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AFRL transitions microwave reactor technology to Space Command for elimination of hazardous materials

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WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A team of scientists and engineers recently developed a technology capable of reducing or eliminating hazardous waste generated from treatment of oxidizers and fuels.

The Air Force Research Laboratory's Pollution Prevention Research and Development Team worked with Air Force Materiel Command's Pollution Prevention Integrated Product Team to develop, test and validate a highly effective microwave reactor capable of eliminating waste.

In 1999 and 2000, AFRL conducted a research and development requirements survey for Air Force Space Command to identify processes where hazardous materials could be reduced or eliminated. During the survey, Air Force Space Command identified eliminating hazardous waste by-products generated by spacecraft as a top priority.

The current treatment, a dual extraction method that uses a vacuum sweep, air stripping and catalytic oxidation, is used for hazardous waste site remediation. Catalytic oxidation requires a significant amount of supplemental fuel and it also produces secondary air pollutants, including nitrogen oxides and dioxins. Using this treatment, hydrazine fuels and oxidizer (dinitrogen tetroxide) used in spacecraft and launch vehicles still generate more than 300,000 pounds of hazardous waste by-product annually. This waste is one of the largest waste streams at Cape Canaveral, Fla., Kennedy Space Center complex, Fla., and at Vandenberg Air Force Base, Calif.

Under a contract between AFRL and Science Applications International Corporation, CHA Corporation was sub-contracted to demonstrate and validate a technology to treat the oxidizer and fuels while significantly reducing or eliminating the hazardous waste by-product. CHA Corporation began work using microwave energy to treat and destroy the waste oxidizer and fuels without producing any hazardous waste by-products.

Using the microwave reactor, volatile organic compounds can be collected using granular activated carbon. When regenerated using microwaves this carbon will release a concentrated stream of VOCs that can then be collected using traditional condenser systems.

Prototype versions of a microwave reactor were tested in the laboratory. The microwave reactor was greater than 99 percent efficient in the destruction of waste oxidizer and fuels and generated no hazardous waste by-products.

Following laboratory testing, AFRL, The Aerospace Corporation, SAIC, and CHA Corporation began working with the Systems Safety Office at Vandenberg Air Force Base to conduct a field demonstration of the microwave reactor unit. After satisfying intense requirements from the System's Safety Office, a field demonstration was conducted at Vandenberg in August 2002.

Microwave Reactor System

The field demonstration validated results obtained in previous laboratory testing. The microwave reactor unit destroyed greater than 99 percent of the waste oxidizer and fuels. The reactor unit performed as or more efficiently than the current treatment system without generating any hazardous waste by-products.

Captain Gary C. Wright, AFRL's project manager for this effort said, "Headquarters Air Force Space Command was extremely pleased with the results obtained from the microwave reactor unit."

With AFRL's technology demonstration and validation complete, Air Force Space Command recently began efforts to design, develop and test a production scale microwave reactor unit. @