

BEFORE THE NORTHLAND REGIONAL COUNCIL HEARING PANEL

UNDER

The Resource Management Act 1991

IN THE MATTER OF

Proposed Northland Regional Plan –
GMO provisions

**SUMMARY STATEMENT OF EVIDENCE OF JACK ALFRED HEINEMANN
ON BEHALF OF THE WHANGĀREI DISTRICT COUNCIL AND FAR NORTH
DISTRICT COUNCIL**

30 October 2018

1. INTRODUCTION

- 1.1 Tēnā koutou katoa. Ko Jack A. Heinemann ahau. My qualifications and experience are contained in my Statement of Primary Evidence. As per paragraph 9 of my primary evidence, I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (2014) and have sought to comply with it in the production of this summary statement.
- 1.2 I thank the Hearings Panel for allowing me to clarify where necessary my own evidence in response to the evidence referring to me prepared on behest of Federated Farmers. In the interests of time and for the convenience of the Panel, I will submit my full rebuttal in writing and not read out its entire content.
- 1.3 The evidence from Federated Farmers does not address the issues of whether:
 - (a) there are or could be GMOs released into or contaminating coastal marine areas; or
 - (b) what risks, if any, they could create.
- 1.4 I will consider the evidence I submitted on these two issues as uncontested.
- 1.5 The matters raised by Professor Allan on behalf of Federated Farmers that I will discuss are:
 - (a) is there scientific certainty or uncertainty on the safety of GMOs?
 - (b) is there scientific rationale and precedent for managing the risk of harm from GMOs at local levels?

2. SCIENTIFIC UNCERTAINTY AND CONSENSUS

- 2.1 The evidence does not demonstrate a consensus amongst scientists that GMOs are considered to be safe.
 - (a) The evidence from the scientific bodies that were cited by Professor Allan does not represent a blanket endorsement of the safety of GMOs. Despite mentioning in paragraph 2 that GMOs can be bacteria, viruses, fungi, plants and animals, the evidence and citations of safety are primarily if not exclusively about plants, only terrestrial plants, and only terrestrial crop

plants.¹ The Panel is considering any and all genetically modified organisms that could be made in the future and/or made from bacteria, viruses, fungi, other kinds of plants including those in the marine environment, and invertebrate and vertebrate animals either terrestrial or aquatic.

- (b) The conclusions drawn overstate those reached by the cited material and in my view misrepresent it. As I will explain, the claims of benefits and safety in other places lacks foundation for extrapolation to New Zealand, Northland or even more specifically, in coastal marine areas.²

2.2 I am a practicing genetic engineer and I believe that existing commercial GMOs and some *hypothetical* GMOs are or could be safe. However, it is untrue that all GMOs in all contexts will be safe.³

2.3 Some are not intended to be safe. For example, GMOs might be developed as bioweapons.⁴ GMOs such as those that might be used as medicines or the source of medicinal or industrial materials may not be safe for ingestion exposure. Some are not intended to be safe to certain non-target insects even if the effect on them is mitigated through other means, such as is the case with insecticidal GM crops. In use for two years in the US, dual dicamba and glyphosate resistant soybean crops have been damaging to some farmers because through their intended use herbicide spray drift has killed soybeans and cotton on neighbouring farms and is

¹ This material is paragraphs 13-20 and Appendix C and D of Professor Allan's evidence. The references to medicinal products are not relevant to the proposed plan changes. In paragraph 20 Professor Allan refers to the seven agencies listed in Appendix D as among the "most respected science organisations in the world". All seven decontextualised statements from them refers to food or crops only and those already approved as safe and are already commercialised.

² See paragraph 23 of my primary evidence. In addition, the US National Research Council and National Academy of Science, also cited by Professor Allan, said that safe use of GMOs in the United States (or anywhere) does not mean that they will be safe everywhere, such as in New Zealand: "One can imagine an argument being made by certain stakeholders, that if the U.S. government found a plant to be safe, that judgment should be good enough for a country without the resources to conduct its own environmental analysis. *That would be wrong*. Just because APHIS finds a transgenic plant to have no significant impact in the United States is not a guarantee that it will not have an impact elsewhere" (emphasis added).

³ Any sounding of the scientific community should take into account the peer-reviewed literature. In a major review of the environmental and human health effects of GM crops published just last year, the authors said that the "amount of uncertainty and unpredictability of risks associated with GM crops developed through modern biotechnological techniques or conventional mutation breeding or hybridization is variable but sure" **Tsatsakis, A.M., Nawaz, M.A., Kouretas, D., Balias, G., Savolainen, K., Tutelyan, V.A., Golokhvast, K.S., Lee, J.D., Yang, S.H., and Chung, G.** 2017. Environmental impacts of genetically modified plants: A review. *Environ Res* 156, 818-833.

⁴ **Reeves, R.G., Voeneky, S., Caetano-Anolles, D., Beck, F., and Boete, C.** 2018. Agricultural research, or a new bioweapon system? *Science* 362, 35-37.

suspected of causing damage to other plants, including trees of commercial or conservation value.⁵

- 2.4 So when someone says that a GMO is safe, or that genetic engineering is safe, it is important for them to specify both the GMO and the social and environmental contexts in which it will be used. That is the basis of international quality assured risk assessment practice. The evidence from Federated Farmers did not do this.
- 2.5 For example, the United States National Research Council and National Academy of Sciences, which was also credited by Professor Allan as confirming the safety of GMOs, said more specifically that: “In this regard the committee’s findings support those of other scientists who have examined this problem of predicting risk and concluded that *risk assessment...must focus on the ecology of the specific introduced organism (or both the donor and recipient in the case of transgenic organisms) and the characteristics of the accessible environment into which the organism will be released*” (emphasis added).⁶
- 2.6 We both did use some of the same references, though, such as the United States National Academies of Science, Engineering and Medicine report of 2016.⁷ I quoted them in paragraphs 25 and 39 of my evidence, where they say that ongoing safety of future products depends not just on continued testing, but improved technologies for testing.⁸

⁵ <https://modernfarmer.com/2017/10/evidence-mounts-monsantos-dicamba-killing-trees/>.
<https://modernfarmer.com/2017/10/evidence-mounts-monsantos-dicamba-killing-trees/>.
<https://www.npr.org/sections/thesalt/2018/09/27/651262491/a-drifting-weedkiller-puts-prized-trees-at-risk>.

⁶ **NRC**. 2002. Environmental Effects of Transgenic Plants: The Scope and Adequacy of Regulation (Washington (DC): National Academies Press (US)
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⁷ **NASEM**. 2016. Genetically Engineered Crops: Experiences and Prospects (Washington, DC: The National Academies Press) . The full name for this reference is the National Academy of Science, Engineering and Medicine (NASEM) but is the same publication that Professor Allan referred to in his paragraphs 13-14 and Appendix C as National Academies (NRC, NAS, NAM). We also both cited the 2005 World Health Organisation report (Professor Allan in his Appendix C and again in Appendix D). I cited them for saying that there was a lack of information needed to adequately assess some risks, including potential long-term environmental and health and safety effects, contributing to scientific uncertainty in risk assessments of GMOs in paragraph 38. **WHO**. 2005. Modern food biotechnology, human health and development: an evidence-based study. (Geneva) Food Safety Department of the World Health Organization
http://www.who.int/foodsafety/publications/biotech/biotech_en.pdf.

⁸ “There is an urgent need for publicly funded research on novel molecular approaches for testing future products of genetic engineering so that accurate testing methods will be available when the new products are ready for commercialization” **NASEM**. 2016. Genetically Engineered Crops: Experiences and Prospects (Washington, DC: The National Academies Press) .

- 2.7 I also refer to them in my paragraph 46b ⁹ where I quote them as saying that “[f]uture GE crops...could greatly expand the use of agricultural biotechnology in the development of biofuels, forestry restoration, and industrial bioprocessing and thus potentially lead to *new* risk-assessment and risk-management issues” (emphasis added).
- 2.8 When in context, the quotes listed in Appendix D of Professor Allan’s evidence do not give the impression that science organisations are plainly endorsing the safety of GMOs. For example, the American Medical Association (AMA) was quoted by him as saying: “Bioengineered foods have been consumed for close to 20 years, and during that time, no overt consequences on human health have been reported and/or substantiated in the peer-reviewed literature,” which sounds like an endorsement of safety. In the next sentence they say: “However, a small potential for adverse events exists. These potential events are centered around horizontal gene transfer, allergenicity, and toxicity.” ¹⁰ The AMA’s nuanced message in context did not say that GMOs were safe, but that current food crops appear to be and that future ones could be. Importantly, it said that ongoing research and monitoring was needed to address their potential to harm the environment. ¹¹
- 2.9 These are not statements that lead me to believe that the US NAS or AMA, among others, believe that all GMOs are inherently safe, much less safe when used anywhere ², such as here. ¹²

⁹ Also footnote 28 to paragraph 39.

¹⁰ Research on this topic continues. Here I list two recent papers on potential allergic or toxic human health effects. **Santos-Vigil, K.I., Ilhuicatzí-Alvarado, D., García-Hernández, A.L., Herrera-García, J.S., and Moreno-Fierros, L.** 2018. Study of the allergenic potential of *Bacillus thuringiensis* Cry1Ac toxin following intra-gastric administration in a murine model of food-allergy. *Int Immunopharmacol* 61, 185-196. **Zdziarski, I., Carman, J. and Edwards, J.** 2018. Histopathological investigation of the stomach of rats fed a 60% genetically modified corn diet. *Food Nutr Sci* 9, 763-796.

¹¹ “Our AMA supports continued research into the potential consequences to the environment of **bioengineered** crops including the: (a) assessment of the impacts of pest-protected crops on nontarget organisms compared to impacts of standard agricultural methods, through rigorous field evaluations; (b) assessment of gene flow and its potential consequences including key factors that regulate weed populations; rates at which pest resistance genes from the crop would be likely to spread among weed and wild populations; and the impact of novel resistance traits on weed abundance; (c) implementation of resistance management practices and continued monitoring of their effectiveness; (d) development of monitoring programs to assess ecological impacts of pest-protected crops that may not be apparent from the results of field tests; and (e) assessment of the agricultural impact of **bioengineered foods**, including the impact on farmers” **AMA**. Bioengineered (Genetically Engineered) Crops and Foods H-480.958. https://www.ama-assn.org/sites/default/files/media-browser/public/hod/a12-csaph-reports_0.pdf. Access date, 23 October 2018.

¹² In fact, the 2016 report from the US NAS ⁷ does not claim that there is a scientific consensus that genetic engineering is safe or that GMOs are safe. Neither does the peer-reviewed scientific literature. For example, even more recent than the US National Academies report in 2016 is this:

- 2.10 I repeat the quote in my primary evidence paragraph 44¹³ from the premier science journal *Nature*. “Tidy stories, in favour of or against GM crops, will always miss the bigger picture, which is nuanced, equivocal and undeniably messy.”¹⁴ The impression that all the research organisations and individuals listed in Appendix C and D of the evidence from Professor Allan have a singular and tidy, uniform view, of safety is not true to their more carefully crafted and multidimensional messages.

3. LOCAL REGULATION

- 3.1 New Zealand is not alone in regulating GMOs and neither is the model of local government being part of regulation unique to New Zealand.¹⁵ Public participation has intrinsic value, not least of which is realised through encouraging a common view on the fundamental question of what is to be protected.¹²
- 3.2 In addition, there is no hard evidence of which I am aware to prove that regulation of GMOs on either the national or local levels is the ultimate or sole cause of any claimed failures to commercialise products of genetic engineering, or will cause a lack of agricultural competitiveness.

4. NEW TECHNIQUES

- 4.1 Finally, I would like to briefly address the information on gene editing (paragraphs 31-38) in the Federated Farmers evidence.
- 4.2 There is agreement between Federated Farmers and me that gene editing is a form of genetic engineering in New Zealand. As such, it should require no special

“Recent claims of consensus over the safety of genetically modified organisms (GMOs) seems to be an artificial and misguided perpetuated construct (Hilbeck et al., 2015; Domingo, 2016) regardless of contradictory evidences published during last three decades which lead scientific community to reconsider that the debate on this topic isn’t ‘over’ yet” **Tsatsakis, A.M., Nawaz, M.A., Kouretas, D., Balias, G., Savolainen, K., Tutelyan, V.A., Golokhvast, K.S., Lee, J.D., Yang, S.H., and Chung, G.** 2017. Environmental impacts of genetically modified plants: A review. *Environ Res* 156, 818-833. The US NAS goes on to say that there isn’t even a consensus on what the risks are. The report authors say instead that in “assessing environmental risks, including stakeholders and the public is important because there is less consensus about what constitutes an environmental risk.” It is not possible to issue a blanket statement of safety for GMOs without a case-by-case evaluation of the place and time where they will be used and agreement on what is being protected.

¹³ Of my primary evidence.

¹⁴ **Gilbert, N.** 2013. Case studies: a hard look at GM crops. *Nature* 497, 24-26.

¹⁵ See paragraph 30 of my primary evidence.

consideration here. Further, it is considered to be genetic engineering also in at least the European Union. ¹⁶

- 4.3 I know of only one product of gene editing anywhere in the world that has been approved for use in agriculture and is possibly near ready for commercial distribution. ¹⁷ Thus, it and any list of developing *hypothetical* products provide little or no basis for extrapolations of safety.
- 4.4 While much is made of the gene editing techniques because they can be used to introduce very small changes to genomes, it is important to note that their use is not restricted to making singular or small changes. The techniques can be used repetitively to introduce major changes to a single location in a genome, or used in one operation to introduce changes at many locations in a genome, and they can be used to do both of these things many times to an evolving product. That these tools can be applied with minimal changes should not imply that future GMOs will be made that way.
- 4.5 Moreover, the size of the change is not the critical issue for risk assessment. As the US National Academy of Science said “risk assessment cannot depend on general characteristics such as the amount of new genetic information introduced.”
⁶ That is why gene edited organisms are appropriately grouped with other kinds of GMOs for risk assessment and management.

5. Conclusion

- 5.1 In conclusion, whereas particular GMOs may be safe for use as and where intended, no scientific consensus exists to assert that all GMOs are safe or that all future GMOs will be safe. Ongoing and increasingly more effective safety evaluations of GMOs are endorsed by major scientific bodies, including the US National Academies, American Medical Association and the World Health Organisation. If there is an international scientific consensus, it might be that a GMO may be found to be safe, but they aren’t necessarily born that way.

¹⁶ <https://www.bbc.com/news/science-environment-44953100>.

¹⁷ <https://cibus.com/press-releases.php>. If I am wrong in the number, it would only be by a few at most.