



A COMMANDER'S ALTERNATIVE REUTILIZATION OF USED ENGINE OIL BY THE ARMY



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PRESENTATION OUTLINE

- INTRODUCTION
- TECHNICAL APPROACH
- EXECUTION OF PHASES
- CONCLUSIONS



INTRODUCTION

BACKGROUND OF PROBLEM

- Genesis at Fort Hood, TX
- Large Quantity of Used Oil Generated Annually, Disposal Problem
- 110,000 Gallons Sold for \$22.00
- National Automotive Center (NAC) Approached for Alternate Disposal Solution



TECHNICAL APPROACH

- Adapt Commercial Trucking Industry Practice
- Four Phases
 - Phase I – Information Gathering
 - Phase II – Laboratory Characterization
 - Phase III – Field Demonstration
 - Phase IV – Implementation



EXECUTION

PROPOSED SOLUTION: Adapt commercial practice of blending used oil with diesel fuel and burning blend in over-the-road trucks.

PHASE I – INFORMATION GATHERING

- Survey of Trucking Industry
 - Three Different Versions Found
 - Version Selected: Blending Only Upon Oil Changes
- Survey of EPA and States Environmental Regulations
 - Most States follow EPA Guidelines
 - EPA Regulates Exhaust Emissions



EXECUTION

PHASE II – LABORATORY CHARACTERIZATION

- Characterization of Used Oil and Used Oil/JP-8 blend
- EPA Certified Engine Exhaust Emissions Tests Conducted
- Industry Standard Engine Durability Tests Conducted
- Analysis of Blended Fuel & Engine Crankcase Oil Samples from Field Demonstration



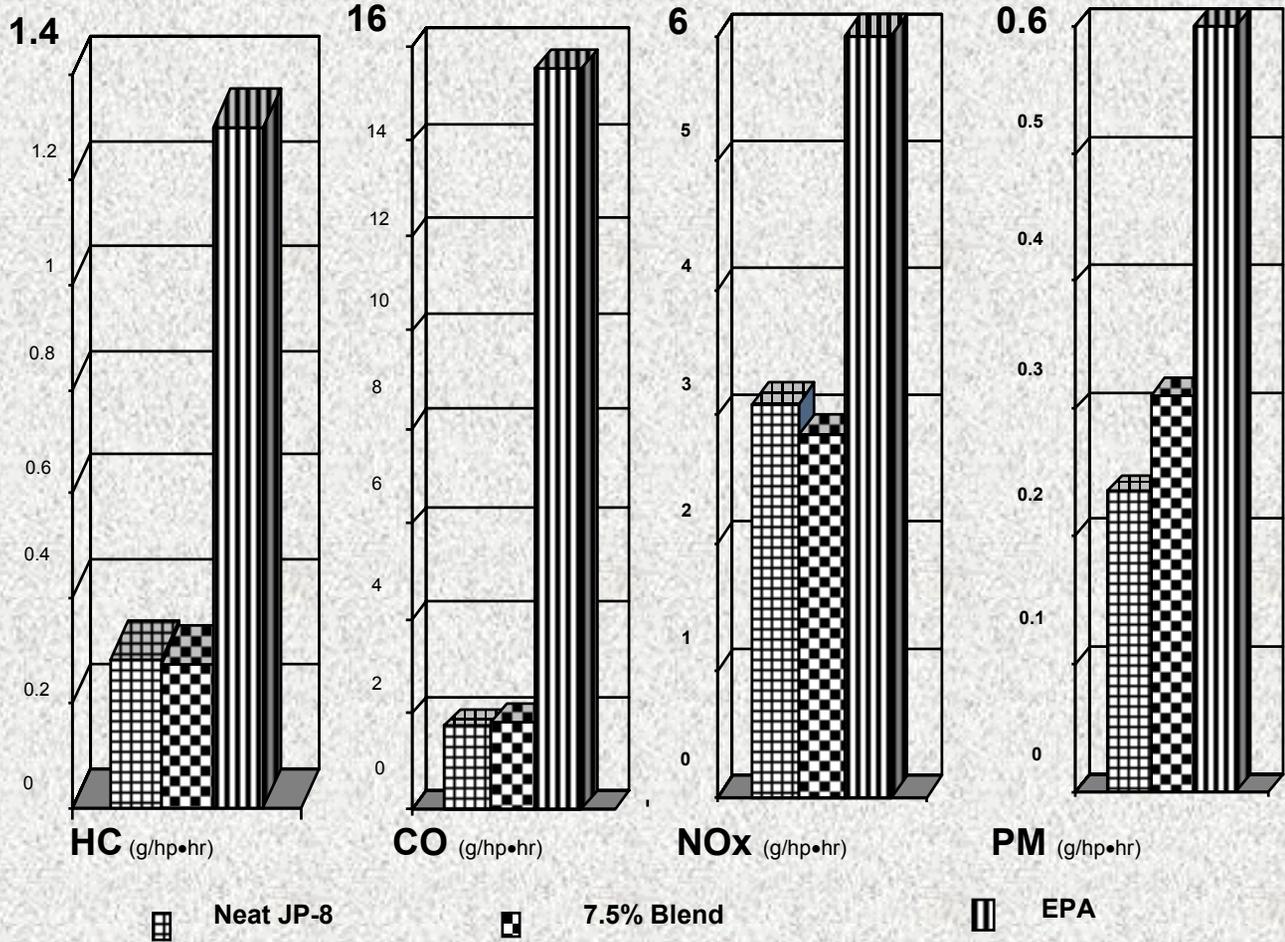
EPA EXHAUST EMISSIONS TESTS



- Two Typical Military Engines Were Tested
 - General Motors 6.2 Liter – HMMWV
 - Detroit Diesel 12.7 Liter Series 60 – Various Vehicles

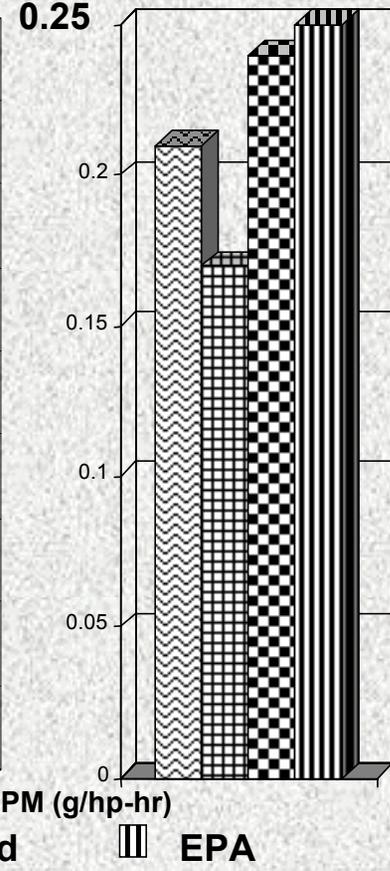
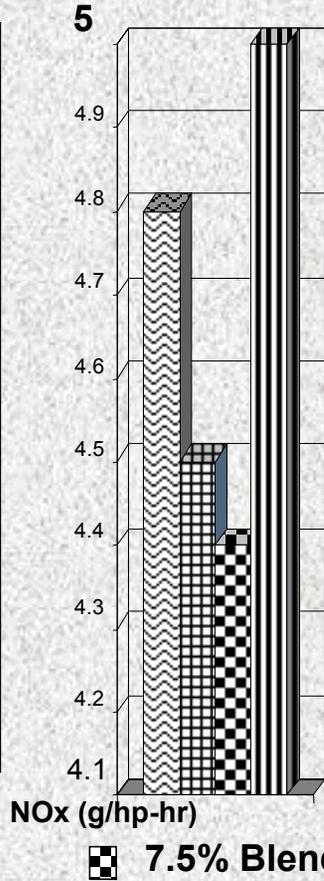
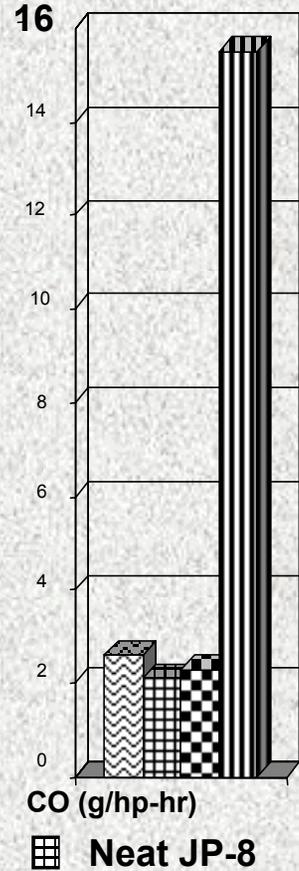
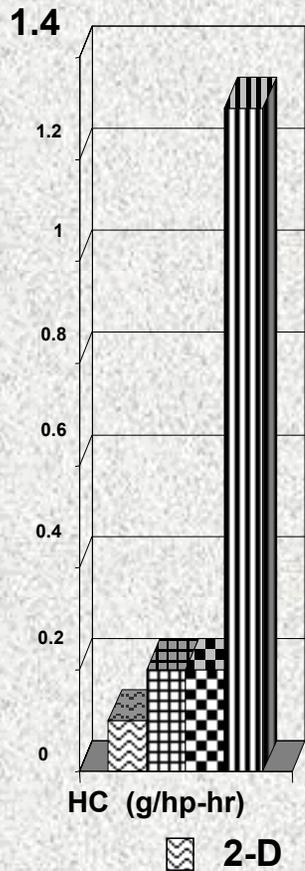
- Results
 - Regulated Emissions Were Below EPA Limits
 - Exhaust Smoke Levels Were Well Below EPA Limits

HMMWV EMISSIONS





DDC SERIES 60 EMISSIONS





ENGINE DURABILITY TESTS



- Two Typical Military Engines Were Tested
 - General Motors 6.2 Liter – HMMWV
 - DDC 6V-53T Two Cycle – Tracked Vehicles
- Continuous Diet of Blend of 7 1/2 % Used Oil with JP-8 Fuel



ENGINE DURABILITY TESTS (cont.)

- US Army/Coordinating Research Council 210 Hour Wheeled Vehicle Endurance Cycle
 - Correlates to 20,000 Miles of Proving Ground Experience

- US Army/Coordinating Research Council 240 Hour Tracked Vehicle Endurance Cycle
 - Correlates to 4,000 Miles of Proving Ground Experience



PUTTING USAGE IN PERSPECTIVE

- Blended Fuel Is Used Only at Time That Oil Is Changed
- CRC 210 Hour Wheeled Vehicle Test: HMMWV Engine Used 1,700 Gallons of Blended Fuel
 - $1,700 \text{ gal.} \div 25 \text{ gal. HMMWV tank capy.} = 68 \text{ fuel tanks of blend.}$ 68 tanks at one oil change/year is equivalent to 68 years' usage of blended fuel or 34 years at two changes a year.



PUTTING USAGE IN PERSPECTIVE (cont.)

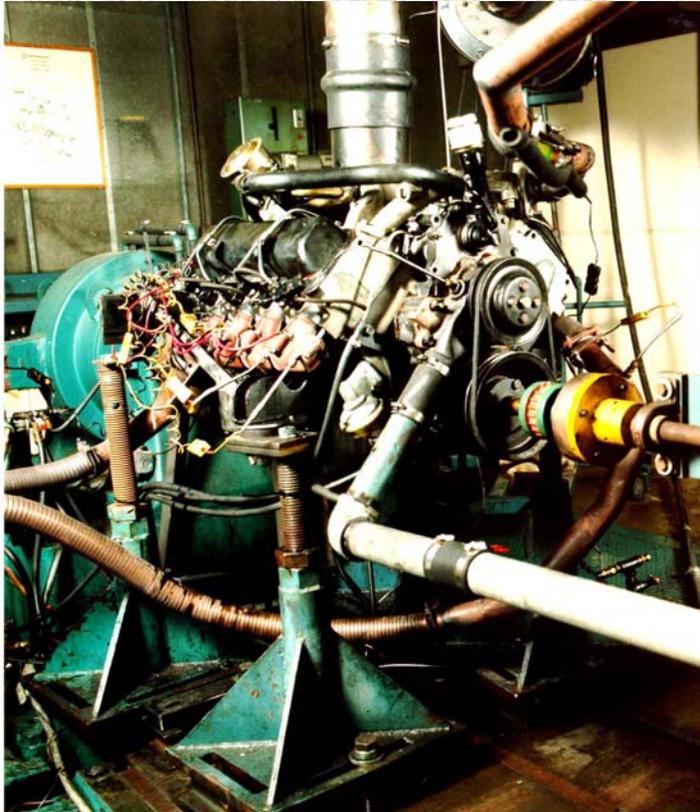
- CRC 240 Hour Tracked Vehicle Test: DDC 6V-53T Engine Used 3,000 Gallons of Blended Fuel
 - $3,000 \text{ gal.} \div 164 \text{ gal. typical track tank capy.} = \sim 19 \text{ fuel tanks of blend.}$ 19 tanks at one oil change/year is equivalent to 19 years usage of blended fuel or $9 \frac{1}{2}$ years at two changes a year



RESULTS

- No Loss of Power From Use of Blend
- No Impact on Fuel System or Fuel Injectors
- Piston Liner Scuffing Reduced
- No Impact on Oil in Crankcases
- Both Engines Had Unusual Ashy Deposits
 - HMMWV engine had deposits in port of pre-combustion chamber
 - DDC 6V-53T engine had deposits and pre-burning streaks on the exhaust valves
- Fuel Consumption Increased 7.2 % in the HMMWV Engine

ENGINES USED IN DURABILITY TESTS

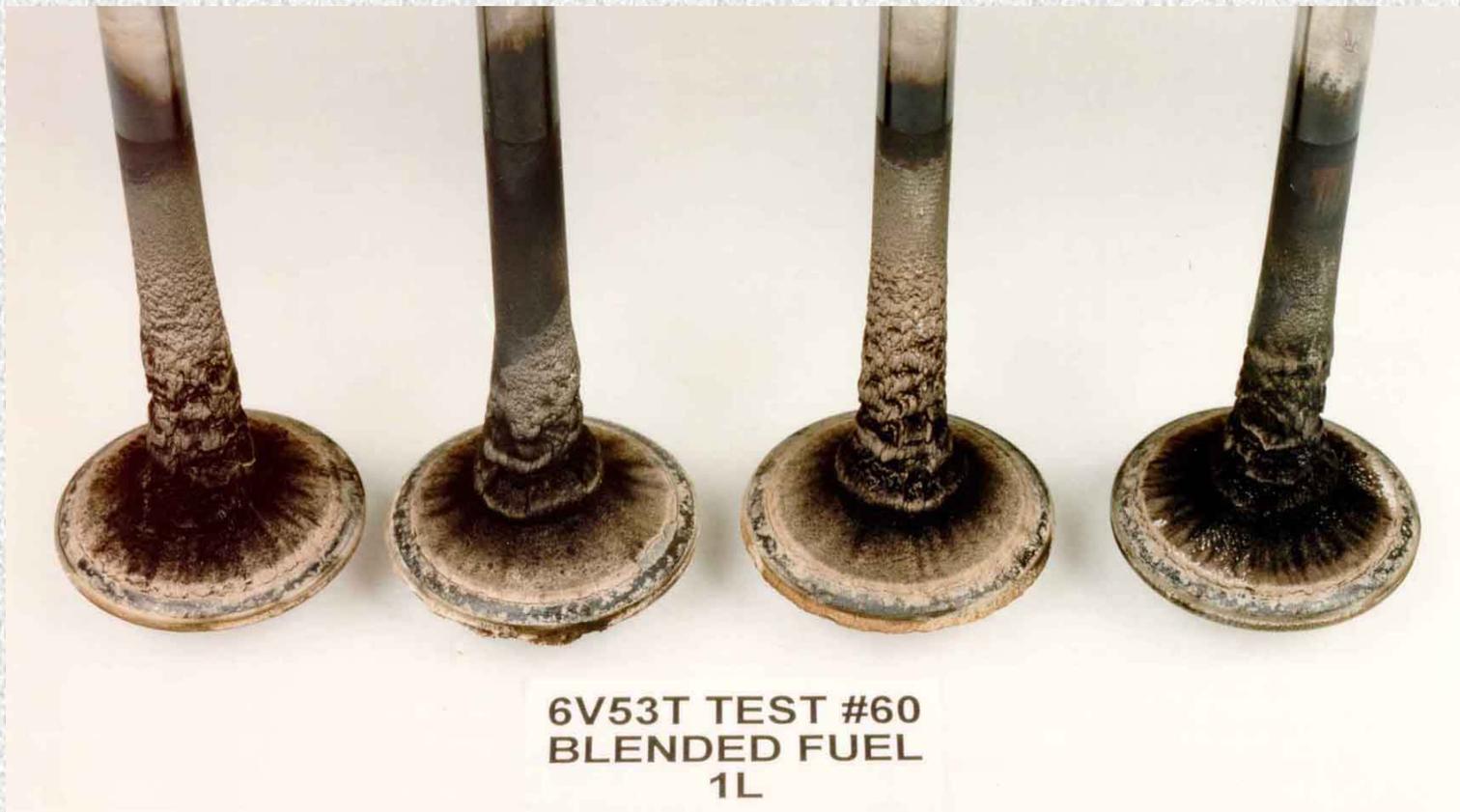


6.2 L HMMWV Engine



6V-53T Engine

ENGINE DEPOSITS FROM TESTS



HMMWV DEPOSITS





PHASE II CONCLUSIONS

NO SHOWSTOPPERS

CONTINUOUS USE OF BLENDED FUEL NOT
RECOMMENDED



EXECUTION

PHASE III – FIELD DEMONSTRATION

- Seven Months of Normal Mission Activities at Fort Irwin, CA
- Test Vehicles: Three HMMWVs and Three 5-ton Trucks Used Continuous Diet of Blended Fuel
- Control Vehicles: Three HMMWVs and Three 5-ton Trucks Used Normal JP-8 Fuel
- Mechanic and Driver survey
- No Problems attributed to Blended Fuel Use



EXECUTION

PHASE IV – IMPLEMENTATION

Blender units are being issued to motorpools at Fort Irwin, CA; Fort Lewis, WA; and Fort Polk, LA, for actual use by soldiers to evaluate the acceptance and feasibility of the program for Army wide implementation.



CONCLUSION

The Commander gets a WIN-WIN situation.

- For every gallon of oil reused (which has already been paid for), he saves the cost of a gallon of JP-8.
- The costs of collecting, handling, storing, and transporting used oil are mostly eliminated.
- Opportunities for environmentally damaging spills and resultant clean-up costs are greatly lessened.