

ADVANCED HYBRID™ Filter Technology

Richard Gebert

W. L. Gore & Associates, Inc., 101 Lewisville Road, P.O. Box 1100, Elkton, MD 21922-1100
E-mail: rgebert@wlgore.com; Telephone: (410) 506-3218; Fax: (410) 398-6624

Craig Rinschler

W. L. Gore & Associates, Inc., 101 Lewisville Road, P.O. Box 1100, Elkton, MD 21922-1100
E-mail: crinschl@wlgore.com; Telephone: (410) 506-3359; Fax: (410) 398-6624

William Swanson

Otter Tail Power Company

P.O. Box 218, Big Stone City, SD 57216

E-mail: wswanson@otpc.com; Telephone: (605) 862-6300; Fax: (605) 862-6344

Summary

INTRODUCTION

The ADVANCED HYBRID™ Filter Technology is an air pollution control device that would allow industrial and power generation companies with stationary sources to meet the present and any proposed air emission standards for fine particulate. Unlike other particulate control devices, the ADVANCED HYBRID™ Filter Technology effectively integrates electrostatic precipitation (ESP) and GORE-TEX® Filtration Products technologies to provide a compact, cost effective system with fewer and more reliable components that produce superior filtration results.

TECHNOLOGY DESCRIPTION

The unique geometry of the ADVANCED HYBRID™ Filter Technology consists of alternating rows of ESP components and filter bags within the collector. The inlet gas flow and dust is directed first into the ESP zone, which removes a majority of the dust. The partially cleaned gas migrates through the holes in the perforated plates to the filter bags, which filter the remainder of the particulate. All the gas must pass through the filter bags prior to exiting the collector. During pulse jet cleaning of the bags, the ejected dust cake from the bag surface travels back through the perforated plates and is effectively captured in the ESP zone, thereby greatly reducing dust reentrainment on the bags. The synergy between these two technologies enables the GORE-TEX® membrane filter bags to operate at high filtration velocities of 11-12 fpm. The perforated ESP collecting plate, besides capturing the charged particles, also serves to protect the filter bags from any potential electrical damage from the discharge electrodes.

FEATURES AND BENEFITS

The ADVANCED HYBRID™ Filter offers many features and benefits including low emissions, fuel flexibility and durable long lasting components. Ultra low emissions are provided by using GORE-TEX® membrane filter bags that capture an order of magnitude more fine particulate than conventional filter bags. The ADVANCED HYBRID™ Filter can effectively limit the emission of fine particulate to levels over 10 times lower than the existing standard for coal-fired power plants and is cost comparable to other existing systems that emit higher volumes of particulate matter. The high air-to-cloth (A/C) ratio of the bags and the compact design requires fewer

components. The ADVANCED HYBRID™ Filter used in conjunction with a dry scrubber and carbon injection would be able to deal with fine particulate, SO₂, and mercury. This air pollution control technology allows greater fuel flexibility to the utility because of its superior filtration efficiency using membrane filter bags.

PILOT UNIT TEST RESULTS

An ADVANCED HYBRID™ Filter pilot unit has been operational since July 1999, filtering 9000 acfm of flue gas from the Big Stone coal-fired power plant in South Dakota.

- The unit has exhibited stable operating levels of 11-12 ft/min A/C ratio on fly ash from a cyclone boiler burning various power river basin coals.
- Average flange-to-flange pressure differentials of 6.5-8.0 inwg have been maintained during continuous operation with an average online pulse cleaning cycle of greater than 20 minutes.
- Particulate matter capture efficiency levels greater than 99.99% by EPA Method 17 have been demonstrated.
- Additional work is ongoing at the pilot scale to demonstrate the effectiveness of this technology to also control mercury emissions.

DOE/NETL AWARD ANNOUNCEMENT

On October 16, 2001, the U.S. Department of Energy/National Energy Technology Laboratories (DOE/NETL) announced that it had awarded funding to support the first full-scale demonstration of the ADVANCED HYBRID™ Filter Technology in a coal-fired utility application. The demonstration will take place at Otter Tail Power Company's Big Stone generating site in South Dakota. It has a scheduled start-up date of October 2002. ELEX AG, a worldwide air pollution control equipment supplier headquartered in Switzerland, that has been granted a sublicense to provide this technology to the market, will deliver the turnkey conversion of the existing ESPs to the ADVANCED HYBRID™ Filter Technology. W. L. Gore & Associates, Inc. (Gore) will supply the GORE-TEX® membrane filter bags that form an integral part of this system.

ACKNOWLEDGEMENTS

This technology was patented by the University of North Dakota's Energy & Environmental Research Center (EERC). W. L. Gore & Associates, Inc. (Gore) has been a technical and financial supporter of this technology from the early stages and has been instrumental in developing the technology to its current commercial form.

The Department of Energy (DOE) has been a key financial sponsor of this technology since its early stages of development.

The Big Stone power plant is operated by Otter Tail Power Company and is co-owned by Montana-Dakota Utilities, Northwestern Public Service, and Otter Tail Power Company.