



Department  
for Environment  
Food & Rural Affairs



Food  
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## Environmental Microbiology and Human Health

### Announcement of Opportunity (AO) – Call for Proposals

**Closing date for outline bids: 16:00 on 24<sup>th</sup> March 2014**

**Closing date for full bids: July 2014 (specific date to be confirmed)**

#### 1.0 SUMMARY

Outline Bids are invited for a new four year NERC research programme on Environmental Microbiology and Human Health. This £4.9m programme is co-funded by the Defence Science and Technology Laboratory (Dstl) (part of the Ministry of Defence) and has additional “top-up” funds of £250k from the Food Standards Agency (FSA) for a relevant project and £250k from the Department for Environment, Food and Rural Affairs (Defra) for a relevant project.

This programme has the vision of providing the scientific evidence to support fast and efficient identification of pathogenic/allergenic microorganisms and biological material in environmental media which can be used in appropriate tools and models for the protection of public health. This directly relates to the delivery of the NERC Environment, Pollution and Human Health theme from the 2007-2012 Next Generation Science for Planet Earth NERC strategy, as well as the “Resilience to Natural Hazards” and “Managing Environmental Change” challenges identified in the Business of the Environment, the new NERC strategy published in November 2013.

The programme is split into two topics, aquatic microbiology and bioaerosols, in total NERC expects to fund four projects under this programme, two in each of the topics. Up to £4.2m is available for this call for (outline) research grants, with £1.8m to cover aquatic microbiology (two projects each of up to £900k at 80% FEC for three years) and £2.4m to cover bioaerosols (two projects each of up to £1.2m at 80% FEC for three years). The remaining programme funds will be used for Knowledge Exchange and impact activities, and programme coordination.

#### 2.0 PROGRAMME OBJECTIVES

The vision of this programme is to provide the scientific evidence to support fast and efficient identification of pathogenic/allergenic microorganisms and biological material in environmental media which can be used in appropriate tools and models for the protection of public health.

The programme aims to cover process and modelling studies in freshwater and coastal waters and for bioaerosols, and support the development of advanced techniques to improve the speed, accuracy and reproducibility of molecular methods and address the problem of counting non-viable organisms through culture methods.

### **3.0 GENERAL OVERVIEW**

Environmental media such as air and water and their associated ecological niches, for instance sediments and biofilms, provide important pathways for human exposure to pathogenic and allergenic microorganisms.

Traditional methods of measurement involve the culturing of organisms. This is slow and highly selective and many organisms cannot be routinely cultured, but it does have the advantage of measuring a sub-set of clearly viable organisms.

Recent rapid advances in molecular biology have the potential to enable enhanced characterisation and rapid quantification of micro-organisms in the environment at a reduced cost compared with traditional methods. Molecular methods, including quantitative PCR, microarrays and full genome sequencing, are capable of rapid speciation and enumeration of organisms, but they depend upon identification of target gene sequences and may be responsive to non-viable organisms which would not present, or index, a threat to health. Such methods have also shown poor reproducibility between laboratories when applied to environmental samples requiring pre-concentration. The UK science base in this area is very strong but is yet to provide new reliable, accurate and appropriate tools for public health and regulation for policy and instead, traditional culture methods are used for operational purposes to provide the current regulatory evidence-base. Improved estimation of exposures is the key to characterising risk to public health and real-time, or near real-time, molecular measurements would greatly enhance our exposure modelling capability.

There is potential for improved molecular methods to have high impact in terms of improved assessment of risk of exposure to pathogens and allergens, particularly through the development of enhanced real (or near real) time detection techniques and understanding of the distribution of microorganisms that would “leap frog” the old monitoring techniques and approaches. It would also provide timely information and demonstrate management practices which are most effective in mitigating risk and therefore safeguard human health in a changing environment. The aim of this programme is to support research into enhanced and novel molecular methods and associated process studies that will enable the identification of pathogenic/allergenic microorganisms and biological material in environmental media and/or address the problem of non-viable organisms. The programme is split into two parts; the first focusses on aquatic (freshwater and coastal) microbiology and the second bioaerosols.

### **4.0 AQUATIC (FRESHWATER AND COASTAL) MICROBIOLOGY**

#### **4.1 Background and drivers**

Microorganisms enter the water cycle from multiple sources, including human activity such as sewage disposal, run-off from agricultural animal waste and ship ballast water. Not all of this water will be treated, and if it is, not all of these microorganisms will be removed by chlorination and other treatments, leading to their sporadic presence in potable water, and more regular occurrence in bathing waters and in shellfish consumed by humans. In addition to routine monitoring of potable supply and recreational waters most information for pathogenic microorganisms is currently collected during large outbreaks of infection and not sporadic or local incidents. Sources may be diffuse and intermittent and highly episodic, if they are a result of weather events, ship movement and system breakdowns for example.

Examples of pathogenic and allergenic microorganisms that may be present in aquatic environments include:

- bathing waters containing microorganisms such as *Escherichia coli* and intestinal enterococci, which can cause gastrointestinal, upper respiratory tract and ear infections;
- freshwaters containing cryptosporidium, which is highly resistant to water disinfection with chlorine and can enter the urban water distribution system;
- small scale “private” water supplies can become contaminated and have an impact on human health;
- shellfish, which may be consumed by humans, can be infected with viruses such as norovirus and hepatitis A and can be poisoned by algal blooms; and
- non-native pathogenic species may be introduced to coastal waters in ship ballast water.

Environmental change may have an effect on the presence and concentration of microorganisms and hence human exposure, for example the predicted increased frequency of heavy rainfall and floods could contribute to increased exposure through sewage overflow, surface water run-off and environmental re-mobilisation, and non-native pathogenic species introduced to coastal waters in ship ballast water may have increased risk of surviving and becoming invasive.

The fast and efficient identification of pathogenic/allergenic microorganisms and biological material in environmental media, including those involved in the food chain, has the potential to enable the real-time prediction of microbial concentrations and the associated risk to human health. Novel molecular techniques will be required to support this. Although there are many inshore models around erosion-deposition relating to geomorphology and coastal engineering, and water quality models of the black box type around algal blooms and eutrophication, we are lacking the predictive microbial modelling capability. Prediction of microbial concentrations requires knowledge of the rainfall-runoff relationships of the organisms, their fate and transport dynamics in fresh and marine near-shore waters, and their transport hydro-dynamics within the coastal zone. The current “black box” types of model used are insufficiently parameterised to reflect complex microbial dynamics in rivers and near-shore waters. As a result, modelling of microbial flux and concentration is not sufficiently precise to deliver the emerging predictive requirements for operational application and decision-making.

There is a significant research challenge here: new and enhanced methods of rapidly identifying and determining the viability of microorganisms and that address the problem of counting non-viable organisms are required. Process studies concerned with regulatory index organisms and other currently ‘unregulated’ pathogens, such as norovirus and cryptosporidium which could offer new insights into risk assessment but do not generally correlate with faecal indicator measurements are also needed. Improved predictive models are required for both regulated and non-regulated pathogenic microorganisms in freshwater and coastal ecosystems to minimise the health risks associated with aquatic microorganisms.

#### **4.2 Remit of call**

There is £1.8m available for the aquatic microbiology topic and it is expected that two grants will be supported, each of up to £900k at 80% FEC for three years. FSA may also contribute up to £250k additional funding for (an expected) one project in this part of the call that addresses outcomes of importance to the FSA (i.e. the total maximum funding that can be applied for as part of this project will be £1.15m). Defra may also contribute up to £250k additional funding for (an expected) one project in this part of the call which addresses areas of interest to Defra (i.e. the total maximum funding that can be applied for as part of this project will be £1.15m). Where there may be some overlap in FSA and Defra interests, applicants should note that they can

only apply for a maximum of £1.15m. It is not a requirement to apply for either the FSA or the Defra “top-up” money as the primary assessment criteria is the fit to the priorities of the call and science excellence.

Applications will be supported on freshwater and/or coastal microorganism(s) that have an impact on human health and **must** cover: 1) enhancing the speed, accuracy and reproducibility of detection and sampling methods, with particular interest in cutting edge and novel techniques; and 2) demonstrating the use of the enhanced techniques for process studies. Within these two elements, there is flexibility, with some suggestions of possible areas below.

- 1) The enhanced techniques research could also cover, as appropriate:
  - improved molecular methods and sequencing techniques and/or address the problem of counting non-viable organisms
  - improve sampling methods, including automated and real-time
  - novel sensors
- 2) The process studies could cover, as appropriate:
  - collection of data of microorganisms present, concentration and natural background levels
  - characterisation of the microbiome in representative environments (including the bivalve shellfish gut)
  - understanding the processes determining the source, fate, transport, distribution and abundance in the environment (including a variety of environments, where applicable, and the longevity)
  - understanding the natural/anthropogenic factors affecting the above point (e.g. changes to land use, management, climate, weather or interaction with other chemical/particles/organisms, where applicable)
  - provide validated process models to predict the risk of human exposure and forecasts

It is for applicants to decide whether they choose to study a narrow range of microorganisms or if they address a broader range and look at a more general picture. Whichever approach is chosen, applicants must clearly demonstrate how the proposed research addresses the objectives of the programme.

### 4.3 FSA funding

As noted above, FSA may “top-up” one of the grants, providing up to an additional £250k for research of interest, so that the maximum grant size is £1.15m. The following outcomes would be of particular interest to the FSA as part of any proposed work programme:

- i. Development of a genomic approach to characterise the viral genomes present in shellfish and related environmental samples. Consideration should also be given as to whether such an approach could be used to determine the levels and intactness of such genomes as an indicator of potential infectivity either alone or in combination with complementary approaches, such as assays measuring virus capsid integrity.
- ii. Application of whole genome sequencing for use in detection and characterisation of norovirus in one step (in shellfish and environmental samples) and its potential to inform source identification and tracking in foodborne disease outbreaks.
- iii. Development of a suitable model or tool to assist regulators and/or shellfish producers/harvesters assess and manage public health risks associated with norovirus contamination of shellfisheries.

FSA is particularly interested in proposals which address one or more of the identified three outcomes.

There is more information about FSA interests in annex 1.

Research that addresses FSA's outcomes should be clearly distinguished in the Outline Bids and the Justification of Resources.

For the "top-up" funding FSA eligibility rules will apply, this means that organisations not normally eligible for NERC funding may be included in the proposals if desired (see section 8.0 for further details of the eligibility requirements).

#### **4.4 Defra funding**

As noted above, Defra may "top-up" one of the grants, providing up to an additional £250k for research of interest, so that the maximum grant size is £1.15m. The following areas would be of particular interest to Defra as part of any proposed work programme:

- i. Bathing Water Quality Prediction: assess the various prediction systems in the UK and abroad and conduct some intensive sample runs to investigate the benefits or risks to public health of each system.
- ii. Virus disinfection methods and efficacy: assess commercially available methods of disinfection and their efficacy for a range of virus types; analyse the use of disinfection methods on intermittent pollution sources; and estimate the cost (£) and carbon costs of the methods and if they can be used on the English sewerage network.
- iii. Modelling bacterial and viral decay and dynamics associated with sediments: assess the number of bathing and shellfish designated waters which have large sediment deposits which may affect compliance, look at existing evidence that sediment may be an environmental reservoir and identify events which may cause the release of pollution from them.

There is more information about Defra's interests in annex 2.

Research that addresses Defra's outcomes should be clearly distinguished in the Outline Bids and the Justification of Resources.

For the "top-up" funding, eligibility has been broadened to also include Defra's executive agencies<sup>1</sup> so this means that these organisations which are not normally eligible for NERC funding may be included in the proposals if desired (see section 8.0 for further details of the eligibility requirements).

## **5.0 BIOAEROSOLS**

### **5.1 Background and drivers**

Bioaerosols are those airborne particles that are all or part of an organism, either living, dormant or dead. This includes pollen, fungal spores, microbial toxins, bacteria, viruses and plant spores. It also includes material such as plant, animal and insect fragments, leaf litter, dander, phytoplankton, epithelial cells and fungal material. Bioaerosols are associated with various sources including dust, water surfaces (both freshwaters and coastal seas), vegetation and animals, but also originate from crop harvesting, livestock emissions, fungiculture, grain silos, damp living conditions, composting sites, deliberate or accidental releases, construction, vehicles, building demolition, wastewater

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<sup>1</sup> Defra's agencies and public bodies can be viewed at the drop down next to the Department for Environment, Food and Rural Affairs at <https://www.gov.uk/government/organisations>.

processing, biotechnology fermentation, metal working fluids, production and processing of wood and paper, and production of certain food stuffs.

Bioaerosols can be pathogenic and/or allergenic, for example:

- airborne pollens and fungal/mould spores are the cause of hay fever which affects about 20% of the population;
- microbes, fungi and their components are powerful stimuli of innate immune responses in the origins and progression of chronic lung disease and other respiratory diseases;
- there are 5.4 million people with asthma in the UK ( $\approx$  11% population) and 80% say their symptoms are triggered by aeroallergens;
- aerosols which enter lower airways can result in alveolitis, fungal colonisation, allergic bronchopulmonary mycoses (ABPM) and allergic bronchopulmonary aspergillosis (ABPA);
- workers at composting facilities can display acute work-related symptoms such as eye irritation, nasal irritation and coughs;
- humans can be infected by Q-fever (caused by *Coxiella burnetii*) spread by shedding of the spore like cell variant from livestock and domestic animals;
- the human infectious disease Anthrax is spread via spores of the bacterium *Bacillus anthracis* and is both a naturally occurring disease of livestock but also classed as a biological agent of warfare; and
- Legionella are a group of bacterium which result in Legionnaires disease and spread via the air most commonly from such sources as cooling, domestic hot water systems and spas.

Bioaerosols range in numbers and predominant species by season, geography and local sources. Atmospheric conditions and weather (e.g. humidity, temperature, rainfall, wind, thunderstorms) are known to influence bioaerosol concentrations, but the mechanisms are not well understood. Climate and environmental change adds an additional layer of complexity through changing weather patterns, increasing carbon dioxide (which is known to enhance pollen production), impacts on the germination, maturation, flowering and senescence of plants, and types of pollen and fungi produced due to changes in plant ranges and presence of different species as well as the potency of pollen and spores.

Air pollutants and allergens have some interaction but this is poorly understood. Modelling atmospheric bioaerosol concentrations requires improved knowledge of emission source terms and deposition processes, as well as the environmental conditions. There is also little known about the physical characteristics of different bioaerosols but this will strongly affect the assumed particle size distribution and particle mobility and hence estimated deposition rates and lung penetration. There are many atmospheric/dispersion models which could be employed for bioaerosols but at present only a few aeroallergens have been simulated, there are very few evaluation studies, only regional scale models are available and source maps are variable. There is also a need for integrated modelling and forecasting so that predictions can be made, particularly for aeroallergens.

The accidental or deliberate release of biological materials (viruses, bacteria or toxins) in the environment could have significant impact on human and animal health and on the economy. Given the implications of an incident, Government response could be directed at the highest level; accordingly the forecasting of an event would require a very high level of associated confidence. There has been significant investment in developing biodetection capabilities for defence and civil applications over the last twenty years. Despite investment, many technical hurdles remain in the ability to deploy a robust capability to rapidly detect, identify and locate a range of biological threats over a wide-area. The persistence of these challenges serves to highlight the complexity of the problems. In autumn 2012, at the request of Home Office (HO) and the Ministry of Defence, the

Government Chief Scientific Adviser convened a "Blackett Review"<sup>2</sup> to address the question "Which technologies or capabilities will enable rapid, wide-area surveillance of a broad spectrum of biological agents in the next 15 years?". The review considered the potential technology solutions for a wide area biodetection (WAB) capability to enable timely responses to an aerosol release of biological materials.

Despite the various health and policy drivers for rapid and accurate measurement of bioaerosols, in the field of aerobiology traditional microscopic and culture methods remain the norm. With this, identification is limited and relies on personal experience, it is a slow process and there are issues surrounding viability, potency and resolution of biologically active components. This could be greatly improved by developments in molecular methods. There are also issues surrounding the damage or inactivation of bioaerosols during sampling and discrimination from the background. Virus detection is particularly lacking in the field of bioaerosols. Real-time bioaerosol sensors which integrate sampling and analysis are also lacking.

## 5.2 Remit of call

There is £2.4m available for this topic which is co-funded by Dstl and funded projects would be expected to interact with Dstl via stakeholder meetings and provide a final report on the research. It is expected that two grants of up to £1.2m at 80% FEC for three years will be supported:

- One of the grants supported will cover research specifically in the area of airborne bacteria and/or viruses that may impact on human health. Applicants will be expected to second an individual into Dstl for a period of time to understand defence related work in this area (specifics to be confirmed and funds to be provided post award; the seconded individual would need to undergo security clearance and be a UK national and would be expected to have the majority of their time on this grant (e.g. a PDRA)).
- The other grant supported is expected to fund research on other outdoor health-impacting bioaerosols, such as pollen, fungi, spores, phytoplankton and plant and insect fragments.

Further information on Dstl's interests and co-funding requirements are provided in annex 3.

Applications **must** cover: 1) enhancing the speed, accuracy and reproducibility of detection methods (possibly including improved molecular methods and sequencing techniques and/or address the problem of counting non-viable organisms), with particular interest in cutting edge and novel techniques; and 2) demonstrating the use of the enhanced techniques for process studies. Within these two elements, there is flexibility, with some suggestions of possible areas below.

- 1) The enhanced techniques research could cover, as appropriate:
  - improved sampling methods, including real-time automated sampling
  - understanding design of sampling and collection
  - identification of the best methodology for sample preparation
  - improved/development of statistical design of sampling and collection regimes
  - improved techniques for sample capture, concentration and preparation prior to detection and identification
- 2) The process studies could cover, as appropriate:
  - collection of data of bioaerosols present, concentration and natural background levels
  - characterisation of the bioaerosol microbiome in representative environments
  - understanding the physical characteristics of bioaerosols, such as the aggregation/agglomeration, fragmentation, size, as appropriate
  - understanding the processes determining the source, fate, transport, distribution and abundance in the environment (including a variety of environments, where applicable, and the longevity)

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<sup>2</sup> Government Office for Science (2014) Blackett Review on Wide-Area Biological Detection.

- understanding the natural/anthropogenic factors affecting the above point (e.g. changes to land use, management, climate, weather or interaction with other chemical/particles/organisms, where applicable)
- provide validated process models to predict the risk of human exposure and forecasts

It is for applicants to decide whether they choose to study a narrow range of microorganisms (or even just one), or if they address a broader range and look at a more general picture. Whichever approach is chosen, applicants must clearly demonstrate how the proposed research addresses the objectives of the programme.

## **6.0 PROGRAMME INTEGRATION, COORDINATION, KNOWLEDGE EXCHANGE AND IMPACT**

PIs of successful grants will be expected to form a management group to integrate the projects and to work with the funders on the day to day management of the programme. This management group will report to the Programme Executive Board (PEB), which will include the funders.

There will also be some additional resources available once grants have been awarded to establish programme wide governance and coordination, including programme-level activities to enhance Knowledge Exchange and impact. Once the grants have begun, there will be a kick-off meeting to discuss these arrangements and a workshop with relevant stakeholders will also be organised. Applicants should note that this funding is for programme-level Knowledge Exchange and that Pathways to Impact are still required for project-level activities.

## **7.0 PARTNERSHIPS**

### **7.1 National Capability**

NERC has significant infrastructure and expertise in its Research Centres<sup>3</sup> that may be relevant to the Environmental Microbiology and Human Health Programme. The National Oceanography Centre (NOC), and with their delivery partners the Scottish Association for Marine Sciences (SAMS) and Plymouth Marine Laboratory (PML), has expertise in marine ecosystems and coastal processes. There is significant expertise in freshwater research at the Centre for Ecology and Hydrology (CEH) and in atmospheric research at the National Centre for Atmospheric Science (NCAS). The National Centre for Earth Observation also has expertise in the use of remote sensing to study the atmosphere and freshwater and marine environments. Applicants are encouraged to explore whether their proposed grants has links to any of the NERC National Capability activities.

### **7.2 Wider partnerships**

There are numerous partners with interest in this area, including industry and policy, and applicants are actively encouraged to make contact where appropriate, to discuss possible collaborations. Applicants should make every effort to build on existing partner activity to add value to these investments, to align with on-going activity and make use of partner knowledge and expertise, where possible. Some examples of where partnerships may be sought include:

- Where applications cover aspects of aquatic microbiology of relevance to environmental regulation, applicants may wish to approach the Environment Agency as a project partner for which they could contribute historic data sets, samples, advice, as appropriate. Please contact Jonathan Porter ([jonathan.porter@environment-agency.gov.uk](mailto:jonathan.porter@environment-agency.gov.uk)).
- Where applications concern airborne bioaerosol emissions from biowaste and intensive agriculture, including sources, dispersion, ambient exposure, etc., applicants may wish to approach the EA as a project partner who, in addition to being an end-user for such

<sup>3</sup> <http://www.nerc.ac.uk/research/sites/centres/>



information, could supply technical expertise, data, facilitated access to sites, standard protocols, links to industry, links to other delivery bodies in this area, as appropriate. Please contact Rob Kinnersley ([rob.kinnersley@environment-agency.gov.uk](mailto:rob.kinnersley@environment-agency.gov.uk)).

- For applications in the aquatic microbiology topic which have relevance to the water companies, applicants may wish to approach UK Water Industry Research (UKWIR) who would be able to provide in kind support via facilitation of data, enabling input of expertise and knowledge from the water companies and hosting meetings. Please contact Jane Haczynskyj ([janehaczynskyj@aol.co.uk](mailto:janehaczynskyj@aol.co.uk)).

## 8.0 ELIGIBILITY

Eligibility for this call is restricted to UK-based researchers normally eligible for funding from NERC. Further information on NERC eligibility can be found on the NERC website and in the NERC Research Grants Handbook<sup>4</sup>.

There are two exceptions to this rule:

- FSA's eligibility rules apply for the "top-up" funding for research on aquatic microbiology that address outcomes of interest to the FSA (see section 4.3 for details). This means that researchers in organisations not normally eligible for NERC funding can be included in the proposals if desired. Applicants not eligible for NERC funding can apply for a maximum £250k (where this is 80% of the FEC) and it should be clearly demonstrated in the outline proposal that this funding will be used to support research that directly addresses FSA's interests. Please note that researchers in organisations eligible for NERC funding can also apply for the FSA "top-up" funding.
- For the Defra "top-up" funding for research on aquatic microbiology that address areas of interest to Defra (see section 4.4 for details), eligibility has been broadened to include Defra's executive agencies<sup>5</sup>. This means that researchers in these organisations which are not normally eligible for NERC funding can be included in the proposals if desired. Applicants not normally eligible for NERC funding can apply for a maximum £250k (where this is 80% of the FEC) and it should be clearly demonstrated in the outline proposal that this funding will be used to support research that directly addresses Defra's interests. Please note that researchers in organisations eligible for NERC funding can also apply for the Defra "top-up" funding.

Full details of how the "top-up" funding will work will be given at the Full Bid stage, but applicants should note that if an organisation that is *not* currently registered on the RCUK Joint electronic Submission (JeS) System is included in the proposal the Principal Investigator will be expected to subcontract the research in that organisation.

Individual researchers may be named on a maximum of two different proposals, but on only one as the lead Principal Investigator.

## 9.0 APPLICATION PROCESS

### 9.1 Outline Bid stage

It is envisaged that the Outline Bid stage will be used to identify a maximum of 12 projects (six for aquatic microbiology and six for bioaerosols) that will be invited to submit a Full Bid. Only

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<sup>4</sup> <http://www.nerc.ac.uk/funding/application/howtoapply/forms/grantshandbook.pdf>

<sup>5</sup> Defra's agencies and public bodies can be viewed at the drop down next to the Department for Environment, Food and Rural Affairs at <https://www.gov.uk/government/organisations>.

applicants successful at the Outline Bid stage will be eligible to submit Full Bids. Any sift of proposals (see section 9.4 for the assessment process) will be made on the basis of the likely fit of applications to requirements of the call.

One Outline Bid is required for each proposed project; i.e. projects that expect to be submitted as joint applications at the full proposal stage need only submit one Outline Bid covering the whole project. It is expected that the Outline Bid will be submitted by the Principal Investigator.

The Outline Bid proforma can be downloaded from the NERC website at. Completed Outline Bids must be submitted to the programme email address: [microbiology@nerc.ac.uk](mailto:microbiology@nerc.ac.uk) by 16:00 GMT on 24<sup>th</sup> March 2014. Applications received after this date will not be accepted.

For all applications, the Principal Investigator must submit a completed Outline Bid proforma. Any proposal which does not use the template provided, comply with these specifications or exceeds the stated word limits will be rejected prior to review.

Applicants must include the following information in the proforma:

- Objectives and anticipated outputs, demonstrating how the outputs will contribute to the delivery of the programme goals;
- Outline of research proposed and its national and international context (including references);
- Composition and experience of the research team;
- Role of Project Partners (proposed and secured);
- Outline project management plan;
- Resources;
- Proposed use of NERC Services and Facilities<sup>6</sup>; and
- Justification of Resources.

Applicants applying for the FSA “top-up” funding should clearly distinguish the FSA relevant elements of their research proposals. Applicants applying for the Defra “top-up” funding should clearly distinguish the Defra relevant elements of their research proposals. Pathways to Impact and Data Management plans are not required at the Outline Bid stage, but will be required the Full Bid stage.

A detailed budget is not required at this stage, but applicants should include the following information in the Justification of Resources section in the Outline Bid proforma:

- an indicative budget setting out the resources required for the proposed research project, and if applicable the FSA/Defra funding sought should be clearly identifiable; and
- information on any anticipated financial contribution to be made by project partners.

Details of eligible costs are given in the NERC Research Grants Handbook<sup>7</sup>.

Proposers should be informed in May 2014 if they are to be invited to proceed to the Full Bid stage.

## 9.2 Full Bid stage

Only applicants successful at the Outline Bid stage will be invited to proceed to the Full Bid stage. It is expected that proposals will evolve between the Outline Bid and the Full Bid (including personnel), but major science elements of the project proposed are expected to remain broadly the same. Applicants should agree any significant proposed changes with NERC prior to submitting their Full Proposals. Changes of up to 10% in the budget submitted at the Outline Bid stage will be accepted at

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<sup>6</sup> <http://www.nerc.ac.uk/research/sites/facilities/>

<sup>7</sup> <http://www.nerc.ac.uk/funding/application/howtoapply/forms/grantshandbook.pdf>

the Full Bid stage without discussion with NERC, if changes of more than  $\pm 10\%$  of that stated in the Outline Bid are envisaged applicants should contact NERC to discuss prior to submitting. Even if changes are made, the total amount of funding requested must remain within the limits set out in this Announcement of Opportunity.

Details on the submission and assessment procedures for Full Bids will be provided to the PIs of successful Outline Bids in due course. It is expected that the call for Full Bids will be issued in May 2014 and the closing date for applications will be in June 2014 (specific date to be confirmed). As an indication of expectations for this stage, applications will have a similar format to NERC Responsive Mode Standard Grants, and the primary assessment criteria will be Science Excellence and Fit to Programme Requirements.

Grants are expected to specify a start in April 2015 but this will be subject to confirmation after the Outline Bid stage.

### 9.3 Studentships

As grants are to be only three years in length, no associated studentships will be funded.

### 9.4 Assessment process

All Outline Bids received will be assessed by an Assessment Panel to shortlist those that will be invited to submit Full Bids. Any sift of proposals will be made on the basis of the likely fit of applications to requirements of the call. Applicants will be given brief feedback from the Panel summarising the reasons why the application was successful/unsuccessful. No further feedback will be available.

It is envisaged that a maximum of 12 projects (six for aquatic microbiology and six for bioaerosols) will be invited to submit a Full Bids.

NERC reserves the right not to fund up to the limit allocated to the call of £4.2m.

### 9.5 Timetable

Outline Bid AO published	31 <sup>st</sup> January 2014
Outline Bid call closes	24 <sup>th</sup> March 2014, 16.00 hrs
Outline Bid Assessment Panel	End April 2014
Full Bids invited	May 2014

Timetable after the Outline Bid stage will be confirmed when Full Bids are invited and may be subject to change. Indicative timetable:

Full Bid call closes	July 2014
Peer review and PI response stage	July – November 2014*
Moderating panel	November 2014
Grant awards offered	December 2014
Grants begin	April 2015
Kick off workshop	April 2015
Grants end	April 2018
End of programme activity	April 2018 – March 2019

\* Applicants should be prepared to respond to reviews during this stage.

## 9.6 Contacts

Application process and programme enquiries:

Sarah Keynes – [microbiology@nerc.ac.uk](mailto:microbiology@nerc.ac.uk)

01793 411541

FSA:

David Alexander – [David.Alexander@foodstandards.gsi.gov.uk](mailto:David.Alexander@foodstandards.gsi.gov.uk)

020 7276 8949

The FSA is an independent Government department set up by an Act of Parliament in 2000 to protect the public's health and consumer interests in relation to food.

Defra:

Victor Aguilera – [victor.aguilera@defra.gsi.gov.uk](mailto:victor.aguilera@defra.gsi.gov.uk)

Defra is the UK government department responsible for policy and regulations on environmental, food and rural issues. Defra's priorities are to grow the rural economy, improve the environment and safeguard animal and plant health.

DSTL:

Adrian Baker – [EMHH@dstl.gov.uk](mailto:EMHH@dstl.gov.uk)

Dstl is MOD's in-house science and technology organisation. It is responsible for managing the defence research programme; its purpose being to maximise the impact of science and technology for the defence and security of the UK. Part of Dstl's remit encompasses the development of the science and technology required to defend against chemical, biological or radiological threats.

## Annex 1

### Food Standards Agency (FSA) partnership funding

The FSA has a shared interest in the objectives of the Environmental Microbiology and Human Health research programme in respect of support for the production of shellfish which are safe to eat and the reduction of foodborne disease in the UK. Ensuring that food produced or sold in the UK is safe to eat is one of five outcomes defined in the FSA's strategy to 2015 "Safer Food for the Nation".

Viruses, particularly norovirus, are important contributors to infectious intestinal disease and greater understanding of their occurrence in food and transmission through the food chain is required to design and target effective interventions that will reduce risks. In January 2013 the FSA hosted a conference on foodborne viruses research to gather existing knowledge and identify key areas for further study. Among the areas for further research identified, the development of improved methods to detect, characterise and determine infectivity of viruses in food and environmental samples was considered to be fundamentally important to improve our understanding of the risks to public health.

The FSA is committed to working in partnership, particularly with other public sector research funders, to achieve its strategic outcomes. The specifics of FSA's interest are laid out in the AO.

Relevant FSA-funded projects:

- Proceedings of the Food Standards Agency's Foodborne Viruses Research Conference, 15-16 January 2013, London, Annex 1 page 38-42.
- FS101088: Enhancing knowledge of norovirus behaviour in the marine environment to enable better risk management in molluscan shellfisheries. Contractor – Centre for Environment, Fisheries and Aquaculture Science. (Jointly funded with Defra).
- FS513404: Desk study to review the available information on approaches for establishing exclusion zones for shellfish harvesting around sewage discharge points, to inform consideration of the possible introduction of exclusion zones as a control for norovirus. Contractor – Aquatic Water Services Limited.
- FS101040: Assessing the contribution made by the food chain to the burden of UK-acquired norovirus infection. Contractor – University of Liverpool.

Summary information for the three current projects listed above will be published on the FSA's web site in the near future (<http://www.food.gov.uk>).

## **Annex 2**

### **Department for Environment, Food and Rural Affairs' interests in aquatic microbiology**

As part of the Environmental Microbiology and Human Health programme aquatic microbiology topic, Defra are keen to gather evidence which supports policy development in the areas of bathing waters, and shellfish and freshwater fish water quality.

#### Bathing Water Quality Prediction

The water bathing directive is to be reviewed in 2020. There is growing interest in using predictions of water quality, or risk to bathers, as an alternative system to regulatory monitoring, which could be as low as one sample per month. This is driven by a new understanding of the large variability of Faecal Indicator Organisms (FIO) in coastal waters over the course of a day.

Defra are interested in projects assessing the various prediction systems in the UK and abroad and conduct some intensive sample runs to investigate the benefits or risks to public health of each system. Outputs would be used to develop a position for the 2020 review of the Directive and to lobby European Commission and other Member States on our position.

#### Virus disinfection methods and efficacy

There is growing concern that viral contamination has an impact on public health and should be controlled at source, generally sewage. However, there is also a growing recognition that viral contamination can be measured and quantified. More evidence is needed to develop a policy on the efficacy of disinfection methods, their costs and applicability to the UK sewerage network.

Defra are interested in research which assesses commercially available methods of disinfection and their efficacy for a range of virus types; analysis of the use of disinfection methods on intermittent pollution sources; and estimations of the cost (£) and carbon costs of the methods and whether they can be used on the English sewerage network. Outcomes would provide a clear assessment of the effectiveness of disinfection systems for viruses and their costs.

#### Modelling bacterial and viral decay and dynamics associated with sediments

Bathing and shellfish waters are monitored on their compliance with bacterial standards, and possible future viral standard for shellfish waters. Sediment is believed to be natural environmental reservoir for bacterial and viruses and thought to have a significant effect on compliance at some sites. Defra are interested in evidence to assess the number of bathing and shellfish designated waters which have large sediment deposits which may affect compliance, looking at existing evidence that sediment may be an environmental reservoir and identifying events which may cause the release of pollution from them.

Results would inform effective policy approaches to manage this type of pollution. Potential benefits from this work include understanding a little known pollution source, evidence to develop management measures to tackle its impacts which may improve compliance with regulatory monitoring and allow shellfish harvesters to better understand risk to their product and take management measures to improve quality.

#### Relevant Defra funded projects

- WT0924: The Impact of Noroviruses on Shellfish – The Effectiveness of Waste Water Treatment Processes on Reducing Norovirus Levels. Contractor – WRc plc.
- WT0923: Impact of chronic microbial pollution on shellfish. Contractor – CEFAS, CREH Analytical Ltd.
- WT0967: Collaboration on Microbial Flux Ribble and Swansea faecal indicators project. Contractor – Environment Agency, CHRE Ltd.
- WT0996: Contamination of shellfish waters with human noroviruses: environmental risk factors and management options. Contractor – CEFAS.
- WT1001: Factors affecting the Microbial quality of shellfish. Contractor – CEFAS.

For further information on the projects listed above please visit the Defra Science & Research website: <http://randd.defra.gov.uk>

### **Annex 3**

#### **Defence Science and Technology Laboratory's interest and co-funding requirements**

The Defence Science and Technology Laboratory (Dstl) has a significant interest in the science proposed across the whole of the Environmental Microbiology and Human Health programme, including the aquatic microbiology topic. However, it has particular interest in the development of enhanced techniques to detect bioaerosols and enhanced understanding of the behaviour of bioaerosols in the environment. These topics directly overlap with areas of MOD's research programme and with the remit to develop the science and technology required to defend the UK against chemical, biological or radiological threats.

Whilst Dstl's science and technology programme is focussed on specific threat microorganisms that present a high hazard, it is not intended that the programme being co-funded should focus on these types of organism as this could limit the number of applicants. The intention is to enable the most innovative science to enhance techniques and understanding from across the science community.

Scientists working within the MOD research programme have developed detection techniques and a significant level of understanding of the behaviour of bio-aerosols in the environment within a defence and security context. Hence, it is suggested that a scientist from the team awarded the grant on bacteria or viruses that may impact on human health be seconded into Dstl for a short period of time to gain an appreciation of the current level of defence science within the area.