



Coordination of national environment and
health research programmes

ERA-ENVHEALTH



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Identification of Common, Strategic and Emerging Environment and Health Issues



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**Report on programme strategic and emerging E&H issues,
complementarities and clustering arrangements**

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WP2: Definition and preparation of joint activities: prioritisation of common strategic issues for trans-national funding

Task 2.1: Identification of common strategic E&H issues

Deliverable D 2.1.1: Report on programme strategic and emerging E&H issues, complementarities and clustering arrangements

Deliverable leader: EA

Environment Agency
Block 1, Government Buildings
Burghill Road, Westbury-on-Trym
Bristol, BS10 6BF
UNITED KINGDOM





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EXECUTIVE SUMMARY

ERA-ENVHEALTH is a European project aimed at enhancing the coordination of Environment and Health (E&H) research programmes. The objective of the project is to bring together European organisations that finance and plan research programmes in the field of E&H and to establish a lasting cooperation in this area. This objective is to be achieved by analysing the E&H research landscape, defining common priority areas and responding to these through joint activities and transnational calls for research projects.

There are two main aims for this report. Firstly to identify common and strategic environment and health issues across the partners. Secondly to use horizon scanning to identify emerging issues in the environment and health area.

The starting point for the identification of strategic and common issues was the database developed in Workpackage 1. The database, at present (August 2010), consists of 464 projects. In considering the strategic and common issues in E&H research, eight themes related to human health were identified as being particularly suitable for joint activities. This was based on the number of projects in the database relating to these themes and the number of partners involved in these areas. The eight broad areas are:

- Outdoor air quality
- Local/living environment
- Water quality and supply
- Indoor air quality
- Chemical agents
- Biological agents and microorganisms
- Particulates
- Pesticides and biocides

Within each of these themes more detailed areas of work have been identified.

To identify emerging issues a futures technique called horizon scanning has been used. This can be described as the systematic search for potential threats and opportunities. To identify these threats and opportunities a large variety of on-line sources (including newspapers, journals, science, health and environment news sites) were scanned on a monthly basis for articles relating to environment and health. A total of twelve scans were completed between July 2009 and June 2010. On average each monthly scan contained about 20 articles. All of the articles collected over the 12 month period were referenced to the same categories and sub-categories of environment and health research used in the analysis of the database of projects.

The theme with most horizon scanning articles was chemical agents, which had double the number of articles compared with the next nearest theme. Other popular themes with 20 or more articles were: outdoor air quality; nanomaterials; climate change and particulates. In addition, there are more detailed work areas for each of these themes.





In comparing current issues with emerging issues there are three themes which feature in both lists at the theme and sub-theme level. These are outdoor air quality (for example the effects of ozone pollution), particulates (for example linking sources and fractions responsible for toxic effects) and chemical agents (for example exposure to flame retardants).

In order to appreciate the range of projects in the database a visualisation of the data was performed. The aim of this visualisation was to depict the distribution of projects by identifying clusters of similar or related project activity. It is generated from the textual descriptions of ongoing research projects in the ERA-ENVHEALTH database collected by the partners. In addition, the horizon scanning articles have also been included in this visualisation. The visualisation will be accessible from the ERA-ENVHEALTH website and can be used in planning collaborative activities and a joint research call.

Following the presentation of a draft version of this report to the Annual Assembly meeting a number of additional emerging issues were identified by the partners based on expert opinion.

The common and strategic issues as well as the emerging issues will be considered by the ERA-ENVHEALTH partners for collaborative activities including as issues for a joint call.

KEYWORDS

ERA-ENVHEALTH, environment and health, environment and health research programmes, environment and health research project, emerging issues, horizon scanning, visualisation





1. INTRODUCTION

It is estimated that around 20% of the burden of disease in industrialized countries can be attributed to environmental factors (EU Environment and Health Strategy 2004). Europe's citizens are concerned about the potential impact of the environment on their health and expect policy makers to act. In a survey carried out in 2002 (Flash Eurobarometer EB123), 89% stated that they were worried about the potential impact of the environment on their health.

Environment and Health (E&H) research is a broad and complex area. Both national and EU level research have significantly improved knowledge about the links between the environment and health (E&H). However, understanding the complex interactions and tackling these issues is still in an early stage. Member States have developed the skills and expertise using different mechanisms to fund E&H research.

In order to tackle the broad and complex issues encompassed in E&H, both the environmental science and the public health communities need to be mobilised. Many networks relevant to E&H exist, but no network provides access to national research programmes and none fully integrates E&H issues. For these reason the ERA-NET project ERA-ENVHEALTH was started.

ERA-ENVHEALTH is a European project aimed at enhancing the coordination of Environment and Health (E&H) research programmes. The objective of the project is to bring together European organisations that finance and plan research programmes in the field of E&H and to establish a lasting cooperation in this area. This objective is to be achieved by analysing the E&H research landscape, defining common priority areas and responding to these through joint activities and transnational calls for research projects.

ERA-ENVHEALTH brings together 16 participants in E&H research management from 10 countries, representing a wide diversity of institutional arrangement for E&H funding.





2. AIMS OF THIS REPORT

There are two main aims for this report. Firstly to identify common and strategic environment and health issues across the partners. Secondly to use horizon scanning to identify emerging issues in the environment and health area.

Prioritisation criteria will then be applied to these issues. These prioritisation criteria are being developed in task 2.2, as a parallel activity, in consultation with the partners. This will result in a set of prioritised work areas specific to environment and health which will be put out for consultation to the consortium.

These prioritised areas will then form the basis of the action plan for joint activities and funding in Workpackage 3. In addition, the list of prioritised areas will be considered by Workpackage 4 to design a second joint call for research proposals.





3. METHODOLOGY

3.1 STRATEGIC AND COMMON ISSUES

The starting point for the identification of strategic and common issues was the database developed in Workpackage 1. In task 1.1 a database was developed for capturing information on the programmes and projects in the Environment and Health research area from the partners. The aim was to describe the E&H research landscape with an emphasis on programmes owned or managed by the consortium partners.

In task 1.2., partners entered programme and project details using a common template in spring 2009. Programmes and projects included those on-going and those that ended within the past two years of commencement of ERA-ENVHEALTH. The details collected included the type of projects funded and key information for on-going projects: title, coordinator details, main objectives and outcomes (all in English).

The database, at present (August 2010), consists of 464 projects. The vast majority of the projects were those belonging to the partners. However, there were a number of other projects added either from other countries or from other organisations within partner countries.

Despite the large number of projects added to the database it is not fully comprehensive due to the variation in the number of projects entered by each country (irrespective of size) and whether other organisations in partner countries have also added projects. In addition the projects had different levels of information associated with them. So in undertaking the analysis only those projects in the database can be considered.

In addition to the database, a report was also completed under task 1.2 entitled an "Overview of environment and health programmes and projects including synthesis and recommendations". This included a breakdown of projects across the various environment and health themes. The report also included information on which partners were working in particular areas and associated spending.

3.2 EMERGING ISSUES

Scientific knowledge, technological innovation and social change can occur at an astonishing speed, presenting new issues for the environment and health. Policy makers and practitioners may make decisions based on insufficient evidence. One reason for this is that issues appear unexpectedly, when with hindsight, many of them were foreseeable. A solution to the problem of being insufficiently prepared is routine horizon scanning, a futures technique. This technique had been selected in





the original plan for ERA-ENVHEALTH to determine the emerging issues in environment and health.

3.2.1 Background to horizon scanning

Horizon scanning can be described as the systematic search for potential threats and opportunities that are currently poorly recognized. Researchers can then decide which issues might be most worthwhile to study. Horizon scanning is one futures technique and can be used in a number of different ways as well as combined with other futures techniques. There has been some evaluation of futures techniques, including horizon scanning (Blass, 2003; Simpson et al, 2004). These show that the technique is robust although there is a wide variation in approach and not a single standard method.

The UK Government, in 2003, called for horizon scanning and futures programmes across all departments and agencies in recognition of the lack of time available in day to day work to address emerging issues. The UK Foresight Horizon Scanning Centre was set up in 2005 as a centre for excellence for strategic future thinking to encourage longer term thinking and evidence-based analysis throughout government.

There are many case studies relating to the use of horizon scanning in the UK. It is used as a tool by the Health and Safety Executive (HSE) to systematically anticipate, identify and prepare for new or changing risks in the workplace. In addition, it is used to consider the implications that new and emerging issues will have on the resources, existing priorities and delivery for work related health and safety (www.hse.gov.uk/horizons). Defra (Department for Environment, Food and Rural Affairs) have a horizon scanning and futures team (<http://horizonscanning.defra.gov.uk/>).

They produce a regular newsletter which covers new insights and emerging issues from a range of topic areas relevant to Defra. Insights include anything from shifts in consumer attitudes and developments to trends in technology, energy and resources and give advice to other departments on future related strategy. The aim is to enable Defra to be more resilient over time and meet the needs of Government and society by identifying risks and opportunities. Horizon scanning has been used for nature conservation for example to identify potential new invasive species in England (<http://nora.nerc.ac.uk/7797/1/ParrottNECR009%5B1%5DN007797.pdf>). One subject that makes much use of horizon scanning is in health for example medical technology (Brown et al, 2005), telehealth innovations (Blackburn et al, 2010). It has also been used in the business world for risk management (Brown, 2007).

Although the above examples relate to the UK, there is extensive use of horizon scanning in Europe and beyond. One example is the International Information Network on New and Emerging Health Technologies (EuroScan). This is a collaborative network of member agencies for the exchange of information on important emerging new drugs, devices, procedures, programmes, and settings in health care. Although originally a European group it is now an international group with members in Australia, Canada and New Zealand (K Douw and H Vondeling,





2006). In July 2010 the EU set up a Horizon Scanning Group which is to advise the EC on the deployment of key enabling technologies. The group is to come up with suggestions for likely future applications of nanotechnology including semi-conductors, advanced materials, biotechnology and photonics. It has also been used to identify global conservation issues for 2010 (Sutherland et al, 2010).

The Horizon Scanning team at the Environment Agency were approached to help identify emerging environment and health issues for ERA-ENVHEALTH. The team has considerable experience in horizon scanning.

The Horizon Scanning team in the Environment Agency systematically identifies and tracks developments in science, technology and society for clues to the future. It is a process designed to discover issues through weight of evidence rather than through conjecture or extrapolation. This provides a forward-looking, evidence-based perspective that can be used to plan research and develop policies.

The team have wide experience of undertaking horizon scanning. In particular they have provided a dedicated horizon scanning service on nanotechnology for the Nanotechnology Issues Dialogue Group. This group was set up by the UK Government following publication of the Royal Society/Royal Academy of Engineering report on nanotechnology risks in 2004. This work has only just finished but ran for a number of years, informing the Group on the new, key developments in this field (Bardsley et al, 2009).

The team have also undertaken work in relation to synthetic biology. Synthetic biology is the process by which scientists can design and make bespoke life forms that do not exist in nature. As a science, it builds upon genetic engineering but incorporates new technologies that allow scientists a greater control over construction and increase reliability. Recent breakthroughs have thrown it into the spotlight, but the radical concept has itself been evolving slowly with time. When Environment Agency Horizon Scanning began in 2004, the team were not aware of the emerging field; however, through the team's continuous scanning process an article was found that described the science. Despite the young nature of the field, synthetic biology's potential impact on the environment was quickly realised. Subsequently the evidence base for this emerging science discipline grew and the team communicated it to the rest of the organisation. In summer 2007, the Royal Society put out a Call for Views on the possible impacts and opportunities of synthetic biology. Before horizon scanning, if the Environment Agency was considering answering a consultation on something so new, someone would need to investigate the issue from scratch. With horizon scanning, there were 30 months of accumulated evidence and a well-developed concept of the potential threats and opportunities. The Horizon Scanning Team give ongoing support to the Royal Society's Synthetic Biology Policy Coordination Group to ensure the environmental concerns of synthetic biology are addressed at an early stage (Bardsley and De Lurio, In Press). This progress can be seen in Figure 3 below.



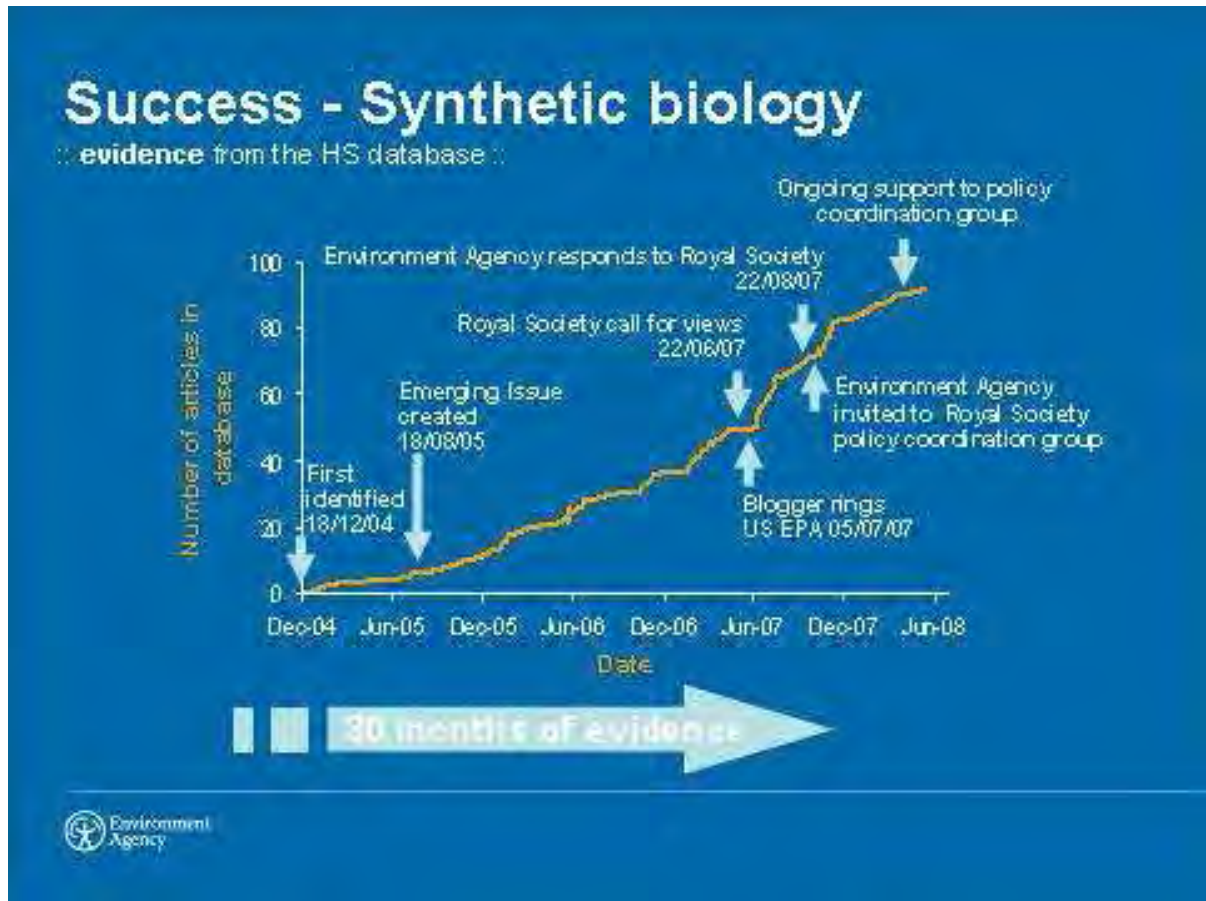


Figure 1– Increase in synthetic biology articles over time

3.3 ERA-ENVHEALTH ANNUAL GENERAL ASSEMBLY MEETING

At the annual General Assembly meeting in The Hague on the 14th of September 2010 a presentation was given on strategic and emerging issues following the release of a draft copy of this report. As a result of the discussion and questionnaires received after the meeting, the report has been revised. In particular a small section has been added on expert opinion of emerging issues that were not identified through the horizon scanning or which reinforce the findings of the scanning.

It was also decided at the annual General Assembly meeting to suggest to initiate a new task focusing on science policy gaps in environment and health. This new task will build on the tasks undertaken in WPs1, 2 and 5.



4. RESULTS

4.1 IDENTIFICATION OF COMMON ISSUES

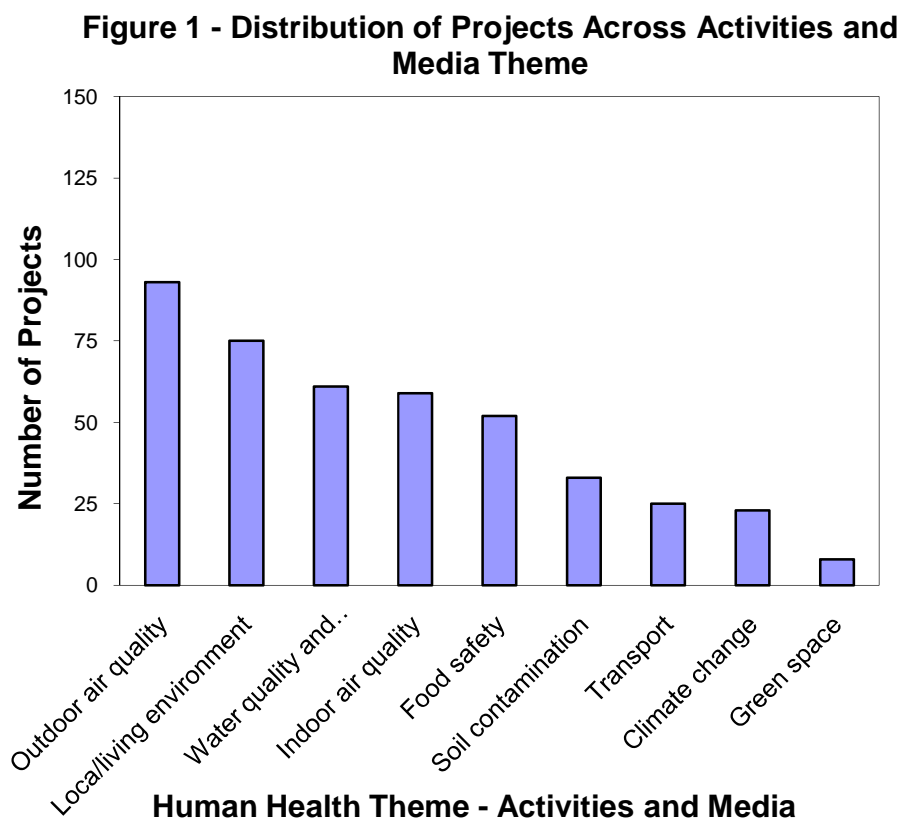
All of the projects (464), when they were entered into the database, were referenced to one or more of the pre-defined themes and sub-themes by the project partners.

The projects were placed in one or more of the following human health themes: activities and media, agents, human health effects, methodologies and finally social aspects of environment and health. These categories were then sub-divided further. There was no limit to the number of categories or sub-categories a project could be referenced to.

In undertaking this analysis the focus for identifying strategic and common issues has been on two of the human health themes: activities and media and agents as the main drivers for undertaking research rather than human health effects, methodologies or social aspects of environment and health.

4.1.1 Activities and media related to human health

Figure 1, below, shows the distribution of projects across the sub-categories within the “activities and media” category.





The category cited by the most projects was outdoor air quality. This was followed by local living environment, water quality and supply, indoor air quality and food safety, all having more than 50 projects in the database. However, with only five partners are working on food safety and so this was not a suitable theme for joint activities. Although there were 12 partners working on soil contamination and 9 on climate change, there were significantly less projects amongst these two themes. This level of activity makes them less suitable for immediate working together such issues as implementing knowledge exchange. However, depending on the analysis of emerging issues they could be suitable for future activities such as capacity building or research calls. The number of projects citing the transport area was low and only eight partners are working in this area. Green space was cited the least (<10 projects) and also had the lowest number of partners (5) working on it. So these two themes will not be put forward for any immediate activities.

The common areas of research across the projects that reference the top four themes are described below. The emphasis has been put on those areas where there are a large number of projects in the database (a lot of research underway) and work is undertaken by more than half the partners. This will maximise participation and interest amongst the partners in activities.

Outdoor air quality

Fifteen partners in nine countries indicated that their E&H programme includes research on outdoor air quality. It was the theme with the largest budget spent and it had been identified as the top priority for research in 6 countries.

The following are areas of overlap between the projects and could be put forward for joint activities:

- Air pollution and links to myocardial infarction
- Characterisation/composition of aerosols
- The health effects of ozone
- The health effects of particulates
- Personal exposure to pollution and mapping

Local/Living Environment

Eleven partners in eight countries indicated that their E&H programme includes research on the local living environment. The projects in this category tend to be wide ranging and many projects in the database have been listed under this category as well as one of the more specific categories. The following are areas of overlap between the projects and could go forward for joint activities:

- Understanding the specific links between the environment and human health
- Personal pollution exposure models

Water quality and Supply

Fifteen partners in nine countries indicated that their E&H programme includes research on water supply and resources. The following are areas of overlap between the projects and could go forward for joint activities.





- Pathogens in water
- Pharmaceutical residues in water
- Endocrine disrupters (including chlorination by-products)
- Cryptosporidium in aquifers and surface waters
- Techniques for detecting faecal contamination in bathing waters
- Tracking faecal contamination in aquatic environment
- Cyanobacterial toxins in drinking waters/bathing waters
- Perchlorates in water

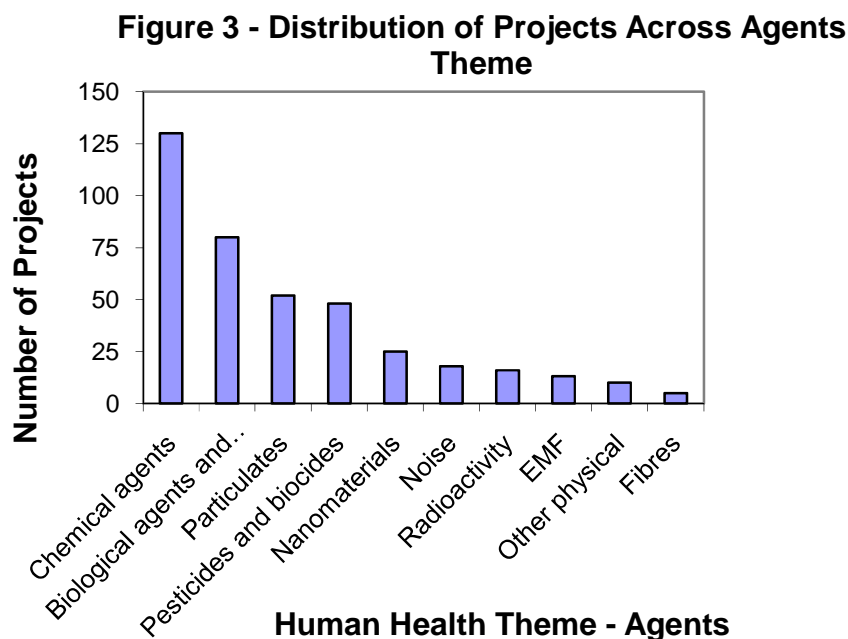
Indoor air quality

Ten partners in seven countries indicated that their E&H programme includes research on “indoor air quality”. The following are areas of overlap between the projects and could be discussed further for joint activities:

- The health effects of nursery/school indoor air quality particularly in relation to respiratory diseases
- Moulds and bacteria present in indoor air and any health effects
- Building materials and emissions/odours
- Investigations into specific chemicals in indoor air for example formaldehyde, VOCs, acrylamide, plasticisers, endocrine disrupters
- Particulates in indoor air
- Detection of contaminants, quantification and measurement of exposure

4.1.2 Agents related to human health

The other important human health theme which could provide areas for joint activities, based on the analysis of the database, is “human health agents”. Figure 2, below, shows the distribution of projects amongst the various sub-categories of the “human health agents”.





The agent referenced by the most projects was chemical agents, followed by biological agents and microorganisms, and particulates all with over 50 projects in the database. Pesticides and biocides had 48 projects in the database. In addition, these four themes had 10 or more partners working in these areas and so these four themes will be put forward for activities by the partners. The other themes had significantly less projects underway. This level of activity makes them less suitable for immediate working together such as implementing knowledge exchange. However, depending on the analysis of emerging issues they could be more suitable for future activities such as capacity building or research calls.

Chemical Agents

There are 14 partners in 8 countries who indicated that their research programmes include research on chemical agents. The following are areas of overlap between the projects and could go forward for joint activities:

- Exposure to trichloroethylene
- Exposure to flame retardants (PBDE)
- Exposure to TCDD
- Risk associated with dietary supplements
- Ethanol vapour from ethanol blended fuel

Biological Agents and Microorganisms

There are 12 partners in 8 countries who indicated that their research programmes include research on biological agents and microorganisms. The following are areas of overlap between the projects and could be put forward for joint activities:

- Inhalation of toxicogenic fungi
- Cyanobacterial blooms and toxins
- Outdoor airborne pathogens and human health
- Disease mapping
- Biogenic emissions

Particulates

There are a total of 11 partners in 8 countries who indicated that their research programmes include research on particulates. The following are areas of overlap between the projects and could go forward for joint activities:

- Linking toxicity effects to particle physico-chemical characteristics
- In-vitro evaluation of particulate reactivity
- Sources and fractions that have a human health effect

Pesticides and Biocides

There are a total of 10 partners in 7 countries who indicated that their research programmes include research on pesticides and biocides. The following are areas of overlap between the projects and could go forward for joint activities:

- Biological monitoring for exposure to fungicides/pesticides
- Pre-natal and post-natal exposure to contaminants, including pesticides, on the development in children





- Pesticide exposure and genetic susceptibility
- Review of epidemiological studies on pesticide exposure
- By-stander exposure during pesticide application
- Pesticides and Parkinson's disease
- Neurobehavioural effects of pesticides
- Gastrointestinal effects of organophosphates/carbamates on children
- Pesticide exposure in non-agricultural occupations
- Effect of pesticides on male reproductive health
- Immunotoxicity of insecticides
- Dose response and mixtures of pesticides in vitro and in vivo

4.2. IDENTIFICATION OF EMERGING ISSUES

In order to identify emerging issues in the environment and health area, monthly horizon scans requested from the Environment Agency's horizon scanning team were used. Each of these scan details of the relevant articles on the environment and health that had been added to their database over the last month. In producing these scans it is estimated that over 150 on-line sites are systematically scanned. These sites include a wide variety of sources of information including newspapers, scientific journals, and specialist on-line science, environment and health news.

In total twelve scans of the horizon scanning database were completed between July 2009 and June 2010. On average each monthly scan contained about 20 articles. These were all checked for relevance and a small number were removed from further analysis. A list of all the horizon scanning articles, including their source, can be seen in Appendix 1.

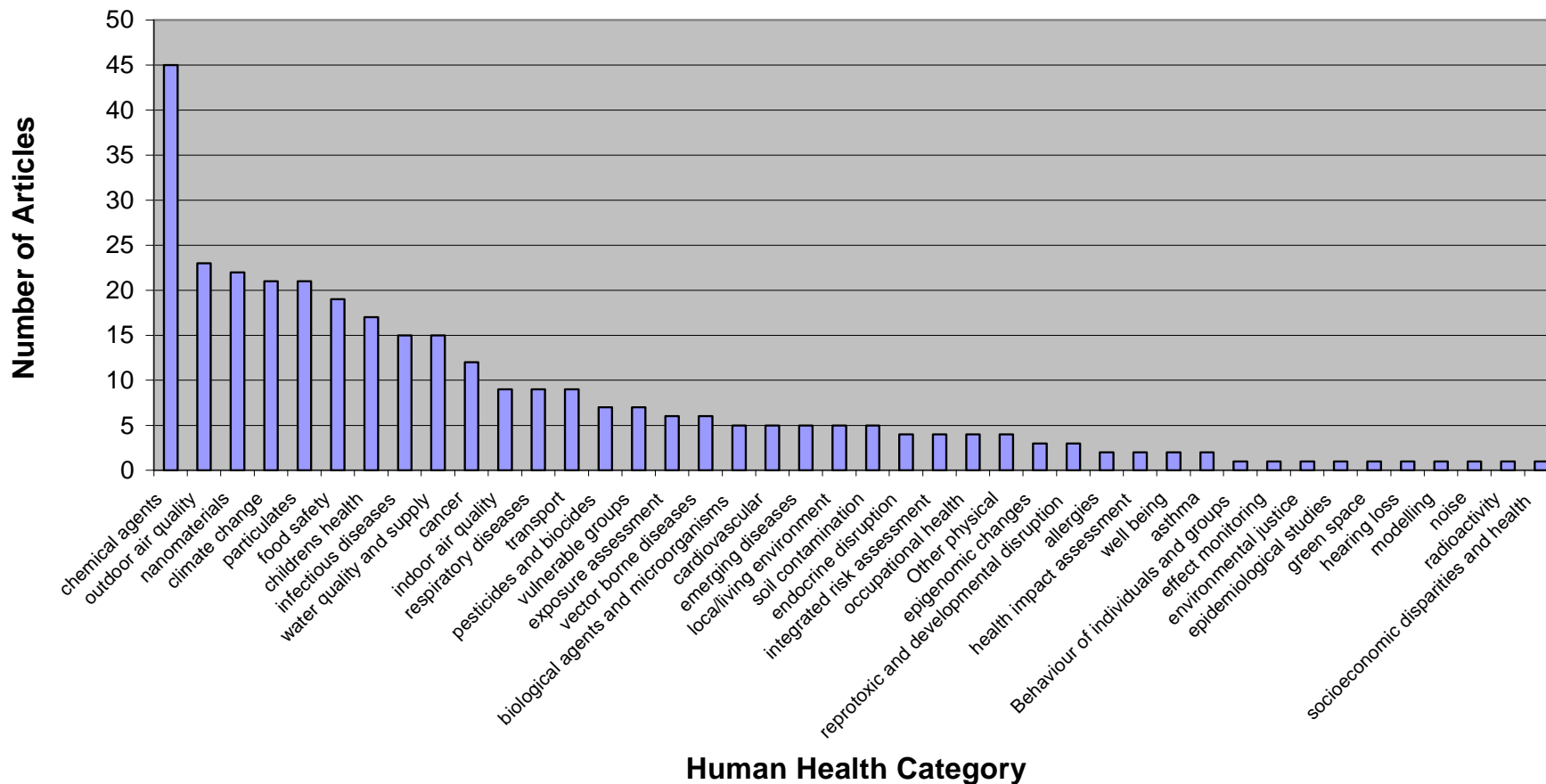
All of the articles collected over the 12 month period were referenced to the same categories and sub-categories used in the analysis of the database of projects. The articles, in the same way as the projects, could be referenced to more than one category or sub-category. In addition a number of articles were identified which did not fit into any of these categories and these are collated separately at the end of this section.

In Figure 4, shown below, the number of horizon scanning articles obtained over the 12 months is shown for each of the sub-categories. For some of the categories there were no articles during the 12 months. These were: biomedical technology, cost benefit analysis, EMF, fibres, gender and health, human biomonitoring, ocular disorders, quality assurance and management, risk communication, sleeping disorders and standardisation/harmonisation.





Figure 4 - Horizon Scanning Articles for Each Human Health Category





The most horizon scanning articles (45) relate to chemical agents with almost double the number of the next most popular theme. There were a significant number of articles for outdoor air quality, nanomaterials, climate change, particulates and food safety.

Although it is difficult to compare the number of articles from horizon scanning with the number of projects in the database due to partners not working in all areas, the relatively the large number of articles for climate change and nanomaterials compared to the project database. This indicates that these are strongly emerging issues.

Only four of the human health effects had more than five horizon scanning articles. These were in decreasing order of number of articles: infectious diseases, cancer, respiratory diseases and vector borne diseases. In terms of the methodology theme, only exposure assessment had more than five or more articles. In terms of social aspects of environment and health, the only theme with a significant number of articles was children's health which was the theme with the largest number of projects in the database.

In a similar way to the analysis of projects, the emphasis is on the activities and media and agents rather than effects, methodologies or social aspects.

A list of possible topics for cooperation or a call for research proposals, based on the horizon scanning, is shown below. This also includes a number of topics which did not fit the categories that were used in the original questionnaire and database developed in Workpackage 1.

Nanomaterials

- Safety (toxicity and ecotoxicity) of nanomaterials and their mode of action
- Use of nanoparticles in sunscreen combined with increased use of sunscreen
- Use of carbon nanotubes
- Genetic damage in animal testing caused by nanoparticles
- Silver nanoparticles and nerve cell damage
- Requirement for exposure data throughout lifecycle of nanoproducts – production, use and disposal

Particulates

- Linking sources and identifying what size or part of PM is responsible for health effects
- Particulates including nanoparticles from hazardous waste incineration

Chemicals

- Flame retardant exposure on fertility
- Stain repellents and thyroid disease
- Chemicals in the environment occur in complex mixtures but risk assessment tends to be based on single chemicals – new approaches are needed





Water

- Perchlorates in water – sources and effects
- Pharmaceuticals and personal care products in waters

Outdoor air quality

- Long term exposure and hospitalizations for elderly people
- Ozone pollution from ethanol and petro-base vehicles
- Effect of air pollution on unborn children
- Long term urban pollution raises blood pressure

Indoor air quality

- School classroom air more polluted with ultrafine particles than outdoor air

Climate Change

- Mental health problems, such as post-traumatic stress and depression are predicted to increase as climate change brings more frequent extreme weather events. Particular groups such as children, elderly and adults with existing mental health problems are more likely to be affected
- Increase in tropical diseases due to movement of insects from tropical areas
- Heat island effect
- Increase in allergies due to the increase in pollen from certain plants/weeds
- Release of pollutants from glacial melting

Food Safety

- Bisphenol A (BPA) leaching from polycarbonate bottles
- Perfluorochemicals used in paper food wrappers leaching into food
- Elevated CO₂ levels on crops particularly changes in nutritional value
- Use of nanomaterials in food packaging
- Commercial fishing of transgenic fish (these are more resistant to toxins and may accumulate)

Monitoring

- Personal health monitoring using cell phones
- Air quality monitoring using sensors attached to vehicles, cyclists and pedestrians
- Use (advantages and disadvantages) of new technology for example twitter and facebook for responding to emergency situations such as flooding

Other

- Physical damage to buildings and infrastructure associated with weed growth which is enhanced by change in climate, reduction in herbicide use and new invasive species i.e. weeds, insects
- Cost effective instruments for measuring continuous PM composition analysis
- Use of satellites and geographic mapping for tracking disease outbreaks
- Green space improves health – identifying diseases that benefit and the types of green space
- Health effects of home insecticides





- Dynamic maps – using hospitalisation rates and superimposing environmental exposure maps in order to determine a link
- Synthetic biology i.e. biofuels – monitoring and regulation

A list of all the articles collected over the past 12 months (June 2009 – May 2010) can be seen in Appendix 1.

4.2.1 Expert Opinion

Following the presentation of the draft report at the annual General Assembly meeting, an opportunity was provided for partners to nominate areas as emerging issues that have not been identified in the draft report or to emphasize ones that had already been identified. Only those subjects where there are likely to be a number of partners working in these areas have been included.

Climate Change

- The potential for alterations in climate to adversely affect exposure to chemical contaminants, e.g. in drier places more dust may be formed from contaminated soils. Conversely, increased soil temperature may lead to increased degradation of some pollutants or it may volatilise others.
- Vector borne diseases, including their control to minimise environmental impact of associated biocides

Indoor air pollution

- How “green construction” can improve indoor air quality

Pesticides and biocides

- The effect of pesticides on pregnancies

Local/Living environment

- Outdoor recreation in urban areas and human health

Chemical Agents

- The health impact of the use of biofuels, instead of fossil fuel, especially for the combustion products
- The impact of chemical agents in the long term, in low doses and in mixtures
- Detect and quantify endocrine disrupters in different media
- Predictive and new methodologies in toxicology and ecotoxicology including alternatives to animal experiments

Nanomaterials

- To detect and characterise nanomaterials

Other

- Combined exposure to environmental stressors e.g. air pollution and noise
- Methods to evaluate environmental protection measures on health
- Globalisation – transport of goods worldwide and movement of people
- Cost-benefit analysis in environment and health





5. VISUALISATION OF DATA

In order to appreciate the range of projects in the database and rather than just listing project titles, objectives etc., there are ways of seeing them as pictures in a so called visualisation. The aim of this visualisation is to depict the distribution of projects by identifying clusters of similar or related project activity. It is generated from the textual descriptions of ongoing research projects in the ERA-ENVHEALTH database collected by the partners. This visualisation approach has been used in the Skep ERA-Net (www.skep-era.net).

Statistical text analysis methods have been applied to the set of project information to identify semantically related research (through the occurrence of shared terminology and vocabulary). Further statistical processes have been applied to enable this information to be displayed in an interactive 2D applet window.

In the visualisation, dots represent different projects, with different colours representing different partner countries in ERA-ENVHEALTH. The radius of the dots is proportional to the budget of the project (this feature can be switched off). The closer the dots are together, the closer they are semantically i.e. the more terminology (keywords) they share. Consequently the further apart projects are in the visualisation, the less they have in common. There are no labelled axes in the 2D visualisation as it uses a force-directed algorithm to obtain the best layout in terms of equilibrium between attraction of similar projects and repulsion of dissimilar ones.

Gaps between projects/articles can be clicked and keywords are displayed which are extrapolated from the keywords associated with the nearest neighbouring projects and serve to give an indication of what the gap refers to. What fits in the gap is dependent on the other keywords that such an item would have associated with it (and liable to other attractions and repulsions in the visualisation accordingly). The keywords in gaps are calculated as follows:

- the 5 nearest neighbours are investigated (regardless of distance - even on the periphery of the visualisation)
- keywords that occur in at least 2 of the nearest neighbours are displayed

Horizon scanning information has been incorporated with this visualisation. Articles specifically about the area of environment and health have been collected and amalgamated with this visualisation to illustrate the potential gaps in the current research programmes (with click-through evidence about these threats or opportunities).

Two visualisations were produced. The first shows all the projects and an option to also view the horizon scanning articles as well. The second visualisation shows only those projects where there are more than 200 characters of available text which equates to 300 of the 464 projects that are in the project database. This visualisation also allows the viewing of the horizon scanning data. By limiting the projects displayed to those with more associated details it is assumed that the visualisation will be more accurate.





Screenshots from some visualisations can be seen below. The first shows all the projects in the database irrespective of the amount of information stored for a project. The second visualisation shows all the horizon scanning articles. The third visualisation shows only those projects where there are more than 200 characters of information held on the project. The final visualisation shows the horizon scanning articles where there are more than 200 characters in the article.

A screenshot of a Microsoft Internet Explorer browser window displaying the ERA-ENVHEALTH Project Information Viewer. The browser's address bar shows the URL 'http://87.84.223.226:8080/EnvHealth.v3/result.jsp'. The page header includes the ERA-ENVHEALTH logo, the text 'ERA-ENVHEALTH', and the date '5 August 2010'. The main content area is titled 'ERA-ENVHEALTH Project Information Viewer (All projects & articles)' and includes a search bar, a 'Keyword and Theme Highlight' section with a list of countries (Austria, Belgium, Canada, Denmark, France, Germany, Ireland, Israel, Italy, Poland, Slovakia, Sweden, Switzerland, The Netherlands, United Kingdom, Horizon Scan), and a 'List Highlighted Projects' section with buttons for 'Clear Highlights', 'Show Project Titles', and 'Highlight Mode'. A large visualization area on the right shows a dense cluster of multi-colored dots. The Windows taskbar at the bottom shows the Start button and several open applications, including 'Inbo...', 'Micr...', 'draft...', 'scre...', 'Proj...', and 'RE: ...', with the system clock showing '09:00'.





Project Information Viewer - Microsoft Internet Explorer

Address: http://87.84.223.226:8080/EnvHealth.v3/result.jsp

ERA-ENVHEALTH

5 August 2010

ERA-ENVHEALTH Project Information Viewer
(All projects & articles)

Click here for help and explanation

Keyword and Theme Highlight

Austria Belgium
Canada Denmark
France Germany
Ireland Israel
Italy Poland
Slovakia Sweden
Switzerland The Netherlands
United Kingdom Horizon Scan

List Highlighted Projects
Clear Highlights

Show Project Titles
Highlight Mode

Figure: A network graph visualization showing a cluster of white nodes on a black background.

Project Information Viewer - Limited - Microsoft Internet Explorer

Address: http://87.84.223.226:8080/EnvHealth.v3/limitedresult.jsp

ERA-ENVHEALTH

ERA-ENVHEALTH Project Information Viewer
(Projects & articles >200 characters)

Click here for help and explanation

Keyword and Theme Highlight

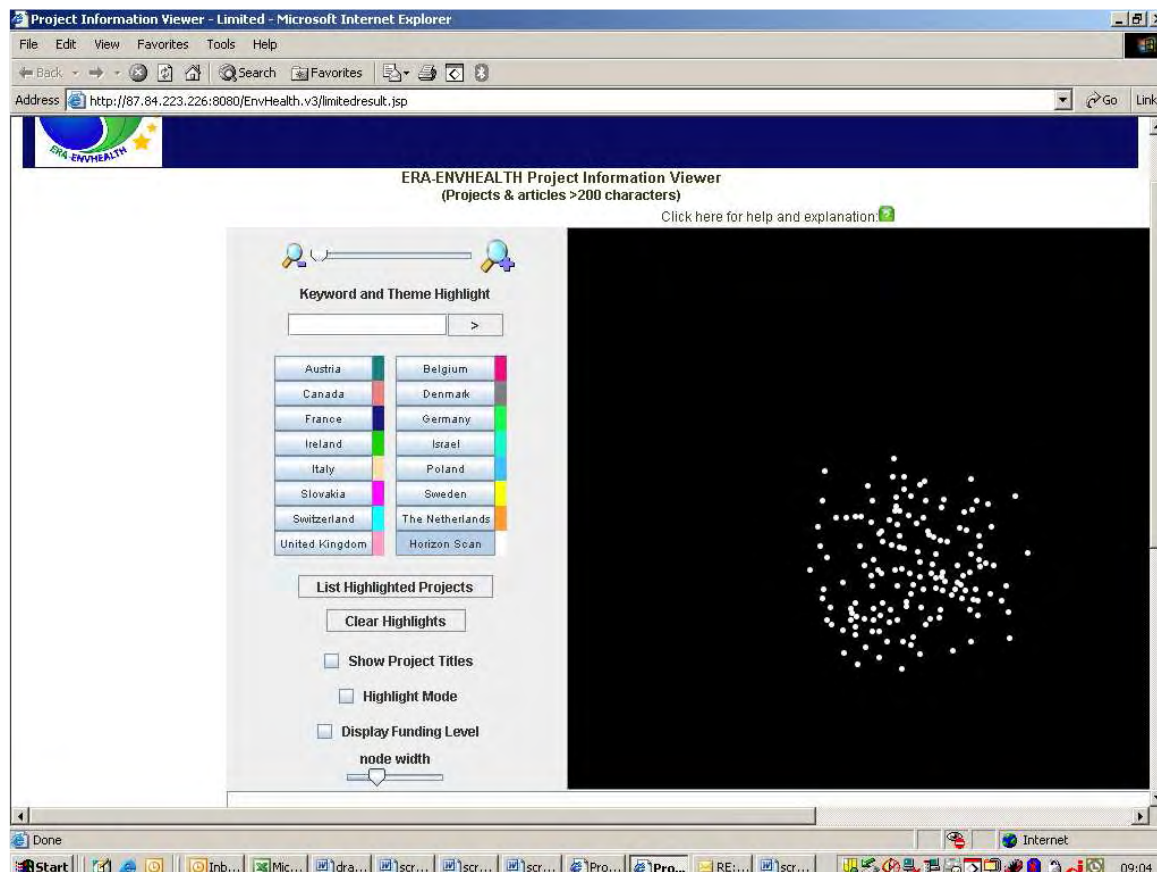
Austria Belgium
Canada Denmark
France Germany
Ireland Israel
Italy Poland
Slovakia Sweden
Switzerland The Netherlands
United Kingdom Horizon Scan

List Highlighted Projects
Clear Highlights

Show Project Titles
Highlight Mode
Display Funding Level
node width

Figure: A network graph visualization showing a cluster of multi-colored nodes on a black background.





In looking at these visualisations a number of areas of clustering of projects can be seen. These are under the keywords of water, nanotechnology, pesticides, particulates and occupational.

The visualisation also shows some gaps in research areas associated with the following keywords:

- Climate
- Impacts, mortality, pathogens
- Climate change
- Pollen
- Indoor air quality
- Indoor dust
- Newborn
- Toxicity
- Spatial inequalities

In terms of the horizon scanning two areas of clustering are climate change and nanotechnology. This would indicate that these two areas are strongly emerging issues for research.

This visualisation is available through the project website so that others can view the data and use it interactively. These visualisations can then be used to help plan further activities for ERA-ENVHEALTH.





6. DISCUSSION AND CONCLUSIONS

In considering the strategic and common issues in E&H research, four themes related to human health – activities and media were identified as being suitable for immediate joint activities such as knowledge exchange. This was based on the number of projects in the database relating to these themes and the number of partners involved in these areas. These four areas are:

- Outdoor air quality
- Local/living environment
- Water quality and supply
- Indoor air quality

Within each of these themes more detailed areas of work have been identified.

Similarly four themes related to agents were also identified as being suitable for immediate joint activities such as knowledge exchange:

- Chemical agents
- Biological agents and microorganisms
- Particulates
- Pesticides and biocides

Again, within each of these themes more detailed areas of work have been identified.

In terms of emerging issues, the horizon scanning has identified a number of broad areas and more detailed topics for possible future work including research calls. These broad areas are:

- Nanomaterials
- Particulates
- Chemical agents
- Water quality and supply
- Outdoor air quality
- Indoor air quality
- Climate change
- Monitoring

In comparing current issues with emerging issues there are three themes which feature in both lists at the theme and sub-theme level. These are outdoor air quality (for example ozone pollution), particulates (for example linking sources and fractions responsible for toxic effects) and chemical agents (for example exposure to flame retardants).





7. RECOMMENDATIONS

The areas and groupings identified as strategic and common issues should be considered by the partners at the Annual General Assembly in September 2010 and subsequent planning of future activities. In particular the partners should consider which topics can be put forward for consideration by Workpackage 3 which will be drawing up a plan for opportunities for the partners to work together.

The emerging issues should also be considered at the annual General Assembly meeting, and subsequent planning, when considering the topics for a second research call. This will be alongside issues identified by partners via a questionnaire issued prior to the General Assembly meeting. In addition this should also be considered alongside the new task on policy relevance.

The work undertaken in Workpackage 2.2 to develop prioritisation can be used to prioritise the research areas.





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Appendix 1 – List of Horizon Scanning Articles

| Title | URL | Source | Date |
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| Short-term air pollution exposure may damage DNA | http://www.healthday.com/Article.asp?AID=627069 | HealthDay | 17/05/2009 |
| New data suggest PBDE byproducts are ubiquitous in U.S. waters | http://pubs.acs.org/doi/full/10.1021/es901200v | Environmental Science and Technology | 27/05/2009 |
| Individuals who apply pesticides are found to have double the risk of blood disorder | http://www.physorg.com/news164037691.html | PhysOrg.com | 12/06/2009 |
| Vancomycin resistant enterococci (VRE) in Swedish sewage sludge | http://www.actavetscand.com/content/51/1/24 | Acta Veterinaria Scandinavica | 11/06/2009 |
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| Nine alien insects to cause pain, illness and even death in Britain as climate warms up | http://www.telegraph.co.uk/earth/environment/climatechange/5463255/Nine-alien-insects-to-cause-pain-illness-and-even-death-in-Britain-as-climate-warms-up.html | The Telegraph | 07/06/2009 |
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How to join the ERA-ENVHEALTH project

Your organisation funds and/or manages E&H research programme

If your organisation is interested in taking part in the ERA-ENVHEALTH project, please contact the leader of the "Extend the network" task for more information on how to join the project as an E&H research funding and/or managing organisation:

Luciana SINISI
ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale
Via Curatone 3
00185 Roma
Italy
Tel: +39 0650071
luciana.sinisi@isprambiente.it

You are interested in becoming a member of the External Interest Group (EIG)

If you are interested in joining the External interest group to be kept informed of the progress of the project and maybe be called upon to participate in certain meetings and discussions, please contact the leaders of WP5 "Dissemination and Communication":

Bart VERHAGEN
and **Mohssine EL KAHLOUN**
ERA-ENVHEALTH project communication
Federal Coordination Environment & Health Services of the President
FPS Health, Food Chain Safety and Environment
Victor Horta Square 40, box 10
B-1060 Brussels
Belgium
Tel: +32-2524 96 89
Fax: +32-2524 90 70
yseult.navez@health.belgium.be
and mohssine.elkahloun@belspo.be

You are part of another ERA-NET focusing on Environment and/or Health

Other ERA-NETs with a focus on environment and health are more than welcome get in contact to exchange ideas and look at possible cooperation. In this case, please contact the coordinator of the project:

Adrienne PITTMAN
ERA-ENVHEALTH project coordination
European and International Affairs Unit
French agency for food, environmental and occupational health safety
27-31 avenue du Général Leclerc
94700 Maisons-Alfort
+33 1 56 29 56 40
adrienne.pittman@anses.fr

Partners of the consortium:

| Partner name | Acronym | Logo |
|---|-------------|---|
| French Agency for food, environmental and occupational health safety (France) | ANSES |  |
| French Environment and Energy Management Agency (France) | ADEME |  |
| Ministry of Ecology, Energy, Sustainable Development and the Sea (France) | MEEDDM |  |
| Belgian federal Science Policy Office (Belgium) | BelSPO |  |
| Federal Public Service Health, Food Chain Safety and Environment (Belgium) | FPS |  |
| Environmental Protection Agency (Ireland) | EPA |  |
| Superior Institute for Environmental Protection and Research (Italy) | ISPRA |  |
| Swedish Environmental Protection Agency (Sweden) | Swedish EPA |  |
| Ministry for Housing, Spatial Planning and Environment (Netherlands) | VROM |  |
| National Institute for Public Health and the Environment (Netherlands) | RIVM |  |
| Public Health Authority of the Slovak Republic (Slovak Republic) | UVZ |  |
| Environment Agency (England and Wales) | EA |  |
| Natural Environment Research Council (UK) | NERC |  |
| Ministry of Health (Israel) | MOH |  |
| Federal Environment Agency (Germany) | UBA |  |
| National Research Council (Italy) | CNR |  |