Question 1. Do you agree that the limit should be reduced to 0.2 l biogas g-1 VS, and that the test duration should be reduced to 10 days?

We believe the RBP test method should not be retained in the PAS 110. The research report claims that the test was introduced to 'provide evidence that an effective anaerobic digestion process has taken place.' However, the test is not used for checking biogas potential at the start of AD processes (which it would also need to do to demonstrate that effective digestion has taken place) and the way that PAS 110 requires it to be used does not cost- and time-effectively meet this objective.

We recognise that the test method is robust and acknowledge all the work that has gone into its development. However, the current test is very costly and it doesn't allow the operator to gain results within a reasonable timescale, which can be particularly problematic when sample testing coincides with times of year when spreading to land is allowed and RBP quality failures occur. In addition, the long laboratory turnaround time for this test means that it has a limited use for process control or verification, because:

a) by the time the RBP test results are returned by the lab it is likely that the digestate has already been dispatched by the AD operator (normally due to limited storage capacity) and,
b) in the event the test results show a RBP failure, it is possible that it is already too late to take an appropriate corrective action and/or make an appropriate change to the HACCP plan if required (as the process may have already deteriorated).

The reduction of the duration of the test from 28 to 10 days is an improvement, but it does not entirely address the above issues. In addition, the research report does not indicate how much the cost of the current test would be reduced if the recommended change (shorten to 10 day test) was to be implemented.

Within the AD sector there are already established parameters that are routinely monitored as indicators of process efficiency and stability (VFA, alkalinity and the ratio between the two, VFA speciation as well as biogas composition), so there is no need to have another test for process monitoring purposes.

We believe that PAS 110 approach should rather focus on the fitness for purpose of the digestate supplied for use, the same as for the PAS 100 approach.

PAS 110 is a product-focussed standard, thus, it should be more concerned about checking whether the digestate is unlikely to cause harm when used according to good practice. If measuring the stability of the digestate is considered essential to evaluate its fitness for purpose, then a stability parameter that meets this purpose should be included in the standard. Such a test should consider factors such as the potential soil oxygen demand from the material being applied to land, impact on soil quality, and phytotoxicity. Correlation of a stability test with impacts on soils and plants would be an alternative approach for assessing risk of harm. Such a test needs to be rapid and cost-effective.

Before establishing whether a stability test needs to be included or not and which stability test is more appropriate, the PAS 110 Steering Committee should decide what the main purpose of the test needs to be.

It is clear from the R&D report that:

1. The RBP test has not been correlated with the degree of environmental impact digestate when digestate is applied to land (as soil processes are predominantly aerobic and the oxygen demand exerted by the material is likely to be more relevant);
2. The test is appropriate to quantify the residual biogas produced by microbes in the digestate and, together with the RBP limit provides a means for checking that the residual biogas potential is low and similar to the RBP of similar materials (e.g. slurry) used in agriculture process. However, the RBP test may not become sufficiently time-effective (even if reduced to a 10 day test) nor cost-effective (change in test price unknown at this time).
3. The test can address the regulator's concern about sham recovery, however this should be controlled by the regulator through the waste regulatory control system, for example under

BAT guidance and 'all reasonable measures' applicable to non-IED facilities. The regulator should consider the best way to control sham recovery and should consider alternative approaches which may be less onerous than the RBP test (e.g. a carbon mass balance approach, setting a maximum threshold on throughput given the designed capacity of a plant etc.).

4. Concerns about odour release from digestates when applied to land should be minimised if good agricultural practice and 'low emission spreading' techniques are followed. The AD Quality Protocol requires that good practice and low carbon emissions spreading techniques are followed when spreading digestate, which should suitably control the risk of odour emissions during landspreading of digestate.
5. The same as for the PAS 100 specification for composted materials, PAS 110 should focus on the product's fitness for purpose. IF digestate stability is deemed crucial as an indicator of product fitness for purpose, then a test that looks at the product stability in terms of oxygen demand seems to be more suitable for this purpose. We encourage WRAP to support further work to look at the Specific Oxygen Uptake Rate (SOUR) as this test appears to be rapid and easy to perform. However, more work should be carried out to understand whether digestate stability affects digestates' fitness for purpose.

It is worth noticing that the IrBEA standard requires testing the phytotoxicity in digestates by using test method BS EN 16086-2:2011. 'Soil improvers and growing media – determination of plant-response test. Part 2: Petri-dish test using cress'. Consideration should be given to this test method during the PAS 110 review, as this test may be more suitable than the current RBP test to check digestate fitness for purpose. However, it should be noted that IrBEA standard acknowledges that further work should be carried out 'to confirm the applicability of this method to the different digestate materials'.

Question 2. Do you agree that the maximum period in which the net biogas production can remain negative is reduced from the current 5 days to 4 days?

If the RBP test is retained, we agree that the maximum period for which the net biogas production is allowed to remain negative is 4 days.

Question 3. Do you agree that the RBP test should be applied to whole digestates only, rather than to separated fractions? This would require differentiation within the PAS, since all other tests would apply to the digestate as supplied to the end user, whereas the RBP test would be associated solely with demonstration of process performance.

If the RBP test is replaced with a method that looks at product performance instead, then all fractions destined for use should be tested in the form they are supplied to the end users.

However, if the PAS 110 review committee decides that the RBP test is to be retained (we hope not) given that the main aim of the test is to demonstrate that an effective digestion process has taken place, it makes sense that only the whole digestate is tested (it is the form of digestate that corresponds with 'full treatment', with the exception of any subsequent step to separate liquid from solids). Operators who are not supplying whole digestate for use should be allowed to sample each of the fractions for which the operator intends to claim PAS 110 conformance.

BCS analysed all available RBP results in September 2011. It was noted that results for a given whole digestate sample were consistently different from the test results from the separate fractions (fibre and liquor) of the same sample. Hence it was recommended that RBP should only be used for whole digestate[1].

[1] RBP Test Report for WRAP 21st September 2011 – Author D Collins BCS

Question 4a. Do you agree that the sampling point should be specified as the outlet of the final tank from which biogas is collected for processing rather than simply vented?

Scenario A (our preferred scenario), where PAS 110 has a 'product quality' rather than 'process performance' stability test: the sampling point for each fraction should be soon after the minimum process has been completed. For whole digestate and separated liquor this should be the outlet from the final storage tank, after thoroughly mixing the contents of the tank (so that what is sampled is representative of the WD or SL ready to dispatch to market). For separated fibre, the sampling point should be after separation from the liquid fraction unless it subsequently undergoes a phase of aerobic biodegradation, in which case the sampling point should be immediately after completion of that last phase of treatment.

The text above is a more specific description of the current requirement in PAS 110 clause 10.2, where the sampling point is required correspond with a digstate state 'after full treatment when it is ready for use'.

QMS and HACCP will identify where 'after full treatment when ready for use' means.

Scenario B, where PAS 110 retains a 'process performance' stability test: the sampling point for whole digestate should be the outlet of 'the final tank from which biogas is collected for processing rather than simply vented'. Stability testing separated liquor and separated fibre seems unnecessary in this scenario.
'End of process as specified in QMS and HACCP and before pumping into the final storage tank.'

Question 4b. If yes, do you think that this definition is sufficiently clear for inclusion with PAS110, or are you able to suggest a clearer alternative?

In the event that PAS 110 specifies the sampling point as 'the outlet of the final tank from which biogas is collected for processing rather than simply vented' this definition does not match the restrictive intention because a final storage tank could be covered and collect biogas which goes to an odour treatment unit. Odour treatment arguably IS 'processing'.

To achieve the restriction intended, we suggest 'the outlet of the final tank from which biogas is collected for conversion into electricity, biofuel or some other marketable resource'.

Question 5. The current (post-validation) testing frequency is *2 per 12 months and not within 3 months of each other, or sooner if and when significant change occurs*. Do you think that this should be changed? If so, please state how and provide data to support your suggestion(s).

We suggest that if RBP tests are all passes during first year after validation, the minimum RBP test frequency is allowed to be once per year thereafter.

The post-validation minimal interval of 3 months between routinely taken RBP tests (not extras in the event of an RBP result exceeding the limit) should be replaced by a requirement that 'Each sample taken for routine RBP testing shall be from a different portion of production'. It is likely that note text would be necessary, explaining that if sampling from a final storage tank a sufficient quantity of newer production would need to be pumped in before taking the next routine RBP sample. Please see our response to question 11, sub-section 'Minimum interval between taking samples during validation – PAS 110, clause 10.6' for more specific suggestions.

Question 6. At present, PAS110 includes limits for PTEs, physical contaminants and bacterial indicators. Do you consider that PAS110 should include further 'environmental

outcome' tests? If so, please state what these should be and provide data to support your suggestion(s).

Answer depends on what is meant by 'environmental outcome'. The PTE limits are an example of a mechanism for protecting the receiving environment, as too are the pathogen indicator species tests (in terms of reasonable confidence that significant levels of human and animal pathogens are not being returned to the soil or the growth medium). Animals are considered part of the environment in the context of controls on biodegradable wastes, and the PAS 110 context too.

As we highlighted above, PAS 110 should focus on the product's fitness for purpose, thus, if a stability test is included in the PAS 110, this should consider the applied digestate's effects on soil oxygen demand, phytotoxicity and rate of plant development (e.g. slower crop establishment in the event of temporary nitrogen lock-up following application of digestate fibre).

However, concerns about odour release from digestates when applied to land are not within the remit of PAS 110 and should be minimised if good agricultural practice and low carbon emission spreading techniques are followed. The AD Quality Protocol requires that good practice and low carbon emission spreading techniques are followed when spreading digestate, which should suitably control the risk of odour emissions during landspreading of digestate.

Question 7. Do you agree with this assertion? If not, please state why and provide data to support your case.

Yes, we agree that VFA concentrations (and VFA speciation) are not appropriate for use as product stability criteria, although in combination with alkalinity they are a good indicator of process stability.

Please note that 'process stability' means process conditions that are controllable and unlikely to go out of control when normal process management practices are implemented.

VFA species and concentrations are not reliable indicators of whether the AD process has removed an appropriate quantity of biogas.

Question 8. WRAP are currently procuring a project to examine this question further. Please provide data comparing RBP and aerobic respirometric tests (or links to such data).

We do not have such data.

Question 9. Do you agree that such an amendment is appropriate? If so, please provide a form of words that you would consider suitable for inclusion within the current method[2].

Yes, such an amendment is appropriate if any outlier result is attributed to:

- a failure or deficiency in the specific part(s) of the equipment that capture and/or measure the gas generated from the test sample; and/or
- human error that affects the specific part(s) of the equipment that capture and/or measure the gas generated from the test sample.

Please note that when testing samples, the laboratory should also run control blanks to check that the equipment and 'control test' set up yields a minimum quantity of biogas.

[2] http://www.wrap.org.uk/sites/files/wrap/Residual%20Biogas%20Potential.pdf

Question 10. Do you agree with assertion? If not, please state why and provide data to support your case.

We agree with this assertion. RBP does not seem to be fit for assessing the performance of an aerobic digestion process. Aerobically produced digestates could generate gases at a very different rate than the anaerobic digestates.

However it is imperative that aerobic digestion IS included within the scope of PAS 110; thus, IF a stability test is to be included it is CRUCIAL that this method is suitable for aerobically produced digestates. As we explained above, the method should look at product performance as opposed to process performance.

See also repose to question 22.

Question 11. Do you have any other comments on this aspect of PAS110?

3-in-a-row passes – PAS 110, clauses 11.2.2 and 12.2.1

Operators believe that the requirement to (re)gain 3-in-a-row passes (e.g. after a test result failure, when working towards validation and particularly in a renewal phase) is extremely onerous, especially if the failure was on RBP and the result was a failure by a narrow margin. They are increasingly aware that the repeatability (and potentially also the reproducibility) of the RPB test should be taken into account.

As a consequence of how long it takes to (re)gain 3-in-a-row RBP test result passes and the issue about likely variation in results if replicates of the same sample are re-tested in the same approved lab or tested in parallel in a different approved lab, AD operators would prefer their digestate compliance to be evaluated on the basis of the average calculated from a suitable number of samples' RBP results (it would need to be a moving average, based on a sufficient number of samples, and they would need to discount any past samples produced according to different Critical Limits at the Critical Control points). This would be the same concept as JRC-ITPS has proposed for the EC EoW criteria for composts and digestates.

An 'averages' approach should encourage more AD operators to try producing PAS 110 digestate because AD operators perceive that the likelihood of having to obtain 'back-up' customers with Environmental Permits to landspread failed portions of production as 'waste' is lower. Some operators report that the time involved in making back-up arrangements in the event of RBP test result failure adds significant cost and workload beyond the benefits associated with gaining/regaining certification.

An alternative approach is for digestate compliance to continue to be evaluated on the basis of individual sample results (by comparing each sample result with the limit level, as per the current version of PAS 110). Under this scenario, to minimise the cost for the operators, we suggest that they are only asked to sample and test one further portion of production following a RBP quality failure, rather than have to re-gain 3-in-a-row passes. If Steering Committee view is that one further RBP pass is insufficient, we suggest that in a set of three successive RBP tests (each on a different sample)
the first or second RBP test result must not exceed 0.30 l / g VS and the other two RBP test results most not exceed 0.25 l / g VS.

Minimum interval between taking samples during validation – PAS 110, clause 10.6

This clause requires that "The minimum time between taking each representative sample from a portion of production shall not be less than the minimum necessary retention time in the digester'." (Influenced by Organic Loading Rate and Hydraulic Retention Time).

Some operators reported a necessary timescale of 1 year to validate their process or regain 3-in-a-row RBP test result passes after one or more RBP test result failures. They believe that the interval between taking each sample is unecessarily long, particularly when operating using retention times greater than circa 50 days.

In general, PAS 110 should make clear that if a test result failure occurs then the AD operator is allowed to produce a new portion of production and sample that as soon as that portion has completed its full treatment process. (The test result failures section in PAS 110 tried to make suitable provision for this eventuality, but perhaps it is perceived to conflict with clause 10.6.)

We propose the following approach, which could be considered for guidance if unsuitable for inclusion in PAS 110:

1. if sampling 'in-line' after treatment but before the storage tank ~ the interval between each sample taken could be the time it takes to pump a batch / portion of production past that sampling point, the size of a 'portion of production' having been determined by the operator and stated in his/her QMS documentation.
2. if sampling from the same storage tank ~ the minimum interval between each sample taken could be the time it takes to pump into that tank sufficient portion(s) of production such that this amount a) replaces at least 50 % v/v of digestate in the tank when it was last sampled or b) adds at least 50 % v/v of digestate in the tank when it was last sampled.
3. if sampling from a different storage tank (scenario added because some AD processes feed more than one storage tank) ~ potentially allows taking each representative sample in rotation (or sequence) from one tank to the next, and the AD operator would have to manage pump-in, storage and dispatch such that the minimum interval between taking a representative sample from the same tank is the same as for option 2) above.

* The v/v % would need to be discussed and perhaps could be specified in certification scheme rules rather than being written into the next edition of PAS 110. Fifty-percent v/v may be higher than necessary, but the concept here is that enough digestate has been pumped into the storage tank such that the next time a sample is taken the tank's mixed contents can reasonably be regarded as a 'substantially different' portion of production (which should in theory – but may not in practice – have very similar characteristics as the last representative sample taken from the tank).

Question 12a. Whilst many AD feedstocks are considered low-risk from a phytohygiene perspective, some cannot be considered 'no risk' in AD systems that do not include a pasteurisation stage. The authors of this report suggest that feedstocks could be risk-assessed to determine whether they should be exempted from the pasteurisation requirement. For the purposes of auditability, a risk assessment option within PAS110 may not be appropriate. What are your views on this?

Comments on WRAP's related reports:
WRAP's report entitled 'A consideration of the PAS 110:2010 pasteurisation requirements, and possible alternatives' should better reflect the results of the trials described in WRAP's report entitled 'Investigation into the effects of anaerobic digestion processes on some common agricultural pests and diseases in the UK'. The former report should at least acknowledge that the trials carried out by FERA and Aquaenviro show that all common plant pathogens tested do not survive mesophilic anaerobic digestion (MAD) at 37 °C (for different timescales, depending on the plant pathogen tested).

As mentioned by WRAP in the introductory text for this question, the former report concludes: 'our data support the retention of a discrete pasteurisation step in PAS 110 specification, although recognise the importance to industry of flexibility in pasteurisation approach'. Indeed the trials carried out by FERA and Aquaenviro showed that (see two tables below, copied from the report) pasteurisation at 70 °C for 1 hour combined with MAD was sufficient to inactivate most pathogens

tested. However, the evidence also showed that MAD on its own was sufficient to inactivate all plant pathogens tested (including *Spongospora subterraneana*, which resisted pasteurisation at 70 °C for 1 hour). Even more notably, the results related to digestate storage on its own (e.g. for a minimum of 6 days) are also very promising as they show that the plant pathogens tested in the batch AD systems were inactivated.

We understand that there is a concern that in continuous or semi-continuous systems plant pathogens may by-pass the reductive effect of digestion. However, the trials show that it is possible, if not likely, that storage would be sufficient to inactivate the pathogens that have by-passed the digestion process. The batch trials suggest that 6 days storage may be sufficient to inactivate all pathogens tested, although operators running continuous or semi-continuous systems may not be able to guarantee that all material within a storage tank is 6 days old (as portions of production are semi-continuously pumped into digestate storage). For this reason it is disappointing that the trials have not looked at the efficacy of storage in connection with semi-continuous AD systems, as these reflect much better what happens in real scale AD plants and may have clarified whether there would be adequate reduction of risk in systems where there is partial by-pass.

Tomato seeds and black grass seeds survived the MAD and also digestate storage, showing that survival of weed seeds may be a concern where pasteurisation at 70 °C for 1 hour is not undertaken, so there is some merit in proposing that a requirement to test for an appropriate weed seeds indicator is introduced.

On the one hand we acknowledge that a pasteurisation step is seen as important by farm assurance schemes and food retailers, but on the other hand, given the capital and operational costs of pasteurisation and the Government's plan to boost on-farm anaerobic digestion, it is crucial that the recommendations given in WRAP's report are entirely supported by sound evidence. We believe that this is not entirely the case, given that control of risks associated with partial by-pass has not been addressed in the trials.

Table 6-1 Time after which levels of inoculated organisms dropped below detection limits (LOD). Batch AD results

Organism	Pasteurisation 70°C	MAD 37.5°C	Stored in digestate at 7-11°C	Detection method(s)
Tomato seed (*Lycopersicum esculentum*) cv Ailsa Craig	1 hour	Still viable at 6 days	Still viable at 10 days	Tetrazolium staining
Black grass seed (*Alopecurus myosuroides*)	1 hour	5 days	Still viable at 10 days	Tetrazolium staining
Phytophthora infestans	1 hour	1 day	1 day	Culture
Phytophthora cinnamomi	1 hour	1 day	5 days	Culture
Phytophthora nicotianae	1 hour	1 day	5 days	Culture
Fusarium culmorum	1 hour	1 day	5 days	Culture
Fusarium oxysporum f. sp. *radicis lycopersicae*	1 hour	1 day	5 days	Culture
Plasmodiophora brassicae	1 hour	1 day	6 days	PCR, Bioassay, Bioassay+PCR

Table 6-2 Time after which levels of inoculated organisms dropped below detection limits (LOD). Semi-continuous AD results. ND=no data

Organism	MAD + Pre-Pasteurisation	MAD	Detection method
Escherichia coli	1 hour	1.8 log decrease at 30 days	Culture
Salmonella	1 hour	3.5 log decrease at 30 days	Culture
Tomato seed (*Lycopersicum esculentum*) cv Ailsa Craig	1 hour	3 days	Germination
Streptomyces scabies	12 days	12 days	DNA PCR
Spongospora subterranea	3 days	12 days	Bait test+DNA PCR
Rhizoctonia solani	15 days	15 days	DNA PCR RNA PCR
Ralstonia solanacearum	6 days	6 days	BIOPCR
Clavibacter michiganensis subsp. *sepedonicus*	6 days	6 days	BIOPCR
Fusarium culmorum	3 days	3 days	DNA PCR RNA PCR

Case by case evaluation of feedstocks

We believe that PAS 110 should allow case by case assessment of feedstock from a specific source to determine whether it can be exempt from pasteurisation during the AD operator's treatment process. Feedstock eligible for such exemption must:

- be supplied under an input material supplier agreement signed by the supplier of that material, confirming that only input materials that have undergone a thermal treatment equal to or exceeding one of the PAS 110 table A.1 regimes will be supplied to the AD operator; and
- be subject to a pre-acceptance procedure that requires the input material supplier to provide evidence to the AD operator (e.g. HACCP plan) which shows that the materials from that supplier always undergo a thermal treatment equal or exceeding one of the PAS 110 table A.1 regimes.

The meeting of such conditions should ensure that risks associated with animal, human and plant pathogens are acceptably controlled.

Certification scheme checks: The certification body's audit of the AD operator would include checks on the signed input supplier agreement and supplied evidence of satisfactory thermal treatment at the supplier's premise. The certification body would reserve the right to also inspect the input material supplier's premise, which is likely to be done in the event that information from the input material supplier is unclear, deficient or known or suspected to be misleading.

We have suggested the above from experience of a few cases of by-product arising from a food / beverage manufacturing process where the material has been subject to a thermal treatment process which is believed to be equal to or exceeding one of the PAS 110 table A.1 regimes.

Co-operative scenarios

With regard to energy crops under the co-operative scenarios, please see our answer to Q12b.

Single-farm digestion scenario

We believe that when the use of digestate is within the same holding as all of the input waste fed in to the AD process, the process should continue to be exempt from PAS 110's pasteurisation requirement.

Question 12b. Do you think that specific feedstocks should be exempted from the pasteurisation requirement? If so, please state what they are and provide data to support your assertion that they should be exempted. Please also suggest suitable forms of words that could encompass your proposed exemptions in a revised PAS110. Please bear in mind that the auditability of the PAS cannot be compromised. This means that it might not be appropriate to co-opt operations into the PAS that are outside the scope of the current auditing process (such as field application records).

Yes. For example distillery by-products such as spent grains and pot ale should be exempted, as they have already undergone thermal treatment during the distillation process. This treatment normally exceeds or is equivalent to the temperature/time, and particle size requirements specified in Table A.1 of PAS 110. Distillery by-products are often sold as animal feeds, which means that they are often subject to extensive routine microbiological testing to ensure they are safe and would not pose a risk to animals.

PAS 110-support consultancy currently includes working with a distillery to assist them with their PAS 110 certification. The company has plenty of data and information that they could provide to support the exemption of distillery by-products from a pasteurisation step. However we are currently unable to provide such data as we have signed a confidentiality agreement with them. We have been in contact with this company and they said they are willing to provide directly this information to WRAP and the technical author (who could present key points to the rest of the PAS 110 steering committee) to support an exemption of distillery by-products from the PAS 110 pasteurisation requirements, under the premise that these data are kept confidential. Confidentiality for them is crucial and should the committee wish to obtain their process records etc., they would require guarantees around this.

In addition, having spoken to Quality Meat Scotland, we understand the digestates derived from distillery by-products are not at all a concern for the food assurance scheme. Digestates made from distillery by-products are NOT considered 'recycled off farm waste' and, thus, none of the restrictions to liquid digestate or solid fibre described in Appendix 2 of the QMS standard for sheep and cattle (see http://www.sfqc.co.uk/farm_schemes/quality_meat_scotland_qms_assurance_scheme-_cattle_and_sheep/downloads) apply. In other words, digestate products from distillery by-products can currently be used on grassland under the QMS standard sheep and cattle with no restrictions other than any regulatory requirement.

We suggest the following words for this exemption: 'By-products from distilleries shall be exempt from pasteurisation. *Note: Examples of such by-products are pot ale and spent grains ('draff').*'

Energy crops under the co-operative scenarios:

The Steering Committee should be asked to consider whether:

- PAS 110 aims to provide phytohygiene assurance (acceptably low risk in PAS 110 digestate),
- PAS 110 aims to provide animal pathogen assurance in the event of input material and digestate transfer between holdings within a co-operative, and
- if yes, whether any inputs in a co-operative scenario should be exempt from pasteurisation on condition that all of the digestate produced is used within the holdings within the co-operative.

Co-operative issues merit attention during the PAS 110 review, in connection with what is practical and effective for checking whether plant pathogen risks have been adequately controlled.

We recognise that end-use risk reduction factors will not be audited (e.g. not cost effective to audit whether digestate has been incorporated in soil in advance of crop establishment if all input to the digestate were not pasteurised, and creates an AD operator certification problem if the farm causes end-use non-compliance).

Question 13. Do you agree with the assertion that other pre-defined approaches to pasteurisation may not be appropriate for PAS110, given their reliance on minimum hydraulic retention times within the digestion phase? If not, please state why and provide data to support your case.

Only if supported by sound evidence pre-defined approaches to pasteurisation should be included in the standard in addition to the process-specific validation approach described in paragraph 4.5.1 of WRAP's report entitled 'A consideration of the PAS 110:2010 pasteurisation requirements, and possible alternatives'.

The statement about pre-defined pasteurisation parameters not having been proven for 'the wide range of potential crop pests and diseases that could be associated with some feedstocks' causes us significant concern.

We suggest that, in addition to the standardised approach proposed in the report (referred to in Q15), PAS 110 include a mechanism for operating novel pasteurisation conditions but with caveat that all relevant crop pest and disease risks be included in the supporting risk assessment document. The work necessary for a robust risk assessment and specialist evaluation of the risk assessment would entail considerable cost that the AD operator would have to cover. We assume that giving AD operators a choice to propose novel pasteurisation conditions would be better than allowing no choice.

Question 14. If the current PAS110 pasteurisation regime were to remain in place, the concept of Pasteurisation Units to design bespoke approaches for control of phytohygienic hazards is extremely appealing, since it would rely on a simple set of calculations to define suitable time/temperature regimes. However, data to support this approach appear scarce. If you are able, please attach data demonstrating the use of Pasteurisation Units to design systems intended to mitigate phytohygienic hazards in AD systems. General comments on the PU approach can be added below:

We do not have data. General comment: PU approach has potential if Z-values are appropriate for anaerobic digestion conditions. It is unclear how an AD operator should try to prove that an alternative regime is equivalent to PAS 110 pasteurisation as currently defined; it may not be practical for the AD operator to pasteurise according to the latter regime to provide comparative data.

Question 15. If the current PAS110 pasteurisation regime were to remain in place, the concept of a standardised approach for validating alternatives is extremely appealing. Do you support the proposal to use *Plasmodiophora brassicae* and tomato seeds as indicator species for such validation? If not, please state why and provide data to support your case.

Use of *Plasmodiophora brassicae* as an indicator for process specific validation

WRAP's report entitled 'A consideration of the PAS 110:2010 pasteurisation requirements, and possible alternatives' does not provide a detailed justification of the reason why *Plasmodiophora Brassicae* is chosen as the plant pathogen indicator, apart from the fact that this microorganism is currently the indicator specified in the German Ordinance. WRAP's trials showed that tomato seeds are relatively persistent and survived the batch experiments; however the trials did also show that *Plasmodiophora Brassicae* is not particularly resistant, as it is inactivated after only 1 day of MAD at 37 °C, so we question whether this is the best indicator. In addition, we question whether an indicator to test the extent of plant pathogen kill is needed at all, given that WRAP's trials showed that all plant pathogens tested did not survive MAD.

We do however support the introduction of a mechanism in the PAS 110 that enables validation of alternative processes to demonstrate the effectiveness of the process to reduce the risks to plant health; we propose that:

1. Scenario 1: if the process includes a minimum of 15 days MAD and a minimum of 6 days digestate storage, the plant is only required to validate the process by testing either tomato seeds or weed seeds (if a suitable test is available for this latter parameter);
2. Scenario 2: if the process does not encompass the above two steps, the plant is required to undertake a process specific validation (like that described in paragraph 4.5.1 of WRAP's report), to check the extent of pathogen and weed seed kill in the process. However we ask WRAP to re-consider whether *Plasmodiophora brassicae* is the most appropriate indicator, given the scarce resistance it showed to MAD.

In the absence of another appropriate plant pathogen indicator for which a test is available, rapid and not costly, we support the introduction of *Plasmodiophora brassicae* for scenario 2 described above. This approach should be introduced in PAS 110 as it provides more flexibility to the industry, providing it is not too burdensome. If possible within the timescale available for PAS 110 review, an evaluation of the impacts in term of costs associated to validation and post-validation for this kind of approach should be undertaken before this is introduced as an alternative, viable option. If the cost of this option is too prohibitive, no AD operators will be able to afford it and, consequently, having this option will not make any difference at all.

Christine Henry at FERA has kindly sent us the following information about the cost of testing the proposed pathogen indicator (*Plasmodiophora brassicae)* and the lab turnaround time for this test:

Test duration: 10 - 14 days. Note that FERA would need 2 weeks notice prior to sending to ensure bait plants are at the right stage of growth.

FERA's testing services and clubroot testing prices will be as follows:

- 1 sample: £123 per test
- 2 samples: £86 per test
- 3 - 5 samples: £75 per test
- 6 - 9 samples: £55 per test
- 10 - 14 samples: £47 per test
- 15+ samples: £45 per test

FERA: 'In the event 36 samples in total are required for process specific validation, as specified in the German Ordinance, the cost of validation in relation to *Plasmodiophora brassicae* is £1620, which is relatively costly (although much cheaper than the cost of pasteurisation).^

Unfortunately we have not had the time to explore the cost of testing tomato seeds.
The strong limitation with the approach proposed in paragraph 4.5.1 of WRAP's report is that, according to the report, semi-permeable membranes cannot be used because of the significant risk of rupture of containers or leaching of the content. It is proposed instead that capsules are used 'that allow sufficient thermal conductance to ensure that the centre of the capsule reaches the required temperature during the specified duration of the sanitisation step'. Our concern is that such capsules would not allow the effect of physicochemical conditions (e.g. pH, ammonia) or indeed microbiological conditions (e.g. presence of antibiotics or antagonist microbes), which may be crucial to ensure adequate reduction of biological risks.

WRAP's report says that semi-permeable membranes are prescribed for use in the German Ordinance and are used for process validation at German AD plants, so it is a shame such containers have not been trialled in the WRAP commissioned R&D. Feedback from German operators or the trade body representing AD operators in Germany should be sought before the option of semi-impermeable membranes is excluded. It is likely that AD operators would be willing to take risk of using semi-permeable membranes if they can show that lower temperatures are able to achieve the same pathogen reduction as the current prescribed temperatures, as this would enable them to make significant energy savings.

Finally, it is important that the protocol used to evaluate whether process specific validations are

effective needs to be clear, robust and transparent.

Question 16. Do you have any other comments on this aspect of PAS110?

No

Question 17. Do you agree with the conclusion that it would be more appropriate for PTE limit concentrations in digestates to be set on a fresh weight basis? If not, please state why and provide data to support your case.

Summary

'Yes' in the case of whole digestates (WDs) and separated liquors (SLs). Perhaps 'no' in the case of fibre digestates (FDs). The R&D report's proposed (precautionary) PTE limits and other information in the report lead us to conclude that setting PTE limits on a fresh weight basis will not guarantee no excessive loading of the receiving soil in all cases of FD application. (In this context, 'excessive' means loading the receiving soil at a rate exceeding the equivalent draft EU EoW PTE limits set on a dry matter basis.)

Whole digestates and separated liquors

Data from the analysis of 51 samples of WD and 17 samples of SL were considered in the R&D report and amongst it's important findings were that for all food based digestate samples: '..there were positive ($P<0.05$) relationships between digestate dry matter content and PTE concentrations expressed on a fresh weight basis for Zn (Figure 14), Cu, Cd, Pb, Ni and Cr (Table 9)'. The findings and proposals mean that WD or SL that is applied in accordance with NVZ total N limits is very unlikely to load the receiving soil with greater amounts of PTEs than would the application of WD or SL that had concentrations of PTEs that matched PAS 110 PTE limits set on a dry matter basis (limits corresponding with draft EU EoW proposals).

In the case of **fibre digestates (FDs)**, we are less confident that the proposed (precautionary) PTE limits on a fresh weight basis would protect all receiving soils as much as the draft EU EoW PTE limits (the set of limits that the R&D report seeks not to be exceeded as a result of its recommendations).

Excerpt about 'worst-case' scenario for separated fibre:
'The implications for soil PTE addition rates were assessed for a 'worst-case' scenario situation i.e. where a digestate fibre with a 'low' N content (4 kg N/t) but with PTE concentrations at the proposed* limit values was applied to land at 250 kg/ha total N. In this scenario, addition rates from all PTEs were generally similar to or below those from compost at suggested EoW limit values (Table 17).'
* We assume 'proposed' means the precautionary PTE limits in the R&D report's table 16.

Excerpt that reveals a lack of relationship between dry matter content and PTE concentrations in fibre digestates: 'When the liquid (<15% dry matter) and fibre (≥15% dry matter) digestates were examined separately, relationships between digestate dry matter content and PTE concentrations expressed on a fresh weight basis were only evident ($P>0.05$) for liquid digestates (Figure 15 and Table 10), with the relationships largely driven by three samples with dry matter content >8%.'

Given the seeming lack of relationship between fibre digestates' dry matter and PTE concentrations and that a small dataset of 22 samples was analysed in the R&D report, it is doubtful that the worst-case scenario would always be represented by 'low' N content FD with typical dry matter content and PTE concentrations. For example, a 'low' N content FD could have a high dry matter content and relatively high concentrations of PTEs (above what was seen in the 22 sample dataset considered) and as a result, its application could load the receiving soil with a greater concentrations of PTEs* than would the use of SF that contained PTE concentrations at the limit levels in the draft EU EoW

criteria (limits on a dry matter basis). * Greatest risk seems in terms of Cu and Zn; see figures 8 & 9 in R&D report.

Also note that the fibre digestates considered in the R&D report were described as 'food-based' so most may not have included a significant proportion of dairy or pig slurry inputs, which can contain relatively high concentrations of Cu and Zn (see figures 8 & 9 in R&D report).

In the case of fibre digestates, if the draft EU EoW limits for PTEs are regarded as 'more stringent than necessary for precautionary protection of the environment', then it may be proportionate to set PTE limits in the revised PAS 110 on a fresh weight basis, as per the R&D report's proposed 'precautionary' PTE limits for fibre digestates.

The above comments are made on assumption that digestate would be applied at rates that do not exceed NVZ allowed loading rates. In markets where NVZ rules do not apply, PTE-associated risks to plant, human and animal health should be considered. For example, if PTE limits in the revised PAS 110 are set on a fresh weight basis, it may be advisable to restrict the applications to those that are controlled by NVZ rules or equivalents. Use of digestate fibre in high proportion in growing media mixes or its supply as bagged soil conditioner might not afford the 'PTE protection' assumed from the material's compliance with PAS 110.

- Embracing the precautionary principle to ensure that digestate applications are as protective of the soil environment as is reasonably achievable and within the ethos of prevention of pollution, we recommend that (fresh weight) PTE limit concentrations are based on PTE addition rates to soils (in context with other commonly applied organic materials), and that PTE loading rates should not exceed those from compost which are considered in EU guidance to be protective of the soil. The following PTE concentration limits are proposed to protect the receiving soil environment.

Proposed fresh weight PTE limit values (g/m^3 or t fresh weight) for digestate products

PTE	Limit values for liquid digestate products (<15% dry matter)	Limit values for digestate fibre (≥15% dry matter)
Zn	30	150
Cu	15	30
Ni	3	5
Cd	0.2	0.2
Pb	5	30
Cr	5	20
Hg	0.1	0.1

Question 18a. Do you agree that it is appropriate to have separate limits for liquid and fibre digestates? If not, please provide data to support your case.

It is necessary to have separate limits for liquid and fibre digestates.

Question 18b. Do you agree that the distinction between liquid and fibre digestates should be set at 15% dry matter? If not, please provide data to support your case.

If PTE limits are set on a fresh matter basis for whole, liquid and fibre digestates, for maximum protection of receiving soils it would be more appropriate if any sample were to be evaluated as 'digestate fibre' if it consisted of ≥ 20 % w/w dry matter.

Dry matter (% w/w in fresh matter samples), summary stats for samples considered in WRAP R&D report on PTEs:

Mean	23.2
Median	22.1
Min	17.5

Max	33.5
Count	22

Question 18c. Do you agree with the proposed PTE limit values? If not, please provide data to support your case.

Yes in the case of liquid digestates.

In the case of fibre digestates, for a precautionary approach to protection of the environment, the proposed (precautionary) limits may not be stringent enough because at 150 g/t Zn and 30 g/t Cu they are not much below the draft EU EoW theoretical limits, respectively 190 g/t Zn and 48 g/t Cu (when converted to fresh matter basis and taking account of typical digestate fibre characteristics) [see figures 29 and 30 in R&D report). This narrow margin is potentially significant because the R&D carried out for WRAP did not establish a relationship between dry matter and PTE contents in fibre digestates. Furthermore, fibre digestate bulk densities can be very different from whole and liquid digestate bulk densities, so in the case of fibre digestates the 'typical' characteristics assumed when calculating precautionary limit values on a fresh matter basis may enable an actual fibre digestate that complies with the fresh matter limits to load significantly more PTEs to the receiving soil when applied (e.g. if it has higher dry matter, bulk density and PTE concentrations than is typical, and has total N content lower than is typical, for fibre digestates).

N.B.: Latest discussions on draft EU EoW criteria for composts and digestates covered the JRC-ITPS proposal to set a 200 mg/kg dm Cu limit and a 600 mg/kg Zn, with labelling drawing attention to Cu/Zn content if the compost/digestate contains between 100 to 200 mg/kg dm Cu and/or 400 to 600 mg/kg Zn. During PAS 110 review, please monitor developments in draft EU EoW proposals and if the most recent Cu and Zn proposals remain JRC-ITPS supported, the 'precautionary' limit values recommended in the PTEs R&D report for WRAP should be re-calculated using 200 mg/kg dm Cu and 600 mg/kg Zn as the 'starting benchmark'.

For greater confidence in fresh matter PTE limits for protecting soils that receive fibre digestates, we propose that the Zn limit be 130 g/t and the Cu limit be 20 g/t. These limits are proposed having taken into account ALARA Zn and Cu concentrations for fibre digestates, as indicated in the R&D report's figures 29 and 30.

Question 19. Do you have any other comments on this aspect of PAS110?

We are aware that there is government / regulator concern about AD operators adding water to samples before sending for PTE testing at suitable labs, which would facilitate samples complying with PTE limits set on a fresh matter basis. Such cheating could be prevented by PAS 110 requiring that any samples to which fresh matter based limits apply must be: taken or witnessed by an 'independent sampling person' at the AD facility (such persons appointed by the certification body or scheme owner). The independent sampling person would also either have to leave the AD facility with the sample and arrange its sending to the laboratory, or on the same day witness the sample collection by the courier or postal service that will deliver the sample to the independent laboratory.

Although such an approach would add more sampling cost than PAS 110 AD operators currently incur, we believe that this would be far outweighed by the digestate 'product' supply benefits that would follow from PAS 110 setting WD, SL and SF PTE limits on a fresh matter basis. I.e. more samples would comply with PAS 110's PTE limits, making the management of digestate product supply to market easier and less costly, and requiring less contingent capacity for storage of digestate that exceeds PAS 110 PTE limits and thus must be stored, supplied and used as 'waste'.

Question 20a. Do you agree that levels of physical contaminants should be set for digestates on an 'as received' basis? If so, please state why and provide data to support

your case. If not, please state why and provide data to support your case.

No, we do not agree that levels of physical contaminants (PCs) should be set for digestates on an 'as received' basis. It is preferable to continue to specify PC limits on a dry matter basis.

Separated liquors tend to have very low dry matter content, and one AD operator has commented that the presence of a few fragments of plastic can cause separated liquor to exceed the PCs limit in PAS 110.

However, we are not aware of a suitably large dataset covering the necessary parameters for converting the current 0.5 % m/m limit from a dry matter basis to a fresh matter equivalent. Even if there were such a database, conversion calculations would have to assume typical dry matter contents for WD, SL and fibre digestates and also typical bulk density in the case of fibre digestates. There would also be 'real world' possibility that digestes with higher dry matter content than is typical could supply higher amounts of PCs to the receiving environment, yet still comply with PAS 110; such 'worst-case' occurrences should be prevented.

Question 20b. Do you agree that different limits should be set for physical contaminants in whole/liquor and fibre digestates? If so, please suggest appropriate limits and provide data to support your case. If not, please state why and provide data to support your case.

Yes, we agree that different limits should be set for physical contaminants in whole/liquor and fibre digestates but believe there is insufficient data available to support such decision making.

We have not visually simulated or spiked samples to view what 0.50 m/m % PCs in digestate looks like on a dry matter basis; the same PCs concentration in dry matter likely to look very different in fibre digestate than it does in separated liquor. Such an exercise has not been done with end-users and/or representatives of end-users.

It is possible that a higher (less stringent) PCs limit could be acceptable for separated liquor than for whole digestate and fibre digestate, and that an acceptable PCs limit for whole digestate could lie somewhere between the two.

If sufficient data were available for PCs in PAS 110 WD, SL and fibre digestates it may be acceptable to revise the PAS 110 PC limits to 'As Low As Reasonably Achieveable' levels. However, we do not have such a dataset to interrogate or supply to WRAP for similar consideration.

Question 20c. Are you aware of methods for determining physical contaminants in whole ('as received') digestate samples? If so, please provide copies of appropriate documentation – or links to the same.

Yes: SOP JAS-497/001, Determination of Physical Contaminants and Stones in Digestate, NRM Laboratories, 25th January 2012. Principle: 'The digestate sample (whole, separated fibre or separated liquor) is wet sieved in order to separate out the physical contaminants (glass, metal, plastic and other non-stone man-made contaminants) that are greater than 2 mm, and the stones that are greater than 5 mm. After drying of the material retained on the 5 mm and 2 mm aperture sieve, these contaminants are then identified and weighed and the results reported as the percentage of physical contaminants > 2 mm present in the dry matter fraction of the digestate, and as the percentage of stones > 5 mm present in the dry matter fraction of the digestate.'

SOP JAS-497/001 is appropriate for determination of physical contaminants > 2 mm and stones > 5 mm (expressed in % m/m DM) in samples of whole digestate, separate fibre and separated liquor. WRAP would have to ask NRM Laboratories for a copy of document SOP JAS-497/001.

NRM's document also cites in its references section: 'REA-DM-PC&S. Methodology for determination of physical contaminants and stones in digestates, May 2010, Renewable Energy Association, London.' To date, at REA we have not received nor previously been in possession of a copy of this document.

NRM inform us that REA-DM-PC&S and SOP JAS-497/001 documents were developed as a result of undertaking the following R&S project for WRAP: 'Waste & Resources Action Programme OVA0035 – Compost and AD Specification BSI PAS 110 Development of a method for determination of physical contaminants in Whole Digestate, Separated Liquor and Separated Fibre, August 2011, NRM Ltd.'

- Digestate can be odorous – with such odours becoming particularly apparent during digestate spreading. This can be the case whether digestate meets the current PAS110 stability requirements (RBP test and limit) or not. Digestate spreading techniques are available that could minimise the risks of odour generation during spreading, and maximise the agronomic value of digestates[3]. However, the auditing of such techniques is outwith the scope of PAS110. In jurisdictions other than the UK, limits on odour have been imposed on materials that can be spread to land[4] – although the potential costs of the associated testing are unknown.

Question 21a. Do you think that PAS110 should include limits on digestate odour? If so, please suggest appropriate limits and provide data to support your case. If not, please state why and provide data to support your case.

No, as already explained above

Question 21b. Do you have any other suggestions around whether/how digestate odour mitigation could be more directly addressed within PAS110?

No.

- The Thermophilic Aerobic Digestion (TAD) industry in the UK is small, but does provide an alternative to treatment of food wastes via Anaerobic Digestion or composting. At present the separated fibre fraction of TAD outputs is eligible for inclusion within PAS100. However, the whole aerobic digestate and separated liquor fall outwith the scope of both PAS100 and PAS110. The lack of a specification and Quality Protocol for such aerobic digestates means that they have to be spread to land as wastes.

Question 22. Should aerobic digestates (whole, separated liquor and separated fibre) be brought within the scope of PAS110? If so, please suggest appropriate tests and test limits, and provide data to support your case. If not, please state why and provide data to support your case.

As explained in WRAP's consultation document, TAD provides a viable alternative to treatment of food wastes via Anaerobic Digestion or composting. We are aware of at least five companies in the UK that use TAD systems. For this reason and as already highlighted above, it is imperative that aerobic digestates are included within the scope of PAS 110. If aerobic digestates are not brought within the scope of PAS 110, TAD operators will be prevented from demonstrating their capability to produce 'quality digestates' that could comply with End of Waste criteria. Applying to the regulator's End of Waste Panel is not a cost effective way to demonstrate having fulfilled EoW criteria and takes a great deal of time and resource.

As highlighted above, our preference is that the RBP test is not retained in the PAS 110. However if PAS 110 retains a digestate stability criterion, although it may be technically feasible to subject aerobic digestates to RBP test (certainly with dried samples and perhaps with fresh), we recommend that that an aerobic test is used rather than subject TAD digestates to the RBP test (researched in terms of anaerobic digestate sample testing).

It would take further test evaluation work to check whether the RBP test method is fit for purpose i.e.

[3] http://www.wrapcymru.org.uk/sites/files/wrap/Digestate%20odour%20management%20-%20Cymru.pdf
[4] http://www.omafra.gov.on.ca/english/nm/regs/nmpro/odour08_09.htm

that there is no significant inhibition with some digestates or in terms of the amount of digestate to be included in the test mix. For example, it is possible that the microbes in the inoculum may inhibit the activity of the microbes in the sample of aerobic digestate, resulting in false positives. Short term inhibition seems possible and would be particularly problematic under shorter test durations (e.g. 10 days rather than 28 days).

We are aware that WRAP have commissioned or is planning to commission a study to identify an aerobic test as a quicker/cheaper replacement for the RBP test for testing digestates from AD. Such aerobic tests (e.g. OUR or SOUR tests) should be suitable for testing TAD digestates.

If it is decided during PAS 110 review that the RBP test is retained and no aerobic test can be included for aerobic digestates, we ask that aerobic digestates are considered for eligibility for RBP testing. The committee responsible for PAS 110 review, WRAP and/or the PAS 110 technical author should try to obtain views from specialists in stability testing on how such samples are likely to behave when undergoing the RBP test. We have suggested this because aerobic digestion operators would probably prefer to try to comply with a 'precautionary RBP limit applicable to aerobic digestates' rather than be excluded from demonstrating compliance with PAS 110 (if TAD remains outside the stated scope).

- During 2012, a consultation was held on a proposed digestate standard in the Republic of Ireland. Many of the tests and associated limits within this proposed standard are different to those specified in PAS110 (indeed, many of the suggested standards are themselves only available as drafts).

Question 23. Do you think that there are elements of the proposed Irish standard that should be considered during the review of PAS110? If so, please state why and provide data to support your case.

The format and text of the Irish Standard should be considered during the review of PAS 110, as it is very clear, concise, and easy to understand. Some sections of PAS 110 are complicated and difficult to understand or interpret and should be simplified. For example, section 13 of PAS 110 ('Actions in the event of test result failures) should be simplified; it may be possible for PAS 110 to refer users to rules in certification schemes covering this topic.

On the other hand, if PAS 110 was to be as concise as the Irish standard, further detail on how AD operators are supposed to implement the requirements of the standard may need to be given in addition to the standard. For example, this could be covered by the Scheme Owner in guidance documents or within the Scheme Rules. It will be crucial that sufficiently detailed guidance or rules are available to AD operators so that:

- the requirements are implemented and enforced consistently across the industry; and
- the Certification Scheme requirements are auditable and accreditable.

A particular element of the Irish standard that is worth highlighting is the absence of a stability test, but the provision for testing phytotoxicity in digestates by using test method BS EN 16086-2:2011. Soil improvers and growing media – determination of plant-response test. Part 2: Petri-dish test using cress'.
Consideration should be given to this test method during the PAS 110 review, as this test may be more suitable than the current RBP test to check digestate fitness for purpose. However, it should be noted that IrBEA standard acknowledges that further work should be carried out 'to confirm the applicability of this method to the different digestate materials' (e.g. electrical conductivity is a characteristic that can strongly affect cress test results).

Question 24. Are there any other comments that you would like to make on PAS110? Where these include suggestions to change limits to biological, physical or chemical tests – please provide data to support your case.

HACCP
Clause 5.2 of PAS 110 should simply require the AD operator to consider all relevant hazards and how their process will adequately control the associated risks, taking into account the types of input materials, process steps used and how they are operated, digestate product types and intended applications.

Water Soluble Chloride and Sodium (Table 1)
Consider in what circumstances the determination and reporting of water soluble chloride and sodium should be mandatory. If there are none, the current requirement to test digestates on these parameters could be deleted.

Covered storage (clause 7 of PAS 110)
Consider the exact aims of covered storage, whether the associated costs are proportionate to the anticipated protection of the environment, and whether covering is practical. It's important that these factors are considered for storage of whole digestate, separated liquor and separated fibre, at the digestion facility and at any intermediate storage location (under the control of the AD operator).

Additionally, if covered storage is required for separated fibre, if it undergoes an aerobic biodegradation phase before storage, must that phase also utilise a cover?

De-packaging of ABP and non-ABP food wastes (clause 6.1 of PAS 110)
The second sentence of the second paragraph requires that: 'the pre-treatment shall remove any non-biodegradable packaging prior to loading those biowastes / biodegradable materials into the digestion system'. At least one operator has commented that they would like to use equipment that would remove plastic after the digestion process, probably with the plastic packaged food waste being mascerated before being pumped into the hydrolysis tank. The PAS 110 text quoted does not allow them to do this. They comment that PAS 110's digestate quality criteria include a physical contaminants limit, so they should be allowed to test and prove the efficacy of a Critical Control Point that occurs after digestion rather than at 'pre-treatment'.

We believe that in the case of packaging, PAS 110 should allow the AD operator to decide the CCP and its Critical Limits and verify whether it sufficiently controls the hazard. The PAS 110 steering committee should consider whether in the case of glass packaging PAS 110 should require the AD operator to ensure that such packaging does not get fed into the digestion treatment system.