

Food Standards Agency

Review of Research Programmes C01 and C02:
Chemical Contaminants from Food Production

Final Report

Produced and written by Richard Burt

July 2005

1. Introduction

1. The Food Standards Agency (FSA) came into being in April 2000 with the main objective “to protect public health from risks which may arise from the consumption of food, and otherwise protect the interests of consumers in relation to food” (Food Standards Act 1999). The FSA’s guiding principles are:

- Putting the consumer first
- Being open and accessible
- Being an independent voice

The FSA is a Government department but it works at arm’s length from Ministers reporting to Parliament through Health Ministers. It has the legal power to publish the advice which it provides to Ministers.

2. The FSA is led by a Board appointed to act in the public interest and not to represent particular sectors. Board members have a wide range of relevant skills and experience and are collectively responsible for the overall strategic direction of the FSA and ensuring that it meets its legal obligations.

2. Research in the FSA

3. The FSA has its UK headquarters in London with national offices in Scotland, Wales and Northern Ireland. The total number of staff in the FSA (excluding the Meat Hygiene Service) is approximately 600 of which about 500 are based in London. Individual policy divisions are responsible for specific areas such as nutrition, microbiological safety, chemical contaminants, food additives, novel foods, etc. Each division undertakes a wide range of work including the negotiation and implementation of new EU legislation, answering questions from Members of Parliament and consumers and commissioning research and surveys.

4. The FSA relies on scientific evidence to underpin its advice and policies in all areas of its business. Much of this scientific evidence is generated by the FSA’s own programmes of research and surveys. The average annual cost of the FSA programmes on research and surveys over the last 5 years is approximately £27m with the programmes on environmental chemical contaminants accounting for about 10% of this total. Other major programmes include research on nutrition (24%), foodborne illness (15%), assessing the safety of food components (19%) and food authenticity (8%). The FSA publishes Annual Reports which provide detailed information on all these programmes.

5. The wide ranging programme of research and surveys is in response to the many pressures facing the FSA. These include proposals for new legislation from the EU Commission, improving law enforcement and the need to ensure the safety and authenticity of the UK food supply and counter new threats to food

safety (e.g. acrylamide). The programme also provides the evidence base for new policy initiatives (e.g. reduction of salt in the diet) and advice to consumers. The programme also helps to ensure that FSA staff are familiar with the scientific developments in relevant areas and able to appreciate the significance of advice from external experts.

6. The FSA is seeking to increase the amount of research which it funds collaboratively with other funders including the UK Research Councils and the EU programmes such as Framework 6. This approach increases the range of research to which the FSA has access and also provides the opportunity for the FSA to influence the research programmes of other funders. The FSA is currently co-funding 23 projects including projects arising from the Biotechnology and Biological Science Research Council's (BBSRC) Government Partnership Award Scheme and the FSA participation in SAFEFOODERA which is an ERA-NET project.

7. It is essential that the FSA and its stakeholders have confidence in the results generated by these programmes. The FSA has for sometime had relevant quality assurance requirements in place for its surveys and has now extended these requirements to any research project which it funds. The FSA along with the Department for Environment, Food and Rural Affairs, BBSRC and National Environment Research Council launched a joint Code of Practice on Quality Assurance in Research in May 2003. From June 2004, potential contractors making applications for funding are expected to make a more definitive declaration of compliance with the Code. The FSA recognises that these moves towards improving QA may lead to some contractors seeking formal accreditation for their research under, for example, ISO 17025, and that this will bring some increase in costs.

3. Dissemination of results

8. The FSA encourages its contractors to present the results from research projects at scientific conferences and to publish work in peer-reviewed scientific journals. The FSA also holds an annual open meeting on research to which it invites representatives from a wide range of organisations. The purpose of these meetings is to present the key findings of its research programme to a wider audience and to put the results into the context of its current policies. The meeting also includes presentations on "hot topics".

9. Most research programmes also hold annual research seminars at which current contractors present the results of their research to fellow contractors and other interested parties including other academics and representatives from the FSA and other Government departments. These meetings also provide the FSA staff with an opportunity to remind the researchers of the policy needs and objectives of the research as well as providing the researchers with an opportunity to exchange ideas with others working in the field.

4. Research management

10. At present, the FSA uses the ROAME system to manage its research and surveys. A document sets out the **R**ationale for the research programme along with its main **O**bjectives and timescale. Proposals for research and surveys are **A**ppraised against these objectives and the resulting contracts are **M**onitored and subjected to **E**valuation on completion. The document which sets out the rationale for the research programme is clearly important as it provides the main justification for the expenditure on research into a specific area. The ROAME A has several sections including

- An abstract of the proposed research
- A summary of the issues which the research will address
- Overall objectives of the research programmes
- Key milestones of the programme
- Criteria for determining the success of the programme

The FSA has recently introduced a new step in its research procedure to improve the quality of the ROAME A document by seeking comments from its independent Advisory Committee on Research on all new ROAME A documents prior to setting up a new research programme.

11. The FSA commissions most of its research through open competition. The normal approach is for the FSA to publish quarterly a Research Requirements Document which list its research needs. Researchers are invited to submit detailed proposals or, in some cases, expressions of interest, which are evaluated by the FSA with help from invited external experts. Once commissioned, a summary of the project is published on the Agency website (www.food.gov.uk). Projects are regularly monitored by FSA staff to ensure that satisfactory progress is being made and that the original objectives are still relevant. On completion of a project, a summary of the main results is published in the FSA News, on the website and the final report placed in the FSA library for wider consultation. The FSA usually appoints an external Programme Manager to help it manage and monitor each project in a research programme – the Programme Manager for C01 and C02 is Dr Geoff Pigott who is an independent consultant toxicologist.

12. Each research programme has a finite life (usually about 5 years) after which the results are reviewed against the objectives originally set out in the ROAME A document at the start of the programme. In addition, the review considers whether further work is justified in the area and, if so, identifies areas which future research should address. The outcome of the review is published by the FSA and also considered by the Advisory Committee on Research.

13 As mentioned above, each policy division is responsible for identifying and commissioning the research and surveys needed to ensure that its policies and advice are based on the best available science. The FSA seeks advice on the research needed from its independent expert advisory committees as well as using its own internal expertise. The FSA and its predecessor also established a Working Party on Chemical Contaminants to advise it on the research and surveys needed in the area of chemical contaminants. Its members represent a wide range of organisations including consumers, local authorities and the food industry.

5. Programmes C01 and C02

14. The programmes C01 and C02 cover three main areas of work on chemical contaminants:

- Inorganic chemical contaminants;
- Dioxins and polychlorinated biphenyls;
- Other persistent organic environmental contaminants.

Programme C01 contains research projects while C02 contains mainly surveys of foods and other similar work. The total cost of these programmes between 2000 and 2004 was approximately £2.5million on 73 projects. The last review of this area of work was in 1999 and the current programmes contain some projects which started before the Agency was formed in 2000. However the majority of the projects are more recent. The current ROAME As (on Form RCU-2B) were written in October 2001 in the new format established by the FSA. The ROAME As covering the above areas are summarised at Appendix A.

15. The two research programmes have several common objectives which are:

- To establish and understand the main pathways through which specific chemical contaminants enter the food chain;
- To estimate the exposure of consumers to specific contaminants and, in particular, identify any vulnerable groups;
- To identify ways of minimising contamination of the food chain and consumer exposure through changes in production practices, etc
- To undertake surveys of foods and other relevant materials to monitor levels of contamination and assess the effect on contaminant concentrations of, for example, new legal limits, changes in food production practices, etc. The surveys also provide the data needed to estimate consumer exposure to specific contaminants;
- To develop and improve methods on analysis for contaminants of concern.

16. The full list of projects is set out in Appendix B with the projects grouped into the following areas of work:

- Metals and other elements;
- Persistent organic chemicals;
- Dioxins and PCBs;
- Toxicological issues raised by chemical contaminants in foods;
- Development of improved methods of analysis;

These groupings were chosen to facilitate the evaluation of the projects both singly and collectively by external experts.

6. Conduct of the Review

17. The FSA invited five external reviewers with expertise in one of the areas listed above to assess projects and surveys in their specific areas of expertise against agreed set of criteria (see Appendix C). In addition, the reviewers also commented on the collective value of the projects in their area and also identified areas of work which the FSA should fund in the future. Some research projects were considered to have greater significance to the overall value of the research programmes and a second reviewer also assessed these projects.

18. The experts who undertook the assessments were:

- Metals and other elements; **Professor Sue Southon**, (Institute of Food Research, Norwich, UK)
- Persistent organic chemicals; **Dr Paul Harrison** and **Professor Len Levy** (Cranfield Centre for Environment and Health and MRC Institute for Environment and Health, Leicester, UK)
- Dioxins and PCBs; **Dr Olaf Paepke** (Ergo Research, Hamburg, Germany)
- Toxicological issues: **Dr John Cocker** (Health and Safety Laboratory, Buxton, UK)
- Development of improved method of analysis; **Professor Mike Ramsey** (Centre for Environmental Research, University of Sussex, UK)

19. In addition, the Programme Manager, **Dr Geoff Pigott** has assessed a research project which reviewed the current suite of mathematical models used by the FSA in its work on chemical and radiological contaminants.

20. The criteria for evaluating research projects were rather more extensive than those for surveys (see Appendix C). This arises because the FSA closely prescribes the scope and reporting arrangements for surveys and works much more closely with the contractor during the course of a survey. The FSA takes full responsibility for the publication of the survey results as surveys may identify particular food safety issues which require the FSA to take some preventative actions and provide appropriate briefing to the media.

7. Summary of comments on specific areas

Metals and other elements

21. Many of the “heavy” metals including lead, cadmium, tin and mercury have a long history of contaminating food occasionally at concentrations which have caused significant toxic effects in consumers. This has led the UK and, more recently, the EU to establish statutory maximum limits for many of these elements in relevant foods. The FSA continues to monitor the concentrations of these elements in foods to ensure that these are not increasing due to the introduction of new food processes, packaging or changes in the origin of raw materials. In addition, the FSA has investigated new potential problems such as whether the wide spread introduction of catalytic converters in car exhausts has increased the concentrations of metals such as platinum in food crops grown near motorways.

22. The specific aims of these research programmes are set out in the ROAME A at Appendix A. Food is a major route of exposure for many consumers to metals and other elements and excessive exposure may cause significant risks to health. The main aim is to understand the pathways by which inorganic contaminants enter food, the levels at which they occur, and the mechanisms by which they accumulate through the food chain. This information will improve the communication of the health risks to consumers and food producers and identify effective and proportionate means of reducing the risks. Any controls needed to reduce consumer exposure may take the form of precautionary advice to consumers and the food industry. However, statutory limits, usually at EU level, are necessary in some cases and the information obtained from the research and surveys informs negotiations with the EU and other international bodies such as Codex Alimentarius Commission.

Comments on individual projects

23. Most research projects were considered satisfactory in terms of the quality of their science and to have provided value for money while most surveys were considered excellent with useful Information Sheets being produced by the FSA. The projects collectively were considered to have addressed the aims set out in the ROAME A although little research was undertaken on the mechanisms by

which contaminants enter the food chain even though this was a major objective of the programme.

24. A major criticism is the lack of information on the utilisation of the results by the FSA. Many of the surveys showed that consumer exposure to the range of elements studied were generally low and raised no toxicological or other concerns. However, a few results raised specific concerns where appropriate action was taken.

Collective value of projects and surveys

25. Some general points relating to several projects and surveys were made including:

- No information was available on whether any of the research or surveys was part of wider UK or EU initiatives.
- In general, little information was available on the use made by the FSA of the research or survey results. Some surveys did result in the FSA issuing specific precautionary advice to consumers (e.g. to avoid the consumption of hijki seaweed due to its high arsenic content) but the policy implications of some results did not appear to have been considered (e.g. C01030)
- Evidence on the wider dissemination of results was poor. Some final reports indicated that the contractor planned to submit papers to peer-reviewed scientific journals but no evidence was available on whether this actually happened.
- The need for some surveys was not evident as previous results had not raised any concerns. The FSA needs to have a more transparent process for prioritising its research and surveys.
- Several of the final reports did not place the results in the context of the question being addressed and contractors need stronger guidance on this issue. Some of the research projects were not well planned as they ran into problems which should have been identified earlier during the project planning stage.

Future research needs

26. Several suggestions for future research were made including:

- An increasing range of “exotic” ingredients from new origins are being used in foods and dietary and herbal supplements. The FSA will need to keep these trends under review and undertake appropriate surveys if justified by a risk assessment.
- The REACH initiative has highlighted the need for better risk assessment with respect to inorganic contaminants and human health. The FSA should work with other funders to sponsor appropriate research.

- Many of the issues addressed in this programme affect other EU countries and considerable scope for collaboration exists. The FSA should also seek to improve its collaboration with other EU and UK funders.

Any future programme should consider the possibility of analysing human blood/tissues as a better indicator of exposure. It is often difficult to predict the availability of contaminants to humans from the analysis of food alone.

Persistent organic chemicals

27. A large number of organic chemicals present in the environment may contaminate food adventitiously as a result of human activity or from natural sources. These contaminants include polycyclic aromatic hydrocarbons, phthalates, brominated fire retardants and synthetic musks. They may enter the food chain at any point from the growing, harvesting and storage of crops to their subsequent processing. Excessive exposure to these contaminants is potentially harmful. The FSA's programmes C01 and C02 investigate the occurrence of these organic contaminants in the UK food supply. The programmes aim to identify ways of minimising consumer exposure particularly to those groups of consumers that are susceptible to higher levels of contamination. This will enable the FSA to base its policies on the best available scientific evidence and inform international negotiations on setting appropriate controls on these contaminants.

Comments on individual projects

28. Several of the research projects in this area investigated the uptake and transfer of organic contaminants into the food chain while the surveys investigated the occurrence of these substances in food. The science in most of the research projects including C01001, C01004 and C01020 was rated as excellent but was let down by their final reports not directly addressing the relevance of the research to the policy needs of the FSA. In addition, the effort made by the contractors to disseminate the results was sometimes poor although this was not always the case as other projects were rated as excellent (e.g. C01001). The results from at least two projects (C01029 and C02004) were limited because of problems with the methods of analysis caused, for example, by poor limits of detection. This was not surprising given the nature of complex mixtures which were often under investigation. However, some of these problems might have been avoided by more attention to detail in the planning stage of the projects by ensuring that the projects were not too speculative or over ambitious in their objectives. The surveys were generally excellent with clearly reported results.

Collective value of projects and surveys

29. Most of the projects have attempted to address the aims as set out in the ROAME A for a number of organic environmental contaminants of current concern to the EU and UK. The project protocols were largely designed to meet these needs. In general, the surveys and research projects have made very positive scientific contributions and underpinned FSA advice to the public, food industry and international negotiations.

Future research needs

30. The EU will continue to be an important driver for research and surveys in this area and future research will need to reflect these wider issues. In addition, the future work will also need to address issues of primary concern to UK as well generating information to ensure that consumer exposure to organic environmental contaminants from food remains at acceptable levels. However, better scientific justification for the choice of sample size in surveys is needed. This should include power calculations and sensitivity analysis wherever possible.

31. Better use could be made of existing data in developing project protocols. This may require the FSA to allow more time for contractors to submit protocols and also require the FSA to modify its procedures for commissioning research so that more thought is given to study designs. A change along these lines may also encourage new research groups to put forward proposals.

Dioxins and PCBs

32. Dioxins and PCBs are ubiquitous environmental contaminants. The term “dioxins” refers to two groups of closely related chlorinated compounds, individually referred to as congeners. Dioxins are unintentionally produced in small amounts during most combustion processes, both industrial and domestic, and may be formed as unwanted by-products in the manufacture of certain chemicals. Dioxins adversely affect the development of young children and are believed to disrupt the endocrine system in humans and wildlife.

33. Unlike dioxins, PCBs were manufactured and used in a wide range of applications from the early 1930s but they are no longer manufactured in the UK and do not have any significant uses. A few exhibit toxicity similar to those of the toxic dioxins.

34. Emissions of dioxins and PCBs into the environment have fallen by about 70% in the last ten years. However, dioxins and PCBs do not degrade easily and so continue to be widespread in the environment. They tend to bioaccumulate and are generally present in low concentrations in most foods particularly fat-containing foods such as milk, meat, fish and eggs. The major food scare in Belgium in the mid 1990s caused by the contamination of animal feed with

dioxins and PCBs led the EU to introduce maximum limits for dioxins in certain food and animal feed products.

Comments on individual projects

35. The 2 research projects (C01007 and C01037) investigated the transfer of dioxins and PCBs from pasture into cow's milk. The scientific quality of projects C01007 was rated as excellent by both reviewers although it was not evident that the results had been disseminated beyond a poster presentation at a scientific meeting. The overall quality of the surveys was also considered excellent with the Food Survey Information Sheets considered to present the results in a clear and consumer friendly way. However, it was suggested that the greater use of graphs or other similar visual aids to present the results would help (see for example Fig 1 in Food Survey Information Sheet 38/03). A further suggestion was that some of the analyses for dioxins and PCBs should be confirmed by a second laboratory as an additional assurance of the quality of the results.

Collective value of projects and surveys

36. The extensive range of surveys was considered as exemplary as they have provided much useful information on the presence of dioxins in a wide range of foods. The results have generally been reassuring for consumers and provided a sound scientific basis for the UK's negotiating position in the EU.

Future research needs

37. Environmental groups are likely to continue their campaigns to reduce the concentrations of dioxins and PCBs in food and the environment. The FSA will need to repeat its surveys of key foods including infant formulae, baby foods and dairy products to confirm the continuing general decline in concentrations in food. Further work may also be needed to investigate specific locations which might have higher levels of dioxins and/or PCBs due to past or current industrial activity. Work on brominated fire retardants (BFRs) needs expanding as these are persistent environmental contaminants and produced in large amounts for use in wide range of applications.

38. Little information is available on consumer exposure to BFRs from food. It is recommended that samples from the Total Diet Study are analysed as well as selected foods (e.g. human milk, infant formula) most at risk to exposure to BFRs.

Toxicological issues

38. The FSA relies largely on independent expert committees including the Committee on Toxicity and the European Food Safety Authority for toxicological

advice. This advice combined with knowledge of food intakes, chemical form and concentrations of contaminants in food enable the FSA to produce risk assessments of chemical contaminants. Much of the toxicological information is generated by the wider scientific community although the FSA does fund some research on toxicology (see programmes T01, T05, T07, T09 and T10). However, the FSA also funds research into specific issues in C01 to improve the interpretation of its data on chemical contaminants or to improve understanding of the exposure of consumer to contaminants through the use of new approaches such as biomarkers.

Comments on individual projects

39. The quality of the science of the projects was generally satisfactory but one project (C01012) was strongly criticised on several grounds including inappropriate assumptions on the effects of metabolism on the compounds under investigation. However, this project may have resulted from the wish to take advantage of arrangements in place for a similar project on the bioavailability of dioxin-like compounds. Again little evidence was available for most projects on efforts made to disseminate the results. The exceptions were C01003 and C01023 which both led to papers in peer-reviewed publications.

Collective value of projects and surveys

40. The projects in this area addressed a number of important but unrelated issues and it is not possible to comment on their collective value in any useful way. Nevertheless, all the projects fell within the aims set out in the ROAME As which include the need to improve the understanding of the effects on health of consumer exposure to chemical contaminants.

41. The standard of management of the research projects in these programmes was variable. Some projects had a well thought out project plans (e.g. C02004) while others did not (e.g. C01012). Projects must have a realistic set of objectives which are achievable within time and budget. Communication between the FSA and its contractors was not always good.

Future research needs

42. The issue of contaminants in food is likely to continue and the FSA will need to be able to respond – either proactively if issues are identified by, for example, results from a survey or reactively if the public or FSA suddenly becomes aware of a problem. The FSA needs knowledge on current levels of contaminants in food as a baseline to respond to known or new problems. Work is needed to maintain these capabilities and knowledge. The analysis of contaminants in food at very low levels requires great skill and the FSA needs to maintain these skills, key teams and analytical capability by predictable funding of selected contractors.

43. The analysis of substances or their metabolites in biological fluids (blood, urine, etc) is increasingly being used as indicators of exposure. These biomarkers of exposure can help to validate risk assessments models and to put actual levels of exposure into perspective as well as giving information on interactions and individual response. The FSA needs to work with others who support work in this area.

44. Opportunities for collaboration with other funders undoubtedly exist. However, this can lead to significant management problems if each organisation has different priorities and timescales. The FSA needs to assess both the advantages and disadvantages of collaboration.

Development of improved method of analysis;

45. The FSA's work on contaminants relies on reliable data generated by validated analytical methods. The data underpins its policies and advice to consumers and the food industry. Robust analytical methods are also needed for law enforcement to ensure that food on the UK market does not exceed statutory limits. These important issues are recognised in the three ROAME A statements (Appendix A). The work on improving methods of analysis in the programmes under review covers only work specifically concerned with chemical contaminants. The FSA has another research programme which covers investigations into wider analytical issues and also funds other work such as collaborative studies.

Comments on individual projects

46. This area of work covers 7 projects which investigated new analytical procedures for estimating the concentration of contaminants in foods. Two important projects investigated new approaches to establish the form or species of contaminant present in food. This is particularly important in the case of arsenic and mercury where the inorganic and organic forms respectively are more toxic. Most projects broadly achieved their objectives although some fell short of being entirely satisfactory due low recoveries of the analyte (e.g. C01005) or inadequate planning (C02007). Some projects were considered excellent including a project developing routine methods for the determination of total and organometallic mercury in food (C01017). A second reviewer also supported this assessment. It may be that the criteria used to judge screening methods in general, such as recovery, should set different thresholds for acceptable performance than are applied to traditional laboratory methods.

47. A criticism of many projects was poor dissemination of the results or, at least, no evidence of dissemination other than a final report to the FSA. This is particularly disappointing as several of the projects generated material which was considered very publishable (e.g. C01015, C01017).

Collective value of projects and surveys

48. The projects concentrated explicitly on certain issues (e.g. development of a method for a specific contaminant) but had few implications for wider issues such as identifying particularly susceptible foods. Nevertheless, several important issues were addressed by the programme leading to improved knowledge within the FSA.

Future research needs

49. A major area for future research is the effect of methods of sampling on the quantification of key contaminants in food. Chemical laboratories take responsibility for the analytical part of the measurement but are usually excluded from the primary sampling procedure. Some mechanism for integrating the two aspects is needed to allow for an improved assessment of the overall uncertainty of any reported concentration of a contaminant in food. Research is needed to identify and evaluate practical options. This also has implications for the development and evaluation of new *in situ* methods on analysis, where food can be analysed on location and measurements produced instantaneously. These methods are generally less expensive but may have higher levels of uncertainty on each measurement. The ability to analyse more samples quickly should provide greater confidence in the reliability of decisions taken on batches of food.

50. The opportunities for collaboration with other funders particularly in the EU need further investigation as many of the problems with contaminants in food are not unique to the UK.

Other projects

51. The programme C01 also included a project which reviewed the current suite of mathematical models used the FSA's Food Contaminants and Radiological Safety Divisions.

Comments on the project

52. The project adopted an analytical approach to the range of models available allowing an early reduction in the numbers for final assessment of their scope and robustness. The results showed that it was not possible to combine the models but suggested other options.

Future research needs

53. The project identified a more general problem that older computer programs were often restricted by hardware limitations especially memory capacity which severely limits the possibility of extension. However many of these models have much wider applications and the FSA should consider collaborating with others to

fund the development of new model which make use of current computing capabilities.

Priorities for future research

54. The reviewers recognised that the FSA has limited funds to address the many issues raised by chemical contaminants in food. Further, the FSA has procedures in place to consult its stakeholders on research priorities but these could change at very short notice if a major incident occurred. However the reviewers recommended that the FSA should consider the following factors in identifying its priorities for future research on chemical contaminants:

- New discoveries on the nutrition/toxicology of specific chemicals or other dietary components may cause the FSA to develop new areas of work. In particular, more information is needed to understand low dose effects and the potential for synergy at low levels of contamination;
- The cost of most analyses has not reduced significantly during the life of the programmes and research is needed to define a new generation of rapid and inexpensive assay protocols. At the same time, the FSA needs to ensure that existing expertise and capabilities are maintained.
- Previous research and surveys have concentrated on the presence of chemical contaminants in foods. However, future work should focus more on the bioavailability of chemical contaminants and the potential for accumulation in the body. This will involve the greater analysis of biological tissues and the development of novel biomarkers.
- The FSA will need to ensure that its programme reflects concerns over “new” chemical contaminants in food.
- Most of the programme was (eventually) published in peer-reviewed journals. It is usually in the best interests of the contractor to attempt to publish results but this is difficult to build into the programme as there is inevitably uncertainty at the outset. Dissemination could be improved by apportioning a small proportion of the available funding specifically to fund publication following completion of projects.

General Conclusions of the Review

55. In addition to comments on specific projects, a number of more general points were made by the reviewers which are also relevant to other research and surveys funded by the FSA. These are summarised below

- The FSA provided little information on the utilisation it made of the results obtained from projects and surveys. More attention to this issue is needed to justify continued expenditure;
- Evidence of satisfactory dissemination of results was often limited. It is generally in the interests of contractors to submit papers to peer-reviewed journals but the FSA should make more effort to ensure this occurs. This is important as it ensures that the research is available to the wider scientific community;
- Some final reports did not adequately put the results of the research into the context of the FSA policy requirements. The FSA needs to ensure that its contractors understand fully the policy needs for the research or survey as this should ensure that the research is better focused on FSA needs. Adoption of a standard format for final reports which included a specific section on this issue might help solve this problem.
- Chemical contaminants in food is area of interest to the EU and wider. Scope for greater collaboration exists but this must not be at the expense increased management costs and delays in generating data. It may be worth examining the possibility of collaboration on larger projects particularly within an EU framework particularly for expensive projects with wider application such as the development of new methods of analysis;
- Some projects did not achieve all they set out to do and, in some cases, this could have been avoided by better appraisal of the original proposal. The FSA needs to ensure that its appraisals are rigorous. However, this issue may reflect a problem with the FSA's commissioning procedures with contractors needing more time to develop their proposals;
- The Food Survey Information Sheets which the FSA uses to present the results of surveys are generally excellent. However, a lay summary and greater use of appropriate graphs or similar would help ensure that survey are more easily understood by consumers;
- Analysis of chemical contaminants requires great skill and the FSA needs to maintain skills and capacity in this area through more predictable long term funding of selected contractors;
- Many contaminants are present in food at very low concentrations which are close to or below the limits of detection of chemical methods of analysis. The analysis of substances or their metabolites in biological fluids is increasingly being used as indicators of exposure. The FSA should develop relevant expertise in this area.

- The presence of chemical contaminants in food is often controversial and the FSA needs to involve its stakeholders in developing its future programmes of research and surveys to ensure that its funds are spent most appropriately.

Richard Burt
July 2005

APPENDIX A: ROAME PROGRAMME OBJECTIVES

1. Inorganic contaminants

Inorganic chemical contaminants are potentially harmful chemicals present in food adventitiously as a result of human activity, or, from natural sources. These include heavy metals such as lead, cadmium and mercury, and other chemical elements such as arsenic and iodine. They may be introduced at any point in the food chain from growth and harvesting through to storage and processing. Although some are essential, all are potentially harmful if exposures are excessive. Food is a major contributor to consumers' overall exposure in most cases, although other routes may also be significant (inhalation, occupational exposure, drinking water). There is a relatively good body of data from past studies on occurrence, exposure and toxicity for elements such as lead, cadmium, mercury, although this focuses mainly on total concentrations or exposures to these contaminants. This programme will build on these data by:

- i) Identifying emerging concerns and improving our understanding of them. Improving our understanding of the entry, pathways and transformations of particular chemicals and species of interest into and through the food chain, their uptake and effects on consumers;
- ii) Identifying ways to minimise contamination, exposure, or its effects;
- iii) Identifying particular groups of foods that are susceptible to higher levels of contamination, and the implications this has to consumers' exposure, particularly for the most sensitive population groups
- iv) This program will also continue to expand the programme of surveys of these chemicals in food to enable up-to-date consumer exposure assessments, and advice to be generated.

The work programme as a whole should enable the Agency to focus its survey work, to aid with the assessment, reduction and communication of risk to consumers from inorganic environmental contaminants present in food, and inform the UK in international negotiations on setting appropriate controls on these contaminants.

2. Dioxins

Dioxins are a group of closely related compounds, 17 of which are known to be extremely toxic to certain species of laboratory animals. They can cause a wide range of effects in animals, including cancer and effects on the immune and reproductive systems. Dioxins are not produced intentionally but are formed in small quantities during combustion processes and are by-products of certain chemical manufacturing processes. PCBs are another group of chemicals, a few of which exhibit a mechanism of toxicity similar to that of the toxic dioxins and are often referred to as being 'dioxin-like'. Both dioxins and PCBs are persistent in the environment and bioaccumulate in the food chain.

To improve the Agency's knowledge on the occurrence and consumers exposure to these chemicals .This programme will:

- i) Develop an understanding of mechanisms by which dioxins and PCBs transfer through the environment and into the food chain.
- ii) Monitor the UK diet for these contaminants, looking at specific food groups where necessary.
- iii) Where appropriate this program will develop analytical methods to help improve both the efficiency and effectiveness of the food surveillance programme and compliance with limits.
- iv) Identifying ways to minimise contamination, exposure, or its effects.

The work programme as a whole should enable the Food Standards Agency to assess and reduce the risk to consumers from dioxins and PCBs present in food, and inform the UK in international negotiations on setting appropriate controls on these contaminants.

3. Other persistent organic contaminants

In addition to dioxins and PCBs there are a large number of organic environmental chemical contaminants (approximately 50,000) that may be present in food adventitiously as a result of human activity, or, from natural sources. These include such groups as Polycyclic Aromatic Hydrocarbons, phthalates, brominated flame retardents and musks. They may be introduced at any point in the food chain from growth and harvesting through to storage and processing. Exposure to these contaminants is potentially harmful in excess.

There are some data on occurrence, exposure and toxicity of organic contaminants. This programme will build on these data by:

- v) Identifying emerging concerns and improving our understanding of them. Improving our understanding of the entry, pathways and transformations of chemicals of interest into and through the food chain, their uptake and effects on consumers;
- vi) Identifying ways to minimise contamination, exposure, or its effects;
- vii) Identifying particular groups of foods that are susceptible to higher levels of contamination, and the implications this has to consumers' exposure, particularly for the most sensitive population groups
- viii) This program will also continue to expand the programme of surveys of these chemicals in food to enable up-to-date consumer exposure assessments, and advice to be generated.

The work programme as a whole should enable the Food Standards Agency to assess, reduce and communicate the risk to consumers from organic environmental contaminants present in food, and inform the UK in international negotiations on setting appropriate controls on these contaminants.

APPENDIX B: LIST OF RESEARCH AND SURVEY PROJECTS IN C01 AND C02

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C01001	Simple methods to reduce potential transfer of organic chemical residues from sewage sludge amended soils to food crop	Uni London – Imperial	238,330	Work on sewage sludge had focused on uptake of metals with little information on organic chemicals known to be in sludge, such as PCDD/Fs and PCBs. Work resulted in some useful information on specific chemicals, but more work needed. (01/10/97 - 31/01/01)
C01003	Assessment of total oestrogenic environmental contaminants in food with recombinant human receptor systems	VLA	144,101	Novel method development for improved analysis. Method was not extended to whole food matrices within the period of this project. (01/04/98 - 30/11/01) Published 29/08/02.
C01004	Food hazard analysis by critical control points (HACCP): Development & evaluation of a whole food chain approach	Uni London – Imperial College – Wye	41,213	Intention was to find ways to reduce contamination of food by environmental chemicals by critical points in routes into the food chain. Not sure on outcome. Papers were published by contractor. (01/11/1998 - 31/10/99)
C01005	Development of analytical methodology and measurement of dietary exposure to alkylphenols and alkylphenol ethoxylates	CSL	9,335	A method for the determination of the alkylphenols, octylphenol and nonylphenol, in UK duplicate diet samples. These were identified as priority chemicals by the WPCCC. No dietary exposure assessment previously known. (01/06/98 - 31/01/01) Published May 2001.
C01006	The effects of processing on lead and cadmium levels in food	AEA Technology PLC	93,529	Aimed to compare concentrations of lead and cadmium in in food raw materials with intermediate and final products. No statistically significant differences were found although this may have been due to the small number of samples tested. Published December 2000.
C01007	Study of the effects of PCDD/Fs & PCBs in river sediment, deposited on pasture by flooding, on concs in cows' milk	CSL	83,294	Demonstration that, in the long term, deposition of sediment contaminated with dioxins and PCBs onto pasture due to river flooding results in significantly higher levels of these contaminants in cows' milk from affected farms than from matched farms that do not flood. (Project extended in C01037) Published April 2001
C01008\9	Rapid, single step PCB extraction from liquid milk using perfluorocarbon fluids	Chimaeron \ CSL	20,510	Previous pilot studies using high concentrations of PCBs looked promising but this novel extraction procedure did not work satisfactorily for the lower PCB concentrations typically found in milk. Published December 2000

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C01010	Measuring the bioavailability of human dietary intake of dioxin-like compounds	Uni Birmingham	139,614	Investigation of the net absorption (or net excretion) of dioxins and PCBs in two age groups, with different body burdens of these contaminants, using a "real time" mass balance approach. (C01012 is a related project.)
C01011	A review of the current suite of models used by FSA's Food Contaminants and Radiological Safety Divisions	Westlakes Scientific	60,548	Evaluation of available environmental and food chain models to assess whether they could be integrated as a single software platform. Project provided a useful in depth review of existing models. Many models were not suitable for integration so this approach was not pursued. Published February 2001
C01012	Measuring the bioavailability of human dietary intake of PAHs, phthalates and aromatic hydrocarbons	Uni Birmingham	136,600	Investigation of the net absorption of PAHs, phthalates and aromatic hydrocarbons using a "real time" mass balance approach similar to that used for C01010. Published in FSA News. (01/10/99 - 31/10/01) Published July 2003
C01013	Dietary nitrate consumption: an investigation of biomarkers of DNA & protein damage in humans	Kings College London	Transferred to other programmes	
C01014	Rapid & automated methods for the screening of foods for the presence of a wide range of organic contaminants	Leatherhead Food International	67,639	A rapid screen for crops and other foods in the event of a release of organic chemicals to determine analytical priorities was developed. However, this method was unsatisfactory for PAHs in these food matrices. Published January 2001
C01015	Feasibility study of rapid detection of some food contaminants using MALDI-TOF MS	CSL	25,153	Although most of the test chemicals could be detected using MALDI-TOF MS (matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry), this method was found to unsuitable for screening for surface contamination of crops because the technique was non-quantitative and not reproducible. Published in FSA News. (01/10/99 - 30/09/01) Published March 2004.
C01016	Investigation of iodine species in milk and infant formulae	CSL	39,838	Need for speciation of iodine levels in milk due to concerns on overall levels
C01017	Development of routine methods for the determination of total and organometallic mercury in food	Uni Plymouth	38,595	Routine and robust method for speciation of mercury required in view of differing toxicity of the various forms (01/12/99 - 30/11/00)

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C01018	The determination of arsenic in foods	LGC	52,125	To provide data for EC negotiations on limits for arsenic and heavy metals in food. Published July 2002
C01019	Transmission and occurrence of persistent organic pollutants through the food chain - a literature review	W S Atkins	11,120	This project fulfilled a requirement to review published data on the occurrence and concentration of specific types of polybrominated and polychlorinated aromatic chemicals in various environmental media, biota and food products to aid rapid assessment of incidents involving release of organic chemicals. Published June 2001
C01020	Transfer and uptake of organic contaminants into meat and eggs of chickens, sheep and pigs	Uni East Anglia	275,532	This project produced a unique set of reliable data regarding the extent to which dioxins and PCBs are transferred from ingested feed, herbage or soil to the meat or eggs of pigs, sheep and chickens reared under free-range or indoor conditions using typical commercial husbandry practices. These results will enhance our modelling capabilities for the dioxins and PCBs in the terrestrial food chain. (01/04/01 - 31/03/03) Published March 2004.
C01021	The use of sorptive minerals to minimise the uptake of arsenic (As) and cadmium (Cd) by food crops.	Uni Reading	132,484	This project tested the use of minerals with strong adsorptive properties for arsenic and cadmium to reduce the plant-available fractions of these elements in contaminated soil. The project yielded two journal publications. (01/01/00 - 31/12/00)
C01022	Development of a mechanistic understanding and model of the air-herbage transfer of persistent organic contaminants	Uni Lancaster	355,821	The transfer of persistent organic pollutants (POPs) such as dioxins, PCBs or PAHs from air to crops or pasture is a key pathway leading to contamination of food. Using a combination of field and laboratory studies, this project has developed a better understanding of the link between the concentrations of various POPs in air and in plants and the dynamics of the transfer of these contaminants between air and plants. (01/02/98 - 01/07/01)
C01023	Development and application of a biomarker-based method to quantify human exposure to phthalates from food	CSL		Previous intake estimates for phthalates calculated from levels in food and patterns of intake. Study intended to produce accurate and reliable estimate of actual uptake from all sources. Published June 1999.
C01025	An investigation into the sources of PAH in infant formulae	CSL	Majority of project completed under MAFF	

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C01026	Validation of a sensitive HPLC method for determination of nitrate and nitrite in meat	CSL	Transferred to other programmes	
C01027	Validation of a sensitive HPLC method for determination of nitrate and nitrite in meat	Leatherhead Food International	Transferred to other programmes	
C01028	Trial to test the effectiveness of the UK codes of good agricultural practice for the production of lettuce and spinach in minimising nitrate residues	HRI	Transferred to other programmes	
C01029	Uptake of alkyl phenols by crops plants	Uni London – Imperial	62,282	Investigation of risk from APs in crops grown on sewage sludge amended land. Results supported the FSA view that APs from sewage sludge to not pose a risk to food safety. Published in FSA News. (January 2001 – March 2004) Published October 2004.
C01030	Integrated assessment of the distributions , behaviour and plant interaction of Pb, Mn, and PGEs in roadside and agricultural environments	SUERC	104,226	Investigation of impact of vehicle emissions on the safety of roadside crops. Results supported the Agency's wash and peel advice and highlighted issues regarding platinum and manganese for the future. (01/01/01 - 15/03/03) Published September 2003.
C01031	Pilot studies to explore alternative methods for the recruitment, collection, storage and management of and archive of breast milk samples	Department Of Health	80,631	Breast milk is principal source of nutrition for breast-fed infants and known to be significant route for excretion of contaminants such as dioxins and PCBs from lactating mothers. Important to develop archive of breast milk to establish dietary exposure during critical development stage. Project demonstrated that it is feasible to set up an archive but the cost would be high. Government Departments are currently discussing whether and how it should be followed up. Published May 2004.
C01032	Simple method to reduce potential transfer of organic chemical residues from sewage sludge amended soils to food crops	Additional code created for retention payment of MAFF project.		
C01033	A multi-element survey of free foods.	Uni Bristol	44,770	A survey (incorrectly numbered as research) aimed at informing correspondence regarding the safety of consuming wild food in terms of inorganic contaminants. (01/07/98 - 30/06/99) Published July 1999.

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C01034	UK soil herbage survey	Uni Liverpool	109,397	Contribution to Environment Agency survey of background levels of PCDD/Fs etc in soil. Results of use to judge impact of incident involving combustion or chlorinated chemicals, or if high levels of PCDD/Fs found in milk. (April 2002 - December 2003)
C01035	Literature survey for chlorinated and non-chlorinated PAHs and chlorinated and non-chlorinated aliphatic compounds in food.	MRC – IEH	24,850	Available published data on these contaminants in food needs to be compiled and summarised to ensure that the FSA's knowledge of their occurrence in food is comprehensive and up to date. This project should reveal if there are any gaps in the available information.
C01036	Project number not used			
C01037	Study of the effects of flooding on concentrations of PCDD/Fs and PCBs in milk from cattle grazing on affected pastureland	CSL	149,855	This is a continuation of C01007 for which only milk samples from October 1998 and March 1999 were analysed. Additional samples that were collected but not previously analysed, including the milk from 1999 and selected soil, grass and feed samples, were analysed for C01037. Comprehensive statistical analyses on all the data have been carried out for this project. The final report is currently being drafted.
C02001	Residues in food of non-active ingredients of pesticide formulations	RHM Technology		Certain non-active ingredients were chemicals prioritised by the MAFF Working Party on Organic Environmental Contaminants in Food. Published in FSA News. Published November 1998 (amended January 2003)
C02002	Analysis of chlorinated paraffins and chlorinated solvents in food	Leatherhead Food International		Chemicals prioritised by the MAFF Working Party on Organic Environmental Contaminants in Food. To estimate dietary intakes. Has been used to support external requests for information (01/06/95 - 31/03/00)
C02003	Analysis of synthetic musks in foods and human milk	Leatherhead Food International		Chemicals prioritised by the MAFF Working Party on Organic Environmental Contaminants in Food. To estimate dietary intakes. Has been used to support external requests for information (01/06/95 - 31/03/00)
C02004	An investigation into the origins of specific phthalate esters in dairy products	Leatherhead Food International		Follow up work to investigate the presence of phthalates additional to those that could have migrated from food contact materials.
C02005	Project number not used			

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02006	Determination of individual phthalate esters in fatty foods	CSL		Infant formulae section published as FSIS. Whole project: follow up work to investigate the presence of phthalates additional to those that could have migrated from food contact materials. Published September 2002.
C02007	Inorganic Arsenic analysis method validation - interlaboratory trial	CSL		Method development for improved arsenic analysis. Published December 2000.
C02008	Dioxins and PCBs in shellfish	CSL		Aim to estimate dietary intakes of dioxins and PCBs by consumers of shellfish to inform EU negotiations. Published March 2000
C02009	Dioxins and PCBs in infant formulae, and in fats and oils for food production	CSL		To allow dietary intakes of dioxins and PCBs by formula-fed infants to be estimated. To assess contributions of cereal products and snack foods to total dietary intakes of dioxins and PCBs. Infant formulae section published under C02038/9, fats and oils section as summary report. Published December 1999.
C02010	Multi-element survey of allotment produce	Uni Bristol	51,775	See C02043
C02011	Survey for dioxins and PCBs in cows milk from individual farms in rural and urban/industrial areas of the UK	CSL	108,000	To establish background concentrations of dioxins and PCBs in milk from such farms.
C02012	Survey for dioxins and PCBs in retail fruit and vegetables	CSL		To estimate contribution to dietary intake of dioxins and PCBs.
C02013	Survey for dioxins and PCBs in fish oil dietary supplements	CSL	37,176	Second repeat survey. To estimate intake of dioxins and PCBs by consumers of fish oil dietary supplements and establish time trends. Poster at Dioxins 2003. Batches of two products withdrawn from sale as a result of finding high levels of cadmium. Published June 2002.
C02014	Project number not used			
C02015	Mercury in imported fish and shellfish and UK farmed fish and their products	Uni Bristol	67,594	Mercury is known to accumulate in fish, which is a very important food group. This survey was used to inform the Agency's advice on fish consumption as well as EU negotiations. Published July 2003.

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02016	Survey of lead and cadmium in foods not included in the draft EC Regulation on lead and cadmium in food	CCFRA	30,966	Background data for EC negotiations. To generate current data on these foods and ensure that dietary intakes not significant. (02/08/99 - 31/03/00)
C02017	UK Monitoring Programme for Nitrate in Lettuce and Spinach	Transferred to other programmes		
C02018	Dioxins and PCB's in milk products	CSL	Not Commissioned	To estimate contribution to dietary intake of dioxins and PCBs.
C02019	Nitrate and nitrite concentrations in 1999 Total Diet Study samples	Transferred to other programmes		
C02020	Tin in canned fruit and vegetable products	CCFRA	22,096	Continuation of on-going concern and to inform EU negotiations (01/12/00 – 31/08/01) Published August 2002.
C02021	Inorganic and total arsenic in fish and shellfish	CSL	34,556	See C02045
C02022	Inorganic and total arsenic in 1999 TDS samples	CSL	29,779	First survey of arsenic to include speciation. Survey identified food groups with high inorganic arsenic content. Data submitted to JECFA. (01/10/00 - 30/10/01) Published January 2004.
C02023	A Multi-element survey of infant foods	CSL	16,500	Routine survey of high profile food type. (01/10/00 – 31/12/01) Published September 2003.
C02024	Ecotoxicological advice from CLS on IDCAFS	CSL	Not Full Project	
C02025	CLS advice on organic/inorganic contam.	CSL	Not Full Project	
C02026	Follow up work to the survey for dioxins and PCBs in infant formulae	CSL		Follow up work to C02009 in respect of two products that previously gave rise to elevated dietary intakes of dioxins and PCBs. (01/12/00 - 31/03/00) Published March 2004
C02027	Follow up work to the survey for dioxins and PCBs in shellfish (crabs)	CSL	2,300	Follow up work to C02008. Crab had been estimated to give rise to elevated dietary intakes of dioxins and PCBs. (01/02/01 - 31/05/01) Published January 2002

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02028	Measurement of metals and other elements in samples from the 2000 UK total diet study	LGC	28,680	Continuation of routine monitoring of inorganic elements in the UK diet. The information informs Agency advice, is used in risk assessments and is referred to by scientists World-wide in food science and toxicological research. Data submitted to JECFA. (15/07/01 - 31/11/02) Published March 2004.
C02029	Survey for PAHs in 2000 TDS samples	CSL	9,160	To allow up-to-date dietary intakes of PAHs from the whole diet to be estimated. 19th International symposium on PAHs. The COT concluded that dietary intakes had probably fallen since the previous survey in 1979. Average exposures have been used to assess significance of exposure from foods found to contain high levels of BaP (e.g. batch of Vit E oil) (17/01/02 - 10/06/02) Published December 2002.
C02030	Survey of phthalate esters in infant formulae	CSL	Not Commissioned	Second repeat survey of infant formulae element of C02006. To check that concentrations of phthalates were still low.
C02031	Survey of samples from the 2001 Total Diet Study for dioxins and dioxin-like PCBs.	CSL	24,318	To estimate intakes of dioxins and PCBs from the whole diet, and to allow time trends to be established. Poster at Dioxins 2004. (01/01/03-11/04/03) Published July 2003
C02032	Survey for Brominated Fire Retardants (BFRs) in samples from the 2001 Total Diet Study and trout and eels from the Skerne Tees River.	CEFAS – Burnham	18,411	To estimate intakes of BFRs from the whole diet. Scoping survey for any more detailed work. Risk assessment for products likely to be subject to highest contamination. (01/09/02 - 31/01/03) Published April 2004
C02033*	Sampling plan and purchase of 100 samples for the survey of dioxins and PCBs in baby foods	Ventress Technical Services	8,503	See C02035.
C02034*	Sampling plan and purchase of samples for the survey of dioxins and PCBs in wild and farmed fish.	Uni Bristol	59,922	See C02036.
C02035	Congener-specific analysis of dioxins and PCBs in babyfoods.	CSL	92,500	To estimate dietary intakes of dioxins and PCBs via baby foods. Data to be used in EC negotiations. (14/03/03 - 28/11/03) Published July 2004

* Sampling project only (shaded rows)

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02036	Congener-specific analysis of dioxins and PCBs in wild and farmed fish	CSL	68,234	To estimate dietary intakes of dioxins and PCBs via fish and shellfish. To establish the range of concentrations in certain species. Concentrations in herring only reported to the EU to inform negotiations on Maximum Limits and Action Levels. (01/07/03 – 30/11/04)
C02037	Project number not used			
C02038	Survey for dioxins and PCBs in infant formulae 2003	Leatherhead Food International	23,764	See C02039.
C02039	Survey for dioxins and PCBs in infant formulae 2003 – analysis	Eurofins Scientific	66,500	Repeat of infant formulae element of C02009. To estimate dietary intakes of dioxins and PCBs by formula-fed infants and provide time trend data in addition to following up high results from previous survey. The results showed that intakes had fallen since the previous survey. Attracted interest in Brussels & some Member States who are considering imposing regulatory limits. (01/03/03 - 20/06/03) Published March 2004
C02040*	Dioxins and PCBs in food - EU monitoring – sampling	Casella GMSS	14,795	See C02041.
C02041	Dioxins and PCBs in food - EU monitoring – analysis 2003	Eurofins Scientific	67,165	To check that UK produced foods comply with the EU Maximum Limits and Action Levels of dioxins as well as compliance with EU monitoring recommendations. The results were published on the Agency's web site and submitted to the EU for inclusion in their database on which future limits, including PCBs, will be based. Published May 2004.
C02042	Survey of total and inorganic arsenic in seaweed	CSL	11,200	Reports of high levels from Canada in seaweed prompted this investigation. Results showed that one type, hijiki, contained elevated levels and consumer advice was issued. Data submitted to JECFA. Published July 2004
C02043	Survey of metals and other elements in allotment produce	Uni Bristol	27,494	To provide data to support advice issued under the contaminated land regime (01/02/04 - 30/04/05)
C02044	Survey of organotins in shellfish	CEFAS – Lowestoft	10,000	To inform EU negotiations on a possible contaminant concern (01/02/04 - 31/12/04)

* Sampling project only (shaded rows)

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02045	Survey of total and inorganic arsenic in fish and shellfish	CSL		Following survey of arsenic in TDS, which identified fish as the largest contribution to As intakes. (01/03/04 - 30/04/05)
C02046	Sampling Survey of Dietary Supplements and Fish Oil Supplements	Ventress Technical Services		See C02050 and C02051
C02047	Measurements of the concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) in samples of infant formulae and baby foods	CSL		To establish background concentrations of PAHs in these products, to inform development of forthcoming EU Maximum Limits. (01/07/04 - 14/01/05)
C02048	Survey of Polycyclic Aromatic Hydrocarbons (PAHs) in Dietary Supplements	CSL		Dietary supplements are becoming an ever more popular fad and it is important for the agency to keep abreast of these trends. A number of Rapid Alerts have been issued for PAH contamination of dietary supplements. Data required for possible setting of EU limits. (01/09/04 - 28/02/05)
C02049	Survey of cadmium, lead and mercury in shellfish	LGC		Survey of a known contaminant concern, the results of which may also be used in EU negotiations. (20/08/04 - 31/12/04)
C02050	Survey of metals and other elements in dietary supplements	LGC		Dietary supplements are becoming ever more popular and it is important for the agency to keep abreast of these trends. Data required for possible EC negotiations (lead). (20/09/04 - 31/01/05)
C02051	Survey of mercury in fish oil dietary supplements	LGC		Following concerns regarding mercury in fish, this survey has been commissioned to inform enquiries from consumers. (10/09/04 - 17/12/04)
C02052	Analysis of samples of farmed and wild fish and shellfish for brominated flame retardants (BFRs), brominated dioxins and polybrominated biphenyls (PBBs)	CSL		To estimate dietary intakes of BFRs, brominated dioxins and PBBs from the whole diet. EFSA has concluded that brominated dioxins and PBBs are likely to exhibit dioxin-like toxicity. EFSA and DG SANCO have requested data on food occurrence be collected. (01/09/04 - 04/02/05)
C02053*	A national retail sampling plan for purchase of representative food samples for the analysis of dioxins	CSL	32,676	See C02060

* Sampling project only (shaded rows)

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
C02054*	A national retail sampling plan and purchase of processed fish	Ventress Technical Services	16,139	See C02058 and C02061
C02055	A national retail sampling plan and purchase of offal products	Ventress Technical Services	15,020	See C02059 and C02062
C02056	Analysis of BFRs, brominated dioxins and PBBs in 2003 TDS samples	CSL		There have been a number of reports of BFRs being found in fish and other foods. EFSA has concluded that brominated dioxins and some PBBs are likely to exhibit dioxin-like toxicity and that exposure data should be collected, and SANCO has also expressed interest in the chemicals. The survey will allow UK dietary intakes of the brominated chemicals to be estimated. (01/11/04 - 31/03/05)
C02057	Survey for Perfluorooctane Sulphonate (PFOS) and Perfluorooctanoic Acid (PFOA) in 2003 Total Diet Study Samples	CSL		A recent assessment has found that these chemicals are accumulating in the environment and may be present in food. This survey will allow an estimate of UK dietary exposure. EFSA and DG SANCO have requested data and the UK is among the first Member States to undertake work on this group of chemicals. (17/01/05 - 31/03/05)
C02058	Survey of metals and other elements in processed fish products	Ecochem	9,300	Following surveys of contaminants in whole fish, processed fish samples will be analysed for metals and other elements. (June 2005 – December 2005)
C02059	Survey of metals and other elements in offal and offal products	CSL	28,600	Samples collected in this survey will be analysed for metals and other elements and will provide the Agency with up to date information on a food group known to accumulate contaminants. (June 2005 - December 2005)
C02060	Survey of representative food samples for dioxins and PCB's	CSL	179,025	This survey is being carried out under EC Recommendation to check that UK produced foods comply with current dioxins and forthcoming dioxin-like PCBs limits, and to inform negotiations on a review of the limits for dioxins and dioxin-like PCBs. (01/02/05 - 31-03/06)
C02061	Survey of dioxins and PCB's in processed fish and fish products	CSL	111,177	This project will provide the FSA with accurate and reliable data on dioxin and PCB levels in processed fish and fish products within the UK, and complement an existing survey on wild and farmed

* Sampling project only (shaded rows)

Project Code	Full Project Title	Organisation	Total cost (£)	Justification for project and outcome (project start / finish date shown in brackets)
				fish and shellfish. The data will allow a review of current product levels of these contaminants in relation to the EC's maximum and action limits. (July 2005 – December 2005)
C02062	Survey of dioxins and PCB's in offal products	CSL	111,177	Some offals, particularly liver, are recognised repositories within the bodies of most animal species, of a range of organohalogen contaminants including dioxins and PCBs. However there is little data from structured studies, that allow establishment, or review, of current background levels of these contaminants in offal. This survey offers a comprehensive study of dioxin and PCB levels in different types of offal and offal products to fulfil the above requirement. (June – December 2005)

APPENDIX C: CRITERIA FOR ASSESSING INDIVIDUAL RESEARCH PROJECTS

1. **Quality of the science:** Was the scientific approach of the project appropriate to the stated objective and delivered to a high standard?
2. **Relevance to policy needs:** Did the results address the policy needs set out in the ROAME A particularly section 8?
3. **Utility of the results:** Were the project results presented in a way which addressed FSA policy needs? If so, what was the significance of the contribution?
4. **Dissemination of the results:** Were the results effectively disseminated through either the scientific press or other ways? Could this have been more effective?
5. **Value for money:** Was the cost of the project reasonable for the value of the results generated?
6. **Any other issues;** Did the results raise any other significant issues?

Criteria for assessing surveys

1. **Scope of survey:** Recognising that funds are limited, was the range and number of samples appropriate for the stated aim of the survey?
2. **Procedure for collecting and analysing samples:** Was the method of analysis used by the contractor “fit for purpose”?
3. **Reporting of the survey results:** Was the Information Sheet and other information produced by the FSA appropriate for the needs of the interested parties (e.g. consumers, food industry, enforcement authorities, etc)? How could this be improved in the future?

Criteria for assessing the collective value of the projects and future research needs

1. **Relevance to policy needs:** Did the projects collectively address all the issues policy needs sets out in the ROAME A at section 7? What issues are likely to influence policy needs in the future
2. **Scientific objectives:** Did the projects collectively achieve the overall scientific of the programme set out in the ROAME A? What key scientific objectives would you set for a future research programme?
3. **Opportunities for collaboration:** Would the programme have benefited from greater collaboration with other funders? If so, how could this be achieved in the future?
4. **Dissemination of results:** Were the results generated by the programme adequately disseminated to interested parties? How could this be improved?