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EDUCATION, PUBLICATION, COMMUNICATION, AND COMMERCIALIZATION

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Project Description

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

CATM takes a comprehensive “cradle-to-grave” approach to solve air toxic metal emission problems that includes putting this information in the hands of stakeholders through technology transfer, workshops, conferences, training material and courses, and support for general public outreach and education—both for domestic and foreign stakeholders. 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 (1–14). With respect to education, 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” (15, 16). 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.

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 reviews of the CATM Program. The outcome of these reviews has been very positive, with the most recent review complimenting CATM as “one of EPA’s best centers” (17).

Goal

Specific goals for CATM are as follows:

- 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.

Rationale

Because of increasing global environmental concerns, training, education, and dissemination of up-to-date information to the general research community that includes stakeholders in government agencies, research and educational institutions, and industry in a timely manner are critical. Sharing cutting-edge research findings with industry, environmental groups, state agencies, and EPA is instrumental in establishing scientifically based regulatory standards. For both stakeholders in the United States and abroad, CATM continues 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.

Approach

In both the United States and Canada, mercury continues to be the trace metal of the most immediate concern. While U.S. industry grapples with the compliance and monitoring issues for EPA's Clean Air Mercury Rule, 2006 was also the year when the Canada-Wide Standards for mercury were officially adopted. This Canadian federal rule paralleled actions taken by EPA to control mercury emissions from coal-fired power plants. Provincial governments are now at work with utilities and other emitters to reduce emissions by 2010. For both countries, as deadlines approach, so many unknowns still exist regarding measurement and control of trace metals. CATM continues to address these and other critical research needs that are germane to the greater research community as well as those who will apply technologies. Regulations in North America have heightened interest in solving mercury control issues, and stakeholders have become even more eager to obtain research that addresses characterization, measurement, and control of mercury emissions based on scientifically sound principals. The general research community and the public are becoming more aware of trace metal issues and need the most current research in this area. 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.

Great strides have been made in the last few years to develop, refine, and test mercury control technologies. While the immediate emphasis is on development of effective control technologies that are also economical, CATM is dedicated to understanding how implementation of these control technologies may negatively impact the environment and finding possible ways to counteract these interactions. Progress has been made, but the scientific community must remain engaged to address questions that remain, especially to ensure that solving one problem does not result in creation of another. CATM's research is focused on addressing these needs.

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) coordination of the CATM annual meeting in conjunction with EPA, Program Affiliates, and the Research Advisory Council (RAC); 2) coordination and sponsorship of the Air Quality VI (AQVI) Conference: Mercury, Trace Elements, SO₃, and Particulate Matter and Greenhouse Gases and the Western Fuels Symposium, as well as participation and presentation at other conferences or forums, in both domestic and foreign venues, that are directed to stakeholders; 3) distribution of the *CATM Newsletter*; 4) updating and maintaining the CATM Web page; 5) serving on environmental advisory committees, including an international working group on mercury; 6) education through various publications and workshops; and 7) overall administration of the CATM Program.

Progress

Presentations, Workshops, and Meetings

The annual CATM RAC meeting was held at the Baltimore Marriott Waterfront Hotel in Baltimore, Maryland, on August 28, 2006, in conjunction with the Power Plant Air Pollution Control Mega Symposium to optimize travel funds for RAC members. This meeting provides a forum by which industry, government, and the research community can exchange information on CATM results and provide direction for future CATM research, development, and commercialization programs. Fifteen people participated, representing government (including EPA and DOE), industry, and other research organizations. Of particular interest was CATM research into trace metal control technologies (especially mercury), ongoing research into the health effects of mercury, new challenges and methodologies for measurement of trace metals, further research into the role that SO₂ and SO₃ play in affecting mercury control, continued development of a model that explains the possible means by which activated carbon sorbs mercury and flue gas interferents that reduce the capacity of the carbon, and dissemination efforts to reach those who most need this research. The group expressed appreciation for CATM's continued role in disseminating research about appropriate technologies for emission control of various air pollutants.

The group also stressed the importance of CATM researchers to use both domestic and international means to present the most current information possible via conferences and workshops to disseminate relevant information in the timeliest manner possible. CATM's staff has increasing visibility and enhanced standing in the international community by taking advantage of opportunities to present results of CATM and EERC mercury research. The CATM staff has had the opportunity to continue work with Canadian entities, as well as continued international dialogue concerning mercury control issues and health impacts of trace metals. CATM's staff has continued to present special workshops in connection with conferences as a means of disseminating this information.

For example, CATM's staff was part of the planning committee for the 8th International Conference on Mercury as a Global Pollutant and presented special sessions on both mercury control and health-related research. CATM's Director also serves on an international working group, the Mercury Emissions in Coal group, to address mercury issues from global perspective. CATM researchers also serve within the American Chemical Society, especially the Fuels Division, providing a vital forum to provide and receive information that is the most current on activated carbons, developing technologies, and other cutting-edge research from an international society.

CATM researchers presented several papers at the Mega Conference this year that addressed trace metal issues, particularly mercury control topics. CATM researchers were key to the planning and delivery of the Western Fuels Symposium, which addressed mercury, selenium, and other issues related

to CATM. Also in 2006, the Ash Behavior and Mercury Short Course was delivered six times around the United States, providing a concise, focused overview for stakeholders.

CATM's researchers in Program Area 4, Health Effects, also presented their findings to numerous groups at workshops and conferences and served on international working groups. For example, CATM Health researchers gave a presentation to the Society for Environmental Toxicology and Chemistry in Montreal, Quebec, that covered the outcomes of their research on mercury–selenium interactions. They have also become part of an international working group that includes industrial stakeholders evaluating selenium issues. They gave a presentation to this group in Bromont, Quebec. Interactions between CATM Health researchers and those from the National Oceanic and Atmospheric Administration (NOAA) have also furthered mercury–selenium interaction research. CATM researchers presented at a NOAA-sponsored workshop in Hawaii this last year, as well as another conference sponsored by the University of Hawaii Medical School.

CATM researchers also created and presented a mercury measurement short course that provided industry personnel hands-on information and tools to use as they choose to install and operate CMMs, as well as learn about other analytical methods. Through this course, a smaller group of technical people worked with CATM experts to gain hands-on experience in the operation of CMMs. In addition, the workshop covered proper procedures for wet-chemistry (including OH method) measurements, an overview of dry sorbent traps, and field data related to mercury measurement. Participants were provided with a handbook as well as a video of the workshop for future reference.



CATM Newsletter

CATM continues publication of the *CATM Newsletter* for distribution to industry and other interested parties throughout the United States and 40 countries. 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.

The first issue of the 2006 newsletter covered a concise overview of the sessions presented at the Air Quality V (AQV) International Conference on Mercury, Trace Elements, SO₃, and Particulate Matter. A second newsletter covered two topics particularly germane to ongoing mercury discussions—a discussion of problems associated with the dry sorbent trap method that is intended for compliance with Appendix K of the Clean Air Mercury Rule. The other article covered some of the most recent CATM research regarding mercury–selenium interactions and the possible implications for consumption of fish. Upcoming issues of the newsletter will feature articles regarding CATM research in coal utilization by-products and other trace metal emission issues. The newsletter, along with topical mercury reports published through the Canadian Electricity Association (CEA), can be accessed electronically via the CATM Web site at www.undeerc.org/catm.

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.

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
- AQVI Planning Committee
- International Mercury Conference Planning Committee (International Conferences on Mercury as a Global Pollutant and Mercury Environmental Conferences)
- U.S. Representative, Mercury Emissions from Coal International Mercury Experts Working Group
- North Dakota Mercury Task Force
- Subbituminous Energy Coalition (SEC)
- Western Fuels Symposium Technical Director
- American Chemical Society (ACS) 2004 Chair, Fuel Division
- ACS, Chair, Fuel Division
- ASME Committee on Corrosion and Deposition Resulting from Impurities in Gas Streams, 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 2006 was a very productive year—three refereed journal articles were published and eight more were submitted for publication. In addition, three additional papers were submitted to the ACS Fuel Chemistry Division Preprints, a well-respected journal that is not refereed. Another article was published in a well-read industry publication.

The CATM staff continues progress on updating and broadening the review presented initially in the “Status Review of Mercury Control Options for Coal-Fired Power Plants,” published in a special issue

of *Fuel Processing Technology* in August 2003. The new article will be a special issue of a peer-reviewed journal and is presently still in preparation.

In 2006, one CATM paper was included in bound proceedings. Four major reports were also published that concluded large, multiyear projects with cofunding by CATM.

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 2006, CATM researchers presented 15 papers at conferences and workshops around the world, with some noted above. In addition to attending workshops and conferences, CATM is also in the process of organizing and coordinating the AQVI Conference for September 2007.

Educational Opportunities for 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.

In 2006, a doctoral student, Alexander Azenkeng, continued his modeling research with CATM. In addition, ten undergraduate students were involved in various CATM research projects.

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.

In 2006, CATM continued building the capacity of University of North Dakota engineering students through delivery of workshops covering mercury. The feedback from the students indicated they found this real-world application of engineering concepts very valuable.

The newsletters and the CATM Web site have also become valuable outlets for disseminating 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*, CEA topical reports, and other technical information related to mercury are available for download to the general public via the CATM Web page.

Quality Assurance/Quality Control

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 quality assurance (QA) plan in effect that addresses trace metal research (16). The CATM QA plan has been reviewed and accepted by EPA. The project 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/quality control associated with this project and report.

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 vertebrates 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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