Review of the Facility Operators' Responses to Community Submissions Respecting Ongoing Victoria Power Station License Reviews

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SUMMARY

At the request of Environment Justice Australia (EJA) I have undertaken a review of the responses of Energy Australia Yallourn (EAY), AGL Loy Yang Pty Limited (AGL) and IPM Operations & Maintenance Loy Yang Pty, Ltd. (IPM) (jointly referred to as the "facility operators") to issues raised by the public respecting the ongoing five-year review of the operating licenses for the Yallourn, Loy Yang A and Loy Yang B power stations by the Environment Protection Agency Victoria (EPA). I note that EJA has submitted comments, including those of Dr. Ron Sahu, concerning this matter. I have worked with Dr. Sahu for a number of years and have always found his views to be credible and well supported. So too, for the comments he prepared for EJA, and so I will not repeat in any depth matters that he has already covered. The comments provided herein reflect my own views and not those of any other person or organization.

A number of other commenters also submitted meaningful comments worthy of consideration and analysis. However, in general, many of the responses of the facility operators do not, in fact, respond to the specific comments raised by members of the public. Rather, those responses mostly consist of a number of general assertions of good corporate behavior. The facility operator responses also include a number of assumptions and factual assertions that are not supported by the underlying facts and/or are inconsistent with the structure of Victorian and Australian clean air requirements.

As in the United States, the Victorian air pollution regulatory scheme includes a risk-based National Ambient Air Quality Standard (NAAQS) component and, to attempt to compensate for the limitations of risk-based standard setting, a technology-forcing best available technology (BAT) component. The facility operators attempt to ignore the latter and offer no demonstration that the cost of upgrading pollution controls at existing plants so high as to be infeasible or that they have been making continuous progress as required by existing license requirements. Further, the publicly available monitoring data do not support the assertion that the air quality in the Latrobe Valley is so clean that further improvement is unnecessary or impracticable. Best practice technology for the Latrobe Valley power stations includes flue gas desulfurization (FDG), selective catalytic reduction (SCR), upgraded particulate matter (PM) controls and activated carbon injection (ACI) for mercury control. These technologies are cost effective and feasible.

The claim by each of the facility operators that continuous monitoring devices for particulate matter (PM CEMs) are not commercially available is simply incorrect. These devices are commercially available, are increasingly being required for new and existing coal plants in the United States and Europe. USEPA investigations in the late 1990s documented the lack of maintenance of existing ESPs and resulting degradation in performance of these devices over time. These investigations established that continuous PM monitors are are necessary to ensure compliance with protective PM emission limits.

Waste oils may contain a number of extremely hazardous chemicals and their combustion may produce high levels of other hazardous emissions as the products of incomplete combustion (PICs). The use of waste oil for unit startup – a time when PM controls may not be in operation - is a particularly dangerous practice that should not be permitted.

Finally, technical advances over the past 20 years remove any argument to limit transparency of operations. There are no cost or other barriers to near real time posting of operating and monitoring data to a publicly available website. Such transparency can serve as a low cost means of reducing risk to the public as it encourages facility operators to pay attention to detail in their day-to-day operation of their facilities and alerts the public and regulators to potential problems far sooner and more effectively than annual summaries.

ABOUT THE AUTHOR

Mr. Buckheit has advanced degrees in physics and law and, for over 30 years, worked for the U.S. Government, serving as Senior Counsel in the U.S. DOJ's Environmental Enforcement Section and as Director of U.S. EPA's Air Enforcement Division. After leaving Federal service in 2004, Mr. Buckheit was appointed to the Virginia Air Pollution Control Board, which is responsible for policy and direction of clean air regulation in the Commonwealth of Virginia. Mr. Buckheit currently provides technical and strategic advice to a broad range of government agencies, corporations, state organizations and environmental groups on issues at the intersection of energy and the environment. These activities have included analysis, advice and comment on a number of U.S. domestic issues, including carbon emission reduction from U.S. power plants, nonconventional oil and gas exploration and development (fracking), hazardous air pollutant emissions from industrial, commercial and institutional boilers, diesel truck emission reduction programs, demand side management regulation in New England and barriers to the development of renewable energy in the mid-Atlantic states. Mr. Buckheit has also been involved in a number of international issues, including analysis and comment on U.S. Exim Bank, World Bank and other international lending agency policies for support of fossil fuel-fired generation, analysis of economic risk associated with reliance on imports of international steam coal for generation and country-specific issues in Armenia, Kosovo, Turkey, Viet Nam, Japan, India, Myanmar and Indonesia.

GUIDING PRINCIPLES FOR THIS REVIEW

Australian and U.S. environmental law each devolve from English common law where private use of "the commons" may be constrained by the interest of the public that jointly owns those commons. The facility operators own their plants, but they do not have an ownership in the Latrobe Valley air and watersheds into which they discharge quite substantial quantities of pollutants. The terms and conditions of those discharges are a matter of public interest, not private right. The cost of pollution controls imposed to protect the public interest will ultimately (and properly) be borne by the customers of the facility – i.e., the public. Here, it should be noted that limiting pollution from large coal-fired power plants is the most cost-effective option for managing pollution from stationary sources – far more cost-effective than attempting to limit pollution from small businesses or individuals. Further, generation of electricity cannot be "offshored." Thus, unlike requiring controls at manufacturing facilities, there is no real argument that requiring controls will encourage power plant operators to shift operations to other countries.

For industries, including lignite-fired electric generating units, where industry-specific emission limits have not been applied, the relevant requirements are found in the State Environmental Protection Policy (Air Quality Management) (SEPP (AQM)) and State Environmental Protection Policy (Ambient Air Quality) (SEPP (AAQ)). Pursuant to the SEPP (AQM)[1] generators of emissions must:

(a) manage their activities and emissions in accordance with the aims, principles and intent of the policy;

(b) pursue continuous improvement in their environmental management practices and environmental performance; and

(c) apply best practice to the management of their emissions or, if they emit Class 3 indicators, reduce those emissions to the maximum extent achievable.

[1] *Victoria Government Gazette* S 240 21 December 2001 (SEPP (AQM)).

"Best Practice" is defined as:

> "the best combination of eco-efficient techniques, methods, processes or technology used in an industry sector or activity that demonstrably minimizes the environmental impact of a generator of emissions in that industry sector or activity."

The SEPP (AQM) provides an "intervention level" table of ambient air quality levels (Schedule B) and a note stating that the Schedule B intervention level table is to be used to determine whether the "Beneficial Uses" of Clause 9 of the SEPP are being protected. Under the SEPP (AQM) exceedances of the intervention levels in ambient air may trigger an obligation to develop a neighbourhood environment improvement plan (NEIP). According to the SEPP (AQM)

> "These [intervention] levels should not considered as 'acceptable' levels but as levels that, if exceeded, would trigger action to improve local air quality through a NEIP process.[2]

Australian licensing (permitting) practice is far different from U.S. practice. U.S. permits, provide quite specific terms and conditions for each facet of a facility's operation.[3]

In contrast, the licenses under review provide only "high level" obligations such as

> "You must establish and implement a risk based monitoring program that enables you and EPA to determine compliance with each condition of this licence. The monitoring program must comply with the requirements of the monitoring guidelines (EPA document 1321.2, released June 2011)."

In this regard, Victorian EPA's Monitoring Guidelines (document 1321.2) provide only that

> "EPA expects businesses to have robust systems and processes in place to ensure that performance against the licence is adequately assessed and demonstrated."

This evaluation seeks to provide useful, unbiased information based on my experience in the United States and other countries concerning the extent to which the facts surrounding this review reflect the implementation of the high level obligations of the existing licenses. It is assumed that where the regulatory authority determines that current operations at one or more of the subject facilities do not reflect the "aims, principles and intent' of the SEPP and/or current license terms, those terms would be revised to provide more specific guidance and obligations. This review also evaluates the extent to which there has been "continuous improvement" in environmental performance or the application of best practices that minimize emissions of for Class 1 and 2 pollutants. Finally this review evaluates the responses of the facility operators to the public comments respecting the Victoria EPA license reviews and responds as appropriate.

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[2] See, SEPP (AQM) at Part four, definitions and at page 46

[3] see, e.g., https://www.deq.virginia.gov/Portals/0/DEQ/Air/Permitting/TitleVPermits/11526_permit.pdf, https://www.deq.virginia.gov/Portals/0/DEQ/Air/Permitting/TitleVPermits/11526_statement.pdf and https://www.deq.virginia.gov/Portals/0/DEQ/Air/Permitting/TitleVPermits/11526_permit_mod.pdf.

CONCLUSIONS AND RECOMMENDATIONS

Latrobe Valley Air Quality - Monitoring Needs Improvement and the Limits of Air Quality Modeling Incorporated in Agency Decisionmaking.

Based on the prevailing wind direction in the Latrobe Valley, the air quality monitors are poorly positioned to properly characterize the air quality impacting the Latrobe Valley population. Accordingly, the reliance on those data recommended by the facility operators would be ill advised. Even so, the reported data do not show that all applicable NAAQS are consistently met.
EAY asserts:

> "The EPA's annual Air Monitoring Report from 2017 (**2017 Report**) which assesses air quality results in Victoria against the NEPM (AAQ) criteria, indicates that the air quality standards for PM10 were met in the Latrobe Valley Air Control Region."

However, this is not true for earlier years. Notably, one operator concedes:

> "The $PM_{2.5}$ air quality standards however were not met at any air monitoring station during 2017. The 2017 Report also indicates that more than half of the source of $PM_{2.5}$ emissions in Victoria are from urban wood fired heater smoke on cold, still days. Another cause of exceedances is related to hazard reduction burns and other unplanned burns."

Further, the ability of air quality modeling to predict low probability, high impact events is limited as models are typically based on weather data for a relatively limited period that may not capture low probability events. However, the history of air pollution regulation teaches us that some of the most significant impacts occur as low probability, high risk events associated with inversion events. One of the more significant of such events occurred on Friday, 5 December 1952, when a dense coal-based smoke-filled fog shrouded London and hung over the city for the next four days. London came to a standstill. Over 4,000 people died in London alone, motor vehicles were abandoned, trains were disrupted and airports were forced to close. Many more thousands died throughout Europe.

Figure One: London, 1952

Similar events in Birmingham, Alabama and other U.S. cities and more recently in China and India have moved governments to adopt policies that included technology-forcing components as insurance against low probability, high risk events that are not captured with current modeling protocols. Cold still days are days in which inversions can capture and concentrate power plant emissions.

The Licenses Should Provide Specific Emission Limitations and Monitoring Requirements That Reflect Application of Best Practices and Provide a Schedule for Continuous Improvement

In the United States "Best Available Control Technology" (BACT) is required for new and modified units while "Reasonably Available Control Technology" (RACT is mandatory for existing, unmodified units – in areas that meet our ambient air quality standards. BACT and RACT each consider costs. However, new or modified units in areas that do not meet ambient air quality standards must apply the Lowest Achievable Emission Rate, where cost is not considered. A unit is considered "modified" if it undergoes a life extension or other modification that increases annual emissions by 40 tons per year (tpy) for SO_2 or NOx, 15 tpy of PM_{10} or 10 tpy of direct $PM_{2.5}$. Such increases are relatively quite small for power plants where annual emissions may be thousands of tons. In addition, since 1970 a number of other programs, including, but not limited to Acid Rain requirements, visibility requirements and interstate pollution transport controls have required additional emission reductions from existing plants. Most recently, the U.S. Mercury and Air Toxics Rule (MATS) effectively required minimum PM and acid gas controls at existing plants, in addition to limits on mercury emissions. These cost effective, technology-driven limits have allowed the U.S. to sustain economic and population growth while improving ambient air quality and public health.

Similarly, the European Union, through its Large Combustion Plant and Industrial Emissions Directives, coupled with its Best Available Technologies (BAT) requirements have provided for a specific concrete path of continuous technological improvement. As in the U.S., these technology-based requirements supplement the obligation to achieve and maintain a NAAQS and operate independently of the NAAQS.

The Maximum Air Discharge Tables in the existing licenses do not appear to reflect the application of any form of best practice. Rather, they "permit" discharges far larger than the plants would emit without any effort to achieve best practice. The Loy Yang A Permit "limits" emissions of SO_2 to 15,768,000 tonnes/year (mt/yr) – far more than this plant could emit without any controls and with the available coal supplies. By way of comparison, a permit I and the other members of the Virginia Air Pollution Control Board authorized several years ago, based on BACT and considering cost, limited SO2 emissions to 547 mt/yr for similarly sized units.[4] Since the Victoria plants have existed for decades without any constraint on SO2, NOx, $PM_{2.5}$ or Hg emissions, or any tightening of the PM_{10} emission limits that I am aware of, it is difficult to envision how a finding could be made that the current operating conditions reflect compliance with the obligation to ***apply best practice*** and ***pursue continuous improvement*** in environmental performance.

BACT for control of SO_2 emissions is flue gas desulfurization (FGD); while a suite of measures including Selective Catalytic Reduction (SCR) is BACT for NOx emissions. While cost effective, these options are capital intensive. Several Victorian operators maintain that these controls are "infeasible" or "not practicable". According to Webster's Dictionary "practicable" means "capable of being put into use or practice"; "feasible" means "capable of being done or carried out." The listing of "barriers to practicability" set out by EAY – plant orientation, valley orientation, Australian coal quality – is

[4] Compliance testing has demonstrated that annual emissions of SO_2 are less than 180 tpy. Mercury emissions are limited to approximately 100 gm/yr).

nonsense. FGD and SCR are mature technologies that have been used in thousands of applications around the globe, often including lignite-fired units. In the U.S. today, there are over 200 GW of coal-fired capacity with FGD and 146 GW with SCR[5]. China claims over 90 percent utilization of each of these technologies – having installed most of that capacity in the last few years. There are no technical barriers to controlling north-facing units, units where the wind direction is predominantly westerly, and so on. A Google Earth review of the plants shows that these facilities appear to have ample space available onsite to install controls – far more space than some plants in the Eastern U.S. that have done so.

As demonstrated throughout the world, these technologies are affordable and can hardly be said to be "infeasible." What the operators are really arguing is that these technologies are not investments that they consider will provide an adequate rate of return to them. But, as pointed out above, the operators do not own the "commons" – here, the Latrobe Valley air shed. Power plant operations may impair that common resource only to the degree that the other users of that resource agree is appropriate. That is a determination that the Victoria government must make on behalf of its residents, with a full understanding of the value choices of those residents and the costs, public health and economic benefits to those residents. Studies in the U.S. and elsewhere around the world have documented that these controls provide a substantial positive economic benefit to the public by reducing health care costs and lost productivity due to pollution-induced illness.

The recent $PM_{2.5}$ and SO_2 monitoring results (and the recognized fact that there is no "floor" – no safe threshold for $PM_{2.5}$) suggest that reducing pollution levels throughout the area will produce health benefits and cost savings to those residents. In addition, as discussed above, the insurance value of these controls as against the risk of catastrophic inversion events is well worth the small investment required. The cost of these controls to the general public does not seem to meet the definition of "infeasible" or "impractical."

Further, there are less costly options – such as dry sorbent injection (DSI) that may be appropriate for SO_2 control at units that are subject to enforceable commitments to close within a few years. Similarly, there are incremental options for control of NOx and PM emissions– including low NOx burners, overfire air and Selective Non-catalytic Reduction, as well as PM control system upgrades for units with limited remaining useful life by which a regulatory authority could incorporate a program for continuous improvement short of BACT.

The major internal components of a coal fired power plant have an engineered useful life of 25-30 years. Based on the age of the units under review it is highly likely that they have undergone substantial, capital-intensive and life-extending modifications – or soon will. One operator reports substantial capital investments in the past few years, while another acknowledges a major outage, with substantial construction in the next few years. These changes meet an engineering and common sense definition of substantial modification. The operators have disclosed plans to run these plants far into the future. Accordingly these units should be considered candidates for application of BACT and the licenses should set out reasonable emission limits and time frames to permit the planning and construction of such controls. The Yallourn plant is scheduled for a major plant outage in 2020-2021. That is the perfect opportunity for EAY to plan and install a full suite of controls. It is also perhaps the last opportunity. As the plant ages further and gets closer to a final retirement date one can readily anticipate arguments that it makes no sense to control the plant at that late date. And so, one of the questions to be addressed in this license review is "If not now, when?"

[5] Most of the FGD installations and nearly all of the SCR installations are retrofits to existing sources.

The Licenses Should Provide for Improved Monitoring and Disclosure of Emissions

Low cost technologies now exist for continuous monitoring of CO, CO_2, NOx, SO_2, Hg and PM_f[6] at a minimum. The cost of transmitting these data to a publicly available website is minimal. Compliance with emission limits that reflect application of best practices can best be assured by providing real time or near real time access to such data by the authorities and the public. Even if EPA declines to impose limits as suggested above, access to real time emission and operational data is an important tool that will allow the authorities, researchers and the public to correlate utility operation and emissions with ambient air quality data.

The operators appear to be open to some form of disclosure, including "alerts" when they fail to control fugitive dust in their operations as required by their license, but argue that disclosure should be delayed to permit "auditing" of the data. There is no reason why unaudited information cannot be provided in real time provided that it is identified as subject to revision upon audit, and no information as to what changes they have and would make to monitoring data during an "audit" as the underlying information is collected and processed electronically, seemingly without the need for human intervention. Prompt publication of these data will encourage plant operators to pay attention to plant emissions in real time, rather than just at the end of the month. Release of information subject to audit is commonly practiced in the release of U. S. Department of Energy statistics concerning operation of U.S. electric generators. At the very least the operators should be called upon to explain their audit processes, identify any and all discrepancies identified by auditors and provide actual facts to support this argument.

Each of the facility operators has represented that PM CEMS are not commercially available. This assertion is simply incorrect. PM CEMS are commercially available and the dozen or more vendors can be found online.[7] PM CEMS were first adopted in Germany decades ago. USEPA published a performance specification for these devices after requiring their use in a number of enforcement actions taken over the past 19 years. They are now required for all new coal plants[8] in the U.S. and are allowed (and used) as a compliance demonstration alternative for the MATS (Mercury and Air Toxics Standard) for new and existing coal plants (including lignite plants) in the U.S.

The facility operators argue against the need for Mercury CEMS based on the fact that 'they have not been required elsewhere in Australia." These low cost CEMS have been demonstrated, are commercially available and are a favored option for compliance demonstration in the U.S. MATS Rule for new and existing coal plants. The fact that they have not been required in Australia to date does not alter the aims, principles or intent of the SEPP (AQM), particularly in respect to the requirements for continuous improvement and best practices. Standing alone, this argument is not a valid reason for declining to require monitoring in the future.

The Licenses Should Phase Out of the Use of Waste Oil

Two of the three operators oppose a license restriction on the use of waste oil for startup and flame stabilization. No detail is provided in the operators' comment, but during my time at US EPA we had some experience with this issue. Based on this experience, the use of waste oil for startup is highly objectionable, especially at such a poorly controlled facilities. Lignite-fired generating stations (and especially these lignite plants) do not incorporate the highly sophisticated and effective pollution

[6] PM_f refers to filterable particulate matter.

[7] https://www.thermofisher.com/order/catalog/product/PMCEMS; http://b3systems.com/b3docs/Paper%20-%20IT3%20HWC%202015%20-%20Baxter%20-%20Final.pdf; http://www.altechusa.com/particulates-monitoring-measured-with-cems-systems.html; http://www.msicems.com/betaguard-pm.html

[8] Among other source categories.

controls of a well-designed hazardous waste incinerator. Waste oils typically contain a variety of toxic metals that are not well measured or characterized (including Class 3 materials such as beryllium or other metals) and operating temperatures and residence times may not be sufficient to destroy dioxins, furans and other highly toxic Class 3 materials that may be present. If chlorine is present HCl may be emitted and, with no acid gas controls, emitted unabated. Based on my enforcement experience over the years my level of trust in the waste characterization process is low and the potential for illicit disposal activities is higher than one might expect. The amount of money earned by the plant operator for disposing of these wastes is trivial. Exacerbating the overall risk is the fact that typical ESP operating constraints make it is highly likely that the ESP is not in operation while the plant is starting up oil.

Mercury Control Requirements Should be Established

The facility operators assert that regulation of mercury is unnecessary because Victorian brown coal is low when compared to coals from parts of Europe, China and the United States of America. They assert that testing and preliminary assessments show that annual emissions of mercury from Latrobe Valley plants are already comparable to annual standards being introduced in Germany.

While some Australian lignite is likely lower in Hg content than some other lignites[9] around the globe, it is also the case that lignite used in the Latrobe Valley is higher in Hg than other lignites being burned. The operators do not claim and provide no data to support a suggestion that Australian lignite is uniquely low in mercury content. Based on the reported Hg content of local lignite, Dr. Sahu calculated that the Latrobe Valley plants under review each emit approximately a metric ton– 1,000,000 grams -- of mercury per year. By way of comparison, the new units that I permitted a few years ago with full mercury controls emit approximately 100 grams of mercury per year while burning waste coal.

U.S. law required that the U.S. limits be set based on the demonstrated performance of the best performing existing units. Mercury emission data for U.S. lignite-fired units at the time of standard development ranged from 0.005g/MWh to 5.4g/MWh. Actual emissions from the best performing lignite-fired plants in EPA's survey averaged 0.0058g/MWh, but EPA applied a very generous variability factor and adopted a limit of 0.12 lb/GWh (0.054g/MWh). For this reason the limits in the final MATS standard had been met by a large percentage of the existing fleet even before adoption of the rule. Post-adoption experience with the MATS rule is that the final limits were met by existing units that had emitted above the limits at modest cost. The annual mercury emission rate for Latrobe Valley plants calculated by Dr. Sahu converts to approximately 0.1g/MWh, roughly twice the U.S. limit and nearly 20 times higher than the best performing existing U.S. lignite-fired units.

One aspect of the Hg fish tissue studies cited is worth noting. The early fish tissue studies identified high mercury levels in fish taken from Lake Wellington – levels higher than U.S. significance levels. However, these data were merged with fish from water bodies further away so the reported "average" of all fish taken was within an acceptable range. When the early fish study was updated no fish from Lake Wellington were included, since the species under study had been eradicated by an invasive species. Accordingly, the latter fish tissue studies include no data from the area most likely to be affected.

[9] I note that EAY compares Latrobe Valley lignite with "coals", presumably including black coals around the world.