CERTIFICATE

OF TECHNOLOGY ASSESSMENT

Gasplasma® **Energy from Waste Process**
(Port Fuels & Materials Services, Inc.)

Based on a review of the data and the information submitted in support of the technology, the ministry concludes that the Gasplasma® energy from waste process, by Port Fuels & Materials Services, Inc. and Leveraged Green Energy, may be used to convert waste material into a fuel gas suitable to generate power.

The Gasplasma® energy from waste process has potential applications to convert municipal solid waste, industrial, commercial and institutional waste, and other waste to a suitable fuel gas. With properly designed emission control equipment, the Gasplasma® energy from waste process may be capable of meeting Ontario regulatory requirements.

The NETE evaluation is not considered an approval or implied approval of the technology and it in no way removes or limits the obligation to obtain the necessary environmental approvals under the Ontario Water Resources Act or the Environmental Protection Act for an application of the technology. The ministry approval process ensures the applicability of the technology against site-specific performance and environmental requirements.

S. Klose

Steve Klose, Director
Standards Development Branch
Ontario Ministry of the Environment and Climate Change
(December 2014)

New Environmental Technology Evaluation Program
Promoting the development and application of new environmental technologies

Ontario

Gasplasma® Energy from Waste System

Notable aspects of the technology include:

/ The Gasplasma® Energy from Waste Process is a unique patented two-stage advanced thermal treatment conversion process that uses both fluidized bed gasification and plasma arc processes in series to convert waste to a fuel gas.

/ The fluid bed gasifier and the plasma converter have been demonstrated individually in multiple installations world-wide.

/ The core of the Gasplasma® process is the conversion of mixed waste material (municipal solid waste, or industrial, commercial and institutional waste) or refuse derived fuel to a fuel gas suitable for use in reciprocating gas engines, gas turbines or fuel cells to generate power.

/ In addition to municipal solid waste and industrial, commercial and institutional waste, the Gasplasma® process may be able to produce energy from wood waste, biomass, biosolids and hazardous/special wastes.

/ Waste is not incinerated or combusted, rather it is gasified and cleaned resulting in a syngas that can be used as a fuel gas.

/ In addition, the process converts the remaining solid inorganic material into an environmentally benign material called Plasmarok®, which can be used as an aggregate.

/ Waste or refuse derived fuel is fed into the fluid bed gasifier along with steam and oxygen to covert the mixed materials into crude syngas. The syngas at this stage contains significant quantities of long chain hydrocarbons. The crude syngas is then transferred to the plasma converter where a thermal plasma arc reforms the hydrocarbons into its basic composition of hydrogen, carbon monoxide, carbon dioxide and water. The syngas exiting the plasma converter should have an approximate temperature between 1,050 °C and 1,200 °C, with a minimum of 1 second residence time.

/ The syngas is then cooled to ~160 °C in a heat recovery boiler. The steam generated by the boiler is used in the Gasplasma® process. Any excess steam can be used for local heating or export.

/ The syngas is cleaned in a dry gas and wet gas cleaning system before it is used to produce power or biofuels.

/ The Gasplasma® process has been operating at a demonstration plant in Swindon UK since 2008. The hydrogen-rich syngas produced is suitable for use in reciprocating engines, gas turbines and fuel cells for producing power.

/ Source testing of the uncontrolled gas engine turbine exhaust at the Swindon UK demonstration plant shows that the emissions did not meet all of the Ontario limits listed in the Ministry's

Guideline A-7: Air Pollution Control, Design and Operation Guidelines for municipal waste treatment facilities. However, the application indicates that additional controls will be added to the engine turbine exhaust for Ontario applications. No source testing results have been provided for this scenario.

/ The measured syngas generated from refuse derived fuel at the Swindon UK plant had an average calorific value of 8.6 megajoules per cubic meter (MJ/m^3).

APPENDIX

Documents reviewed:

NETE Application dated August, 2014 to the Ontario Ministry of the Environment and Climate Change from Mr. Robert M. Clark, RADM U.S. Navy (Ret), Chief Operating Officer.

Supplement to NETE Application 'US Army Renewable Energy Testing Center (RETC) Technikon Report' dated September 25, 2012.

Supplement to NETE Application 'Gas Technology Institute (GTI) Report' dated December 6, 2013.

Supplement to NETE Application 'Gasplasma® Demonstration Plant in Swindon, UK' dated September 25, 2012.

Supplement to NETE Application 'Catalyst Environmental Source Test Reports' dated July 14, 2011, June 27, 2012 and November 27, 2013.

Supplement to NETE Application 'Wardell Armstrong Report' dated April, 2007.