Written Testimony of

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Senator Boxer, Senator Carper, Senator Inhofe, Senator Vitter and Members of the Committee:

Good morning, I am Dr. Michael Durham, President and CEO of ADA Environmental Solutions (ADA-ES). ADA-ES is a company that develops and commercializes air pollution control technologies for the power industry. We have been involved in mercury control since the early 1990's and currently supply activated carbon injection systems, activated carbon (AC), mercury measurement instrumentation, and related services. To meet the needs of the power industry for mercury control, the Company is developing state-of-the-art facilities to produce activated carbon with our first plant projected to come on-line in 2010. Additionally, the Company is developing technologies for power plants to address issues related to the emissions of carbon dioxide.

I would like to thank Senators Boxer, Carper, Inhofe, and Vitter for the invitation to participate in this hearing on the Clean Air Act Amendments of 2010. It is my privilege to present this testimony on our current understanding of commercial technologies to control emissions of mercury. In this testimony, I would like to focus on the following key points:

- ADA believes that the continued reliance on coal for a significant portion of our electrical power generation is critical to both our economy and natural security. We are working with the electric power industry to develop clean coal technology to maintain progress demonstrated over the past decades toward burning coal with significantly lower emissions.

- Regulations provide certainty that drive investments, innovation, cost reductions, and implementation of emission control technology.

- The accelerated development of mercury control technology has been a major success story with significant improvements in technologies resulting in higher mercury capture efficiencies and lower costs.

- Because of differences in the age, location, and design of the 1100 plus plants in the US coal-fired generating fleet, there will be differences in the costs and difficulties of achieving high levels of emissions control at each plant.

- The commercial mercury control market is well under way with over 150 contracts awarded to date for mercury specific control technologies driven by new regulations in nineteen states, as well as existing Federal regulations on new power plants.

- Multiple control technologies are now commercially available to meet the needs for controlling mercury from different coals and various equipment configurations.

- Mercury control technologies can also take advantage of co-benefits with other air pollution control equipment for criteria pollutants. Therefore, costs can be minimized under a multi-pollutant regulatory framework in which decisions about mercury control can be integrated with decisions to address control of sulfur dioxide, nitrogen oxides, and fine particles.

- There are still challenges remaining that provide additional opportunities for technology innovations and further cost reductions.

- Flexibility in a mercury control regulation can be used to address differences in plant by plant operations resulting in reducing overall costs of implementation, overcoming technical challenges of the most difficult applications, and minimizing potential impacts on the reliability of electrical supply, while still obtaining overall high mercury removal. The recent mercury control regulations enacted in a number of states provide good examples of providing flexibility in the form of safety valves, phase in periods, and averaging between plants.

Regulations Drive Technology Investment, Innovation, and Implementation

As you should be aware, air pollution control technologies follow and respond to regulatory drivers. The synergies of state-specific actions and federal requirements have created control technology markets with considerable certainty as to when and what technologies will be needed. These regulations drive implementation of emission control technology; stimulate innovation to overcome operating issues, ultimately resulting in improved reliability, increase emission reductions, and lower costs.

We can look at the history of air pollution control technology for coal-fired power plants over the past 40 years and see that the regulations for SO_2, NO_x, and particulates have led to continuous improvements in the technology resulting in more effective pollutant removal and lower costs.

There are two primary reasons why regulations are the drivers of innovation in emission control technology. The first is due to the fact that the power generation industry has to operate under very tight cost structures. For the regulated producers, their operating expenses and capital budgets are fixed by PUCs. For the non-regulated producers they have to compete on the open market for a commodity. In both cases, they make decisions within a business environment in which they cannot economically justify the addition of new emission control equipment unless they are mandated by regulations. Therefore, from the perspective of manufacturers of emission control technologies, without a market for a product, there is no incentive to invest in a new technology or improvements of an existing technology.

In the early stages of technology development, government supported R&D is critical to overcoming the "chicken and egg" dilemma in which there is no control technology on which to base a regulation and without a regulation there is no incentive for private industry to invest in the development of the control technology. For example, progress made to date on the rapid development of commercial mercury control technology has been the result of funding from the DOE National Energy Technology Laboratory (NETL), which was supplemented by funding from the Electric Power Research Institute (EPRI) and directly from power companies to support over 40 full-scale demonstrations of mercury control technology.

The success of this mercury control program provides evidence of how R&D funding can be effectively used to stimulate the development of clean coal technology. It also shows how such funding in the early development stages provides a huge highly leveraged return to the American people.

The Federal funding reduces the risk to the technology developer, including both technology risk and the risk that no market is created for potential future sales. Once the technology has been proven, regulations can be put in place, and then the market forces can take over with further investment by the private sector.

The second reason that regulations drive innovation is that most improvements in emission control technologies result after the equipment has been installed and operated. Again looking at past history, there has been a consistent pattern of installing new emission control technology, discovery of operating issues and side effects, followed by competition among equipment providers for the development of innovative solutions to the problems that can then be incorporated throughout the industry. Therefore, once the regulations drive the installation of new equipment, improvements follow.

We have already seen examples of cost reductions for mercury control that have resulted from operating experience gained after installation of ACI equipment. In 2004, the difficulties related to capturing mercury from western coals resulting in cost estimates in excess of $100,000 per pound of mercury removed. Control at a 90% level was not achievable for many plants burning Western fuels. However, technology developers working in concert with their power producing customers discovered the root cause of this limitation, then they developed new chemically-treated sorbents to overcome the problem, and now 90% control of mercury from power plants burning Western coals is readily achievable at costs under $10,000 per pound of mercury removed. Future cost reductions are likely to occur with the development of improved sorbents designed to overcome other limitations such as higher operating temperatures, reduced interference with acid gases, and reduced impact on the sale of flyash with AC for use in concrete.

Multiple Technologies Are Available for Reducing Mercury Emissions

There are many approaches that can be taken to achieve mercury emission reductions depending on the stringency of the regulatory requirement and the boiler's operating parameters (e.g. coal type, existing emissions control systems, boiler size). Technology demonstrations have proven that significant amounts of mercury are being removed through the use of existing control technologies. Installed technologies including fabric filters, electrostatic precipitators, flue gas desulfurization, selective catalytic reduction, and others currently achieve high levels of mercury reductions. Although these processes were not originally intended, designed, nor optimized for mercury capture, the collateral mercury control is often sufficient to meet current requirements. Because mercury is captured as a co-benefit from these control technologies, the reductions are cost effective.

Recent clean air regulations for coal-fired power plants have required the installation of a significant number of flue gas desulfurization systems on coal-fired boilers to reduce emissions of SO_2. Approximately one-third of the coal-fired power plant capacity has some form of FGD installed and an additional one-third of the units are expected to have FGD systems installed by 2015. Wet flue gas desulfurization systems or wet scrubbers are able to simultaneously capture soluble mercury as a co-benefit of the SO_2 control process.

Additional mercury control can be achieved by modifying these emission control technologies to enhance their operation to capture mercury. Enhancing the performance of flue gas desulfurization systems provides one method of achieving mercury control with existing emissions control equipment. The mercury that is captured in the FGD is in the form of oxidized mercury, which is soluble in liquids. The extent of capture varies based on a number of parameters but can be enhanced with the addition of chemicals to the wet scrubber and/or through the oxidation of mercury as it passes through a selective catalytic reduction system situated upstream of the wet scrubber. Full-scale test results have demonstrated greater than 90 percent mercury removal from coal-fired power plants with SCR and wet scrubber emissions control combinations for certain coal types. Co-benefit control of mercury through a wet-FGD is likely the least cost option as a minimal amount of new capital equipment is required to achieve enhanced mercury removal.

For other mercury control options, elemental mercury can be converted to oxidized mercury so that the mercury is more easily captured in downstream air pollution control equipment. A number of these approaches are being tested and deployed today. One example of a mercury oxidizing technology that will provide additional mercury reductions is with the addition of an oxidation catalyst upstream of a wet scrubber. The catalyst oxidizes elemental mercury to oxidized mercury, which is more readily captured in liquids such as those found in wet scrubber processes. The oxidation catalyst can be installed upstream of an SCR system or as an alternative to installing an SCR system. The mercury oxidation technologies mentioned above provide a few examples of mercury control approaches that can enhance mercury capture and optimize control costs.

Mercury Specific Control Technology

Concerning mercury specific control technologies, activated carbon injection (ACI) has been successfully applied in the United States and Europe on waste-to-energy plants for over a decade with the technology being transferred to coal-fired power plants in the U.S today. The technology injects activated carbon upstream of a particulate collection device and has demonstrated mercury emission reductions as high as 80 to 95 percent.

The technology, which is shown installed at a power plant in Figure 1, is relatively simple in comparison to typical emission control equipment such as the SO_2 scrubber and fabric filter shown in the photograph. An ACI system consists of a storage silo for the activated carbon and pneumatic conveying system that injects the activated carbon at a controlled feed rate at the desired locations in the ductwork prior to the particulate control device. The mercury reacts with the particulate sorbent which is then removed in the particle control device along with the flyash. Tests have shown that the mercury is not leachable from the sorbent so that it can be disposed of in a landfill without concern for contamination of waterways. Because of their simplicity and small size, ACI systems can be retrofit on virtually any power plant with minimal engineering. In most cases, installations can be completed in as little as nine months after an order is placed. ACI technology has been tested at full-scale on over 50 coal-fired boilers in the U.S. under the Department of Energy's demonstration program and through the Electric Power Research Institute (EPRI) and other self-funded electric power industry initiatives. Because of the extensive number of full-scale demonstrations on a variety of power plants burning different coals with a broad range of equipment configurations, we now have more full scale operating and performance data on activated carbon injection technology for coal-fired power plants than was available in past instances for any other emissions control technology, such as selective catalytic reduction, prior to the development of regulations by state and federal clean air agencies.

In general, the science and understanding of mercury control technology has moved rapidly from research through development, demonstration and into full system deployment. The success of this rapid progression is the result of strong support from federal and public-private partnerships, and the ability of regulators, particularly in the states, to enact regulatory programs that harnessed the suite of control options in a flexible regulatory framework. For example, the strong research and demonstration program conducted through the U.S. Department of Energy overturned the previous assumption that sub-bituminous coals would be the most difficult and expensive to control. This issue was highlighted in a January 2005 report by the Energy Information Administration report to the Senate Environment and Public Works Committee entitled "Analysis of Alternative Mercury Control Strategies". In this report, EIA projected that mercury control regulations could increase electricity prices by as much as 2.5 cents per kW-hr. because of difficulties in treating mercury from Western coals. As a result, the report concluded that a 90% mercury control regulation would increase resource costs by $358 billion.

Through these demonstration programs, the better understanding of western, sub-bituminous coals led to successes in dramatically reducing the cost of controlling mercury emissions while increasing the control effectiveness. With the improvements in technology developed under DOE and EPRI funding, the most recent cost analyses by both EPA and DOE suggest that the costs will be only a small fraction of the earlier EIA estimates. Today, technology vendors are addressing challenging issues surrounding sorbent injection technology as it applies to eastern, bituminous coals, particularly in the presence of sulfur trioxides (SO_3).

Figure 1. Activated Carbon Injection System Capable of Achieving 90% Capture of Mercury Emissions at a Power Plant.

Other innovations have also occurred to address specific issues. Given that a number of power plants sell flyash that is captured in a particulate control device such as an electrostatic precipitator, the presence of activated carbon in flyash became a challenge. To avoid the potential loss of flyash sales to the concrete industry, the Electric Power Research Institute (EPRI) developed two control systems to meet these challenge, TOXECON™ and TOXECON II™. TOXECON allows flyash to be collected by the electrostatic precipitator, and then injects the sorbent downstream where it is collected in a fabric filter. This preserves the flyash for sale, and controls mercury emissions. In a second system, TOXECON II™ injects the sorbent between the last two fields in an electrostatic precipitator, allowing at least 90 percent of the flyash to be sold and only 10 percent of the flyash to be commingled with activated carbon. The activated carbon can then be disposed of with the flyash.

The installation of a TOXECON™ system at the WE Energies Presque Isle Power Plant in Marquette, Michigan in 2006 as part of a DOE Clean Coal Program represented the first commercial operation of a mercury specific control system to the power industry. The Presque Isle system has been operating at 90% mercury control levels for over two years. Typical of many first installations of emission control technology, some operating problems were encountered during startup. The root cause of the problems was discovered, and new operating procedures were developed and implemented that can now be used in other commercial systems based upon this technology.

Commercial Market

Today, control technology vendors are actively installing mercury control systems across the United States to meet regulations in nineteen states for existing plants and permit requirements for new power plants. The air pollution control industry has reported booking new contracts for mercury specific control equipment, primarily activated carbon injection, on coal-fired power plant boilers representing a vast range of boiler configurations, sizes, and coal-types. This has been a very competitive market with more than a half dozen companies having won contracts for over 150 ACI systems. These bookings are for controlling mercury on new and existing boilers ranging in size from 52 to 880 MW in capacity with the average size unit being 500 MW in size. The technology bookings are for all three of the predominant types of coal burned in U.S. electric power boilers including subbituminous, bituminous, and lignite coals. The diversity of coal burned by the units is broad including units burning high-sulfur bituminous, low-sulfur subbituminous, bituminous blended with biomass, western bituminous and subbituminous blends, bituminous blends, and lignite/subbituminous multi-fuel applications.

The performance of the commercial mercury control systems was highlighted in a study by U.S. Government Accountability Office that was conducted for the EPW committee. This October, 2009 study reported that sorbent-injection systems achieved substantial mercury reductions on all three main types of coal and on boiler configurations that exist at nearly three-fourths of U.S. coal-fired power plants. Specific findings included:

- Sorbent-injection systems are seen by the Department of Energy as a promising technology since they cost an average of $3.6 million per plant, which is low compared to other types of emission-control equipment.

- The managers of 14 coal-fired power plants reported that they currently operate sorbent injection systems on 25 boilers to meet the mercury emissions reduction requirements of five states and several consent decrees and construction permits. Data from power plants show that these boilers have achieved, on average, reductions in mercury emissions of about 90 percent.

- Of note, all 25 boilers currently operating sorbent injection systems nationwide have met or surpassed their relevant regulatory mercury requirements, according to plant managers.

Mercury control is a good example of the fact that once regulations are put in place, the resulting market forces stimulate investment by the private sector. Recognizing the increase in demand for activated carbon driven by the State regulations, ADA made plans and investments into new and expanded activated carbon production facilities. We led the effort to build what will be the largest and most environmental friendly AC manufacturing plant in the US. This plant, which is shown in Figure 2, is located in Louisiana and is scheduled to startup this spring and will have the capacity to produce 150,000 million pounds of activated carbon annually. In addition, the Louisiana plant is already permitted for another line of equal size and we've initiated permitting on four additional AC production lines to produce the approximately 1 billion pounds per year that may be required to meet a strict Federal rule. This would require in capital investments of nearly $2 Billion.

Figure 2. ADA Activated Carbon Manufacturing Plant Being Built in NW Louisiana.

Flexibility in the Regulation Reduces Costs and Enables Smooth Implementation

All power plants are not created equal as they are engineered for specific conditions and needs. Different coal types, boiler designs, and power plant configurations will provide a variety of technical challenges that will result in significant plant by plant variations in the costs to implement high levels of emissions reductions. This has also been the challenge for the application of emissions control technologies for other pollutants on coal-fired power plants that has spurred the development of a suite of control technology options for each pollutant.

Flexibility as a part of emission regulations is good for both technology suppliers and users so that emission reduction goals can be attained while reducing risks and lowering costs. The more stringent the regulation, the more important the issue of flexibility becomes. With potential regulations requiring 90% removal of mercury, flexibility can be invaluable in reducing costs and risks.

ADA supports flexibility in a regulation because it can be proven to reduce overall costs of controlling emissions including significant burdens for the most challenging applications. In addition, a well designed program will ultimately result in achieving greater reductions in mercury emissions without jeopardizing the reliability of electricity supply. Some options for providing flexibility include:

- To level out site by site differences in the costs to implement control strategies, market-based cap-and-trade programs or system-wide averaging have proven effective. While the emission control cap required by CAMR was much too low to overcome concerns over hotspots, a 90% requirement would minimize this concern.

- Phased approaches that incrementally require more emissions reductions over time reduce risk to both the power generator and the equipment supplier. A two-phased approach might be one method of dealing with the timing discrepancy in a multi-pollutant regulation such as this three pollutant bill. For plants that burn bituminous coals, the SCRs that will be installed for control of NOx and the scrubbers that will be installed for control of SO_2 will be a key part of their mercury control strategy. However, the 2015 deadline for reducing mercury emissions will occur a few years before the SCRs and scrubbers are installed. Therefore, it may be appropriate to have a lower mercury reduction threshold for plants that have agreed to install multi-pollutant equipment at a later time.

- Concepts such as "soft landings" and "safety valves" permit the installation of the technology and set the emissions limits based on the best performance achievable from the newly installed equipment. This greatly reduces costs and risks at plants that run into unexpected limitations on performance because of specific design or operating characteristics. The mercury regulation passed by the State of Illinois EPA for their sixty plus coal-fired power plants is a good example of an effective use of this concept. The rule was based upon data from DOE demonstrations and commercial ACI installations that indicated that 90% reduction could be achieved at many plants at a feed rate of 3 pounds of activated carbon per million cubic feet of flue gas treated (lb/MMacf). To provide a safety valve, the rule was set for 90% reduction by July 2009 with the caveat that if a plant injected a high-quality AC at 5 lb/MMacf and did not achieve 90% reduction, then it would be considered in compliance until 2015 when it would have to take additional measures to achieve the 90%. This type of approach achieves near-term reductions of mercury emissions, while allowing for plants on a case by case basis to continue to operate if the initial attempt to meet the emission standard is not completely successful.

- Flexibility in the form of a multipollutant approach can potentially create the greatest cost reductions. All mercury control technologies incorporate interactions with other air pollution control equipment often resulting in co-benefits. This includes oxidation of mercury across SCRs, capture of mercury in wet scrubbers, and increased fine particle capture and higher mercury removal when ACI is used with a fabric filter. Therefore, costs can be minimized under a multi-pollutant regulatory framework in which decisions about mercury can be integrated with strategies to address other criteria pollutants.

There are many examples of these types of flexibility that have been used in the more than a dozen state regulations that have been implemented for mercury control. However, many of these options are not available to EPA when forced to operate under a MACT regulatory environment. To fully take advantage of all of the options for flexibility in a mercury control regulation, it will be necessary for Congress to address this issue through legislation.

Emission Control Regulations Create Jobs

Mercury control regulations will impact growth of new jobs as have previous regulations of other pollutants. For a mercury specific control technology, such as activated carbon injection (ACI), a great deal of expansion of activated carbon production is currently being planned, but is contingent on a Federal mercury regulation.

These expansion plans will be implemented in a timely manner to meet the market created by a Federal mercury control rule. It is estimated that a 90% mercury control rule could require capital investments for new AC production plants creating $2 Billion in construction jobs. In addition to the construction jobs to build the plants, there will be continuous operating jobs to run the new facilities, as well as mining jobs to supply the feedstock material needed to make AC.

In order to finance these expansions, it will be necessary to have certainty in the regulations. Building a large scale AC production facility is a three to five year process which must begin in anticipation of a regulation. However, construction cannot begin until the regulations are final. Debt financing is challenging to obtain when lenders are concerned that the regulation creating the market for the product from the new plant might disappear as was the case with CAMR.

In summary, the air pollution control industry continues to work with power plant operators to ensure that mercury control systems are integrated into the facility's design and specific coal requirements, and that any operational issues can be addressed. Significant advancements continue to be made in mercury control technology and commercial deployment is ongoing.