

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

AD HOC GROUP ON SEWAGE SLUDGE

Introduction

1. This note reports latest developments in connection with the ACMSF's peer review of the microbiological aspects of the risk assessment being carried out for pathogens in biosolids.

Background

2. The Royal Commission on Environmental Pollution (RCEP), in its report on the sustainable use of soil, recommended that all sewage sludge applied to agricultural land should be treated by at least one of the methods listed in the DoE 1989 code of practice for agricultural use of sewage sludge. RCEP also recommended that the scientific basis for the specified periods laid down in the code between application of sludge and planting and harvesting of crops and/or livestock grazing should be reviewed. Against this background, WRc plc (formerly the Water Industry Research Centre) were commissioned to carry out a review which would be peer reviewed to ensure that the resultant report was authoritative and independent.
3. The ACMSF was asked, and agreed, to assist with the peer review of those aspects of the study relating to the microbiological risks to public health arising through food chain exposure pathways. An *Ad Hoc* Group on Sewage Sludge was set up to take the work forward. The Group first met the contractor in 1997 to discuss the scope of the project, in order to ensure that nothing of concern to the ACMSF was being overlooked. Detailed ACMSF comments were conveyed to the contractor in 1998.

Risk assessment : Phase I

4. The *Ad Hoc* Group again met the contractor, in February 2001, to consider the first phase of a microbiological risk assessment in respect of pathogens in biosolids. The aim was to establish whether sewage sludge recycling operations were associated with a risk with respect to human and animal pathogens. The risk assessment was demonstrated for *Salmonella* and *Listeria monocytogenes* only. The ACMSF's comments are summarised in ACM/512, paragraph 6.

Risk assessment Phase II

5. The second phase of the risk assessment was considered by the *Ad Hoc* Group on 8 November 2002 in a meeting with representatives of the water industry (the contractor for the risk assessment and related work on the disposal of sewage sludge to agricultural land). Present for the *Ad Hoc* Group were Tim Wyatt (Chairman), Geoff Andrews and Alec Kyriakides. Apologies were received from David Brown, Paul Hunter, David Piccaver and Quentin Sandifer; and from Judith Hilton, the FSA assessor. The Secretariat comprised Colin Mylchreest, Sonia Molnar and Claire Wilkes.
6. Mr Kyriakides formally declared an interest, having been involved on behalf of the British Retail Consortium in the steering group which developed the Safe Sludge Matrix, assessed compliance, and also requested research on microbiological risk assessment.
7. The water industry was represented by Dr Paul Gale (WRc-NSF), Dr Chris Rowlands (Sludge Planning Manager, Severn Trent Water) and Dr Julian Dennis (Chief Scientist, Thames Water Utilities).
8. In addition to the pathogens included in Phase I, the latest risk assessment also covered *Campylobacter*, *E. coli* O157, *Cryptosporidium*, *Giardia* and Enteroviruses. The scope of the risk assessment had been extended to include estimated risks of human infection arising from the consumption of root crops grown in sewage sludge treated soil.

What was the *Ad Hoc* Group asked to do ?

9. The Group was asked to give its opinion of the science underpinning the risk assessment and the relative importance of the risk estimates within the overall burden of foodborne infectious disease. In particular the Group was asked to address the following questions :-
 - is the general risk assessment approach satisfactory and robust for the purpose of carrying out a generic UK assessment of the potential risks of human infection arising from the consumption of food crops grown on soil receiving sewage sludge;
 - if not, how can the general approach be improved;
 - are the important exposure assumptions used in the risk assessment reasonable;
 - are there relevant issues related to the risk assessment that the project steering group should consider before the risk assessment is published.

10. The contractor also asked whether the ACMSF would be prepared to provide a summary of its peer review comments for inclusion in the foreword to the contractor's report.

8 November 2002 meeting

11. Dr Gale explained that the objective of the risk assessment was to estimate the risks of infection to humans from the consumption of root crops grown on soil to which sewage sludge had been applied. The parameters used in the risk assessment reflected the conditions of the Safe Sludge Matrix and the proposed revised statutory controls for the agricultural use of sewage sludge. The risk assessment was based on experimental studies examining the fate of pathogens during sewage treatment processes. A quantitative risk assessment based on a "source-pathway-receptor" approach had been developed for seven enteric pathogens, ie. *Salmonella*, *E. coli* O157, *Campylobacter*, *Listeria monocytogenes*, *Cryptosporidium parvum*, *Giardia* and enteroviruses. Event trees had been constructed to model the partitioning of pathogens present in raw sewage into sludge at the sewage treatment works, and to model the pathways by which root crops were exposed to these pathogens after treatment and application of treated sludge to agricultural land. The main barriers included in the risk assessment were sludge treatment, and dilution and subsequent decay of the pathogens in the soil. Washing of the crops prior to consumption had also been modelled, although only a 1-log pathogen reduction had been assumed. No allowance was made for washing, peeling or cooking in the kitchen, due to a lack of authoritative information on the volume of fresh vegetables treated in this way. Variations in the concentrations present in sewage and the removal efficiencies of the various barriers had been accommodated by using the arithmetical mean. To calculate the risk of infection, the arithmetical mean pathogen exposure had been used directly in a dose-response model.
12. Dr Gale took the Group through the risk assessment for all seven pathogens, and he and his colleagues answered questions on points of detail as the presentation proceeded. The intention is that the full report of the risk assessment will be publicly-available in due course. What the *Ad Hoc* Group saw represented a progress report, the contents of which might be modified either in the light of the Group's comments or of any new information that becomes available in the scientific literature. The contractor therefore asked that the report presented to the Group should not be distributed widely at this stage.

Outcome of 8 November 2002 meeting

General

13. The *Ad Hoc* Group noted a number of points arising from their discussion with the contractor of the risk assessment :-

- there was little use of pasteurisation and there would be huge costs involved in increasing usage of this option significantly;
- there were comprehensive HACCP-based controls on the treatment processes at sewage plants. The final product was also monitored for *E. coli* levels;
- both water companies and the Environment Agency monitored compliance with application etc requirements on-farm. Many farmers were also monitored for compliance with the requirements imposed under farm assurance schemes;
- a rather optimistic assumption had been included in the risk assessment for the decay rate for *E. coli* O157 on soil.¹ The *Ad Hoc* Group subsequently wrote to the contractor asking for a more conservative assumption to be used.² Following a meeting of the UKWIR/EA/DEFRA Project Steering Committee, the contractor explained that the Bolton data had been used in preference to those derived by Maule on the basis that the former had been derived from field plots whereas the latter relied upon microcosms. The contractor agreed, however, to perform a risk assessment based on the Maule data and to include this in the final report of the risk assessment for comparison purposes;
- an additional, and potentially more significant, *E. coli* risk appeared to centre on the disposal to agricultural land of sludge from waste water treatment plants associated with abattoirs. This route was not subject to the controls applying to the disposal of sewage sludge.

Campylobacter risk assessment

14. The contractor's risk assessment estimated that around 37,000 potential human *Campylobacter* cases per annum could arise from the consumption of crops grown on land to which sewage sludge had been applied. However, the *Ad Hoc* Group noted that the risk assessment for *Campylobacter* took no account of secondary storage (either in liquid or dewatered form) after mesophilic anaerobic digestion (MAD). Storage was a very important element in reducing *Campylobacter*, as the organism appeared to be unaffected by MAD conditions. In addition, the Group noted that the model allowed for only 16 days' decay on soil (post-application) and was not extrapolated to reflect the requirements of the Safe Sludge Matrix.³ The *Ad Hoc* Group raised this issue with the contractor.

¹ Decay on soil. Bolton (1999) data : 4.5-log decay in 50 days.

² Decay on soil. Maule (1995) data : 1.05-log decay in 49 days.

³ 1 year harvesting delay for potatoes, leeks, parsnips, sprouts and rhubarb. 30 months delay for carrots and lettuce.

15. Having discussed the matter with the Project Steering Committee, the contractor responded, proposing the use of a 0.34-log reduction⁴ to reflect the effects of secondary storage.
16. The contractor also explained that the particular difficulty with modelling decay on land arose from the acceptability of extrapolating post-application survival data for periods of time greater than the period of the experiment from which the data were derived, in order to reflect Safe Sludge Matrix restrictions. The contractor therefore proposed extrapolating survival data over a period of time equivalent to the shortest time feasible to produce a ready-to-eat crop in the open field. Having consulted Horticulture Research International, the contractor proposed a 6 week period (i.e. the period appropriate for lettuce).
17. The *Ad Hoc* Group was satisfied that these 2 proposals were reasonable and wrote to the contractor confirming this but asking to see the exact basis of the calculations used, as well as the original report from which the data being extrapolated were derived. Of course, the Group also asked to see the results of the revised *Campylobacter* risk assessment performed using these new assumptions.

Conclusions

18. Overall, the *Ad Hoc* Group considers that the risk assessment is based on a very conservative approach embodying large margins of safety. The risk to human health from consuming root crops grown on agricultural land on which treated sewage sludge has been spread seems very small. Indeed, the Group considers the risk to be much lower than that posed by animal wastes and manures, which are not controlled.
19. The contractor's approach to making the risk assessment for *Campylobacter* more realistic seems reasonable and the *Ad Hoc* Group looks forward to seeing the results of this further work, together with the supporting evidence. Once it has done so, and taken a view on the human health implications, a further report will be made to the full ACMSF.
20. As regards the contractor's request for the ACMSF to provide a summary of peer review comments for inclusion in the foreword to the report (see paragraph 10 above), there seems no reason in principle why this should not be done provided the necessary reassurance is received in relation to the *Campylobacter* risk assessment. However, it is recommended that a final decision should be taken in the light of the finished draft report. At that stage, the *Ad Hoc* Group would propose to draw up a draft contribution which would be cleared with the full ACMSF before being sent to the contractor.

⁴ Based on Horan data.

Recommendations

21. The ACMSF is invited to indicate that it is content for matters to be progressed in line with the above conclusions.