OPA RESPONSE TO LOUGHBOROUGH REPORT

On 11th March 2010 the Department for the Environment and Rural Affairs (DEFRA) of the UK Government published a Report dated January 2010 entitled "Assessing the Environmental Impacts of Oxo-degradable Plastics Across their Life-cycle." This is a report prepared by four members of staff of Loughborough University in the UK, none of whom are professors, and none of whom is a specialist in oxo-biodegradable science or technology. They state that their recommendations are their own opinions, and that their views do not necessarily reflect DEFRA policy or opinions[1].

The Oxo-biodegradable plastics industry was not given a copy of the Report before publication nor asked for its views on the Key Findings and Recommendations.

1. EXECUTIVE SUMMARY

1.1 The Loughborough report is both helpful and unhelpful toward a better understanding of the role of oxo-biodegradable technology.

1.2 It is helpful because the UK government has at last realised the importance of this technology, and has initiated an open debate on the subject.

1.3 It is also helpful because it has dealt with some of the misconceptions about oxo-biodegradable technology which had become all too common. It has confirmed that oxo-biodegradable plastics:

- ARE NOT TOXIC[2]
- CONTAIN NO HEAVY METALS[3]
- ARE SAFE FOR FOOD CONTACT[4]
- DO NOT EMIT METHANE, EVEN DEEP IN LANDFILL[5]
- DO DEGRADE ABIOTICALLY IN A NORMAL ENVIRONMENT[6]
- DO DEGRADE ABIOTICALLY UNDER ELEVATED TEMPERATURES IN LANDFILL[7]

The report has also confirmed that:

- THERE IS NO EVIDENCE THAT DEGRADABLE PLASTICS ENCOURAGE LITTERING[8]
- THERE IS NO EVIDENCE OF BIO-ACCUMULATION[9] NOR ANY HARMFUL[10] EFFECT ON THE ENVIRONMENT
- THERE IS NO EVIDENCE OF ACCUMULATION OF POLLUTANTS[11]
- PRO-DEGRADANT ADDITIVES ARE NOT HARMFUL AND HAVE NO NEGATIVE ENVIRONMENTAL IMPACT IN THE PRODUCTION AND USE PHASE[12]

1. Second page
2. 1(c) 2.3, 2.4, 6.4.1, 6.8 (xxv)
3. 2.4 (p. 13)
4. 4.1.4, 6.5.1,
5. page 14 – para 2.7,
6. Page 7/8
7. 6.9
8. Page 14
9. p 13, 6.3.1, 6.3.2
10. Page 9,
11. 4.1.3.3
12. Page 16

1.4 The Report is UNHELPFUL BECAUSE THE AUTHORS HAVE:

- MISUNDERSTOOD RECYCLING[13] – oxo-biodegradable plastics can be recycled
- MISUNDERSTOOD COMPOSTING[14] - oxo-biodegradable plastics are not a threat to composting
- MISUNDERSTOOD OIL-DEPLETION[15] - oxo-biodegradable plastics do not cause oil-depletion
- MISUNDERSTOOD THE PURPOSE OF OXO-BIODEGRADABLE PLASTIC[16] - it is not intended for composting, nor for long-term storage, nor to degrade deep in landfill
- MADE AN INCOMPLETE COMPARISON WITH "LONG-LIFE BAGS"[17] - they are not a better alternative to oxo-biodegradable plastics
- ACCEPTED THAT BIODEGRADATION OCCURS[18], BUT HAVE MISUNDERSTOOD TIMESCALE and EXTENT OF BIODEGRADATION[19] There is no need for oxo-biodegradable plastics to biodegrade in a very short timescale.
- CONFUSED OXO-BIODEGRADATION WITH HYDRO-BIODEGRADATION[20]

1.5 NOBODY IS SUGGESTING THAT BIODEGRADABLE PLASTIC SHOULD SIMPLY BE THROWN AWAY

1.6 However, **oxo-biodegradable plastics will degrade then biodegrade without human intervention if they do get into the open environment, leaving no harmful residues. They will do so more quickly than nature's wastes such as twigs and straw, and much more quickly than ordinary and recycled plastics.**

1.7 By contrast "compostable plastics" biodegrade under industrial composting and are useless elsewhere. They are even useless in compost because EN13432 requires almost complete conversion of the carbon in the plastic to CO_2 gas within 180 days, thus depriving the resulting compost of carbon, which is needed for plant growth, and wasting it by emission to atmosphere - contributing to climate-change.

1.8 **Even the industrial composters do not want "compostable" plastics** See https://www.biodeg.org/oregon-composters-dont-want-compostable-packaging/ https://www.biodeg.org/exeter-rejects-compostable-plastic/ Most recently Suez, one of Europe's leading waste management companies, has also rejected "compostable" plastic https://www.usinenouvelle.com/article/sacs-plastiques-compostables-le-grand-malentendu.N926789

13. 1(e), 4.3.4, C6.3, C6.14 & page 4
14. 1(a), 6.10, C5.1 C6.1 & pages 9, 12
15. Page 24
16. 1(d) (h) 1.3 & page 16, 24
17. 2.1
18. 2.2, 4.1.1
19. 1(a), 1(h) & page 28
20. 1.4

1.9 **The Loughborough report claims that oxo-degradable plastics "do not improve the environmental performance of petroleum based plastics." It should however be obvious that plastic which self-destructs at the end of its useful life, leaving no harmful residues, is better for the environment than normal or recycled plastic, which can lie or float around for decades.**

1.10 The Report contains familiar assertions which Symphony and other companies in the oxo-biodegradable plastics sector have had to face before - (usually from the "compostable" or "bio-based" plastics industry) and which they have had no difficulty in refuting (see eg. http://www.biodeg.org/files/uploaded/biodeg/OPA_Response_to_SPIBC-2.pdf)

1.11 Loughborough University did not do any experiments itself, and Symphony were concerned to find that **none of the Professors in other universities with specialized knowledge of oxo-biodegradable plastics were invited to peer-review the report.** In fact, two of the three assessors of the Report are engaged in bio-based plastics, which is a totally different product, in competition with oxo-biodegradable. One of them is a well known and very vociferous advocate of bio-based plastics, who appeared from his website (https://www.msu.edu/~narayan/general.htm) to be connected with companies that produce bio-based plastic products

2. THE PURPOSE OF OXO-BIODEGRADABLE PLASTICS

2.1 Go into any supermarket, hotel, hospital, etc. and what do you see? - Plastic.

2.2 Not just carrier-bags, but almost everything is wrapped or bottled in plastic – from frozen peas to fresh potatoes – from sandwiches to milk - beer cans to newspapers, televisions and even ironing boards. At the back of store there are acres of shrink-wrap, pallet-wrap and bubble wrap used to deliver goods in bulk. Why? – because plastic is in most cases the best and most cost-effective way to protect goods from damage, contamination and wastage.

2.3 So why are some people concerned about plastic? "Because plastic is made from oil or natural gas, or coal, which is a finite resource?" - but this is a mistake, because it is actually made from a by-product which will always be produced so long as the world needs these types of fuel, and it makes good economic and environmental sense to use the by-product.

2.4 "Because plastic waste is filling up the landfills?" - another mistake, because plastic takes up a very small proportion of space in the average landfill. In any event all combustible waste, including plastic, should be diverted to incineration when it can no longer be re-used or recycled. This is being done in other developed countries. Modern incinerators do not cause pollution, and they employ the heat for useful purposes.

2.5 Because "plastic is symptomatic of a "throw-away" society?" Well – life moves at a much faster pace whether we like it or not. We can no longer buy milk in a jug from the corner shop, and packaging has adapted to modern life. Of course we must recycle plastic where practical, but it is not enough just to use recycled plastic because, whether recycled or not, and we will never collect it all. Some will inevitably find its way into the open environment, where it could lie or float around for decades, for example in the North Pacific Gyre.

2.6 This is the real problem - to which there is a solution. It is a masterbatch which is added to conventional plastic at the manufacturing stage, and causes the plastic to degrade at the end of its service life, by a process of oxo-biodegradation, leaving no harmful residues. It is called "Controlled-life" or "Intelligent" plastic, as it is the only type of plastic whose life can be controlled. All plastic will in time fragment and completely biodegrade, but d_2w controls the process, so that the fragments are bioassimilated faster than straw and twigs and much faster than ordinary or recycled plastic. Symphony's d_2w has passed the usual eco-toxicity tests[21] and does not contain "heavy-metals." It is certified for food-contact.[22]

2.7 Plastic made with d_2w costs very little extra, because it is made with the same machinery as conventional plastic, and it causes no loss of jobs in the plastics industry. There is no need to change suppliers, but finished-products can be supplied if required.

2.8 Plastic has been used safely and cost-effectively for more than five decades.

2.9 If all the plastic found in the "North-Pacific gyre" had been made with oxo-biodegradable technology the plastic would probably have degraded and biodegraded long before it reached the gyre.

21. OWS Reports R-MST-4/1c and 4/2c 8th Mar 2006. See also Prof. G. Scott and others, Degradable Polymers: Principles and Applications, Kluwer, 2002, Chapter 13, Section 9.11, page 472, et seq.
22. RAPRA test SYP 01A 15.3.05

2.10 Nobody is suggesting that oxo-biodegradable plastics are a complete answer to plastic pollution of the environment. Of course not. They need to be seen as part of an integrated approach, which includes education, re-use, recycling, and incineration.

2.11 **Dr. Caroline Jackson M.E.P**[23] made the following statement in July 2008: "European legislation on waste has tended to concentrate on waste which can be collected, and to encourage people to reduce, re-use, and dispose responsibly of their waste, by recycling, incineration with energy-recovery, or by other disposal routes."

2.12 "However, we also need to take account of the fact that we will never succeed in collecting all the waste and that some may remain to disfigure the landscape. This is particularly the case with plastic waste, from errant supermarket bags to agricultural plastic. Where this goes uncollected it can accumulate in the environment, polluting the land and the oceans for many decades, and perhaps for hundreds of years."

2.13 She continued "Technologies have now become available which can produce plastic products such as shopping bags, garbage sacks, packaging etc. which are fit for purpose, but will harmlessly degrade at the end of their useful life. These fall into two broad categories, namely:

> (a) **Hydro-biodegradable plastics, made wholly or partly from crops, which biodegrade in a highly microbial environment, such as composting, and**
>
> (b) **Oxo-biodegradable plastics, made from a by-product of oil-refining, which degrade in the environment by a process of oxidation initiated by an additive, and then biodegrade after their molecular weight has reduced to the point where naturally-occurring micro-organisms can access the material."**

2.14 "We need to encourage both of these technologies, and to ensure that European Standards are developed which are appropriate to both. It is worth bearing in mind that the European Parliament is concerned by the use of scarce land and water resources around the world to produce biofuels in competition with food-crops and the same concern applies to growing crops to make biodegradable plastics, so I hope the European Commission will give more positive support to oxo-bio plastics."

2.15 Vegetable-based or hydro-biodegradable or "compostable" plastic is far too expensive for everyday use, it has a worse Life-Cycle Assessment than ordinary plastic,[24] and it emits methane deep in landfill. On page xvi of 6.6 the authors found evidence that "In the case of greenhouse gas emissions, **the impact of oxo-degradable PE was considerably less than PLA (polylactic acid).**"

2.16 We agree with the packaging manager of Tesco who said on 20th October 2009 that they "do not see the value in packaging that can only be industrially composted" and that "local authorities do not want to touch it, as it can contaminate existing recycling schemes."

23. Press statement 18th July 2008.Dr. Jackson was Chairman of the Environment, Public Health, and Food Safety Committee of the European Parliament, and was the Rapporteur for the EU Waste Framework Directive.
24. Germany's Institute for Energy and Environmental Research June 2009

3. BIODEGRADATION AND TIMESCALE

3.1 Oxo-degradation is defined by CEN (the European Standards Organisation) in TR15351as "degradation resulting from oxidative cleavage of macromolecules." And oxo-biodegradation as "degradation resulting from oxidative and cell-mediated phenomena, either simultaneously or successively."

3.2 **The Loughborough authors are in no doubt that abiotic degradation occurs,25 even in landfill,[26] but they are mistaken in thinking that it is initiated by light and heat.27 It is accelerated by light and heat but is initiated by contact with oxygen, and is not inhibited by moisture.** They are also mistaken in thinking that the time over which the degradation process takes place depends on the concentration of additive in the plastic.[28] It depends on the formulation of the additive. They have also confused oxo-biodegradable with photodegradable. [29]

3.3 **They have found ample evidence that BIO-degradation of oxo-biodegradable plastic does occur after the additive has reduced the molecular weight to the point where it no longer has the molecular structure of a plastic and can be accessed by naturally-occurring micro-organisms.** They found evidence of between 15% and 60% mineralisation in the laboratory but in their opinion the material does not biodegrade fast enough.

3.4 Fast enough for what? A high level of biodegradation is not to be expected from products designed for a useful life exceeding six months, as the antioxidant additives must be first consumed before degradation begins.

3.5 The authors say that "BIO-degradation of oxo-degradable plastics can only occur after they have fragmented and then proceeds very slowly, for example, at a rate many times slower than that of a compostable plastic." They are not however comparing like with like. Compostable plastics are designed to biodegrade rapidly under the highly-microbial conditions and high temperatures found in an industrial composting process, but they do not biodegrade rapidly if they are left in the open environment. The authors have advanced no evidence that compostable plastics biodegrade faster than oxo-biodegradable plastics in the open environment.

3.6 The industrial composting standards require 90% biodegradation within 180 days, and the reason for this short timescale is purely commercial. The Standards were created by the vegetable-based plastic industry for their type of plastic, and industrial composting is carried out as a business, where time is money. A Standard for oxo-biodegradable plastic is being delayed by the vegetable-based plastic industry and their allies on the Standards Committees.

3.7 However, as indicated above, oxo-biodegradable plastics are not intended for composting. They are intended to address the problem, identified by Dr. Jackson, of plastic waste which escapes into the open environment.

25. Page 7/8
26. page 54 "the oxo-degradable polyethylene recovered from the landfill trial had a significantly reduced molecular weight (4,250-4,280)."
27. 1.4
28. 1.1
29. 6.2.4
30. 6.2
31.
32. 1(a)
33.
34. EN13432, ASTM D6400 etc.
35. n 21 above

3.8 **Therefore the appropriate reference materials so far as timescale is concerned are ordinary plastics (without d_2w), and nature's wastes such as twigs and straw. The authors have not addressed these materials, but twigs and straw can take up to ten years to biodegrade and ordinary plastic can take decades.**[36]

3.9 The authors say[37] "The length of time to degradation of oxo-degradable plastic cannot be predicted accurately because it depends so much on the environmental conditions." This is correct, and it should not be claimed that an oxo-biodegradable product will degrade in anything other than an approximate timescale. The degradation period depends also on the formulation of the additive and the characteristics of the particular product. Prof. Chiellini's work shows that the rate-determining step is peroxidation and the microbes simply scavenge the low molar mass products at a rate very much faster than peroxidation.

3.10 The authors continue "It is suggested that oxo-degradable plastics left in the open environment in the UK degrade to small fragments within 2 to 5 years" but they are confusing time to mineralisation with time to fragmentation. At 2.1 they say they fragment into small pieces in one or two years. However, even 2-5 years in the open environment is a lot better than decades, and we are therefore confident that d_2w oxo-biodegradable plastics are better for the environment than ordinary plastic.

3.11 Additives are formulated according to timescales required by the customer. The technology is constantly improving, and formulations are being developed which can cause degradation then biodegradation in a very much shorter timescale than that, whilst still allowing a sufficient period of fitness-for-purpose. **These products can be controlled within a time range of a few months or years depending on customer needs**. Testing and product performance evaluation is regularly done by natural aging in the environment as well as artificial aging, of hundreds of samples every week.

3.12 The authors have found evidence that plastic "nurdles" attract toxins in a marine environment, but no evidence that they are any more likely to attract toxins than fragments of seaweed or wood or other fragments naturally present in the oceans. In any event, "nurdles" consist of pure polymer, but a fragment of oxo-biodegradable plastic which has undergone the abiotic phase of degradation is no longer a polymer and has a completely different molecular structure. The authors have found no evidence that such fragments would be harmful.

3.13 The first industrial application was in mulching films and is fully reported in the papers identified in the reference section of the Report (Annex D, references 1,9, 41, 47, 52, 55,61). Mulching films have been used continuously in successive seasons in Israel, USA, Japan, China, Taiwan and some South American countries since 1975 with **no evidence of residual plastics particles or loss of soil fertility year on year.**

36
37. 1(a)

4. RECYCLING

4.1 **Retailer B who gave evidence for the Report38 "uses oxo-degradable plastics in packaging because they do not interfere with established recycling streams.**" The Loughborough authors were aware of the Oxo-biodegradable Plastics Association's Position-paper on Recycling[39], but do not appear to have allowed it to inform their opinion[40] T**hey have failed to distinguish between (a) recyclate for making short-life and long-life products; between (b) recyclate whose provenance is known and not known; (c) between products where rapid degradation is desirable and not desirable; (d) between products where recyclate is allowed and not allowed; and (e) cases where stabilisers are necessary whether there is any pro-degradant additive or not.** The OPA Position-paper makes it clear that oxo-biodegradable plastics can be recycled without necessarily adding stabilisers.

4.2 The authors appear to have focussed on recycling of post-consumer plastic waste. However, the evidence of RECOUP[41] a national charity promoting plastics recycling in the UK, is that "a limited amount of household films are currently collected, baled and sold to reprocessors, but this is often at a negative value. The plastic film also causes technical issues with sorting equipment in materials reclamation facilities. The Recoup guide currently specifies that "film should not be collected for recycling." RECOUP point out that it is **the vegetable-based "bioplastics," not the oil-based oxo-biodegradable plastics that cause problems for recyclers**.

4.3 The authors themselves accept[42] that "Barriers to recycling include: the high volume to weight ratio of [ordinary] waste plastic, which makes it expensive to collect, store and transport; high levels of contamination, which compromise the quality of the recyclate; the wide range of plastics, which requires sorting and the low market price for recyclate."

4.4 They added "in the course of this study, it was difficult to find evidence of the impact of oxo-degradables on the recycling stream. At present there seems to be very little post-consumer recycling of the sort of plastic film products where oxo-degradable plastics are usually used. This is mainly because such material is difficult to collect, is generally of poor quality and is therefore not economically viable for recyclers. Hence, at present, any deleterious effect is limited (Annex C6.4)."

4.5 The Quebec report[43] shows that oxo-biodegradable plastic is compatible with recycling, and further independent trials reach the same conclusion. http://www.biodeg.org/recycling-and-waste/

4.6 The Loughborough authors say "there is another more far-reaching concern, that now that this technology is being developed for use in other plastics, such as polyethylene terephthalate (PET), and for other applications, such as bottles, then there is more potential for a negative impact on the quality of recycled plastic from existing recycling schemes." They do not seem to be aware that oxo-biodegradable technology is not suitable for PET.

4.7 **The OPA Position Paper on Recycling** is as follows:
"The Oxo-biodegradable Plastics Association supports the recycling industry, but recycled plastics are not normally degradable and will, like ordinary plastics, accumulate for decades if they get into in the open environment. However, recycled plastic and ordinary plastic can now be made oxo-biodegradable by the inclusion of a pro-degradant formulation at the extrusion stage.

38. C 3.2
39. http://www.biodeg.org/position-papers/recycling/?domain=biodeg.org
40. 1(e)
41. C6.4
42. 1.5
43 Annex B6

4.8 According to RAPRA[44] , "Oxo-biodegradable packaging is recyclable, as would be any similar plastic material without the pro-oxidant additive.

4.9 Oxo-biodegradable plastics have been in commercial use since the 1970s, and are based on commodity polyolefins, particularly polyethylene and polypropylene. Their performance during manufacture and use is indistinguishable from that of regular polyolefins, and their biodegradation is caused by formulations that promote transition metal ion oxidation in the presence of oxygen.

4.10 The length of the useful life of an oxo-biodegradable plastic product is determined by antioxidants (processing stabilisers and UV stabilisers) contained within the formulation, which can be modified so that the plastic product degrades according to whatever timescale is required.

4.11 Obviously if any plastic is going to be recycled it will have to be collected and recycled before it has become embrittled. Oxo-biodegradable products currently have a useful life before embrittlement of at least 18 months, and if they have not been collected and recycled by then, they probably never will be.

a. New oxo-biodegradable products made with recyclate

If a new product is to be made with recycled polymer which contains or might contain a pro-degradant formulation and the new product is intended to be degradable, the process is obviously straightforward, as a pro-degradant effect is actually desired. This applies particularly to recycling of oxo-biodegradable offcuts in plastic factories, or where used oxo-biodegradable "back-of-shop" plastics (e.g. shrink-wrap pallet-wrap, bread-wrapping etc) are sent back for recycling into more oxo-biodegradable products.

b. Short-life products

If the new product to be made from recyclate which contains or might contain a pro-degradant formulation, is intended for short-life products such as refuse-sacks, bin-liners, shopping bags, bread wrappers etc. the effect of any pro-degradant formulation is unlikely to manifest itself during the intended service-life, and biodegradability for such items is in any event desirable. It is desirable because a proportion of these items will always find their way into the land or sea environment, where they would otherwise subsist for decades after they had been discarded.

c. Long-life products

Since polymers lose stabilisers every time they are reprocessed, it is good practice to add new stabilisers each time, whether the feedstock contains oxo-biodegradable plastic or not. If suitably formulated, the stabilisers will also neutralise any pro-oxidant which may still be effective. According to RAPRA[45] "Care must be taken to ensure that the cleanup of the recyclate will deal with any remaining pro-oxidant either by removal or by the addition of a neutralising agent, otherwise it may result in premature degradation of the products made with the recycled material."

44. http://www.rapra.net/consultancy/biodegradable-plastic.asp
45. Ibid.

c (1) Building Films

If the new product to be made is a plastic film intended for long-term durability - such as a building film for damp-proofing or waterproofing - the specification in some countries for some of these films requires the use of a virgin polyolefin compound[46] and recyclate is not therefore relevant. For all other building films the specification will usually require the use of stabilisers where necessary.[47] There will of course be no pro-degradant formulation in recyclate chosen from in-house scrap, or from other feedstock whose origin is known.

In the case of lower-grade building films, where no guarantee is given, these are often made from recyclate whose origin is not known, and the manufacturer should always add stabilisers as above, whether the feedstock contains a pro-degradant formulation or not.

c(2) Pipes

(1) ISO Standard 8779 "Plastics piping systems — Polyethylene (PE) pipes for irrigation" provides at para. 4.2 that only clean reprocessable material generated from a manufacturer's own production may be used if it is derived from the same resin as used for the relevant production. As the origin of the material will be known, it will not therefore be used for this purpose if it could contain any pro-degradant formulation.

(2) European Standard EN 12201-1 provides at para 4.3 that items such as PE pipes for water for human consumption, cannot be produced from recycled material other than process regrind. Residues of oxo-biodegradable materials are likewise not an issue here.

(3) SABS[48] piping is manufactured to a specification which permits the use of recyclate only from "in-house scrap." Small bore piping class 6 and 10 is usually LDPE and, larger sizes, HDPE.

"In-house scrap" is scrap which has been generated during manufacture of the SABS grade pipe which can be chipped up and added back.

There is therefore no difficulty with the manufacture of such piping, as the origin of the recyclate is known and it will not therefore be used for this purpose if it contains any pro-degradant formulation.

(4) "SABS Equivalent" piping is manufactured from 100% recycled material according to the SABS specification but is not marked. Usually HDPE with from 5-20% LDPE blended for flexibility. For a quality product where a guarantee is demanded, clean industrial scrap is used where product history (material source and material grade) is known. This will not therefore contain a pro-degradant formulation.

46. Eg South African Bureau of Standards Specification 952-1985 para. 3.2.2
47. South African Bureau of Standards Specification 952-1985 para. 3.2.1
48. South African Bureau of Standards

(5) Agricultural and Domestic piping is manufactured in South Africa from 100% LDPE scrap. Normally the same scrap is used as in (c) above, but it should only be used in low-tech situations if the origin of the recyclate is unknown. Stabilisers should always be added if there is any doubt about the origin of the recyclate, and there is a case for an industry specification for this category of piping, which would include a requirement to add stabilisers.

"Low tech situation" refers to small bore piping Class 3 and 6 used for piping water to cattle or game troughs or on domestic irrigation systems, essentially at low pressures.

D. HYDRO-BIODEGRADABLE PLASTICS

Hydro-biodegradable plastics, unlike oxo-biodegradable plastics, cannot be recycled with the most abundant components of plastic waste. They therefore have to be segregated from the waste stream and treated separately, with considerable increase in cost. Furthermore it is difficult for the manufacturers of recyclate to physically distinguish between hydro-biodegradable and normal plastic.

Hydro-biodegradable plastics have been called into question by recyclers[49] and Recoup's project manager has warned that starch-based plastics could "have a negative impact on plastics recycling as a whole.[50] .... the fear is that bioplastics will increasingly find their way into the plastics recycling stream – impacting on quality and un-doing the work done on raising public awareness of plastics recycling."

Recyclers should therefore be concerned to see that hydro-biodegradable plastics are not encouraged."

49. Materials Recycling Weekly 20 Nov 2006
50. Addressing the Local Authority Recycling Advisory Committee conference in November 2006.

5. COMPOSTING

5.1 It is not clear why the authors have attached so much importance to composting in a report on oxo-biodegradable plastics, because OBP are not intended or marketed for composting.

5.2 At 1(a) the authors give their opinion that "Oxo-degradable plastics should not be included in waste going for composting, because the plastic fragments remaining after the composting process might adversely affect the quality and saleability of the compost."

5.3 However, the evidence of the composting company who contributed to the Loughborough report[51] is that "the best policy is to allow **no plastic bags of any sort** in the green waste." Indeed in some countries[52] no plastic of any kind is permitted to enter an industrial composting process. Also, the Loughborough authors found evidence that even so-called "compostable" plastic **does not always work in industrial composting.**[53]

5.4 **As indicated above, in a January 2020 Report the industrial composters of Oregon https://www.biodeg.org/oregon-composters-dont-want-compostable-packaging/ gave nine reasons why they don't want "compostable" plastics, and in the same month the City of Exeter, UK rejected "compostable" plastic and paper. https://www.biodeg.org/exeter-rejects-compostable-plastic/ Most recently Suez, one of Europe's leading waste management companies, has also rejected "compostable" plastic https://www.usinenouvelle.com/article/sacs-plastiques-compostables-le-grand-malentendu.N926789**

5.5 The composting company who gave evidence to the Loughborough authors,[54] and the local authorities, are saying that residents cannot use 'compostable' plastic bags, because of their potentially poor compostability and because of the risk of confusion with ordinary plastic bags by both the consumer and the collection crews.

5.6 Reference is made in the Report[55] to an article which concludes that increasing use of 'compostable' bags will lead to higher contamination levels and more green waste ending up in landfill.

5.7 **Composting is not the same as biodegradation in the environment**. Composting is an artificial process operated for commercial reasons according to a much shorter timescale than the processes of nature. Therefore, Standards such as ISO 17088, EN13432, and their American (ASTM D6400-04; D6868) and Australian (AS 4736-2006) equivalents, designed for compostable plastic should not be used for plastic which is designed to biodegrade if it gets into the environment. These are specifications for the special conditions found in industrial[56] composting.

5.8 **Home composting of plastic packaging can be dangerous and should not be encouraged,** as it is often contaminated with meat, fish, or poultry residues, and temperatures may not rise high enough to kill the pathogens. See https://www.biodeg.org/exeter-rejects-compostable-plastic/

51. C6.2
52. Eg French law NFU 44/051
53. C6.2
54. C6.2
55. C6.2
56. ASTM D6400 states that it "covers plastics and products made from plastics that are designed to be composted in municipal and industrial aerobic composting facilities, and EN13432 states that it does not take into account packaging waste which may end up in the environment through uncontrolled means, ie as litter.

5.9 We do not agree that "biodegradable" is a meaningless term. It indicates that a material is capable of being bioassimilated by micro-organisms. It is no more meaningless than any other general description. We do not agree that "labelling oxo-degradable plastic products as "biodegradable" can lead to confusion on the part of consumers who may assume that "biodegradable plastics" are compostable." It is obvious that in order to see the word "biodegradable" the consumer has looked at the label, which can and should say "Not intended for composting."

5.10 The absence of a European Standard for oxo-biodegradable plastic gives the compostable plastic industry an unfair marketing advantage, which their representatives on the Standards bodies use their votes to retain.

5.11 We agree with the packaging manager of Tesco (Britain's largest supermarket) who said on 20th October 2009 that the supermarket "does not see the value in packaging that can only be industrially composted" and that "local authorities do not want to touch it, as it can contaminate existing recycling schemes." A few days earlier, Tesco's head of waste and recycling had told a conference that the supermarket group was "not taking compostable packaging any further."

5.12 We are all aware that landfill sites in the UK are filling up, but only "0.2% of the average household dustbin is plastic carrier bags.[57] The fraction of landfill represented by plastic shopping bags is 0.05%. This is based on domestic waste being 17% of landfill and plastic bags being 0.2% of the average dustbin.[58] A far greater impact on saving landfill space would be made by diverting away from landfill bricks, concrete, wood, glass and other building materials and other items such as household appliances, which occupy much more space.

5.13 All combustible waste which is suitable only for landfill, should be diverted to modern incineration facilities, as in other developed countries (eg in Zurich), where the heat energy can be put to use with no harmful effect on the environment.[59] This is particularly suitable for waste plastics, which do not retain moisture and have a high calorific value. Retailer D[60] believed that this option should be further considered. There are currently 15 Energy-from-waste plants operating in the UK.

5.14 **Composting of organic waste makes sense, but compostable plastic does not**[61]. It is up to 400% more expensive than ordinary plastic, and it converts into CO_2 gas, not compost; it is thicker and heavier and requires more trucks to transport it; recycling with oil-based plastics is impossible; it uses scarce land and water resources to produce the raw material. It is not "renewable" because substantial amounts of fossil fuels are burned and CO_2 emitted, by the tractors and other machines employed. If buried in landfill, compostable plastic will emit methane (a greenhouse gas 23 times more powerful than CO_2) in anaerobic conditions. The authors acknowledge[62] that the production of methane in landfill is undesirable.

5.15 EN 13432, ASTM D6400 and the other standards for industrial compostability are not appropriate for testing oxo-biodegradable plastics because they are based on measuring the emission of carbon dioxide during degradation over a short timescale. Hydro-biodegradable plastic is compliant precisely because it emits CO_2 (a greenhouse gas) at a high rate. Oxo-biodegradable plastics do not emit CO_2 at that rate.

57. Plastic Bag Tax Assessment, HM Treasury, UK, December 2002.
58. (Packaging and Films Association 2007).
59. See OPA Position Paper on Incineration
60. 6.3.4
61. http://www.biodeg.org/files/uploaded/biodeg/Oxo_vs_Hydro-biodegradable.pdf
http://www.biodeg.org/files/uploaded/biodeg/Hydro-biodegradable_Plastic_Production_Process.pdf
62. 1.5

5.16 If a leaf were subjected to the CO_2 emission tests included in EN13432 it would not pass! Leaves are not of course required to pass any such test, but it shows how artificial the test is.

5.17 Another problem with EN 13432 and ASTM D6400, is that they require almost complete conversion of the carbon in the plastic to CO_2, within 180 days, thus depriving the resulting compost of carbon, which is needed for plant growth, and wasting it by emission to atmosphere - contributing to climate-change.

5.18 Conversion of organic materials to CO© at a rapid rate during the composting process is **not "recovery" as required63 by the European Directive on Packaging and Packaging Waste (94/62/EC as amended),**[64] **and is not consistent with a circular economy**. It should not really be part of a standard for composting at all. Nature's lignocellulosic wastes do not behave in this way, and if they did they would have little value as soil improvers and fertilisers, having lost most of their carbon.

5.19 The EU Directive does NOT require that when a packaging product is marketed as "degradable" or "compostable" conformity with the Directive must be assessed by reference to EN13432. Although the Directive[65] provides that conformity with its essential requirements may be presumed if EN 13432 is complied with, it does not exclude proof of conformity by other evidence. Indeed Annex Z of EN13432 itself says that it provides only one means of conforming with the essential requirements.

5.20 We agree with Germany's Institute for Energy and Environmental Research[65] and Ademe, the French Agency for the Environment,[67] who concluded that oil-based plastics, especially if recycled, have a better Life-cycle Analysis than compostable plastics. The IEER added that "The current bags made from bioplastics have less favourable environmental impact profiles than the other materials examined" and that this is due to the process of raw-material production.

6. OIL-DEPLETION

6.1 Ordinary plastics are currently made from by-products of oil, natural gas, or coal. These by-products arise because the world needs fuels, and would arise whether or not the by-product were used to make plastic goods. So, nobody is extracting or importing oil, gas or coal to make plastic. Until other fuels have been developed it makes good environmental sense to use the by-product, instead of using scarce agricultural resources and water to make paper or cloth bags or vegetable-based plastic.

63. Annex II para. 3
64. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1994L0062:20050405:EN:PDF
65. Article 9(2)
66. June 2009 (http://www.kunststoffverpackungen.de/en/news/LCA%20waste%20bags%20-%20Study%20Extract%20B.pdf)
67. December 2007

7. LONG-LIFE BAGS

7.1 **These are not the answer.** They are much thicker and more expensive to make, and a large number of them would be required for the weekly supermarket shopping of an average family.

7.2 30,000 jute or cotton bags can be packed into a 20-foot container, but the same container will accommodate 2.5 million plastic carrier-bags. Therefore, to transport the same number of jute or cotton bags 80x more ships and trucks would be required than for plastic bags, using 80x more fuel, using 80x more road space and emitting 80x more CO_2.

7.3 Cloth bags are not hygienic[68] if a tomato is squashed or milk is spilled. Research by Guelph Chemical Laboratories in Canada in 2008 Microbiological Study of Reusable Grocery Bags has shown that "re-usable grocery bags can become an active microbial habitat and a breeding-ground for bacteria, yeast, mold, and coliforms. .... The unacceptable presence of coliforms - ie intestinal bacteria, in some of the bags tested, suggests that forms of E.Coli associated with severe disease could be present in a small but significant proportion of the bags."

7.4 Whilst sometimes called "Bags for Life" they have a limited life, depending on the treatment they receive, and become a very durable form of litter when discarded.

7.5 Shoppers do not always go to the shop from home, where the re-usable bags would normally be kept, and consumers are unlikely to have a re-usable bag with them when buying on impulse items such as clothing, groceries, CDs, magazines, stationery etc. Research conducted for the Scottish Executive[69] carrier bag case studies showed that 92 per cent of people think re-using carrier bags is good for the environment but 59 per cent forget their re-usable bags and have to take new ones at the checkout!

7.6 As durable bags are a cost to the consumer and carrier-bags are expected to be provided free, one can easily understand why supermarkets are in favour of reducing the number of carrier bags and increasing the number of durable bags. Even those who give the profit to charity have saved themselves the cost.

7.7 The thin high-density vest-style carrier bag is used on average 5 times in the UK and when finished is used as a bin liner. Now the consumer is being encouraged to pay for a bag for life and also to buy a bin liner. It is therefore not reducing the impact of plastic in the environment but is reducing the spending power of the consumer who has not been told the facts.

7.8 However, for those who believe in long-term re-usable bags, they can be made from washable extended-life oxo-biodegradable plastic which will last for 3-5 years before they will harmlessly self-destruct, leaving no harmful residues.

68. www.cpia.ca/epic/media/default.php?ID=2054
www.cpia.ca/files/files/A_Microbiological_Study_of_Reusable_Grocery_Bags_May20_09.pdf http://network.nationalpost.com/np/blogs/theappetizer/archive/2009/05/20/back-to-plastic-reusable-grocery-bags-may-pose-public-health-risk.aspx
69. http://www.scotland.gov.uk/Topics/Environment/funding-and-grants/carrier-bag-case-studies/Q/EditMode/on

8. AGRICULTURAL MULCHING FILM [35]

8.1 **For many years farmers and growers have used plastic sheets to protect their crops, to save water, and to inhibit weeds, but after the crop has been harvested many thousands of square kilometres of dirty plastic have to be removed and disposed of. This is a very expensive process, and creates huge quantities of contaminated waste, which cannot be burned on the farm, or recycled into useful products.**

8.2 The Report says at 4.3.1 "Another application where compostability has been an issue is in the use of agricultural mulch films. The main reason for using them in these applications is that they can be disposed of in-situ and need not be removed and disposed of. Citing their lack of compostability, the Environment Agency does not allow un-degraded oxo-degradable plastics to be returned to the soil by ploughing in. This prohibition, fundamentally limits the application of these materials and means that oxo-degradable mulch films have only been used in trials in the UK. The NFU suggests that degradable mulch films that can be ploughed in are of potential benefit to the farmer, avoiding the need for collection and disposal that can be both costly and potentially damaging to the environment.

8.3 **Oxo-biodegradable plastic sheets have been designed to be programmed at manufacture to degrade after the harvest.** The degraded material is intended to be ploughed into the soil where it completes the biodegradation process and becomes a source of carbon for next year's plants. Alternatively it can be placed in a corner of the farm under a net, where it will degrade and disappear leaving no harmful residues.

8.4 Oxo-biodegradable plastics have been used as protective films in agriculture in many countries (including USA, China, Japan and the EU). They are applied to the land in the same way as straw to retain moisture and to increase root temperatures.

8.5 The evidence of the UK's National Farmers' Union to the Loughborough Report[70] is that "Farmers suffer from having relatively small amounts of widely dispersed plastic that needs to be collected and disposed of. A potential advantage of the oxo-degradable plastics is that they could be disposed of in-situ, thus avoiding the need for collection, with its attendant financial and environmental costs. Similarly, costs of final disposal in landfill would also be avoided."

8.6 **This would not only result in major cost and time savings for farmers, but would also divert huge quantities of material from landfill.**

8.7 "The NFU continues "However for oxo-degradable plastics to move into mainstream use, farmers would have to be convinced of their effectiveness and environmental safety." It is for this reason that Symphony Environmental has for the past three years been conducting trials under different climatic conditions in nine countries, and does not supply agricultural mulching film unless satisfied as to effectiveness and environmental safety. Vegetable-based compostable plastics would not be cost-effective nor strong enough.

70. C5.2

8.8 The Report indicates[71] that the UK's Environment Agency does not accept the ploughing in of oxo-degradable plastic mulches because it is not considered beneficial or environmentally benign. The decision was based on the results of a literature search and peer review into the composting of oxo-degradable plastics." The OPA does not think that this is a sufficient basis for depriving British farmers of the benefits of oxo-biodegradable plastics, and we would be willing to accept an invitation from the Environment Agency to discuss the matter with them.

8.9 Oxo-biodegradable plastic would satisfy Tiers 1 and 3 of EN 13432 and the other composting standards. It would not pass Tier 2 because it would not convert itself into CO_2 gas within 180 days, but as indicated above this is neither necessary nor desirable.

71. C5.1