



Transport Refrigeration Unit ATCM Technology Review Workshop September 12, 2007

1

Overview

- ◆ Background
- ◆ TRU ATCM Overview
- ◆ Facility Reports
- ◆ Operator Requirements
- ◆ Verified Diesel Emission Control Strategies
- ◆ Technology Review
- ◆ Further Information and Contacts
- ◆ Questions and Comments
 - Webcast participants – email to auditorium@calepa.ca.gov

2

Background

- ◆ TRU ATCM adopted February 26, 2004
- ◆ Effective December 10, 2004
- ◆ Requested U.S. EPA waiver,
March 28, 2005
- ◆ EPA waiver hearing, January 2006
- ◆ Facility Reports were due January 31, 2006
- ◆ First Technology Review Workshop
held June 14, 2007

3

TRU ATCM

- ◆ ARB implementation
 - ARB inspectors audit facilities and conduct roadside inspections at scales and border crossings
- ◆ Two parts to regulation
 - Distribution facility requirements
 - Operator requirements



4

Distribution Facility Requirements

- ◆ Applies to “large” distribution centers in California where TRUs operate
 - “Large” is 20 or more loading spaces serving cold storage areas
- ◆ One time facility report was due January 31, 2006
- ◆ Required reporting of
 - Facility information
 - TRU activities and inventory



5

TRU Operator Requirements

- ◆ Requirements apply to TRU engines and TRU generator set engines, unless otherwise stated
- ◆ Engines must meet in-use performance standards
 - Applies to ALL TRUs and TRU generator sets that operate in California
 - Includes TRUs based out-of-state, that operate in California
- ◆ ARB I.D. number/registration – Apply by January 31, 2009
 - Required of California-based TRUs
 - Voluntary for out-of-state TRUs
- ◆ Operator reports – First report due by January 31, 2009
 - Applies only to California-based TRUs
 - Report compliance status and how compliance with in-use standards achieved
 - Update required within 30 days of any changes

6

TRU Operator Requirements (cont'd)

- ◆ Forms available by early December 2008
 - IDN Application Form
 - Initial Operator Report Form
 - IDN Information Revision Form
 - Operator Report Update Form
 - Download from TRU website and mail into ARB, or
 - Fill out and submit via Internet
 - Link will be added to TRU website



In-Use Performance Standards

Less than 25 hp TRU Engines

In-Use Performance Standard	Requirement
LETRU	Use 0.30 g/hp-hr engine or Level 2 retrofit
ULETRU	Level 3 retrofit or Alternative Technology

25 to 50 hp TRU and TRU Generator Set Engines

In-Use Performance Standard	Requirement
LETRU	Use 0.22 g/hp-hr engine or Level 2 retrofit
ULETRU	Use 0.02 g/hp-hr engine, Level 3 retrofit, or Alternative Technology

LETRU = Low-Emission TRU In-Use Performance Standard
ULETRU = Ultra-Low-Emission TRU In-Use Performance Standard
Alternative Technology = ULETRU (and LETRU) if diesel PM emissions are eliminated at distribution centers and limited at delivery point facilities.

In-Use Performance Standards Compliance Schedule

Engine Model Year	In-Use Compliance Standard Compliance Date	
	LETRU	ULETRU
2001 and older	December 31, 2008	December 31, 2015
2002	December 31, 2009	December 31, 2016
2003	Does Not Apply	December 31, 2010
2004	Does Not Apply	December 31, 2011
2005	Does Not Apply	December 31, 2012
2006	Does Not Apply	December 31, 2013
2007	Does Not Apply	December 31, 2014
2008	Does Not Apply	December 31, 2015
2009	Does Not Apply	December 31, 2016
2010	Does Not Apply	December 31, 2017
2011	Does Not Apply	December 31, 2018
2012	Does Not Apply	December 31, 2019
2013	Does Not Apply	December 31, 2020
2014	Does Not Apply	December 31, 2021

Generally, the compliance date is December 31st of model year plus 7 years.

9

Compliance Options

- ◆ Replace in-use engine with new engine
 - Resets the compliance clock to the replacement engine model year plus 7 years
- ◆ Retrofit with VDECS
- ◆ Use an engine meeting LETRU or ULETRU
 - Provide test data and report that shows:
 - In-use emissions meet LETRU or ULETRU, AND
 - A maintenance program is in effect that will sustain emissions to meet LETRU or ULETRU (records required)
- ◆ Use Alternative Technology
 - Must eliminate diesel engine emissions from the TRU engine at distribution centers

10

Compliance Plan

- ◆ Start planning now
- ◆ Plan to comply early



11

Verified Diesel Emission Control Strategies (VDECS) for TRUs

- ◆ TRU VDECS are posted on TRU website
<http://www.arb.ca.gov/diesel/tru.htm>
- ◆ All VDECS are listed on the Verification web page
<http://www.arb.ca.gov/diesel/verdev/vt/vt.htm>
- ◆ Read VDECS' Executive Order before you buy
 - Verified for specific engine models and model years
 - If not installed appropriately, then DECS is not verified
 - Warranty claims issues
- ◆ DECS owners manual
 - DECS and engine maintenance required for warranty

12

Alternative Technology

- ◆ Electric standby or hybrid electric/diesel
 - To qualify, operator must plug in at distribution centers so diesel emissions are eliminated
 - Must plug in at any delivery point where more than 2 TRUs present or delivery takes more than 30 minutes
 - Records required to prove compliance
- ◆ Cryogenic temperature control
 - Hybrid cryogenic-diesel – records required to prove compliance
- ◆ Alternative diesel fuel (e.g. 100% biodiesel)
 - Records required to show exclusive use of these fuels
- ◆ Qualifying Alternative Technologies meet LETRU and ULETRU

13

Technology Review

- ◆ Key issues from June 14th workshop
- ◆ DRAFT Control Option Matrix update
- ◆ Sign up for TRU list serve to get notices
- ◆ Technical assessment report by year-end

14

Technology Review Key Issues from June 14th Workshop

- ◆ Preemption waiver application status
 - U.S. EPA decision by end of 2007
- ◆ Compliance option availability
 - No need for delayed compliance dates
- ◆ Compliance costs
 - Too soon to evaluate
- ◆ Conflict with Biodiesel Use Guidelines
 - Should be resolved with MMA and verification

15

Technology Review Key Issues from June 14th Workshop (Cont'd)

- ◆ Use of asset numbers in lieu of ARB IDNs for TRU gen sets
 - Still evaluating legal issues
- ◆ Compliance options for TRU gen sets
 - Products are being developed

16

Technology Review

Key Issues from June 14th Workshop

(Cont'd)

- ◆ IDN applications for multiple units
 - Automated checks are needed
 - Cloning strategies may be possible
- ◆ Outreach to small TRU fleets
 - Outreach efforts will increase
- ◆ Fleet averaging
 - Not an option for this regulation

17

LETRU (Level 2 – 50% PM Reductions)

Technology	Company	Design Ready for Trailer/Truck/GenSet TRUs	Demonstrated in Trailer/Truck/Gen Set TRUs	Verified for Trailer/Truck/Gen Set TRUs	Estimated Cost
Passive catalyzed flow-through filter	Thermo King/ FinnKatalyt	Yes/No/Yes	Yes/No/No	Yes/No/No MY 2002 and older Isuzu D201 Yanmar 4TNE82-TK/ETK Yanmar 4TNE86-TK/ETK	\$4,000 - \$5,500 installed (includes pre-installation tests)
Active flow-through filter (sintered metal fiber with periodic electric regeneration)	Rypos	Yes/Yes/Yes	No/No/No Trailer TRU tested in lab, field demonstration planned.	No/No/No	\$2,500 to \$3,500, installed
Catalyzed Flow-Through Filter	Company A	Yes/Yes/Yes	No/No/No (planned)	No/No/No	Unknown.
Catalyzed Flow-Through Filter	Company E	Yes/No/No	Yes/No/No (Lab only, to date)	No/No/No	Unknown
Replace engine with new engine kit	TRU Dealers	Yes/Yes/Yes	NA	NA	Truck: \$4,000-5,000; Trailer: \$6,600 - \$9,000 with parts & labor.

ULETRU (Level 3 – 85% PM Reductions)

Technology	Company	Designed for Trailer/Truck/Gen Set TRUs	Demonstrated in Trailer/Truck/Gen Set TRUs?	Verified for Trailer/Truck/Gen Set TRUs?	Estimated Cost
Active DPF (fuel burner regeneration)	Huss FS-MK Series	Yes/Yes/Yes	Yes/No/No	Yes/Yes/Yes	\$6,000 (installed)
Active flow-through filter (sintered metal fiber with periodic electric regeneration)	Rypos	Yes/Yes/Yes	No/No/No	No/No/No	\$4,000 to \$5,000 installed
Passive DPF (catalyzed wall-flow filter)	Company B	Yes/Yes/No	Yes/No/No	No/No/No	\$3,000 to \$5,000
Active regeneration DPF (HC injection onto catalyzed DOC ahead of SiC DPF)	Company F	Yes/Yes/Yes	No/No/No (Lab tests completed on trailer TRU, field tests planned)	No/No/No	\$2,500 to \$3,000
Active regeneration DPF (electric regeneration)	Company G	Yes/No/No	No/No/No	No/No/No	Unknown
Active DPF (electric regeneration)	Company H	Yes/Yes/No	No/No/No	No/No/No	Unknown
Replace engine with new engine.	TRU Dealers	Yes/Yes/Yes	NA	NA	Truck: \$4,000-\$5,000 Trailer: \$6,600-\$9,000

Alternative Technologies

Technology	Company	Designed for Trailer/Truck/Gen Set TRUs?	Demonstrated in Trailer/Truck/Gen Set TRUs?	Verified for Trailer/Truck/Gen Set TRUs?	Estimated Cost
Electric standby (option available for most TRU models)	TRU OEMs	Yes/Yes/NA	Yes/Yes/NA	NA	Truck: \$350-\$1,000 Trailer: \$2,000-\$4000, plus facility electric plug infrastructure
Hybrid e-TRU (diesel engine running generator w/ semi-hermetic electric motor running refrigeration compressor & electric motor-driven fans)	Carrier Transicold – Vector 1800MT	Yes/No/NA	Yes/No/NA In production for multi-temp models	NA	\$3,000 to \$4,000 over conventional TRU; Maintenance costs about 30% less than standard TRU
Biodiesel (100%)	Many producers	Potentially, if meets ASTM 6751 specification and BQ9000 quality standard.	Yes/No/No	No. Multimedia assessment and in-use verification are required	Same as CARB diesel with tax credits; additional fueling infrastructure costs, if dual fuel at terminal
Gas to Liquid (GTL) Diesel or Fischer-Tropsch (F-T) Diesel (100% ultra-low aromatic synthetic diesel fuel)	Many companies. Most current production overseas.	Any diesel engine	Yes/No/No	No. Multimedia assessment and in-use verification are required.	\$7/gal until bulk transport systems needed for volume, then \$0.15 to \$0.25 per gal more than ULSD
Cryogenic Refrigeration (open cycle liquid carbon dioxide)	Thermo King	Yes/Yes/NA	Yes/Yes/NA Operating in EU.	NA	Cost models available. Unit list price is within 10% of diesel unit
Cryogenic Refrigeration (open cycle liquid nitrogen)	Ukram ecoFridge	Yes/Yes/NA	Yes/Yes/NA Operating in EU.	NA	\$18,000/unit, liquid nitrogen infrastructure lease costs \$5,000/yr, 25% less hourly operating costs
Hybrid Cryogenic Temperature Control Systems (cryogenic temperature control in conjunction with diesel-powered TRU)	Thermo King	Yes/Yes/NA	Yes/Yes/NA In production for truck TRUs.	NA	Unknown

Further Information/Contacts

- ◆ TRU website:
<http://www.arb.ca.gov/diesel/tru.htm>
- ◆ Verification website:
<http://www.arb.ca.gov/diesel/verdev/vt/vt.htm>
- ◆ TRU List Serve
<http://www.arb.ca.gov/listserv/tru.htm>
- ◆ Rulemaking record:
<http://www.arb.ca.gov/regact/trude03/tru03.htm>
- ◆ ARB contact:
 - Rod Hill
 - 1-888-878-2826 (1-888-TRU-ATCM)
 - rhill@arb.ca.gov

21

Questions and Comments

- ◆ DECS manufacturers' comments
- ◆ Other questions and comments
 - Webcast participants may email their comments to:
auditorium@calepa.ca.gov during the webcast
 - Conference call participants:
 - Please use "Mute" or *6 when not talking to conference
 - Please do not use your telephone's "Hold" button
- ◆ Please identify yourself:
 - Name and company

22