Final Responses to Submissions from Operators of Loy Yang A, Loy Yang B, and Yallourn Power Plants

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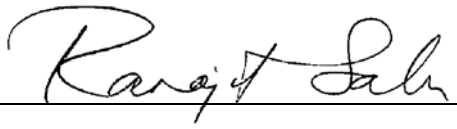

Criticism of the Comment and Response Process

Various members of the public had provided comments on the draft permits for the three power plants subject to the EPA's licence review. However, it is clear from the responses provided by the three power plants to the comments that there is a fundamental process problem. The responses do not directly address the comments provided by the public. Instead, company responses were to the 15 "key" issues or "groups" of comments, supposedly consolidated from the actual comments provided by the public. It is not clear how the actual comments were packaged (or by whom) into the "groups" or "key" issues to which the companies have responded. The only fix is obvious – the power plants should provide responses directly to each of the public comments, and not to the "grouped" version of the comments.

A second process deficiency is that there is as yet no response by the Victoria EPA itself to the public comments. Since the comments were directed at an agency action – namely the proposal to issue the permits to the power plants in question – it is striking that the agency did not provide responses to each of the public comments. As such, the public record accompanying these permitting actions is incomplete.

General Criticism Relating to All Three Power Station Operators' Responses

First, all three station operators essentially make the overall argument that, because ambient air monitoring data from the currently available monitors in the Latrobe Valley (which are part of the Latrobe Valley Air Monitoring Network) for pollutants such as SO_2, NO_x, and PM are generally below the ambient air quality standards (AAQS), no further reduction in the mass of air pollutants being emitted by the stations – which would occur if the stations install modern pollution controls

that are presently lacking at each of the units at the stations – is required. This fundamental premise of the power station operators is incorrect or unsupported for the following reasons:

(i) it presumes that there are sufficient numbers of ambient air monitors located in the proper locations to capture the maximum impacts of the stations' mass emissions of pollutants. Since the locations of the current monitors[1] were not guided by robust air modeling studies, the operators simply cannot rely on ambient monitoring data as the definitive proof that the AAQS are not being exceeded;

(ii) it presumes that simply meeting the AAQS assures that pollution levels are not of concern. This is incorrect, given that the AAQS are periodically revised and generally made more stringent as knowledge of the adverse health impacts of even low levels of pollution (such as for $PM_{2.5}$, for example) is factored into the AAQS revision process;

(iii) it presumes that there are AAQS for all of the relevant pollutants from coal combustion. That is demonstrably false since AAQS exist only for a handful of pollutants and not for many, such as mercury. Since the companies have generally agreed that a broader health-based impact or risk analysis is required to properly assess the impacts of the power stations, they are effectively recognizing that simple reliance on the AAQS is not sufficient;

(iv) following from the point above, it presumes that the current ambient monitoring network is even monitoring all relevant pollutants. That too is demonstrably false since the network does not monitor for pollutants such as mercury; and

(v) there are instances when the AAQS are exceeded, which the companies simply wave away as not being important.

At a minimum, a robust air dispersion analysis should form the basis for the numbers and locations of the ambient air monitors. Unfortunately, the recent and hasty GHD dispersion modeling analysis commissioned by the power station operators is not adequate in this regard due to

[1] I recognize that some of the ambient monitors in the network currently are located near population centers and provide data relevant to exposure of the population to certain pollutants. While these are appropriate, these monitors do not include all (or even the major) pollutants at issue. Thus, they too are inadequate.

deficiencies in certain key aspects of such modeling – namely the emissions inputs included and the extent to which representative meteorological data were considered.

Second, while the companies seem to agree that a comprehensive health risk assessment of the power stations' environmental impacts is in order, it is important, for such an assessment to be meaningful, that it include at least the following broad scope elements:

(i) include all media and potential exposures, such as impacts to potential receptors via surface water, groundwater, solid waste disposal, as well as air (including dispersion and deposition);

(ii) segment potential receptors such as infants/children (from adults), the elderly, those with pre-existing conditions, etc. since the exposures and harms are different across such receptors;

(iii) include non-health but equally important values such as visibility, haze, and impacts to sensitive environmental areas that might be impacted by pollution emanating from the power stations;

(iv) include not just monitoring data which does not provide good coverage for a proper exposure analysis (see my previous critique of the air monitoring network and its deficiencies) but also modeling analyses – not just for air but also for groundwater and surface water impacts;

(v) include the latest toxicological data for the pollutants at issue – including both cancer and non-cancer endpoints; and

(vi) include reasonably conservative measures of risk such as the risks at the upper bounds of exposure as opposed to just central tendencies – given the many toxicological unknowns and uncertainties in such assessments.

Third, to the extent that the companies have pushed back against additional pollution reduction controls due to cost (especially modern air pollution controls commonly deployed not just in the US but also in China, India, and other developing countries), the Victorian EPA has an obligation to consider the cost-benefit of reducing pollution, including air pollution-related morbidities and mortalities in the exposed populations, the reduction in water pollution, etc. I am fully aware that in the current political context where there is great focus on the cost of electricity, the benefits due

to pollution reduction might not get sufficient attention – but that is simply a matter of trading off what is often an immediate impact (i.e., potentially marginally higher electricity bills) against a less-immediate adverse impact (i.e., higher health costs). Administrative agencies such as the EPA have the obligation to take the long (and balanced) view, especially for power stations that plan to run decades into the future, as they consider licence renewals.

I provide additional comments below.

Loy Yang A Response Discussion

General

The company states that it will cease operations at Loy Yang A (and, presumably, the Loy Yang mine) "no later than" 2048. Thus, it expects to continue operations (mining and power station) for 30 more years. A typical design life of a power station is around 30 years. Thus, LYA, whose units became operational "through the 1980s" will be over 60 years old by the time it is shut down.

As such, the LYA units expect to operate, in effect, for a full lifetime of a power station without modern air pollution controls that are essential and in operation at most coal-fired power stations worldwide – for not only PM, but also SO_2, NO_x, mercury, as well as various toxic air compounds that are inherent to the combustion of coal.

Importantly, it is not just installing the proper controls but also operating them at the highest levels of pollutant reduction that must be a verifiable and enforceable goal of the licence for LYA. In this, the licence fails to do its job. It does not require the LYA units to meet modern emissions limits, which can only be met using current technology air pollution controls installed and in operation at most stations but missing at LYA.

AGL Does Not Meet Its Own Environmental Policy

AGL, the current operator of LYA, states that it "…will continue to invest in Loy Yang A and the Mine in accordance with all regulatory requirements and the commitments made in the AGL Environment Policy." My review of the AGL Environment Policy shows that AGL's words do not comport with its actions or obligations. Specifically, it is not clear how AGL actually meets at least the following underlined aspects of its own stated Environment Policy:

• Adhere to high standards to protect the environment where it does business;

• Meet or exceed its regulatory obligations;

• Improve the way it does business to reduce environmental risks and impacts;

• Continuously improve its environmental performance through developing and reviewing effective management systems, measurement and targets;

• Contribute to research and adaptation to new technologies that improve environmental outcomes;

• Use resources and energy efficiently, minimising emissions and waste.

Thus, it is clear that AGL does not meet its own modest Environment Policy when it comes to operating LYA and the Mine.

In support of its commitments to its Environment Policy, AGL cites to a few greenhouse gas emissions reductions projects (turbine refurbishment at Unit 1, expected future turbine refurbishment at Unit 3, some carbon capture collaboration projects with CSIRO, and a coal-to-hydrogen project at the Mine with the "potential" to reduce carbon emissions). What AGL does not attempt or discuss is the actual sustainable carbon reductions from these efforts and when they might occur; and how those reductions compare to the massive and ongoing carbon emissions from LYA and the Mine.

Of course, it is worth noting that AGL does not point to any efforts to reduce any pollutants other than carbon emissions at LYA and the Mine. Thus, the massive emissions of harmful pollutants such as SO_2, NO_x, PM, mercury, heavy metals, acid gases, and other air toxic compounds, are expected to continue for 30 more years, or the effective design life of a brand new coal-fired power station.

Modeling

I note that in reaction to public comments, AGL commissioned an air dispersion modeling report by GHD. Technical comments on this modeling exercise are provided elsewhere.

Dust Emissions from the Mine (Key Issue 1)

AGL pushes back against specific and prescriptive (and therefore enforceable) conditions in the licence for eliminating harmful coal dust (and other particulate matter) emissions from mining activities. Not surprisingly, it claims that its current practices, described only qualitatively – i.e., qualitative actions triggered based on anticipated weather conditions – should be sufficient. First, without quantitative and enforceable conditions in the permit, AGL's commitments are: (a) not measurable as to effectiveness; and (b) cannot be, and are not, "best management" practices. Simply, one cannot "manage" what one cannot "measure" – much less do it the "best" way.

Thus, AGL's response is self-serving. I note that AGL does not at all discuss whether or not its current approach to dust management actually results in benign outcomes.

Impacts from Ash Ponds and Landfill (Key Issue 2)

AGL acknowledges that its unlined ash ponds and landfill have impacted groundwater but that "natural attenuation" has limited groundwater impacts to within a specified "zone." Without any technical details (i.e., detailed groundwater monitoring and modeling reports), it is impossible to verify and accept AGL's reassurances. Many of the potential pollutants from the ash that can impact groundwater, including selenium, barium, arsenic, bromine, etc. cannot be "attenuated" without actual remediation of groundwater. Thus, AGL's reference to "natural" attenuation of ash compounds in groundwater is disingenuous.

Wastewater Discharges (Key Issue 3)

AGL provides a vague and qualitative description of its two wastewater discharge points to Traralgon Creek via discharge locations L171 and L160. It does not discuss what pollutants are monitored at these two discharge points, especially L171. The description of its wastewater "treatment" system makes it clear, however, that it is essentially settling basins aided by flocculant additives to improve settlement. While this may be adequate for certain pollutants that might be suspended in wastewater, it is not clear what effect, if any, this "treatment" will have on numerous dissolved constituents in wastewater resulting from mining and the burning of coal – such as selenium, bromine, and other dissolved solids, etc.

I am more concerned about wastewater impacts from LYA and the Mine after reviewing AGL's response.

Continuous Improvement to Reduce Emissions Using Best Available Techniques (Key Issue 7)

AGL demonstrably fails on this count. Its long-winded response on this issue falsely conflates its licence requirements, and its assertion that it meets the current ambient air quality goals, with having best available techniques to reduce emissions. Just because LYA meets its licence requirements or ambient air quality requirements – even if these were both true – does not mean that air pollution controls at LYA (and which will remain for 30 more years as previously noted) qualify as "best" by any standards or that AGL is doing anything at all to "continuously improve" its performance with respect to this facility.

To be clear, my previous comments on "best practices" include costs. They were fully consistent with what other countries have already implemented at existing coal-fired power stations on a retrofit basis, as opposed to brand new power stations. And, costs of retrofit controls are explicitly included as part of the determination leading to the requirement to retrofit existing units with modern controls. And, to reiterate, this does not just include the US but also China. It is factually

true that LYA today (much less 30 years into the future) is one of the more poorly controlled coal-fired power stations in the world, including not only power stations in the US and Europe, but also China.

For SO_2, AGL's LYA discussion has nothing to do with controls, i.e., lack of modern scrubbers. Rather, it claims that it is meeting it's licence conditions and that the (lenient) ambient air standard in Victoria as measured s at a few locations are not being exceeded. That is factually incorrect since SO_2 exceedances do occur, for example, at Jeeralang Hill.

For NO_x, LYA does not have Selective Catalytic Reduction (SCR). LYA's NO_x "controls" as detailed in AGL's response (i.e., flue gas recirculation) were state of the art in the 1980s when the units were built – i.e., 30 + years ago.

For PM, the LYA units have electrostatic precipitators (ESP). While these can be effective, it is without question that fabric filters do a much better job, not just for PM but also for acid gases and mercury, which are not addressed at all by ESPs. AGL's response dealing with the distinctions between brown and black coals does not address the totality (and superiority) of benefits from using fabric filters.

Availability of CEMS for PM (Key Issue 8)

AGL asserts that such continuous emission monitoring systems (CEMS) are not available. That is incorrect. CEMS to measure filterable PM are widely available and have been for roughly two decades now. See https://www3.epa.gov/ttnemc01/cem/pmcemsknowfinalrep.pdf, which discusses the state of PM CEMS in 2000 – 18 years ago. Numerous coal-fired power stations, as well as cement manufacturing plants, use such CEMS in the US at the present. US EPA has a performance specification for PM CEMS, available at https://www.epa.gov/emc/performance-specification-11-particulate-matter.

Mercury Monitoring (Key Issue 10)

AGL states that it is "…reviewing the monitoring options available for Loy Yang A and will work with the EPA and the community to put in place mercury limits and mercury monitoring and reporting for Loy Yang A consistent with the best practice principles…"

It is not clear what monitoring options AGL is reviewing. I note that CEMS for monitoring gaseous mercury compounds are widely available. Roughly 250 coal-fired units in the US use such CEMS. Additionally, periodic integrated monitoring of mercury using so-called sorbent tubes is widely available.

Loy Yang B Response Discussion

There is little additional in LYB's responses that are different from the LYA responses discussed above. I therefore reiterate our discussion above to the extent that they apply to LYB.

Yallourn Response Discussion

General

EnergyAustralia (EA) operates the Yallourn power station and Mine. EA notes that the mining licence has been extended by an additional 25 years. EA's Yallourn responses are organized around the same 15 "themes" previously discussed. Please see the general discussion earlier as to the impropriety of not responding to each of the specific public comments and relying instead on these grouped "themes."

Dust Emissions from the Mine (Key Issue 1)

Not surprisingly, EnergyAustralia does not support prescriptive licence conditions to ensure that best practice approaches to dust emissions management are enforceable. For the reasons discussed above, I do not believe that the qualitative, performance-based approaches discussed by EA are

verifiable, measurable, or effective. Consider that, as EA notes, dust deposition monitoring is conducted at just six locations near the Mine, which encompasses a very large area. It is not clear how monitoring dust deposition at just these six locations ensures that "best management" practices are being used for dust control. This simply indicates that fallacy of using a few fixed monitors as surrogates for "best practices."

EA's criticisms of prescriptive approaches on page 8 of its response are untenable. Prescriptive approaches are often (and have to be) tailored to the specific mine and its activities and can address the potential short-comings noted by EA.

Wastewater Discharges (Key Issue 3)

Yallourn discharges wastewater to the Morwell River, a tributary of the Latrobe River, at a single location. EA indicates in its response that discharged wastewater is treated for the removal of suspended solids and turbidity and monitored for pH and turbidity; and that down-river salinity levels are often higher than up-river levels.

This wastewater monitoring is grossly inadequate. Numerous toxic contaminants are discharged via the dissolved (and not just the suspended) phase in wastewater. Not only is there no treatment of these contaminants, they are not even being monitored. I recommend that the licence require the monitoring of an extended set of pollutants discharged to the Morwell River – including total suspended solids, oil and grease, metals such as mercury, selenium, arsenic, barium, lead, zinc, cadmium, cobalt, molybdenum, copper, etc., bromine, chlorine and also a range of organic compounds. Based on such monitoring for, say, two years, under all power station and river conditions, suitable limits protective of the receiving Morwell River water should then be incorporated into the licence.

Continuous Improvement to Reduce Emissions Using Best Available Techniques (Key Issue 7)

EA's response under this "theme" is a study in mis-direction. Simply put, other than ESP for removal of particulates, the Yallourn station does not have any of the modern controls one would expect to find at a coal-fired power station. It does not have scrubbers that can remove SO_2 and acid gases; it does not have SCR to remove NO_x; it does nothing to remove mercury.

In its response, EA makes factually unsupportable statements. Considering SCR and FGD, EA notes that these technologies are "…not practicable in the circumstances given the particular design and orientation of Latrobe Valley power stations and prevalent wind conditions near population centres, the standard of Australian coal quality, local prevalent atmospheric conditions and the generally high standard of ambient air quality."

The "design and orientation" of the Latrobe Valley power stations has little to do with retrofitting Yallourn with SCR and FGD. Similarly, the "prevalent wind conditions near population centres" and the "generally high standard of ambient air quality" has little to do with minimizing emissions using best available techniques, especially for a station that is expected to operate decades into the future.

While the "standard of Australian coal" will affect how an SCR or FGD may be designed, there are no known flaws which indicate that these technologies will not work with the coal being burned at Yallourn.

Please see previous discussion in this regard under the LYA response, which apply equally to the Yallourn response, including the benefits of fabric filters as opposed to the ESP that is present at Yallourn.

It is true that retrofitting modern pollution controls to an existing power station does require resources, including money. But that determination should also include the financial benefits from reducing emissions. The EA response only addresses the cost of retrofits and not its benefits.

<u>Continuous Stack Monitoring (Key Issue 8)</u>

In its response, EA indicates that there are no CEMS at Yallourn for NO_x, SO_2, filterable PM, or mercury. NO_x and SO_2 CEMS are widely available (and in use at other Australian power stations, including LYA). There is no excuse to not having NO_x and SO_2 CEMS at Yallourn.

Please see previous discussions under LYA for filterable PM CEMS and mercury CEMS. Like AGL, EA erroneously states that PM CEMS are not available.

Responses to Issues Raised by Environmental Justice Australia

Q. The assertion in the Air Quality Modelling Report that Ambient Air Quality standards are being met and that further pollution controls would not significantly improve ambient air quality;

A. First, it is premature to assert, based on the GHD report, given some of the methodological issues associated with the modeling that was conducted, that Ambient Air Quality standards are being met. Second, with further pollution controls, there will be further reductions in the mass of emissions being emitted – and this will, logically, improve ambient air quality. In other words, there will always be lower ambient impacts from a given source of air emissions if the mass of those emissions are reduced, such as with additional controls. To claim otherwise is not logical. And, given what we know about the harmful effects of certain air emissions, such as $PM_{2.5}$ (which has no threshold below which there is no harm), the lowest possible emissions (and the lowest possible impacts) should always be the goal – rather than just aim to meet current Ambient Air Quality standards, which are not health protective in an absolute sense.

Q. Submissions made by GHD in the Air Modelling Report regarding the performance of Electrostatic Precipitators versus Bag Filters for the capture of fine particles and mercury during combustion of high moisture content coal;

A. Bag filters (or fabric filters or baghouses) are always better for control of fine particulates (and particulate mercury) than ESPs. While baghouses can be adversely affected by high moisture content, it is the moisture content of the exhaust gases and not coal moisture content (i.e., before combustion) that is the relevant parameter. So GHD's comments that the effectiveness of ESPs increase as coal moisture increases is misleading and incorrect. ESPs are far less robust and their performance depends significantly on maintenance, which is not always properly done – leading to more PM emissions.

Note, however, that neither bag filters nor ESPs will do that much for mercury that is emitted in gaseous form (such as elemental mercury or oxidized/soluble mercury). Elemental mercury can be controlled with the injection of activated carbon, which is then easier to capture with a bag filter. Unfortunately, any soluble mercury can only be properly captured in a wet scrubber or similar control device (which is generally used to control SO_2, acid gases, etc.).

Q. Submissions made with respect to barriers to retrofitting post combustion pollution reduction technologies and in particular, risks, costs and benefits surrounding the installation of bag filters in the above reports;

A. I have reviewed the responses by the operators of the power stations. Yes, there are undoubtedly costs to installing bag filters, especially in existing power stationa – i.e., retrofitting them. However, there are significant benefits (see above). The issue comes down to the response in the first question above – i.e., to what extent the goal should simply be meeting the AAQS (which are NOT health protective for PM, given that there is no "safe" threshold for PM from a health standpoint) – which is what the operators of the power stations are arguing relying on the modeling to basically say that ESPs are fine – versus recognizing that compliance with the AAQS is not enough. Recognizing that compliance with the AAQS is insufficient is entirely a proper argument from a health standpoint.

Q. Submissions made with respect to the implementation of Best Practice in the context of the EPA Publication 1517 Demonstrating Best Practice.

A. Based on my reading of Pub 1517, the operators of the Latrobe Valley power stations are NOT implementing either the spirit or the letter of the "best practice" demonstration. Plainly not using mature control technologies such as SCR (for NO_x), bag filters (for fine PM), etc. shows that "best practice" is not being implemented.

Q. Submissions that there are no commercially available CEMS for monitoring PM10 and PM2.5 particulates in stack emissions.

A. Here is the technical reality with regards to CEMS for monitoring PM_{10} and $PM_{2.5}$: currently, CEMS are available for measuring continuously the filterable fraction of these pollutants but not the condensable fraction (which generally consists of less than 2.5micron droplets or aerosols of acid gases such as sulfuric acid mist). So, the statement by the companies is only partially true. Many power stations in the US currently use filterable PM CEMS.