PROOF OF TECHNOLOGY

Summary of an Independent Performance Evaulation report of the PARCON 125 Hazardous Waste Destruction System conducted by the Acurex Environmental Corporation.

THE PARCON 125

Hazardous Waste Destruction System

PLASMA ENVIRONMENTAL

TECHNOLOGIES INC.

EXECUTIVE SUMMARY

In objective third-party tests the Plasma Arcing Conversion (PARCON) unit has met and exceeded the most stringent standards in the world, those of the American Government's Environmental Protection Agency, the EPA. As part of a continuing program to document the capability of plasma destruction technology, Plasma Environmental Technologies Inc. arranged to test its smallest unit, the PARCON 125 at the Environmental Research Center in North Carolina. This facility is managed by the Air Pollution Prevention and Control Division of the US Environmental Protection Agency's National Risk Management Research Laboratory.

Testing was conducted by Acurex Environmental Corporation, an independent organization at arms length from Plasma Environmental Technologies Inc. In the first set of tests, an approved simulant mixture was used to prove the efficacy of the PARCON for PCB destruction. In a second set of tests Acurex used a simulant mixture mandated by the U.S. Army's Chemical and Biological Defense Command to prove PARCON's ability to destroy the chemical agents HD, HT, GB and VX as well as the explosives TNT and Tetryol.

In their official report, Acurex scientists Johannes Lee and Dennis Tabor conclude, "...the PARCON 125 unit demonstrates that it is capable of destroying chemical agent simulants and energetic simulants to greater than 99.99999 percent efficiency."

In their summary Lee and Tabor list 6 key advantages of the PARCON 125. "It has an extremely high destruction and removal efficiency. It is transportable and can be easily and quietly moved to the source of the waste generation and/or cleanup sites. It is safe to operate because of the numerous auto-stop functions. It is convenient. Shutdown and clean-up procedures are both rapid and safe. It has wide capability. The unit can treat a wide array of liquid hazardous wastes such as petroleum derivatives, pesticides, fungicides, and chemical and biological weapons' agents. It is quiet and it is flexible. Parcon units can be combined in modular fashion to increase total throughput."

PARCON was originally developed in Hungary by HungaroPlasma. It is licensed to Plasma Environmental Technologies Inc. for the treatment of hazardous materials in the North America, South America, Central America and Asia.

TEST RESULTS SUMMARY

Acurex Environmental Corporation tested the PARCON 125 at its facility in North Carolina. Acurex is an independent corporation at arms length from Plasma Environmental Technologies Inc. Acurex provides on-site environmental engineering support to the U.S. Environmental Protection Agency's Air Pollution Prevention and Control Division (EPA/APPCD) of the National Risk Management Research Laboratory (NRMRL). Technology verification is included in Acurex's scope of responsibility for EPA/APPCD.

Two separate test series were conducted. In September 1997 Acurex tested to determine the PARCON 125's efficiency at treating PCB like wastes. In October 1997 the system was tested to determine its efficiency at destruction of chemical warfare nerve agents and energetics.

PCB Tests

For PCBs, PARCON 125 was tested using a surrogate compound mixture. After installation, a shakedown of the PARCON 125 was conducted to verify that it was operating within normal specifications. Nine separate tests were conducted. In early tests, problems with the nozzle configuration prevented the PARCON unit from performing at anticipated levels. However after reconfiguration and a modification of the test matrix, test results were consistent with expectations.

In their final report the Acurex engineer conclude, "the PARCON 125 unit demonstrates that it is capable of treating surrogates for PCBs to DREs greater than 99.9999 percent. Tests conducted using chlorobenzene and 1,2-dichlorobenzene yielded DREs of 99.99993 percent and 99.99995 percent respectively, while testing with a mixture of cholobenzene, 1,2-dicholorobenzene and biphenyl in Fuel Oil No. 2 yielded DREs greater than 99.9999 percent." The Acurex engineers also recommend that "additional tests with an improved nozzle design and a clean system are needed to more accurately determine PARCON 125's full performance potential."

Test Series	Test Date	POHC	Conditions	Highest DRE
1	7/25/97	chlorobenzene	Baseline	99.97%
2	7/30/97	chlorobenzene	Baseline	99.994%
3	7/31/97	1,2-dichlorobenzene biphenyl chlorobenzene	Parametric runs w/ variable reactor temperature	99.998%
4	8/1/97	Not applicable	System blank	N/a
5	8/4/97	Not applicable	System blank	N/a
6	8/5/97	chlorobenzene	Parametric runs with variable injector conditions	99.998%
7	8/6/97	chlorobenzene	Parametric runs with variable injector conditions	99.9998%
8	8/7/97	chlorobenzene	Parametric runs with variable injector conditions	99.9990%
9	8/8/97	1,2-dichlorobenzene 1,3-dichlorobenzene biphenyl	Run at optimized conditions	99.99993%

Chemical Agents and Energetics Tests

For the Chemical Agents and Energetics Tests Acurex outlined strict procedures and protocols. The system was "operated and tested using a simulant mixture for the chemical agents HD, HT, GB, and VX, as well as a simulant for the energetics (explosives) TNT and Tetryol. All simulants used for this test sequence were taken from a list of such materials developed by the U.S. Army's Chemical and Biological Defense Command (CBDCOM)."

After installing the PARCON 125, the Plasma engineering team conducted a shakedown of the system, verifying that it operated within normal specifications. Following that procedure Acurex conducted two tests, one with chemical agent simulants and the other with energetic simulants. Unlike other scenarios in which samples were taken in the exhaust flue after full oxidization had occurred, these gaseous samples were collected to measure the results of direct plasma destruction of the tested simulants. To facilitate this type of sampling process, a built-in collection port was installed directly inside the top portion of the reactor chamber near the bottom of the plasma region. As a result, all simulant destruction measurements were obtained from the plasma region only (a worst case scenario) to demonstrate the destruction capabilities of the hot, ionized plasma stream. Other gaseous products of the reaction were measured using continuous emission monitors.

According to Acurex, "Data quality Indicator goals were set before testing to allow the determination of the quality of the data gathered and to determine potential limits on its usefulness in determining the PARCON 125. For this series of tests, the critical measurements were the simulant feedrates and the concentration of the simulants at the plasma region exit.

	Test 1	**Test 1**	**Test 1**	**Test 2**
Test date	9/2/97	9/2/97	9/2/97	9/2/97
Simulant	Thioanisole	Dimethyl methylphosphonate	Tributyl phosphate	2,4-Dinitrotoluene dissolved in toluene
Material Simulated	HD, HT	GB	VX	TNT, Tetrytol
Waste feed rate (kg/h)	2.18	0.736	2.01	0.45
Total air (Nm^3/h)	40	40	40	40
Reactor temp.				
Test 1	850 ^oC	850 ^oC	850 ^oC	1270 ^oC
Test 2	1350 ^oC	1350 ^oC	1350 ^oC	1350 ^oC
Test 3	570 ^oC	570 ^oC	570 ^oC	1200 ^oC
Destruction efficiency (%)	>99.999992	>99.999994	>99.99999 8	>99.999996

Simulant feedrates were determined by first principle measurements: simulant feed over a known recorded test duration. The potential error of these two measurements was less than five percent.

The error of the measured concentrations of simulants at the plasma region exit during these tests, based on matrix spike and recovery and the potential error of the sampling and recovery procedures, can range from –25 percent to +25 percent. Because all simulants, except tributyl phosphate, were below their respective detection limits, the likelihood for the actual DRE to be less than the reported minimum values is expected to be low."

The two tests with the PARCON 125 system yielded results that confirm that more than 99.99999 percent of the simulants were destroyed in the plasma region.

The PARCON 125 was operated at baseline conditions as determined by the HungaroPlasma operators. Two method 0010 samples were collected for the determination of DRE. Run conditions and simulant destruction efficiencies are summarized in the table below.

Acurex concludes "Testing of the PARCON 125 unit demonstrates that it is capable of destroying chemical agent simulants and energetic simulants to greater than 99.99999 percent efficiency. Preliminary results related to reaction by-products that may be formed suggest that they are present, but at fairly low levels. The true identities of these tentatively identified compounds are believed to be substantially less hazardous (toxic) than the candidate chemical agents and energetic materials.