1. In December Members discussed a summary of the methods used in the two risk assessments carried out under the Waste And Resources Action Programme (WRAP) Confidence in Compost Programme (COT 2009/39). The draft risk assessments on Use of Green Composts in the Scottish Livestock Sector study and All composts in all agricultural sectors study are attached at Annexes 1 and 2 respectively. There is a detailed description of the methods summarised in COT 2009/39 on pages 10 to 27 of Annex 1 and pages 10 to 19 and 24 to 30 of Annex 2. The Agency has also been provided with the internal peer review commissioned by WRAP and this is attached at Annex 3. This peer review covers all three reports in the programme, one of which considers only microbiological risks.

2. Members asked that to facilitate discussions the Secretariat should summarise and highlight the chemical risk assessments in these reports.

Use of Green Composts in the Scottish Livestock Sector study

3. The relevant risk assessments from this report were on toxins of plant origin, organic pollutants (polycyclic aromatic hydrocarbons, polychlorinated biphenyls, dioxins) and fourteen metals.

Toxins of plant origin

4. The results are on pages 28 to 32 with further details on pages 82 to 104 of Annex 1. Nine species and their principal toxins were identified from the initial screening but four of these (ragwort, bracken, laburnum and monkshood) were sifted out at an initial stage based on evidence for degradation of their toxins under conditions likely to occur during commercial composting. Exposure assessments were carried out for the remaining five species (rhododendron, privet, foxglove, hemlock and yew) based on either information on the incomplete degradation of their toxins or an absence of information on their degradation. Two composting scenarios were considered either compost containing 1% of the species or compost made entirely from the species using mean and maximum levels of toxins in fresh plant material (except for rhododendron where levels following composting were available). These were considered in exposure models for grazing following soil treatment and consumption of fodder cultivated on treated soil at a high and low application rates and realistic and worst case consumption for both sheep and cattle.
5. The overall conclusion was that toxins of plant origin would present a negligible risk to grazing animals when feedstock contained less than one percent of these plants. In the grazing scenarios rhododendron, hemlock and yew were identified as needing further evaluation particularly for sheep due to their lower body weight and greater soil consumption. However for hemlock and yew this was principally because of a lack of data on degradation during composting of coniine and taxine respectively.

**Organic pollutants**

6. The results are on pages 33 to 46 with further details on pages 105 to 123 of Annex 1.

7. Data were available on levels of seven polycyclic aromatic hydrocarbons (naphthalene, benzo-a-anthracene, chrysene, benzo-b-fluoranthene, benzo-k-fluoranthene, benzo-a-pyrene and indeno(1,2,3-cd)pyrene). These can be considered representative of polycyclic aromatic hydrocarbons. The relative risks for livestock in all the scenarios were considered negligible and since ingested polycyclic aromatic hydrocarbons would be metabolised by livestock there would be no exposure to the foodchain.

8. Eleven polychlorinated biphenyls (28, 52, 95, 101, 118, 132, 138, 149, 153, 174 and 180) including one dioxin like (118) and ten non-dioxin like polychlorinated biphenyls were compared in the grazing scenario. Risks for cattle were negligible for all application rates and soil ingestion rates whilst at high application rates the risks for sheep need further investigation. The modelling of plant uptake indicated that polychlorinated biphenyls would not be significantly taken up by plants so there was no need to consider the consumption of fodder.

9. Data were available on seven polychlorinated dibenzo-dioxins and –furans, however risk assessments were done for these individual congeners and not for their combined toxic equivalents. The risks of the individual congeners were considered negligible for cattle and for sheep in the grazing scenario with the exception of 1,2,3,4,6,7,8-heptachlorodibenzodioxin in sheep. However when levels of this congener, which is associated with industrial bleaching processes and combustion, measured in other soil improvers (cattle manure, pig slurry, paper crumb and sewage sludge) were modelled similar risks were measured. The modelling of plant uptake indicated that polychlorinated dibenzo-dioxins and –furans would not be significantly taken up by plants so there was no need to consider the consumption of fodder. Members may wish to note that this risk assessment uses the EPA slope factor and cancer as the critical end point, this was not considered the most sensitive end point in other risk assessments (COT, WHO, SCF) which derived TDIs based on reproductive effects.

10. Apart from Clopyralid (and the related Aminopyralid) none of the pesticides and herbicides considered had an identifiable pathway. The risks were therefore
considered negligible. The identified risks with Clopyralid were to crops grown on land treated with compost containing Clopyralid. Aminopyralid was not assessed as its use was temporarily banned due to the reported effects following use of manure contaminated with Aminopyralid.

**Potentially Toxic Elements**

11. The results are on pages 46 to 55 with further details on pages 124 to 128 of Annex 1.

12. A total of fourteen compounds measured in compost were classified as potentially toxic elements (arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, manganese, molybdenum, nickel, selenium, vanadium and zinc). After initial screening four of these (cadmium, chromium, copper, lead) were assessed as potentially being in compost at levels of concern and were assessed in the exposure scenarios.

13. In the grazing scenario all the risks from PAS100 green compost were considered negligible. If the comparator materials were considered in this scenario then a potential risk from elevated intake of copper by sheep, which are more susceptible to copper than cattle, was identified at higher application rates. However the authors note that the models assumed immediate grazing whilst normal practice is a grazing free period after spreading of soil improvers.

14. However in the incorporation into fodder crops scenario, there would be the potential for cadmium accumulation if PAS100 green compost were applied at the highest application rate either at the maximum levels of cadmium reported in the literature (4 mg/kg) or at the PAS100 limit (1.5 mg/kg) so that it exceeded the limit of 1 mg/kg cadmium allowed in animal feed.

**All composts in all agricultural sectors study**

15. Twenty scenarios of concern to the research team and to agricultural stakeholders comprising various source-segregated composts feedstock and end-use combinations were selected for quantitative risk assessment using generalised exposure assumptions. The chemical scenarios used for quantitative risk assessment were toxins from ragwort and yew (scenario 4, page 81 of Annex 2), fungicide residues on barley (scenario 8, pages 88 to 92 of Annex 2), potentially toxic elements (scenario 10, pages 94 to 96 of Annex 2), polychlorinated biphenyls and dioxins in ready to eat crops (scenario 10a, pages 97 to 100 of Annex 2), marine biotoxins in ready to eat crops (scenario 10b, pages 101 to 103 of Annex 2) and cadmium and lead in cereal crops (scenario 13, pages 105 to 106 of Annex 1). There were also proposed scenarios on human risks from nuts and allergens (scenario 5 and 6) which were not undertaken following advice on the likely survival of these through the process. Another proposed scenario on glues and polyvinylacetate in
wood waste (scenario 9) was not completed as these wastes are not allowed in PAS 100 waste.

16. The results of all the risk assessment scenarios are summarised in table 4.5 (pages 33 to 35 of Annex 1). The risk ratios (as described in COT 2009/39) estimated for average and high (95%ile) consumers and highly exposed infants were all below 0.1. The authors concluded that the risks in all these quantitative scenarios were considered to be negligible. However for the marine biotoxins scenario additional work is currently being undertaken since it was initially assumed that these would be present in shellfish waste at levels at or below legislative limits. However this might not be the case as shellfish waste would not necessarily have to comply with the legislative limits.

Questions asked of the Committee

17. Members were invited previously in COT 2009/39 to comment on the methodology used and the derivation of the reference doses and the decision not to evaluate dioxins and dioxin like PCBs with a toxic equivalency factor approach.

(i) Members are invited to comment on whether the approaches employed are appropriate and sufficiently rigorous to fully assess the risks associated with application of PAS 100 compliant composts to food producing land.

(ii) Members are asked whether they agree with the conclusions derived for each of the scenarios assessed with regard to chemical risks to the food chain.

(iii) Members are asked whether they consider that possible risks to the food chain have been adequately considered in this programme of work and whether any additional chemical food safety scenarios should be brought to the attention of WRAP.

(iv) Members are asked whether in relation to chemical food safety they agree with the overall conclusion that the risks associated with the use of PAS 100 compliant composts in agriculture are low.

(v) Members are asked whether there are any particular data gaps that should be prioritised in future research programmes in order to allow additional potential chemical food safety risks associated with compost use to be more fully quantified.

Secretariat
January 2010
COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

WASTE AND RESOURCES ACTION PROGRAMME (WRAP) - RESERVED BUSINESS

Use of Green Composts in the Scottish Livestock Sector study

For copyright reasons the paper in this Annex is not included in the published version on the COT website. The bibliographic details will be updated when the article is published on the WRAP website.

Note: The Committee were provided with a pre-publication copy of this work. This was received in confidence and will not be released when this paper becomes publicly available. As indicated above the work will be publicly available once complete.

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January 2010
COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT

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All composts in all agricultural sectors study

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Secretariat
January 2010
Peer review comments on the WRAP reports

This Annex contains an internal peer review commissioned by WRAP which will not be published. It has been provided to the Committee for information and to highlight where further clarification of the reports in Annexes 1 and 2 might occur during finalisation.

Note: The Committee were provided with a copy which was received in confidence and will not be publicly available. The reports commented upon will be publicly available from WRAP once complete.

Secretariat
January 2010
RISK ASSESSMENT OF THE USE OF PAS100 GREEN COMPOSTS IN SCOTTISH LIVESTOCK PRODUCTION

Comments from K C Jones, Lancaster University – November 2009.

General comments

I came to these reports with a background in work (undertaken some years ago now) on sewage sludge amendment on agricultural land, and with an ongoing interest in contaminants (primarily organics, but also heavy metals) – their sources, fates, behaviour, and environmental significance. I am not particularly close to the composting issue, or pathogens. This may help to set the context of my remarks.

1. I would have found it very helpful to have had a section aimed at a more general introduction/context setting. Clearly whether you think this is useful or not depends on the intended readership (who are the intended readers??), but I found myself wanting to know:
   a. What (in almost layman’s terms) are ‘green composts’?
   b. Where do they come from and in what quantity?
   c. What happens to them now?
   d. What are the BENEFITS (to the environment as a whole and to agriculture) of putting them to land/using them in ag production?
   e. Why would they have any ‘nasties’ in them in the first place? This is useful context, I think. Many green composts are presumably ‘just leaves, vegetation matter etc’, so why would there be any particular issue with thing like dioxins etc? Or – why would they have any more /higher concentrations of ‘nasties’ than the general background environment?
   f. What – practically – would be happening with green composts? Where are they generated, how are the processed, how would they transported/reach ag systems, and how would they be applied? In other words, what scope is there for control of the feedstock, sorting/processing, control of practice etc etc? Surely critical issues?
   g. What would be ‘standard practice’ and what could ‘go wrong’? i.e. role of suppliers, users etc.

2. I know the focus of the report is ‘risk’, but I found myself constantly thinking the preoccupation with risk needs to be balanced with ‘what are the benefits, for the environment, for the farmer, for the consumer etc’. Surely this is a useful thing to be clear about in the report?

3. Even now, after reading the report, I must admit to having only a hazy idea about the origins of ‘green composts’. Material from gardens, landscaped areas, pruning / trimming etc – right?

4. So, this led me to be wondering- are they then entering the municipal waste stream? Are they always segregated or are they sometimes mixed with other things? Why would they be
3. What happens when the green compost is applied to agriculture/used in agriculture? What are the relative proportions of actual and intended uses in arable/livestock ag? Is it an intended feedstock and why? Is it mixed with other feeds and in what proportion, etc etc. What are the ‘mass flows’? i.e. how many tonnes are we talking about? Is it a resource or waste, to whom, and why?

4. The plant toxins issue is presumably a bigger one than the metals/organics one? Given the source/composition of green composts, I think it is important to set in context why it would have particular contaminants in at all (why would it be any different in composition than – for example – pasture grass, hay etc etc). A simple comparison of e.g. PAHs/other chemicals in grass, compost and sewage sludge would be informative and give context, for example.

5. Is the green compost segregated materials? If so, why/how? What are the benefits of segregating versus mixing? Who does the segregating, how, and where?

6. Broadly, what happens during the composting process? What is the mass change? What happens to the organics and pathogens? Is there scope to control/modify the composting process to ensure a certain quality of product? If so, who/how is that decided and monitored?

7. What are the alternative outlets/uses for the green composites? Why is agriculture better or worse?

8. Then, I wanted a layman’s coverage of what is this ‘PAS100 specification’, who monitors it and how, can there be drifts in quality which are difficult to manage etc, etc.

9. Is composted at all, rather than being ‘shredded’ or ‘used raw’? What else could happen to them and what are the different outlets and their merits/risks? I wanted to know all this, before thinking about the ag. outlets.

10. I suspect the feedback to my comments will be ‘much of this lies outside the scope of the report’. But I think that if the report is to be read by the public/educated layperson – then I think all of these very practical things will set the context and tone to the debate, and will help with an appreciation of the pinch points, benefits/risks etc etc. I think that is by no means clear in the report at the moment, so if it is not to be covered here, the reader needs to be clearly directed to where they can find this information.

Specific comments

1. I don’t have any particular issues with the steps of the risk assessment process that were undertaken, although I am somewhat surprised that the results sometimes suggest ‘relative risks may require further investigation’ e.g. for PAHs, PCDD/Fs, PCBs. I would have expected that the quality/levels present would fall below any levels of concern. This leads me to wonder about the assumed concentrations in the green compost scenarios (would typical leaf concentrations be more appropriate to use / corrected for DM losses?) and – if not – why not?

2. Mackay models. Why were these chosen? What are their assumptions, strengths and weaknesses? Are they appropriate for the job in hand? Are they equilibrium or kinetic models? Some critical assessment/context is important here, I think.

3. One big issue with the plant toxins is ‘how much are they degraded during composting, or after use in agriculture?’ In general, there was little data available on this. So, what are the
merits of assuming that green composites decompose with half lives typical of plant material in general, or lignins/cellulose/carbohydrates etc? I am guessing that the practical points I wanted to see above would really help here, because – on the ground – it will be important to control the input stream. E.g. avoiding too much ragwort/rhododendron etc – can that be achieved reliably, where and by whom?

5. The tables presenting chemical contaminants in composites – I think it would be useful to give a bit more information, where it is available. i.e. is it data for green composites (comparable to the usage being considered in the report), or composted municipal wastes, leaves, biosolids etc?

6. Pathogens. Again, I miss some context – why would there be a particular issue with pathogens in green composites at all? Where would they come from? Are they likely to be at levels over and above those in environmental compartments anyway? Wouldn’t composting act to lower them still further?
UPDATE OF 2002 RISK ASSESSMENT

1. This report addresses some very important areas of scientific and public interest. It builds on the work of a previous report by the same author.

2. In my opinion, it is an extremely well written report, and very comprehensive. As a non-expert in the pathogens/microbiology etc, I found it to be very easy to follow, logical, well explained and comprehensive. I guess some experts may not agree with some of the approaches used, but it would be clear/easy to follow the logic and approach.

3. The style of presentation and the results and their interpretation gave me a high level of reassurance that I was reading material prepared by somebody with real expertise in the subject, and that there was a degree of caution in the conclusions and recommendations that gave re-assurance about a complex topic. So, I think the author has done an excellent job.

4. There are some editorial and layout ‘blips’ that I am sure the author and review group are aware of, which will be tidied up.

5. Recommendations/thoughts:
   a. Given my comments under 2 and 3, my thoughts are more about what is not covered, rather than what is.
   b. The report might benefit from a clear statement about aspects that are deliberately not covered. E.g. are there pathogen/microbiological hazards that are not included, because of agreed scope, or lack of information?
   c. I found myself wondering about whether there were issues of time/seasonality that were important in the exposures/risks. Different species are addressed, and spatial/loading issues are considered in the scenarios. But are there any issues to do with the seasons, for example (when more compost might be produced or applied to land, or in terms of host/receptor vulnerability to infection/disease? E.g. are numbers of pathogens greater in the summer? Are hosts more vulnerable when they are breeding, or at certain stages of their life cycle, for example. Are there underlying trends in certain pathogens/infections, which might flag up a future potential problem or the need for extra caution?
   d. In a changing world (e.g. climate changes), where soil moisture status, temperature, natural versus invasive microflora etc, are there issues to flag up?
   e. Are there risks of trans-generational transfers of disease/infection to consider?

6. I thought Table 24 was very useful. Is it worth bringing that into the Executive Summary, either in its entirety, or edited down?
RISK ASSESSMENT FOR THE USE OF SOURCE-SEGREGATED COMPOSTS IN UK AGRICULTURE

1. In my opinion, this is a comprehensive approach and report. I found it to be very easy to follow, logical, and well explained. I guess some experts may not agree with some of the approaches used, but it would be clear/easy to follow the logic and approach.

2. The authors/team are well respected in the field, their approach is pragmatic and comprehensive.

3. I agree with the conclusions – namely that the message at the end is re-assuring for safe and responsible use of source segregated composts in UK agriculture.

4. I would have liked to have seen the ‘risks’ set in context with a section explicitly addressing ‘the benefits’.

5. Many of the ‘context’ of the issues I raised about ‘report 1’ (Risk Assessment – Scottish Livestock...) are considered here. The Introduction and context gives a solid coverage of ‘what is green compost’ etc, and I think the authors of the Scottish report should consider something of this kind of coverage in their report.

6. The style of presentation and the results and their interpretation gave me a high level of re-assurance that I was reading material prepared by a team with expertise in the subject.

7. There are some editorial and layout ‘blips’ that I am sure the author and review group are aware of, which will be tidied up. e.g. in the Exec Summary, ALARP and TAG are not defined.

8. I found sections 1.1-1.5 useful and Figure 1.2 helpful. Could something be added, to elaborate on the likely masses/usage statistics?

9. Section 2.1 – general principles of RA. Could be useful to explain what has been tried previously (e.g. USEPA biosolids?, any EU approaches?). How widely used are the methodologies employed here?

10. Building on Figure 2.2 (identifying flaws and assumptions), can the authors be explicit about flaws in the methodology/assumptions used here? For example, I note on page 13 the authors say ‘it has been assumed that the minimum requirements for PAS100 have been met’. But might this go wrong sometimes? And if it does, what are the implications? Often issues around loss of public confidence are to do with the things that are supposed to happen not happening. ‘The system’ fails. What pre-cautions can/do safeguard against that in the PAS-100 segregated composts story?

11. I think use of the semi-quantitative and quantitative 2 step approach is pragmatic and defendable. I think the choice of scenarios for detailed assessment is also defendable.
12. Figure 3.2 is a bit cheesy and should be improved.

13. Just an observation, but much of the discussion on pathways analysis seems to be more about the methodology than the findings/outcomes. Is that what the authors want?

14. I think it would be useful to give some context to the ‘additional margins of safety’ that are built into the ‘safe daily dose’ concept (page 29, risk characterisation). The authors calculate the ‘risk ratio’ – fine, but I think ‘safe doses’ are themselves inherently conservative (right?), often by orders of magnitude.

15. There might be some scope to have some coverage in this report of the ‘practical things’ I raised in connection with the Scottish report. The kinds of things I am thinking about are listed here (I appreciate that this report does cover some of this already, but perhaps more could be done to give the context and identify some of the assumptions/gaps/things that could go wrong in practically managing the ‘source-segregated compost issue’:

   a. Where do they come from and in what quantity?
   b. What happens to them now?
   c. Who are the stakeholders and are there conflicts of interest that might impact the consumer somehow? Who generates them and where, and who handles and receives them? Who ‘regulates’ or controls what? Where can things go wrong and what safeguards can be put in place to re-assure the public?
   d. What are the BENEFITS (to the environment as a whole and to agriculture) of putting them to land/using them in ag production?
   e. Why would they have any ‘nasties’ in them in the first place? This is useful context, I think. Many composts are presumably perceived of as quite innocuous, so why would there be any particular issue with things like dioxins etc? Or – why would they have any more /higher concentrations of ‘nasties’ than the general background environment?
   f. What scope is there for control of the feedstock, sorting/processing, control of practice etc? Surely critical issues? What would be ‘standard practice’ and what could ‘go wrong’? i.e. role of suppliers, users etc.
   g. I know the focus of the report is ‘risk’, but I think the pre-occupation with risk needs to be balanced with ‘what are the benefits, for the environment, for the farmer, for the consumer etc’. Surely this is a useful thing to be clear and upfront about in the report?