# **Exploring Low Emission Lubricants for Diesel Engines**

RECEIVED AUG 1 1 2000 OSTI

J.M. Perez Perez Consulting and Technical Services State College, Pennsylvania





1617 Cole Boulevard Golden, Colorado 80401-3393

NREL is a U.S. Department of Energy Laboratory Operated by Midwest Research Institute • Battelle • Bechtel

Contract No. DE-AC36-99-GO10337

## **Exploring Low Emission Lubricants for Diesel Engines**

J.M. Perez

Perez Consulting and Technical Services State College, Pennsylvania



NREL Technical Monitor and Editor: K. Shaine Tyson

Prepared under Purchase Order No. 166234



PROCESSED TROM BEST AVAILABLE COFY

**National Renewable Energy Laboratory** 

1617 Cole Boulevard Golden, Colorado 80401-3393

NREL is a U.S. Department of Energy Laboratory Operated by Midwest Research Institute • Battelle • Bechtel

Contract No. DE-AC36-99-GO10337

This publication was reproduced from the best available copy Submitted by the subcontractor and received no editorial review at NREL

#### NOTICE

This report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available to DOE and DOE contractors from:

Office of Scientific and Technical Information (OSTI)
P.O. Box 62
Oak Ridge, TN 37831
Prices available by calling (423) 576-8401

Available to the public from:

National Technical Information Service (NTIS)
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 605-6000 or (800) 553-6847
or
DOE Information Bridge
http://www.doe.gov/bridge/home.html



## **DISCLAIMER**

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

### TABLE OF CONTENTS

I.	EXECUTIVE	SUMMARY	111	
II.	Introduct	TION	_ 1	
III.	TECHNICA	L Program	2	
		OE OHVT OVERVIEW	2	
	B. KEYN	NOTE ADDRESS	3	
	C. FUELS		6	
	D. CATALYSTS/TRAPS/AFTERTREATMENT		9	
	E. BASESTOCKS		10	
	F. ADDITIVES		13	
	G. LUBRICANTS		15	
	H. PARTICULATE		17	
	I. Tribology		18	
	J. OTHER		19	
	K. Question & Answer Sessions		20	
	L. Brea	KOUT GROUP REPORTS	22	
	Discussion	N	25	
		LYSTS/TRAPS/AFTERTREATMENT	-	
		ALTERNATIVES		
		ICANTS		
	4. Basestocks			
	5. ADDITIVES			
	6. PARTICULATES			
		DLOGY		
V.	Conclusio	NS AND RECOMMENDATIONS	31	
VI.	ATTACHME	INTS:		
	1. AGEN			
		2. ATTENDANCE		
		3. "Overview of the DOE Heavy Vehicle Technologies R&D Program" by Dr.		
	James J. Eberhardt, Director of Heavy Vehicles Technologies, USDOE.			
		4. Keynote Address. "The Diesel Challenge" by Rodica Barenescu, Chief		
	_	Engineer, Navistar International Truck and Engine Corporation (SAE Pres. Elect		
	5 - 8.	FUELS		
		CATALYSTS, TRAPS, AFTERTREATMENT		
		BASETOCKS		
		ADDITIVES		
		LUBRICANTS		
	25.	PARTICULATE		
		TRIBOLOGY		
	28 & 29.			
	30.	LIST OF ACRONYMS		