
EPA CLEAN DIESEL ENGINE IMPLEMENTATION WORKSHOP

CHUCK SALTER

AUGUST 6-7, 2003

TOPICS

- **CUSTOMER & TECHNOLOGY NEEDS**
- **TECHNOLOGIES COMPARED**
- **SELECTIVE CATALYTIC REDUCTION UPDATE**
- **UREA DISTRIBUTION**
- **CONCLUSIONS & ACTIONS**



CUSTOMER PREREQUISITES

EPA 2007 TECH WORKSHOP

SCR STATUS

- **RELIABILITY**
- **FUEL ECONOMY**
- **COST**
- **PERFORMANCE, DRIVEABILITY**
- **SERVICE COSTS**
- **WEIGHT**
- **NOISE**



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TECHNOLOGY FEASIBILITY PARAMETERS

EPA 2007 TECH WORKSHOP

SCR STATUS

- **DURABILITY**
 - **USEFUL LIFE**
- **FUNCTIONALITY**
 - **EMISSIONS**
 - **PERFORMANCE**
 - **RELIABILITY**
 - **SYSTEM INTEGRATION**
- **COST**
 - **FIRST COST**
 - **FUEL ECONOMY**
 - **MAINTENANCE**
 - **INSTALLATION IMPACT**
 - **INFRASTRUCTURE**



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2007 EMISSIONS TECHNOLOGY

- **PARTICULATE CONTROL WILL BE ACCOMPLISHED VIA DIESEL PARTICULATE FILTER.**

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- **NO_x CONTROL WITH VARIOUS COMBINATIONS OF BASE ENGINE MODIFICATION AND AFTER-TREATMENT.**
 - **NO_x AFTER-TREATMENT REQUIRES USE OF A REDUCTANT (E.G. AMMONIA) TO STRIP OXYGEN FROM NITROGEN.**

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- **DIESEL OXIDATION CATALYST TO CLEAN UP UN-BURNT HYDROCARBONS.**



SCR-DPF INTEGRATED

- **PACKAGING FOR PERFORMANCE & ENVELOPE**
 - **SELECTIVE CATALYTIC REDUCTION(SCR) WITH UREA AS REDUCTANT**
 - **CDPF IS INTEGRAL TO THE SYSTEM**
 - **ULSD FUEL IS NECESSARY**
 - **UREA-SCR FEASIBILITY IS AT AN ADVANCED STATE**



SCR & DPF INSTALLATION

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SCR STATUS

UREA
TANK



DPF &
SCR
SYSTEM



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SELECTIVE CATALYTIC REDUCTION

- **FEATURES**
 - **BEST FUEL ECONOMY INCLUDING DIESEL AND UREA**
 - **BEST LIFE CYCLE COST**
 - **SIMPLIFIED BASE ENGINE**
- **ISSUES**
 - **PERIODIC UREA FILL-UP (FREQUENCY DEPENDENT ON TANK SIZING)**
 - **USE RATE IS ABOUT 4% OF FUEL**
 - **NEED TO DEVELOP INFRASTRUCTURE FOR UREA DISTRIBUTION**
- **VOLVO POWERTRAIN EXPERIENCE**
 - **10 TRUCKS IN US CUSTOMER FLEETS, 23 ADDITIONAL UNDERWAY**
 - **1,000,000 MILES TO DATE**
 - **DURABILITY TESTS SUGGEST NEAR-ZERO CATALYST DETERIORATION**



SCR EMISSION RESULTS

EPA 2007 TECH WORKSHOP

SCR STATUS

VOLVO/MACK 12L ENGINE

- **ENGINE CALIBRATED TO EPA2000 (~6 G/BHP.H)**
- **CERTIFICATION TEST RESULTS**
 - **FTP WEIGHTED COMPOSITE**
 - **1.06 G/BHP.H**
 - **82% REDUCTION**
 - **ESC**
 - **0.85 G/BHP.H**
 - **86% REDUCTION**
- **WVU CHASSIS DYNO RESULTS (G/MILE)**
 - **HIGHWAY CYCLE**
 - **84% REDUCTION**
 - **REFUSE CYCLE**
 - **87% REDUCTION**



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TECHNOLOGIES COMPARED

EPA 2007 TECH WORKSHOP

SCR STATUS

	Operating Cost*	Current Experience	2007 Readiness	Unrea Infrast ructure
2002 EGR	Baseline	Production	N/A	N/A
2007 DPF+SCR	Equal	1,000,000 Miles	Yes	Possible
2007 DPF+HEGR	Worse	Cell Tests	Likely	N/A
2007 DPF+LNA	Worse	Many Issues	Unlikely	N/A

* Operating cost includes consumables and service, but not ULSD cost differential.



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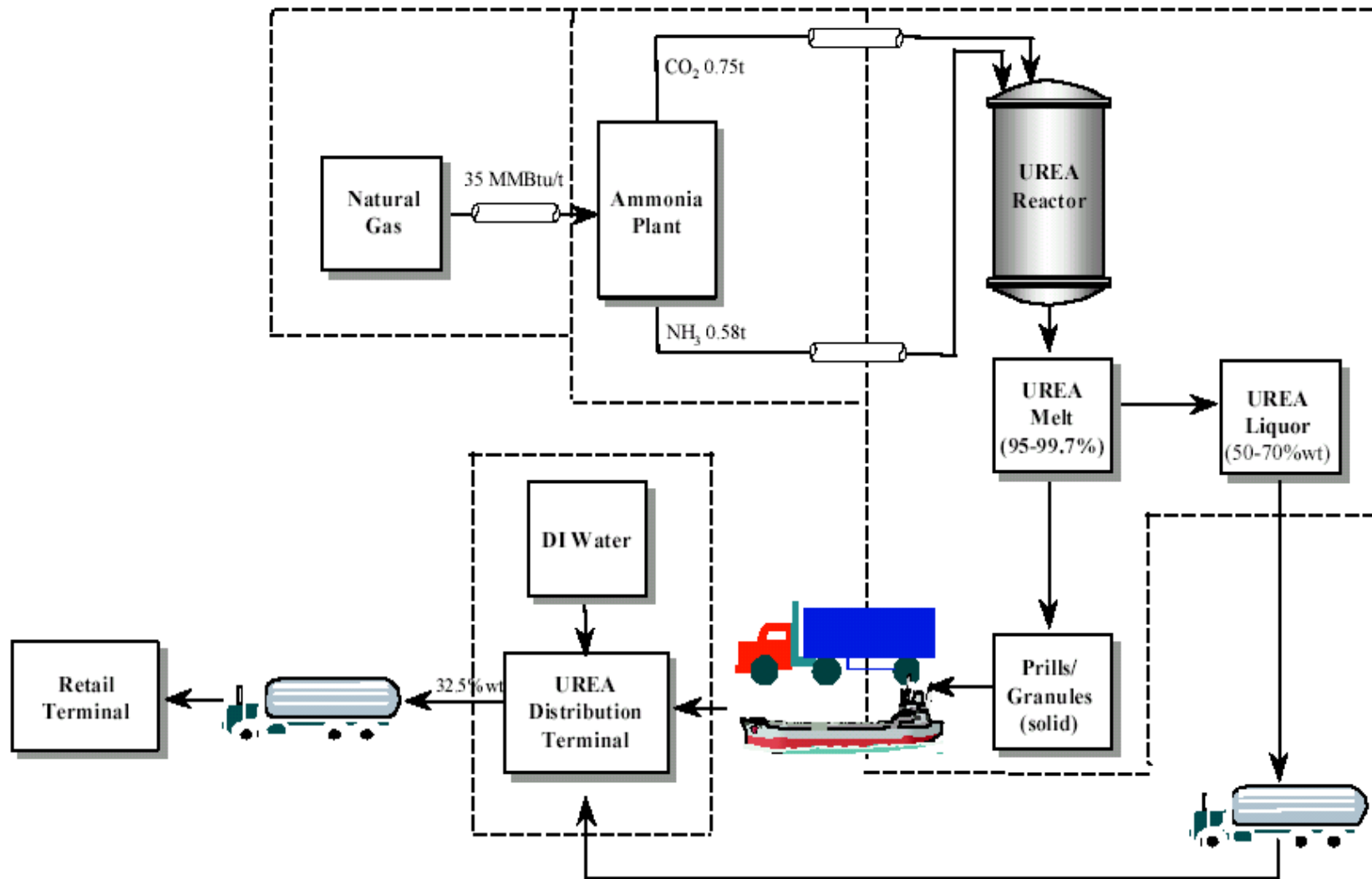
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UREA DISTRIBUTION PATHWAYS

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SCR STATUS



AFTER TIAx



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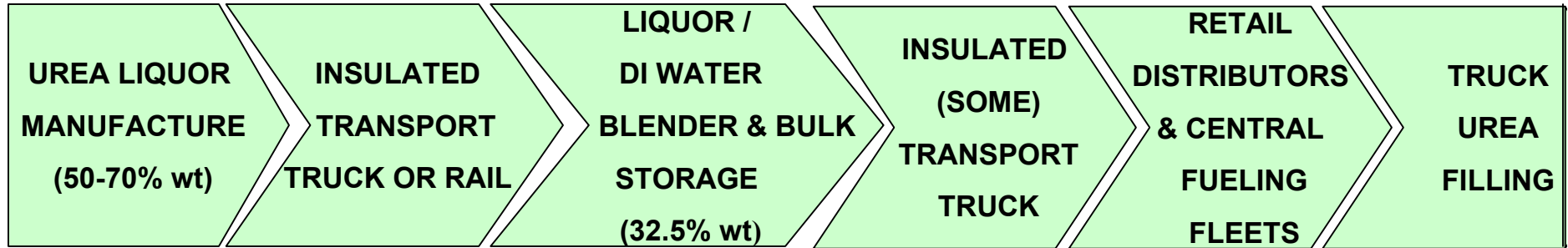
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UREA DISTRIBUTION STAKEHOLDER

EPA 2007 TECH WORKSHOP

SCR STATUS

PROGRESS REPORT



AGRICULTURE FERTILIZER INDUSTRY	AGRICULTURE FERTILIZER INDUSTRY MEMBERS	NAT ASSO CHEM DIST MEMBERS	NAT ASSO CHEM DIST MEMBERS	NATSO MEMBERS	45,000 TRUCK COMPANIES
THE FERTILIZER INSTITUTE		THE FERTILIZER INSTITUTE MEMBERS	THE FERTILIZER INSTITUTE MEMBERS	FUEL COMPANY DISTRIBUTORS	
		NAT ASSO TRK STOP MEMBERS	NAT ASSO TRK STOP MEMBERS		
SOME CAPITAL FOR LIQUOR PROCESSING	EXISTING INSULATED TRUCK AND RAIL TANKERS	CAPITAL FOR BLENDING & STORAGE	CAPITAL FOR TANK TRAILERS	CAPITAL FOR TANKS; DISPENSING	



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CONCLUSIONS & ACTIONS

- **SCR MEETS THE NEEDS OF CUSTOMERS**
 - **CONSUMABLE COSTS, INCL UREA, ARE LEAST OF ALL TECHNOLOGIES.**
 - **SCR TECHNOLOGY APPROPRIATE FOR 2010(0.2G NO_x).**
- **UREA DISTRIBUTION INFRASTRUCTURE CAN BE ACHIEVED IN NEEDED TIMEFRAME.**
 - **STAKEHOLDERS ACKNOWLEDGE INTEREST TO PARTICIPATE.**
 - **CENTRAL BLENDING/DISTRIBUTION GROUP(S) NEED FURTHER CONFIRMED.**
- **2007 TECHNOLOGY SELECTION SCHEDULED FOR 4Q-2003.**
 - **ENGINE MANUFACTURERS MUST INITIATE FIRM ACTION.**
 - **BALANCE OF STAKEHOLDERS CAN THEN MOVE AHEAD IN CONCERT.**
- ***SEE DDC PRESENTATION FOR STATUS OF "IN-USE COMPLIANCE" ISSUE.***

