff proposes to align~~The definition of "carryover" has been aligned with the federal definition of "carryover' in 40 CFR, part 1039.801 to ensure uniform criteria for the application of data from previous model year engine families.

II. EMISSION STANDARDS

- ~~Proposed~~ Alternate Tier 4 NMHC+NOx standards and FEL Caps.

Table R - II.A; Tier 4 Exhaust Emission Standards
(grams per kilowatt-hour)

MAXIMUM ENGINE POWER	MODEL YEAR	TYPE	PM	NMHC+ NOX	NMHC	NOX	CO
			grams per kilowatt-hour				
56≤kW<75	2012-2014	PHASE-IN	0.02	-	0.19	0.40	5.0
		PHASE-OUT		4.7	-	-	
		or/ ALT NOX		-	0.19	3.4	
		or/ ALT NOX+NMHC		3.5	-	-	
	2015 and later	FINAL		-	0.19	0.40	
75≤kW<130	2012-2014	PHASE-IN	0.02	-	0.19	0.40	5.0
		PHASE-OUT		4.0	-	-	
		or/ ALT NOX		-	0.19	3.4	
		or/ ALT NOX+NMHC		3.5	-	-	
	2015 and later	FINAL		-	0.19	0.40	
130≤kW≤560	2011-2013	PHASE-IN	0.02	-	0.19	0.40	3.5
		PHASE-OUT		4.0	-	-	
		or/ ALT NOX		-	0.19	2.0	
		or/ ALT NOX+NMHC		2.1	-	-	
	2014 and later	FINAL		-	0.19	0.40	

- ~~Proposed~~ ALT NOx FEL Cap Applicability

Table R - II.B; Tier 4 Family Emission Limit (FEL) Caps

MAXIMUM ENGINE POWER	FEL TYPE	MODEL YEAR	PM	NOX	NMHC+ NOX
			grams per kilowatt-hour		
56≤kW<75	Phase-in	2012-2014	0.04	0.80	-
	Phase-out			-	7.5
	Alternate NOx Std	2012-2013	0.04	3.0	-
		2012-2014		4.4	
	Alternate NOx+NMHC Std	2012-2013/2014	0.04	-	4.7
	Primary	2014/2015 and later	0.04	0.80	-
	ALT 20% PM	2012-2015	0.40		-
	ALT 20% NOX	2012-2015		4.4	-
	ALT 20% NOx+NMHC Std	2012-2015	-	-	4.7
	ALT 5%	2016 and later	0.40	4.4	-
75≤kW<130	Phase-in	2012-2014	0.04	0.80	-
	Phase-out			-	6.6
	Alternate NOx Std	2012-2013		3.0[7]	-
		2012-2014		3.8	-
	Alternate NOx+NMHC Std	2012-2013/2014		-	4.0
	Primary	2014/2015 and later		0.80	-
	ALT 20% PM	2012-2015	0.30		-
	ALT 20% NOX	2012-2015		3.8	-
	ALT 20% NOx+NMHC Std	2012-2015	-	-	4.0
	ALT 5%	2016 and later	0.30	3.8	-
130≤kW≤560	Phase-in	2011-2013	0.04	0.80	-
	Phase-out			-	6.6/6.4
	Alternate NOx Std	2011-2013		2.7	-
	Alternate NOx+NMHC Std	2011-2013		-	4.0
	Primary	2014 and later		0.80	-
	ALT 20% PM	2011-2014	0.20		-
	ALT 20% NOX	2011-2014		3.8	-
	ALT 20% NOx+NMHC Std	2012-2015	-	-	4.0
	ALT 5%	2015 and later	0.20	3.8	-

III. DIFFERENCES BETWEEN CALIFORNIA AND FEDERAL REGULATIONS

A. ~~PROPOSED~~ NEW NON-ALIGNMENT REQUIREMENTS

1. Replacement Engine Labeling

~~Staff proposes to include a~~Additional information is required on replacement engine labels to assist ARB's in-use off-road diesel modernization programs that rely on accurate power and emissions performance information to ensure the calculation of appropriate fleet emission averages. In addition to the ~~proposed~~ harmonized statement of compliance in §2423(j)(1) of the regulations and §1068.240 of the Test Procedures, the new California label ~~would~~ also includes "engine power," "reference family name," and "date of manufacture." These additional parameters ~~would~~ provide end-users with the information necessary to accurately register their engines and equipment, and ~~would~~ should greatly enhance the ability of ARB's field inspectors to enforce the regulations. Federal regulations do not include a similar requirement because U.S. EPA does not currently regulate in-use off-road engines, making knowledge of these parameters less critical outside of California.

2. Preliminary Approval

ARB is not aligning~~Staff proposes not to align~~ with a U.S. EPA amendment to §1039.210 that gives manufacturers the assurance that preliminary approvals (i.e., those given prior to the approval of a manufacturer's certification application) will not usually be reversed apart from the discovery of new information contrary to the findings that resulted in the preliminary approval. Rather than to provide potentially specious global assurances, staff prefers to continue the practice of working with industry on a case-by-case basis to provide direction on certification requirements and options prior to application. Ultimately, however, it is the manufacturer's responsibility to ensure that it has met the letter of the law regarding certification requirements. The issuance of an Executive Order, after reviewing an application for certification, is, and should remain, the official means for granting binding approval.

3. Untracked Replacement Engine Provision

ARB is not aligning~~Staff proposes not to align~~ with an amendment to §1068.240 permitting a small number of replacement engines to be exempt from tracking requirements (e.g., labels). As noted above in the discussion for replacement engine labeling, properly labeled engines are extremely important for the correct implementation and enforcement of California's in-use off-road fleet modernization programs. Even a small number of engines without labels could hamper registration and enforcement efforts sufficiently to compromise the effectiveness of those programs and the emission reduction benefits associated

with them. This is not as large a concern federally because U.S. EPA does not regulate in-use off-road engines like California.

4. Engine Definition

ARB is not aligning~~Staff proposes not to align~~ with U.S. EPA's definition of an engine as an engine block with an installed crankshaft, nor U.S. EPA's definition of a partially complete engine as defined in §1068.240. Rather, staff chooses to remain flexible in its interpretation of what constitutes an engine, generally, an assemblage of systems and components that are capable of providing power and generating emissions. Nevertheless, the lack of a generic and formal "engine" definition is not necessary for compliance with the California regulation or any portion of the incorporated Test Procedures. The California regulations already provide for the labeling and final assembly of partially complete (or ""incomplete") engines in §2423(l). This section, as noted below in the discussion on the rebuild labeling prohibition and supplemental label requirement is already a departure from federal requirements and would not support the federal definition of a partially complete engine.

B. PRIOR NON-ALIGNMENT REQUIREMENTS

Flexibility Engine Labeling
ARB requires the inclusion of a reference engine family name on the emission control label of flexibility engines to aid in the verification of emission levels by field inspectors

Flexibility Engine Executive Orders
ARB requires that engines produced for use in flexibility equipment be covered by an Executive Order.

Rebuild Labeling Prohibition and Supplemental Label Requirement
ARB adopted a new §2423(l) during the previous amendment of the off-road diesel regulations that clarifies the categorization of remanufactured engines as a subset of rebuilt engines, thereby subject to the same requirements as rebuilt engines, and specifies labeling content for the different types of rebuilt engines.

Extension of Replacement Engine Reporting Requirements
ARB clarified that when replacing a California certified off-road diesel engine, equipment manufacturers are generally required to use the cleanest engines available. This interpretation of existing language differs from U.S. EPA's interpretation which states that the replacement engine must be "at least as clean" as the engine it replaces.

In-Use Compliance/Recall Program

ARB maintained the independent authority of California to investigate and recall engines found to be in violation of the regulations apart from U.S. EPA, if necessary.