Advances in Pollution Control Technology
Uncovering Solutions to Cleaner Air

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Put Energy into Emission Control Projects p. 10
Sulfur Dioxide Controls for Small Utility Boilers p. 14
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This issue explores advances in pollution control technology that will help small utility boilers control SO₂ emissions, help reduce greenhouse gas emissions, add more effective controls for nitric acid plants, and explain key technologies for mercury emissions from industrial boilers.

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As the summer draws to an end in the United States, much of the South has been cursed with unusually hot temperatures…and the media has suffered much the same with the heat of the health care debate. The unseemly shouting matches in town hall meetings have not inspired confidence that the public debate will render the best policy.

Sadly, the same has been true at times in the climate debate. I remember testifying before the Utah state legislature last year on climate science and policy when a committee chair remarked, “Rick, I see you have drunk the Kool Aid, too.” This is a reference to those in Jonestown years ago who drank poisoned Kool Aid in a mass suicide blindly following their leader, religious fanatic Jim Jones. Regrettably all sides of the climate issue have exaggerated for their cause from time to time, thus making it far more difficult to develop cogent and meaningful policy.

The bedrock principle of our Association—provide a neutral forum to exchange varied views on policy and science—has always been the thing that keeps me committed. Some particular paper, presentation, panel, or day in a program might seem a bit tilted, but overall through any period of time, our ship seems to hold the course very well in providing all credible perspectives.

That’s not to say we are dull. For example, a speaker at our recent Greenhouse Gas Reporting Conference in Baltimore was urged to apologize for comments he made in a presentation. I love it when sparks fly…but it all happened most respectfully…which I made in a presentation. I love it when sparks fly…but it all happened most respectfully…which I did for the Kool Aid incident. Regrettably all sides of the climate issue have exaggerated for their cause from time to time, thus making it far more difficult to develop cogent and meaningful policy.

Next month the world will be watching the goings on in Denmark at the United Nations Climate Change Conference (COP 15). Thousands will attend; a few will have the power to actually accomplish something. A lot is riding on how far the U.S. can advance climate legislation before the event. Though most are skeptical that anything fundamental can emerge from Congress in the short time left and with health care reform being the top priority, it will still be important to learn what does and does not happen (and maybe why) in Copenhagen.

How in the world will we in A&WMA get the straight scoop?

Many of us are associated with trade groups, advocacy groups, or institutions that will have representatives there and will share their insights.

But you will also have an A&WMA representative as well. WHAT? Yep!

I had lunch with the East Central Section at this year’s annual conference in Detroit and was approached by Gary Bramble about attending the talks as a representative of A&WMA. Gary will be there on vacation and wanted to donate his time and energy to giving us a first hand look at the proceedings. Now that is commitment!

So, look for interesting and informative tidbits and accounts from Gary, our man on the scene, which will likely be followed up with more information in the future on the substance of the conference and perhaps his reflections on the process as a whole. I can’t wait for that! What a great benefit for our members who are engaged in practices that are impacted by such negotiations.

In addition, I will be leading other Association leaders to meet with senior U.S. Environmental Protection Agency officials this month so we can explore ways to enhance our relationship. It is vitally important for us to engage our regulators to better understand the basis for policy and how it will be implemented so we can make recommendations as individuals on how to improve both.

One of my two strategic objectives this year was to improve our partnership with state and federal regulators. Hopefully these discussions will advance that goal. Meanwhile, watch for Gary’s items on our webpage soon and in this publication next year.
Introduction to the Feature Articles on Recent Advances in Air Pollution Control Technology
An Interview with the Experts

The task of compiling articles on recent advances in air pollution control technology for this issue of EM led us naturally to the Institute of Clean Air Companies (ICAC), the national trade association of companies that supply air pollution control and monitoring technologies for stationary sources. We asked Dave Foerter, ICAC’s Executive Director, and Carolyn Slaughter, Senior Environmental Program Manager at ICAC, to help us find articles to address this topic and to answer some questions to help explain the general scope of technological advances that are occurring today.
The four feature articles included in this issue explore advances in control technology that will help small utility boilers control sulfur dioxide (SO2) emissions, help reduce greenhouse gas emissions through increased energy efficiency, add more effective controls for nitric acid plants, and explain key technologies for mercury emissions from industrial boilers. We talked to Dave and Carolyn to put those articles in a broader context.

**EM**: Dave and Carolyn, thanks for helping us organize this issue covering this important topic. In your view, what are the main drivers for advances in pollution control technology?

**Dave**: The deployment of emissions control technologies is fundamentally driven by regulation and legislation, which not only require emissions reductions, but also stimulate innovation to lower costs of emissions reductions.

An example of a successful driver of technological advances is the regulation of SO2 and nitrogen oxides (NOx) emissions starting in the 1990's. Federal and regional control requirements for the utility sector have led to innovations in SO2 and NOx control technologies to meet increasingly stringent emission requirements. All four of the feature articles in this issue show how the industry has responded to regulatory initiatives.

Regulations stimulate innovation and investment by technology developers. Innovation benefits all, in that it functions as a driver to lower costs.

ICAC helps show how the result can be remarkable emission reductions while preserving industrial progress in the U.S. ICAC advances the common business interests of the air pollution control industry by working for strong, flexible clean air policies that rest on a sound technical basis and that promote public health, environmental quality, and industrial progress.

**EM**: Energy efficiency is very important in today’s economy. How has the pollution control industry responded to that imperative?

**Carolyn**: The largest gains in energy efficiency will be realized through efficiency improvements from improved boiler design; any efficiency gains from air pollution control (APC) equipment would be additive to an entire plant’s efficiency improvements. A good example of such gains is provided by flue gas desulfurization (FGD) or scrubber systems. Twenty years ago, the FGD system used up to 2.5 percent of a plant’s electricity output; today, that has dropped to less than one percent for a dry system. The APC industry is also responding to the need to look at all pollutants simultaneously. This holistic multi-pollutant approach will lead to overall gains in plant efficiency.

**EM**: What is the outlook for greenhouse gas controls?

**Dave**: As an industry, we expect to see continued progress in the development and deployment of greenhouse gas control technologies. The greatest potential for reducing emissions of carbon dioxide from the existing coal-fired fleet is in the development of retrofit technologies that can be applied to existing boilers. There are 1,100 coal-fired boilers in the U.S. that vary in design, size, operation, age, coal characteristics, and location. A variety of technologies and approaches are necessary to meet the challenges of this diverse fleet.

The near term options for controlling carbon dioxide (CO2) emissions include technology that is available today for efficiency improvements as well as technology that is currently in the early stage of development for separating and concentrating CO2 from flue gas. With adequate funding and regulatory support for the air pollution control industry, the development, and deployment of these technologies can be accomplished efficiently. With the proper mix of regulations and incentive for early action, the APC industry can efficiently demonstrate small scale and then deploy large scale carbon capture technologies.
**EM:** What about controls for greenhouse gas pollutants other than CO\(_2\)?

**Carolyn:** A suite of emissions control technologies is available for non-CO\(_2\) greenhouse gases. Emission control technologies for non-CO\(_2\) greenhouse gases such as methane, nitrous oxide, and selected fluorocarbons represent immediate opportunities to control greenhouse gas emissions.

Mike Durilla’s article *NO\(_x\) and N\(_2\)O Control in Nitric Acid Plants: A Time to Review the Past and Look Ahead* on p. 6 describes how the nitric acid industry is one example of an industry installing emissions control technology to simultaneously abate NO\(_x\) and nitrous oxide (N\(_2\)O) emissions. Nitrous oxide is a greenhouse gas with a global warming potential 310 times more potent than CO\(_2\). Catalyst manufacturers have developed specific catalyst technologies to reduce N\(_2\)O emissions up to 99%.

**EM:** The development of measurement technology is also important because you can’t know that you’ve controlled something unless you can measure it. What’s happening in this sector?

**Carolyn:** A source’s ability to quantify and potentially receive emissions credits verified through measurement technologies will continue to drive innovations, especially as greenhouse gas emitters are required to monitor and report their emissions. A few advancements include real-time reporting using software continuous emission monitoring (CEM) systems to measure ultra low levels of NO\(_x\), and mercury continuous emission monitors able to provide real-time feedback to control carbon injection systems. Since the 1990s, we have seen CEM systems that are smaller, more cost-effective and less maintenance intensive. New measurement technologies can be expected to provide improved monitoring of stack and ambient pollutant contributors such as flares and tank vents.

**EM:** We hear a lot about green jobs lately. How real is the potential for job creation in the air pollution control industry?

**Dave:** The job opportunities created by this green industry range from both high-tech jobs such as engineering design and computer modeling positions to skilled laborers required to fabricate and install the technologies for end users. ICAC expects the U.S. market for APC equipment to expand from $4 billion in 2008 to almost $6 billion by 2012. Let’s look at power plants as an example. Installing an FGD system on a typical 500 megawatt coal-fired power plant can employ as many as 200-700 skilled and unskilled construction laborers over the duration of a three- to four-year project. Similar numbers of workers will be needed for future amine and ammonia-based scrubbers for capture of power plant CO\(_2\) emissions.

**EM:** Thanks to you both for helping to gather the informative articles for this issue. We encourage readers to write to us or *EM* with any comments on these or other articles. *em*

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‘We expect to see continued progress in the development and deployment of greenhouse gas control technologies.’

>>Dave Foerter  
ICAC Executive Director
by Mike Durilla

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The New Source Performance Standards (NSPS) for Nitric Acid Plants were last updated in 1989. The standards address only opacity and nitrogen oxides (NOx). The U.S. Environmental Protection Agency (EPA) is currently looking to propose new standards; however, today the “climate” is much different than in 1989. Now there is a worldwide discussion regarding the reduction of greenhouse gases. The nitric acid segment is the largest generator of nitrous oxide (N2O), a greenhouse gas having 310 times the impact of carbon dioxide (CO2). Today, there are technologies available which can significantly reduce N2O and there has been a long successful history of NOx control in this segment. As new standards are being considered, the time has come to once again review emission controls for the nitric acid sector.

The Nitric Acid Process

The basic process to make nitric acid (HNO3) first involves catalytically oxidizing ammonia (NH3) with air to form nitric oxide (NO). Typically, the NO yield is 93–98%, but this depends on the operating conditions in the reactor and the age of the catalyst. Some N2O will also form.

The mixture is cooled, which oxidizes the NO forming nitrogen dioxide (NO2) and dinitrogen tetroxide (N2O4). The temperature and pressure will determine the distribution of NO2/N2O4 and the residual amounts of NO and N2O.

Environmental Impacts

NOx has been the principal undesired byproduct and is defined as NO + NO2. The NSPS specifies a limit of 1.5 kg NOx (expressed as NO2) per ton of HNO3 produced. In addition, NO2 has a characteristic reddish brown color which, coupled with
the stack diameter, determines opacity. The NSPS specifies a maximum of 10% opacity.¹

The NOₓ emissions exiting the absorber can be as high as 2,000 to 5,000 parts per million (ppm). There can be additional surges in NOₓ during start up and shut down operations. The N₂O emissions can be 1,500 to 3,500 ppm. It should be emphasized that every nitric acid plant runs differently and the actual emissions are dependent upon the particular operating conditions of each step.²,³,⁴

The current NSPS does not specify a limit for N₂O.¹ Some nitric acid plants can control their NOₓ emissions by upgrading the existing absorber or adding a second absorber. Most installations require supplemental NOₓ controls.²

**NOₓ Control**

**Decolorization**

Even before the Clean Air Act of 1970, nitric acid plants were using catalytic combustors to improve the energy balance in their process while at the same time decolorizing their stacks.⁵,⁶ NO is colorless, but NO₂ is reddish brown. In the nitric acid process, fuel was added to the exhaust to increase the exhaust temperature thus increasing the power recovery. If excess fuel was added, some would react directly with NO₂ and convert it to NO. The increased temperature also resulted in a movement on the NO/NO₂ thermal equilibrium curve to a point where the NO₂ was further reduced. The net effect was to decolorize the stack. The total NOₓ level, however, remained unchanged.

**Nonselective Catalytic Reduction (NSCR)**

With the passage of the Clean Air Act, actual reduction of the NOₓ level was required. The NSCR process uses a fuel and a catalyst to burn out residual oxygen (O₂). Once the O₂ is gone (O₂ consumption step), the fuel will react directly with NO₂ (decolorizing step) to form NO and with NO (abatement step) to form CO₂, nitrogen (N₂), and water. Waste heat boilers are added to recoup energy from the high temperatures inherent to the process. This technology was widely used in new plants constructed between 1971 and 1977. However, as fuel prices rose, efforts shifted to enhancing the performance of the absorption section of the process so as to reduce the use of fuel while still meeting NOₓ limits.³,⁵,⁶

**Selective Catalytic Reduction (SCR)**

In the SCR process, NH₃ reacts with NOₓ across a catalyst in the presence of O₂ to form N₂ and water. This process was of particular interest to the nitric acid industry because it could be situated at a number of locations within the process and did not have the high temperature requirements associated with the NSCR process. This also eliminated the cost for the waste heat boilers often inherent to the NSCR process as used in the nitric acid plant. SCR is a mature technology dating back to the 1950s and has been applied to a number of applications. A number of catalyst types and forms have been used in the nitric acid industry. The selection is most often determined by the temperature of the location in the process. SCR control technologies are being used extensively around the world in the nitric acid segment. About 80% of the nitric acid plants in the U.S. utilize SCR to control NOₓ emissions. Whereas 80–95% NOₓ control was once considered a standard, more recent installations have targeted 95% or higher.²,³,⁷

**N₂O Control**

N₂O control technologies are typically identified by their location in the nitric acid manufacturing process. The technologies are referred to as primary, secondary, or tertiary control as shown in Figure 1.

**Primary**

Primary N₂O control refers to reducing the N₂O emissions out the stack by reducing the amount of
N₂O formed in the NH₃ oxidation step. Theoretically, this can be done by modifying the catalyst used in this step and/or modifying the operating conditions of this step. However, to date nitric acid plants do not use this approach to reduce N₂O emissions.⁷

Secondary
Secondary N₂O control refers to reducing the N₂O emissions out the stack by reducing the N₂O immediately after it is formed in the NH₃ oxidation step. In this approach, a specific catalyst is located immediately downstream of the NH₃ oxidation catalyst. N₂O is decomposed to N₂ and O₂ almost instantaneously after it is formed.

This approach has the lowest capital cost because the reactor that currently is required for the ammonia oxidation catalyst is utilized with minimal modifications. There are no additional operating costs. Typically, up to 90% N₂O reduction is targeted. There are greater than 60 nitric acid plants worldwide implementing this technology.⁷

Tertiary
Tertiary N₂O control refers to reducing the N₂O emissions out the stack by installing a catalytic reactor at an appropriate location within the process stream. Several different technologies are available that look to combine with the existing need for SCR NOₓ reduction. Each has different performance capabilities and different operating condition requirements.⁷

When the monitoring of specific levels of N₂O reduction is required or is beneficial (as for emission trading), tertiary control is the method that allows the easiest access to make the required measurements. However, tertiary control has the highest capital cost and may require extensive engineering costs in order to modify an existing reactor or add an additional reactor to an already cramped production facility. Tertiary N₂O control simply may not fit into every nitric acid plant. There are 10-15 installations currently being operated worldwide in nitric acid plants.

One of the technologies operates best at ~430° C. A first stage catalyst targets N₂O. NH₃ is then added and a second stage catalyst targets NOₓ. Up to 99% reduction of N₂O is offered.

A second technology operates at ~330° C. NH₃ is added prior to the first stage which targets NOₓ. Hydrocarbons are added to a second stage which targets N₂O. Up to 99+% reduction of N₂O is offered with this process.

A third technology reduces both NOₓ and N₂O in a single stage at temperatures as low as 300° C. Only NH₃ is added. The higher the temperature, the higher the N₂O reduction achieved. Simultaneous 90% N₂O destruction and 90% NOₓ reduction has been seen at 540° C.

When the concern about N₂O emissions rose, a close study of the operating NSCR units in a number of nitric acid plants indicated that those units were reducing N₂O levels by approximately 80%.⁸,⁹ While NSCR units are no longer being installed on new installations, the question has been raised as to how to account for their potential 80–90% N₂O reduction benefit. In scenarios where SCR is being considered as a replacement of an existing NSCR unit in order to improve NOₓ control, the N₂O reduction from the added SCR may be minimal. The new SCR system might have lower NOₓ emissions, but higher N₂O emissions than the NSCR unit it replaced. Installations that currently only have to “decolorize” might also consider upgrading to full NSCR to take advantage of increased N₂O reduction.
The Effect of the Kyoto Protocol
Clean Development Mechanism countries under the Kyoto Protocol allow N₂O reduction products to generate tradable carbon credits and financial revenues. This has accelerated the implementation of the N₂O reduction technologies in a number of industrial sectors including nitric acid.

A Final Thought
The ultimate approach to NOₓ and N₂O control in the nitric acid segment is based on an optimization between the capital and operating costs of each option being considered. The final solution may well be a combination of several technologies. The uncertainty of the future value of N₂O reduction has slowed the implementation of N₂O reduction techniques in the U.S. Nitric acid plants located in countries under the Kyoto Protocol are already considering and realizing the value of N₂O reduction in their emission control strategies.

References
7. Institute of Clean Air Companies (ICAC) Member Installation Lists.
Many companies feel pressured to spend the least amount possible to meet environmental regulations, primarily because compliance isn’t a profit generating endeavor. What some environmental and compliance managers fail to realize is that emission control equipment can quickly become a profit decreasing endeavor with this penny wise-pound foolish approach. With mandatory greenhouse gas (GHG) reporting on the horizon, it’s about to get a whole lot worse for those who went down this road. Manufacturers could soon be paying for the carbon emissions generated by some of these pollution control systems, adding to the capital and operating costs associated with regulatory compliance.

This concentrator and oxidizer are handling high volume, low concentration emissions with very little CO₂ emissions.
Thermal and catalytic oxidizers are used in a wide variety of industries for the destruction of Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs). These process emissions are destroyed through the process of high temperature combustion, or oxidation, and can be explained using the following equation:

\[ C_nH_{2m} + (n + m/2) O_2 \rightarrow n CO_2 + mH_2O + heat \]

During the thermal oxidation process, heat breaks apart the contaminated compounds which then reform naturally, bonding into carbon dioxide and water. Catalytic oxidation has the same byproducts, however the contaminated air is introduced to a catalyst (precious or base metal) during the heating process allowing the bonds to break apart at lower temperatures. Both forms of high temperature combustion require some type of fossil fuel to bring the oxidizer up to temperature.

This article focuses on the oxidizer options and recommendations that should be considered when buying a new system to reduce GHG emissions. It will also explore some of the add-on features and practices that plants should implement on an existing oxidizer to reduce their carbon footprint.

Some experts argue that while oxidizer systems prevent hazardous chemicals from being released into the atmosphere, they also emit significant amounts of carbon dioxide (CO₂) and nitrogen oxides (NOₓ). Contrary to popular belief, CO₂ and NOₓ are not necessarily a by-product of these air pollution control devices, especially the newer technologies. However, there are certain features that an oxidizer should have in order to achieve self-sustaining, fuel-free destruction. These energy efficient options that "weren’t in the budget" when the system was purchased could now affect the bottom line.

Before we begin examining some of the options, it is important to note that the Regenerative Thermal Oxidizer (RTO) emits a fraction of the GHGs than its predecessors do. It is generally considered to be the most energy-efficient control technology when compared to the recuperative, catalytic and direct-fired systems because of its ability to capture heat from the purified exhaust air and preheat incoming airflow. If process conditions allow, upgrading from an older oxidizer technology to the RTO should be considered before implementing any of the modifications referenced below. As you can see in Figure 1, under standard process conditions the RTO is the only self-sustaining, fuel-free control technology.

**Make Process Modifications and Efficiency Upgrades**

Quantifying GHG emissions specifically from an oxidizer in the stack is not an easy task, oftentimes CO₂ is generated by the process dryers, ovens, or burners and not the oxidizer. Making modifications or efficiency improvements to your process equipment such as recirculation or heat recovery is an excellent way to not only reduce operating costs but also your carbon footprint.

The other source of pollutants in the stack that is often overlooked is the actual pollution generating solvents and carcinogens. A function of oxygen and temperature (500-1600°F) causes the molecules to break apart, oxidizing the carbon in organic solvents (VOCs) to CO₂. Figure 1 demonstrates just how significant the carbon emissions can be from the solvent itself. Limiting the amount of solvents used or changing to a more environmentally-safe chemical can reduce the GHGs that ultimately exit the stack to the atmosphere. However, doing this also takes fuel from the oxidizer and may negatively impact system performance so an expert should be consulted before changing solvents.

![Figure 1. CO₂ Emission sources from various oxidizer technologies.](image-url)
**Turn Off the Oxidizer Burner**

When properly designed and applied, Supplemental Fuel Injection (SFI) is an excellent means of reducing system operating cost and providing a cleaner “burn”. Natural gas is injected directly into the emission laden airstream, typically at or near the inlet of the oxidizer through a quill in the ductwork transition. As a general rule of thumb, NOₓ is created when temperatures reach 1500°F or higher, but the combustion burner is not in operation when SFI is used, thereby eliminating the NOₓ production and reducing combustion air. SFI also gives the oxidizer a more uniform temperature profile that improves energy recovery and overall efficiency.

**Concentrate High Volume Low VOC Airstreams Prior to the Oxidizer**

If a significant portion of the air entering an oxidizer is at or near ambient temperature with low levels of VOC loading, a concentrator may be applicable for reducing the heat input required by the oxidizer system.

As a result of recent regulations, many facilities around the United States have been forced to improve localized VOC capture as well as prove high destruction efficiency in their system. In many cases this has led to the installation of additional capture hoods or enclosures and increased the amount of air to be treated by a particular oxidizer system. A concentrator can take exhaust streams at or near ambient temperatures and concentrate it so that the airflow actually sent to the oxidizer is reduced by a factor between eight to fifteen. This greatly reduced stream is typically rich in VOCs and much less of an operating cost burden on the oxidizer system; in fact, it generally allows for self-sustaining, fuel-free destruction.

**Improve Primary Heat Recovery**

Oxidizers are typically designed with some form of internal heat recovery. Usually the hot purified gases leaving the combustion chamber are used to pre-heat the incoming solvent laden airstream. This is referred to as the ‘primary heat recovery’ of an oxidizer system. Projects that improve the primary heat recovery often offer the quickest payback because they provide additional heat recovery at all times the oxidizer is in service. For recuperative thermal and catalytic units this typically consists of adding additional passes to the internal air-to-air heat exchanger.

For RTOs and Regenerative Catalytic Oxidizers (RCOs), this would be handled by increasing or changing the type of ceramic heat recovery media or altering the control scheme that dictates how often beds are switched from inlet to outlet. For example, if an average size RTO (25,000 SCFM) originally designed for 95% TER (Thermal Energy Recovery) slips to 93% TER for a full year, this could create additional operating costs upwards of $65,000. New media types can offer 97% or higher TER with lower pressure drop for reduced electrical consumption.

**Consider Secondary Heat Recovery**

If improving primary heat recovery is not cost effective or operating conditions do not allow it, then secondary heat recovery may be the best option for reclaiming heat from an oxidizer system. When added to the stack, heat exchangers capture the excess heat so that it can be reused to generate hot air, water, steam, or even electricity. There are a wide variety of low back-pressure designs that can be added to an oxidizer stack without requiring a replacement of the system fan.
Payback for these projects is greatly improved if the captured heat can be used back in the exhaust generating process itself, because, again, it is assumed that the process is operating at all times that the oxidizer is running. For example, fresh air is passed through a secondary heat exchanger in an oxidizer exhaust stack and supplied back as heated supply air for the oven zones that the oxidizer is treating. Every time the oxidizer is on the oven zones require heat, so this heat recovery project pays back all year long. If the same fresh air was supplied back to the plant as tempered makeup air, this may only provide payback during the heating season.

Following this logic, comfort heat applications may have been ignored in the past. Considering today’s unstable and rising fuel costs, coupled with the energy recovery grants available to facilities, these projects deserve attention, as do emerging technologies like heat-to-power. Sometimes referred to as cogeneration, heat-to-power is a technology capable of sending electrical power directly back into a facility. The concept has been implemented on different applications throughout the world, but is only now being integrated with combustion devices such as oxidizers. As electricity costs increase and greater efficiencies are achieved with the technology, it will be a very attractive option in the near future. Today, heat-to-power is not necessarily a cost reduction strategy but rather a green initiative that could be used to promote a company as a leader in energy conservation.

Properly Maintain Existing Systems
Finally, no matter how well an overall system is designed, it cannot continue to operate at a high efficiency level without proper maintenance. A handful of small inefficiencies in system operation can lead to large operating costs over the course of a year. For instance, making sure burners are tuned properly and not firing on excess combustion air can drastically reduce fuel consumption and GHG emissions. At today’s energy prices, regular calibration of feedback instruments and control loops can pay for themselves many times over. All too often production facilities take the “No News is Good News” approach to their air pollution control equipment when they really should be chasing the benefits of “A Company Stays Green and Saves Green” motto instead.

For decades, air pollution control companies used to claim that oxidizers released “harmless” CO₂ and water vapor. That was way before Al Gore, former Vice President of the United States and once Presidential hopeful, would create a movie that brought climate change to the forefront by drawing millions of viewers worldwide. Indeed, things are much different today than they were even five years ago—as individuals and businesses alike are trying to reduce their environmental impact.

This article only covers the primary means of GHG, fuel, and operating cost reduction. To maximize return on investment, plants should consult with a professional as each application is unique. Achieving the upcoming standards for GHG emissions won’t come without challenges but putting “energy” into your emission control device will help your facility meet these goals while reducing operating costs. em
After the U.S. Supreme Court remanded the Clean Air Interstate Rule (CAIR) in December 2008, the U.S. Environmental Protection Agency (EPA) started developing new rules for deep cuts in nitrogen oxides (NO\textsubscript{x}) and sulfur dioxide (SO\textsubscript{2}) from coal-fired power stations. EPA told the Court that it would take two years to issue the new rules, which will include a proven cap-and-trade program to reduce NO\textsubscript{x} and SO\textsubscript{2}. In an action closely related to CAIR, EPA will also impose the first ever federal requirements for coal-fired power stations to reduce mercury emissions. While federal rules are being made, the states have their own pollution control requirements that are active until federal rules are promulgated.
There are more than 420 coal-fired boilers in the United States with capacities from 50 to 300 megawatts (MW) that currently are not equipped with a selective catalytic reduction (SCR) system for NOx control, a flue gas desulfurization system, or a mercury control system. Many of these boilers, which collectively represent almost 60 gigawatts (GW) of installed capacity, are difficult to retrofit for deep emission reductions because of space constraints or unfavorable economics of scale. Considering many boilers are over 50 years old, they are increasingly vulnerable to retirement in the face of progressively more stringent environmental regulations.

While new rules are being written, there is a brief opportunity for a power utility to plan emission controls for a new boiler or to save a boiler from retirement. For small utility boilers firing coal, there are several scrubbing options to control SO2 emissions. The choice of the scrubbing technology depends not only in its ability to reduce SO2, but also co-benefits such as removing sulfur trioxide (SO3), fly ash, and mercury. Removing SO3 eliminates acid mist formation after the stack avoiding a secondary visible plume. It is increasingly important what happens to the fly ash from a boiler and whether the byproduct from removing SO2 with a scrubber is land-filled or can be used. The ability of a scrubbing technology to remove mercury may determine whether a boiler must shut down or be allowed to operate.

**Wet Scrubbers**
Wet scrubbing is familiar to power utilities, and it used to treat flue gas for a wide range of boiler sizes with single absorber vessels as high as 1000 MW. Figure 1 shows a typical open tower wet scrubbing absorber. The scrubber sprays the flue gas with a wet limestone or lime slurry using powerful recycle pumps. The calcium in the slurry reacts with the SO2 in the flue gas to produce calcium sulfite (CaSO3) and calcium sulfate (CaSO4). At the bottom of the absorber, there is an agitated liquid level of reacted slurry. Fresh lime slurry is injected into the absorber sump. A mist eliminator at the top of the absorber separates the spray from the absorber and the water used to wash the mist eliminator maintains the liquid level in the sump below. Forced oxidation blowers pump air near the agitators and the air converts calcium sulfite to calcium sulfate, also known as gypsum—a useable byproduct. Bleed pumps continuously remove the gypsum slurry from the absorber sump. Hydroclones separate water from the slurry, and the gypsum byproduct is sent to a secondary dewatering system. An upstream particulate removal device captures most of the fly ash upstream of the absorber resulting in the fly ash being disposed of separately from the byproduct. The dewatered gypsum byproduct and remaining fly ash from the absorber is typically used to make wall-board.

Wet scrubbers use a lot of water to make slurry and maintain sump level, and the waste water is usually high in chlorides. The materials for the absorber must be corrosion resistant because the absorber works at the water saturation temperature of the flue gas. While a wet scrubber provides excellent SO2 control, its control of SO3 and mercury is limited.
Dry Scrubbers
Spray Dryer Absorbers (SDA) and Circulating Dry Scrubbers (CDS) are dry scrubbing technologies that use less water and consume less of the gross power of the power station than a wet scrubber. A dry scrubber operates above water saturation to avoid exotic materials found in a wet scrubber. A dry scrubber is ideally suited for a small boiler while a large single vessel wet scrubber is most likely applied to a large boiler.

Spray Dryer Absorber (SDA)
SDAs have been used to remove SO2 from flue gas for a wide range of boiler sizes with single absorber vessel sizes as high as 600 MW. (See Figure 2) The sorbent, a slaked lime slurry, is sprayed into the flue gas at the top of the absorber using high-speed rotary atomizers. The lime slurry is then dried by the flue gas in the absorber as it captures SO2. The reacted byproduct is collected in an integrated fabric filter particulate removal device that also collects the boiler fly ash. The collected solids are usually recycled into the lime slurry to improve sorbent utilization.

An SDA is less costly to build than a wet scrubber because it is made from mild steel. The footprint of an SDA is smaller, making it a likely choice for a retrofit and it uses less water, making it a likely choice for a new or existing boiler where water is scarce. The boiler fly ash and scrubber byproduct are removed together using less expensive handling equipment. An SDA usually consumes less power than a wet scrubber.

One co-benefit of an SDA is that it removes SO3. Therefore, it is often used downstream of an SCR that converts a small amount of SO2 into SO3 as it removes NOx with a high temperature catalyst. An SDA produces a much less visible plume than a wet scrubber, and it does not require an expensive wet stack. This type of dry scrubber also removes mercury by injecting powdered activated carbon. The effectiveness of mercury removal depends upon the type of coal and the form of mercury as it enters the SDA, but it is enhanced by the filter cake on the bags of the fabric filter.

However, as a dry scrubber, the SDA uses a more expensive lime instead of limestone typically used in a wet scrubber. The stoichiometry (moles of calcium per mole of SO2) is higher in an SDA than a wet scrubber, so more of the sorbent is needed to achieve an SO2 removal rate than required by chemistry. The byproduct is not converted to gypsum that can be sold, but it has been used in road construction or mortar used in mining. If it is disposed, it is done so in a way similar to the fly ash from the boiler.

Circulating Dry Scrubber (CDS)
The circulating dry scrubber is used for coal and waste-to-energy boilers in Europe. It is a single system for boiler sizes up to 300 MW. (Multiple CDS designs are used for larger boilers.) As a new technology to the U.S., it is less familiar, but it includes some similar features of a dry scrubber such as an integrated particle removal device and a dry by-product. It is also constructed with mild steel, offering the same cost benefit as an SDA.

Figure 3 is a schematic of the CDS process. It includes a reactor, a fabric filter, and air slides that circulate the solids captured by the fabric filter back...
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- Trace elements found in coal ash and FGD by-products
- Different uses of CCPs
- Advantages of using CCPs in various applications

WEF/A&WMA Odors and Air Pollutants 2010
March 21-24, 2010 – Charlotte, NC

As communities grow in size and population, more municipal, industrial, and agricultural facilities are confronted with issues related to odors and air emissions. To assist the air and water quality professionals tasked with the effective management of these pollutants, the Water Environment Federation (WEF) and the Air & Waste Management Association (A&WMA) are cosponsoring the international specialty conference Odors and Air Pollutants 2010, in cooperation with the North Carolina Water Environment Association.

Odors and Air Pollutants 2010 is designed to foster informed decision-making and encourage the use of effective innovative technologies. The conference’s technical program stresses real-life experiences and lessons learned. The conference will include oral presentations, interactive discussions, posters, workshops, and exhibits.

to the reactor. The flue gas enters the bottom of the reactor, and passes through venturis that increase the flue gas velocity. The solids enter from the air slides above the venturis to form a fluidized bed. Fresh hydrated lime is injected into the reactor to control the SO2 removal rate. Water is also added to control the reactor temperature at the optimum temperature level for removing SO2 above the saturation temperature of the flue gas. The temperature is controlled well above saturation to maintain the flow of the solids in the reactor.

Unlike an SDA where a lime slurry is sprayed into the flue gas, the flue gas in a CDS contacts a fluidized bed of lime and recycle product. The higher solids concentration, made possible with independent control of water and sorbent, means that the CDS achieves higher SO2 removal rates up to 98 percent compared to an SDA that more typically achieves 92 to 95 percent SO2 removal. In an SDA, the inlet temperature must be high enough to evaporate the lime slurry sprayed into the absorber. In a CDS, water is added separately from hydrated

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Figure 3. Circulating Dry Scrubber
lime, so the stoichiometry is not limited by a slurry concentration. This feature allows the CDS to treat a higher sulfur coal than an SDA. The motive force to move solids to the CDS reactor is low pressure air rather than the high-speed rotary atomizer used in an SDA, which is usually a high maintenance device.

As a dry scrubber, the CDS uses hydrated lime instead of less costly limestone used in a wet scrubber. The byproduct is not sold as with a wet scrubber, but the CDS byproduct is very similar to that of the SDA. Currently, there is much activity to develop uses for this type of scrubbing system.

Similar to the SDA, the CDS removes many other acid gases in the flue gas including SO₃, hydrochloric acid, and hydrogen fluoride. In a CDS, the typical removal rates for these acid gases are 95% or more. The CDS has been proven to remove greater than 95% of mercury from the flue gas generated from firing a high-sulfur bituminous coal reactor without injecting powdered activated carbon. If powdered activated carbon is injected into the reactor to achieve high mercury removal for other coals, then its effectiveness is enhanced not only by the fabric filter as with an SDA, but also by the high solids concentration in the CDS reactor.

**Development Needs**

Wet scrubbers operate at a lime stoichiometry near one and development is not directed to improve it, but there are efforts to improve the liquid-to-gas ratio to limit power consumption. Wall-rings, for example, limit flue gas sneaking around the recycle sprays in the vessel. Materials such as ceramics for erosion control are also being developed for wet scrubbers and additives have been developed to improve oxidation rates to increase gypsum production. New technology development is needed to capture other gas species and toxic metals including mercury in a wet scrubber.

There is room to improve the stoichiometry for a dry scrubber while keeping the same high SO₂ removal rate. For example, there may be an additive that can improve the reactivity of the lime in the reactor. While it is not likely that limestone could be used in an SDA, the CDS has been applied to a Circulating Fluidized Bed (CFB) boiler that uses limestone to remove most of the SO₂ in the boiler.

In a CFB-CDS application, the CDS polishes SO₂ removal from the CFB boiler using the unreacted limestone carried over from the CFB boiler. As mentioned above, new development is needed to use the byproduct from dry scrubbers since they are frequently used throughout the power industry.

**Drivers and Choices**

The drivers for a power utility to choose and implement an SO₂ control device are mainly the deep emission reductions that will be mandated by the federal and state governments. If these rules are challenged or delayed further, then the decision of whether to retrofit or replace becomes more difficult. Given that the rules have already been through the courts, and an array of state laws are in place, it is likely that large reductions in SO₂ will be required for coal-fired power stations.

For power stations with small boilers, dry scrubbing is a good choice because of its smaller footprint and impact on water and power. There is almost no visible plume with a dry scrubber and no acid mist when SO₃ is removed. While no saleable gypsum is produced by a dry scrubber, the boiler fly ash and byproduct are both removed with the integrated fabric filter. If the dry scrubber works well to remove mercury and the other acid gases, then it would be a good choice to meet the likely stringent new rules. The CDS removes a high percentage of SO₂ for high sulfur coal, making it a preferred option for fuel flexibility. In the case of a new coal-fired boiler, a CFB with a CDS polishing device may make the most sense.

Making the decision of which type of SO₂ control device to use is not simple because it depends upon many considerations, including: whether it is a new boiler or the age of the boiler; whether an SCR is installed or will be installed; the availability of water; the space constraints at the site; the size of the boiler; and the impact of the device on the boiler heat rate. There is likely much more to consider when choosing a device for a boiler, so a careful analysis including comparisons among the different technologies is needed before making a final choice.
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Mercury Control in the Industrial Boiler Sector

Airborne mercury from numerous combustion and other sources settles into our water systems, and when consumed by fish, becomes a readily metabolizable form of mercury (methyl-mercury). Consumption of fish containing this form of mercury can affect pregnant women and the early brain development of children, costing society untold dollars each year. Pressure to increase mercury regulation continues to grow, affecting many different sources. This article discusses the impacts on the industrial boilers source and key technologies for controlling mercury.
History

For over 20 years, flue gas from municipal waste combustors has been regulated for mercury. The sources of mercury include broken thermometers, thermostats, and many other household items containing mercury that are disposed of in municipal waste. The regulations that were implemented in 1995 resulted in the reduction of nearly 50 tons of mercury annually. The best available control technology for mercury removal for this application is dry activated carbon injection into the flue gas. The mercury is adsorbed by the activated carbon and subsequently collected in the particulate control device. Removal efficiencies of greater than 90% are common for this procedure.

Recently, regulations have been promulgated at the state level for mercury reduction in coal-fired power plants and these state regulations vary in removal requirements. Illinois’ regulation is targeting a 90% removal across nearly all coal-fired units and is already in place. A number of northeast states require 80% or greater removal. Other states have less stringent rules for the time being, but move to higher requirements within a few years. A federal regulation, the Clean Air Mercury Rule (CAMR), was promulgated in 2005 and then later vacated by the DC Circuit Court of Appeals in early 2008. The result of this vacatur is that the U.S. Environmental Protection Agency (EPA) has been mandated to write a regulation under Section 112 of the Clean Air Act requiring a MACT standard for mercury removal. This will likely also require the control of other Hazardous Air Pollutants (HAPs) including a broad spectrum of chemical species and metals. EPA is in the process of regulating industrial boilers for mercury. It is anticipated that
the forthcoming industrial boiler regulation will also contemplate the removal of these additional HAPs. In anticipation of a federal regulation for coal-fired power plants, a substantial amount of research and development began in 1999 and has provided meaningful information that can be used for the industrial boiler industry.

Mercury is a natural element of the coal that when burned, is released into the boiler flue gas. Each boiler system has its own unique combination of boiler type or configuration, fuel source(s), and air pollution control (APC) equipment (sulfur scrubbing, nitrogen oxides reduction, and particulate control). This provides a highly variable chemistry in the flue gas, which makes for a challenging environment for the predictable removal of mercury. Adding to this variability, the largest coal-fired utility boiler is approximately 20 times the size of the smallest utility boiler. In contrast, the largest industrial boiler is perhaps 200 times the size of the smallest industrial boiler in terms of the amount of coal (burn/consumed). This variance range, in conjunction with the limitless combination of fuels and APC configurations, creates an even greater removal challenge for the industrial boiler segment.

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<tr>
<th>Area of Study</th>
<th>Driver</th>
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<tr>
<td>Low Sulfur Bituminous Fuels</td>
<td>Very common east coast fuels</td>
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<tr>
<td>High Sulfur Bituminous Fuels</td>
<td>Difficult application for activated carbon/also common east coast</td>
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<tr>
<td>Sub-Bituminous Fuels</td>
<td>Early PAC trials showed limited removals, solved with halogenated PACs</td>
</tr>
<tr>
<td>Lignite Fuels</td>
<td>Early PAC trials showed limited removals, solved with halogenated PACs</td>
</tr>
<tr>
<td>ESP Applications</td>
<td>Distribution and opacity concerns/high temperature applications (hot-side)</td>
</tr>
<tr>
<td>Baghouse Applications</td>
<td>Function of bags with additional loading/efficiency/design requirements</td>
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<tr>
<td>Contact Times</td>
<td>Many sites have limited injection points with minimal contact time</td>
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<tr>
<td>Effect of SCR/Wet Scrubber</td>
<td>Can combination be used without additional mercury removal</td>
</tr>
<tr>
<td>Temperature Effects</td>
<td>What are the useful temperature ranges of sorbents in flue gas?</td>
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As can be noted from the items in Table 1, most have material significance to coal-fired industrial boiler applications. There are 500-700 industrial boilers expected to be affected by an industrial boiler regulation. At this writing, an EPA Information Collection Request (ICR) is in process, collecting current detailed information on industrial boilers. This will provide the first extensive assessment from which we can gauge expectations from a regulation; however, generalizations can be made from the experience we have to date.

Some typical material differences exist between the utility boilers and the industrial boilers that create greater challenges for removing mercury from industrial boilers.
1. **Operating temperatures.** Although highly variable, the smaller boiler systems typically have higher operating temperatures at a typical injection point than utility boilers often due to reduced heat recovery configurations.

2. **Fuel characteristics.** The majority of the projects have been implemented on boilers firing bituminous fuels and a disproportional number have been with fuels higher in sulfur. This presents the additional challenge of dealing with higher levels of sulfur tri-oxide, which makes mercury more difficult to remove.

3. **Configuration challenges.** With the lower air flows, the equipment is scaled down and distribution of an injection media becomes more difficult to predict. Also the points at which a sorbent can be injected may also be more limited.

4. **APC equipment challenges.** Particulate control devices in the industrial boiler sector are often venturis and mechanical collectors. This may provide an additional challenge of effective collection of the fine activated carbon.

5. **Duty cycle.** Industrial boilers often are in more variable duty cycle service, presenting higher variability in the flue gas conditions.

These distinctions will help drive research and product development efforts for this market. Although both sulfur tri-oxide resistance and improved performance in higher temperature applications have been a topic for utility boilers, the prevalence in the industrial sector will drive it further.

**Key Technologies for Mercury Control**

Many subapplications for mercury removal exist within the broad category of industrial coal-fired boilers. Listed below are a number of the key technologies that have promise for mercury control for industrial boilers.

1. **Powdered activated carbon (PAC).** PAC has been the most thoroughly tested and is the most commercially-available technology of all the technologies to date. It has been proven to successfully remove mercury up to 90% in many configurations. Additionally, activated carbon also is successful in removing numerous other HAPs present in the gas streams, although research will be required to quantify its capacity on these other species. It is more effective in baghouses than in ESPs and in general is more efficient in lower temperature application than in high temperatures. Mercury needs to be in its oxidized form for best removal, and thus the fuels should provide an oxidizer for greatest success. This usually takes the form of chlorine in the coal. PAC has challenges in several areas.

   a. **Sulfur trioxide tolerance.** The presence of sulfur tri-oxide adversely affects the ability of the activated carbon to remove mercury. Research is being completed by several activated carbon suppliers to provide products with the required tolerance. Pre-treatments or co-treatments with basic materials such as lime, soda ash, and trona in the flue gas prior to the activated carbon injection have shown positive impacts on this issue.

   b. **Fly ash compatibility.** The presence of activated carbon in the fly ash can result in the loss of salability of the fly ash for use in concrete mixes. This is due to the adsorption of air entrainment agents necessary to increase certain strength characteristics of the finished concrete products. Most activated carbon suppliers have created new products reducing or eliminating the interference of the activated carbon. Color can still be an issue.

   c. **High temperature applications.** Adsorption by activated carbon has a kinetic component by nature. The higher the temperature, the more the process is shifted toward desorption—hence the lower removal efficiency. As the industrial boilers seem to have a higher average temperature at the treatment point, increased research will be required to improve efficiency in these applications. Some installations have evaluated retrofit cooling.
technologies to aid mercury removal efficiency in these cases.

2. **Co-benefits with other scrubbing applications.** Mercury removal has been successfully demonstrated in wet sulfur scrubbing installations, particularly when used in conjunction with selective catalytic reduction (SCR). It is doubtful that the smaller industrial boilers will utilize SCRs in their treatment train and wet scrubbing is less common than dry. Other scrubbing methods have shown mercury removal ability and will need to be looked at more closely.

3. **Fluidized bed boilers.** Testing of some of the newer style fluidized bed boiler designs has been completed and mercury emissions have been found to be very low. This is suspected to be due to reactions in combination with the sulfur scrubbing that takes place in the “inert” bed material when limestone is used.

4. **Fixed-bed activated carbon applications.** Work is currently underway in the use of fixed activated carbon beds for removal of mercury. The typically smaller scale and gas flow rates of the industrial boiler are more favorable to the implementation of such a process.

5. **Catalytic removal.** This technology has been evaluated in a utility boiler. Although there were several technical difficulties, once again the smaller scale may make this technology more viable.

The industrial boiler user will face a number of challenges when approaching the different technologies they may utilize in removal of mercury and other HAPs. Other air pollution control devices will have a role and influence the pathway chosen to meet the needs of individual sites. As was the case in the coal-fired utility boilers, it is expected that industry will bring new technologies and improved and more targeted applications of current technologies to industrial boiler users. It will be important to follow closely the developments and expectations as the ICR data is completed and released to the public domain.
Hear the latest research and program news directly from EPA! Topics will include:

- Utility ICR and MACT rule development
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- Coal combustion residues (CCRs)
- Climate change

Registration for the two-day meeting is only $125 for A&WMA members and $150 for nonmembers who pre-register. These discounted prices will increase by $25 after November 17, 2009 – so act now!

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December 1, 2009 • 6:00 – 9:00 p.m.

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6:00 - 7:00 p.m. Cash bar
7:00 - 8:00 p.m. Dinner
8:00 - 9:00 p.m. **Climate Legislation: Update from EPA**
Speaker: Jenny Noonan, Acting Director of the Policy Analysis and Communications Staff, US EPA Office of Air Quality Planning and Standards

Cost: $30

**New:**
A&WMA Federal Facilities Committee (EI-1) Extended Meeting with EPA to discuss new/emerging regulations
December 3, 2009 - 8:00 a.m. - 12:00 p.m.

Cost: Advance Registration: $35
After November 17, 2009: $40

Please visit [www.awma.org/go/informationexchange09](http://www.awma.org/go/informationexchange09) for more information!

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An Integrated Approach to Governance
Get the Most Out of your Auditing Budget

As companies continue to look for every opportunity to save money and perform more efficiently, environmental organizations have been under tremendous pressure to cut costs. This column examines an important aspect of every environmental group, namely governance, and explores techniques to raise audit quality while lowering costs.

Governance vs. Auditing

Many business executives, and even some environmental managers, define environmental governance as “good regulatory compliance audit systems.” Wrong. This narrow view is especially prevalent in companies that consider environmental functions as service-type activities. As a result, the rationale behind environmental governance programs is reduced to, “Are we following the regulations?” and “Is someone doing anything that they should not (e.g., falsifying records)?” Not surprisingly, “governance” functions are sometimes outsourced or placed into service organizations while manufacturing sites complain that they do not want or need this intrusive corporate oversight.

Environmental governance, just like business governance, is all about protecting shareholder value. Governance focuses on the assurance that the company’s policies and systems are being implemented according to the instructions of the directors and business executives. Auditing for compliance is one dimension; the more significant dimensions are related to strategic direction and the protection and growth of the corporation. Governance answers the question “Are we in compliance with the regulations and our internal policies?” while it also explores the query “Are our management systems appropriate, and might we be overlooking any issues that may have a material impact in the future?”

Companies could be in 100% compliance but fail miserably on governance, as measured by these other dimensions. Corporations today get evaluated not only doing what they have to do, but by doing what they should have been doing.

There is a wide spectrum of activities that corporations can be doing to provide environmental governance. Table 1 illustrates the various stages, from pure compliance (Stage 1) to pure business governance (Stage 4) with the former more checklist-oriented and the latter more strategic and ad hoc. The object is to properly cover this complete spectrum with the resources available.

The Turf Factor

In large companies, the corporate department typically checks that the business groups’ management systems are in place. The business groups, in turn, check that the sites’ compliance or management systems are in place, while the sites complete the day-to-day compliance check lists. In other words, resources are spent to check the checkers who check the checkers. It does not have to be this way.

In a perfect world, an integrated audit effort could provide verification to the satisfaction of everyone: corporate, business groups, and sites. Every organizational layer would be satisfied and well-informed, and the entire process would be cost-effective.

In the real world, I have found that management control is the dominant consideration in structuring audits. It is also one of the least talked-about issues. Management insecurity, number of problems anticipated, a “punish the messenger” culture, etc. contribute to the perceived need for control over the process. Each level wants to manage the situation and look their best in a process that could uncover some very bad news.

In some companies, business groups or even sites hire their own auditors over which they have direct control. To avoid being challenged on audit validity or competency, they may hire a prestigious, name-brand organization which may or may not supply...
the specialized and experienced talent to get the job done properly. There are all sorts of variations on this theme such as (1) allowing corporate people to participate to a limited degree and (2) bringing in external individuals who have credibility with upper management.

That said, managing the flow of information by these methods is not the same as “covering up” or filtering bad news. To be fair, management should have the opportunity to demonstrate that problems are being properly identified and dealt with. It is also a question of allowing adequate time to analyze the information and prepare alternative correction action plans.

There is nothing wrong with this as long as the flow of information is not unreasonably held up or someone does not try to court favors from those higher in the organization. If you stack up all the incentives and disincentives; however, management’s concern over who is probing around in their backyard and who has access to information almost always wins out in determining how audit information is managed. Self-preservation is a strong incentive.

**Integrated Team Approach**

The more unified and integrated the audit approach, the more robust and cost-effective it is. That is Business 101. However, the core purpose—to identify and deal with issues—discourages such an approach. Utilizing a single auditor to manage everything also has drawbacks. For example, an auditor may have overlooked something, over- or underemphasized an issue or not had adequate expertise to evaluate an issue and not even realized it.

If integration is cost-effective but difficult because of turf, how might it be accomplished? One possibility would be to support the business groups, not corporate, in forming and spearheading integrated teams. Depending on the specific needs and circumstances, these teams might consist of business and site staff, external auditors, and corporate staff. The key is to have one or more individuals who are “qualified corporate reviewers/auditors” heavily involved.

The “heavy lifting” is done by the external auditors and the business groups. What corporate gets is someone that they know is competent and can trust to “tell it like it is,” just like one of their own staff. That way you can be confident that the job is being done right without having to spend an inordinate amount of time and resources on it.

Again, the key is to fill the team with people that the businesses can respect as well as individuals that corporate will trust who have a reputation for integrity, holding confidences and working within the chain of command. They also have to be willing to stand up to any pressure by the businesses if an attempt is made to put too much spin on an issue.

You don’t get these results by specifying an external audit company by brand name; you can only do this by handpicking individuals. You also have to specify their competencies. For example, some may be good at the “big picture” and strategic issues but not be competent with the minutia of regulatory compliance. You also have to be sure that roles and responsibilities are clear and that external consultants do not run up the billable hours.

The system could be set up so that the businesses plan the audits/reviews and if a recommended consultant is included, corporate kicks in some portion of the total cost out of their budget. The incentive is that the audit costs go down for both corporate and the business if an integrated team is used.

Another potential issue that this integrated approach avoids is the conflict of interest between the individuals doing the audits and the individuals recommending the fixes. When corporate does the audits in isolation and they also specify the fix, then the sites will sometimes no longer feel ownership and responsibility over the outcome.

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<thead>
<tr>
<th>Table 1. Four Levels of Auditing</th>
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<td><strong>Compliance</strong></td>
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<td><strong>Enterprise</strong></td>
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Best of Times, Worst of Times

Reward and Recognition for Peak Performance

Although growth in the environmental industry slowed in 2009, our industry has done much better than others. *Environmental Business Journal* (Volume XXII, Number 7, 2009) forecasts environmental industry growth of 0.6% for 2009, reporting that this translates into roughly the same 3-point growth differential that the environmental industry has averaged over the economy since 2002. *Engineering News-Record* (August 3, 2009, pp. 28-38) reports that environmental firms working down backlog from 2008 are now facing the recession but are still planning for recovery.

If things are so great, then why do things seem so bad? In today’s business climate, it can be hard to find team members with the enthusiasm for our projects, our companies, and our profession. Tempers flare unexpectedly. Coworkers that were once enthusiastic about taking on new assignments are conditional in their responses. What a team member may have started with passion is now undertaken as drudgery. While growth of the environmental industry may enjoy a three-point differential over the economy, I’m not convinced that environmental industry employee satisfaction shares that same three-point lead.


“Nonfarm business sector labor productivity increased at a 6.6 percent annual rate during the second quarter of 2009. This was the largest productivity increase since the third quarter of 2003, and reflects declines of 1.5 percent in output and 7.6 percent in hours worked.”

Or as summarized in an excerpt from the previously referenced Engineering News-Record article (p.38): “Top 200 firms report that constrained staffing is a fact of life in the recession’s new world order.”

Given the hard work that has been completed and that which lies ahead, it’s time for recognition and reward. As this year comes to a close, we’re likely to find several opportunities to reward and recognize project team members. Taking advantage of opportunities to recognize and reward can rekindle enthusiasm, translating in improved morale and loyalty. There are hundreds of books and websites that offer suggestions for rewarding and recognizing employees but here are a few that can work within our profession:

1. **Recognize with written words.** I learned several years ago the importance of including a personalized message with a holiday greeting card when

by David Elam

David L. Elam, Jr., CIH, CQM, is principal consultant with Summa Consultants Inc. E-mail: delam@summaconsultants.com.

In other words, growth and productivity in our industry have come because our people have been willing to work longer, harder, and smarter. This has never been a 40-hour per week profession so many work even longer, harder, and smarter than they did in good times. They’ve picked up the additional workload resulting from unfilled open positions. They’ve found ways to advance progress in the face of declining budgets and cash flow restrictions. They’ve pored over thousands of pages of draft legislation, enacted legislation, proposed regulations, and promulgated regulations to glean information that reduces costs, improves competitiveness, or points to new opportunities. And while the outlook for our industry may be brighter than most, our people are overworked and they realize that they must continue this pace “in the recession’s new world order.” The additional burden can be tolerated when there are other opportunities in the marketplace but can feel imprisoning when prospects for growth—internally or externally—are perceived as limited.

Given the hard work that has been completed and that which lies ahead, it’s time for recognition and reward. As this year comes to a close, we’re likely to find several opportunities to reward and recognize project team members. Taking advantage of opportunities to recognize and reward can rekindle enthusiasm, translating in improved morale and loyalty. There are hundreds of books and websites that offer suggestions for rewarding and recognizing employees but here are a few that can work within our profession:

1. **Recognize with written words.** I learned several years ago the importance of including a personalized message with a holiday greeting card when
they would like to undertake. Help them free up time on other assignments so that they can contribute in these new areas. New assignments and responsibilities make us feel like we’re working for progressive organizations that value and trust our contributions.

4. Reward with conference attendance. Offering team members the opportunity to present papers at conferences is an excellent way to recognize contributions, allow employees to build credentials, and gain recognition for the firm.

Many companies have standing policies and programs for recognizing and rewarding contributions and these programs should be used whenever practical; however, project managers may find that less formal tools can better build team morale, setting the stage for outstanding project performance in 2010.

And project performance will be the focus of this column in 2010. I hope you’ll join me as we explore a range of financial performance criteria and metrics and their relationship to project management. em
Tracking Air Pollution Sources for Exposure, Health, Ecology, and Regulation

This summer, the U.S. Environmental Protection Agency’s (EPA) Clean Air Research Program in the Office of Research and Development (ORD) began sampling air across Cleveland, Ohio, to better understand the sources, spatial patterns, and health effects of air pollution in Cleveland. The study, referred to as the Cleveland Multiple Air Pollutant Study (CMAPS), will provide information to support the development of new regulations and effective mitigation strategies, as well as ORD’s exposure, health, and ecological research programs.

Cleveland was chosen as the study location because the city’s air quality is affected by many local and regional air pollution sources that impact human health and the environment. Additionally, two existing air monitoring sites have shown levels of air pollution that exceed current national ambient air quality standards for particulate matter (PM). Cleveland also is impacted by local and regional coal-fired power plants, major sources of mercury to the air.

Air pollution is associated with multiple adverse human health effects and ecological impacts. The wide array of contaminants found in air pollution can be directly released by different types of sources, or photochemically transformed into new pollutants such as ozone. A complex mixture of local, urban, and regional sources contribute to air pollution including motor vehicles, industrial facilities—such as power plants—agriculture activities, and the use of home equipment such as lawn mowers.

CMAPS is designed to provide information on air pollution sources using a combination of high time-resolution measurements of key air pollutants and meteorological conditions (wind speed and direction, temperature, and rainfall). Such measurements will provide researchers with detailed information about how pollutant concentrations vary with time across Cleveland and surrounding areas. ORD scientists will analyze the air samples collected in the study looking for chemical components that serve as tracers for specific sources of air pollution. Combining this information with meteorological data will allow scientists to track pollutants in a given area to their particular source or sources.

For example, measurements of PM, mercury, and other pollutants in the ambient air and in wet and dry deposition will be quantified and related to air masses that travel from the predominant southwest wind direction from rural to industrial Cleveland. These measurements will be used in advanced modeling approaches to provide information on the contribution of regional and local sources of these contaminants.

Understanding the relative contribution of different sources is important for the assessment of health effects. Recent studies suggest that health impacts vary depending on sources. Moreover, air pollutants from sources may infiltrate indoors to varying degrees, which is important for human exposure. CMAPS samples will be screened in routine cell and animal toxicity testing systems and their effects will be compared to the effects associated with samples from other locations and from other specific combustion sources. ORD exposure modelers will also use CMAPS data to estimate human exposures to PM sources and nitrogen dioxide for a planned asthma epidemiology study.

Identifying multi-pollutant sources will provide regulators with the ability to develop more customized strategies for controlling air pollutants emanating from specific sources. For example, if analysis shows motor vehicles are the main source of air pollution in a given area, then changing fuels to reduce pollution may be most effective. However, if samples show that a primary air pollution source is a power plant or a particular industry, then installing pollution-control equipment in that specific industrial...
sector should reduce emissions and subsequently lower the airborne levels of the pollutant(s).

CMAPS is being conducted in two parts: A year-long air pollution measurement period that began in July 2009 to collect data on PM and mercury; and two, month-long measurement periods—August 2009 and February 2010—to collect pollution data on PM, ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, mercury, black carbon (soot), volatile organic compounds (VOCs), and ammonia. These other pollutants are being examined since they are often co-emitted or are involved in the formation of PM. During the month-long measurement periods, high time-resolution monitoring is being conducted at two sites in Cleveland and at a background monitoring site southwest of the city. In addition, integrated week-long measurements of some pollutants will be collected at 27 passive monitoring sites located within Cleveland and at one regional background site outside of Cleveland. During the year-long study, measurements will continue at one site in downtown Cleveland and at the background monitoring site. Meteorological measurements will be taken at multiple sites and upper-air meteorology will be measured at one site.

Additional PM samples will be collected and analyzed for chemical components and then added to human heart and lung tissue cells to assess cellular-level toxicity. Mouse lung exposure studies also will be conducted with the sample material to assess health effects in the whole animal system.

CMAPS will allow EPA to evaluate the relationship between PM and mercury sources, exposures, and potential health impacts through the combination

A new background air monitoring station for Cleveland was established by EPA with the Medina County Parks District in Ohio, the Akron Air Quality Management District, and the State of Ohio Department of Environmental Protection. The site has samplers for particulate matter, mercury and gaseous pollutants. A trailer for collecting toxicology samples is located next to the deck.
of high time-resolution sampling and advanced modeling techniques. By investigating the local, urban, and regional sources of air pollution in the Cleveland area, EPA scientists can further refine current understanding regarding how various sources across a region can contribute to air pollution.

To advance understanding of human exposure, modeling will be conducted using CMAPS data to predict how sources impact exposure of residents to multiple pollutants. CMAPS data will also be used in health effects studies to learn more about which sources may be important for understanding the impact of air pollutants on health. Finally, CMAPS measurements will be used to evaluate and improve advanced modeling tools that can be used in future air quality modeling analyses in Cleveland and other areas of the United States. Data and modeling analyses using CMAPS measurements will continue through 2011.

A critical part of the success of CMAPS has been the partnerships established by EPA ORD with the Cleveland Department of Public Health’s Division of Air Quality, Akron Regional Air Quality Management District, Medina County Parks District, Wolf Creek Environmental Center, State of Ohio Environmental Protection Agency, EPA Region 5 (in Cleveland and Chicago), EPA Region 4, MetroHealth Medical Center, City of Cleveland Fire Department, ArcelorMittal Steel, University of Iowa, Alion Science and Technology, Research Triangle Institute, and Sonoma Technology Inc. In particular, EPA ORD would like to extend our appreciation to our Cleveland, Akron, and State of Ohio collaborators for their contributions to CMAPS.
Established in 2006, the IPEP Annual Awards recognize exceptional contributions to the environmental profession or to society at large, occurring or substantially completed within the prior calendar year. Each award recipient must be a current QEP, EPI or QEP Emeritus, and may be recognized individually or as a substantial contributor to a group. Award nominations should highlight one or more of the following areas, reflective of the values of IPEP and its membership: Professional Standards and Ethics, Professional Development and Mentoring, International Collaboration and Cooperation, Interdisciplinary Management Approach, Multi-media Technological Solutions, and Lifetime Achievement in Environmental Practice. An award may be designated in one of these six categories or granted without designation.

Nominations are evaluated by a committee of QEP volunteers and must include an abstract of no more than 350 words, with no more than six pages of supporting materials (photographs, diagrams, client commendation letters, etc.). Self-nominations are not accepted.

2010 nominations will be accepted through March 31, 2010, and more information as well as nomination forms can be found at www.ipep.org.

As a proud supporter of IPEP and the QEP and EPI certification, A&WMA congratulates the newest* QEPs and EPIs on their outstanding achievement.

QEPs
William Stephan, Greenville, SC
Layi Oyelowo, Edwards, CA
Mohamad Laboun, Safat, Kuwait
Ronda Randolph, Spain
Rania Kheir, South Yorkshire, UK
Jillian Williams, Pipersville, PA
Mahalingam Ravichandran, San Antonio, TX
Mary Savin, Fayetteville, AR
Duane Wolf, Fayetteville, AR
Brian Freeman, Safat, Kuwait
Denise Haiduk, Kingston, Jamaica
Kathy Watts, Corunna, ON, Canada

EPIs
Shamar Wright, Kingston, Jamaica
Logan Hyland, Pittsburgh, PA
Miriam Grundman, Pittsburgh, PA
Ben Thompson, Springdale, AR
Kaushik Shandilya, Toledo, OH

*QEPs and EPIs certified after September 30, 2009 will be acknowledged in the next edition of IPEP Quarterly.
EPA to Assess 109 Coal-Ash Impoundments with High Ratings
EPA has determined that by the end of 2009, it will have assessed all 109 coal-ash impoundment units that have been determined to have a high or significant hazard rating under the National Inventory of Dams criteria. EPA released a complete list of coal-ash impoundments nationwide, in response to a Freedom of Information Act request by several environmental groups. EPA then released more detailed information about the impoundments and said that, based on the initial information and site visits to date, it has not encountered any issue that “required immediate action or attention on the part of the utility or federal or state government.” EPA gathered the data as part of a rulemaking process initiated after the December 2008 coal-ash impoundment breach at a Tennessee Valley Authority power plant in which more than 1 billion gallons of coal-ash sludge covered more than 300 acres around the Kingston Fossil Plant. Shortly after her confirmation, EPA Administrator Lisa Jackson said the agency would propose a rule on the management of coal-ash by the end of 2009.

NAS Says ‘Compact Development’ Would Reduce Greenhouse Gases
Policies to promote more compact land development would reduce automobile use, energy consumption, and greenhouse gas emissions and should be encouraged, a panel of the National Academy of Sciences said in a report. The report defined compact development as about twice as dense as what it would be under a business-as-usual scenario. The definition includes residential population, employment, and retail. According to the report, Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions, compact development could reduce vehicle miles traveled by 25 percent and reduce greenhouse gas emissions by seven to eight percent by 2030, and eight to eleven percent by 2050. This would occur if 75 percent of new development is compact, according to the report. If 25 percent of new development is compact, it would cut driving by 12 percent and would reduce greenhouse gas emissions by one percent above baseline emissions in 2030, and between 1.3 and 1.7 percent by 2050. The report was compiled by the Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption of the academy’s Transportation Research Board.

Carbon Dioxide Emissions Projected to Fall in 2009 Due to Recession
Carbon dioxide emissions from burning of fossil fuels in the United States are expected to fall six percent during 2009 due to the weak economy and reduced consumption of most fossil fuels, according to figures released by the Energy Department’s Energy Information Administration. The decline in carbon dioxide emissions is largely due to a 10 percent decline in the use of coal because electric power generators have switched fuel from coal to natural gas, EIA’s Short-Term Energy Outlook said.
Emissions are projected to fall from 5,790 million metric tons in 2008 to 5,442 million tons in 2009 and then climb to 5,488 million metric tons in 2010—an increase of 0.9 percent—as the economy recovers.

Report Calls for U.S. to Abandon Offsets in Climate Change Strategies

A report issued by Friends of the Earth calls on the United States to abandon carbon dioxide emissions offsets as part of its domestic and international climate strategy. “Offsetting does not work, will not work and must be scrapped,” said Friends of the Earth President Brent Blackwelder in the foreword to the report, A Dangerous Distraction. “Instead the world needs developed countries, especially the United States, to cut their own emissions first and fast and provide financing for adaptation and mitigation in developing countries.” Offsets allow companies and nations to satisfy greenhouse gas reduction obligations by offsetting pollution emissions with emissions reductions elsewhere. The Friends of the Earth report said international offsets deliver lower total greenhouse gas emissions cuts than are required to prevent catastrophic climate change, basing its claim on data from the Intergovernmental Panel on Climate Change. The report said developed countries need to make major emissions cuts, but that offsets allow them to delay emissions cuts by paying the developing world for them. em

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Alberta - CCS Projects Receive Federal Money

The Alberta and federal governments will spend a total of $779 million on what is expected to be the world’s first large-scale carbon capture and storage (CCS) facility. “Project Pioneer” will be built onto TransAlta Corporation’s Keephills 3 coal-fired power plant, near Edmonton.

The system will use a chilled ammonia process to capture CO2 and inject it 2,600 to 2,800 meters below the earth. The joint venture between TransAlta and Capital Power will use the CO2 for enhanced oil recovery.

The Alberta government expects Project Pioneer to trap one million tons of CO2 annually, once it starts up in 2015. If successful, the system could also be applied to other emission sources, including coal, natural gas, and oil sands production.

“We have refineries, generating stations, industrial settings,” said Jerry Bellikka, a spokesperson with Alberta Energy. “But we’re not just looking at this as how it could be applied in Alberta; we’re looking at how it could pioneer a new technology around the world,” Bellikka said. Alberta is “already right in the game with some of the best technology out there,” he added.

Recently, a CO2 project led by the Alberta Research Council received international recognition. The Alberta Enhanced Coalbed Methane Recovery Project, which wrapped up in 2008, injected CO2 into coal beds, displacing underground methane. The project won an award from the Carbon Sequestration Leadership Forum, held on October 13, 2009 in London, England.

Project Pioneer—the first fully integrated CCS project for a coal-fired power plant—could earn Alberta more global attention. The province has signed a letter of intent with TransAlta, agreeing to fund $436 million of the project. The funding comes from Alberta’s $2-billion commitment to pursuing CCS projects. The federal government is investing $343 million in the project through its Clean Energy Fund and ecoENERGY Technology Initiative.

In addition, they declared funding for another CCS project, this one undertaken by Athabasca Oil Sands Project. A joint venture among Shell Canada Energy, Chevron Canada Limited, and Marathon Oil Sands LP was allocated $865 million. The project is expected to trap up to 1.2 million tons of CO2 annually from the steam methane units at the Scotford Upgrader and Scotford Upgrader Expansion, near Fort Saskatchewan.

“What we’re trying to do with the $2-billion CCS fund is invest in pilot projects of different technologies, rather than choosing just one,” Bellikka said. He added that, as of mid-October 2009, roughly half of the $2-billion fund has been allocated.

Canadian Companies Plan to Cut GHGs Below World Average

More Canadian companies are increasing their climate change initiatives, according to the Conference Board of Canada’s Carbon Disclosure Project (CDP) 2009: Canada 200 Report. Since 2006, the CDP has surveyed corporate reaction to climate change across the globe.

The 2009 Canadian CDP found that even in an uncertain economy, more companies than ever have expanded their climate change activities. But Canadian companies are still below the global average in areas like emissions reduction plans and external verification for emissions data. They also fell below average compared to the number of companies worldwide that perceive carbon as physical and regulatory opportunities, rather than risks.

Companies in Canada did place on par in some areas like disclosing direct emissions from their operations and their external supply of electricity. They were also in the average when it came to engaging with policy-makers on climate change, getting involved in emissions trading, and sound climate change governance at the board level. The Carbon Disclosure Project 2009: Canada 200 Report is available at www.cdproject.net.
Canadians’ Climate Change Views to Reach World Leaders in Copenhagen

Opinions from Canadian citizens will be included in the upcoming United Nations Climate Change Conference in Copenhagen (COP 15). Canada was one of 38 countries to take part in a public consultation organized by World Wide Views on Global Warming (WWViews).

WWViews will provide input from the citizens’ panel discussions to world leaders when they meet from December 7, 2009 to December 19, 2009 to outline international targets to reduce greenhouse gas (GHG) emissions. It is the first global effort to officially include input from citizens in the UN’s climate change discussions.

The Canadian chapter of WWViews randomly selected 103 citizens from every province and territory to take part in the consultation, which was held in Calgary on September 26, 2009. To reflect a range of ages and occupations, participants were chosen using census data. As the Canadian panel was taking place, consultations were underway in countries across Africa, Asia, Europe, and North and South America.

Panel participants discussed the same climate change policies that the COP delegates will deliberate, such as determining CO2 emissions reduction targets, financing climate change efforts, and recommending technology options. Canada’s panel agreed that developed nations should set the same short-term GHG emissions reduction targets recommended by the UN’s International Panel on Climate Change—a 25 to 40 percent reduction by 2020. That’s more ambitious than the current Canadian government’s target of 20 percent from 2006 levels by 2020.

Both the Canadian and international panels said that climate change is urgent and needs to be addressed, but responses differed on how to address it. The panels were asked if countries that do not meet their commitments under a new climate deal should be punished so severely that no benefit can be gained by not meeting the commitments.

33 percent of the Canadian panel agreed with punishing the countries to that degree, just slightly more than 30 per cent of the United States panel. An overwhelming majority—83 percent—of the panel in Egypt said that the countries should be punished that severely. So did 75 percent of Chile’s panel and 61 percent of Sweden’s panel.

“One of the sticking points at the negotiations was over what kind of standard to apply to rich countries versus developing countries,” said Edna Einsiedel, a University of Calgary communications professor who led the WWViews Canada panel. Poorer nations don’t have the same technologies to meet GHG reduction targets so it may not be fair to hold them to parallel standards, she said. More than three-fourths of the panel agreed an international fund should be set up to help lower-income countries reduce their emissions. But questions arose over how to deal with lower-income developing nations like India, or China, which currently has the highest emissions per capita. More information is available at WWViews’ website: www.wwviews.org.

Wind Energy Producers to Strategize with Canadian Manufacturers

A new partnership between manufacturers and wind energy producers could mean more green jobs for Canadians. The Canadian Wind Energy Association (CanWEA) and the Canadian Manufacturers & Exporters are exploring how the two industries could mutually benefit each other.

“The more than 8,000 parts that go into a wind turbine require highly skilled trades and quality manufacturing facilities,” said CanWEA President Robert Hornung. By 2020, more than 2 million jobs are expected to be created in the global wind energy sector, with many in manufacturing and export, he said.

The two national associations will be producing a co-branded market report throughout fall 2009 to explore how Canada can meet its potential for new wind energy manufacturing and component production.

The wind energy sector is growing in Canada, with almost 800 megawatts (MW) of new wind energy to be installed in 2009. By 2010, nearly every province in Canada will have wind energy facilities operating for the first time, generating enough electricity to power nearly 1 million Canadian homes. em
Call for Abstracts
for the Air & Waste Management Association’s
103rd ANNUAL CONFERENCE & EXHIBITION

The Air & Waste Management Association’s (A&WMA) 103rd Annual Conference & Exhibition (ACE) will be held in Calgary, Alberta, Canada, June 22-25, 2010. On behalf of A&WMA, we are pleased to invite abstracts of original work on any environmental issue, including those related to the listed Focus and Principal Areas. The abstracts will be evaluated for:

- Technical quality
- Relevance and significance to current environmental issues
- Lack of commercialism

The theme for the conference is “Energy and the Environment,” while the 2010 Critical Review will cover multipollutant air quality management. Papers that are related to the conference theme or the Critical Review topic are encouraged.

Abstracts should be submitted through the abstract submission site which can be found on the ACE 2010 Web site at www.awma.org/ACE2010.

Please select from the Focus and Principal Area list provided on the following pages when submitting your abstract online. Abstracts may be submitted to either a general Focus Area, usually associated with a Technical Coordinating Committee (TCC) in Technical Council and which encompasses a particular subject area, or specific Principal Areas (a bulleted list of subtopics). Some Focus Areas may have similar Principal Areas, so review the entire listing before deciding where to submit an abstract. If a chair of a specific area or TCC has invited you to participate, please be sure you have the correct Focus Area and check the box to indicate that the paper was solicited. When submitting your abstract, please make sure that your contact information is correct.

The schedule for the development of the 2010 technical program is shown on the left.

Abstracts must be submitted no later than December 4, 2009.

An extended abstract or full manuscript will be required for each accepted paper and poster abstract. For inclusion in the ACE technical program, a complete draft manuscript or extended abstract must be received by March 5, 2010, and reviewed and revised by April 2, 2010. Final acceptance for the conference will be based upon the final manuscript/extended abstract. The manuscript/extended abstract must adhere to the Style Guides, which are available online at www.awma.org/ACE2010.

Authors will be notified of the preliminary acceptance of their abstract by February 13, 2010.

In 2010, A&WMA is placing special emphasis on poster presentations, to provide more opportunities for researchers who prefer to present their findings in this format. A&WMA plans to have one or more poster-only sessions scheduled in prime time slots, with no competing paper or panel sessions. Poster presentations are particularly appropriate for 1) data-rich research findings, and 2) research topics that may not be fully developed, where the researcher would like the opportunity to solicit direct feedback from his/her peers. As with any abstract accepted by A&WMA, posters must still be accompanied by a full manuscript or extended abstract. A&WMA will provide a separate forum for presenters who are required by their employer to make a presentation in order to attend the conference, so that they will be able to both present their poster and make a brief (five-minute) presentation on the same topic. Please consider a poster presentation for ACE 2010, especially if you plan to submit more than one abstract for the conference. Note that paper and poster submissions will be treated identically with respect to submittal and review. They differ only in the method of delivery at the conference. Authors who do not show up at the conference to present their paper or poster risk having their manuscripts removed from the Conference Proceedings.

Young Professional Best Paper Awards:
Each year, Best Paper awards are presented to Young Professionals (YPs) who submit outstanding work. YPs, as defined by the Association as age 35 or younger, who wish to have their submissions considered for a YP Best Paper award must indicate it when they submit their abstracts and must provide the necessary personal information. To be eligible for the YP Best Paper award, the individual must be the lead author, have the major responsibility for the work, and be the presenter at the conference. Please refer to www.awma.org/ACE2010 for detailed requirements.

NOTE: There will be a separate Call for Abstracts for the student poster contest abstracts which are to be submitted to a separate submission site. Students may submit similar material for the student poster contest and the technical program.

Richard Tropp
Technical Program Chair

Allan Legge
Technical Program Vice Chair

A&WMA policy stipulates that all authors who attend the Annual Conference must register for the conference and pay the appropriate registration fees.
2010 A&WMA Annual Conference
List of Proposed Principal Areas

Abstracts are solicited on current issues, case studies, and practical experiences. Please review the proposed principal areas and indicate through the online submission site which focus area/principal area best encompasses your abstract. If your abstract matches more than one focus area/principal area, list the choices in your preferred order. The following list of focus areas is segmented according to the Technical Council Groups (Air, Environmental Management, and Resource Conservation & Waste Management), Divisions, and Technical Coordinating Committees. Also included are focus areas for Education Council, international focus, and local and regional issues.

### PRINCIPAL AREAS

#### AIR

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• Advances in Alternative Energy Technologies
• Mitigation of Acid Mine Environmental Damage Issues
• Environmental and Economic Challenges Facing the Livestock and Swine Industries
• Water, Air Quality, and Environmental Management in Western Canada
EPA Will Publish Heat Exchanger Rule, Withdraw Other Standards for Refineries

The Environmental Protection Agency will publish portions of a rule setting technology-based air toxics control requirements for petroleum refinery heat exchangers that was signed by the Bush administration Jan. 16 but will withdraw and reevaluate other standards for hazardous air pollutants at refineries. EPA intends to withdraw portions of its proposed air toxics standards for refineries that evaluated any remaining health risk posed by hazardous emissions from refineries, the agency announced Oct. 19.

However, EPA will publish a final rule setting maximum achievable control technology standards for air toxics emissions from refinery heat exchangers. The final rule, which amends 40 C.F.R. Parts 9 and 63, will take effect upon publication in an upcoming edition of the Federal Register.

The technology-based limits for controlling hazardous emissions reflect the average emissions level of the best-performing 12 percent of sources in a source category and must be reviewed every eight years under the Clean Air Act.

The final rule would define a leak as 6.2 parts per million by volume (ppmv) of strippable volatile organic compounds for existing units and 3.1 ppmv for new units. The heat-exchanger controls are expected to reduce emissions of hazardous air pollutants such as benzene by 630 tons annually and volatile organic compound emissions by 4,100 tons per year.

Refineries that commenced construction or reconstruction after Sept. 4, 2007, will have to comply with the rule’s requirements immediately. Existing refinery heat exchangers will have 36 months to come into compliance.

EPA said it chose not to finalize portions of the rule evaluating any lingering health risks posed by air toxics emissions from refineries and will withdraw those portions of the previously proposed rule. According to EPA, the prior residual risk evaluations “may not accurately characterize the risk posed by this source category.” Instead, the agency plans to conduct further residual risk studies and issue a new proposed rule. Section 112 of the Clean Air Act requires EPA to review MACT standards every eight years to evaluate any residual risk posed by current emissions. EPA set the MACT standard for refineries in 1995 (60 Fed. Reg. 43,620).

EPA had proposed no new emissions controls beyond establishing the MACT standard for heat exchangers and new emissions controls for storage tanks, which will also be reviewed.

By Andrew Childers, BNA

Obama Orders Agencies to Set 2020 Targets for Greenhouse Gas Emissions Reductions

President Obama issued an executive order Oct. 5 instructing federal agencies to set greenhouse gas emissions reduction targets for 2020 within 90 days.

The order also requires a 30 percent reduction in vehicle fleet petroleum use by 2020, a 26 percent improvement in water efficiency at federal agencies, a 50 percent recycling and waste diversion rate by 2015, and a requirement for federal buildings to achieve net-zero energy use by 2030.

Agencies also will be required to use federal contracts to promote environmentally responsible products and technologies and follow forthcoming guidelines for locating federal buildings in or near central business districts and close to transit.

“As the largest consumer of energy in the U.S. economy, the federal government can and should lead by example when it comes to creating innovative ways to reduce greenhouse gas emissions, increase energy efficiency, conserve water, reduce waste, and use environmentally-responsible products and technologies,” Obama said in a statement.

Obama’s order builds on Executive Order 13423, signed by former President Bush in 2007, which set goals for federal agencies in energy and resource conservation and pollution reduction, the White House said (16 DEN A-1, 1/25/07). Taxpayer benefits include substantial energy savings and reduced costs due to improved efficiency, the White House said.

Under the order, each agency will develop and implement an integrated strategic sustainability
Efficiency, Renewables Could Achieve Most Emissions Cuts Needed by 2020

The world’s governments could fail to agree on new targets to cut greenhouse gas emissions at climate talks in Copenhagen but still make significant progress on global warming if they can commit to a global renewable electricity standard, improved energy efficiency, and limits on global deforestation, U.N. Foundation President Timothy Wirth said Oct. 6. A global commitment to obtain 20 percent of electricity from renewable sources by 2020, combined with efficiency gains and policies that cut current deforestation rates in half, would generate significant reductions in global emissions over the next decade, said Wirth.

A commitment on just those three “core elements” could achieve 75 percent of the emissions cuts needed by 2020 to put the nations on a path to curbing emissions, he added. Wirth and Center for American Progress President John Podesta told reporters that they continue to support a climate deal that includes binding targets and commitments by nations to cut emissions. But with the Copenhagen meeting “just 60-plus days away,” there is a growing sense that the talks cannot produce a deal that includes binding targets and commitments by nations to cut emissions. But with the Copenhagen meeting “just 60-plus days away,” there is a growing sense that the talks cannot produce a deal that includes targets, Wirth said. A global renewable energy standard and other steps—what Wirth called “building blocks”—could be negotiated as commitments in Copenhagen and could be incorporated into a broader deal at some future point, he said.

The U.N. Foundation and CAP released a joint report Oct. 6, Meeting the Climate Challenge: Core Elements of an Effective Response to Climate Change, that said implementing a 20 percent-by-2020 renewable electricity standard on a global scale, when combined with the efficiency and forest measures, would reduce annual emissions by 13.2 gigatons by 2020.

Wirth said the focus in the coming months needs to be “on what can actually be done to reduce carbon” at the Copenhagen meeting, including an agreement on what steps, or domestic policies, nations can commit to.

Utility Given Options for Compliance

The Michigan Department of Environmental Quality issued final rules Oct. 19 that require coal-fired power plants to take steps to limit mercury emissions. Beginning in 2015, existing coal-fired electric-generating plants must reduce mercury emissions by as much as 90 percent, the agency said.

“Mercury is a serious health concern, and Michigan is eager to see a major reduction in mercury air emissions,” said Department of Environmental Quality Director Stephen Chester. “We have worked closely with Michigan’s utilities, the environmental and conservation communities, and other key organizations to develop this critically important regulation, and we will now work to ensure it is properly implemented.”

The regulation comes as federal officials prepare new national rules for emissions of mercury and other pollutants from power plants (24 DEN A-1, 2/9/09). The national rules could render the Michigan regulation obsolete. “There is always a recognition that there may be federal rules coming at some point, and we really designed our law to go along with that,” said Department of Environmental Quality spokesman Robert McCann.

Utilities Given Options for Compliance

The Department of Environmental Quality said companies will have three options: an “input-output” strategy of either reducing emissions 90 percent from 1990 input levels on a 12-month rolling average basis, or cutting the amount of mercury in coal before it leaves the smokestack; a “multi-pollutant” compliance demonstration project that reduces mercury emissions by 75 percent, along with reductions in nitrogen oxides and sulfur dioxide emissions; or, for plants that use no more than nine pounds of mercury per year, an alternative compliance demonstration project.

By Nora Macaluso, BNA
ICAC Collaborates with IEA Clean Coal Center on International Efforts to Address Global Mercury Emissions

ICAC staff met with a representative from the International Energy Agency (IEA), who is heading up efforts to develop mercury emission inventories from coal-fired power plants in China, India, Russia and South Africa. In February 2009 the UN Environmental Programme’s (UNEP) Governing Council unanimously decided to launch negotiations on an international mercury treaty to address worldwide mercury emissions. A global, legally binding treaty on mercury is expect in 2013. IEA is working on behalf of the UNEP as a non-partisan organization to develop mercury emissions inventories, develop country level mercury reduction process level optimization plans which would be similar to maximum achievable control technologies (MACT) and or best available control technologies (BACT) requirements for coal plants and fund demonstration programs in the countries of interest. ICAC is working with its member companies to identify existing projects in the countries of interest that are utilizing a co-benefits approach to reduce conventional pollutants and mercury.

ICAC Reappointed to U.S. Dept. of Commerce’s Environmental Technologies Advisory Committee

ICAC’s Executive Director received a request from the Secretary of the U.S. Department of Commerce renewing the appointment to serve on the Environmental Technologies Trade Advisory Committee (ETTAC) as a representative of the Institute as well as the air pollution segment of the environmental industry sector. The ETTAC was created in 1994 to promote a close working relationship between government and industry and to expand export growth in priority and emerging markets for environmental products and services. ETTAC is comprised of representatives from the private sector that work with the Department of Commerce in its pursuit of competitive trade objectives, policies, and programs for the environmental sector. ICAC has been represented on ETTAC for several years and reappointment has been pending in the new Obama administration. Serving on ETTAC has enhanced the visibility and influence of ICAC and resulted in continuing opportunities to inform federal agencies and stakeholders of our industry’s technologies, capabilities, and concerns.

ICAC Members Develop Bid Specification and Evaluation Form for Activated Carbon Injection Systems

The Bid Specification Information Requirements and Bid Evaluation Form for Activated Carbon Injection Systems is the latest publication from ICAC's Mercury Control Division. The publication contains a sample bid specification, and accompanying text for collecting data necessary to solicit bids from vendors for activated carbon injection systems, preparing specifications and bid documents, and for collecting the elements of and evaluating the bids received. Explanations and commentary are also included to aid the purchaser in writing complete specifications and properly defining parameters needed for design. The document is available for purchase by contacting ICAC via email at icacinfo@icac.com.

ICAC Publishes 3rd Issue of the Inside the APC Industry Newsletter

Inside the APC Industry newsletter is an outreach tool to provide insights into the recent and relevant activities and issues within the air pollution control industry, and an introduction to ICAC, its members and the breath of technologies and information available. The third installment of the Inside the APC Industry newsletter highlights include: Comments ICAC submitted supporting Post Combustion NOx Controls for Cement Kilns; ICAC Outreach to Stakeholder Organizations; Association Perspective on Emission Controls for GHG; Mobil SCR Systems for Cleaning Natural Gas Drilling Operations; Mercury Control Carbon Capacity Expansion; Momentous Flow Technology for FGD Systems; Fuel Chem Optimizes Coal-Fired Boiler Performance; Modeling Ensures Effective Mercury Capture; and New Mercury Oxidation Catalyst Introduced. Please visit: http://www.icac.com/files/public/Inside_APC_Newsletter_April_2009.pdf, to download the latest edition.

New ICAC Members

ICAC is proud to announce its newest members: WPS Industrial, TDC LLC, MC Industrial, and Udhe Corporation of America. Please visit www.icac.com for more information about ICAC and its member companies. em
Call for Abstracts
Power Plant Air Pollutant Control “MEGA” Symposium
August 30-September 2, 2010
Baltimore, MD
Abstract Deadline: January 11, 2010

The internationally popular MEGA Symposium returns in 2010 to address issues related to coal fired power plant air emissions through the combined efforts of four key industry players – the Electric Power Research Institute, the U.S. Environmental Protection Agency, the U.S. Department of Energy, and the Air & Waste Management Association. The eighth MEGA Symposium will showcase the latest development and operational experience with air pollution controls from fossil-fired power plants in light of the evolving environmental regulatory directions. The symposium will look at state-of-the-art methods for reducing SOx, NOx, CO2, particulate, mercury, and hazardous air pollutant emissions from fossil-fueled boilers. Presentations are also encouraged on experience with the impacts of plant cycling on air pollution controls. To view the full Call for Abstracts visit www.megasymposium.org.

15th International Union of Air Pollution and Prevention and Environmental Protection Associations’ (IUAPPA) World Clean Air Congress
September 12-16, 2010
Vancouver, British Columbia, Canada
Abstract Deadline: March 12, 2010

The 2010 IUAPPA Congress theme of “Achieving Environmental Sustainability in a Resource Hungry World” recognizes the need for holistic management approaches to effectively mitigate potential water, food, energy, and environmental challenges. This Congress will bring together specialists from academia, industry, consulting, environmental advocacy groups, and government to present innovative ways to improve air quality, reduce greenhouse gas emissions, and minimize environmental impacts. The program will examine international, national, and local-scale issues facing both emerging and developed economies. To view the full call for abstracts visit www.iuappa2010.com.

EPA Alumni Association
A nationwide alumni organization of former employees of the U.S. Environmental Protection Agency (EPA) has been formed and is now accepting membership from anyone who, as Federal employee, worked at EPA for at least one continuous year in any location and any position. Membership is free for the first year and if donations to the Association continue, for future years as well. A state-of-the-art website (www.EPAalumni.org) will be the primary locus of alumni interactions, but local “chapters” or groups will be encouraged in order to develop interaction at the local level. The EPA Alumni Association’s website contains a member directory as well as many ways for alumni to communicate and interact with each other. Two former Administrators, Bill Ruckelshaus and Russ Train, are already members, along with many other alumni, and the nationwide membership drive now underway is intended to bring in alumni from every kind of job and location.

Visit the Association website at www.EPAalumni.org and complete your profile so you can find colleagues, share news, make new contacts, and contribute to environmental efforts.
Upcoming Webinars

December 10 (2:00 - 4:00 p.m. Eastern Time)
Coal Combustion Residues and Beneficial Uses
Presenters: Ken Ladwig, Senior Research Manager, EPRI; Bob Dellinger, Director, Materials Recovery and Waste Management Division, Office of Resource Conservation and Recovery (formerly Office of Solid Waste), US EPA; and Constance Senior, Manager, Engineering R&D, Reaction Engineering International

Join the Air & Waste Management Association to discuss new developments in the storage and disposal of coal ash and advantages to using coal combustion products (CCPs). This timely Webinar will bring together industry experts and will cover topics including: current regulations on disposing of coal ash; review of flue gas desulfurization (FGD) by-products and where they come from; safe methods of handling FGD by-products; trace elements found in coal ash and FGD by-products; different uses of CCPs; and the advantages of using CCPs in various applications.

For more information about the courses and conferences on this page, go to www.awma.org/events.

JOURNAL

NOVEMBER 2009 • VOLUME 59

Listed below are the articles appearing in the November 2009 issue of the Journal. For ordering information, go to www.awma.org/journal or call 1-412-232-3444.

In This Month’s Issue...

Deciphering the Role of Radical Precursors during the Second Texas Air Quality Study

A Comparative Analysis of Modeled and Monitored Ambient Hazardous Air Pollutants in Texas: A Novel Approach Using Concordance Correlation

PM4 Crystalline Silica Emission Factors and Ambient Concentrations at Aggregate–Producing Sources in California

Application of Optimally Scaled Target Factor Analysis for Assessing Source Contribution of Ambient PM10

An Optimal Spatial Configuration of Sample Sites for Air Pollution Monitoring

Capacity Planning for Waste Management Systems: An Interval Fuzzy Robust Dynamic Programming Approach

Impact of Fly Ash Composition on Mercury Speciation in Simulated Flue Gas

Comparison of Exhaust Emissions Resulting from Cold- and Hot-Start Motorcycle Driving Modes

Impact of Mine Waste on Airborne Respirable Particulates in Northeastern Oklahoma, United States

The Relation between Moderate Resolution Imaging Spectroradiometer (MODIS) Aerosol Optical Depth and PM2.5 over the United States: A Geographical Comparison by U.S. Environmental Protection Agency Regions

A Comparison of Lagrangian Model Estimates to Light Detection and Ranging (LIDAR) Measurements of Dust Plumes from Field Tilling

In Next Month’s Issue...

Quantifying Sustainability

Next month EM looks at various methods and techniques for quantifying sustainability including environmental assessment, environmental management systems, life cycle assessment, and IT solutions that mark our progress toward the goal of sustainability.

Also:

• IT Insight
• Inside the Industry
2009

NOVEMBER
1–5 International Society of Exposure Science (ISES) 2009 Annual Conference: Transforming Exposure Science in the 21st Century, Minneapolis, MN

4–6 1st International Conference on Solid Waste Management (IconSWM) and Exhibition of Municipal Services, Waste Management, Urban Development, and Public Works, Kolkata, India; www.iconswm.com

17 A&WMA Rocky Mountain States Section’s Conference on Air Quality Issues in the Rocky Mountain Region, Golden, CO; sharon.good@anadarko.com

Nov 30 –Dec 1 A&WMA Canadian Prairies and Northern Section (CPANS) International Workshop on Environmental Nuisances (Noise, Light, Odor, and Fugitive Dust), Calgary, Alberta, Canada; pstaniaz@mems.ca

DECEMBER
1–3 34th Annual A&WMA/EPA Information Exchange, Research Triangle Park, NC

2010

JANUARY
17–21 American Meteorological Society 90th Annual Meeting and Exhibit, www.ametsoc.org/meet/annual, Atlanta, GA

MARCH
7–10 GEO 2010: 9th Middle East Geosciences Conference & Exhibition, Manama, Bahrain; www.geobahrain.org

21–24 WEF/A&WMA Odors & Air Pollutants 2010, Charlotte, NC

22–26 Air Pollution and Health: Bridging the Gap from Sources to Health Outcomes, An International Specialty Conference by the American Association for Aerosol Research, San Diego, CA; www.aaar.org/index2.cfm?section=Meetings_and_Events

MAY
10–14 International Specialty Conference: Leapfrogging Opportunities for Air Quality Management, Xi’an, China

17–20 2010 International Conference on Thermal Treatment Technologies and Hazardous Waste Combustors, San Francisco, CA

18–19 18th International Symposium Transport and Air Pollution, Zürich, Switzerland, www.empa.ch/TAP2010

JUNE
22–25 A&WMA’s 103rd Annual Conference & Exhibition, Calgary, Alberta, Canada

AUGUST
Aug 30 Power Plant Air Pollutant Control “MEGA” –Sept 2 Symposium, Baltimore, MD

SEPTEMBER
12–16 15th International Union of Air Pollution and Prevention and Environmental Protection Associations’ (IUAPPA) World Clean Air Congress, Vancouver, British Columbia, Canada

29–30 Vapor Intrusion 2010, Chicago, IL

NOVEMBER
2–4 Symposium on Air Quality Measurement Methods and Technology, Los Angeles, CA

Events sponsored and cosponsored by the Air & Waste Management Association (A&WMA) are highlighted in bold. For more information, call A&WMA Member Services at 1-800-270-3444 or visit the A&WMA Events Web site: www.awma.org/events.

To add your events to this calendar, send to: Calendar Listings, Air & Waste Management Association, One Gateway Center, 3rd Floor, 420 Fort Duquesne Blvd., Pittsburgh, PA 15222-1435. Calendar listings are published on a space-available basis and should be received by A&WMA’s editorial offices at least three months in advance of publication.
Marcel L. Halberstadt
Associate Director, Retired Engineer Technical Assistance Foundation
Detroit Section
A&WMA Member Since 1969

What inspired you to become an environmental professional?
My interest in the science of the environment dates from my earliest days as a professional chemist, when I was a postdoc at the U.S. National Bureau of Standards in Washington, D.C. The Section in which I was fortunate to get a fellowship was studying the photochemistry of gases that often simulated the atmosphere. These were early studies of what later became known as photochemical smog. This interest stayed with me when, as a young assistant professor, I joined the (then) Air Pollution Control Association in 1969.

What environmental leader do you admire most and why?
Perhaps the person who most exemplifies these principles, as a true professional and a clear-thinking leader, is my former colleague, George Wolff, of General Motors. His talents were given recognition by the U.S. EPA, among many other groups, where he served for a number of years as Chairman of the Clean Air Scientific Advisory Committee and worked on the review of some of our National Ambient Air Quality Standards.

What advice would you give to students and/or young professionals just starting out in the field?
Being an environmental professional in these times is exciting and challenging. Never have there been so many opportunities in so many different fields. Consider the options and challenges in the development of alternative vehicles. A traditional chemist can spend a career on battery and fuel cell development, an electrical engineer can work on vehicle propulsion systems, and a mechanical engineer can put it all together on a vehicle while a computer scientist develops the software to make it all perform as intended.

What does A&WMA membership mean to you?
The major benefit I have always found as a member of the Association is the level playing field and the neutral meeting ground it provides for environmental professionals, whether they are from industry, government or academia. Attendance at the annual meeting and an occasional regional topical meeting allow me to meet and renew acquaintances with colleagues from all over the country and, together with the excellent publications, let me keep up with current issues.

Tell Us What Makes You Tick!
The Member Minute is a great way to share your experiences, work, and accomplishments with A&WMA’s membership and EM readers. Want to see your photo and story highlighted in EM, or do you want to recommend someone to be featured? Just e-mail your contact information to EM Managing Editor Lisa Bucher at lbucher@awma.org for consideration.
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