

**Submission
No 84**

**INQUIRY INTO COSTS FOR REMEDIATION OF SITES
CONTAINING COAL ASH REPOSITORIES**

Organisation: Polyagg Pty Ltd

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RESOURCEFUL FLY ASH SOLUTIONS

Hon. Daniel Mookhey MLC
Committee Chair
Public Works Committee
Parliament House
Macquarie Street
Sydney
NSW 2000

RE: INQUIRY INTO COSTS FOR REMEDIATION OF SITES CONTAINING COAL ASH REPOSITORIES

Being aware that the deadline for submissions has passed, but given the current circumstances and the fact that the inquiry activity has been postponed, we would appreciate your indulgence in including this submission for consideration in the Inquiry, if possible.

COMPANY BACKGROUND

Polyagg Pty Ltd is a start-up company that was registered in 2013 with the focus of utilising fly ash (primarily from black coal-based power generation), as the primary raw material in the production of construction materials and products. To date, the company has developed and initially up-scaled an effective geopolymer based lightweight aggregate product, which has the potential to replace 100% of the large aggregate in a concrete mix, while delivering comparable performance. The aggregate is 33% lighter than conventional crushed rock aggregate.

Having done up-scaling trials, the Company is now at the stage of planning a pilot plant, to refine the already specified production process and deliver sufficient materials to do product trials.

Polyagg is a member of the Ash Development Association of Australia and subscribes to its charter of fostering economic market opportunities for the beneficial use of coal combustion products.

SUBMISSION SUMMARY

The primary focus of this submission is to address item c) in the Terms of Reference, being:

c) the economic and employment opportunities associated with coal ash re-use, site remediation and repurposing of land.

As will be shown, addressing the re-use through the Polyagg process will help reduce the cost of remediation and repurposing. In addition, it will contribute to a reduction of the problem in the first instance, without impacting the current fly ash market dynamics. Thus it will address the continually increasing volume of ash in pond storage, in a practical and economically meaningful way.

Effective implementation of the Polyagg process will also provide meaningful employment opportunities in the plant construction as well as the operating phases. In addition to the utilisation of fly ash, it also has other major environmental benefits including indicative reductions in greenhouse gas emissions and lower materials usage in construction through its lightweight characteristics.

Furthermore, when used as an aggregate in concrete it can be shown that the resultant product encapsulates the toxic heavy metal leachates that are present in fly ash.

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INDUSTRY PERSPECTIVE

As is well documented, approximately 12 million tonnes of Coal Combustion Products (CCPs) are produced annually in Australia. Ash Development Association of Australia (ADAA) industry statistics for 2018 indicate that approximately 11 million tonnes of this is in bituminous (black) coal. Based on data from the Australian Energy Market Operator (AEMO) and the Department of Energy and Environment, Polyagg estimate that around 50% (5.5 million tonnes) are attributable to New South Wales (NSW).

Based on ADAA statistics for 2018, annual national beneficial use is indicated at around 47% (~5million tonnes), resulting in the balance of around 6 million tonnes being diverted to primarily pond ash storage. Using a variety of sources, it is Polyagg's estimate that NSW generators would be diverting in the region of 3 million tonnes to storage annually. In addition, the ADAA estimates that in excess of 600 million tonnes of material is already in storage, nationally.

The net result is that there are significant quantities of fly ash stored in ash ponds, either capped or uncapped, which are being added to daily.

The level of concern, the solutions and the potential costs associated with addressing these solutions vary greatly, dependent on the position of the parties. There is no doubt however, that there is a certain level of risk and an associated cost dependent on the perspective adopted by the parties involved.

Publicly available information indicates that in regard to the liabilities for the CCP issues in NSW, there is joint responsibility between both the NSW government and the current NSW's power generators. The level of liability is dependent on commercially confidential contractual obligations. Management and remediation costs will depend on the approach taken.

By way of example, in the USA:

- Primary liability for fly ash management lies fully with the power generators and;
- the US Environmental Protection Agency have taken a very tough approach to management and rehabilitation of ash storage dams.

This position has resulted in a situation where Duke Energy, a leading coal-based power generator has reportedly reached an agreement with the North Carolina Department of Environmental Quality (DEQ) to remove 76 million tons of coal ash in 7 storage basins, from unlined to lined landfills. This is at an estimated cost of US\$3.5 billion. (Source: Engineering News Record – January 8th 2020). The Company initially planned to cap the basins at a significantly lower cost.

For perspective, ash ponds in Australia are unlined.

PROJECT DYNAMICS

Indications are that the Polyagg process has the ability to utilise graded, run of station and recovered pond ash (which has been pre-processed), to deliver a consistent lightweight aggregate suitable for application in a number of construction applications.

The production process as currently specified utilises commercially available equipment to deliver the product. The main production consideration is the need to locate the commercial production facility in close proximity to the raw material source, given the huge volumes of ash that has to be processed.

It is estimated that based on average Australian power generation coal composition, the generation of 800MW of electricity produces ~500,000 tpa of fly ash. To process this volume would require a Polyagg plant capacity of 75tph running 24/7, for 48 weeks of the year. Specification of a plant to meet Australian production standards and with all of the logistic facilities required to be able to move this volume to market, would cost in the region of \$60 million. The construction of this plant is estimated to take 110 weeks to commissioning and would result in the employment of an estimated 23 Full Time Employees (FTEs) supported by an additional 250 subcontract employees engaged over the duration.

While a significant capital investment in absolute terms, in the context of employment potential, remediation and potential environmental costs, the figure is not out of context. Add to that the contribution to the circular economy by recycling waste and the addition of other environmental benefits such as a reduction in greenhouse gas emissions and potential contamination of ground water through leaching from ponds etc., the Polyagg option will be seen to provide a cost-effective alternative to the current and future challenges.

Costs of remediation of ash ponds in Australia are relatively undefined and are believed to vary quite significantly, depending on the type of remediation and environmental risks. The USA have significantly more published data.

In a paper presented to a Technical workshop of the ADAA in July 2018, the US-based Electric Power Research Institute (EPRI) estimated that remediation of an 80 acre facility in 2016 could cost anywhere from around US\$15 million to US\$210 million, depending on the nature of the remediation. To put this into context, Alabama Power reportedly has one 600-acre ash pond holding 21 million tons of coal ash waste. Applying the EPRI estimate of transferring this to a lined facility would cost in the region of US\$1.5 billion. This aligns with the Duke Energy example set out earlier in this document.

Put in different terms and closer to home, on a simplistic calculation (given that some areas are already capped), remediation of the estimated combined quantity of materials in storage across the Eraring and Vales Point sites on Lake Macquarie (reportedly 65 million tonnes), would cost in the region of US\$ 4.6 billion. This is to remediate from unlined to lined landfill, using US specifications. Using the figures at the lower end of the EPRI estimates, would still incur costs in the region of US\$350 million.

It is accepted that these figures are indicative, based on the US examples and their regulatory requirements. The intention is to try to put the potential costs in context of alternative solutions to the current, but potentially environmentally damaging process of filling, capping and rehabilitating.

POLYAGG – THE CURRENT POSITION

As indicated earlier, Polyagg is at the point of up-scaling a proven geopolymer based process, converting a range of fly ash sources into effective lightweight aggregate, replacing 100% of the crushed rock aggregate conventionally used in a concrete mix.

Being a start-up and having self-funded to date, the owners of Polyagg do not have the working capital required to move the project to the next step and are in the process of seeking investment to progress the opportunity.

To date, early discussions have been held with a number of players, both locally and internationally, including power generators, property developers, builders and building material suppliers. In the majority of discussions in Australia, there has been positive reaction to the opportunity, but hesitation to engage.

Concerns raised have centred on:

- A lack of an established lightweight aggregate market in Australia. i.e. potentially the project also involves market development. This is despite well-established lightweight aggregate markets in a number of countries overseas.
- Higher costs of a manufactured raw material despite calculations showing that application in a 15-storey building could potentially lead to structural steel and concrete cost savings of over 10%, which is equivalent to ~\$1 million.
- The volume of readily available fly ash raw material, given the vertically integrated nature of the construction materials industry in Australia, combined with the current contractual off-take agreements that are in place. The answer to this concern lies in the fact that the Polyagg model and process is based on the usage of that proportion of material that is not currently beneficially used. In effect, it is looking to commercialise the excess materials currently going to storage, with the potential to reclaim ash pond material as well.
- Linked to this, power generators are reportedly looking for higher utilisation rates but are being limited by the apparent lack of demand. Polyagg provides a practical solution to this dilemma.
- The potential impact on the current aggregate market and supply. The answer to this concern lies in that the conversion of the estimated excess fly ash available in NSW will equate to less than 10% of the existing market, which is already at risk of limiting construction growth, due to finite quantities in close proximity to market combined with environmental issues and costs.
- The projected capital costs. This is apparently driven by a conviction that the storage and remediation of fly ash ponds by the “cap and cover” method is a low-cost exercise with little or no environmental risk under current contractual obligations. In the US context, this would be significantly reversed.
- Overall and to move the project to commercial applications, there would initially need to be alignment across a number of partners from different industries with vested interests. Polyagg is in the process of trying to address this by looking to develop a consortium of relevant partners.

Against these industry concerns are the following significant benefits of successful commercialisation:

- A large proportion of the non-beneficially used fly ash currently being produced could be converted into a commercially viable, industry beneficial product.
- Diversion from storage has cost and environmental risk reduction implications.
- There is potential to utilise existing pond ash, thus reducing costs of remediation and environmental risk.
- The capital investment can deliver a financial return versus the expense involved in storage and remediation.
- Potential savings in the region of 15% on the greenhouse gas emissions over the product lifecycle.
- Cost reductions in both building and infrastructure construction, including reduced materials quantities, transportation costs and other savings such as crane hire.
- Greater architectural design flexibility due to the lightweight nature of the product, leading to potential for higher Green Star ratings.
- Reduced environmental impact of quarried materials.
- Additional employment opportunities, both in the construction as well as the operational phases. It is estimated that to be effective, each NSW power generator would build a plant on the power station site. As indicated above, construction of a typical plant will employ in the region of 23 FTEs plus 250 subcontractors over the project duration. Once operational, the total compliment required will be in the region of 22 FTEs.

The next step is to draw the proposed consortium together. This is however proving difficult given the situation outlined above.

RECOMMENDATION

Our recommendation is for the NSW Government to take a lead position in the consortium and provide meaningful funding to plan and develop a pilot plant as a matter of urgency. Costs for this will be in an estimated range of between \$8.6 and \$21.0 million, depending on the volume dynamics considered appropriate for trial and product development purposes.

The timing could well be outside of the Inquiry's time frame. If so, then it would be appreciated that the recommendation, if positively considered, be passed on to the relevant authorities for further action.

This position would ensure that the project does not fail due to lack of funding and short-term commercial interests, but creates a proven base that addresses the commercial concerns identified above and starts to effectively address the challenges presented in the safe disposal of fly ash. Success in this will create the platform from which the Intellectual Property (IP) will not only benefit NSW and Australia as a whole, but can be leveraged internationally.

In addition and given the current economic environment, ensuring the success of this project will provide immediate employment opportunities for an estimated 10 – 15 FTEs and between 45 and 100 subcontractors over the duration of the pilot plant construction phase. At the same time, it will be laying the base for meaningful additional employment as commercial plants are commissioned. In addition, the serious longer term environmental problem posed by the ongoing production and storage of fly ash will be addressed.

Your favourable response to including this submission in the Inquiry report would be appreciated and should the recommendation be accepted, look forward to progressing this opportunity further with you.

For further information or expression of interest please feel free to contact the writer in the first instance.

Yours Faithfully,

Trevor Burt
Commercial Director
Polyagg Pty Ltd