

**Submission
No 573**

INQUIRY INTO PROPOSED ENERGY FROM WASTE FACILITIES

Organisation: O.C.O Technology Australia Pty Ltd

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22nd October 2025

O.C.O Technology Australia Pty Ltd

Introduction

O.C.O Technology (O.C.O) were founded in 2010 following more than 20 years of award-winning university research and are part of the Grundon Waste Management Group (the largest privately owned waste management company in the UK). O.C.O employ over 100 staff across 3 production sites and 2 aggregate processing sites in the UK located in Yorkshire, Bristol and Norfolk. Due to increased customer demand in the UK, investment continues with expansion of two sites to increase production capacity and a 4th production site imminent.

O.C.O has developed a Carbon Capture and Utilisation (CCU) process to treat and stabilise thermal residues, and in turn valorise them into sustainable carbon negative construction products.

O.C.O Technology Australia Pty Ltd is a fully owned subsidiary of O.C.O International Ltd, part of the O.C.O Technology Group. The aspiration of O.C.O is to bring our technology to Australia for the treatment of industrial wastes, our niche market being the treatment and recovery of Air Pollution Control residues (APCr) from Energy from Waste (EfW) facilities.

As well as operating in the UK, we are currently in build with our first facility in Spain in a Joint Venture with Petronor, part of the Repsol Group of companies, the largest oil and gas business in Spain. The Project achieved funding from the EU Innovation Fund which promotes the funding of projects aimed at reducing Green House Gas emissions. The Joint Venture will use captured carbon dioxide (CO₂) from processes operated by Petronor. In Japan we have a licence agreement with Kobelco Eco Solutions with a pilot plant in operation and a commercial plant in build. In Japan our facilities will utilise the CO₂ direct from flue gases to treat thermal residues.

The company is a waste valorisation technology provider, offering an innovative and patented process called Accelerated Carbonation Technology (ACT). Many lime-based wastes react naturally with CO₂. If the conditions are carefully controlled, this natural reaction can be accelerated, taking place in minutes rather than years. This results in the formation of calcium carbonate (limestone).



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Unless stated, all UK subsidiaries are registered at Larkshall Mill, Thetford Road, East Wretham, Norfolk, United Kingdom IP24 1QY.

A member of the O.C.O Group of companies, the UK parent of which is O.C.O Technology Group Limited (registered in the UK Company Number 15112154)

O.C.O Technology Ltd. Registered in England. Company No: 07247345

Registered office: Larkshall Mill, Thetford Road, East Wretham, Norfolk, United Kingdom IP24 1QY



Our niche market for the ACT process is the treatment of APCr, also known as Flue Gas Treatment residues (FGTr), from EfW plants; this forms about 85-90% of the wastes we treat. However, many other industrial wastes and by-products can also be treated in this way, e.g. fly ash from coal, steel slags, cement kiln dust and other mining wastes and residues.

Our interest in this NSW Government Inquiry into EfW is as follows:

- to ensure that the inquiry does not automatically assume that APCr is a ‘toxic’ [words used by those that do not support the technology] residue whose only means of treatment is to a specialist hazardous waste landfill.
- to illustrate that EfWs with the combined recovery of Incinerator Bottom Ash (IBA) and APCr can provide a fully 100% landfill free option and contribute to the circular economy, contrary to some commentator’s beliefs.
- that NSW does adopt and promote the use of EfW as part of the waste management hierarchy, above that of landfill and the use of EfW technology can be seen as a recovery option rather than simply final disposal. Landfill is an outdated management option and should be the very last resort for waste.
- that NSW EPA consider the resource recovery framework and revise the current restrictions and limitation to allow for the recovery of wastes such as APCr and IBA.

In terms of our activity in NSW, we are currently in discussions with several potential EfW developers and have had initial discussions with EPA NSW, having provided them with background information on our process, and now await their initial assessment prior to further discussions.

Submission

The Terms of Reference (ToR) for this Inquiry, although succinct, are far ranging. It is not proposed to address all issues in this submission. EfW technology providers and operators will be far better placed to do that than O.C.O.

Our submission really sits in reference (j), ‘any other matter’ and the reason we feel this submission is important, is because there is a significant amount of misinformation on EfWs and their impacts. Some of this is the creation of residues, and for this submission, specifically the APCr – or fly ash and boiler ash.

Prior to the flue gasses being released to atmosphere, modern EfWs use flue gas treatment processes to ensure they can adhere to the strict limits in emission operating permits, a standard approach across the world. There are several technologies available but thus far the type being adopted in Australia, and proven around the world, is known as a semi dry scrubber. This involves the injection of lime and activated carbon into the flue gasses, which allows particulates and contaminants to be removed from the flue gas. This lime and activated carbon are then retrieved in fine mesh bag filters. The resultant lime-based powder is known as APCr, and it is that which O.C.O treat and use to manufacture carbon negative aggregate.

Again, such processes will no doubt be described in detail in submission to the ToR items (a) through to (e) and (h) by those that operate, supply and build such technologies.

This submission is focussed on the by-product from this flue gas clean up and how that is perceived; along with how it can be treated positively and used to mitigate carbon and use of virgin raw materials in the construction industry. O.C.O believe it is important that those considering EfW in NSW understand and appreciate that the residues can and are used in a socially and environmentally positive way. APCr should not be considered as a ‘toxic’ by-product, but something that can be promoted as a positive ‘circular economy’ outcome from the EfW process.

Allowing by-product recovery through internationally recognised treatment and processes will be a crucial part of the economics of the EfW facilities. Landfill is not sustainable, is costly and is certainly not promoting the circular economy.

APCr is considered hazardous, mainly due to its high pH (lime) and some elevated free moving heavy metal content. It is comparable, however, to cement. Cement is accepted as it is a product, not a waste. However, APCr is often labelled ‘toxic’ even by some in the industry, consequently it has been used by those opposed as one reason to avoid the use of EfWs as a waste management tool.

APCr Treatment Process

ACT is a genuine Carbon Capture and Utilisation (CCU) technology, allowing significant volumes of carbon dioxide to be permanently captured as stable carbonates with the further benefit in the valorisation of thermal wastes as construction products. The ACT process allows industrial wastes such as APCr to be treated creating a carbon negative aggregate that can then be used in the construction industry.

The basic reaction within the ACT is shown in figure 1 below.

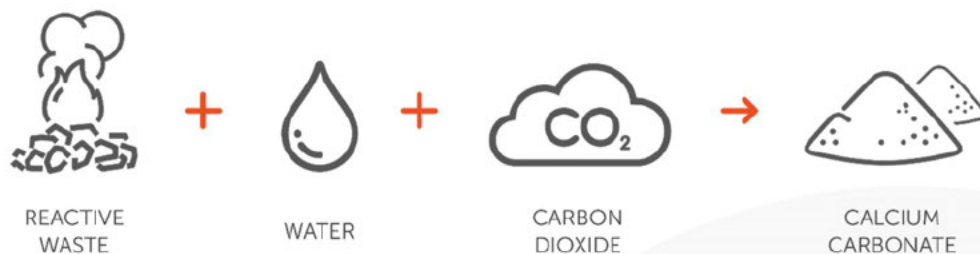


Figure 1 – stage 1 reaction within the ACT process

O.C.O have three manufacturing facilities in the UK, which combined have a processing capacity of some 300,000 tonnes of waste, in turn able to manufacture up to 750,000 tonnes of manufactured limestone (M-LS) each year, resulting in a reduced need to quarry virgin aggregates, a true circular economy and recycling solution for difficult to handle residues.

The process for converting waste residues into M-LS contains multiple stages. Typically, the delivered APCr is pumped into a reception silo. The APCr is extracted from the storage silos and conveyed to a specialist mixer, where it is initially homogenised and then reacted under positive

pressure with CO₂ and water. The CO₂ reacts with lime (calcium oxide or calcium hydroxide) and other salts in the residues to form calcium carbonate commonly known as limestone.

The carbonated waste is then blended with binders and fillers to produce the correct mix for pelletising into our sustainable aggregate, known as Manufactured LimeStone (M-LS). The process is illustrated in the schematic at Figure 2 below.

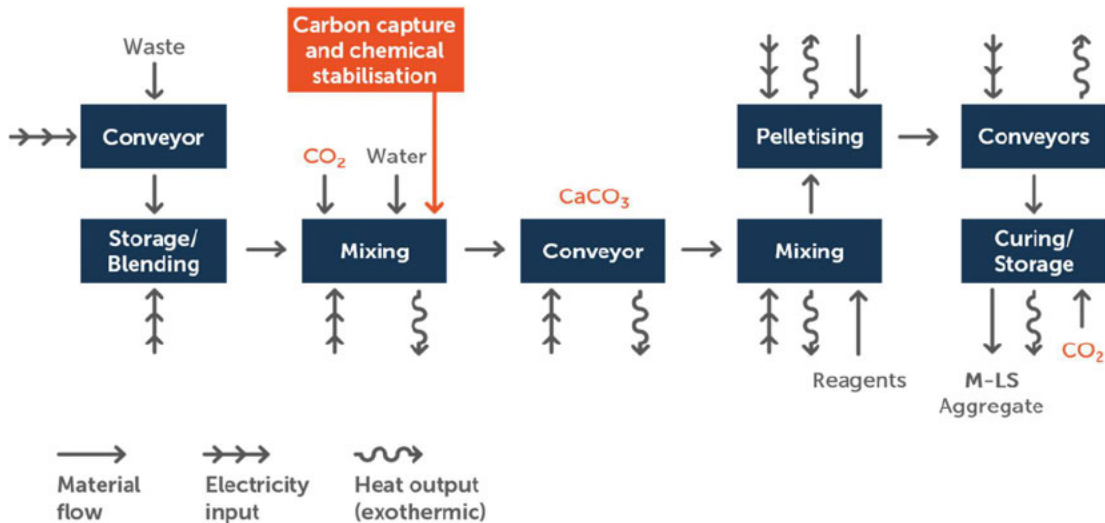


Figure 2 - Schematic of the ACT process

No wastes or by-products are generated from the manufacture of M-LS. 100% of the APCr accepted into our facilities is recycled and diverted from landfill and all process water is absorbed within the aggregate resulting in no contaminated waters being discharged to sewer or requiring additional treatment or disposal.

The energy, raw materials, waste and transport emissions are all taken into account in our approved life cycle assessment and Environmental Product Declaration (EPD) calculations.



These calculations for 2024 show that for every tonne of aggregate we produce in the UK there is a global warming potential value of negative 54kg CO₂e, the World's first carbon negative aggregate. This means that the process of manufacture emits less CO₂ than is absorbed during the aggregate's formation.

Using O.C.O's solution, the EfW industry has the option to recycle its residues, in an operation which is carbon negative and that produces a sustainable aggregate for the construction industry. With all the initiatives O.C.O has taken to reduce their own carbon footprint, we have been awarded and recognised by several organisations. These include, winning RoSPA's *International Dilmun Environmental Award*, *The Carbon Capture and Storage Award* at the UK National Sustainability Awards and one of our proudest accolades is achieving the King's Award for Enterprise in the category of Sustainable Development in 2024.



Founder and CEO of O.C.O Steve Greig meets King Charles III at awards presentation

The King's Award for Enterprise is an awards programme for British businesses and other organisations who excel at international trade, innovation, sustainable development or promoting opportunity through social mobility. They are the highest official UK awards for British businesses. The scheme was established as The Queen's Award to Industry by a royal warrant of 30 November 1965, and awards are given for outstanding achievement in each category.

Carbon and M-LS Benefit



M-LS can be used as a substitute for natural aggregate in a wide variety of applications. The aggregate is predominantly used in masonry, earthworks, pavements, concrete, and asphalt.

Successful trials have been undertaken using our M-LS material by two National Australian block makers, as well as with recycled aggregate producers and most recently an asphalt producer.

M-LS offers a number of universal benefits:

- Carbon capture. M-LS is certified as carbon negative with a global warming potential value of minus 54kg CO₂e/tonne. This has been calculated according to the methodology defined in BS EN 15804 and ISO14064; verified by an accredited third party (EPD Hub).
- Preservation of natural resources. Each tonne of M-LS negates the need to extract 1.4 tonnes of natural limestone.
- Diverting waste from landfill. M-LS valorises thermal residues from industrial processes, which would otherwise be sent to landfill.



- Consistency. M-LS is manufactured to an exact standard, and product performance is constantly maintained.
- Adaptability. The properties (strength, density, particle size) of M-LS can be adapted to suit specific applications.
- Lightweight. M-LS is around 25% lighter than natural limestone, which helps to reduce haulage and improve yield without impacted product strength.

End of Waste

Under UK and European law, a manufacturer of a product made from a waste can apply for 'end of waste'. This is essentially an application to the regulators which allows an assessment of the product to be made and the regulator giving an opinion that the product is no longer to be defined as waste, even though it was manufactured from waste.

O.C.O achieved this status for M-LS in the UK from the Environment Agency in 2011, and from the Basque Regional Government in Spain in 2024.

In Australia the EPA Victoria have provided us with a position letter, stating that if we have a market for the M-LS, that the M-LS meets specification and that the process can be defined as a Resource Recovery, then they could consider the M-LS to be a product and not a waste, so controlled under the General Environmental Duty rather than by specific waste regulation.

EPA Victoria took this stance as they saw the importance of our technology supporting the Victorian EfW industry and circular economy, but that the waste framework under which we were being assessed could not be used due to the type of process and wastes. Perhaps a similar situation to NSW.

We are about to start the end of waste application process in Queensland having had a very positive initial meeting with DETSI.

End of Waste is important, as it allows the M-LS product to be sold into a market with confidence of that market and it allows investment into innovative technologies, without End of Waste status (or similar) the risk that all the manufactured products would have to go to landfill is too high.

Our facility in the Southwest of the UK was pleased to welcome a visit from Sir James Bevan, the Chief Executive Officer of the Environment Agency in the UK. He was keen to see a process that had been given 'End of Waste' status and to find out more about O.C.O. We would draw your attention to the quote from Sir Bevan following his visit about our process and facility:

"The Environment Agency's 'End of Waste' approval is rare and well deserved".

<https://oco.co.uk/environment-agency-ceo-visits-o-c-os-avonmouth-facility/>

(also reproduced at the end of this submission)

We are proud to have received this endorsement from the head of the regulatory authority in the UK and believe this does provide further credibility and endorsement to our process and product.



Issues impeding recovery of APCr

Under the waste recovery framework, the EPA NSW can issue a Resource Recovery Order and Exemption (both are required). The Order gives the operator the conditions under which the use is permitted, the Exemption provides a list of regulations that the use is exempt from eg waste levy.

The definition of waste in NSW includes:

‘any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations’

“applied to land’ is not restricted to direct application. It is defined as (emphasis added):

- a) waste that is applied, or is intended to be applied, to land as follows—**
 - i) by spraying, spreading or depositing it on the land,**
 - ii) by ploughing, injecting or mixing it into the land,
 - iii) by filling, raising, reclaiming or contouring the land,**
- b) waste that is used, or is intended to be used, as a fuel,
- c) waste used, or intended to be used, in connection with a process of thermal treatment.**

Thermal treatment includes brick making and asphalt; depositing on land includes subbase, fill etc.

For the purpose of this submission, we have assumed that M-LS will be considered as ‘applied to land’ and therefore would fall into the definition of waste.

First hurdle in the regulations is that such matters and definitions are simply not clear. They require interpretation and as such open to legal challenge or scrutiny. Equally regulators tend to be cautious, which ends up with the route of least resistance being taken. In our case, that the M-LS would be deemed to fall into the description of waste and thus subject to waste regulations.

If the waste definition was clearer or applied to land was more definitive, perhaps our manufactured M-LS product could be treated as a product and not a waste. Still with overall environmental controls but outside the need for regulators to apply direct waste legislation to control the use.

Challenges to interpretation of waste definitions would need to be tested in court – most innovative processes and new start-ups do not have the finance to take such issues to court.

Even if we accept that the M-LS is a waste to be ‘applied to land’, yet more barriers are found. To deposit waste to land the regulations allow an operator to apply for a Resource Recovery Order and Exemption. Primarily designed for soils, and only lasting two years, these allow waste or products incorporating waste to be used.

However, there are certain conditions where the EPA will not consider an application for an order and exemption. One such situation is:

Hazardous waste. The EPA cannot issue orders and exemptions for hazardous waste. However, under limited circumstances the EPA may issue an order and exemption for restricted solid waste.



We understand that the current stance of the EPA NSW is that as APCr is hazardous, the recovery order and exemption route for it or products using it will not be considered.

We have provided EPA NSW with information on our treatment process and testing data on the M-LS, on the basis they would consider their position, but the promised meeting has not materialised. This may be due to this inquiry and potential impacts of the outcome.

The M-LS is, of course, not hazardous but as the M-LS is expected to fall under the waste definition, it is likely the EPA will see the M-LS falling under the hazardous label.

This is where the resource recover framework is lacking, there is nothing allowing a product made from waste to be considered anything but a waste; no framework under which a product can gain 'End of Waste' status such as in the UK, Europe and in Queensland. Once a waste, always a waste and once hazardous always hazardous.

Logically there should be a specified route for such situations, so that O.C.O can apply for a Resource Recovery Order and Exemption for the M-LS as it is not in itself hazardous. As the process of application is not simple and requires significant testing and information to be provided, along with a specialist panel to assess the application, it is highly unlikely that a product that could cause environmental harm would be allowed. Therefore, the resource recovery and exemptions should be open to all.

Another restriction of the resource recovery process is the requirement that 'the relevant planning authority had granted development consent'. So, O.C.O needs consent for the process prior to the recovery order. Not useful in terms of investment and cost risk.

How can anyone invest in a site and planning, without knowing if a Resource Recovery Order and Exemption is to be issued. In addition, the Orders last for just 2 years. They are designed for short-term recovery options such as soil disposal to land (improvements) rather than specific marketable products.

An ACT plant costs some \$40m, payback is significantly more than 2 years. The risk that the order will not be renewed, for reasons maybe not to do with environmental but subjective or policy interpretation, would be too great. An opportunity to re-use waste in a practical, socially responsible and environmentally beneficial way is lost.

When in discussion with regulators in Australia, we are often challenged on our data sets and how comparable the APCr is when the assessments we provide are based on UK APCr.

APCr does vary. This can be due to the technology, the management of the EfW facility and the waste burnt by the facility and the seasonality of certain wastes. However, O.C.O treats APCr from 24 different facilities in the UK. These are across the UK and demographics and technologies. We have tested and assessed APCr from facilities across the world including the Asia, Europe (north and south), North America and Japan. Yes, some variances exist but within a given range. Our process can adapt to these variances and we see no reason why Australian APCr should be any different to that in Europe.



The regulators should expect analysis of overseas APCr as typical as it is not going to be possible to wait for the APCr to be produced in NSW prior to any investment being made. By then, investment in landfill options will have had to be undertaken by the EfW promoter as they cannot operate without an APCr offtake. O.C.O would not invest in a plant, unless the investment had regulatory approvals in place for both operating, construction and use of the M-LS product.

It is essential UK and European examples are accepted, to enable investment in innovative technologies such as ACT. Regulators need to appreciate the expertise and experience from across the globe in such matters.

It is acknowledged that EPA NSW do have an 'Innovation Pathway' for resource recovery technologies that currently do not exist in NSW. This is primarily aimed at "the development, scaling, demonstration, and/or piloting" of resource recovery ideas that result in a product or process that is new or unique and adds value to the circular economy.

The ACT process is already proven as a commercial treatment process, in the UK and elsewhere. It does not need to be 'proven' or be 'scaled or demonstrated'. It has worldwide patents and consequently such a pathway may not be accepted, nor would it be cost effective. O.C.O can already demonstrate that the treatment process can be utilised to create a product, a product accepted by the Environment Agency in the UK and is sufficiently scaled for commercial use. This route does not de-risk the required investment in a full-scale plant that can be ready and in operation for the EfW industry in NSW.

Conclusions

First we support a positive outcome for the EfW industry from this review. Energy from Waste is a safe and effective tool in managing waste and avoiding landfill. It can also be 100% landfill free if regulation allows.

Secondly, we would urge the Inquiry to initiate a review of the Resource Recovery Orders and Exemption process and allow for an 'end of waste' Order to be developed, allowing processes that use waste in their manufacturing process to be able to market their product, once found by the EPA to be sound and acceptable in terms of risk and use.

If the NSW Government is serious about the circular economy and encouraging re-use and the reduction in use of virgin raw materials, this is an easy win and shows a commitment to opening pathways for re-use, in a structured and regulated fashion.



Kind Regards

Andrew Short
Director of Project Development ANZ



ENVIRONMENT AGENCY CEO VISITS O.C.O.'S AVONMOUTH FACILITY

22nd August 2022

Sir James Bevan, Chief Executive Officer of the Environment Agency, visited O.C.O Technology's Avonmouth facility on Wednesday (August 17).

The two-hour visit gave him the chance to see the company's world-leading Accelerated Carbonation Technology (ACT) in action and talk to its experts about future developments in the fight against climate change.

O.C.O's ACT uses carbon dioxide gas to treat and valorise a wide range of wastes, including Air Pollution Control residues (APC_r) from the Energy from Waste sector, turning it into carbon negative aggregate – called Manufactured Limestone (M-LS).

Because more CO₂ is permanently captured than is used in the manufacturing process, it has been recognised as the world's first carbon negative aggregate and is increasingly sought after as a sustainable building material.

Speaking afterwards, Sir James said: "What O.C.O Technology delivers as a company is truly innovative: a technique of capturing carbon that turns hazardous waste into a non-hazardous resource in a process that is net carbon negative."

"The Environment Agency's 'End of Waste' approval is rare and well deserved. I look forward to developing our relationship further to support the delivery of UK Net Zero targets."

O.C.O's Managing Director, Steve Greig, hosted the visit alongside fellow directors Clayton Sullivan-Webb (also Managing Director of Grondon Waste Management) and Non-Executive Director Stephen Roscoe.

Steve said: "We were very pleased to welcome Sir James and his EA sustainability team colleagues to Avonmouth."

"It was an opportunity for them to see first-hand how our innovative processes turn hazardous waste materials, which would otherwise have been sent to landfill, into an award-winning carbon negative aggregate, with the power to make significant CO₂ savings versus more traditional building materials."

"We had a number of wide-ranging discussions on topics including the potential for using M-LS in future EA projects, O.C.O's ongoing development plans, and our trials of new materials."

"We already have a very positive working relationship with the EA, further strengthened by this visit, and we thank Sir James for his encouraging comments."

Last year (2021), a project involving O.C.O's M-LS earned top honours in the Towards Net Zero category of the Environment Agency Flood & Coastal Excellence Awards.

The M-LS was a key component in a groundbreaking low carbon asphalt mix used in the construction of a low carbon cycle path, built for Birmingham City Council as part of the Bromford Flood Alleviation Scheme.

O.C.O was one of a number of supply chain partners brought together by Jackson Civil Engineering on the building project for the Environment Agency. At the time, the award judges said the use of carbon negative aggregate on the flood defence cycle scheme was "a great step forward in the right direction and could be transformational if applied to flood schemes more extensively in the future".

Estimates showed that the 2.5km new low carbon foamed asphalt path could deliver CO₂ savings of more than 70 tonnes – equal to a 90% reduction – compared with using a traditional hot AC20 asphalt mix.



Pictured left is Sir James Bevan, CEO of the Environment Agency, taking a closer look at O.C.O Technology's world-leading carbon negative aggregate. Alongside him is O.C.O's Lee Thompson, Health, Safety, Environment and Quality (HSEQ) Manager.