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Exhaust Emissions from Two Medium Duty Trucks Equipped with the Dana-UOP Truck Retrofit System

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Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency

Background

In a cooperative program with Dana Corporation and Universal Oil Products, the Emission Control Technology Division has been conducting emission tests on medium duty trucks retrofitted by the two corporations. The Emission Control Technology Division agreed to test two vehicles retrofitted with a UOP catalyst and a Dana exhaust gas recirculation (EGR) system called the Dana Retronox. Testing began the week of March 15, 1974, and ended on April 1, 1974.

System Description

The system was basically the same as used before by Dana and UOP and is described in detail in report 74-10, "Evaluation of Dana Retronox EGR and UOP Oxidizing Catalyst Retrofits on Two Medium Duty Vehicles," dated September 1973. The Dana Retronox is an EGR system employing engine speed and ported carburetor vacuum controlled EGR, and an engine speed-controlled vacuum advance cut-off. The UOP catalyst is a pellet-type, noble metal oxidizing catalyst. The only difference between this and their preceding system was that the catalyst was made to be more tolerant to lead, but had less mechanical strength.

Test Program

The vehicles used in the test program were a 1973 Chevrolet C-50 truck with a 350 CID engine and automatic transmission, tested at 7500# inertia weight, and a 1973 Ford F-250 truck with a 360 CID engine and automatic transmission, tested at 5500# inertia weight. Each truck was tested in three configurations:

1. Stock configuration (baseline)
2. With the Dana Retronox installed
3. With the Dana Retronox plus the UOP Catalyst installed

Each truck was tested three times in each of the above three configurations according to the 1975 Federal Test Procedure (FTP). The fuel used was Indolene Unleaded gasoline, a standard test fuel.

Test Results

The emission test results are presented in the Appendix of this report along with calculated fuel consumption/economy. A summary of the results is given below.

	% Reduction from Baseline with Both Emission Control Systems Installed				
	HC	CO	CO_2	NOx	Fuel Consumption
Chevrolet C-50	74%	72%	-18%*	4%	-6%
Ford F-250	87%	86%	-22%*	9%	-4%

* A negative sign indicates an increase in emissions or fuel consumption.

Conclusions

Retrofitting the two trucks with the Dana-UOP systems showed very substantial reductions in hydrocarbon and carbon monoxide emissions and small, but significant, reductions in oxides of nitrogen emissions. A small fuel consumption penalty was also associated with the systems.

APPENDIX

TABLE I

Medium Duty Retrofit Test Results
1975 Federal Test Procedure

Mass emissions, grams per kilometer
Fuel consumption, liters per one hundred kilometers

A. Chevrolet C-50 Truck

Baseline	HC	CO	CO_2	NOx	Fuel Consumption (l/100km)
1	4.15	90.1	802	4.35	41.3
2	3.91	89.1	779	4.03	40.6
3	3.65	82.2	717	4.45	37.3
Average	3.90	87.2	766	4.28	39.9
w/Dana Retronox					
1	3.08	40.9	818	2.67	38.6
2	3.12	49.8	852	3.22	40.6
3	2.96	50.4	851	4.09	40.6
Average	3.05	47.1	841	3.32	39.9
% Reduction from baseline	22%	46%	-9%*	22%	0
UOP catalyst & Dana Retronox					
1	1.01	22.6	932	3.91	42.0
2	1.03	24.9	921	4.25	42.0
3	.93	26.8	944	4.13	42.8
Average	.99	24.7	932	4.10	42.3
% Reduction from baseline	75%	72%	-22%*	4%	-6%

*A negative sign indicates an increase in emissions/fuel consumption

TABLE I (cont'd)

B. Ford F-250 Truck

Baseline	HC	CO	CO_2	NOx	Fuel Consumption (l/100km)
1	2.79	56.3	461	3.34	24.2
2	2.96	62.8	518	3.56	27.3
3	2.57	63.2	516	3.73	27.0
Average	2.77	60.7	498	3.54	26.1
w/Dana Retronox					
1	2.00	33.0	529	2.11	25.8
2	1.38	32.2	549	2.96	26.4
3	1.91	26.4	531	2.91	25.3
Average	1.76	30.6	536	2.65	25.8
% Reduction from Baseline	36%	50%	-8%*	25%	1%
UOP catalyst & Dana Retronox					
1	.30	5.7	608	3.60	27.0
2	.36	7.7	600	3.07	27.0
3	.38	11.7	602	2.96	27.7
Average	.35	8.4	603	3.21	27.2
% Reduction from baseline	87%	86%	-21%*	9%	-4%*

*A negative sign indicates an increase in emissions/fuel consumption

TABLE II

Medium Duty Retrofit Test Results
1975 Federal Test Procedure

Mass emissions, miles per gallon
Fuel economy, miles per gallon

A. Chevrolet C-50 Truck

Baseline	HC	CO	CO_2	NOx	Fuel Economy (mi/gal)
1	6.69	145.4	1294	7.02	5.7
2	6.30	143.8	1257	6.50	5.8
3	5.89	132.6	1156	7.18	6.3
Average	6.29	140.6	1235	6.90	5.9
Dana Retronox					
1	4.96	66.0	1320	4.30	6.1
2	5.04	80.4	1375	5.19	5.8
3	4.77	81.3	1373	6.60	5.8
Average	4.92	75.9	1356	5.36	5.9
% Reduction from baseline	22%	46%	-9%*	22%	0
UOP catalyst & Dana Retronox					
1	1.63	36.4	1503	6.31	5.6
2	1.67	40.1	1485	6.67	5.5
3	1.50	43.3	1522	6.67	5.5
Average	1.63	39.9	1503	6.61	5.6
% Reduction from baseline	75%	72%	-22%*	4%	6%

*A negative sign indicates an increase in emissions/fuel economy

TABLE II (cont'd)

B. Ford F-250 Truck

Baseline	HC	CO	CO_2	NOx	Fuel Economy (mi/gal)
1	4.50	90.9	743	5.39	9.7
2	4.77	101.3	835	5.74	8.6
3	4.15	101.9	833	6.02	8.7
Average	4.47	98.0	803	5.72	9.0
w/Dana Retronox					
1	3.23	53.3	853	3.40	9.1
2	2.22	52.0	885	4.77	8.9
3	3.08	42.6	857	4.69	9.3
Average	2.84	49.3	865	4.29	9.1
% Reduction from baseline	36%	50%	-8%*	25%	-1%*
UOP catalyst & Dana Retronox					
1	.49	9.2	981	5.81	8.7
2	.58	12.4	968	4.95	8.7
3	.62	18.9	971	4.78	8.5
Average	.56	13.5	973	5.18	8.6
% Reduction from baseline	87%	86%	-21%*	9%	4%

*A negative sign indicates an increase in emissions/fuel economy