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EDUCATION, PUBLICATION, COMMUNICATION, AND COMMERCIALIZATION

Project Description

The CATM Program continues to provide scientific and technical information on trace metals to interested parties and stakeholders in the general research community, comprising research organizations; federal, state, and local agencies; the energy sector; industrial partners; and environmental groups. In addition, CATM encourages and supports activities that provide training and educational opportunities for students, professionals, and outreach to the general public.

The CATM Program continues to provide improved educational courses and materials that make students and the public more aware of environmental issues and serve as reference documents to the scientific community and the general public (1–16). With respect to CATM’s education and outreach efforts, the goals of the CATM Program are consistent with EPA goals, which state that “increased information exchange between scientists, public health officials, businesses, citizens, and all levels of government will foster greater knowledge about the environment and what can be done to protect it” (17, 18). Because CATM research involves both basic and applied research, it provides excellent tools to the public for moving beyond understanding trace metals and air pollution and actually being able to apply the research in ways to reduce air pollution.

As one of the Centers of Excellence within the EERC, CATM continues to be instrumental in focusing attention on these issues in various public forums, both domestically and abroad. As trace metal information becomes more widely distributed through various public media, it becomes increasingly more important to provide a proper context and interpretation of the information and data that become available. It is also important to ensure that the public has the most current data in order to arrive at sound decisions based on solid research. CATM’s data continue to be used by commercial entities to bring this research from the laboratory to real-world application.

Additionally, CATM strives to develop and demonstrate products and technologies that aid in emission characterization, measurement, prevention, and/or control. As concepts evolve, CATM works with partners to commercialize these technologies in the marketplace. To ensure that these goals, as well as the overall goals of CATM, are met, EPA has conducted on-site peer review of the CATM Program. The outcome of these reviews has been very positive, with the last review complimenting CATM as “one of EPA’s best centers” (19).

Goal

Specific goals for CATM are as follows:

- Provide expertise to stakeholders in domestic and foreign venues to further dissemination of trace metal research to those who need to understand and apply scientific principles.
- Prepare, publish, and present information regarding issues related to air toxic metals and CATM research at conferences and workshops and in peer-reviewed journals and conference proceedings for the benefit of stakeholders and the general research community.
- Provide educational opportunities for students through CATM research.
- Promote technology development and commercialization.
- Promote positive attitudes, adopt changes, and apply best practices for environmental stewardship.

Rationale

Because of increasing global environmental concerns, timely training, education, and dissemination of up-to-date information to stakeholders in government agencies (both in the United States and abroad), research and educational institutions, and industry are critical. Sharing and transferring cutting-edge research findings to industry, environmental groups, state agencies, and government groups internationally have been instrumental in establishing scientifically based regulatory standards. CATM will continue to provide valid and timely information to those decision makers who must implement policy, evaluate environmental and health impacts, and determine the most judicious course of action in light of the most recent information. In a time when environmental transparency is becoming more important to the general public, it is critical that valid, well-established research is available in order for an informed public to contribute to the ongoing dialogue concerning energy and the environment. CATM strives to provide that information in a way that can be understood by the affected sector of the public so that stakeholders both understand and can apply the research data to their current needs to reduce air pollution.

Approach

Across the world, mercury and other trace metals are being controlled. Stakeholders continue to express an urgent need for updated research data concerning trace metals, especially mercury, as they seek to understand and apply sound scientific principles to decision-making processes. Despite the fact that the United States does not have mercury control regulations to replace EPA's Clean Air Mercury Rule (CAMR), mercury control issues continue to be an integral part of decisions about future emission control, especially for trace metals. As states and regions forge regulations of their own, stakeholders are seeking scientifically sound solutions to these challenges. In Canada, which faces established regulatory deadlines for mercury, and several other nations, mercury control continues to be a pressing issue. In addition, regulation of mercury has served to heighten the public's awareness of other pollutants. Stakeholders continue to request current research data that address characterization, measurement, and control of trace metal emissions. Regulations to control particulate matter, SO₂, NO₂, and other pollutants will always be related to trace metal emissions.

As a new administration takes office in the United States, it is becoming very apparent that greenhouse gas control, especially for CO₂, will be proposed soon, resulting in the need for additional research into the impacts of cocontrol of greenhouse gases and trace metals. In order to address an audience with varying levels of knowledge and sophistication, several vehicles of communication are necessary to ensure that this critical information reaches those who need it most.

To facilitate the transfer of information to government, research organizations, academia, industry, and the general public, CATM continues to support efforts to transfer timely scientific knowledge including the following venues: 1) involvement in several international and domestic working groups to share scientific research data concerning trace metal behavior and control; 2) coordination and sponsorship of the Air Quality Conference, held in the Washington, D.C., area, which will again be held in 2009: Carbon Management, Mercury, Trace Elements, SO_x, NO_x, and Particulate Matter, and the Western Fuels Symposium, as well as participation and presentation at other conferences or forums that are directed to stakeholders; 3) distribution of the *CATM Newsletter* and topical reports on trace metal research; 4) updating and maintaining the CATM Web page; 5) serving on environmental advisory committees; 6) education and outreach through various publications and workshops; and 7) overall administration of the CATM Program.

Progress

Meetings/Conferences

An annual meeting was not held in 2008, although several other conferences were used as an informal forum by which industry, government, and the research community could exchange information on CATM results and future directions for the research.

In January 2008, CATM staff presented data at the Electric Utilities Environmental Conference & Expo on Clean Air, Mercury, Global Warming and Renewable Energy in Tucson, Arizona. A presentation was given on the emissions of various hazardous air pollutant (HAP) trace metals from various studies, showing the resulting emissions for several trace metals and an indication of the resulting partitioning between the vapor and particulate phase.

In addition, CATM's director presented data regarding past and ongoing mercury research at the Gas Cleaning at High Temperatures Conference (GCHT-7) in Newcastle, Australia. This presentation highlighted research conducted at the EERC, including that done through CATM and that done by others to understand the complexities of controlling mercury emissions at high temperatures. This presentation included an overview of mercury control in combustion systems other than the standard pulverized coal combustion units that operate at ambient pressures. Participants appreciated the newest research involving measurement and trace metal control in fluidized-bed combustion and gasification systems, among others. An outcome of this conference is the development of a peer-reviewed paper that provides a good review of mercury control across high-temperature coal combustion systems.

The international Mercury Emissions from Coal (MEC 5) Working Group was also held in 2008 immediately following the GCHT-7 Conference. In early 2009, this working group became one of the partnerships that feeds research to the United Nations Environmental Programme Chemical Division. At this workshop, mercury and trace metal experts from the U.S. research community engage with their peers from other countries to discuss research and developments in mercury emissions from coal-fired combustion sources.

In August 2008, CATM's director was part of the Power Plant Air Pollutant Control Mega Symposium (7th MEGA Conference), where data were presented on a project involving long-term application of activated carbon for mercury control.

CATM researchers are again involved in the planning and coordination in order to present the Air Quality Conference in 2009. The conference, entitled "Carbon Management, Mercury, Trace Elements, SO_x, NO_x, and Particulate Matter," will again be held in the Washington, D.C., area, with preconference workshops again planned as a way to provide in-depth understanding of current research data.

CATM Newsletter

CATM continues publication of the *CATM Newsletter* and makes it available as a resource through its Web site. The newsletter is designed to inform interested parties on air toxic issues and CATM activities and to encourage further participation and collaboration between industry and government. Access increases continually for the newsletter through the Web site, providing a way for stakeholders to gain immediate access and notify others that it is available. Both domestic and foreign entities continue to find this an entry point to mercury experts who can help them and frequently follow up with questions and comments for the author(s) of newsletter articles.

CATM Web Page

The CATM Web page continues to serve as a vehicle for easy access to recent developments and results from the CATM Program. General information about CATM is also maintained and includes background; role and activities; accomplishments; key education and training activities: conferences, short courses, workshops, and academic programs; and CATM personnel. There has been a dramatic increase in Web activity over the years as the public seeks current, relevant information related to trace metals.

Committees

CATM researchers and managers continue to serve on several advisory committees to provide expert advice and technical guidance on a number of issues related to air toxics. Below are a few of the committees on which CATM researchers serve:

- Binational Strategy Utility Mercury Reduction Committee
- Air Quality Conference Planning Committee
- U.S. Representative, Mercury Emissions from Coal International Mercury Experts Working Group (now a partner arm of UNEP)
- North Dakota Mercury Task Force
- Subbituminous Energy Coalition (SEC)
- Western Fuels Symposium Technical Director
- ACS, Chair, Fuel Division
- American Society of Mechanical Engineers, Advisory Member

- Minnesota Pollution Control Agency Advisory Committee
- Elsevier Science, *Fuel Processing Technology*, Editorial Board Member

Education Through Publications

CATM disseminates information in several ways, and 2008 was again a very productive year—12 refereed journal articles were published and several more were submitted for publication. In addition, especially in the health area, CATM researchers contributed to several publications that were later published by other authors and research groups.

CATM staff continue to work on an in-depth special issue for Elsevier that covers papers that were presented at the last Air Quality Conference. The special issue will be entitled Air Quality VI: Mercury, Trace Elements, SO₃, Particulate Matter, and Greenhouse Gases and will have the following sections: Policy, Regulations, and Health; Measurement; Deposition, Transformation, and Atmospheric Reactions; Control Fundamentals/Science; Control Sorbent Injection; Control Scrub/Multipollutant Systems; and Mercury and Coal Utilization By-Products. Elsevier hopes to publish this special issue in late 2009.

CATM staff members also gave presentations at and participated in several conferences and workshops throughout the year; for several they also served in a planning capacity. In 2008, CATM researchers presented nine papers at conferences (plus several workshops) around the world, with some noted above.

Educational Opportunities for Postdoctoral Candidate and Students

Through CATM, numerous students have been involved in hands-on research into air toxic metal and related research. Not only does this provide access to research opportunities with key researchers in this area, but it provides a venue for students to be active participants while gaining valuable insights into the scientific and technical issues that face us on a local, regional, and global level. In addition to this benefit, these students enter the energy and environmental fields with real-world knowledge that increases their worth to employers.

CATM hosted a postdoctoral candidate from China, Dr. Chaubin Chen, who performed bench-scale experiments involving mercury transformations and kinetics. Dr. Chen will be presenting the data from these experiments at the International Conference on Mercury as a Global Pollutant in June 2009 in Guiyang, China. His year working at the EERC was a memorable one for him; he indicates that he will recommend that other colleagues pursue a postdoctoral position here in the future. CATM research also included one graduate student and 12 undergraduate students in various facets of research.

In 2008, CATM researchers once again provided an educational outreach program to middle school-aged students to give them a wholistic understanding of a specific aspect of pollution, in this case, air pollution, and to show them how individual responsibility affects changes that, as an aggregate, have a large impact on overall pollution reduction. Materials are thematic, but are structured to give classroom flexibility, allowing teachers to use all or part of the material, as well as to have an in-class presentation and discussion.

EERC researchers have worked with Prairie Public Television to develop several fine educational videos dealing with environmental issues. This is an outreach mechanism that has proven very effective and may be a possibility for the future, depending upon the availability of future funding for CATM outreach.

Status

Educational and information-sharing activities will continue throughout the year. Involvement in community environmental activities will continue, as well as the programs in place to reach out to and help area schools in their efforts to educate students and teachers on energy and environmental issues. At all levels, professors and teachers who have been involved in previous classroom education and outreach have shown that students retain what they have been taught and it affects their decision making in the future. For the educational outreach program, CATM makes materials available to educators year-round at no cost.

CATM newsletters and the Web site continue to be valuable outlets for disseminating current research and information, and both will continue to provide valuable up-to-date information. The CATM Web page is regularly maintained throughout the year and can be accessed at www.undeerc.org/catm. Copies of the *CATM Newsletter*, topical reports, presentations, educational and outreach materials, and other technical information related to trace metals are available for download free of charge to the general public via the CATM Web page. Each year continues to show that this resource is accessed with greater frequency. This is also demonstrated by the requests for additional information or the opportunity to speak to a researcher to obtain additional information.

Quality Assurance/Quality Control (QA/QC)

The EERC is committed to delivering consistent, high-quality research. An organizationwide quality management system (QMS), authorized and supported by EERC managers, is in effect and governs all programs within the organization. The EERC established and formalized a QMS in August 1988. A quality manual defines the requirements and the organizational responsibilities for each major element of the QMS and references the supporting documents needed to provide a comprehensive program. Compliance with this manual and its supporting documents ensures that the EERC adequately fulfills governmental and private client requirements relating to quality and compliance with applicable regulations, codes, and protocols. Additionally, the CATM Program at the EERC has a QA plan in effect that addresses trace metal research (20). The CATM QA plan has been reviewed and accepted by EPA. The projects reported on herein has complied with the quality manual, the CATM QA plan, and all revisions. An independent QA auditor has reviewed all aspects of QA/QC associated with these projects and reports.

Potential Users/Technology Transfer

Stakeholders from industry, government agencies (specifically EPA and DOE), and the general scientific community will benefit from the results of the project, with information and data that will provide a much better understanding of air toxic issues and the control of air toxic emissions. Health effects research from CATM Area 4 is providing key information that has not been well studied regarding the impact of mercury–selenium interactions. This research provides fresh insights into the ways that mercury toxicity affects both vertebrate and invertebrates. The general public will continue to benefit through the publication of refereed papers and documents, college courses, workshops, and numerous outreach programs initiated and supported by CATM.

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