24 October 2022

ZEOTECH TO DEVELOP PRODUCTS FOR METHANE CONTROL IN COLLABORATION WITH CLEANAWAY

Emerging mineral processing technology company, Zeotech Limited (ASX: ZEO, "Zeotech" or "the Company") is pleased to advise it has executed a 12-month multi-stage targeted research program with Griffith University ("Griffith") to develop and validate the application of Zeotech products for controlling landfill methane emissions.

The program will be undertaken in collaboration with Cleanaway Waste Management Limited ("Cleanaway"), Australia's leading waste management, industrial and environmental services company. The project will incorporate lab-based characterisation and infield trials aimed at establishing scientific and economic validation for potential Zeotech product applications for methane emission control.

The project will focus on landfill methane emissions and offer the opportunity to assess the potential capacity and capability of utilising Zeotech products to control methane emissions across a range of commercial industries.

HIGHLIGHTS

- Targeted research program executed with Griffith to establish scientific and economic validation for Zeotech product applications for controlling landfill methane emissions
- The program will be undertaken in collaboration with Cleanaway who will provide landfill cover soils for early-stage characterisation, alongside potential access to transition landfill sites for field validation
- Landfill methane control was the highest-ranking opportunity identified in the recently completed carbon market scoping study by Griffith, and is made possible with Zeotech's proprietary mineral processing technology for the low-cost production of manufactured zeolites
- Methane is the second most significant greenhouse gas (GHG) with a 100-year global warming potential 28 times greater than CO_2 and landfills release just under 1 Gt of atmospheric CO_2-e of methane p.a.[1]
- A manufactured zeolite layer within landfill capping soils could function to intercept and oxidise methane emitted from the underlying refuse, reducing GHG emissions
- The project is focused on landfill methane emissions and will also evaluate the potential for Zeotech products to be applied for methane emission control measures across diverse industries such as mining and agriculture

[1] IPCC. Climate Change (2014): Synthesis Report, IPCC, Geneva, Switzerland

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Griffith University, School of Environment and Science, Australian Rivers Institute, Dr Chris Pratt said:

"Griffith University values its technical partnership with Zeotech and the opportunity to develop zeolite applications to reduce methane emissions in commercial settings. Methane is a powerful greenhouse gas with a global warming potential more than 80 times greater than carbon dioxide in the first 20-years following atmospheric release. We identified this project as offering the best near-term opportunity for emission reduction in the recently completed carbon market scoping study."

"We are therefore excited to be working on such a valuable project which could help a traditionally hard-to-abate sector achieve greenhouse gas reduction, and potentially support Australia's recent pledge to reduce methane emissions by 30 per cent by 2030[2]"

Cleanaway Waste Management, Remediation & Sustainability, Srikar Rapole added:

"The proposed research project is strongly aligned with Cleanaway's strategy, which is to make a sustainable future possible together. Cleanaway is leading the way in providing total waste management solutions to our customers and at the same time achieving the triple bottom line of sustainability."

Cleanaway Waste Management, Head of Engineering, Barry Griffin added:

"We are pleased to be collaborating with Zeotech and Griffith University on an innovative project which leverages novel mineral processing technology to potentially contribute to greenhouse gas abatement and assist Cleanaway to achieve its sustainability goals."

BACKGROUND

Extended Carbon Market Scoping Study ("Study")

The Study, completed in April 2022[3], investigated opportunities for materials-based GHG mitigation, made possible with Zeotech's proprietary mineral processing technology for the low-cost production of manufactured zeolites.

The Study was strategically tailored to commence at the beginning of the Company's comprehensive dual-stream agricultural product development program ("Program"), which is currently underway at Griffith.

Seven additional opportunities were identified for manufactured zeolites to contribute to climate change mitigation for the three major GHGs - carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Zeolite application to control landfill methane emissions was ranked the highest potential opportunity on a scale of 'readiness and value proposition of testing'.

[2] www.abc.net.au/news/2022-10-13/australia-set-pledge-methane-emission-reduction
[3] ASX release 12/04/2022 "Opportunities for Zeolite-Based Greenhouse Gas Mitigation"

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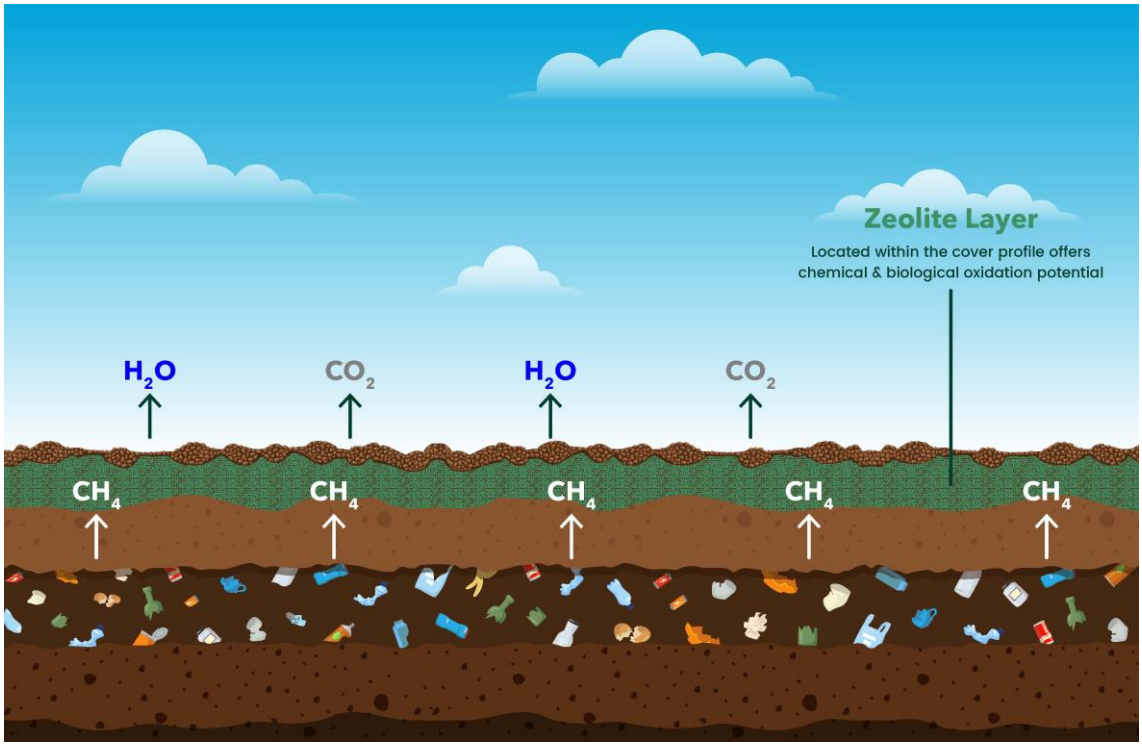
Landfill Methane Emissions

Landfilling of domestic waste is a significant source of methane (CH_4) emissions, releasing just under 1 Gt of atmospheric CO_2-e per annum.

Methane (CH_4) is the second most significant GHG, with a global warming potential (GWP) 28 times greater than carbon dioxide (CO_2) over a 100-year period[4].

Manufactured zeolites possess high gas exchange and high surface area properties, and consequently their application to landfill cover soils could significantly boost baseline CH_4 oxidation rates.

The application of a layer of manufactured zeolite to landfill capping soils could function to intercept and oxidise methane emitted from the underlying refuse, reducing GHG emissions.



A layer of manufactured zeolite (indicated in green above) located within the cover profile offers the potential for chemical and biological oxidation.

Manufactured zeolites could offer ideal habitats for a group of bacteria termed 'methanotrophs'. These bacteria are specialist methane consumers and can oxidise the methane into water and carbon dioxide. Whilst the latter is a GHG, it has significantly less global warming potential (GWP) than methane.

In addition to stimulating biological CH_4 oxidation, zeolites applied to landfill cover soils could also catalyse chemical CH_4 oxidation.

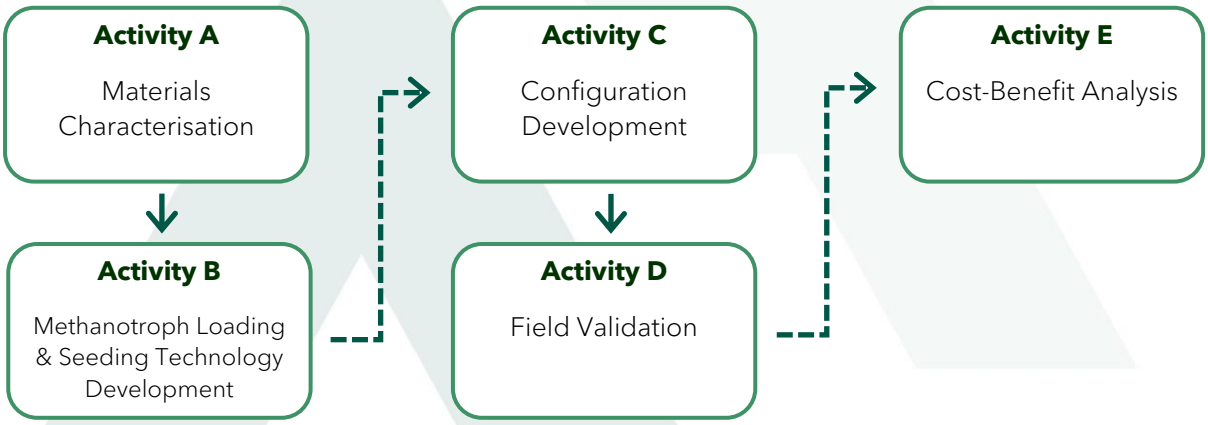
[4] IPCC. Climate Change (2014): Synthesis Report, IPCC, Geneva, Switzerland

Zeotech products carry metal oxides Fe_2O_3 and TiO_2, potentially providing an additional oxygen source to enhance the capacity for methane oxidation.

Manufactured zeolites exhibit exceptional effective CH_4 oxidation potential, noting that they may hold the key to substantive climate change abatement[5].

ZEOTECH PRODUCTS FOR LANDFILL METHANE CONTROL

The 12-month research program aims to investigate and validate opportunities for Zeotech products to control landfill methane emissions over four sequential research and development stages, with an additional fifth stage to undertake cost-benefit (economic) analysis.



The project is developed with contingent activity outcomes, ensuring continuation of the program is based on positive results at key stages.

The commercial research agreement with Griffith represents a financial commitment of up to $475,163 based on all 5 sequential activities being completed. The project is fully funded from the proceeds of the recent capital raise[6].

Project IP that is developed under the program will vest with Zeotech immediately upon its creation and is aligned to the Company's existing research agreements with Griffith.

The project is scheduled to commence from 1 February 2023, and contract execution allows Griffith to commence recruitment of a highly specialised Post-doctoral Research Fellow specifically for the program.

Activity A: Materials Characterisation

- This activity aims to establish the chemical methane oxidation and carbon dioxide adsorption capacities of Zeotech products from fundamental characterisation measurements and in-lab adsorption tests.
- The anticipated outcome of this activity is the characterisation of the chemical methane oxidation potential of Zeotech products.

[5] Jackson, R. B.; Solomon, E. I.; Canadell, J. G.; Cargnello, M. and Field, C. B. Methane removal and atmospheric restoration. Nature Sustainability. 2019, 2(6): 436-438. 10.1038/s41893-019-0299-x
[6] ASX release 26/09/2022 "Placement Secures $2.2m to Advance Company Projects"

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Activity B: Methanotroph Loading & Seeding Technology Development

- Activity B aims to evaluate the capacity of Zeotech products to host microbial methanotroph communities (key micro-organisms responsible for methane consumption).
- The anticipated outcome of this activity is the characterisation of the biological methane oxidation potential of Zeotech products.

Activity C: Configuration Development

- This aims to develop practical configurations for Zeotech products in filter systems for mitigating methane emissions in landfill sites.
- The anticipated outcome of this activity is to establish at least one practical Zeotech product configuration with methane emission abatement potential that can be trialled at an operating landfill site.

Activity D: Field Validation

- This activity will test the most successful configuration(s) from Activity C at separate operating landfill locations and using different capping soil materials.
- This initiative plans to use small-scale static chamber methods to validate methane abatement at field-scale, acknowledging that success in decreasing methane emissions will need to be verified by a government regulated carbon accounting system and/or by the landfill operators themselves.
- The anticipated outcome of this activity is a baseline understanding of Zeotech product performance in mitigating infield methane emissions at landfills.

Activity E: Cost-Benefit Analysis (Economic Analysis)

- Utilising economic methodologies, this activity will use the methane research results (activities A to D) to inform a cost-benefit analysis and evaluate the commercial opportunities for Zeotech.
- The cost-benefit analysis will be undertaken primarily from a 'private' perspective and focus on commercial benefit, together with identification of co-benefits that could accrue from a 'public' perspective (costs and benefits to broader society, encompassing economic, social, health and the environment).
- The anticipated outcome of this activity is provision of an economically sound evaluation of market opportunities for Zeotech products as a treatment for methane emission abatement for landfill operators.

PROJECT TEAM

Griffith has assembled a project team representing extensive expertise, capability and capacity which leverages the university's experts in landfill methane monitoring and mitigation.

It will comprise Research Project lead, Dr Chris Pratt, supported by a highly experienced academic colleague Dr Ali El Hanandeh. Further, the project will benefit from the full-time appointment of a highly specialised Post-doctoral Research Fellow who will be recruited specifically for the program.

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Dr Pratt has direct experience in landfill methane control and has developed unique models for quantifying methane removal rates in landfill cover soils, which have been published in peer-reviewed international journals[7,7]. His expertise in landfill methane and cross-sectoral methane emission and mitigation control programs will be utilised in leading this project.

The cost-benefit analysis (Activity E) will be led by Associate Professor Jim Smart, an environmental economist with extensive experience conducting cost-benefit assessments and environmental economic evaluations for commercial companies and Queensland & Federal Government.

Dr Chris Pratt

Dr Pratt is a Senior Lecturer at Griffith University and a member of the Australian Rivers Institute. His research interests span several high-level challenges relating to soil management, particularly in the areas of Sustainable Agriculture, Climate Change Mitigation and Adaptation, and Soils' roles in Waste Management.

His research outputs include publications in high-ranking international journals, development of best-practice guidance documents for primary producers, and findings adopted by the Australian and New Zealand Greenhouse Gas Inventories.

Associate Professor Jim Smart

Assoc Prof Jim Smart is an environmental economist with expertise in ecosystem service assessment, cost-benefit analysis, cost-effectiveness evaluation, nutrient offsetting, incentive-based approaches for managing water quality, environmental-economic accounting, and non-market valuation.

He has extensive experience conducting cost-benefit assessments and environmental economic evaluations for commercial companies, the Queensland and Federal governments in Australia, and the Danish and UK governments

His economic evaluations have been used by industry and Government, informing strategies for managing drinking water quality in Southeast Queensland, pollution runoff to the Great Barrier Reef, and marine water quality in the Baltic Sea. His research has also informed policies regarding investment in green infrastructure, biodiversity management and agricultural land use.

GRIFFITH UNIVERSITY

Ranking in the top 2% of universities worldwide, Griffith has come to be regarded as one of Australia's most innovative tertiary institutions and one of the most influential universities in the Asia-Pacific region.

Griffith draws on a large multi-disciplinary pool of experts and researchers, allowing engagement in complex and technically advanced projects.

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[7] Pratt, C.; Walcroft, A.S.; Deslippe, J. Tate, K.R. CH_4/CO_2 ratios indicate highly efficient methane oxidation by a pumice landfill cover-soil. Waste Management. 2013, 33(2): 412-419, https://doi.org/10.1016/j.wasman.2012.10.020.

[7]Pratt, C.; Walcroft, A.S.; Tate, K.R.; Ross, D.J.; Roy, R.; Reid, M.H.; Veiga, P.W. In Vitro Methane Removal by Volcanic Pumice Soil Biofilter Columns over One Year. J. Environ. Qual. 2012, 41:8087. https://doi.org/10.2134/jeq2011.0179

Its unique infrastructure ensures the delivery of timely, cost-effective and innovative projects and solutions without compromising on quality, safety, sustainability and environmental considerations.

Soils and Land Use Team

Griffith University's Soil and Land Use team is one of Australia's most highly specialised and well-resourced teams in the area of soils-based greenhouse gas emission abatement and nutrient management. Zeotech will have access to the contingent's state-of-the art analysis suite – which includes a carbon fractionation analyser and a carbon greenhouse gas chromatograph coupled with a bespoke methane oxidation model developed by project lead Dr Chris Pratt.

The group comprises expertise spanning multiple high-level themes, including Climate Change Mitigation and Adaptation, Sustainable Fertiliser Development, and Soil Waste Management.

Environmental Engineering Group

Griffith University's Environmental Engineering group is one of Australia's most established practicing teams in its field. With a strong emphasis on developing realistic solutions to meet industry-government needs, the group's expertise in nutrient waste management and recycling, gas emission measurement and modelling and Life Cycle Analysis, will be invaluable in the proposed research programs.

Environmental Economics Group

Griffith University's Environmental Economics group is one of the country's leading research groups in environmental and resource economics, making significant contributions to public and private sector frameworks and practice, both nationally and internationally.

The group's expertise spans cost-benefit analysis, ecosystem service assessment, cost-effectiveness evaluation, nutrient offsetting, incentive-based approaches for managing water quality, environmental-economic accounting, natural resource and environmental economics, climate change economics, tourism economics, social and economic project/program evaluation, sustainable development, non-market valuation, and the economic determinants of subjective wellbeing.

CLEANAWAY WASTE MANAGEMENT

The program will be undertaken in collaboration with Cleanaway Waste Management Limited (ASX: CWY or "Cleanaway") who will provide landfill cover soils for early-stage characterisation, alongside access to transition landfill sites for field validation.

Cleanaway is Australia's leading total waste management, industrial and environmental services company.

Cleanaway have supported Australian businesses for over 50 years with over 6,300 expert staff and a fleet of over 5,300 specialist vehicles across more than 250 locations around Australia.

The company is Australia's largest waste, recycling, industrial and liquids service provider with a substantial network of state-of-the-art facilities, transfer stations, engineered landfills, liquid treatment plants and refineries.

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Cleanaway's mission is to make a sustainable future possible. They are leaders not just through their total waste management solutions but also by achieving the triple bottom line of sustainability:

- a financially strong and resilient business;
- contributing to a thriving population through employment and community engagement; and
- leading their industry to protect our planet for generations to come.

This announcement has been approved by the Board.

- End -

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About Zeotech

Zeotech Limited (ASX: ZEO) is a team of dedicated people, working together to build a future focused company, leveraging proprietary technology for the low-cost production of advanced materials 'manufactured zeolites' to deliver solutions aimed at addressing sustainability challenges.

Zeotech Limited - Social Media Policy

Zeotech Limited is committed to communicating with the investment community through all available channels. Whilst ASX remains the prime channel for market-sensitive news, investors and other interested parties are encouraged to follow Zeotech on Twitter (@zeotech10) and LinkedIn.

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This release may contain certain forward-looking statements with respect to matters including but not limited to the financial condition, results of research and development, operations, and business of Zeotech and certainty of the plans and objectives of Zeotech with respect to these items.

These forward-looking statements are not historical facts but rather are based on Zeotech current expectations, estimates and projections about the industry in which Zeotech operates, and its beliefs and assumptions.

Words such as "anticipates," "expects," "intends," "potential," "plans," "believes," "seeks," "estimates", "guidance" and similar expressions are intended to identify forward looking statements and should be considered an at-risk statement.

Such statements are subject to certain risks and uncertainties, particularly those risks or uncertainties inherent in the process of developing technology and in the endeavour of building a business around such products and services.

These statements are not guarantees of future performance and are subject to known and unknown risks, uncertainties, and other factors, some of which are beyond the control of Zeotech, are difficult to predict and could cause actual results to differ materially from those expressed or forecasted in the forward-looking statements.

Zeotech cautions shareholders and prospective shareholders not to place undue reliance on these forward-looking statements, which reflect the view of Zeotech only as of the date of this release.

The forward-looking statements made in this announcement relate only to events as of the date on which the statements are made. Zeotech will not undertake any obligation to release publicly any revisions or updates to these forward-looking statements to reflect events, circumstances or unanticipated events occurring after the date of this announcement except as required by law or by any appropriate regulatory authority.

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