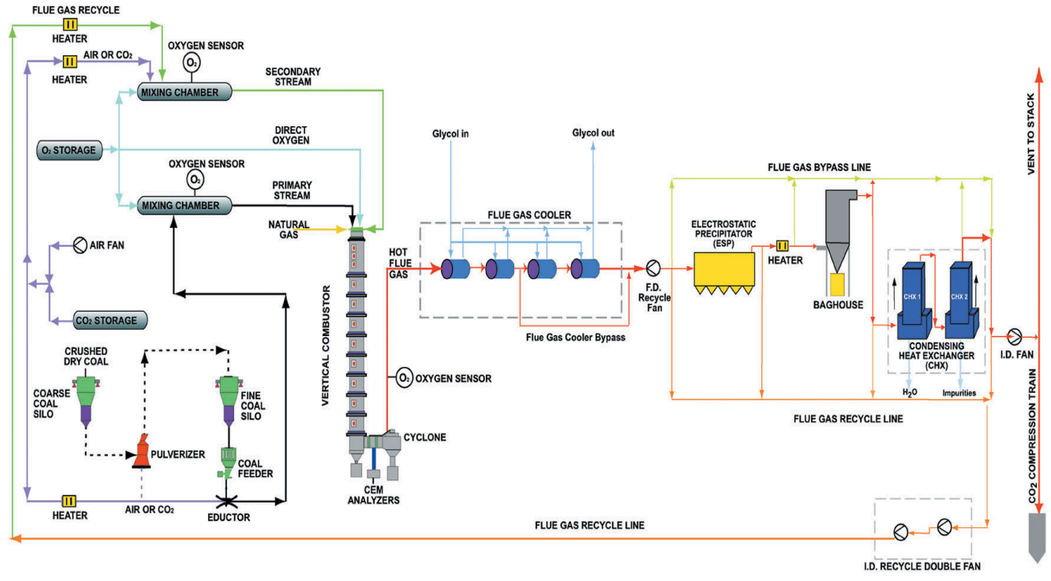

Schematic of CETC's 0.3MW Vertical Combustor and Flue Gas Treatment Units

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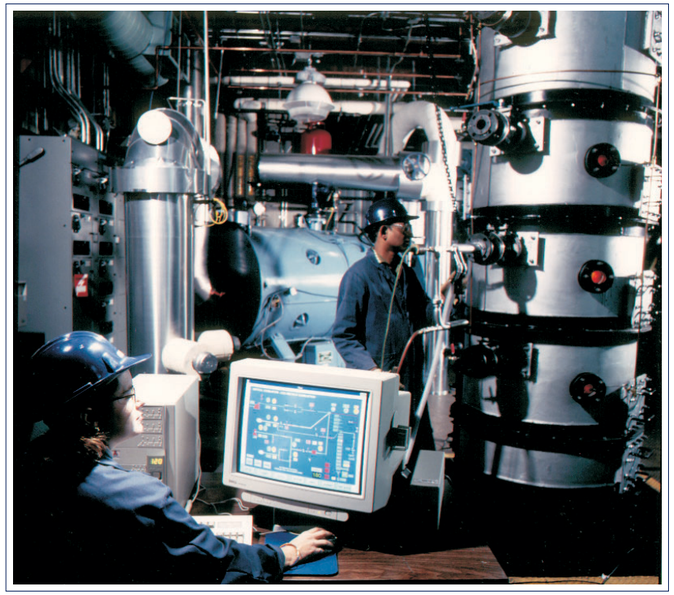
CETC
CANMET Energy Technology Centre

Our Power is Innovation

Integrated Emissions Control

The Canmet Energy Technology Centre's (CETC) new collaborative program on integrated control of combustion emissions addresses the most cost effective energy efficient means of meeting current and anticipated environmental requirements. The Advanced Combustion Technologies Group provides state-of-the-art testing services and innovative technology solutions to help industry meet today's regulations for SO_x, NO_x and particulate control, while selecting technologies compatible with future requirements, including control of trace elements.



Vertical Combustor

Background

Factors such as changing fuel quality and more stringent environmental regulations create a constant challenge for utilities and users of industrial fuel. CETC's Integrated Emissions Control (IEC) program helps Canadian industry respond to this challenge.

CETC's furnace modeling and combustion research have already rendered valuable assistance to electrical utilities and other users of carbon-based fuels in the control of SO_x, NO_x and particulates. Today's social and economic pressures drive fuel users to achieve better energy efficiency (reducing greenhouse gas emissions) and limit trace element emissions while maintaining or improving SO_x and NO_x controls. The program addresses interactions between control technologies. It offers pilot-scale analysis and evidence to fuel users as a basis for selecting cost-effective, energy-efficient technologies that both satisfy current environmental regulations and enhance the user's ability to meet the more stringent requirements of the future.

Advanced Combustion Technologies

Natural Resources Canada | Ressources naturelles Canada

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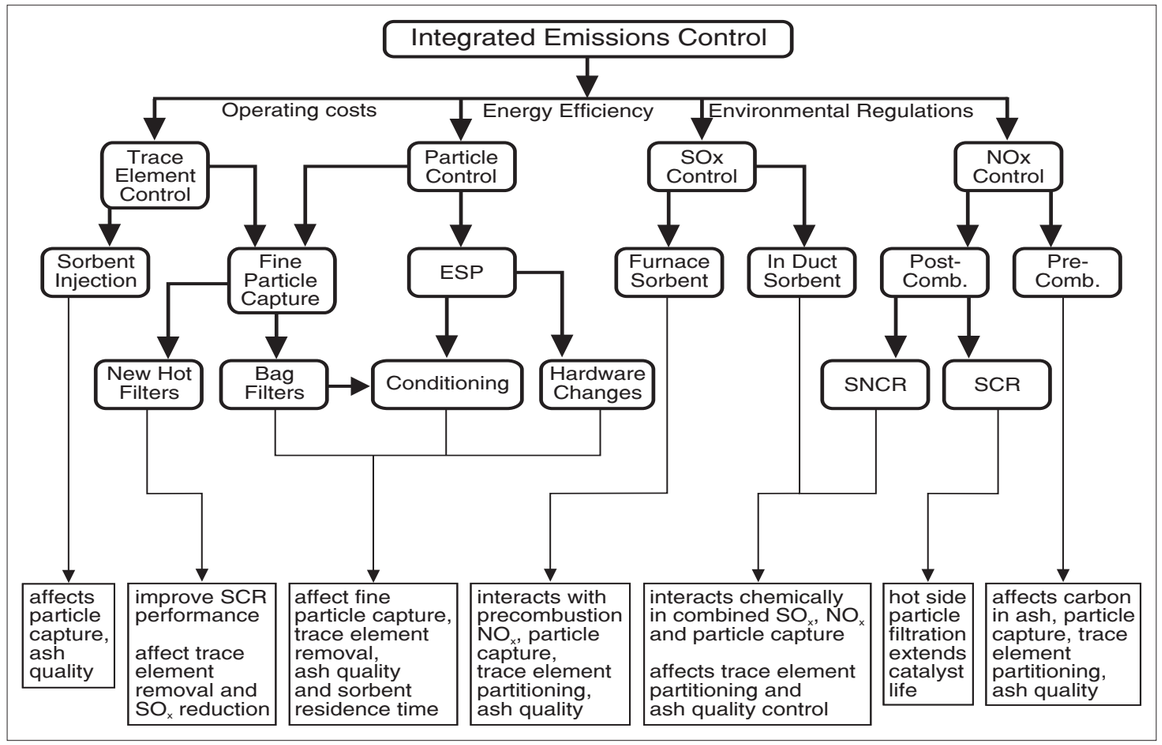

Interactive Processes in the Control of Airborne Polllutants from Fuel Combustion

The Canadian Environmental Protection Act defined several substances emitted during the combustion of fossil fuels as toxic. Environment Canada therefore initiated a "Strategic Options Process" to examine the impact and potential need for containment of nickel, arsenic, mercury, hexavalent chromium and cadmium compounds, as well as certain fluorides. The process will focus on the electric utility sector and report to the federal government, recommending options to reduce atmospheric emissions of these substances.

Related environmental initiatives include the Acid Rain Program, the NO_X/VOC Management Plan, the Canada/U.S. Air Quality Accord (which involves amendments to the U.S. Clean Air Act), the United Nations ECE Heavy Metal Protocol, and the Accelerated Reduction/ Elimination of Toxics Program. The program will assist utilities and other stakeholders in the Strategic Options Process to make recommendations that are based on soundly derived scientific and technical data.

Program Elements

Trace Elements

The program helps industry to specify the most economic and effective technologies for containing trace element emissions. It offers an integrated evaluation of the release of trace elements in conjunction with the performance of devices to control SO_X, No_X and particles. It also determines the most cost-effective ways to meet both current and anticipated emission regulations for trace elements. The program can also identify the fate and pathway of trace elements released from the combustion of fuels or fuel mixtures.

Particulate Control

The program examines new systems to meet increasingly stringent requirements for higher levels of solids removal, especially ultra-fine particles. CETC's program examines the performance of current and new devices for containing fine particles and reducing opacity. It determines the extent of trace element concentration in the smallest emitted particles. By analyzing the interaction between particle collection devices and other emission controls, it defines the most economic way to meet regulations.

SO_X Control

Optimal economic methods of SO_X control depend on the level of sulphur in fuel as well as other emission regulations. The program offers industry a way to determine the most cost-effective pre- or post-combustion SO_X control technology for specific circumstances.

NO_X Control

The program examines the conflict between NO_X control and energy efficiency, determining how to balance these demands at minimum cost. By studying how staged burning affects the amount of carbon in ash, the program can recommend practical trade-offs for specific fuel applications.

Control Regulation Studies

CETC offers Canadian industry an unrivaled window on regulatory and standardization activities. CETC's professionals take part in industrial problem-solving as well as participating with Environment Canada and other national and international agencies in formulating regulations. CETC's staff therefore lend an industrially oriented voice to committees writing regulations and standards. These perspectives allow CETC to design programs that anticipate the direction and scope of forthcoming environmental regulations.

Program Implementation

CETC's combustion team of scientists, engineers and technicians helps industrial clients find solutions to their needs, either singly or in consortia. As clients deem appropriate, we supplement our expertise by involving experts from other parts of Natural Resources Canada, the federal government, provincial governments, other research organizations or universities. We encourage participation by industrial associations. Contracts under the program are flexible and tailored to clients' needs.

In a typical SO_X and trace element project, CETC and one or two utility companies, possibly with the collaboration of Environment Canada, would join forces to:

- determine the extent, pathways and fate of specified trace elements during the combustion of the coals that the utilities expect to use;
- evaluate the effectiveness of sorbent injection for SO_2 control on the capture of volatile trace elements; and
- compare the partitioning of trace elements in a pilot-scale research boiler under known conditions with those obtained under similar conditions in utility boilers.

Working with the utilities, we would select the coals and proposed sorbent. We would compile all available data on trace elements in the chosen coals and their combustion products, taking fireside samples. The facilities would be cleaned rigorously to avoid errors from contamination. Using the research boiler and downstream flue-gas processing circuit of our pilot plant, we would measure the emissions of trace elements when burning the coals (with the emissions caused by burning natural gas as a base case for comparison) and prepare mass balances for the trace elements as they pass through the type of fly-ash collection system used by the utilities.

We would apply in-furnace or post combustion sorbent injection to determine the effects of a lime-based sorbent on emissions of trace elements for each coal.

Such a project would include detailed studies by our combustion experts, spectroscopic and chemical analyses in comprehensive facilities, and reports on trace element partitioning under defined combustion regimes in pilot-scale or commercial-scale boilers. We would comment on the type, extent and fate of trace elements and suggest strategies for our clients to minimize costs of compliance with expected environmental regulations. Observation and participation by clients' officers is always welcome.

CETC's pilot facility offers clients the choice of a 0.6 MW (2 million BTU/hr) pilot scale research boiler or a 0.3 MW (1 million BTU/hr) vertical combustor. The combustors operate at temperatures of up to 1800°C and the electrostatic precipitator and fabric filters operate at temperatures up to 200°C. The facility allows observations of heat flux, temperature and gas flow rate, the withdrawal of entrained fly-ash for analysis and on-line gas analysis at all critical points. Sampling methods conform to EPA protocols and we are ISO 9002 certified.

The facility is highly flexible. Designed to burn coal, natural gas or oil, it can be modified for other fuels. Pulverized coal size, combustor geometry, proportion and temperature of flue gas recirculation, type and temperature of fly-ash collection and sorbent utilization can all be tailored to suit our clients.

CETC's capabilities are available for use on a "fee-for-service basis".