

ANNEX 5.3 Annual Report 2009-10

RESEARCH PROGRAMME ANNUAL REPORT 2009/10

***** Please Return to the Programme Administrator by 22nd March 2010 *****

This form supplements the NERC OPM questionnaire and should be completed for each Research Programme. The boxes may be resized but the form **MUST NOT** exceed **FOUR sides of A4**, to which may be appended no more than **FIVE** sides of supporting information (single spaced, 12pt). Supporting information should include a summary of each research project's progress, a list of peer-reviewed publications from the projects and a summary of programme activities and publications (if applicable) in 2009/2010.

Name of Research Programme	Joint Environment & Human Health Programme (E&HH)
Programme Administrator / Manager	Dr Andrew Empey
Science Coordinator (if applicable)	Prof Michael Moore
Core Team Leader (if applicable)	
Date:	15th March 2010

Indicate the percentage of total programme activities in 2009/10 in each of Science themes of the NERC Strategy			
Biodiversity		Natural Hazard	
Climate System		Sustainable Use of Natural Resources	
Earth System		Technologies	
Environment, Pollution and Human Health	100		

1. Scientific Achievements for 2009/10

Selected achievements are presented below and illustrate why the problems being addressed by this programme, can only be addressed by multi- and interdisciplinary groups of scientists working together in cohesive collaborative projects. **44 research papers** have been published or are in press and many other achievements can be found in the attached summary of Programme Activities & Publications (ANNEX 1).

- 1.1 The risks associated with soil contamination of own-grown food in urban areas are currently assessed using very conservative risk-management methods, leading to unnecessary scares and poor communication of the overall risks to health posed by this. The health benefits of increasing intake of fruit and vegetables, and of physical activity connected with growing food has not previously been considered in assessing and managing the risks.
- 1.2 Effects of metal/metal oxide nanoparticles have been shown in a range of animal models – This has established common effects of metal/metal oxide nanoparticles on a range of species and cellular model systems.
- 1.3 Characterisation of carbon nanotubes in the context of toxicity studies - A new discovery shows that impurities in carbon nanotubes, which could have a potential effect on toxicity, may occur at scales invisible to techniques used in their characterisation by manufacturers.

- 1.4 The genomic and proteomic effects of real urban air particles dosed on human lung tissue is dependent on the size of the particle used. This is the first time that the gene and protein responses of size fractionated (in the nanoparticle range) real environmental air samples have been tested on human lung tissue. The relevance being that the differential observed in biological response by size category indicates that causal biomolecular pathways of significance to health should be investigated at a global gene and protein level. This should elucidate, when married to full physico-chemical analysis, the size components and physico-chemical constituents of the urban aerosol responsible for driving epidemiologically observed health effects. This in turn will inform policy and regulation with respect polluting sources.
- 1.5 Infection rates for Cocksfoot Streak Potyvirus (CSV) in cocksfoot grass can be high, though variable. Virus-induced alterations in components of grass pollen have the potential to alter the allergenic potency.
- 1.6 UK Patent Application Filed for on “Simplified gut model for bioaccessibility assessments” - The patent is currently in a very broad format to cover measurement in a range of media including soils, which it was developed for, and foods.
- 1.7 Potential relevance to Government and policy makers of soil helminths (nematode worms) as reservoirs of bacterial pathogens - The evidence for pathogen vectoring by nematodes has implications for agricultural land produce decontamination. Recommended decontamination measures will need to take resistance of nematode vectors as well as bacterial pathogens into account.
- 1.8 Providing a customised version of our product on health inequalities to a local authority - As a direct result of our work to publicise the products from this grant, we have been commissioned to produce a local environmental deprivation index for South Lanarkshire council. We will apply the methods we have developed to a slightly different set of environmental characteristics to try and measure how multiple physical environmental deprivation varies across the local authority.
- 1.9 Modelling surface atmospheric ozone during the 2003 heatwave in the UK - Paper published in Atmos. Chem. Phys. and one in revision for Atmos. Chem. Phys. The ozone concentrations during the August 2003 heatwave have been simulated using coupled weather and chemistry transport models operating at a high horizontal resolution of 5km by 5km over the UK. On the hottest day of the heatwave (10th August) elevated isoprene emissions (by a factor of 2-5) are likely to have been an important contributor to high ozone concentrations measured on that day.
- 1.10 A methodology has been presented and validated through which long-term fixed site air quality measurements can be used to characterise and remove temporal signals in sample-based measurements which have good spatial coverage but poor temporal resolution. The work has been carried out specifically to provide a spatial dataset of atmospheric ultrafine particle (UFP < 100 nm) data for ongoing epidemiologic cohort analysis but the method is readily transferable to wider epidemiologic investigations and research into the health effects of other pollutant species.
- 1.11 The Environment Health and Development Network, established via a supplement to this grant, hosted its inaugural conference (symposium and e-conference) in June 2009. Participants in the events included UK and overseas researchers, together with stakeholders from UNICEF, funding bodies and non-governmental organizations. An agenda for the network was defined and

plans taken forward for continuing policy engagement, including funding applications for ongoing work.

1.12 Demonstrating microbial organisms associated with drinking water contamination - The work has demonstrated that when disinfection and distribution network integrity are maintained, low diversity community of bacteria occurs. When disinfection is not intact a more diverse community that also includes Archaea and eukaryotes is found.

1.13 Unpasteurised milk samples from 50 organic and 50 conventionally farmed dairy herds were screened for methicillin resistant staphylococci (MRSA) to investigate the hypothesis that decreased antibiotic use in organic farming practices will result in a reduction in the occurrence of antibiotic resistance in staphylococci. Methicillin resistant staphylococci were isolated from both organic and conventional farming practices, but more frequently from conventional farms. More known pathogens were isolated from conventional farms than organic, and these were resistant to a wider range of antibiotic classes.

2. Science activities during 2009/10

Please list major science meetings, workshops, field campaigns, cruises etc.

2.1 Publication of the proceedings of the Annual Science Day Conference (U. Birmingham) February 2009. Eighteen papers from the conference were published in "Environmental Health" as well as an editorial paper on the E&HH Programme.

2.3 Workshops related to the Exploratory Studies Projects (see ANNEX 1 for full details).

3. Knowledge Exchange and User Liaison activities

The Joint Environment & Human Health Programme has succeeded in bringing together many scientists from a broad range of environmental and biomedical backgrounds in order to address critical questions on health issues that are linked or believed to be linked to the natural environment. This has resulted in knowledge and skill transfers and new collaborations (see Programme Summary & Publications). Many of health issues relate to complex problems such as the environmental biology and geochemistry of soils and how these influence the transport, accessibility and bioavailability of chemical pollutants and infectivity of pathogens. The dispersion of harmful particles in the atmosphere is another area of major concern where the E&HH Programme is breaking new ground on how the chemical and physical properties of such particles influence their environmental behaviour and may govern their toxicity and resultant pathological reactions induced following inhalation. Again this has required the formation of interdisciplinary teams of materials scientists, surface and environmental chemists, geochemists, environmental and human toxicologists, food scientists, veterinary scientists, pathologists, epidemiologists, geographers, social scientists, economists and atmospheric modellers. Working groups and workshops have identified potential health problems concerning the transport and emergence of pathogenic human viruses associated with food and water.

User organisations have been involved in many of these projects either as Co-Is or invitees at workshops and mini-conferences.

4. International Dimensions

Please provide details of International activities in 2009/10.

- 4.1 Project Workshops have included many non-UK participants / collaborators and presentations have been made at various International Conferences (see ANNEX 1 and ROD for details).
- 4.2 Implementation of EU-ERANET Programme on Environment and Human Health supported by the UK, Netherlands and France.
- 4.3 Two of the Projects supported by the E&HH Programme have been operating overseas: in the Mekong delta (NE/E009042/1) on contamination and seasonal flooding and in Malawi (NE/E008313/1) on the health consequences of micro-nutrient deficiency in agricultural soil.
- 4.4 Many of the Exploratory Studies projects have international collaborators and two projects are carrying out their research in the developing world (Vietnam and Malawi).
- 4.5 Many of the outputs from the projects have global implications particularly in relation to food security and air quality.

5. Data Management

Please provide a brief statement of progress in data management in 2009/10

Since this is primarily a capacity building programme, data management on a large scale is not relevant.

6. Science and Society

Please provide details of any relevant activities (promotion of Programme, media contact, public understanding, science communication etc) undertaken during 2009/10.

- 6.1 The Programme has been actively promoted at various UK and international conferences and meetings as mentioned in sections 4 and 7, as well as many other less formal meetings and visits to potential future stakeholders (e.g., HPA, EA and Department of Health).
- 6.2 A member of "New Scientist" editorial team is kept apprised of developments in the E&HH Programme.
- 6.3 The online journal "Environmental Health" has published the peer-reviewed Proceedings of the 2009 Science Day Conference. This online journal is widely accessed by a very large audience.
- 6.4 The success of the programme has helped to foster the evolution of two new successor programmes (i.e., *Environmental and Social Ecology of Human Infectious Diseases*- ESEI; and *Environmental Exposure and Health*- EEHI).

7. Science Coordination

Please provide information about science coordination activities not detailed above e.g. numbers of visits to PI's, conferences attended, liaison with other programme participants, co-funders, stakeholders and service providers etc.

The Programme Science Coordinator attended the preparatory Workshops for the Environmental and Social Ecology of Human Infectious Diseases (ESEI) and Environmental Exposure Initiative (EEHI) Programmes and gave a presentation on the E&HH programme at the ESEI Workshop and also led 3 of the breakout group meetings. A presentation on an analysis of the 48 proposals submitted to ESEI was delivered at the Initiative Management Board Meeting in January 2010. A summary version of this analysis will be presented to the ESEI Grants award Panel in March 2010.

The establishment of new active research links between many of the projects funded by the Joint E&HH Programme has to build a cohesive community of research scientists with both UK and international linkages. Feedback from the researchers themselves has strongly indicated that the interfacial nature of much of the research has resulted in exciting and challenging projects with a lot of intellectual cross-fertilisation and the spawning of new collaborations involving existing and proposed future projects.

To try and identify which has been the most successful matching of disciplines is very difficult, and probably impossible at this stage of the Programme, given the huge range of disciplines involved and the very high quality of the research that has been and is being generated. The Programme has not only succeeded in bringing together scientists from a broad range of environmental, social and biomedical backgrounds, but also fostered new relationships with end-users and policy makers. This new community is helping to provide the multidisciplinary capacity able to respond in an interdisciplinary way to resolve problems that are intrinsically interfacial in character. Many of these questions relate to complex issues such as the environmental biology and geochemistry of soils and how these influence the transport, accessibility and bioavailability of chemical pollutants and infectivity of pathogens. The dispersion of harmful particles in the atmosphere is another area of major concern where the E&HH Programme has broken new ground by showing how the chemical and physical properties of such particles influence their environmental behaviour and may govern their toxicity and resultant pathological reactions induced following inhalation. Working groups and networks, which have identified potential health problems concerning the transport and emergence of human pathogens associated with food, soil, air and water, have now largely completed their projects but are still publishing their outputs. The consequence(s) of global and regional climate change for the environmental behaviours of pollutants and pathogens have been considered by a number of the projects supported by the E&HH programme.

The coordination process has been facilitated by numerous PI visits and lengthy telephone discussions during the course of the year, and the preparation of the published proceedings of the 2009 Annual Science Conference and Workshop on Risk Perception ensured that there was frequent contact with many of the PIs and CoIs. Many of the Projects have regular contact with Stakeholder Organisations as have the Programme Manager and Programme Science Coordinator.

The Science Coordinator has held many other informal meetings with Co-funders/Stakeholders, PIs, CoIs and Postdoctoral Researchers in the E&HH Programme during the course of the year. He has also given 3 presentations on the Joint E&HH Programme at SETC – Italy (Alessandria) and SETAC – UK (London) conferences and the ESEI Workshop in London. The Science Coordinator has maintained contact with the appropriate personnel responsible for environment and health in various EU (EC- Science Directorate) and US programmes (EPA, NOAA and NIH).

8. Problems

Please identify any problems or serious risks (e.g. scientific, technical, financial) that have prevented the achievement of planned targets for 2009/10 or will affect the programme in other ways.

The overall research progress has been excellent with many exciting developments highlighting new avenues for future investigation as indicated above. Fortunately, there have been few problems in the implementation of the programme, which given its complexity is perhaps surprising, but nonetheless serves to underline the dedication, skill, ingenuity and resourcefulness of the many scientists involved. Where problems have arisen, they have largely been limited to logistical and staffing issues. Completion of Projects, with starts delayed by the requirements of University Ethics Committees, are now on course for completion and all projects will have finished by July 2010.

9. Plans for 2010/11

Please summarise major targets for 2010/11

9.1 Completion of the final Projects which had delayed starts and final PI visits (Prof Donaldson, Edinburgh; Dr Pearson, Durham; Dr Toledano, Imperial College).

9.2 Preparation of Final Programme Report

If you have any questions regarding the completion of this form, please contact the appropriate

