Submission on Water New Zealand's 'Draft Guidelines for Beneficial Use of Organic Materials on Productive Land'

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Introduction

Environmental and Human Health Aotearoa (**EHHA**) is concerned with the impact of pollution on both ecosystem and human health locally, regionally and globally. We have a particular focus on chemical pollution and waste disposal.

In February 2018, EHHA first became aware that Water New Zealand had been reviewing the *Guidelines for the Safe Application of Biosolids to Land in New Zealand* 2003 (the **Biosolids Guidelines**) and had produced a draft document titled 'Guidelines for Beneficial Use of Organic Materials on Productive Land' (the **Draft Guidelines**). The Draft Guidelines have now been published for public comment, but there is apparently no intention for wider public discussion before the Guidelines are finalized.

We submit that the citizens of New Zealand have not being given an appropriate opportunity to be involved in discussing and evaluating the significant issues surrounding the land application of sewage sludge. This is particularly relevant given the growing understanding of the historic and ongoing contamination of New Zealand's land and waterways from agricultural and industrial wastes and the failure of industry bodies to prevent or significantly mitigate this contamination.

Sewage sludge is not merely 'human manure', but is rather a complex mixture of contaminants including heavy metals, persistent and toxic synthetic chemicals used in industrial and domestic applications, persistent contaminants from personal care and cleaning products, and pharmaceuticals, including the endocrine disrupting chemicals that can have toxic effects at very low concentrations. We submit that a precautionary approach must be taken to the disposal of sewage sludge. It is not acceptable to proceed to apply the sewage sludge to land and test in five years to see whether certain contaminants might be of concern, after the land and water is already irreversibly contaminated. The precautionary approach requires a proof that the sewage sludge will not endanger environmental and human health before there is any consideration of the application of sewage sludge to land.

In this submission, we will address some of the significant flaws that we consider are contained in the Draft Guidelines. However, we also state at the onset that we do not consider that such non-binding 'guidelines' are appropriate for addressing such a significant issue concerning the health of New

Zealand's land and people, and which also has repercussions for the export of New Zealand's primary products. We submit that the issue of the disposal of sewage sludge needs to be addressed by open, informed and democratic evaluation of all the issues and subsequent binding regulations, as appropriate. In the interim, there must be a moratorium on any further land application of sewage sludge, and sale of 'compost' products containing sewage sludge, pending this evaluation.

Summary of submissions

EHHA submits that:

- The disposal of sewage sludge must be addressed by open, informed and democratic evaluation of all the issues and subsequent binding regulations, as appropriate.
- There has been insufficient input from the citizens of New Zealand on the environmental and human health hazards of the application of sewage sludge to land.
- The Draft Guidelines actually relate solely to the application of sewage sludge to land and this should not be obscured by reference to 'organic materials' more generally.
- The Draft Guidelines currently allow for the application to land of sewage sludge without appropriate testing for a large range of known sewage sludge contaminants. Appropriate testing must be part of any guidelines.
- It is not possible to control the levels of contaminants on land using an arbitrary and unrelated measure of nitrogen loading. Appropriate control levels for all relevant contaminants must be implemented and monitored.
- The Draft Guidelines do not properly consider the impact of the leaching of contaminants from sewage sludge into ground water.
- Until all of the above concerns are addressed fully, a moratorium on any further land application of sewage sludge, and sale of 'compost' products containing sewage sludge, is essential to safeguard New Zealand citizens and the environment.

Submissions on specific aspects of the Draft Guidelines

The Draft Guidelines solely concern the land application of sewage sludge and this should be specified

The first notable feature of the Draft Guidelines is that the term 'biosolids' has been removed from the title and replaced with 'organic materials'.

Firstly, we submit that the term 'biosolid' is an unclear designation of the actual product in question: sewage sludge. The definition of 'biosolid' provided in the Draft Guidelines (and taken from the Biosolids Guidelines) is: '[a] sewage or sewage sludge derived from a sewage treatment plant that has been treated and/or stabilised to the extent that it is able to be safely and beneficially applied to land'.[1] This of course means that the product is actually sewage sludge until it can somehow be completely proven to be capable of being safely applied to land. Logically, this also means that there can be no 'risk assessment' of 'biosolids' *per se* (for example as discussed on pages 11-27 of Volume 1 of the Draft Guidelines), as by definition, they can have no more 'risk' once that have been given the designation 'biosolid', that can be 'safely' applied to land. This convoluted definition renders the term 'biosolid' meaningless in relation to assessing the potential for land and water contamination through the application of sewage sludge to land. At best, the term 'biosolids' is unclear and confusing. At worst, it may be used in an attempt to obscure the true nature of the product.

The term sewage sludge is widely used and understood internationally, including under European regulations, and is better understood by citizens generally. It is this term that should be used to describe the product that is actually the subject of the Draft Guidelines.

Secondly, the actual focus of the Draft Guideline is clearly the land application of sewage sludge and not 'organic materials' more generally. By far the major component of the actual content of the Draft Guidelines (which are said to replace the Biosolids Guidelines) is the land application of sewage sludge, the subject of the current Biosolids Guidelines is entirely the land application of sewage sludge, and the Draft Guidelines have been prepared largely by parties involved in wastewater treatment and disposal. It is therefore unclear why there is a nominal shift in the Draft Guidelines to include various other 'organic materials' including, inexplicably, pulp and paper waste, dead stock, animal manure and household food and green waste.[2]

In the Draft Guidelines it is stated that the change in scope from a focus on sewage sludge to a more general 'organic material' is based on a 'recognition' that:

> *all wastes of animal origin, whether human or otherwise, contain similar levels of pathogens, trace elements and organic contaminants and therefore pose similar risks to productive soils and society*.[3]

EHHA strongly disagrees with this statement.

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[1] *Draft Guidelines*, Volume 1, p 61.
[2] *Draft Guidelines*, Volume 1, p 1.
[3] *Draft Guidelines*, Volume 1, p 3.

The contaminant hazard profile for sewage sludge differs markedly from the hazard profile of other organic materials stated to be included in the Draft Guidelines (many of which are not even of 'animal origin'). Sewage sludge is composed of a very complex array of inputs into sewer and wastewater treatment systems and contains contaminants originating from pharmaceuticals and personal care products, cleaning products, some trade waste. By their very nature, sewer and wastewater treatment systems collect and accumulate heavy metal and organic contaminants, including persistent pollutants, meaning that the contaminant profile for sewage sludge is highly complex and needs to be carefully assessed before there is any consideration of application of sewage sludge to land.

Due to its particular and complex nature, it is essential that the contaminant levels in sewage sludge be monitored and managed very carefully. We submit that this can only be achieved through specific and binding regulation on the disposal of sewage sludge and not through a 'dilution' of standards that obscures sewage sludge-specific issues within guidelines that purport to encompass a broad variety of organic materials with differing hazard profiles.

We submit that the disposal of sewage sludge needs to be addressed through regulation that specifically addresses the particular hazards for sewage sludge and sewage sludge alone.

The contaminant guidelines in the Draft Guidelines do not reflect current knowledge on contaminants present in sewage sludge

The Draft Guidelines include limits for the following non-biological contaminants: arsenic; cadmium; chromium; copper; lead; mercury; nickel; zinc; nonylphenol and ethoxylates (NP/NPE); phthalate (DEHP); linear alkydbenzene sulphonates (LAS); and the musks tonalide and galaxolid. The authors of the Draft Guidelines appear to consider that this short list represents the full range of potential non-biological contaminants in sewage sludge that should be tested before spreading sewage sludge on land. However, the current state of knowledge on contaminants known to be present in sewage sludge includes a vastly greater number of compounds of concern to environmental and human health, including persistent organic pollutants and endocrine disrupting chemicals, and also microplastics which themselves act as carriers for chemicals of concern to environmental and human health.

In the *Organic Materials Guidelines – Organic Contaminants Review*, by the Centre for Integrated Biowaste Research, and included in volume 2 of the Draft Guidelines, it is stated that 516 different emerging organic contaminants have been reported to be present in sewage sludge around the world.[4]

[4] Tremblay, L. A. ; Gielen, G. and Northcott, G. L. (2014) *Organic Materials Guidelines – Organic Contaminants Review* (appended to the *Draft Guidelines*, Volume 2) p 5.

This document also states, for example, that unpublished data reveal that a range of pharmaceuticals have been detected in New Zealand sewage sludge, including some at 'relatively high levels'. [5] There is currently minimal understanding of the effects of the complex mixture of sewage sludge contaminants. The authors from the Centre for Integrated Biowaste Research recognise this and concede that 'it is challenging to select organic contaminants of concern for inclusion in the guidelines due to the large numbers of chemicals entering sewage systems and the knowledge gaps about their potential fate and effects'.[6]

We submit that the response to the knowledge gaps and uncertainties is not to choose a small set of contaminants to test (apparently at least partially chosen by the cost of the analysis) and apply limits and 'hope for the best' in relation to remaining contaminants. Many these contaminants have the potential for harmful environmental and human health at relatively low environmental concentrations, such as endocrine disrupting chemicals and pharmaceuticals which are designed to have significant biological effects at low concentrations. It is essential that we take a precautionary approach to the contaminants in sewage sludge, as once contaminants are applied to land in sewage sludge, and potentially leached into the groundwater, it will be difficult or impossible to remediate. We submit that it is irresponsible to proceed with the land application of sewage sludge in New Zealand on the basis of this minimal evaluation of a small subset of the hazardous contaminants that the latest research demonstrates to be present in sewage sludge.

A further illustration of how the knowledge of the extent potentially harmful contaminants in sewage sludge is developing is in the recent recognition that sewage sludge is a repository of microplastics.[7] It is now well recognised that microplastics cause considerable harm in the marine environment, through wildlife ingesting plastic particles and also because of the hazardous substances that bind to, and are transported with the particles. It is now essential that extensive microplastic pollution of land also be prevented. Accordingly, microplastic contamination of sewage sludge must be monitored prior to disposal.

Testing for POPs is an obligation under the Stockholm Convention

EHHA is very concerned with a decision to remove a requirement for testing of sewage sludge for known persistent organic pollutants (POPs) apparently at least partly on the basis that the chemicals are now

[5] Ibid. p 6.

[6] Ibid, p 11.

[7] Mahon, A.M. *et al*., (2017) Microplastics in sewage sludge: Effects of treatment *Environ. Sci.Technol.*, **2017**, *51* (2), pp 810–818; Nizzetto, L. et al (2016) Are Agricultural Soils Dumps for Microplastics of Urban Origin? *Environ. Sci. Technol.* 2016, 50, 10777−10779.

listed under the Stockholm Convention on Persistent Organic Pollutants (the **Stockholm Convention**), to which New Zealand is a signatory. The very nature of POPs is that they are persistent and are mobile in the environment. There has been much recent publicity about perfluorinated compounds (particularly PFOS) from firefighting foam being detected in soil and groundwater around air force bases in New Zealand.[8] While PFOS use was banned in New Zealand in 2006, it continues to persist in the environment, as well continues to pollute the environment via a number of PFOS containing products. Furthermore, it has been subsequently discovered that at least one airport in New Zealand was still using products containing PFOS (apparently either in ignorance of the ban or the nature of the composition of the product in use).[9] Accordingly, even though the POPs may be on the 'banned' list, these compounds may still be in use (as they were incorporated in products before the ban) and/or they are clearly often found in waste materials.

Under Article 11 of the Stockholm Convention, the New Zealand Government is obliged to 'encourage and/or undertake appropriate research, development, **monitoring** and cooperation pertaining to persistent organic pollutants … 'including on their: (a) **Sources and releases** into the environment' [emphasis added]. Accordingly, we submit that New Zealand is obliged to test for the POPs that are already well known to be potential contaminants of sewage sludge. Particularly given the persistence of POPs and the legacy issues around POPs containing products that continue to be stored and used, it is highly inappropriate and, we submit, contrary to New Zealand's obligations under the Stockholm Convention, to stop testing for POPs merely on the basis that they are now on the 'banned' list.

Nitrogen levels cannot be used to control contaminant levels

We submit that the nitrogen loading levels have not relevance to controlling contaminant application to land in sewage sludge.

The Draft Guidelines provide that the primary means of limiting the amount of contaminants applied to land is the provision of nitrogen loading limits. Nitrogen levels are in no way directly related to the contaminant levels in sewage sludge. It is accepted in the Draft Guidelines that the contaminant levels in sewage sludge vary greatly, for example depending on the sources of wastewater entering the treatment plant and the nature of the treatment process.[10] Therefore, there can be no fixed nitrogen to contaminant ratio to enable the nitrogen levels to represent contaminant levels. Furthermore, some contaminants will be persistent and accumulative and some will not. Some contaminants may leach into

[8] https://www.stuff.co.nz/environment/100057264/nationwide-investigation-into-toxic-firefighting-foam-launched
[9] https://www.radionz.co.nz/news/national/351376/banned-toxic-foam-found-at-nelson-airport
[10] *Draft Guidelines*, Volume 2, p 24.

groundwater and some may not. These factors cannot be taken into account when the 'contamination limits' are assessed through an arbitrary nitrogen loading level.

The Draft Guidelines refer to unsubstantiated 'assessments' that are said to show that nitrogen loading limits provide 'effective means of limiting contaminant applications for good quality products and safeguarding our soils'.[11] There is no evidence provided for these 'assessments' and we submit it is impossible to provide any such 'safeguarding' assurance, given the variable nature and complex contaminant profile of sewage sludge.

The Draft Guidelines appear to rely on controlling the inputs into the sewage system to reduce the contaminant load of this product, with specific reference to trade waste. Firstly, not all hazardous contaminants in sewage sludge are derived from so-called 'trade waste'. Secondly, trade waste bylaws may not capture all discharges of so-called 'trade waste' into the sewage treatment system. By their very nature, the inputs into wastewater treatment systems are complex and contaminants accumulate in the sewage sludge. Contaminants derived from pharmaceuticals are integral components of the human waste that the wastewater treatment system is designed to treat. Other so-called 'emerging organic contaminants' such as brominated flame retardants, enter wastewater treatment systems from divergent sources. There is a clear need to control the input of toxics into the wastewater treatment system, which will require, for example, limitations on the use of toxic compounds in domestic and industrial cleaning products and personal care products and the responsible use of human and veterinary pharmaceuticals. However, these are long-term goals that require a concerted effort at reducing overall toxics. The only way to currently establish the level of toxic contaminants in sewage sludge is by the direct and comprehensive measurement of contaminant levels for each specific batch of sewage sludge.

The Draft Guidelines do not address contaminant leaching into groundwater

The contamination of freshwater systems has become an issue of great concern to New Zealand citizens. It is therefore highly concerning that the Draft Guidelines downplay this important issue with the unsubstantiated statement that 'the contaminants covered by this Guide are less likely to move from organic product to groundwater because of the low water solubility and binding properties of the soil for many contaminants'.[12] We note that this statement is contradicted even within the Draft Guidelines documents themselves, for example as demonstrated in the following text excerpts:

[11] *Draft Guidelines*, Volume 1, p 4.
[12] *Draft Guidelines*, Volume 1, p 11.

> *However, evidence is accumulating that the leaching of both trace metal cations and anions does occur, and in some circumstances may result in significant movement of trace metals down the soil profile and into groundwater*.[13]
>
> *Without considerable further research in this area, our ability to predict likely metal bio-availability or* ***mobility*** *trends on the basis of biosolids properties will remain extremely limited.* [emphasis added][14]
>
> *Recent studies in New Zealand have shown increased concentrations of Cd, Ni and Zn in* ***drainage water*** *and soils after biosolids application to soil-grassland systems (Keller et al. , 2002; Speir et al. , 2007) and undisturbed soil (McLaren et al. , 2004), illustrating a strong need to monitor TE concentrations in biosolids subject to soil application.* [emphasis added][15]

An expectation of leaching of contaminants from soil is also provided as an aspect of a 'model' that allows for contaminants to be applied to the land up to the 'soil guidelines' level as follows:

> The total TE concentration in soil (TE_{soil}) could be calculated by adding the concentration applied with the biowaste (TE_{biow}) to the concentration already present in soil ($TE_{i\ soil}$), but reduced by the amount taken up by plants (TE_{plant}) and lost via leaching (TE_{leach}).
> $TE_{soil} = TE_{i\ soil} + TE_{biow} - (TE_{plant} + TE_{leach})$ [16]

According to this model, leaching (presumably including into groundwater) appears to be considered to reduce the level of 'trace elements' in the soil and allow for further application of trace element-containing sewage sludge before any 'guideline' is exceeded. Given the risk of groundwater contamination, surely leaching must be considered as a factor to reduce rather than increase contaminant application to land.

Finally, it is also noted that Dr Grant Northcott makes the following comment in relation to the potential for groundwater contamination by emerging organic contaminants (EOCs):

> *The potential contamination by EOCs of groundwater used for drinking water, off-site migration of EOCS, and management practices minimising this risk should be mentioned. Many organic wastes contain a complex mixture of other non-toxic components, for example relatively labile*

[13] *Draft Guidelines*, Volume 2, p 21.
[14] Ibid, p24
[15] Esperschütz, J. and Robinson, B (2014) Organic Materials Guidelines – Contaminants Review (appended to the *Draft Guidelines*, Volume 2) p 3.
[16] Ibid, p 8-9.

and leachable DOC, which can significantly enhance the solubility or hydrophobic organic contaminants and facilitate the leaching and/or off-site migration of organic contaminants.[17]

We note that this technical input from Dr Northcott has not been included in the Draft Guidelines. Accordingly, it appears that the interaction of components within the complex mixture that is sewage sludge has again, not been taken into account in the Draft Guidelines.

Conclusions

We submit that the Draft Guidelines are significantly flawed and do not provide sufficient protection to New Zealand's land and waterways from the complex mixture of contaminants present in sewage sludge.

The disposal of sewage sludge needs to be addressed by open, informed and democratic evaluation of all the issues and subsequent binding regulations, as appropriate. There must be a moratorium on any further land application of sewage sludge, and sale of 'compost' products containing sewage sludge, pending this evaluation.

[17] Comments of Dr Grant Northcott, provided at https://www.waternz.org.nz/Article?Action=View&Article_id=1043