Report of Dr George Fisher, expert witness.

Specialist in cattle farming production systems, grassland growth and utilisation, soil health and management.

On instructions of Saunders and Partners LLP (Saunders Law), acting for Platts Agricultural Ltd.

Platts Agriculture Ltd.

and

Natural Resources Wales (NRW)

Preliminary report of Dr George Fisher

Dated: 14th July 2023

Subject: Appeal against deemed refusal of NRW for an environment permit for production of cattle animal bedding from recycled waste wood feedstock.

Specialist area of report: Potential impact of bedding material on soil health, following application to agricultural land via incorporation with cattle slurry.

George Fisher Consulting

37, Portland Drive, Scholar Green, Congleton, Cheshire, ST7 3BS

Tel: [redacted]

Introduction

1. Platts Agriculture Ltd. (Platts) produce a pulverised woodchip product that is supplied to cattle farmers as a bedding material. The woodchip is used in conjunction with rubber matting to create comfortable and dry bedding for cubicle housing of cattle.

2. Platts source the pre-pulverised material mainly from furniture manufacturers, and regard the origin as a by-product. However, NRW regard the material as a waste and as such require Platts to apply for an environment permit, adhering to the relevant waste handling and environment legislation.

3. Platts have instructed Saunders Law to represent them in appealing the case. Saunders Law have instructed Dr Vince as an expert witness in risk management and the associated legislation. Saunders Law also instructed Dr Atkinson as an expert witness in animal health and welfare. Dr Atkinson sent me an email on 10th May, 2023 to ask for a discussion on the issues around the use of the material, its addition to cattle slurry and soil health. I spoke with Dr Atkinson on 11th May, and he referred my details to Saunders Law. Mr Steve Garratt (Solicitor with Saunders Law) contacted me by email on 16th May, outlining the requirements for an expert witness on the potential impacts of the material use, via cattle slurry, on soil and the relevant legislation and regulation around the use of cattle slurries and manures. I replied on 16th May with a copy of my CV and introduction to my areas of relevant expertise.

Having read through the relevant materials and the draft reports of Drs Vince and Atkinson, I compiled a draft report and submitted this to Saunders Law on 26th May, 2023.

4. I am Dr George Fisher and I have been working as an independent consultant to the farming industry, specialising in grassland based production systems (milk and meat), since 2011. My clients include farmers, farm input companies and supply chain partners, as well as education establishments, Government agencies and funding bodies for scientific research. I have previously worked in the fertiliser and feed industries (agronomy, product development, marketing and communications, and team management) and as a research scientist (with the Scottish Rural University Colleges). I have preliminary, first and second degree qualifications in biology, livestock science and livestock nutrition. I have been a member of the British Grassland Society (and 2005/6 President of the Society) and British Society of Animal Science for 38 years. I have also been a member of the International Fertiliser Society (and served on the Society Council from 2003 to 2007) for 26 years. I was a member of the Agricultural Industries Confederation, Agriculture and Environment Committee for seven years.

5. I was initially instructed as an expert witness, regarding soil and slurry issues, by Saunders Law via email on 19 h May, 2023. The instructions were accompanied by two documents; the draft report of Dr Vince (dated 12th April, 2023) and the draft report of Dr Atkinson (dated 13th February, 2023).

6. I received updated instructions from Saunders Law on 7th July, along with an Expert Declaration, updated instructions for Dr Vince, a report by Dr Atkinson (dated 3rd July, 2023), a copy of Article 6 ‘End-of-Waste Status’ and the final End of Waste Justification (addendum) by Environmental Compliance Limited.

Overall opinion

7. It is my opinion that the use of the pulverised furniture woodchip material by Platts as a saleable product for cattle bedding, does not pose a significant risk to the farmed environment. This opinion is based on:

7 (a) The regulations and codes that govern the application of slurries by cattle farmers.

7 (b) The levels of heavy metal contaminants in the material and what this represents to application rates to land through slurry.

7 (c) The fact that other materials (considered wastes), such as sewage sludge products, that can legally be applied to land, have significantly higher contents of heavy metals and thus pose much greater potential risks than slurry containing the woodchip bedding material.

7 (d) The fact that other common legal farm practices, such as the application of manufactured nitrogen based fertilisers, pose a greater potential risk to soil health than the used bedding material, and that the carbon content of the bedding material might have beneficial impacts on soil health.

8. This overall opinion is explained in detail below.

Incorporation of bedding material in cattle slurry and regulations for the on-farm handling of slurries

9. I can confirm that for the large majority of cattle farmers, the bedding material will first be incorporated with, and stored with, slurry (a combination of faeces and urine). Standard practice is for cattle standing, feeding and lying areas to be cleared by scraping material from where it is deposited to a slurry store. For standing and feeding areas, this is usually carried out twice per day, and less frequently for bedding areas (once or twice per week). Bedding material will mostly remain in the bedding area, but some will move, via cattle movements, to the standing and feeding areas.

10. In some housing system practice, the bedding material will be removed and stored with farmyard manure (FYM). FYM has a higher dry matter (DM) content than slurry (typically 20% DM and above). The dry matter content of cattle slurry typically ranges (dependent on the housing and storage system) from 2 to 10% DM. Storage of used bedding material with FYM as a cattle farm practice, is much less common than removal and storage with slurry. However, it should be noted that all used bedding material will be handled in these ways, and all slurry and FYM is eventually applied to land. Therefore, all used bedding material is also all applied to land.

11. The handling of slurries and manures on cattle farms is governed by two main instruments:

11 (a) The Codes of Good Agricultural Practice[1]. Slurries usually contain high levels of nitrogen and phosphorus, in forms which are chemically active in the environment, and therefore can cause pollution and related environmental damage to water bodies, air and soils. Adhering to these codes is part of Cross Compliance regulations, which means that if cattle farmers fail to operate within the codes of good practice, the Environment Agency (Natural Resources Wales in Wales) and Rural Payments Agency can recommend that part of their Government support (Single Farm Payment, now transitioning to the Environment Land Management Scheme in England, and similar in Wales) can be withheld.

11 (b) The Nitrate Vulnerable Zone regulations. These apply (currently) to specific areas within England and Wales (and Scotland and Northern Ireland) and are built on the Codes of Good Practice and the European Union (EU) Nitrates Directive (still in UK law). They oblige cattle farmers to adhere to practices which specifically reduce the risks of damage to water environments through loss of nitrogen from slurries. The regulations are more exacting and specific than the Codes of Practice, requiring for example, that farmers have at least five months storage capacity for slurries and imposing ‘do not apply’ periods and zones for slurries and manufactured nitrogen fertilisers. These regulations (commonly termed ‘NVZ’) are driven by the amount of nitrogen used on-farm, including that being processed through the slurry storage and handling system. Within the NVZ regulations, the amount of slurry that can be applied by cattle farmers to land in a 12 month period over the whole farm is equivalent to 170kg total nitrogen(N) per hectare (ha). Dairy farmers can apply for a derogation to lift this limit to 250kg N/ha. The actual quantity that this represents is dependent on the nitrogen content of the slurry, which farmers should ideally measure, but they can also use ‘book values’ based on typical figures derived through research. These are contained in The Nutrient Management Guide (RB209)[2].

12. The NVZ regulations are explained in the document ‘Nitrate Vulnerable Zones (NVZ) – Record Keeping and My Farm Business’[3]. This document contains practical advice

on implementing and adhering to the regulations, as well as links to all the regulatory documents and support materials. It is published by Catchment Sensitive Farming, which is part of the Environment Agency and is delivered in partnership with Natural England and DEFRA (Department of Environment, Farming and Rural Affairs). Cattle farmers who farm (partly or wholly) within a NVZ are obliged to keep records of slurry management, which are detailed in this document.

13. It should be noted that Welsh Government are moving towards designating the whole of Wales as a NVZ. This is likely to come in 2024, although objections and appeals from farming organisations are ongoing. Welsh Government have stated that they will apply the 170kg N/ha farm limit and not allow a derogation for dairy farmers.

14. The relevance of these regulations and codes to the subject of used bedding materials is that they set standards for how cattle slurry is stored and managed, as well as how, when, where and at what application rate it can be applied to land. Thus, any additional contaminants from Platts used bedding material, applied to land via slurry, will be done in a regulated way that is designed to minimise the risk of pollution to water environments.

Heavy metals in the bedding material and application rates to land

15. The contents (highest averages found through laboratory analyses) of Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Zinc, (Zn), Arsenic (As) and Selenium (Se) have been taken from the draft report of Dr Vince[4] (para 17, page 8). I have used these in the following analysis.

16. It should be noted that the science evidence base for the amount of heavy metals that can be found in cattle slurries do not always include Mercury.

17. It should be noted that the acceptable levels of heavy metals in soils and for contents in cattle slurries do not include Selenium, as this element is beneficial for animal health and is considered ‘deficient’ for animal production in most UK agricultural soils.

18. Dr Vince states in an email received by me from Saunders Law (19th May, 2023) that the content values in the bedding material, *‘should be divided by 82 to yield conservative values for the mean concentration increments in the slurry’*. This divisional factor seems reasonable, although it can be considered a ‘conservative estimate. The factor will depend on the amount of slurry (dung and urine) excreted by cattle, relative to the amount of bedding material used. The amount of slurry excreted by cattle varies with type (dairy/beef), size of cattle (calves, heifers, mature dairy and beef cattle) and milk yield level (for dairy cows). The range is from 7kg per day (for calves) to 64kg per day (for dairy cows yielding over 9,000 litres milk per annum)[4]. For an ‘average’ dairy cow yielding 6,000 – 9,000 litres milks per annum, the daily excretion rate used in the NVZ calculations is 53kg. An estimate of the amount of bedding material used per cow per day would be in the region of 0.5kg, giving a dilutional factor of 106. However, I have used the factor of 82 proposed by Dr Vince in my analyses below. I have made this decision in the interest of using a ‘worse case scenario’ approach, so that any risks from heavy metal contamination can be assessed for most cattle housing situations. Note that at an excretion rate of 53kg per animal per day, the daily bedding material rate back calculated by the

dilution factor of 82 would be 0.65kg, which is 30% higher than my estimate of 0.5kg per day.

19. In the calculations below, I have assumed a slurry application rate of 250kg total N/ha, based on a typical cattle slurry of 6% DM (RB209[2]). The upcoming NVZ regulations from Welsh Government are likely to use a farm limit of 170kg slurry N/ha (see para 13 above), but with an individual field limit of 250kg total N/ha. Therefore, it is likely that cattle farmers in Wales can apply 250kg total slurry N/ha within a 12 month period on individual fields, as long as the rate applied across the whole farm does not exceed 170kg N/ha. The use of 250kg N/ha is therefore, a 'maximum application case' scenario and aligns with the conservative approach to analysing risk advocated by Dr Vince.

20. The table below shows the contents of heavy metals in the bedding material used by Dr Vince, the contents in cattle slurry evidenced from peer reviewed scientific publications and the likely additional content from the bedding material. It shows that the likely percentage increases in heavy metals through the incorporation of used bedding material into slurry range from negligible (Cadmium and Nickel) to 11.4% (Lead).

Element	Content in Platts bedding material[5] (mg/kg DM)	Typical content in cattle slurry[6] (mg/kg DM)	Likely additional content from Platts bedding material (mg/kg DM)*	Likely content in typical slurry with use of Platts bedding material (mg/kg DM)*	Percentage likely increase in slurry content from use of Platts bedding material (%)*
Cadmium	0.26	0.30	0.0032	0.30	0.0
Chromium	23.08	6.0	0.2814	6.28	4.7
Copper	45.00	45.00	0.5488	45.55	1.2
Lead	65.39	7.0	0.7974	7.80	11.4
Mercury	0.33	Not determined	-	-	-
Nickel	3.15	6.0	0.0384	6.0	0.0
Zinc	72.25	170.00	0.8811	170.88	0.5
Arsenic	13.27	2.0	0.1618	2.16	8.0

*These values have been rounded up.

21. This analysis can now be put into the context of legislation regarding heavy metal contents in soil and in comparison with other commonly used materials applied to land (sewage waste and manufactured nitrogen fertilisers - see sections below).

22. The following table shows the likely application of heavy metals from slurry with and without the addition of the bedding material from Platts. This assumes a 'standard' cattle slurry of 6% DM, containing 2.6kg total N/t[2], which at the NVZ field limit of 250kg N/ha (see 19 above) equates to an application of 5.77 tonnes slurry DM/ha. Note that this is the maximum field limit and NOT the farm limit for cattle slurry applications within the NVZ regulations (previously stated as 170kg total slurry N/ha). I have done this to demonstrate the 'maximum case' scenario.

Element	Likely annual application of element in 'typical' cattle slurry[6] (g/ha)	Likely annual application of element in cattle slurry with addition from use of Platts bedding (g/ha)
Cadmium	1.73	1.75
Chromium	34.60	36.24
Copper	259.65	262.82
Lead	40.39	44.99
Nickel	34.60	34.84
Zinc	980.90	985.98
Arsenic	11.54	12.47

Comparison with other materials commonly applied to agricultural land

23. European Union legislation, still in place for the UK, states the legal limits for materials used as fertiliser products within agriculture[7]. These include organic fertilisers, which encompasses cattle slurry. The levels of heavy metals potentially in cattle slurry with additions from used woodchip bedding supplied by Platts all (except Chromium) fall well within these limits. The EU legislation also regulates the heavy metal contents of inorganic manufactured nitrogen-based fertilisers, which are used on most cattle farms in the UK. Comparisons are shown in the table below:

Element	Likely content in typical slurry with use of Platts bedding material (mg/kg DM)**	Regulatory content limits for organic fertilisers (of which cattle slurry is an example) under EU legislation[7] (mg/kg DM)	Regulatory content limits for manufactured inorganic nitrogen-based fertilisers under EU legislation[7] (mg/kg DM)
Cadmium	0.30	3.0	3.0
Chromium	6.28	2.0	2.0
Copper	45.55	300	600
Lead	7.80	120	120
Mercury	-	1.0	1.0
Nickel	6.0	50	100
Zinc	170.88	800	1.500
Arsenic	2.16	40	40

** Taken from the table in para 20 above.

24. It is unclear why Chromium is an outlier in this comparative analysis. Little specific scientific research has been conducted on Chromium within cattle production systems, and the quoted figure from the published paper used in this evidence[6] is the most science-based example of chromium content in cattle slurry within the UK. It should be noted that it is not the addition of Platts bedding material to cattle slurry that pushes the chromium content over the regulatory limit. Rather, the science evidence[6] suggests that cattle slurry is generally already over this limit 6 mg/kg DM, compared to the regulatory limit of 2.0 mg/kg DM[7], without the addition of Platts bedding material.

25. Even considering this outlier, the likely annual applications of heavy metals from cattle slurry with additions from Platts woodchip bedding fall well within the UK limits for application rates, and this includes Chromium. These limits, alongside the likely annual application rate from cattle slurry with additions from Platts woodchip bedding are shown in the table below:

Element	Likely annual application of element in cattle slurry with addition from use of Platts bedding (kg/ha)***	Maximum permissible average annual rate of application over a 10 year period (kg/ha)[6]
Cadmium	0.002	0.15
Chromium	0.036	15.0
Copper	0.263	7.5
Lead	0.045	15.0
Mercury	-	0.10
Nickel	0.035	3.0
Zinc	0.986	15.0
Arsenic	0.013	0.70

*** Taken from para 22 above, with values rounded up to the nearest 0.001 of a kg.

26. The limits for application of heavy metals per annum shown in the table above (para 25 – taken from reference 6) accommodate the application of sewage sludge products to agricultural land. These products typically contain much higher levels of heavy metals than any other organic or inorganic materials applied to agricultural land. Some 75 to 80% of sewage water treatment plant waste is applied to agricultural land in the UK[8]. This equates to around 0.50 million tonnes of sewage dry matter applied to agricultural land per year; compared to approximately 1.75 million tonnes dry matter produced by cattle in the UK, and applied as slurry, or deposited directly onto land whilst grazing. Typical heavy metal contents[8] of cattle slurry and sewage waste are shown in the table below:

Element	Typical content in cattle slurry[9] (mg/kg DM)	Typical content in sewage sludge[9] (mg/kg DM)
Cadmium	0.30	3.4
Chromium	6.0	163
Copper	45	565
Lead	7.0	221
Mercury	Not determined	2.3
Nickel	6.0	59
Zinc	170	802
Arsenic	2.0	6.0

27. On the basis of the comparative heavy metal contents shown in the tables above, it is not possible to argue, on grounds of application to agricultural land, that the application of sewage sludge should be allowed, whilst the application of cattle slurry with the additions of Platts used bedding material should not.

Impacts on soil health

28. ‘Soil health’ is a commonly used, but ill-defined term. Whether a soils is ‘healthy’ or not depends on its fitness for purpose. In an agricultural context, this means that the soil can support optimal provision of primary food production (crop yields, animal performance), which is safe and nutritious for human consumption. In recent decades, additional roles for agricultural soils have been recognised, including biodiversity, resilience and flood prevention. These ‘public good’ measures of soil health are intertwined with their role in food production. For example, a soil which is biodiverse in the microbial, fungal and fauna species that it contains will also be more efficient at turning over nutrients from slurries and manures and in releasing nutrients for plant growth from the organic matter held within the soil profile. Thus, the more

biodiversity soils have, the more primary food production they can support. These soils will also tend to have higher organic matter contents, which allows them to hold more water and therefore help to alleviate flood risks.

29. 'Soil Health' can also be defined from biological (described in para 28 above), physical and chemical perspectives. A healthy soil is free from physical compaction and therefore holds more air and water. A healthy soil also has a high base level of fertility and chemical environment for natural nutrient transformation processes to take place without hindrance from a deficit of any particular nutrient (chemical) element. Again, like soil function, these three definitions of soil health (physical, biological and chemical) are also inextricably linked. For example, a soil which is high in organic matter content (organic carbon) will be more resistant to challenge and have less physical compaction. This means that the soil will hold more air and moisture, which allows aerobic conditions to exist, where the chemical process of nutrient release and cycling within the soil are at their optimum. Likewise, a soil with these 'healthy' physical and chemical conditions also has the opportunity to have a greater diversity of microbial species through the soil profile. This microbial diversity allows the chemical processes to act with even greater efficiency, and builds more organic matter (organic carbon) within the soil. And so a soil can develop to an even 'healthier' state.

30. The study of the impacts of agricultural practices, including the additions of inputs such as organic and inorganic fertilisers, is a rapidly expanding area of science. Much is being discovered and yet much remains unknown. A recent review of the potential impacts of agricultural manures on soil health[10] reveals the complexity of this research area and draws some useful generalisations:

30 (a) High inputs of heavy metals can harm soil microorganisms (the soil 'microbiome'), reducing microbial diversity. There is a greater tendency for this to occur on acidic soils (low pH), which creates conditions for the increased biological availability of heavy metals.

30 (b) Manufactured nitrogen-based fertilisers (widely used on cattle farms) can have profound negative impacts on soil microbial populations. These can be transient in effect and harm, but nonetheless limit a soil's ability to function optimally from the perspective of soil microbial diversity.

30 (c) Manure quality, rather than quantity, is the most important factor governing the impact of manure (and slurry) application on soil health. Manures with higher organic matter content tend to promote soil health, whilst those with low organic matter content (such as slurries) do not.

30 (d) Related to 30 (c) above, manures with a higher carbon content tend to improve soil microbial population diversity.

31. It is not possible to unequivocally state what the impacts of cattle slurry are on soil health. This will depend on many factors intrinsic to the slurry applied and the soil to which it is applied, and the way in which it is applied, including timing, rate and means of application. However, in my opinion, the addition of Platts bedding material to slurry is likely, on balance, to have a tendency to improve soil health compared to slurry from systems without woodchip or sawdust as a bedding material. This is because the addition of heavy metals from the woodchip is so small as to not add to the potential negative impact on the soil microbiome, compared to other slurries, and the fact that the woodchip adds to the carbon (organic matter) content of the slurry,

even minimally, is likely to have a small positive impact on soil biological, physical and therefore chemical health.

Conclusions

32. The addition of Platts pulverised woodchip bedding product to slurry is very unlikely to have a negative impact on slurry use and soil health.

33. The additional heavy metals arising from the use of the woodchip are relatively small and will not effectively add to the heavy metal load of cattle slurry.

34. As long as cattle slurry is used within the Codes of Good Agricultural Practice and the forthcoming Welsh Government NVZ regulations, there will be no additional negative impact of cattle slurry on soil health and the wider agricultural environment.

35. Compared to other commonly used organic manure materials, cattle slurry with additions from Platts woodchip has much lower contents of heavy metals.

36. The levels of heavy metals in cattle slurry with the addition of Platts bedding material are (with the exception of Chromium) well within the limits for organic and inorganic fertilisers as governed by current (EU) legislation. The issue of Chromium is derived from examination of the germane scientific literature, and applies to all cattle slurries and not only those that use bedding materials similar to that provided by Platts.

References

1. Protecting our Water, Soil and Air: A Code of Good Agricultural Practice for Farmers, Growers and Land Managers (2009) DEFRA (Department of Environment, Farming and Rural Affairs), 124 pages.
2. The Nutrient Management Guide (RB209). AHDB (Agriculture and Horticulture Development Board) 2021: Section 2 – Organic Materials. 44 pages.
3. Nitrate Vulnerable Zones (NVZ) – Record Keeping and My Farm Business. Catchment Sensitive Farming (Environment Agency).
4. Slurry Wizard, July 2022. AHDB (Agriculture and Horticulture Development Board). https://ahdb.org.uk/knowledge-library/slurry-wizard
5. Preliminary report of Dr Ivan Michael Vince, trading as ASK Consultants, to Saunders Law, dated 12th April 2023.
6. Nicholson, F.A., *et al.,* (1999). Heavy metal contents in livestock feeds and animal manures in England and Wales. *Bioresource Technology,* 70: 23 – 31.
7. REGULATION (EU) 2019/1009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003. 114 pages.
8. Biosolids: Agricultural Good Practice guidance Leaflet. Published by the Biosolids Assurance Scheme and based on the output from UK Water Industry Research (UKWIR) project 14/SL/11/7. 14 pages.
9. Nicholson, F.A., *et al.,* (2003). Inventory of heavy metals inputs to agricultural soils in England and Wales. *The Science of the Total Environment,* 311: 205 – 219.
10. Köninger, J. (2021). Manure management and soil biodiversity. Towards more sustainable food systems in the EU. *Agricultural Systems,* 194 – 103251.

Dr George Fisher, expert witness

On instructions of Saunders Law acting for Platts Agricultural Ltd

Statements and Declarations

1 Statement of conflicts

I have no known conflict of interest in preparation of this report. I have no relationship, social, professional or other, with Platts Agricultural Ltd.

I will advise the party by whom I am instructed if, between the date of this report and any possible trial, there is any change in circumstances which affects this statement.

2 Statement of compliance

I understand my duty as an expert witness is to the court or tribunal concerned. I have complied with that duty and will continue to comply with it. This report includes all matters relevant to the issues on which my expert evidence is given. I have given details in this report of any matters which might affect the validity of this report. I have addressed this report to Saunders Law Solicitors who instructed me but it may be addressed to the court or other tribunal if necessary in the future. I further understand that my duty to the court or tribunal overrides any obligation to the party from whom I received instructions.

5.03 Declaration of Awareness and Statement of truth

I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer. I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

14th July, 2023