

**ALTERNATIVES TO AUTOMOTIVE  
CONSUMER PRODUCTS THAT USE  
VOLATILE ORGANIC COMPOUNDS (VOC)  
AND/OR CHLORINATED ORGANIC  
COMPOUND SOLVENTS**

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**Institute for Research and  
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# **BACKGROUND**

- **CARB ESTIMATES 4.5 MILLION AEROSOL SPRAY CANS AND BOTTLES OF AUTOMOTIVE CLEANING AGENTS SOLD IN CALIFORNIA EACH YEAR**
- **IN 2000, EMISSIONS AMOUNTED TO 17 TPD**
  - **EMISSIONS FROM CHLORINATED SOLVENTS WERE 5.2 TPD**
- **APRIL 2000 ATCM PROHIBITED USE OF CHLORINATED SOLVENTS**
- **VOC PRODUCTS CONTAIN TACs**
- **CARB FURTHER REGULATED VOCs**



# EMISSIONS AND VOC LIMITS FOR AUTOMOTIVE CONSUMER PRODUCTS

CATEGORY	VOC EMISSIONS 2000 (TPD)	VOC Limits (Wt%)	
		12/31/2002	12/31/2004
BRAKE CLEANERS	5.8	45	-
CARBURETOR AND FUEL- INJECTION AIR INTAKE CLEANERS	6.9	45	-
ENGINE DEGREASERS	2.3	50	35
GENERAL PURPOSE DEGREASERS	2.1	50	-



# **BACKGROUND CONT'D**

- **FOUR TYPES OF PRODUCTS USED BY AUTO REPAIR FACILITIES, DETAILERS, CAR WASHES AND CONSUMERS**
- **EARLIER WORK**
  - **WATER-BASED PARTS CLEANERS**
  - **WATER-BASED BRAKE CLEANERS**
- **CARB WANTED FURTHER VOC REDUCTIONS**
  - **CONTRACTED WITH IRTA TO IDENTIFY, TEST, DEVELOP, DEMONSTRATE WATER-BASED AND OTHER LOW-VOC ALTERNATIVES**
- **IRTA CONDUCTED RELATED WORK WITH DHS**



# **TECHNICAL REVIEW COMMITTEE (TRC)**

- **ASSEMBLED TRC**
- **MEMBERS INCLUDED**
  - **AEROSOL INDUSTRY**
  - **WATER CLEANING FORMULATORS**
  - **AUTOMOTIVE TRADE ORGANIZATIONS**
  - **AUTO REPAIR SHOPS**
  - **GOVERNMENT AGENCIES**
- **TRC ASSISTED**
  - **TECHNICAL INPUT**
  - **TEST AEROSOLS**
  - **REGULATORY/TOXICITY GUIDANCE**



# RESEARCH APPROACH

- **IDENTIFIED/ASSESSED EXISTING WATER-BASED CLEANERS**
  - AEROSOL
  - NON-AEROSOL
- **ESTABLISHED VOC LIMIT OF 275 GRAMS PER LITER OR 27.5% VOC AND THAT CLEANER CONTAIN AT LEAST 70% WATER.**
- **IDENTIFIED 11 AEROSOL AND 18 NON-AEROSOL CLEANERS THAT MET CRITERIA**



# APPROACH CONT'D

- **DEVELOPED PROTOCOL FOR SCREENING TESTS**
- **COLLECTED “RECYCLED” AUTO PARTS FROM FOUR AUTO REPAIR FACILITIES**
- **TESTED AEROSOL AND NON-AEROSOL (PESTICIDE SPRAY BOTTLES) ON PARTS IN LABORATORY SETTING**
  - **USED 10 SECOND SPRAY**
  - **COMPARED WITH BASELINE CLEANERS ON BRAKE, CARBURETOR/FUEL INJECTION SYSTEM PARTS**
- **TESTED AEROSOL AND NON-AEROSOL CLEANERS AT THREE AUTO REPAIR FACILITIES**



# APPROACH CONT'D

- **PACKAGED NON-AEROSOL WATER-BASED CLEANERS WITH HC PROPELLANTS**
- **TESTED IN LABORATORY SETTING AND AUTO REPAIR FACILITIES**
- **ALSO TESTED TWO SOLVENTS**
  - ACETONE
  - SOY
- **ELEVEN CLEANERS PERFORMED WELL IN SCREENING TESTS**
  - TWO COMMERCIAL AEROSOL WATER-BASED CLEANERS
  - EIGHT NON-AEROSOL WATER-BASED CLEANERS
  - ACETONE



# **TWO SIGNIFICANT ISSUES**

- **AROSE DURING SCREENING TESTS**
- **WATER-BASED CLEANERS FOAM WHEN PACKAGED IN AEROSOLS**
  - **ACCEPTABLE IN ENGINE DEGREASING BUT NOT BRAKE CLEANING OR GENERAL PURPOSE CLEANING**
  - **DIFFICULT TECHNICAL ISSUE**
  - **LIMITED NUMBER OF CLEANERS FOR FIELD TESTING**
- **CARBURETOR/FUEL INJECTION SYSTEM CLEANERS SHOULD NOT BE WATER-BASED**



# **FIELD TESTING PARTICIPANTS**

- **13 AUTO REPAIR FACILITIES PARTICIPATED**
  - DEALERSHIPS
  - SERVICE STATIONS
  - BRAKE SHOPS
  - GENERAL AUTOMOTIVE REPAIR FACILITIES
- **OTHER PARTICIPANTS**
  - ONE CAR WASH
  - TWO DETAILERS
  - THREE CONSUMERS



# **FIELD TESTING BACKGROUND**

- **AUTO REPAIR FACILITIES DO NOT PERFORM ENGINE DEGREASING**
  - **DETAILERS, CAR WASHES DO NOT USE AEROSOL CLEANERS, USE BULK PRODUCTS**
  - **CONSUMERS USE AEROSOL PRODUCTS**
  - **CAN FOAM**
- **AUTO REPAIR FACILITIES USE TWO OR THREE TYPES OF PRODUCTS**
  - **ONE BRAKE CLEANER/GENERAL PURPOSE DEGREASER**
  - **ONE CARBURETOR CLEANER**
  - **ONE INTERNAL CARBURETOR CLEANER**
  - **CANNOT FOAM**





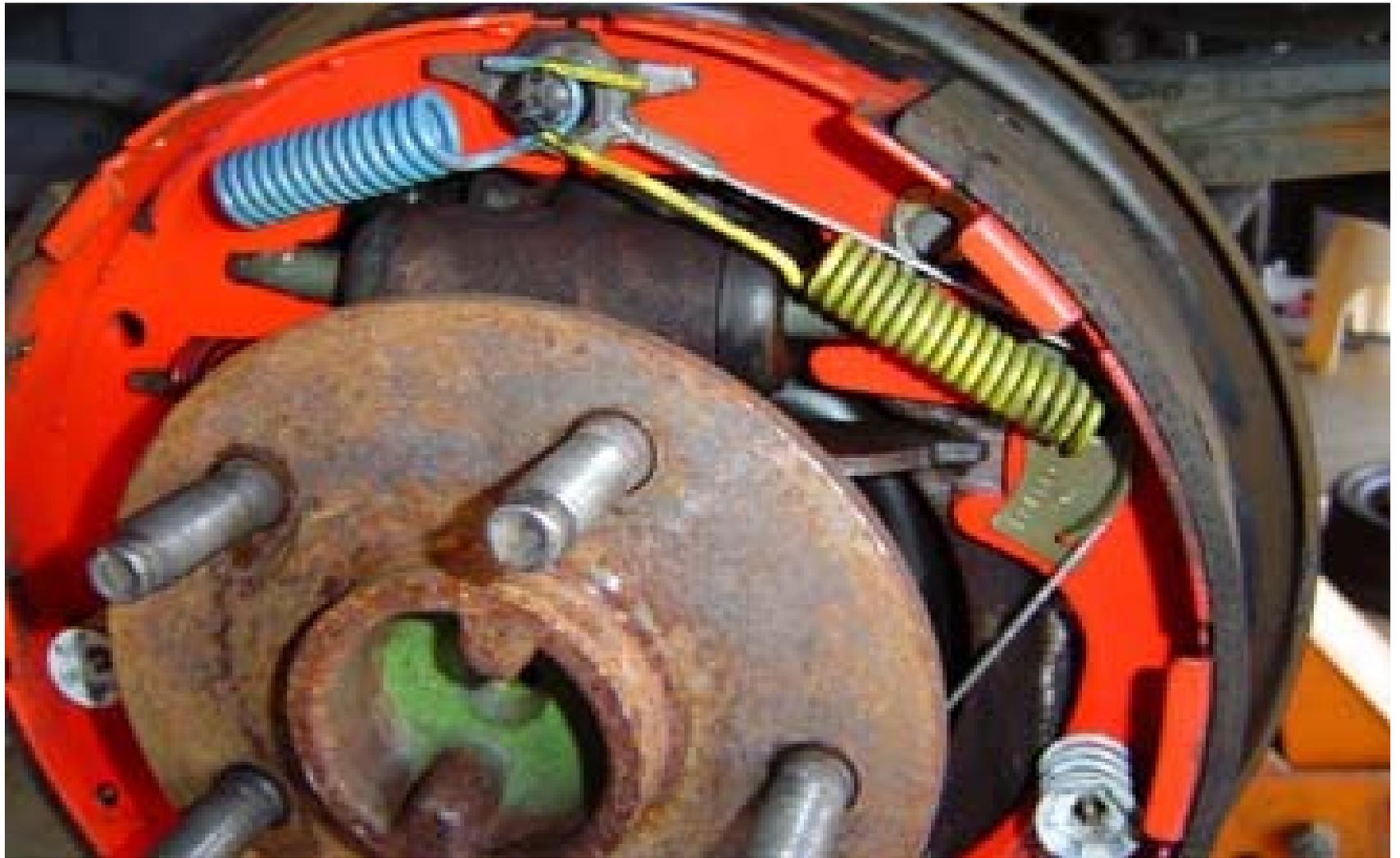












# FIELD TESTED CLEANERS

- **ENGINE DEGREASERS**
  - **EIGHT PRODUCTS**
    - **THREE COMMERCIAL PRODUCTS WITH SOLVENT ADDITIVES**
    - **FIVE NEW PRODUCTS WITH NO SOLVENT ADDITIVES**
    - **ALL PRODUCTS USED HC PROPELLANTS**
  - **ALL WERE FOAMING PRODUCTS**
  - **TESTED WITH CAR WASHES, DETAILERS AND CONSUMERS**



# **FIELD TESTED CLEANERS CONT'D**

- **CARBURETOR AND FUEL INJECTION SYSTEM CLEANERS**
  - **THREE PRODUCTS**
    - **SOY/ACETONE BLENDS**
    - **ALL PRODUCTS HAD CARBON DIOXIDE PROPELLANTS**
  - **TESTED WITH AUTO REPAIR FACILITIES PRIMARILY FOR THROTTLE BODY VALVE CLEANING**
- **BRAKE CLEANERS, GENERAL PURPOSE DEGREASERS**
  - **SIX NON OR LOW-FOAMING PRODUCTS FROM THREE MANUFACTURERS**
  - **TESTED WITH AUTO REPAIR FACILITIES**



# **RESULTS OF ENGINE DEGREASING TESTS**

- **FACILITIES AND CONSUMERS THOUGHT MOST ALTERNATIVE CLEANERS PERFORMED ACCEPTABLY**
- **SEVERAL ALTERNATIVE CLEANERS WERE RANKED BY FACILITIES AS ALMOST AS GOOD OR BETTER THAN CURRENT CLEANER BY AT LEAST ONE OF THE TESTING FACILITIES**
- **FACILITIES LIKED LOW-FOAMING CLEANERS AND CONSUMERS LIKED FOAMING CLEANERS**



## Alternative Engine Degreasers – Adequacy of Cleaning

<b>Facility</b>	<b>Foamy Engine Brite</b>	<b>Simple Green</b>	<b>Mirachem All Surface</b>	<b>AX-IT L-7768</b>	<b>L-7820 ScrubTub</b>	<b>Kyzen Aerosol Cleaner</b>	<b>Kyzen Aerosol Degreaser 11</b>	<b>Kyzen Engine Degreaser 2</b>
<b>Triple Shine Detail</b>	1	1	1	1	1	0		0
<b>VREJ Detail</b>	1	1	1	1		0	1	1
<b>New Image</b>	1	1	1	1	1	1	0	1
<b>California Car Wash</b>	1	0	1	1	1	1		1
<b>Consumer 1</b>	1	1	1	1		1	1	1
<b>Consumer 2</b>	1	1	0	1	1	1	1	1
<b>Consumer 3</b>	1	0	0	1		0	1	1

Key: 0 = Did not clean; 1 = Cleaned



## Alternative Engine Degreasers – Ranking

<b>Facility</b>	<b>Foamy Engine Brite</b>	<b>Simple Green</b>	<b>Mirachem All Surface</b>	<b>AX-IT L-7768</b>	<b>L-7820 ScrubTub</b>	<b>Kyzen Aerosol Cleaner</b>	<b>Kyzen Aerosol Degreaser 11</b>	<b>Kyzen Engine Degreaser 2</b>
<b>Triple Shine Detail</b>	1	2	1	1	2	0		0
<b>VREJ Detail</b>	2	2.5	2	1		0	2.5	2.5
<b>New Image</b>	1	1	1	1	2	2.5	0.5	2.5
<b>California Car Wash</b>	1	0.5	1	1	2	2		1
<b>Consumer 1</b>								
<b>Consumer 2</b>								
<b>Consumer 3</b>								

Performance Key:      0 = Poor; 0.5 = Marginal; 1 = Almost as good as current cleaner; 1.5 = Nearly as good as current cleaner; 2 = As good as current cleaner; 2.5 = Somewhat better than current cleaner



# **RESULTS OF CARBURETOR AND FUEL INJECTION SYSTEM CLEANING TESTS**

- **CARBURETOR CLEANERS**
  - **FASTER EVAPORATING**
  - **USED FOR CLEANING THROTTLE BODY VALVES**
- **TESTED THREE FORMULATIONS**
  - **50, 35 AND 25 PERCENT SOY BLENDED WITH ACETONE**
- **MOST TECHNICIANS INDICATED THAT ALTERNATIVE CLEANERS CLEANED AS WELL OR BETTER THAN CURRENT CLEANERS**
- **PREFERRED 35 OR 25 PERCENT SOY CLEANERS OVER 50 PERCENT**



## Alternative Carburetor and Fuel Injection System Cleaners– Adequacy of Cleaning

<b>Facility</b>	<b>50% Soy/ Acetone</b>	<b>35% Soy/ Acetone</b>	<b>25% Soy/ Acetone</b>	<b>CyberSolv Degreaser 11</b>
<b>ARCO</b>	1	1	1	
<b>Shell (Santa Monica)</b>		1	1	
<b>Samo Tire</b>				
<b>Morgan's Auto Service</b>	1	1	1	
<b>S.M. Auto Center – Aljerome</b>			1	
<b>S.M. Auto Center – Rene</b>	1	1	1	
<b>S.M. Auto Center – Catarino</b>		1	1	
<b>S.M. Auto Center – Esmet</b>	1			
<b>Big Blue Bus</b>	1		1	
<b>Brake Master</b>		1		
<b>German Auto Technik</b>	1	1		
<b>Mercedes Benz</b>	1	1	1	1
<b>Connell Chevrolet - Tony</b>	0	1		
<b>Connell Chevrolet – Joe</b>		1		
<b>Ira Newman Automotive - Scott</b>	1		1	
<b>Ira Newman Automotive - Norm</b>	1	1	1	
<b>Shell (Rose) – Luis</b>			1	
<b>Shell (Rose) – Avelino</b>			1	
<b>Shell (Rose) – Jesus</b>	1			
<b>Guaranty Chevrolet - Mechanic 1</b>		1		
<b>Guaranty Chevrolet - Mechanic 2</b>		1		

Key: 0 = Did not clean; 1 = Cleaned



## Alternative Carburetor and Fuel Injection System Cleaners – Ranking

Facility	50% Soy/ Acetone	35% Soy/ Acetone	25% Soy/ Acetone	CyberSolv Degreaser 11
<b>ARCO</b>	1	2	2.5	
<b>Shell (Santa Monica)</b>		3	2.5	
<b>Samo Tire</b>				
<b>Morgan's Auto Service</b>	1	2	1	
<b>S.M. Auto Center – Aljerome</b>			2	
<b>S.M. Auto Center – Rene</b>	2	2.5	2	
<b>S.M. Auto Center – Catarino</b>		2.5	2	
<b>S.M. Auto Center – Esmet</b>	2			
<b>Big Blue Bus</b>	2		1	
<b>Brake Master</b>		2		
<b>German Auto Technik</b>	2	2		
<b>Mercedes Benz</b>	2.5	3	2.5	2
<b>Connell Chevrolet - Tony</b>	0.5	2		
<b>Connell Chevrolet - Joe</b>		2		
<b>Ira Newman Automotive - Scott</b>	1		2	
<b>Ira Newman Automotive - Norm</b>	2.5	3	1.5	
<b>Shell (Rose) - Luis</b>			2	
<b>Shell (Rose) - Avelino</b>			2	
<b>Shell (Rose) - Jesus</b>	2.5			
<b>Guaranty Chevrolet - Mechanic 1</b>		2.5		
<b>Guaranty Chevrolet - Mechanic 2</b>		3		

Performance Key:

0 = Poor

0.5 = Marginal

1 = Almost as good as current cleaner;

1.5 = Nearly as good as current cleaner

2 = As good as current cleaner;

2.5 = Somewhat better than current cleaner

3 = Better than Current Cleaner



# **RESULTS OF BRAKE CLEANING AND GENERAL PURPOSE DEGREASING TESTS**

- **USE ONE CLEANER FOR BOTH CLEANING ACTIVITIES**
- **TECHNICIANS ESTIMATE THAT 90 PERCENT OF THE TIME, ONLY DUST OR FINGERPRINTS ARE REMOVED WITH BRAKES**
  - **10 PERCENT OF THE TIME, OIL OR GREASE NEEDS TO BE REMOVED**
- **MANY COMPANIES IN SOUTHERN CALIFORNIA USE WATER-BASED BRAKE CLEANING SYSTEMS FOR ALL OR PART OF THEIR BRAKE CLEANING**



# **RESULTS CONT'D**

- **TESTED SIX WATER-BASED CLEANERS AND FIVE NON-WATER-BASED CLEANERS WITH ALL OR SOME OF THE FACILITIES**
- **TWO WATER BASED AND TWO SOY/ACETONE CLEANERS WERE JUDGED TO BE ADEQUATE FOR GENERAL PURPOSE DEGREASING**
- **MAJORITY OF SHOPS FOUND FOUR WATER-BASED CLEANERS, TWO SOY/ACETONE CLEANERS AND ONE ACETONE CLEANER TO BE ADEQUATE FOR BRAKE CLEANING**



# ALTERNATIVE PROPELLANT TESTS

- **EXAMINED**
  - HC
  - DME - TWO CONCENTRATIONS
  - HFC - 152a
  - CARBON DIOXIDE
  - NITROGEN
- **PACKAGED ONE OF WATER-BASED CLEANERS WITH ALL PROPELLANTS**
  - CARBON DIOXIDE DELIVERY THE BEST IN LAB TESTS
  - LAB TESTS INDICATED HC, DME AT HIGHER CONCENTRATION AND HFC -125a PERFORMED WELL, DME AT LOWER CONCENTRATION AND NITROGEN DID NOT PERFORM WELL
  - FIELD TESTING SHOWED SAME RESULTS



# VOC CONTENT OF ALTERNATIVE CLEANERS

- **ENGINE DEGREASING**
  - EIGHT PRODUCTS TESTED PERFORMED ADEQUATELY
  - SIX PRODUCTS HAVE VOC CONTENT OF ABOUT TEN PERCENT
- **CARBURETOR AND FUEL INJECTION SYSTEM CLEANING**
  - THREE PRODUCTS TESTED PERFORMED ADEQUATELY
  - THREE PRODUCTS HAVE VOC CONTENT OF NEAR ZERO
- **BRAKE CLEANING/GENERAL PURPOSE DEGREASING**
  - FIVE PRODUCTS TESTED PERFORMED ADEQUATELY
  - THREE PRODUCTS HAVE VOC CONTENT OF ABOUT 10 PERCENT AND TWO HAVE A VOC CONTENT OF NEAR ZERO



# **PRELIMINARY COST ANALYSIS**

- **ASSUMPTIONS**

- USE ONE BASELINE CLEANER IN EACH APPLICATION FOR COMPARISON
- CAN, VALVE AND OTHER PACKAGING ASSUMED TO BE THE SAME FOR ALL CLEANERS
- IGNORED PRODUCT MARKUP ETC.
- USE RAW MATERIAL COST
- INCLUDED PROPELLANT COST
- USE COST RANGE
- ASSUMED EQUAL USAGE

- **RESULTS**

- ONE ENGINE DEGREASER ALTERNATIVE LOWER COST, OTHERS HIGHER COST
- BEST PERFORMING TWO ALTERNATIVE CARB CLEANERS HIGHER COST
- BEST PERFORMING BRAKE CLEANING/GENERAL PURPOSE DEGREASING ALTERNATIVES HIGHER COST



## Raw Material Costs of Baseline and Alternative Engine Degreasers

Cleaner	Raw Material Cost Including Propellant (cents per pound)
Engine Brite Heavy Duty Engine Degreaser--Baseline	20 to 40
Foamy Engine Brite	15 to 30
Foaming Simple Green	35 to 45
Mirachem All Surface Safe Cleaner	40 to 50
Scrub Tub	40 to 50
Kyzen Engine Degreaser 2	35 to 45
Kyzen Cyber Solv Experimental Degreaser 11	35 to 45
Kyzen Aerosol Cleaner	35 to 45
AX-IT L-7768	35 to 45



## **Raw Material Costs of Baseline and Alternative Carburetor and Fuel Injection System Cleaners**

Cleaner	Raw Material Cost Including Propellant (cents per pound)
MOC Throttle-Body & Air-Intake Cleaner--Baseline	30 to 40
50% Soy/50% Acetone	45 to 55
35% Soy/65% Acetone	40 to 50
25% Soy/ 75% Acetone	40 to 50



## **Raw Material Costs of Baseline and Alternative Brake Cleaners/General Purpose Degreasers**

Cleaner	Raw Material Cost Including Propellant (cents per pound)
CRC Brakleen Brake Parts Cleaner	30 to 40
Baseline	
AX-IT L-7769	35 to 45
Kyzen Cyber Solv	35 to 45
Kyzen Cyber Solv Experimental	35 to 45
Degreaser 11	
35% Soy/65% Acetone	40 to 50
25% Soy/75% Acetone	40 to 50



# TOXICITY COMPARISON

- **DHS's HESIS EVALUATED BASELINE AND ALTERNATIVE CLEANERS**
  - **USED MSDSs**
- **HESES CONCLUDED THAT ALTERNATIVE CLEANERS ARE OF LOW TOXICITY AND POSE SIGNIFICANTLY LESS RISKS OF HEALTH HAZARDS THAN HIGH VOC BASELINE CLEANERS**
  - **ACETONE LOWER IN TOXICITY THAN MOST OTHER ORGANIC SOLVENTS**



# CONCLUSIONS

- **EIGHT WATER-BASED CLEANERS FOUND ACCEPTABLE FOR ENGINE DEGREASING**
- **THREE SOY/ACETONE CLEANERS FOUND ACCEPTABLE FOR CARBURETOR AND FUEL INJECTION SYSTEM CLEANING**
- **THREE WATER-BASED AND TWO SOY/ACETONE CLEANERS PERFORMED ADEQUATELY FOR BRAKE CLEANING AND/OR GENERAL PURPOSE DEGREASING**
- **VOC CONTENT COULD BE SET AT 10 PERCENT TO REFLECT USE OF HC PROPELLANTS**

