

EVALUATION OF NASA
THERMAL REACTOR

April 1972

Henry L. Gompf
Test and Evaluation Branch
Environmental Protection Agency

Background

An automotive thermal reactor technology program is being conducted by the NASA-Lewis Research Center. This program was initially funded as a joint effort between NAPCA and NASA. While EPA financial support has been withdrawn a cooperative effort in the form of emission test support continues. The major effort in the program has been one of materials development, but an assessment of emissions control is a valuable input. As part of this program a NASA reactor-equipped vehicle was tested in March 1972.

System Evaluated

The NASA reactor was tested on a 1971 Ford pickup. The truck was equipped with a 302 CID engine and automatic transmission. The NASA ceramic reactor was attached to one bank of the vehicles' eight cylinders. The reactor was evaluated in two different configurations: with and without flame holders. Testing at two different idle mixture settings in each configuration was also accomplished.

Test Program

Emission testing was done in accordance with the November 10, 1970, and July 2, 1971, Federal Register. Hot start 1972 FTP and cold start 1975 FTP were employed. All testing was performed using Indolene Clear fuel, an unleaded gasoline.

Emission Results

The emission results are presented in the Appendix of this report. None of the tests approach 1975 or 1976 required levels. However, relatively low levels of hydrocarbon and oxides of nitrogen were achieved.

Conclusions

The emission test results indicate several shortcomings of this reactor.

1. Reactor warmup time must be shortened.
2. Control of carbon monoxide is minimal.
3. The use of flame holders appears to be of little benefit in this design.

APPENDIX

Cold Start 1975 FTP
All Results in Grams Per Mile

	<u>HC</u>	<u>CO</u>	<u>CO₂</u>	<u>NOx</u>	<u>Date</u>
With Flame Holder & Lean Idle	1.70	69.0	746.4	1.8	4-6-72
Without Flame Holder & Rich Idle	1.60	70.0	786.6	1.9	4-7-72

Hot Start 1972 FTP
All Results in Grams Per Mile

	<u>HC</u>	<u>CO</u>	<u>CO₂</u>	<u>NOx</u>	
With Flame Holder & Rich Idle	.52	39.1	831.8	1.6	4-5-72
With Flame Holder & Lean Idle	1.10	53.3	736.9	1.8	4-6-72
Without Flame Holder & Rich Idle	1.02	55.3	787.5	1.8	4-7-72
Without Flame Holder & Lean Idle	.22	21.7	737.1	1.7	4-7-72