SUBJECT: Further Information Concerning the Use of Continuous Emission Monitors at Coal-fired Electric Generating Units

TO: Dr. James Whelan, Researcher and Community Organizer, Environmental Justice Australia

FROM: Bruce C. Buckheit[1] and Dr. Ranjit Sahu[2]

You have asked us to review the responses of certain Australian coal-fired power plant operators to a proposal by the New South Wales Environmental Protection Agency (NSW-EPA) to incorporate continuous emission monitoring requirements in licenses for these plants. As we understand the correspondence with NSW-EPA, power station operators (via their consultant, Jacobs) are opposed to continuous emission monitoring. Instead, they advocate opacity monitoring of undifferentiated particles. They are opposed to methods referred to as SP3, PS11 or USEPA performance specification 11 which they describe as expensive, cumbersome and prone to error. Some operators also oppose the NSW-EPA's proposal that moisture, oxygen, temperature and volumetric flow rate be continuously monitored. We also understand that NSW-EPA has withdrawn its original proposal and may issue licenses with far less rigorous monitoring requirements.

We believe that issuing permits without a full suite of today's monitoring technologies is not in the public interest and would not satisfy NSW-EPA's duty to consider the objectives of the EPA as referred to in section 6 of the *Protection of the Environment Administration Act 1991*, specifically,

(a) to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development, and

(b) to reduce the risks to human health and prevent the degradation of the environment, by means such as the following:
- promoting pollution prevention,
- adopting the principle of reducing to harmless levels the discharge into the air, water or land of substances likely to cause harm to the environment,
- setting mandatory targets for environmental improvement,
- promoting community involvement in decisions about environmental matters,
- ensuring the community has access to relevant information about hazardous substances arising from, or stored, used or sold by, any industry or public authority.

According its website, under the *Protection of the Environment Operations Act 1997*, the NSW-EPA must include license conditions that relate to

- **complying with the law** to prevent and monitor pollution
- **improving performance** through pollution reduction studies and programs
- **cleaner production** through implementing best practice.

CEMS ARE A MATURE AND COMMONLY EMPLOYED TECHNOLOGY.

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CEMS have been employed in Europe for several decades. Over1000 U.S. electric generating units (EGUs) subject to Title IV of our CAA have employed NOx and SO_2 CEMs for approximately 30 years. The data from these sources are publicly available at ampd.epa.gov. Broadly speaking PM CEMs are simply continuous opacity monitors that are calibrated to the filterable PM emissions at the individual stack.[3] USEPA started requiring PM CEMs as part of its settlements of power plant enforcement actions in the late 1990s. More recently, air toxics rules for cement kilns and settlements with other types of sources such as smelters and steel mills have required or considered the use of PM CEMs. EPA's MATS (mercury and air toxics) rule authorized the use of PM CEMS at coal-fired power plants as an alternative to periodic reference method tests and approximately half of the plant operators **voluntarily** selected this option as simpler and less expensive than periodic reference method stack testing.[4] Further, industry publications have recently recognized the advantages of PM CEMS over periodic reference testing and encouraged those operators who did not initially choose PM CEMS for MATS compliance to reconsider their earlier decision.[5] It should be noted that the Jacobs Report and other assertions that PM CEMS are "cumbersome", "difficult" and other complaints by unidentified sources are unsupported by any factual record. The "real world" application of PM CEMS cited herein refute the unsupported claims that PM CEMS are impracticable.

New South Wales and other Australian states rely heavily on model-predicted concentrations of NAAQS pollutants to ensure compliance, and infer that the public health is protected. We have each separately commented that this approach is inadequate for this purpose. Providing real time source emissions for PM and its precursors (SO_2 and NOx) can help in determining whether the current modeling is protective of the health of NSW residents.

In our experience some operators oppose CEMS because the monitoring is continuous, and would require them to pay more attention to the operation and maintenance of their pollution control devices under all plant operating conditions, as opposed to infrequent stack testing, often conducted under ideal conditions not reflective of day-to-day operations. This is exactly why NSW-EPA should insist on the installation of the full suite of CEMS (including PM and Hg CEMS) and the near real-time posting of the data on a publicly accessible website.

CEMS ARE NOT "COST PROHIBITIVE"

In fact, CEMs are the most cost-effective pollution monitors available in the market today. With annual plant operating costs in the tens of thousands of dollars each year, these devices provide information that allows the operator to more efficiently operate the unit and its pollution controls that may cost hundreds of millions of dollars. Thus, CEMS not only provide critical air emissions data; they are also highly useful as process monitors. US plants routinely integrate

[3] There are technical differences, including the color of the light source and several alternative technologies. The following demonstrates the state of knowledge 12 years ago - https://www.burnsmcd.com/.../pm-cems... _/articletechnicalpaperpmcemsmonitoringpart...

[4] http://apps.nelac-institute.org/nemc/2016/docs/presentations/Tue-Air%20Methods%20&%20Monitoring%20-%20Session%201-8.2-Parker.pdf

[5] https://www.powermag.com/simplify-mats-compliance-particulate-matter-continuous-emission-monitors/

CEMS data into the plant process controls so that operators can make adjustments (such as air/fuel ratio control adjustments, based on observed NOx emissions, as an example) to the unit itself.

The utilities argue that PM CEMs would cost up to $170,000 for the initial purchase and installation and (perhaps) several thousand dollars per year in additional external calibration costs. While some sources[6] suggest that these estimates are too high, even if one accepts this figure, but determines the cost over the expected life of the monitor, it can readily be seen that the cost is trivial. Using a useful life of 15 years and a 10 percent interest rate, the annual capital cost amounts to a little over $20,000 per annum. Including operating and maintenance and calibration costs, the annual estimate might be perhaps $30,000-$40,000 per year. A 500MW power plant operating at a 70 percent capacity factor in the U.S., where wholesale electricity prices average $40 MWh, would earn slightly over $120 million dollars per year in wholesale revenue and substantially more if it is in the retail market. It is hard to see how an expense in the tens or hundreds of thousands of dollars per year can be considered "prohibitive," especially in consideration of the tens of thousands of tonnes of pollution emitted into the NSW air shed each year by each of these sources. Any analysis of the supposed "cost" should also consider the monetary value of the benefits of reduced health care and other costs associated with the reduction in pollution that can be expected from the installation of CEMS and timely publication of the resulting data.

Gaseous emission monitors, such as SO_2 and NOx monitors cost far less to install and calibrate, since they can be calibrated against known standards. Moreover, a full suite of continuous emission monitors can share the cost of the flow monitor, O_2 monitor and the data acquisition system with the PM CEMs system.

As noted earlier, reference method stack testing, done periodically under ideal conditions, is sometimes referred to as a "beauty contest". The source receives a notice from the state (perhaps in the form of a permit condition) that it must conduct a test in the next several months. Ample time is provided for the source to engage a testing contractor – and to "optimize" the unit for the time (typically three hours) of the test. If the source fails, a retest is ordinarily allowed after repairs/upgrades to the unit. Thus, a reference method test tells the regulators and the public what the source can do "on its best day", not what it is doing "day in and day out". In USEPA's experience, PM control devices that were enforced with periodic reference method tests and opacity monitoring were allowed to deteriorate in their performance over time. For this reason the agency's enforcement actions in the late 1990s and thereafter required upgrades to PM control devices and PM CEMs.

OPACITY IS A POOR SUBSTITUTE FOR PM

Opacity readings, even at the same level of PM concentrations, differ because of the shape and composition of the particles and other. And during the beauty-contest PM reference method compliance testing opacity is usually 5 percent or less. However, opacity limits in New South Wales are either 20 percent or 60 percent. Each of these opacity limits can be met even when the source is not in compliance with its PM limits. Thus, compliance with the lenient opacity standards means little to nothing as far as PM emissions.

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[6] See, e.g., http://www.mcilvainecompany.com/Decision_Tree/2015%20WEBINARS/April%202015/Derek%20Stuart,%20Ametek%20-%204-16-15.jpg.pdf

NSW-EPA SHOULD REQUIRE STUDIES TO QUANTIFY EMISSIONS OF DIOXINS AND FURANS AND SEEK TO MINIMIZE EMISSIONS OF THESE SUBSTANCES

Dioxins and furans are among the most toxic chemicals known to man.[7] Power plants can be substantial sources of these chemicals and their tall stacks permit wide dispersion that can affect the food supply, which is the source of most human uptake of these toxins. Further, the factors that lead to the creation of important isomers of these chemicals are complex. Other countries have conducted such studies and there is no reason why Australian power plants should not at least examine their levels of emissions of these classes of pollutants and what, if anything, can or should be done to reduce them.[8] The U.S. MATS standards for power plants set forth work practices, instead of numerical limits, to limit emissions of organic air toxics, including dioxin/furan, from existing and new coal- and oil-fired power plants. Because dioxins and furans form as a result of inevitable, inefficient combustion, the work practice standards require an annual performance test program for each unit that includes inspection, adjustment, and/or maintenance and repairs to ensure optimal combustion.

[7] https://www.who.int/news-room/fact-sheets/detail/dioxins-and-their-effects-on-human-health

[8] Carbon injection, used for reducing mercury emissions, have been found effective in reducing dioxin/furan emissions.