

Requirements for food R&D;, 1994 / MAFF.

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Food Safety Directorate

**MAFF Food Research
Requirements
Document
1994-95**

October 1993

Ministry of Agriculture, Fisheries and Food



22501848908

FOREWORD

1. The MAFF Food Strategy & Requirements Document, published in October 1992, provided information on the strategic aims which the principal food R & D programmes were designed to address, and emphasized some of the criteria to be used in selecting proposals for funding. In addition, for each of the principal research programmes, the specific research requirements for 1993 were indicated and research contractors invited to bid for the resources available for re-investment.

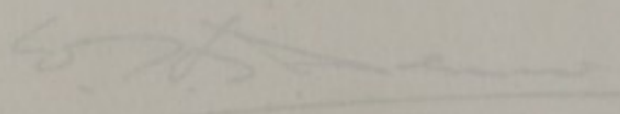
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MAFF

REQUIREMENTS FOR FOOD R & D

3. At present the strategic objectives of the food research programmes are being re-evaluated by the MAFF food policy customers for R&D. It is hoped to publish any revised strategy as soon as this evaluation is complete. Any revised strategy will form the basis for issuing a further set of research requirements for the 1995/96 financial year.

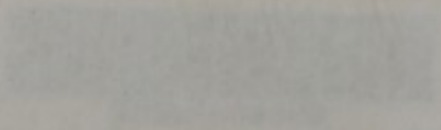
1994


DR W H B DENNER
CHIEF SCIENTIST (FOOD)

MAF

REQUIREMENTS FOR FOOD & D

1991



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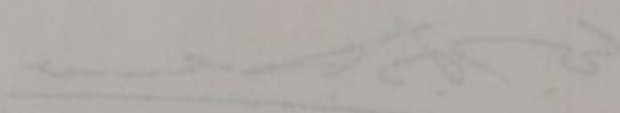


DR W H B DENNER
CHIEF SCIENTIST (FOOD)

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 DR W. H. DRENTH
 (HEAD SCIENTIST (FOOD))

MAFF REQUIREMENTS FOR FOOD R&D

CONTENTS

	<u>Page</u>
INTRODUCTION	1
SUBMISSION OF PROPOSALS	1
SELECTION CRITERIA	2
MONITORING OF PROGRESS	2
RESEARCH REQUIREMENTS 94/95	3
MINIM PP1:08 FOOD QUALITY AND APPLIED NUTRITION	
Introduction	3
Objectives	3
Antioxidants in Food	4
Dietary Lipids	4
Measurement of Optimal Nutrient Status	5
Role of Complex Carbohydrates in the Diet	6
Food Acceptability and Choice	7
Food Composition and Dietary Surveys	7
Food Authenticity	8
MINIM 001:01 FOOD SAFETY	
Introduction	9
Chemical Contaminants from Food Production	9
Inorganic Contaminants	9
Organic Environmental Contaminants	10
Chemical Contaminants from Food Contact Materials	10
Natural Constituents of Food	14
Risk Assessment	16
Risk Management	19
Food Irradiation	20
Food Additives	21
Pathogenic Micro-Organisms	22
MINIM 001:07 RADIOLOGICAL PROTECTION	
Introduction	24
Assessment of the Effects of Radioactive Discharges	25
Response to Emergencies Involving Radioactivity	26

MAYT REQUIREMENTS RESEARCH CONTENTS

	<u>Page</u>
MINIM CE2:10 FOOD & DRINK MANUFACTURING AND DISTRIBUTION INDUSTRIES RESEARCH REQUIREMENTS	
LINK Initiatives	27
Advanced and Hygienic Food Processing	28
EUREKA	28
Teaching Company Scheme	29
Technology Transfer	29
MINIM 001:08 FOOD QUALITY AND APPLIED NUTRITION	
Introduction	3
Objectives	3
Antioxidants in Food	4
Dietary Lipids	4
Measurement of Oxidant Potential Status	5
Role of Complex Carbohydrates in the Diet	6
Food Acceptability and Choice	7
Food Composition and Dietary Surveys	7
Food Authenticity	8
MINIM 001:01 FOOD SAFETY	
Introduction	9
Chemical Contaminants from Food Production	9
Inorganic Contaminants	9
Organic Environmental Contaminants	10
Chemical Contaminants from Food Contact Materials	10
Natural Constituents of Food	14
Risk Assessment	16
Risk Management	19
Food Irradiation	20
Food Additives	21
Pathogenic Micro-Organisms	22
MINIM 001:07 RADIOLOGICAL PROTECTION	
Introduction	24
Assessment of the Effects of Radioactive Discharges	25
Response to Emergencies Involving Radioactivity	26

INTRODUCTION

1. The principal research requirements of the Food Group of MAFF for the 1994 financial year are defined according to the existing research programmes, as well as for new programmes whose rationale were published in the 'MAFF Food Strategy and Requirements Document. 1993/95'. Copies of this document are available on request from the address given in paragraph 3. The responsibility for research in the areas of pesticides and veterinary residues, currently held by Food Science Division, will be transferred to the Pesticides Safety Directorate and Veterinary Medicines Directorate respectively on 1 April 1994. Any proposals for research in these areas should be addressed to Dr J E King (pesticides) Tel: 071 238 5303 and Dr K J MacOwan (veterinary medicines) Tel: 071 238 5506.

SUBMISSION OF PROPOSALS

2. All potential contractors are asked to submit proposals which detail the scientific objectives of the project and the experimental approaches envisaged. An estimate of the cost and timescale of the project should be given. The project must fall within the scientific objectives of the programmes listed. A contact person is identified in this document who will be able to assist contractors with any questions they may have concerning the programme in question.

3. The principal contact point for the submission of the application is:

Scientific Liaison Officer (Food)
Chief Scientist's Group (Food)
Ministry of Agriculture Fisheries and Food
Room 211
Nobel House
17 Smith Square
London
SW1P 3JR

Tel: 071 238 5537

4. **All applications must reach the Chief Scientist's Group by 6 December 1993.** The Chief Scientist's Group hope to be able to inform applicants of the outcome of their application by 28 February 1994.

SELECTION CRITERIA

5. All proposals for research are critically evaluated by the Chief Scientist's Group and policy customers for the following criteria:

- Relevance to the policy customer's requirements;
- Overall scientific quality and value-for-money (in conjunction with external referees where necessary);
- Where the research has the potential to, or is intended to, lead to a technological development, the proposal has the support of a potential industrial partner or user;
- Whether the approach proposed is the most feasible;
- Likelihood of achieving the stated objectives within the proposed timeframe;
- Research not already supported elsewhere.

6. In addition, for much of the work in food safety and applied nutrition, it will be important to demonstrate that there is collaboration between scientists covering the multi-disciplinary skills which are frequently necessary to achieve effective advances. This collaboration often crosses the traditional boundaries of Research Councils and University Departments.

7. Contractors will be informed of the reasons why a proposal could not be supported but it must be appreciated that limited resources preclude any detailed discussions on the reasons for rejection.

MONITORING OF PROGRESS

8. All research commissioned by MAFF is monitored according to the milestones and key measures of achievement laid down in the Contract. For each strategic research programme, MAFF has appointed, or is in the process of appointing, Programme Managers who are responsible for managing specific research programmes. In particular they:

- Encourage co-operation and interchange of ideas amongst the contractors contributing to the programme;
- Regularly monitor progress by individual contractors;
- Inform relevant policy divisions within MAFF of any developments and advice on the need to set new milestones or goals as the research progresses;
- Hold regular seminars between contractors, MAFF officials and management committees where appropriate.

RESEARCH REQUIREMENTS 1994/95

9. The most important requirements which policy divisions have indicated will be necessary to implement their aims are defined in accordance with the Ministry's major management and planning topics [MINIM programmes, Ministerial Information in MAFF].

MINIM PP1:08 FOOD QUALITY AND APPLIED NUTRITION

INTRODUCTION

10. At present the research portfolio consists of eight sub-programmes, six of which are concerned with nutritional issues and one programme on food acceptability and choice which has a major input to meeting nutritional goals. Food quality issues are targeted on consumer protection through support for a programme on food authenticity and adulteration.

OBJECTIVES

11. Although the Ministry has always been concerned with the role of the diet in relation to health, two separate (but linked) recent Government initiatives have reinforced the foundations of the Ministry's nutrition research programme. The first is the Department of Health's Committee on Medical Aspects of Food Policy (COMA) which sets new dietary reference values (DRVs) for the UK population (Dietary Reference Values for Food and Nutrients for the United Kingdom, DH 1991) but gave clear indications where present scientific knowledge was insufficient to set DRVs with great confidence. The second is the Government's White Paper, *The Health of the Nation*, which recognises that the nation's eating and drinking habits make a contribution to many aspects of health and ill-health. In order to reduce the prevalence of premature death and ill-health due to vascular disease, the White Paper sets two diet and nutrition targets. These are to reduce the percentage of food energy derived from total fat by at least 12% (from about 40% in 1990 to no more than 35% by 2005), and from saturated fat by at least 35% (from 17% in 1990 to no more than 11% by 2005). If these targets are to be met, the implications are that the contribution of complex carbohydrates will have to increase.

12. In order to meet these targets information is required to support the measures proposed both in understanding the effects of specific dietary lipids, and the role that complex carbohydrates can play in the provision of positive health benefits. Although anti-oxidants are not specifically mentioned in the *Health of the Nation*, their intake could be affected by a reduction in fat intake and present levels of intake may not be optimal. The programme on the measurement of optical nutrient status is designed to assist setting certain specific DRV's with greater confidence, particularly those which play a role in oxidation processes *in vivo* and thereby give further support to the overall emphasis of the nutritional programmes in understanding the role that oxidative processes may play in the initiation of adverse effects.

13. Wherever possible research proposals should involve *in vivo* experimentation rather than *in vitro*, and focus on effects in man rather than in animal models.

ANTIOXIDANTS IN FOOD

SPECIFIC RESEARCH REQUIREMENTS

14. There are no plans to invite further work in this area in the coming year.

DIETARY LIPIDS

Metabolic Effects of Triglyceride Structure

15. There are a number of ongoing projects in the dietary lipids programme which are investigating the physiological effects of individual fatty acids and fats of differing fatty acid composition. However, people do not ingest mixtures of free fatty acids but rather mixtures of triglycerides. The three positions on glycerol are not metabolically equivalent and randomisation of the fatty acids in butter abolishes its hypercholesterolaemic effect. This type of experiment suggests that triglyceride structure is at least as important as triglyceride fatty acid composition in determining metabolic effects but information in this area is sparse.

- **Proposals are sought on the effects of differences in structure on triglyceride absorption, metabolism, transport and tissue uptake in man.**

Dietary Lipids and Haemostasis

16. Haemostatic mechanisms in humans appear to respond much quicker to dietary manipulations than atherosclerotic mechanisms. Since Health of the Nation targets are to be met by the year 2005, it would seem more sensible to attempt to meet these targets using dietary interventions which work via haemostatic mechanisms. This area of research has been neglected in favour of effects of nutrition on atherosclerotic mechanisms.

- **Studies on the effects of and mechanism of action of individual saturated, monounsaturated and polyunsaturated fatty acids and fats with different fatty acid compositions on cells and tissues involved in the process of thrombosis, fibrinolysis and other haemostatic mechanisms in man are sought.**

Dietary Fatty Acids and Insulin Sensitivity

17. Insulin sensitivity is associated with good health. Insulin resistant states such as obesity and non insulin dependent diabetes are associated with hypertension, hyperglycaemia and hypertriglyceridaemia, all of which are risk factors for coronary heart disease. Loss of body weight which improves insulin sensitivity lowers blood pressure, blood glucose and blood triglycerides. There are indications in the literature that certain dietary fatty acids can improve insulin sensitivity.

- **Proposals which focus on the effects of individual saturated, monounsaturated and polyunsaturated fatty acids and fats with different fatty acid composition on insulin sensitivity in man are sought.**

Polyunsaturated Fatty Acid Intake and Antioxidants

18. Attempts to lower the level of saturates in the diet could result in an increase in intake of polyunsaturates. While there may be beneficial effects associated with this strategy it is also possible that this could promote oxidative damage.

- **Information is needed on whether increasing the intake of polyunsaturated fatty acids promotes oxidative damage and, if so, whether simultaneous ingestion of antioxidant nutrients reduces the effect.**

Total Fat Intake and the Absorption of Fat Soluble Vitamins

19. Dietary recommendations advise reductions in the consumption of total fat. It is possible that this could also reduce the absorption of fat soluble vitamins.

- **Information is needed on whether a decrease in the intake of total fat could influence the absorption of fat soluble vitamins, and at what levels of nutrients this effect becomes significant.**

FURTHER INFORMATION

20. Dr J C Stanley of Nutrition Branch II of Food Science Division II (Tel: 071 238 6010, Fax: 071 238 5597) can advise further on any specific issues prospective contractors may wish to raise. Dr Stanley is the Programme Manager for this work.

MEASUREMENTS OF OPTIMAL NUTRIENT STATUS

Iron and Copper as Pro-Oxidants

21. It is well established that iron and copper catalyse free radical mediated damage *in vitro*. However, there is little information about the significance of this process *in vivo*. As a result the question of whether under certain conditions iron or copper supplements could be dangerous has not been resolved. Such pro-oxidant effects would presumably be dose dependent and may depend on the dietary form of iron or copper.

- **Information is required on the significance of iron and copper as pro-oxidants *in vivo* in man. It is important to know whether different dietary forms of iron and copper have different pro-oxidant capacities, and if so, at what levels of intake.**

Functional Effects and Dietary Forms of Selenium

22. Selenium is an integral part of a number of proteins, two of which, glutathione peroxidase and type I 5'-iodothyronine deiodinase, have been identified. As pointed out in the COMA Report on DRVs, there is little scientific data upon which to base recommendations for selenium intakes. Information on functional effects of selenium is lacking and in addition dietary forms of selenium remain to be characterised.

- **Studies are invited on the functional effects of selenium and its speciation.**

Carotenoid Metabolism

23. Carotenoids such as β -carotene, γ -carotene, lycopene, lutein and β -cryptoxanthine are generally thought to have antioxidant properties. In order to exert their protective effects they must reach the site of free radical mediated damage. The study of carotenoid absorption, metabolism, transport and tissue uptake is in its infancy.

- **Proposals which will study carotenoid absorption, metabolism, transport and tissue uptake are invited.**

FURTHER INFORMATION

24. Dr J C Stanley of Nutrition Branch II of Food Science Division II (Tel: 071 238 6010, Fax: 071 238 5597) can advise further on any specific issues prospective contractors may wish to raise.

ROLE OF COMPLEX CARBOHYDRATES IN THE DIET

25. The Government's White Paper, Health of the Nation, recommends that intakes of total and saturated fat as a percentage of energy should be decreased. Though not spelt out in the White Paper, the COMA Report on Dietary Reference Values (DRVs) recommends that this should be accomplished by increasing intakes of complex carbohydrates. Complex carbohydrates may have effects beneficial to health independent of their role in lowering saturated fat intakes. It is often suggested that complex carbohydrates improve insulin sensitivity. This would be expected to improve health since increased insulin sensitivity is associated with lower blood pressure, blood triglycerides and blood glucose. Adequate methods for the measurement of insulin sensitivity *in vivo* in man are now available.

- **Proposals to study the effects of different types and levels of intake of complex carbohydrates on insulin sensitivity *in vivo* in man are sought.**

FURTHER INFORMATION

26. Dr J C Stanley of Nutrition Branch II of Food Science Division II (Tel: 071 238 6010, Fax: 071 238 5597) can advise further on any specific issues prospective contractors may wish to raise. Dr Conning (Tel: 071 404 6504, Fax: 071 404 6747) is the Programme Manager for this work.

FOOD ACCEPTABILITY AND CHOICE

27. In order to better inform the consumers of food and to assist in promoting healthy nutritional goals, research is required which will investigate influences on food choice through the following research priorities:

- **Studies on the factors which operate against the greater consumption of fruit and vegetables, particularly in some parts of the UK;**
- **The influence of presentation of labelling information on consumer use of that information; whether a standardised format would have beneficial effects;**
- **Strategies for the effective communication of recommended dietary changes and hence the achievement of those changes by the population in general;**
- **Constraints on free choice and the maintenance of good diets that may be imposed by limited resources;**
- **Consumer attitudes to the choice of "health foods" and dietary supplements and the effects that this has on the achievement of recommended dietary goals;**
- **The role of fat and other food components in satiety.**

FURTHER INFORMATION

28. Mr R W Taplin of Consumer Protection Division (Tel: 071 238 5700; Fax: 071 238 6763) or Dr N J Jardine, PO Box 204, York, YO1 1XY (Tel: 0904 603114 Fax: 0904 620439) can advise further on any specific issues contractors may wish to raise. Dr Jardine is the Programme Manager for this work.

FOOD COMPOSITION AND DIETARY SURVEYS

FOOD COMPOSITION

SPECIFIC RESEARCH REQUIREMENTS

29. Research proposals are invited on:

- **Methods of analysis for folate, carotenoids, vitamin D metabolites, oligosaccharides and dietary fibre;**
- **The bioavailability of carotenoids, iron, zinc, calcium and selenium, all in the context of the diet as a whole;**
- **The biological activity of carotenoids, folates, tocopherols, selenium and vitamin D metabolites.**

DIETARY SURVEYS

SPECIFIC RESEARCH REQUIREMENTS

30. Research proposals are invited on improving survey methodology, particularly in the use of biomarkers.

FURTHER INFORMATION

31. Dr David Buss of Nutrition Branch I of Food Science Division II (Tel: 071 238 5773, Fax: 071 238 5597) can advise further on any specific issues contractors may wish to raise. Dr Buss is the Programme Manager for this work.

FOOD AUTHENTICITY

32. Selling food which is not as it is described misleads and can defraud consumers. It is therefore necessary, in the interests of fair trading and giving the consumer good value for money, that the consumer is protected from such practices. Misdescription can take many forms, from the addition of water or cheaper raw materials to the wrong quantitative declaration of ingredients. It is important therefore to develop analytical methods which permit Government, enforcement authorities and industry to have the ways and means to ensure that products are correctly described and labelled.

SPECIFIC RESEARCH REQUIREMENTS

33. Further research is required in the following areas:

- To identify markers which characterise the presence or origin of food or ingredients. These markers could be at a fundamental level such as stable isotopic ratio of components or DNA and RNA sequences. They could also be at a biochemical level using products of gene expression such as specific proteins for analysis by electrophoresis, immunoassay or spectroscopic methods;
- To develop techniques which may not distinguish individual components but look at the physico-chemical behaviour of the whole food as a way of characterising it, such as visco-elastic properties, NIR;
- To develop an understanding of the variability of the marker due to variety or species difference, climate, origin, processing and other factors. Such investigation would entail the collection of a range of authentic samples to form a data-base, and the validation of developed methodologies through rigorous and collaborative testing;
- To refine or develop methodology for quantitatively identifying ingredients or foods in compound foods;
- To develop or apply novel techniques to authenticity problems.

FURTHER INFORMATION

34. Dr Mark Woolfe of Food Composition Branch of Food Science Division (Tel: 071 238 6168; Fax: 071 238 6591) can advise further on any specific issues prospective contractors may wish to raise. A Programme Manager for this work is in the process of being appointed.

MINIM PP1:01 FOOD SAFETY

INTRODUCTION

35. The objective of the Government's policy on food safety is that food should be safe for general consumption. This objective requires the identification, surveillance and evaluation of potential risks and benefits of individual chemicals in the diet be they contaminants, additives or natural constituents.

CHEMICAL CONTAMINANTS FROM FOOD PRODUCTION

OBJECTIVES

36. Many inorganic and organic chemicals have the potential to enter the food chain. For those of toxicological concern, it is essential to generate sufficient data on their presence in food to assess whether these concentrations are likely to give rise to intakes which are a risk to consumers. It is also important to consider the pathways by which inorganic chemicals move into and through the food chain, the chemical form in which they exist in food and the absorption and excretion of these chemicals by humans. The core objectives of the Working Parties on Inorganic Contaminants and Organic Environmental Contaminants in Food are to ensure that contaminants in food do not prejudice food safety. This is achieved by generating surveillance data which enable the determination of the extent of contamination of the food supply. However, interpretation of this surveillance data is often difficult and more specific research is needed to strengthen the scientific basis for risk assessment.

INORGANIC CONTAMINANTS

SPECIFIC RESEARCH REQUIREMENTS

37. Further research is required in the following areas:

Transfer of Cadmium, Arsenic and Mercury from Feedingstuffs and Environmental Sources into Meat, Milk and other Foods of Animal Origin

38. These elements may enter the food chain at different points in the food production process since they may be present as contaminants in, for example, soil, fertilisers and feedingstuffs. Information is required on their uptake by plants and/or food animals as appropriate. Research based on the use of mathematical models to investigate the transfer through the food chain is of particular interest.

The Speciation of Lead, Cadmium, Arsenic and Mercury in Soils, Foods and Animal Tissues used for Food

39. The toxicity of a metal depends on its chemical form - for example, organoarsenic species are generally less toxic than the inorganic forms of this element. However, in the case of mercury it is the organic (methylmercury) form that is of most concern. Research is required on the speciation of lead, cadmium, arsenic and mercury at all stages of the food chain and their accumulation in crops, food and animal tissues.

Research on the Factors which Affect Uptake by the Gut of Elements from Food by Adults and Infants, the Priority Element being Cadmium

40. Ingestion of food is the major route by which inorganic contaminants can enter the body. The average absorption of lead from food in an adult gut is generally assumed to be around 10%, while the average figure for cadmium is around 5%. However, the degree of absorption of both metals can vary widely depending on certain factors such as physical and chemical form of the ingested metal and degree of fasting. More knowledge is required of these and other factors for normal adults and susceptible groups including infants.

Factors Affecting the Exposure of Special Risk Groups such as Children and Pregnant Women to Cadmium, Arsenic and Mercury

41. There is concern over exposure of the developing foetus and young children to inorganic chemicals. Low level exposure to lead has received much attention in recent years but cadmium, arsenic and mercury are toxic elements which can also accumulate in man, particularly through the diet. Further research is needed to investigate factors affecting exposure of these groups particularly through the use of biomarkers.

Factors Affecting the Uptake and Retention of Nitrate by Growing Food Crops

42. The EC Commission is likely to propose statutory limits on nitrate concentrations in certain vegetables including lettuce. Nitrate concentrations in crops are subject to considerable variation and factors affecting nitrate uptake are known to be complex and include season, light intensity, plant variety, fertiliser application and length of storage. The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment has recommended that levels of nitrate in food be reduced as far as is reasonably practicable. Further work is needed on procedures to reduce nitrate in food crops.

ORGANIC ENVIRONMENTAL CONTAMINANTS

Dioxins and Polychlorinated Biphenyls (PCBs) in Food Producing Animals

43. Emissions of these contaminants may enter the food chain by a number of routes. These include deposits on plants and soil ingested by grazing animals. Research is needed into the uptake, metabolism and excretion of these contaminants by such species.

Analytical Methods for Chlorinated Benzenes and Glycol Ethers

44. Sensitive and reproducible analytical methods need to be developed for the detection and quantification of these contaminants in food and the identification of point sources for potential contamination of the food supply by these compounds.

Hydrocarbons and Halocarbons in Foods

45. Hydrocarbons and halocarbons may enter the food chain by many different routes. Examples include spills from oil tankers contaminating fish or shellfish, or petrol vapour being absorbed by food sold in petrol stations. Accurate interpretation of the results of surveillance requires research on the factors affecting the extent of contamination of food by these compounds.

Organic Environmental Contaminants in Sludge-Amended Soils

46. The use of sewage sludge for agricultural purposes is set to increase in the UK with the phasing out of alternative methods of disposal. Sewage sludge contains several organic compounds which may have adverse effects on agriculture and compromise food safety. Further research is needed on the persistence of organic environmental contaminants in sludge-amended soils, their uptake by plants and grazing animals and their subsequent presence in food.

Modelling the Transmission of Contaminants through the Food Chain

47. Contaminants may enter the food chain at many points after their release from geochemical or industrial processes into the environment. The ways in which the nature or concentration of these contaminants change through the food chains are complex. Mathematical modelling offers the opportunity of determining the relative importance of these various pathways. The development of robust models will allow the results of surveillance of food commodities, soil, herbage and other matrices to be interrelated. The objectives of modelling are to minimise the resources required to assess the total exposure of consumers to organic and inorganic environmental contaminants via food or by other routes, and to establish maximum tolerable concentrations of contaminants in the environment on the basis of defined maximum tolerable concentrations in foodstuffs.

FURTHER INFORMATION

48. Dr Nigel Harrison of Food Science Division I (Tel: 071 238 6235, Fax: 071 238 5331) can advise on any specific issues contractors may wish to raise. A Programme Manager for this work is in the process of being appointed.

CHEMICAL CONTAMINANTS FROM FOOD CONTACT MATERIALS

49. The work described in this section is of interest to both industry and other governments in the EC. Projects that involve collaboration with industry or that are likely to receive EC support will be given the highest priority for funding. Joint funding could take place under the EUREKA Scheme (see paragraph 116), or under

the Agriculture and Agro-industries Research programme (AAIR) as part of the EC Framework Programme.

SPECIFIC RESEARCH REQUIREMENTS

50. Further research is required in the following areas:

Alternative Simulants for Migration Testing

51. EC Directive 82/711/EEC stipulates the use of a standard set of food simulants to test for chemical migration. However, several technical difficulties have come to light. In particular, it is difficult to use olive oil as a simulant for fatty foods particularly when analysing for small quantities of migrants. Work is needed to look at possible alternatives to olive oil as a simulant. It is important that a new simulant behaves like fatty foods in contact with a wide range of plastic materials.

Investigate the Stability of Positive List Substances in Food Simulants

52. To enforce the 'positive lists' in current and, possible, future EC Directives, it is important to establish the stability of relevant chemical migrants in food simulants in order to:

- To determine the extent of degradation of migrants to other chemical species in a given simulant; and
- Provide practical guidance, where there is degradation, on the appropriate simulants to use in testing for migration of specific monomers.

Migration of Plastics Additives from Packaging

53. The European Commission intends to review possible controls on plastics additives. Therefore, information is required to ensure that there is a firm scientific basis for setting Specific Migration Limits (SMLs) for these additives. The list of plastic additives is currently very long; a synoptic document summarising the current view of the toxicology of plastics additives is available (Synoptic Document; from Mr A Moore, R429e, MAFF, Ergon House, c/o Nobel House, 17 Smith Square, London, SW1P 3JR). A first step would be to produce a short list of substances that particularly need to be studied. This list would be based on known toxicology of plastics additives and experimental determination or mathematical modelling of their potential to migrate into foods under normal conditions of use.

Identification of Major Migrants from Paper and Board Used for Food Contact in the UK

54. Information is required to identify the major chemicals present in paper and board which are likely to migrate into food and to develop standard methods to test migration. Present evidence indicates that only a few substances need investigation. This list includes phthalates, epichlorohydrin, formaldehyde, stilbenes, ethyleneimine, acrylamide and styrene-maleic anhydride co-polymer. Work is needed to investigate

whether these substances are present in paper and board used in the packaging of food consumed in the UK, and, if they are present, to what extent they migrate into food under normal conditions of use.

Functional Barrier - Scientific Criteria for Determining Whether Functional Barriers Exist

55. The EC Commission is proposing that the concept of a 'functional barrier' may obviate the need for extensive testing of multi-layer packaging. Therefore it is important to establish whether the concept can be applied in practice. This will require investigation of a wide variety of products such as : composite packaging with a plastic layer that is in contact with food, and is backed with paper and board; varnishes and coatings on metal substrates; and other laminates including microwave susceptors. This investigation might be suitable for support through the EC's EUREKA scheme.

High Temperature Testing

56. Further experimental work is needed to complete the establishment of a set of conditions of time and temperature that will be the most appropriate in testing plastics for monomer migration, and which relate to actual conditions of usage for plastics used in food packaging. At present the EC conditions of testing are not appropriate for many food contact materials. Thus this work is essential for the effective implementation of EC controls.

Correlation between Specific Migration Limits (SMLs) and Compositional Limits (QMs)

57. Current EC controls on food contact plastics use both SMLs and QMs. An arbitrary factor of 100 is employed when multiplying a SML to produce a QM. The applicability of this needs investigation for each substance. Industry has a preference for QMs mainly because of the simplicity of testing in comparison with testing for SMLs. There may be a good case for adopting QMs in future regulations, but this would require the establishment of a clear relationship between SMLs and QMs for individual substances. A review of present evidence is needed first, followed by appropriate experimental work to test if a quantitative relationship can be established between QMs and SMLs for chemicals that migrate from packaging into food. This project might be suitable for support through the EUREKA scheme.

Development of New Techniques for Testing Chemical Migration from Food Contact Materials

58. With the very large number of chemicals currently used in food contact materials there is a need to develop new rapid analytical techniques for the simultaneous analysis of several chemical migrants. This is to ensure the effective use of resources to meet the above objectives.

FURTHER INFORMATION

59. The programme manager is Dr David Watson, of Unit C, Branch A, Food Science Division I, MAFF (Tel: 071 238 6250; Fax: 071 238 6951), to whom enquiries should be directed.

NATURAL CONSTITUENTS OF FOOD

60. Specific research requirements for the Natural Constituents of Food programme are outlined below.

SPECIFIC RESEARCH REQUIREMENTS

61. The Working Party on Naturally Occurring Toxicants in Food has drawn together available data on those classes of natural constituents of food for which there is evidence of toxicity. As a result of this exercise, a number of specific requirements has been determined.

Mycotoxins

62. Details of a number of requirements, and the background to these needs, are given in Food Surveillance Paper No. 36, Mycotoxins: Third Report. In addition, the following areas are of interest:

- **Determination of mycotoxins or their metabolites in human blood as a means of measuring exposure of the UK population [the work should include generation of data on the effects of storage and stability in biological fluids as necessary to validate the work]; and**
- **Determination of the formation of DNA or protein adducts with human material.**

Aquatic Biotoxins

63. MAFF has not previously commissioned work on blue-green (freshwater) algal toxins. However, a particular area of interest has now been identified:

- **Determination of the extent to which blue-green algal toxins accumulate in fish flesh and liver.**

64. MAFF already has an extensive programme of R & D for marine biotoxins (paralytic shellfish toxins and diarrhetic shellfish toxins). A number of projects are concerned with developing alternatives to the mouse bioassay which is currently used in surveillance work. However, work is hampered by the lack of pure samples of the component toxins for use as analytical standards and MAFF wishes to commission work:

- **To synthesise the major toxins involved (in UK waters) in paralytic shellfish poisoning in sufficient quantities for use as analytical standards.**

Inherent Natural Constituents

65. Interest in inherent natural constituents of food and their dietary significance continues to be high. A review of individual classes of natural toxicants by the expert advisory committees is underway and, until it is completed, opportunities for R and D on these specific toxicants is limited. However, the following areas of interest have been identified:

- **An investigation of the dietary significance of phytoestrogens in infant foods [the work should include determination of the levels of phytoestrogens in UK retail infant foods];**
- **Further investigation of the biological effects of dietary phytoestrogens in adults, including exploration of the possible effects on oestrogen receptors and mammary cell proliferation;**
- **An investigation of the mammalian absorption, distribution and metabolism of agaritine to determine whether it is likely to be transformed into a mutagenic species; and**
- **An investigation to determine which other components of *Agaricus bisporus* may be responsible for mutagenic and carcinogenic effects observed in laboratory animals.**

LONG TERM STRATEGIC REQUIREMENTS

66. Consumption of food involves ingestion of many hundreds of compounds that have no nutritive value but which may have biological effects. In the past, emphasis has been placed on those substances which may give rise to toxic effects. Whilst this area remains the subject of considerable research investment by MAFF, there is an increasing awareness that some of these non-nutritive compounds may have beneficial effects on human health. The Ministry has begun to fund work to look at the anti-oxidative effects of non-nutritive compounds in the diet. However, before it can expand its programme to include other protective effects, it needs:

- **An overview of the current state of knowledge of protective effects (excluding antioxidants) covering their identity and occurrence, mode of action and highlighting areas of future research.**

67. Natural constituents of food with potentially toxic effects on humans continue to be discovered and it seems likely that many more remain to be identified and characterised. Some work to develop screening tests for the identification of toxic factors in food extracts is already being funded by MAFF. To date, this effort has been directed primarily towards tests for genotoxicity and cytotoxicity. However, other toxic end points are also of concern. Work is required to:

- **Develop in vitro screening methods for foods or extracts of foods for the following end points (in order of priority). Human material should be used unless the experimental criteria dictates otherwise:**

hepatotoxins
 neurotoxins
 hormonal effects
 phototoxins

(Extraction procedures for foodstuffs should take into account the fact that some compounds may be fat soluble. In general, the procedures should not destroy or modify food components except where certain foodstuffs may not be eaten uncooked. Emphasis should be placed on evaluation and validation of the procedures).

68. In order to consider the health effects of whole foods rather than each constituent separately, work is needed to:

- **Apply the in vitro screening tests developed above (or others which are already available) to specific foods of interest (eg apples because of concerns about contamination by patulin) and compare these results with those obtained by toxicological testing of isolated toxicants.**

69. There is need for work using biomarkers in the investigation of natural constituents of food. In particular, work is needed to:

- **Determine for those toxicants which have already given evidence of genotoxic potential whether there is evidence of formation of potentially hazardous DNA or protein adducts in humans.**

FURTHER INFORMATION

70. Dr Julie Norman in Contaminants Branch B, Food Science Division I (Tel: 071 238 6198; Fax: 071 238 6591) or the Programme Manager, Dr David Conning (Tel: 071 404 6504; Fax: 071 404 6747) can advise further on any specific issues contractors may wish to raise.

RISK ASSESSMENT

71. Whilst it is the primary responsibility of industry to undertake safety evaluation of products intended for use in or on food, the framework within which the evaluation takes place is the responsibility of Government. There is therefore an important need to ensure that this framework is scientifically sound, that it takes account of the latest knowledge in the biological sciences, and that it is cost-effective. In addition there is a responsibility for the assessment of risks from natural toxins, contaminants and food chemical interactions which falls to Government. Conventional animal toxicological testing procedures require huge resources to evaluate any toxic effects and current risk assessment procedures are based on testing such compounds in isolation. Frequently doses which are well in excess of the levels likely to be present in the diet are needed

before any effects are observed in animals and major difficulties arise in assessing the potential risk at the levels that would be found in the diet. Even if these approaches were feasible sound judgements could not be made about the long-term health effects of such compounds present in food since the risk might be modulated by the presence of other factors whose potential contribution to decreasing the risk is not being addressed. Unlike the situation where compounds are intentionally added to food, and where there is an option not to permit them if the risks are judged to outweigh the benefits, such a policy applied to naturally occurring toxins, for example, could result in a severe economic impact with little measurable benefit. Risk assessment in this situation therefore needs to be approached from a different scientific perspective.

SPECIFIC RESEARCH REQUIREMENTS

Review of Current Animal-based Hazard Evaluation Techniques and Alternative Approaches which Provide a Closer Approximation to Human Systems

72. Current animal-based hazard evaluation techniques which are based on the very high doses necessary to produce effects in animal testing can result in toxic end-points induced by mechanisms which bear no relevance to the potential effects on man at intake levels likely to be encountered. These must therefore be reviewed to identify the need for alternative approaches which provide a closer approximation to human systems. Approaches which might be considered include the development of *in vitro* cell lines which maintain the functionality of those cells found in the whole organism.

Potential Utility of Biomarkers as a Measure of Dose and of Potential Toxic Effects

73. One approach to making more meaningful assessments of the risks associated with chemicals in food may be through the use of biomarkers. Research is needed to identify biomarkers of food chemical uptake and to support the interpretation of surveillance results. There is also a need to investigate the potential use of biomarkers which are related to the effects induced by food chemicals in humans under extreme but realistic conditions of exposure. DNA and haemoglobin adducts have been proposed as markers of genetic damage and their potential role in food risk assessment needs full evaluation. Other areas where appropriate biomarkers might prove practicable include liver enzyme induction, neurotoxicity, genetic susceptibility and interactions with specific target receptors.

Interactions between Toxins, Agonists and Protective Factors in the Diet and Techniques for the Assessment of Food-related Risks in the Context of the Diet as a Whole

74. A second area which warrants special attention is the role of other dietary constituents in influencing toxicity. While some compounds may act additively or synergistically with food chemicals there is evidence that many of the compounds naturally present in food, in particular the anti-oxidant vitamins, may have a protective influence. Also some food components may stimulate de-activation pathways. Studies are needed to investigate such interactions and to develop *in vitro* systems which can evaluate food chemicals in the presence of potential agonists and antagonists which are

also present in the diet and at the concentrations at which they would normally occur. This is an area where the use of biomarkers might also be important particularly in the assessment of the effects of oxidative stress and the role of free radical formation in the induction of toxic effects.

Existence of Genotoxic Thresholds for Carcinogens in Food and Methods for their Quantification

75. If a more quantitative approach to food chemical risk assessment is to become a reality then more information on the mechanisms of interactions between food chemicals is necessary, in particular those associated with genotoxicity. The possible existence of a threshold for carcinogenic events may be related to protective factors or to physiological events. The use of biomarkers may help to reveal such a threshold.

Evaluation and, where appropriate, Development of Computer-based Methods for Hazard Prioritisation and the Quantification of Risks

76. Effective prioritisation of chemical compounds for further evaluation requires a knowledge of their toxicological characteristics. For many compounds, particularly those which occur naturally, are adventitious contaminants or are the products of food chemical interactions, such data are lacking. There is however an enormous literature on chemical toxicology which might be incorporated into an information system. Toxic effects are often related to particular molecular sub-structures and an expert system might be used to identify such structures in new compounds. Research is also needed into molecular modelling techniques which aim to predict toxicity from molecular conformation. If such techniques were combined with an expert system approach then a very effective technique for identifying 'toxic alerts' and setting priorities for the risk assessment system, might be developed.

77. The application of risk assessment techniques to food safety issues is growing rapidly on a global scale. Quantitative risk assessment (QRA) techniques used in the US have already been evaluated and found to have limited value in the UK regulatory context. A scientifically valid method for making quantitative estimates of the risks associated with genotoxic carcinogens in food would provide valuable information and might be related to the use of biomarkers. There is therefore a need to continue monitoring developments elsewhere and to investigate techniques which are rationally based on known underlying biological mechanisms.

Review Methods for Estimating Intakes of Food Chemicals and Development of Improved Intakes Methodology

78. Whilst the estimation of intakes is relatively well developed in the UK there are still areas that need closer study. Making estimates that relate to acute or chronic effects, rarely consumed foods, the choice of cut-off to define upper level consumers and the identification of 'critical groups', such as those consuming ethnic diets, are areas which require particular attention.

FURTHER INFORMATION

79. Dr David Tennant in Risk Assessment and Management Strategies Branch of Food Science Division I (Tel. 071-238-6216; FAX 071-238-6233) can advise further on any specific issues contractors may wish to raise. A Programme Manager is in the process of being appointed.

RISK MANAGEMENT

80. It needs to be sensitive to the social context in which risk management decisions are applied if truly optimal policies are to be identified. At the moment there are no formal systems for taking account of costs, benefits, consumers' perceptions or novel policy approaches when evaluating the risks associated with food. There is a need to develop specific techniques and an overall framework so that food risk management policy is understandable, rational, credible, and acceptable to all sectors of society served by the system.

SPECIFIC RESEARCH REQUIREMENTS

Theoretical Approaches to the Development of Strategies for Balancing Risks, Costs and Benefits in Food Chemical Risk Management

81. Effective management of food-related risks relies upon a thorough understanding of the costs and consequences of the various options available. Cost- and risk-benefit analyses include many techniques which are well developed and applied in sectors where the costs and benefits are easy to identify and straightforward to evaluate. Food safety is a complex system where optimal decisions are based on a mixture of scientific, technical and social data. However classical economic theory might provide a framework for identifying and evaluating some of these factors. In particular, 'willingness to pay' studies may provide useful quantitative information about consumer's concerns and their priorities.

Alternative Approaches to the Setting of Regulatory Limits for Chemical Contaminants in Food

82. There are many fields where risk management can be applied, ranging from engineering to the provision of health services. There are therefore many tried and tested strategies in practice world-wide and it may be that some of these can be readily adapted for food safety applications. One area where alternative strategies are needed is food chemical contaminants where the setting of regulatory limits can penalise some producers, whilst having little impact on levels of intake by consumers in general. Less prescriptive approaches based in risk reduction strategies might provide more effective control whilst reducing the costs of compliance.

- To identify significant sources of influence upon groups of consumers' perceptions of food-related risks and to provide a multivariate statistical model of their interrelations;
- To model the relationships between food-related risk perceptions and

behaviour such as patterns of food purchase, preparation and consumption; and

- To evaluate the range of strategies or methods which may be used to monitor consumers' perceptions of specific food-related issues and to establish how these may be most effectively linked to appropriate statistical techniques for analysing change;

83. Consumer perceptions are of value in analysing policy options to ensure that the particular factors which concern consumers are properly and fully addressed. However, in order to do this effectively a clear understanding of these factors and the way that they operate is necessary. It is also important to know how perceptions and behaviour are interrelated so that analyses of behaviour patterns can help inform about the underlying perceptions. It will be also be necessary to develop techniques for gathering information about consumers' perceptions of specific issues on a regular basis so that it can be fed into the policy-making framework.

Factors which Influence the Efficacy of Communications about Food-related Risks and Examination of how Food-related Risk Communication Strategies can be Improved

84. Consumers' perceptions are also important in developing an effective risk communication strategy. A knowledge of the concerns of consumers in a particular context will allow those concerns to be addressed. This will allow an effective exchange of information which should provide consumers with access to the information they consider relevant and allow them to reach their own conclusions.

FURTHER INFORMATION

85. Dr David Tennant in Risk Assessment and Management Strategies Branch of Food Science Division I (Tel. 071-238-6216; FAX 071-238-6233) can advise further on any specific issues contractors may wish to raise. A Programme Manager for this work is in the process of being appointed.

FOOD IRRADIATION

86. The Food (Control of Irradiation) Regulations 1990 allow Ministers to license the irradiation of seven broad classes of food and to approve equivalent imports. The Government is committed to undertake research into detection tests for irradiated food to aid enforcement of the Regulations and to provide assurance to consumers on effective enforcement, particularly in relation to undeclared imports. Test methods have already been developed for certain foods, a successfully trialed method has been published in the MAFF "Food Analysis" series.

SPECIFIC RESEARCH REQUIREMENTS

87. The principal R&D requirements are for:

- **The development of analytical methods or the adaptation of existing methods for the detection of wider range of foods that may be irradiated; principally seafood and to a lesser extent fruit and vegetables;**
- **The development of a cheap and rapid microbiological screening test which would complement the MAFF developed LAL screening test;**
- **Evaluation of the reproducibility and accuracy of these methods through collaborative trials.**

88. At the present time resources only permit the commissioning of a small number of projects aimed at the development of detection tests for irradiated food. Projects which involve collaboration and joint funding will have priority.

FURTHER INFORMATION

89. Mr P A Holley of Food Safety Radiation Unit (Tel: 071 238 6188; Fax: 071 238 6591) can advise further on any specific issues contractors may wish to raise. The Programme Manager is Mr Holley.

FOOD ADDITIVES

SPECIFIC RESEARCH REQUIREMENTS

Methods for Monitoring Food Additive Intakes

90. Accurate estimation of food additive intakes is extremely expensive since it requires precise information on the dietary behaviour of the whole population including specific critical groups such as diabetics. This information then needs to be translated into food additive intakes through a knowledge of the formulations of individual branded products provided by manufacturers. The collection of this dietary and brand information is resource intensive and expensive. One alternative approach currently being explored is the quantitative measurement of urinary biomarkers as determinants of the intakes of certain food additives. Suitable methods will have to demonstrate a dose-response correlation between the levels of intake and the levels of the urinary metabolites. Additives of particular interest are those which are widely consumed and which have relatively low ADIs. Further guidance may be sought from Food Surveillance Paper No.37 - Dietary Intakes of Food Additives in the UK: Initial Surveillance, published recently by HMSO.

Analytical Methodology for Refining Food Additive Specifications

91. The UK food industry is making more use of food additives from natural source materials in preference to synthetic materials. Food additive legislation does not distinguish between natural and synthetic food additives, and both have to be

assessed equally for need and safety before they can be approved. However for synthetic food additives it is generally easy to establish a meaningful statutory specification since they are usually highly defined with a high level of purity. In contrast certain food additives from natural source materials are by their nature less easy to define and present a number of problems in establishing a meaningful specification. This is essential to ensure the commercial material is that which has been toxicologically tested and found to be safe in use. These additives include annatto, cochineal and capsanthin.

FURTHER INFORMATION

92. Dr David Atkins in Food Additives 1 Branch of Food Science Division I (Tel: 071 238 6234; Fax: 071 238 5337) can advise further on any specific issues contractors may wish to raise. A Programme Manager for this work is in the process of being appointed.

PATHOGENIC MICRO-ORGANISMS

93. MAFF seeks to ensure that food, as consumed, does not contain pathogenic micro-organisms or their toxins at levels sufficient to cause food poisoning, and that the levels of pathogenic micro-organisms in raw materials is as low as practicable. To this end, the Ministry needs to know more about specific areas of food microbiology, and would welcome research proposals from contractors in the following areas.

94. When evaluating research proposals MAFF will pay particular attention to the potential for promoting food safety by application of the results to the food chain.

Conditions Leading to Growth or Inhibition of Pathogens

95. The topics of particular interest are:

- The effect of processing conditions such as heat, cold, water activity, pH, atmosphere, and packaging on the growth of pathogenic food micro-organisms;
- The effectiveness of various processes on controlling microbial growth, including microwave and ohmic heating, irradiation, aseptic processing, sous-vide, and cook-chill operations;
- The factors needed to ensure the safety of minimally processed foods.

Detection of Pathogens and their Toxins

96. Traditional microbiological methods can be time consuming, labour intensive and can require skilful manipulations and interpretation of subjective results. In addition, methods for emerging pathogens can be inappropriate or non-existent. Consequently, there is a continuing need for the development of improved and more rapid methods of analysis for micro-organisms in food. Topics of particular interest are:

- **Rapid methods for the detection of pathogenic micro-organisms or their toxins in food;**
- **Methods suitable for the screening of pathogenic micro-organisms (specific identification is not necessarily required);**
- **Methods suitable for the specific detection of pathogenic strains of selected food organisms with particular emphasis on non-culturable forms of *Campylobacter*;**
- **Methods suitable for on-line detection.**

Factors Leading to the Presence, Survival, or Growth of Pathogens in Foods or Food Handling Environments

97. The general principles guiding hygienic design of equipment are well established. However, there is still a need to identify and control those aspects of foods or food handling environments which may result in the presence, survival or growth of pathogens.

98. Proposals would be welcome in the following areas:

- **Behaviour of pathogens in food preparation, (including domestic and catering), and food processing, packaging and distribution operations;**
- **The efficiency and effects of cleaning or sanitising of equipment or environments in which food is handled.**

Separation and Concentration of Pathogenic Organisms from Food

99. Rapid methods of detection introduced in recent years have resulted in some improvement in the speed in which results can be obtained. However, they still require lengthy preliminary steps. Therefore to improve the measurement of pathogens in food, work is needed on technologies which improve the selective extraction of pathogens from food.

100. The topics of particular interest are:

- **Methods to isolate current major food-borne pathogens (eg *Salmonella*, *Listeria* and particularly *Campylobacter*);**
- **Methods to isolate 'emerging' pathogens or pathogens relevant to new processes (eg *E. Coli*, *Yersinia*, *Psychrotrophic Bacillus* species).**

FURTHER INFORMATION

101. The Programme Manager for the work on Separation and Concentration of Pathogenic Organisms from Food is Dr Martin Easter (Tel: 0895 206191). Programme Managers for the work in other areas are currently being appointed.

MINIM PP1:07 RADIOLOGICAL PROTECTION

INTRODUCTION

102. MAFF aims to safeguard food and agriculture in respect of emissions of radioactive substances into the terrestrial and marine environment. The Ministry has statutory responsibility under The Radioactive Substances Act 1993 to ensure that any discharges which may be authorised from licensed nuclear sites pose no significant risk to man via agricultural pathways. There is also a similar requirement under the Food and Environmental Protection Act 1985 when food may be contaminated following an accident. Furthermore, EC regulations also set limits for concentrations of radioactivity in foodstuffs following an accidental release of activity. At present the research portfolio consists of three sub-programmes focused on radiological protection issues. The first deals with R&D required to undertake surveillance of radionuclides in food and the food chain, the second to measure and model the effects of radioactive discharges on the food chain, and the third is focused on research which will improve responses to and amelioration of the effects of emergencies involving radioactive discharge.

SPECIFIC RESEARCH REQUIREMENTS

Usage of Minor Foods

103. The requirements are:

- The identification of "free foods" such as hedgerow berries used for jams and wines, flowers (dandelions, nettles) etc, together with an assessment of their potential contribution to radioactive intakes;
- Improving surveillance efficiency and effectiveness;
- Lower cost analytical methods which will contribute to a more comprehensive surveillance programme of important radionuclides in the environment.

FURTHER INFORMATION

104. Mr B Walters of Food Safety Radiation Unit (Tel: 071 238 6187; fax: 071 238 6591) can advise further on any specific issues prospective contractors may wish to raise. Dr Michael Segal is the Programme Manager for this work.

ASSESSMENT OF THE EFFECTS OF RADIOACTIVE DISCHARGES

SPECIFIC RESEARCH REQUIREMENTS

105. There is a specific requirement for research in the following areas:

- **Modelling of crops of agricultural importance.** The aim of the project would be to examine changes in crops of agricultural importance during recent years, for example the wide introduction of rape and maize, and to determine if current modelling capabilities are adequate to predict the movement of radioactivity through these foodstuffs;
- **Losses of radioactivity during food processing - production of a database.** The potential importance of losses of radioactivity due to food preparation and processing is recognised. The aim of this project would be to draw together results of work carried out in this area (UK and International) and to make recommendations on which parameters should be used in a given situation;
- **Testing and validation of models for C-14 transfer in agriculturally important crops such as leafy, leguminous and root vegetables, cereals and fruits.** To carry out research into the behaviour of C-14 in soil-plant animal systems with specific emphasis on transfer via direct root uptake. The aim is to provide data sets that can be used to test and validate the models used for assessment purposes;
- **To provide information on the possible effects of the sequence of and transition between different climate states (Temperate, Greenhouse, Boreal, Peri-Glacial and glacial), on the radiological impact of radionuclides released from a deep waste repository back to the local human population;**
- **To investigate the behaviour of radionuclides, released from a deep waste repository, in the terrestrial/aquatic interface zone (coastal margins) in relation to the use of coastal margins for agriculture;**
- **To provide data on the transfer of deposited radioactivity from foliage to edible organs (grain, fruit and tubers) of common crops such as root vegetables, potatoes, orchard and soft fruits for a range of nuclides including iodines, Cs-137, Sr 90, Co-60 and Ru-106;**
- **Dynamics of H-3 uptake and loss after short term releases.** To develop a realistic and justifiable methodology for the assessment of doses from such releases.

FURTHER INFORMATION

106. Mrs R Hignett of Food Safety Radiation Unit (Tel: 071 238 6170, Fax: 071 238 6591) can advise further on any specific issues prospective contractors may wish to raise. Dr Michael Segal is the Programme Manager for this work.

RESPONSE TO EMERGENCIES INVOLVING RADIOACTIVITY

BACKGROUND

107 The primary objective of this programme is to improve the Ministry's capability to respond effectively in the event of any accidental release of radioactivity, to ensure the safety of the food supply. Using models based on an improved understanding of the processes by which radionuclides are transferred through the food-chain, it will be able to predict more accurately the consequences of a given accident, and thus ensure that advice on the most appropriate action is available as soon as possible, and that the response is efficiently targeted at the correct geographical areas and foodstuffs. A further objective is the development of alternative means of protecting the safety of the food supply to the imposition of restrictions on sale or movement, in the event of a future accident.

SPECIFIC RESEARCH REQUIREMENTS

108. The requirements are:

- The effect of snow on the deposition of radionuclides from a plume released as the result of a nuclear accident;
- An initial assessment of the types of uncertainties associated with atmospheric dispersion models used in emergencies, and their relative importance;
- The analysis and evaluation of data on the likely form of plutonium dispersed from a nuclear weapons accident, and the availability of these physico-chemical forms for uptake into the food chain;
- Improvement of the accuracy and capability of atmospheric dispersion models;
- Validation and sensitivity studies on atmospheric dispersion models such as R91STAR and UKADMS, using tracer techniques where appropriate;
- Validation studies on models which predict the transfer of radionuclides through the food chain following an accidental release. Particular attention should be paid to the sensitivity of transfer parameters to the chemical form of the radionuclide;

- **The development of simple and rapid techniques, for use in the immediate aftermath of a nuclear accident, to assess the availability of deposited radionuclides for plant uptake;**
- **Evaluation of potential ameliorative techniques for application in the aftermath of a nuclear accident, with particular emphasis on the radioisotopes of strontium and iodine;**
- **Review and development of potential applications of Geographic Information Systems in Nuclear Emergencies.**

FURTHER INFORMATION

109. Mrs Caroline Morris of Food Safety Radiation Unit (Tel: 071 238 6209; Fax: 071 238 6591) can advise further on any specific issues prospective contractors may wish to raise. The Programme Manager is Dr Michael Segal.

MINIM CE2:10 FOOD & DRINK MANUFACTURING AND DISTRIBUTION INDUSTRIES RESEARCH REQUIREMENTS

LINK INITIATIVES

FOOD PROCESSING SCIENCES

110. Almost all of the available funds for this programme have now been committed and no further projects are being solicited for funding. However, new collaborative research initiatives are presently being formulated (see paragraph 113).

AGRO-FOOD QUALITY

111. This programme is not due to terminate until 1995 and resources are still available for support for funding. The programme seeks proposals which will address the following technical themes:

- **Improved quantitative measurements of quality;**
- **Understanding of the compositional factors in raw materials which determine processing and eating quality;**
- **Stimulation of biotechnological means of obtaining these attributes;**
- **Improved shelf-life and storage quality;**
- **Improved understanding of the quality parameters which determine food choice.**

FURTHER INFORMATION

112. Dr Christina Goodacre, Biotechnology Unit, Laboratory of the Government Chemist (Tel: 081 943 7346; Fax: 081 943 2767) will be able to offer advice on how to develop any ideas for a full submission for approval. Dr Goodacre will also be able to help in suggesting or locating suitable collaborative partners if it is proving difficult to put appropriate consortia of academic groups and/or companies together. Dr Goodacre is the Programme Manager for this work.

ADVANCED AND HYGIENIC FOOD PROCESSING

113. Currently, the case for a new programme is being assessed; this will support pre-competitive research into hygienic and cost-effective manufacture of microbiologically safe, high quality foods.

114. The major research themes of the new programme are likely to be:

- **Hygienic processing and hygiene assurance;**
- **Process simulation and modelling;**
- **Novel processing methods;**
- **Production flexibility;**
- **Advanced manufacturing systems.**

115. It is hoped that this new programme will begin from April 1994. Individuals who have ideas for collaborative research should contact Dr Goodacre (Programme Manager of the LINK programme on Agro-Food Quality) for further information. A separate announcement will be made at a future date giving further details of the programme.

EUREKA

116. This European-wide programme focusing on facilitating industrial collaboration and co-operation provides a mechanism creating new market opportunities throughout Europe. It is ideally suited for extending the marketing and technical skills of SME's and the UK Government is committed to increasing the awareness of UK industry to the opportunities presented by EUREKA. Both the French and Spanish EUREKA offices are assisting in the development of specific initiatives in the agri-food sector and MAFF are closely involved. Companies interested in the possibilities afforded by EUREKA should contact Dr Christina Goodacre, Biotechnology Unit, Laboratory of the Government Chemist (Tel: 081 943 7346; Fax: 081 943 2767) or Dr Michael Doel, Chief Scientist's Group (Food) (Tel: 071 238 5996; Fax: 071 238 6591).

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

PROJECT APPLICATION FORM

1. Applicant(s)	Applicant 1	Applicant 2	Applicant 3
Surname			
Forename(s)			
Age			
Title			
Post held			

2. Institution/Authority (administering grant if approved)	Department accommodating project (and institution if other than opposite)
City or Town	

3. Title of project

4. Abstract of research

5. PROPOSED STARTING DATE:	PROPOSED DURATION (months):
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6. PROJECT LEADER:

7. SUMMARY OF TOTAL ESTIMATED COSTS

This should include the costs of any of the research work which will be funded by industry or bodies other than MAFF. Please indicate the percentage of the total cost for which you are requesting MAFF funding.

Year 1 £	Year 2 £	Year 3 £	TOTAL £

Percentage of total estimated cost required from MAFF

MAFF USE ONLY

Project code	Project Officer
CSA File Reference	Referee
Class	

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8. (a) Is your related research currently being supported by an outside body? If yes, please indicate the topic, supporting organisation, value and tenure.
- (b) Are you currently applying elsewhere for support for work relating to the present proposal? If yes, please give details as for 8(a).
- (c) Is this application currently being submitted elsewhere? If yes, to which organisation; and by what date is a decision expected?
- (d) Has this application been submitted elsewhere over the past year? If yes, to which organisation and what was the result?
- (e) Indicate any academic or industrial laboratory with whom you intend to collaborate in this research proposal.
- (f) Is the proposed research likely to lead to patentable or otherwise commercially exploitable results? If yes, please give brief details.

9. Full of ficial postal address of project leader Telephone number of applicant
(please give STD code from London and extension)

FAX:

10. Signature of project leader: Date:

11. This application should be submitted by/through (i) the Head of Department and (ii) the officer who will be respon sible for administering any grant that may be awarded. Each should sign the following declaration:

I confirm that I have read this application and that, if granted, the work will be accommodated and administered in the Department/Institution in accordance with MAFF's contractual arrangements. The **staff gradings and salaries** quoted are correct and in accordance with the normal practice of this Institution.

(i) Signature of **Head of Department**

(ii) Signature of **Administrative Authority**

Title

Finance Officer/Bursar/Registrar/Secretary
of Institution (delete as appropriate)

To be appended in typescript or block capitals

To be appended in typescript or block capitals

Name and initials (of (i) above)

Name and initials (of (ii) above)

Institution

Institution

Address (if different from 10 above)

Address and telephone number
(including STD code from London and
extension)

Date:

Date:

12. Name, address and telephone number (including STD code from London and extension) in typescript (or block capitals) of the officer who should be contacted regarding the administration of the grant if awarded, if different from (ii) above:

13. INTERMEDIATE OBJECTIVES (Scientific and technical)

Highly detailed description of the scientific and technical objectives of the project, which explain why project costs the Ministry is prepared to fund.

Attachment 3

PROJECT COSTS - £ thousands

	Year 1	Year 2	Year 3	Total
14. FINAL OBJECTIVES				
15. KEY MEASURES OF ACHIEVEMENT (Performance targets and target dates for achievement)				
16. SUMMARY OF STAFF EFFORT REQUIRED FOR MAFF COMPONENT OF THE WORK (Show the total person-years (to first decimal place) expected to be spent on the project by each of the staff involved, including both scientists and assistants).				

TOTAL PROJECT COSTS

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17. ESTIMATE TOTAL COSTS - DETAIL

Before completing this section you should read carefully the enclosed Guidance Notes "Project Cost Estimates", which explain what project costs the Ministry is prepared to fund.

PROJECT COSTS : £ thousands

	Year 1 £	Year2 £	Year3 £	Total £
Pay costs: (see note a)				
Salary				
National Insurance				
Superannuation				
Total:				
Consumables (specify (see note b)				
Capital equipment (see note c)				
Travel Expenses (see note d)				
Overheads (see note e)				
Consultancy, sub contracts (see note f)				
Other costs (see note g)				

TOTAL PROJECT COSTS

--	--	--	--

18. Estimated Support from Bodies other than MAFF

APPENDIX 1 page 2

Give estimates of any support from industry or other bodies which you believe will be forthcoming.

£ thousands

1

YEAR 2

3

Will there be any support in kind? If so give brief details.

PROPOSED INVESTIGATION

1. Title of project
2. Purpose of proposed investigation
3. Background of the project
4. Plan of investigation
5. Detailed justification for support requested

Please
leave
margins
blank

	Year 1	Year 2	Year 3	Total
Pay costs (see note a)				
Salary				
National Insurance				
Superannuation				
Total				
Consumables (specify) (see note b)				
Capital equipment (see note c)				
Travel Expenses (see note d)				
Overheads (see note e)				
Casualty, sub-contracts (see note f)				
Other costs (see note g)				
TOTAL PROJECT COSTS				

PROPOSED INVESTIGATION

- | | |
|--------------------------------------|---|
| 1. Title of project | 4. Plan of investigation |
| 2. Purpose of proposed investigation | 5. Detailed justification for support requested |
| 3. Background of the project | |

Please
leave
margins
blank

PROPOSED INVESTIGATION

- | | |
|--------------------------------------|---|
| 1. Title of project | 4. Plan of investigation |
| 2. Purpose of proposed investigation | 5. Detailed justification for support requested |
| 3. Background of the project | |

Please
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margins
blank

PROPOSED INVESTIGATION

- | | |
|---|---|
| 1. Title of project | 4 |
| 2. Purpose of proposed investigation | 5 |
| 3. Background of the project | 6 |
| 4. Plan of investigation | 7 |
| 5. Detailed justification for support requested | 8 |

PROPOSED INVESTIGATION

- | | |
|--------------------------------------|---|
| 1. Title of project | 4. Plan of investigation |
| 2. Purpose of proposed investigation | 5. Detailed justification for support requested |
| 3. Background of the project | |

Please
leave
margins
blank

1. Degree, etc. (subject, class, university, and date)	2. Degree, etc. (subject, class, university, and date)
3. Posts held (with dates); please identify nature and source of funding of present post	3. Posts held (with dates); please identify nature and source of funding of present post
4. Recent publications (title and reference)	4. Recent publications (title and reference)
1. Summary	1. Summary
2. Degree, etc. (subject, class, university, and date)	2. Degree, etc. (subject, class, university, and date)
3. Posts held (with dates); please identify nature and source of funding of present post	3. Posts held (with dates); please identify nature and source of funding of present post
4. Recent publications (title and reference)	4. Recent publications (title and reference)

SWP 31R

CURRICULUM VITAE OF APPLICANT

1. Surname	Forename(s)	Age d.o.b
2. Degrees, etc. (subject, class, university, and date)		
3. Posts held (with dates). Where personal support is requested please identify tenure and source of funding of present post.		
4. Recent publications, also papers in press		

CURRICULUM VITAE OF PROPOSED RESEARCH STAFF

1. Surname	Forename(s)	Age d.o.b
2. Degrees, etc. (subject, class, university, and date)		
3. Posts held (with dates), please identify tenure and source of funding of present post		
4. Recent publications (title and reference)		
1. Surname	Forename(s)	Age d.o.b
2. Degrees, etc. (subject, class, university, and date)		
3. Posts held (with dates); please identify tenure and source of funding of present post		
4. Recent publications (title and reference)		

Please return form on completion to: MAFF, Chief Scientists Group, G23 Nobel House, 17 Smith Square, London SW1P 3JR

NOTES ON COMPLETING A PROJECT APPLICATION FORM

GENERAL NOTES

1. Applications

Applications for project grants are put forward and judged exactly as they are received; applications which do not conform to the accepted layout will be returned and applicants asked to revise them. In their own interest, therefore, should provide the information requested in the application form and appendices as fully and as clearly as possible within the space provided, completing each section of the form as appropriate; stapled or pinned additions are not acceptable.

Applicants are particularly asked to note that the form should be completed in typescript which is sufficiently clear, dark and even to ensure good quality reproduction. The use of dot matrix printers and variations in darkness (eg overprinting of headings) should be avoided. Applications which are not suitable for reproduction will have to be returned for re-typing.

Applicants should send the top (signed) copy of the form and three photocopies.

Where a junior worker requires a personal salary, the application should normally be made by, or jointly with, the Head of his/her department or other senior colleague. In all other cases, the applicant should be the person who, in the event of a successful application, would take responsibility for directing the research and would be actively engaged in following it through.

2. Address for Applications

Applications should be addressed to MAFF, Chief Scientists' Group, Room G23, Nobel House, 17 Smith Square, London, SW1P 3JR.

GUIDANCE FOR ANSWERING QUESTIONS 1 - 21

1. Section 1

When an application is made jointly the details requested should be inserted in respect of both/all applicants. If the post held by an applicant is not permanent, please indicate tenure.

2. Section 3

The title should not exceed 116 characters (including spaces).

3. Section 4

This section should be limited to not more than 150 words.

4. Section 4

Please indicate a realistic starting date (mon/year) bearing in mind that up to 6 months could elapse before a successful application is commissioned. Generally the duration of a project will be 36 months.

5. Section 6

The project leader should be the main point of contact for the project.

6. Section 7

The purpose of these questions is to allow decision-makers to see at a glance the total cost and manpower implications of the proposal. You may want to leave this question blank until you have filled in question 17.

7. Section 8

Any collaborative arrangement with third parties which might affect exploitation should be explained in Appendix 1.

8. Section 10

If the project leader will not be actively engaged in the proposed project, the particular circumstances should be explained in a separate letter accompanying the form.

APPENDIX I : PROPOSED INVESTIGATION

9. This section is particularly important. The statement should be self-contained so that reference to any papers quoted is not essential to understanding the proposals. It should be set out within the six pages provided and under the five headings shown on the form: see details below.

10. Title

This should match that in section 3 of the application form.

11. Purpose of Proposed Investigation

A brief description of the immediate and longer-term objectives of the research.

12. Background of the Project

A concise description of the relationship of the proposed research to the present body of knowledge on the subject, including previous work carried out by the applicant and/or by other workers. In particular, the results of any pilot experiment undertaken should be stated: when a three year project is proposed it is expected that the applicant will have completed sufficient work to show that the period of support is justified.

13. Only essential references to published work should be included; where reference is made to papers submitted for publication or "in press", a summary of the work in question should be given and 3 copies of the relevant manuscript or reprints enclosed.

14. Plan of Investigation

Applicants should indicate plainly what work is proposed and how it is planned to carry out; any technique that is not well-known should be briefly described.

15. Colleagues who are likely to be associated with the project should be named. If the viability of the proposal is dependent on collaboration the exact role of collaborator(s) should be clearly stated and a copy of a statement of willingness to collaborate enclosed with the application.

16. Detailed Justification for Support Requested

You should try and identify all the major physical and financial central assumptions which you have used when estimating costs and benefits. Your central set of assumptions is your best guess about what is most likely to happen. These assumptions necessarily include your views about the successful outcome of the technical aspects of work. You should highlight which technical aspects of the work are most uncertain.

Examples of important physical assumptions include:

- results you expect in the time given. (You may want to indicate the degree of scientific risk involved);
- rate of uptake of benefits;

Examples of important financial assumptions include:

- the level of research costs;
- the level of cost associated with adopting the results of the research.

You should also try and indicate the degree of uncertainty attaching to each assumption. You could give each assumption a mark out of 5 to indicate how certain you are about it (5 means totally certain). Identify the key assumptions - ie those assumptions which you think are most important in influencing the results of the

appraisal.

17. Section 13

The intermediate objectives should be the technical and scientific aims of the research. These objectives should reflect what the research is hoped to achieve with the available time and resources.

18. Section 14

The final objectives should relate to the beneficiaries of the research and should normally be expressed in physical and financial terms. If the objective is to provide say, an unquantifiable benefit to the consumer (eg in food safety projects) then the financial objective would be to achieve this in the least cost way.

19. Section 15

To assist in the monitoring of the project you are asked to describe targets throughout the course of the project against which progress can be measured. The targets asked for more performance targets.

It is recognised that the problem with research is that the output or result often does not occur until the end and it is rarely the case that output proceeds at a steady pace each year. If it is possible to list intermediate objectives then these could be given as your performance target. For example if the creation of a new team of scientists is required then this could be part of the target for the first year. If the project is composed of a number of experiments then the targets could relate to completion dates for each one. The targets for the final year could be to complete the final report and, if the research is successful to have decided on a programme of dissemination. For some work the setting of targets may be much harder and you will just have to indicate how far you hope to be at each date towards achieving the final result.

20. Section 16

The staff effort required only for the MAFF component of the work should be summarised here.

21. Section A

The contracts to be issued will be at fixed prices and future variations in costs will not be considered.

Please specify:

a) Pay Costs - You should include the costs of personnel working directly on the project. Your costings must be supported with a breakdown showing:

- i. the amount of effort to be deployed (for example, number of days or years) broken down into grade/salary bands;
- ii. the rate of (daily or yearly) for each grade or salary band (excluding superannuation and NI - see iv. and v. below);
- iii. the number of days in the year used to arrive at the daily or yearly rate ii. above;
- iv. superannuation; and
- v. National Insurance (NI).

Please detail assumptions used to take account of any increases in labour costs when the project spans more than one year.

b) Consumables - These will be essentially laboratory materials purchased from third parties. Please detail separately any foreseen cost increases, eg on specific materials costs.

c) Equipment - The Ministry will only meet the rental cost of equipment which

is essential to carry out the project. The costs will be based on the useful life of the equipment (normally 5 years) and the level charged shall not exceed one-fifth of the purchase price for each year that the equipment is used solely on the project. Where equipment has a useful life of more than 5 years and/or is used for other purposes the contractor shall make an appropriate reduction in the annual rental charged to the Ministry.

Where new equipment is purchased please indicate the year when bought and the purchase price of each item. Likewise please indicate when equipment is being leased from the manufacturer etc.

- d) Travel - Visits to conferences, similar functions and visits abroad will not normally be regarded as an eligible cost. Exceptionally, however, such costs may be funded where you can demonstrate to the Ministry's satisfaction that the visits are essential to the project.

Where travel costs are necessary details of their frequency and purpose should be given.

- e) Overheads - The overheads should exclude the cost of land and buildings but may include accommodation services. Other operational costs not directly attributable to the project should likewise be excluded. You should include a summary showing the method of calculation of overhead rate, the items, and their values making up the overhead rate and source of such information.

The level of overheads will be one of the factors taken into account in the placing of contracts and will not normally exceed 40% of direct salary costs (excluding Superannuation and NI) and consumables.

- f) Sub-contracts, consultancy fees, etc - You should show that their work is essential to the success of the project and the expertise does not exist in the collaborative group. For example, your case may be based on the lack of developing in-house skills which would only apply to this one project. Such costs should be identified separately and must be claimed on the basis of actual costs incurred.

- g) Other costs - You should include here items which do not readily fit under the headings provided. You should provide a short explanation of the need for the items you list here.

The following are excluded from eligible costs:

- * interest charges;
- * hire purchase interest and any associated service charges;
- * profit earned by a subsidiary or by an associated undertaking on work sub-contracted under the project;
- * input VAT (an allowance may be negotiated with organisation with limited scope for recovery of input VAT).

NB: Inflation and contingency allowances expressed as an arbitrary percentage overall addition to eligible costs are excluded. However, see the note on personnel costs (a) and materials (b).

22. Section 18

If you are aware of any forthcoming support from other bodies then please indicate.

ADDITIONAL INFORMATION

23. If your application is successful and you become a Contractor to the Ministry, the following conditions will apply:

- A Project Officer will be appointed to issue instructions on behalf of the Ministry. He/she should have reasonable access to the work and to all documents relating to the administrative and financial matters concerned with the contract.
- The Contractor must produce and submit to the Project Officer yearly interim reports and 3 copies of a final comprehensive report covering the whole project on completion. Final payments may be withheld if a satisfactory report is not received.

GUIDELINES FOR PROJECT COST ESTIMATES

The attached guidelines should be read in conjunction with point 21 of the "Notes on Completing a Project Application Form"

GUIDELINES FOR PROJECT COST ESTIMATES:

All contracts are issued at fixed prices and future variations in costs will not be considered. It should be noted that any over or underspends in any one financial year, cannot be carried over into the next financial year.

Please specify:

(a) Pay Costs You should include the costs of personnel working directly on the project. Your costings must be supported in an Annex by a detailed breakdown showing for each person separately:-

(i) the amount of staff time (eg. number of days, months of years) broken down into grade/salary bands for each year of the project, including for staff to be recruited;

NB. An explanation should be given where the staff effort increases or decreases during the life of the project.

(ii) the proposed annual salary (excluding London (or other town) Weighting Allowances, NI and Superannuation) and spine point of each person during each year of the project;

(iii) where a daily rate of pay is appropriate, the total number of days in the year used to calculate the daily rate plus the annual salary excluding any London (or other town) Weighting Allowances, NI and Superannuation;

(iv) the inflation factors used for each year of the project;

NB. If you are not sure what inflation factors to use, advice should be sought from your own Finance Department and not the Ministry.

(v) where appropriate, the amount of London (or other town) Weighting Allowances and specify the location for each person during each year of the project;

(vi) the amount of National Insurance (NI), indicating whether contracted out or contracted in rates have been used. If both, please indicate which persons are contracted out;

(vii) the amount of Superannuation, indicating whether non-industrial and/or industrial rates apply and what those rates are as a percentage of basic salary.

(b) Consumables These will be essentially laboratory materials, (eg. test-tubes, chemicals) costing individually up to £500 in value which are purchased from third parties. Please list separately all consumables to be used, including, if possible, quantities.

Separate details should also be given of any foreseen cost increases, eg. on specific materials and/or of any inflation factors used to increase the cost of consumables for each year of the project.

(c) Equipment Capital equipment is a fixed asset costing over £500 in value which is expected to yield continuous service beyond the year in which it is purchased. It includes items such as scientific and information technology equipment.

The Ministry will only meet the rental equivalent cost of new or hired equipment which is essential to carry out the project. 3 quotations must be obtained for each item of equipment. (see notes (ii) and (iii) below). For new equipment the cost will be based on its useful life (normally 5 years) and the amount charged shall not exceed one-fifth of the purchase price for each year that the equipment is used solely on the project. Where equipment has a useful life of more than 5 years and/or is used for other purposes, you should make an appropriate reduction in the annual rental charged to the Ministry. Where new equipment is required please give details of the make, model, price and the year when each item is to be purchased and its purpose. Likewise, please indicate when equipment is to be leased from the

manufacturer and give details of the costs of rental for each year.

NB. You may be asked by the Ministry to provide the following, as appropriate:-

(i) the original purchasing invoice or top copy of the rental agreement. This will be returned immediately after a copy has been taken; and

(ii) where equipment costing over £1,000 in value is to be purchased or hired, the original written quotations obtained from three different suppliers; or

(iii) where equipment costing up to £1,000 in value is to be purchased or hired, details of three oral quotations obtained from three different suppliers.

(d) Travel Visits to conferences and similar functions in the UK or elsewhere and any foreign visits will not normally be regarded as an eligible cost. Exceptionally, however, such costs may be funded where you can demonstrate to the Ministry's satisfaction that the visits are essential to the project.

Where travel costs are necessary details of their frequency, purpose, destination, for road travel the mileage and rate per mil, air/rail fares, and number of persons travelling should be given plus any inflation factors that have been included.

(e) Overheads Central and departmental costs (direct) that underpin the research activities and costs (indirect) which cannot readily be uniquely assigned to particular research projects. These may include the following:

- financial services (finance, accounting, tendering, marketing);

- personnel services;
- staff facilities (transport, health and safety, training, welfare, laundry);
- departmental services (administration, library, secretarial, printing, minor stores items and laboratory and workshop support.)

You should include a summary table showing the method of calculation of the overhead rate, (to be expressed as a percentage of direct salary costs (excluding Superannuation and NI) plus consumables) and list the items covered.

The level of overheads will be one of the factors taken into account in the placing of OCS contracts and the Ministry will not normally accept an overhead rate greater than 40%.

- (f) Sub-contracts, consultancy You should show that this work is essential to the success of the project and the expertise does not exist in the fees, etc collaborative group. For example, your case may be based on the lack of cost effectiveness of developing in-house skills which would only apply to this one project. Any costs under this heading must be identified separately and claimed on the basis of actual costs incurred.

Please detail separately the component parts of any consultancy or sub-contract, including salary costs, NI, Superannuation, consumables, equipment, travel, overheads and other costs plus any inflation factors which have been included.

- (g) Other costs You should include here items which do not readily fit under the headings provided eg. laboratory/analytical services, laboratory animals, servicing of equipment, any non-equipment rental charges, recruitment costs, computer software, stationery items, student registration fees and glasshouse heating.

You should also provide a short explanation of the need for all the items you list here and indicate what inflation factors you have used for each year of the project.

The following are excluded from eligible costs:

- * interest charges;
- * hire purchase interest and any associated service charges;
- * profit earned by a subsidiary or by an associated undertaking on work sub-contracted under the project;
- * input VAT (an allowance may be negotiated with organisations with limited scope for recovery of input VAT).
- * inflation and contingency allowances expressed as an arbitrary, percentage, overall addition to eligible costs. (However, see the notes on personnel costs [a], consumables [b], travel [d], sub contracts [f] and other costs [g].)

You should also provide a description of the need for
all the items you list here and indicate what indication
of interest, interest, or interest in the project.
Physical, technical

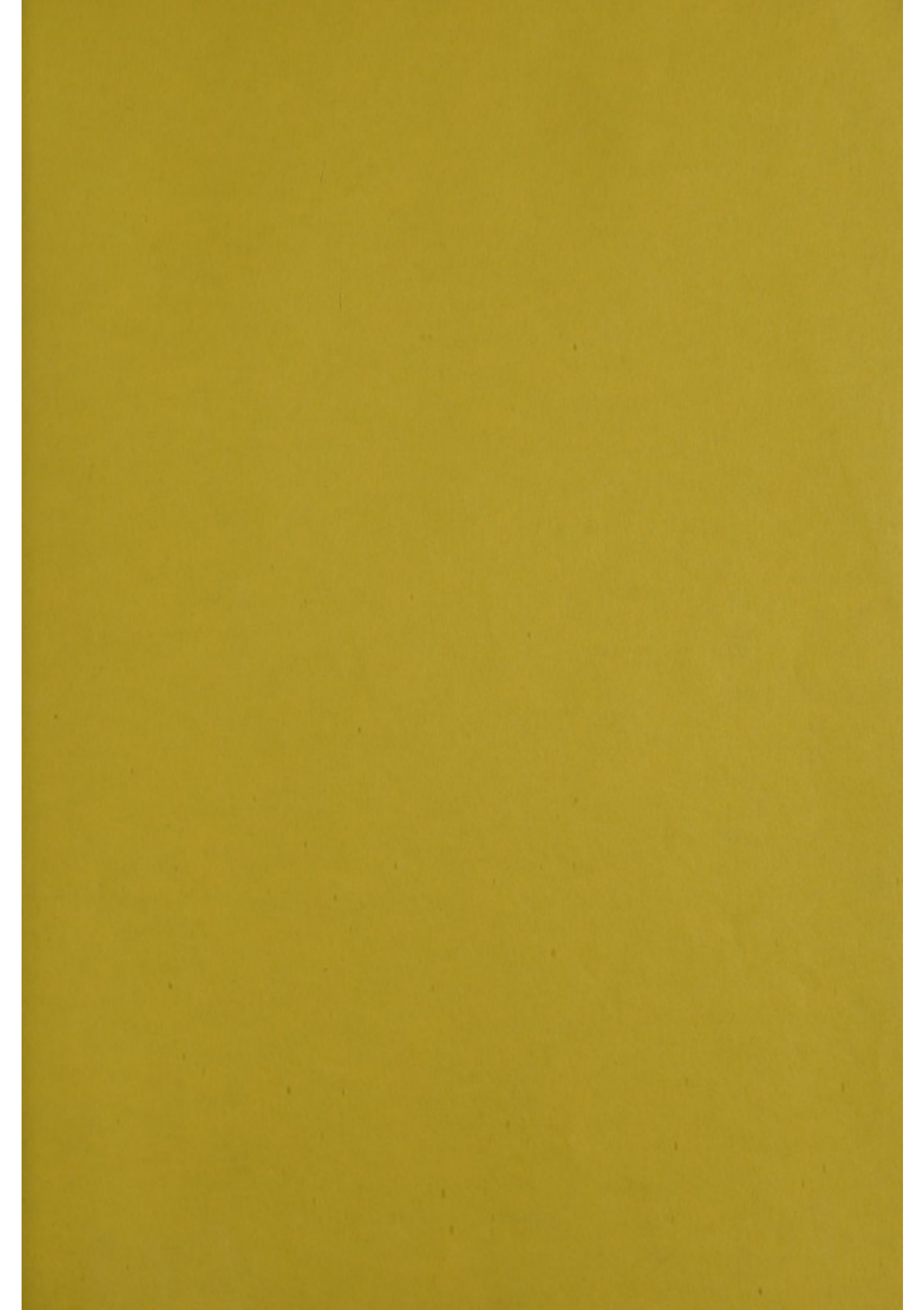
The following are excluded from eligible costs:
1. Interest, payroll, contractual services, insurance,
pension and retirement benefits, taxes, utilities,
rent, depreciation, and other indirect costs.
2. Direct costs
3. Indirect costs
4. Costs for purchase of services and any associated service
to be used in connection with the project.
5. Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose.
6. Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose.

Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose,
shall be excluded from eligible costs.

Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose,
shall be excluded from eligible costs.
Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose,
shall be excluded from eligible costs.

Costs for purchase of any other goods or services
not necessary for the project, or for any other purpose,
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Ministry of Agriculture, Fisheries and Food

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