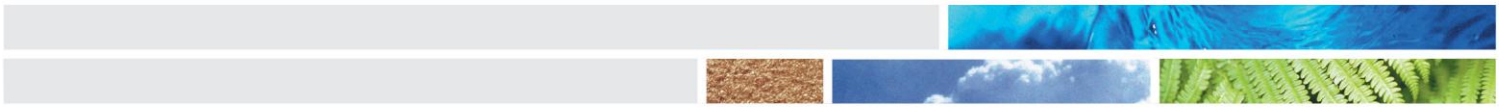
Environmental Protection Authority
Te Mana Rauhī Taiao

EPA advice on application ERMA200833 – the proposed release of *Clostridium magnum*

MARCH 2012



ADVICE TO THE DECISION MAKING COMMITTEE

New Zealand Government

Executive Summary

Application ERMA200833 from LanzaTech New Zealand Limited (LanzaTech) is for the release of *Clostridium magnum* – a bacterium new to New Zealand that can convert carbon-based gases to acetic acid.

LanzaTech has carried out research on *C. magnum* in their containment laboratory and now wishes to carry out activities outside of a containment facility. In order to carry out such activities they have applied for a release approval without controls under the Hazardous Substances and New Organisms (HSNO) Act.

During our assessment we identified significant benefits associated with the release of *C. magnum* and did not identify adverse effects. Therefore we recommend that the HSNO Decision Making Committee approve this application.

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1. Information used in the risk assessment

1.1. The assessment of the risks, costs and benefits of the release of *C. magnum* was undertaken for five areas of impact: human health and safety, the environment, society and community, the relationship of Māori to the environment, and the market economy. *Clostridium magnum* was also assessed against the criteria of the minimum standards (section 36 of the HSNO Act).

1.2. Information provided in the application and in submissions (summarised in Appendix 2) was among the information used in the risk assessment.

2. The assessment of benefits

2.1. There are a number of benefits that will result from the release of *C. magnum* should it be approved. Appendix 1 outlines our identification and assessment of benefits.

2.2. We identified the following benefits as being significant:

- Gaining scientific knowledge from the operation of the plant(s), honing the process for commercialisation and intellectual property generation.
- Retaining international class scientific talent in New Zealand.
- Society and community beneficial effects from the development and use of sustainable 'green' technologies and greenhouse gas-capturing technologies.
- Providing growth and support opportunities for associated companies including enhancing the ability to form partnerships with carbon gas emitters and promoting increased international investment into research and development.

2.3. In the evaluation of the benefits we note that many New Zealanders see scientific research (e.g. into green technologies) as a way to fulfil their personal self-development as well as a way of contributing to making New Zealand a better place to live in. Regardless, the freedom to explore new and novel techniques is part of New Zealand's cultural and social heritage.

2.4. This means that scientific research does not need to "succeed" in order for it to be valuable (Rankin, 2011). Research contributes to New Zealand's wider society and community through the promotion of exploration and growth. Therefore even if the technology is ultimately unsuccessful, there is value to New Zealand and New Zealanders in allowing research activities to occur (Appendix 1).

2.5. The approval of this application would encourage LanzaTech to maintain their facilities in New Zealand, enhance opportunities for other New Zealand companies, enable further collaborations with waste gas producers and enhance the opportunities for international investment.

2.6. We note that LanzaTech has previous successes including an existing pilot plant which produces ethanol from waste gases. LanzaTech has formed collaborations to build demonstration plants overseas and has been successful in attracting international investors and contracts (Appendix 1).

2.7. In addition, the development of technologies that use microorganisms to convert carbon-based waste gases into valuable products is consistent with the Government's strategy of reducing New Zealand's greenhouse gas emissions (Appendix 1).

2.8. We note that should this technology be ultimately successful and be commercially adopted in New Zealand and worldwide, the magnitude of these benefits is expected to be greater.

2.9. An example of an innovative industry that has come from humble beginnings and now provides significant economic benefits to New Zealand is the superyacht industry which, within the last decade or so, has gained a reputation for high standards of workmanship in both the building and refiting of superyachts. The building and refiting of superyachts is expected to contribute significantly to the marine industry's target of $2.7 billion/annum by 2015 (New Zealand Marine Industry, 2010).

2.10. In relation to a possible reduction in carbon-based gas emissions (and subsequent production of acetic acid):

- For a pilot plant: If it is assumed that a 50-100 metric tonne/year reduction in carbon emissions could result (LanzaTech, pers. coms), this would be equivalent to removing 17-34 cars off the road or planting 1.5-3 hectares of radiata pine in the Auckland region (Appendix 1). Although this is not a significant reduction when compared to New Zealand's total carbon emissions, a reduction would provide proof of the potential value of this technology.
- Should the commercial adoption of this technology in New Zealand or overseas occur: As the magnitude of any benefits would depend upon which facilities adopt the technology, their current level of carbon-based gas emissions, and the level of reduction in carbon-based gas emissions and production of acetic acid seen after the use of this technology, at this stage we consider it would be too speculative for us to make an assessment (Appendix 1).

Conclusion

2.11. Given LanzaTech's prior successes we have assessed the likelihood of the benefits listed in section 2.2 as **highly likely** to occur. The magnitude of the benefits has been assessed as **major** based on their significance to New Zealand and New Zealanders. In conclusion the benefits of the release of *C. magnum* described in section 2.2 have been assessed as **high**.

3. The assessment of adverse effects including assessment against the minimum standards

3.1. We investigated the following potential adverse effects:

- *Clostridium magnum* causing disease in humans, plants or animals.
- *Clostridium magnum* displacing native species within their natural habitat, causing significant deterioration of natural habitats or causing significant adverse effect to New Zealand's inherent genetic diversity.

Will Clostridium magnum cause disease?

3.2. After reviewing the known biological charactertistics of *C. magnum*, there is no evidence that *C. magnum* will cause disease in humans, plants and animals or will become a vector for human, plant or animal diseases (Appendix 1).

Will Clostridium magnum displace native species within their natural habitat, cause significant deterioration of natural habitats or cause significant adverse effect to New Zealand's inherent genetic diversity?

3.3. We consider that *C. magnum* would be only metabolically active when the substrate that it utilises is available (i.e. it would be effectively absent when the substrate is absent). We note that the colonisation of a substrate by *C. magnum* would be through a chance encounter with that substrate rather than it actively seeking that substrate (Appendix 1).

3.4. Therefore we consider that should *C. magnum* reach an anaerobic niche, it is unlikely to displace other organisms present, cause significant deterioration of natural habitats or cause significant adverse effect to New Zealand's inherent genetic diversity (Appendix 1).

Minimum standards

3.5. Any organism being assessed for release must pass the five minimum standards as stated in the HSNO Act. *Clostridium magnum* was assessed against these standards in Appendix 1. The outcome of the assessment is summarised in Table 1.

Table 1: Summary of the assessment against the minimum standards

Minimum standard criteria	Overall assessment
Is *C. magnum* likely to cause any significant displacement of any native species within its native habitat?	No
Is *C. magnum* likely to cause any significant deterioration of natural habitats?	No
Is *C. magnum* likely to cause any significant adverse effects on human health and safety?	No
Is *C. magnum* likely to cause any significant adverse effect to New Zealand's inherent genetic diversity?	No
Is *C. magnum* likely to cause disease, be parasitic or become a vector for human, animal or plant disease?	No

3.6. Therefore we consider that *C. magnum* meets the minimum standards as stated in the HSNO Act.

Conclusion

3.7. We could not identify adverse effects associated with the release of *C. magnum*.

4. Should controls or restrictions be imposed?

4.1. A submitter requested that *C. magnum* be limited to non-sporulating laboratory strains, or controls be imposed so that *C. magnum* is contained (Appendix 2). The applicant considers that should containment measures be imposed, the project would not be economically viable or cost effective (page 9 of the application).

4.2. While we recognise that imposing restrictions or controls is a way to mitigate risks and to proceed with caution, as we did not identify adverse effects associated with the release of *C. magnum*, we do not consider that it is appropriate to impose controls such as restricting the approval to specific strains of *C. magnum* or imposing controls to contain the organism (Appendix 2).

5. Recommendation

5.1. After reviewing the relevant information we consider that the benefits arising from the release of *C. magnum* would be significant. We did not identify adverse effects.

5.2. Therefore we recommend that the release of *C. magnum* be approved.

6. Impact on international obligations

6.1. We are not aware of any international obligations that may be impacted by the approval of this application.

7. References

New Zealand Marine Industry 2010. *New Zealand marine industry sets ambitious course for $2.7 billion p.a by 2015*. http://www.nzmarine.com/Industry+News/New+Zealand+Marine+Industry+sets+ambitious+course+for+2.7+billion+p.a.+by+2015.html Retrieved February 2012.

Rankin, DJ 2011. A Darwinian approach. *Science* 333: 526.

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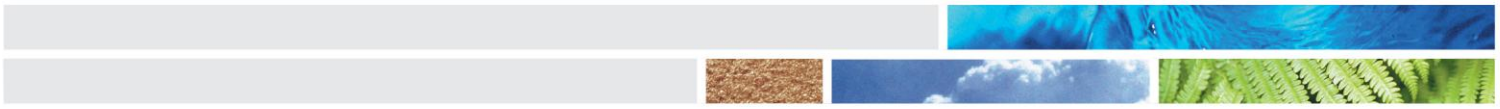

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