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INQUIRY INTO PROTECTION OF THE ENVIRONMENT OPERATIONS AMENDMENT (CLEAN AIR) BILL 2021

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Submission to the Parliamentary Inquiry into the Protection of the Environment Operations Amendment (Clean Air) Bill 2021

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INTRODUCTION

[1] Mr. Buckheit is a consultant in the area of energy and environment, with degrees in Physics and Law. Formerly, he was a member of the Virginia Air Pollution Control Board, the Director of USEPA's Air Enforcement Division and Senior Counsel to the USDOJ's Environmental Enforcement Division. The opinions expressed in this report are based the author's 37 years of experience in studying, regulating and enforcing clean air regulation of coal and lignite-fired Electric Generating Units (EGUs), the cited references and generally available reference materials. In addition, these comments are based on reviews conducted by the author over the past several years of license reviews and other regulatory actions respecting Australia's coal-fired EGUs. The author's resume is attached hereto.

This report responds to a request by the Parliament of New South Wales (NSW) for information concerning proposed Clean Air Bill 2021 (CAB 2021) which, in substance would amend section 128 of the Protection of the Environment Operations Act 1997 to set specific emission limits for power station pollutants commonly regulated in most global economies; specifically:
Nitrogen Oxides (NOx) – 200 mg/m^3
Sulphur Dioxide (SO_2) – 200 mg/m^3
Filterable Particulate Matter less than 10 microns in diameter (PM_{10}), referred to in the proposed legislation as Total Particulate Matter (TPM) – 20 mg/m^3
Mercury – 1.5 ug/m^3

COMMENT

The EGUs at issue emit Class I pollutants (PM10, SO_2, NOx, CO, and lead), Class II pollutants ($PM_{2.5}$, mercury, hydrogen chloride, chromium, ammonia, and nitric acid) and Class III pollutants (arsenic, beryllium, cadmium, hexavalent chromium, nickel, dioxins and furans.

The proposed CAB 2021 emissions limits are conservative in that they do not call for the lowest emissions levels possible with today's technology. Rather, the proposed limits represent reasonable "mainstream" application of today's technologies over a variety of underlying power station design and coal/lignite choices and provide an ample margin of compliance for the range of NSW EGUs. These limits should be considered as an "upper bound" of acceptable emission limits in that less stringent limits would not require use of the most effective pollution control technologies.

Table 1: Emission levels that can be achieved with installation of BACT for existing coal-fired power stations[2]

	Annual Average (mg/m^3)	**Short term (daily or reference test) (mg/m^3)**
PM[3]	2-8	3-11
SO_2 & SO_3	10-130	25-165
NO_x (coal)	65-150	<85-165
NO_x (lignite)	<85-150	140-165
Hg (coal)	<1-4 ug/m^3	<1-4 ug/m^3
Hg (lignite)	<1-7 ug/m^3	<1-7 ug/m^3

[2] See: Commission Implementing Decision (EU) 2017/1442 of July 2017, establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants. *"BAT Associated Emission Levels, Section 2 "BAT Conclusions for the Combustion of Solid Fuels"*, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503383091262&uri=CELEX%3A32017D1442

[3] The EU Directive assigns slightly less stringent limits (2-10 mg/m^3; 3-11mg/m^3) to plants with a heat input of less than 1000 MW of thermal input (approximately 280-320 MW electric output).

Table 2: Representative emission limits for existing coal-fired power stations in other jurisdictions

	SO_2 (mg/m^3)	NO_x (mg/m^3)	PM (mg/m^3)	Hg (ug/m^3)
China[4]	35	50	10-30	30
Japan[5]	65.4	41.4	14.3	10
South Korea[6]	65.4	28.2	10	50
U.S.[7]	60	99	23	1.7/15.3[8]
EU[9]	75	85	20	2.0/4.0[10]

The US and the European Union (EU) have long employed both technology-based approaches and risk-based approaches to the management of air pollution. Technology-based approaches (BACT and BAT) complement risk-based management by favoring the lowest cost options for pollution reduction (i.e., the largest emitters) and preserving "head space" in the emissions inventory to permit ongoing economic development without significant adverse health impacts. It appears that NSW EPA policy has evolved to the point where the benefits of technology-based options and the limitations of risk management approaches are not properly considered. Thus, for example, for the very largest emitters in the state (coal-fired EGUs) NSW currently establishes no limits for SO_2 emissions and lax NOx emission limits that merely reflect uncontrolled emissions. CAB 2021 would rectify this deficiency for the power sector.

In 2019, The Australian Energy Council retained WSP Global, an international engineering firm to estimate the cost of retrofitting Australia power stations with Flue Gas Desulphurization (FGD) for SO_2 control, Selective Catalytic Reduction (SCR) for NOx control and Activated Carbon Injection[11] (ACI) for mercury control. Based on the cost estimates generated by this study,[12] the capital projects

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[4] 火电厂大气污染物排放标准/Emission standard of air pollutants for thermal power plants (GB 13223-2011). Partial English translation: https://english.mee.gov.cn/Resources/standards/Air_Environment/Emission_standard1/201201/W020110923324406748154.pdf, Full English translation available at: https://www.codeofchina.com/search/default.html?page=1&keyword=GB13223-2011

[5] See: http://www.env.go.jp/air/osen/law/t-kise-1.html

[6] See: http://www.law.go.kr/lsInfoP.do?lsiSeq=155442#AJAX; http://netl.doe.gov/publications/proceedings/99/99korea/edkim.pdf; http://www.neaspec.org/sites/default/files/S2_17pm_Ki-Suh(KCC).pdf

[7] See: http://www.gpo.gov/fdsys/pkg/FR-2012-02-16/pdf/2012-806.pdf; http://www.gpo.gov/fdsys/pkg/FR-2013-04-24/pdf/2013-07859.pdf; http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title40/40cfr60_main_02.tpl

[8] Higher limit is for lignite plants.

[9] See: Large Combustion Plants Directive, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1402653842533&uri=CELEX:32001L0080; Industrial Emissions Directive, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075

[10] Higher limit is for lignite plants.

[11] And fabric filters where necessary.

[12] https://www.energycouncil.com.au/media/dtyjfcdh/addendum-and-report.pdf. This reference is not intended as an acknowledgement that the industry sponsored cost estimates are correct.

required to comply with CAB 2021 would require an investment on the order of AUD$ 4 billion[13] over the next 8 years and create hundreds of new, well paid, construction jobs during that period. This capital expenditure would be funded by lending or a mix of equity and loan funds. If fully supported by loans over the useful life of the controls/power station and fully passed on to consumers, these costs, and the associated operating costs, would result in a nominal, and perhaps unnoticeable increase in user utility bills. This is because the estimated cost increase to the consumer (< 5 percent) is on the order of magnitude as the volatility in fuel and other operating costs currently experienced by the power station operators. The specific cost to the user depends on the fraction of total system generation that is coal-fired, the capacity factor of those power stations, user consumption and approved rate design, but nominally would be on the order of a few cents per day per capita.

There is also a question as to whether the operators would be able to pass these costs on to the consumers. The Australian wholesale energy market operates to dispatch generation on a merit order basis. Stations with higher operating costs will dispatch less often and the retail energy market has its own pricing structure, where consumers are free to choose suppliers. In such a market operators of coal-fired power stations may be price constrained and not be able to raise rates to consumers.

Australia is ranked higher by the World Bank in terms of per capita Gross Domestic Product (GDP) on a purchasing power parity (PPP) basis than a number of other countries that have implemented the far more stringent emission limits on power station emissions cited herein, including[14] China, Japan, the EU as a whole, South Korea, Britain and France. Accordingly, there is no reason to believe that Australia cannot afford effective pollution controls.

In the course of responding to environmental agencies during license reviews and other fora, operators have argued that the controls that would be required by CAB 2021 are not "viable" given:

- "the relatively low environmental benefits of further emissions reductions in the context of the existing high ambient air quality;
- the significant technical risks which give rise to potential implications for the ongoing security of electricity supply for Victoria and across the Australian national electricity
- site based constraints; and market;
- the very high costs of certain emission reduction options."[15]

With respect to the first of these objections it should be noted that:

> 1. Emissions from power stations add to the harm resulting from emissions from other sources such as motor vehicles and woodstoves and are more amenable to additional reductions controlled than the latter. Generation of electricity cannot be "offshored" to

[1313] This figure assumes that all existing units other than Liddell would retrofit with controls rather than retire, which may not be correct given the age of certain units. Liddell's operator has announced its retirement in 2022.

[14] https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?most_recent_value_desc=true

[15] See, letter from AGL's consultant, HRL Technology Group Pty Ltd (HRL), to EPA Victoria, dated 23 August, 2019.

foreign countries in the way that manufacturing can and so, emission reductions in this sector come at a reduced risk to NSW's overall economy than reduction imposed on others in the manufacturing sector.

2. This approach provides no reserve margin to protect public health during pollution episodes caused by unusual weather events, such as the inversions that caused severe public health impacts in London, Birmingham and elsewhere -- and the bushfires that affected Australia in recent times. Without controls, emissions from power stations unnecessarily exacerbate conditions resulting from those bushfires.

3. This approach does not protect against degradation of air quality in areas that currently have "clean" air.

4. Over time and as additional data are available, ambient air quality standards have been lowered in the U.S., Australia and elsewhere around the world for existing "criteria" pollutants and new standards adopted for pollutants previously not regulated (i.e., $PM_{2.5}$). This history cautions against over reliance on the current NEPM as fully protective.

5. NAAQS/NEPM are commonly not set at a level that will protect the most sensitive populations.

6. There is no known "safe level" for exposure to $PM_{2.5}$.

7. Emissions from tall stacks, such as those employed at power stations, can travel hundreds of kilometers and add to local pollution in areas well downwind, including Greater Metropolitan Sydney. The majority of the $PM_{2.5}$ in Northern Virginia where I live is generated by large emitting sources (primarily coal-fired EGUs) in upwind states (West Virginia, Pennsylvania and Ohio). It is reasonably well documented that monitoring networks in NSW are not sufficiently robust to fully assess transport and existing levels of air pollution.

8. Actual emissions of PM_{10} and $PM_{2.5}$, including condensable PM emissions, are not well known. Testing for condensable PM is limited to infrequent reference method tests, with advance knowledge to the facility and an opportunity for the facility to "optimize" performance during the test. The recent NPI submissions from power station operators show an unexplained and concerning level of variability in the ratio of filterable to condensable PM at coal and lignite-fired EGUs. Wet FGDs can dramatically reduce emissions of condensable PM.

9. Data regarding ambient concentrations of Class 2 and 3 pollutants are quite limited. NSW does not adequately monitor to determine the extent to which emissions of Class 2 and 3 pollutants from its coal-fired EGUs pose a significant public health risk at discrete locations throughout the state. It is also not clear that sufficient monitoring and modeling have been conducted to evaluate the extent to which emissions from these facilities may lead to exceedances of design values or NEPM for these pollutants. These data are also lacking in the U.S. The inability of the USEPA to adequately regulate

emissions of HAPs based on risk led to the adoption of technology-based MACT standards. The BACT level controls discussed below (FGD, SCR and fabric filters) can substantially reduce emissions of many HAPs emitted by coal-fired EGUs.

10. A number of air dispersion models do not accurately predict ambient pollution levels during quiescent (low wind velocity) time frames. It is not clear that the modeling relied on by operators evaluates the potential for plume looping and/or stagnation/ fumigation during those periods.

11.FGD/SCR control of SO_2 and NOx provides substantial co-benefits in terms of reducing secondary formation of $PM_{2.5}$ and ozone and inexpensive control of mercury emissions.

During my tenure as the National Program Manager for Clean Air Act Enforcement at the USEPA we determined that many coal-fired power stations had violated our "modification" rule[16] and so were obliged to retrofit BACT – including SCR and FGD. In those cases, the operators raised many of the same feasibility objections. I signed the notices of violations and personally participated in many of those settlement discussions, inspected facilities and, while some configurations were more costly than others, we never encountered a facility where retrofit was infeasible. The scope of this effort was far larger and involved many more power stations than exist in NSW.[17] Since coal-fired power station designs are essentially "international", it is highly unlikely that any of NSW's EGUs are of such a unique design that installation of these controls is, in fact, infeasible (i.e., "cannot be done"). My review of Australia's power stations over the past four years has included GoogleEarth visits that reveal that these stations generally are located at semi-remote locations with adequate space for controls. In any event, the operators have offered no specific documentation for assertions of infeasibility.

The controls that would be required by CAB 2021 have been installed in hundreds, if not thousands of applications throughout the world, over a broad range of site and environmental operating conditions. Thus far, NSW EGU operators have not contracted for the engineering services necessary to design and construct these devices and so have no basis to assert that there are technical risks that have not been addressed and resolved in those installations. I was a contributor to Section 3 of EJA's Clean Air Strategy and developed the template schedule for installation of controls in that document. In order to ensure adequate supply of electricity during the "tie in" shut down and to rebut anticipated arguments about a shortage of skilled boilermakers (as was falsely claimed in the U.S.) the strategy set out specific retrofit dates that staggered installation of controls within a market. The template schedule also called for the installation of the pollution controls to occur during spring and fall seasons, when demand is lowest and there is ordinarily excess capacity in the market. It also limited the installations to no more than one unit at any power station at any time[18] and phases in the installation of these

[16] Given the age of a number of NSW's power stations, there is a reasonable likelihood that some units have violated NSW's modification rules.

[17] See, https://www.epa.gov/enforcement/coal-fired-power-plant-enforcement, for the overall scope of these settlements.

[18] Operators may choose to share controls and stacks at a power station.

controls over several years.

If controls are not mandated in the near term, the argument to do so in the future becomes weaker as the time to retirement is shortened. And so, a deferral at this time creates a risk that the public will be subject to unabated SO_2, NOx and hazardous air pollutant emissions from these power stations for decades into the future.

Thank you for the opportunity to submit these comments. I am available at your convenience to answer any questions you may have and provide underlying support for these comments.

Attachment A: Resume of Bruce C. Buckheit