

# Environmental Research Centre

## Report Series No. 15

### Understanding the Links Between the Environment, Human Health and Well-Being

#### STRIVE

Environmental Protection  
Agency Programme

2007-2013

# Environmental Protection Agency

The Environmental Protection Agency (EPA) is a statutory body responsible for protecting the environment in Ireland. We regulate and police activities that might otherwise cause pollution. We ensure there is solid information on environmental trends so that necessary actions are taken. Our priorities are protecting the Irish environment and ensuring that development is sustainable.

The EPA is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Heritage and Local Government.

## OUR RESPONSIBILITIES

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- intensive agriculture;
- the contained use and controlled release of Genetically Modified Organisms (GMOs);
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- Co-ordinating research on environmental issues (including air and water quality, climate change, biodiversity, environmental technologies).

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### MANAGEMENT AND STRUCTURE OF THE EPA

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The work of the EPA is carried out across four offices:

- Office of Climate, Licensing and Resource Use
- Office of Environmental Enforcement
- Office of Environmental Assessment
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet several times a year to discuss issues of concern and offer advice to the Board.

# **Understanding the Links between the Environment, Human Health and Well-Being**

## **Environmental Research Centre Report**

*End of Project Report available for download on <http://erc.epa.ie/safer/reports>*

Prepared for the Environmental Protection Agency

by

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Reports produced through the Environmental Research Centre are intended as contributions to inform policy makers and other stakeholders to the necessary debate on environmental protection.

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# Executive Summary

## 1 Context

Challenges exist with regard to environmental health, in that there is a critical need to form stronger partnerships between the various agencies and medical specialists in activities that will further the science, education, and health of the community. Following controversial licensing decisions by the Environmental Protection Agency (EPA) in 2005, a series of meetings was held between the EPA and the Health Service Executive (HSE) in an effort to clarify the different roles of each organisation with respect to the protection of public health. The EPA also had discussions with the Institute of Public Health (IPH) and with the Food Safety Authority of Ireland (FSAI) on a similar theme. Following these meetings, a Memorandum of Understanding (MOU) was agreed and signed by both the HSE and the EPA. Also, in order to advance the area of environment and health, the EPA, through the Environmental Research Centre (ERC), agreed to fund a postdoctoral research fellowship. The results from that fellowship are reported here.

## 2 Methods

The focus of the fellowship was on a number of key topics such as:

- Health Impact Assessment (HIA);
- Databases and the use of Geographical Information Systems (GIS) tools;
- Possible role of the ERC;
- Issues raised in the European Environment Agency (EEA) *Environment and Health* report<sup>1</sup>;
- Prioritising environment/health issues for Ireland;

1. EEA, 2005. *Environment and Health*. Adapted from EEA and the Third Assessment Report from the Intergovernmental Panel on Climate Change [http://reports.eea.europa.eu/eea\\_report\\_2005\\_10/en/EEA\\_report\\_10\\_2005.pdf](http://reports.eea.europa.eu/eea_report_2005_10/en/EEA_report_10_2005.pdf)

- Developing joint position papers on selected topics;
- Possibilities for human biomonitoring (HBM); and
- Research needs in the area of environment and health.

It also included interaction among and exchange of information between the EPA, the HSE and the IPH, which were advanced through a series of face-to-face meetings, telephone and email contacts, and discussions. The future role of the ERC in allocating funding for research projects under the environment and health strand and suggested research and development were explored using published literature, policy documents, liaison and contact with other agencies involved in similar research activities. The role of HBM in Ireland has been followed by continuous liaison with the Expert Team to Support BIOmonitoring in Europe (ESBIO) and the Environmental Health Unit within the Irish Department of Health and Children (DOHC). As a research component was also a major part of the fellowship, an evaluative case study was conducted on the collaborative process used in the investigation of the presence and influence of lead in the Silvermines area of North Tipperary.

## 3 Results

Partnerships between the EPA, the HSE and the IPH were developed, with a commitment to work mutually on issues that concerned the organisations and with a collective objective and agenda, creating joint action towards arranged targets. During the 2 years of the fellowship, a number of position papers were produced in cooperation between the HSE and the EPA. Suggested changes to the text contained in the EPA *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EISs) were written in cooperation with the IPH, which aims to give more focus to human health when preparing an EIS. Links between the HSE Health Atlas Team and the EPA GIS Team have also been developed. The future of environment and health research within the Irish

context was explored through examination of published literature and in consultation with other stakeholders. A detailed case study of the collaborative process employed during the investigation into the presence and influence of lead in the Silvermines area was undertaken through a series of semi-structured interviews with participants of the process.

## **4 Conclusions**

The increasing emphasis on collaboration between agencies and sectors entails potential partners developing their capacity for working together across organisational and sectoral boundaries. Partnerships across government departments and their agencies are central not only to dealing with complex

environment and health issues but also to improve health and to build healthy policies and to support healthier communities. Partnerships and collaborations must be seen as important change strategies.

## **5 Policy Recommendations**

Multiparty working by government departments and government agencies must be seen as fundamental to mainstream activities in the area of environment and health, and levels of trust must be cultivated. Commitment to partnerships must have support at a senior level in order for the partnerships to be effective and to bring about change. A policy regime of mutual gain can realise widespread and lasting environmental health benefits.

# 1 Introduction

The area of environment and health, in its broadest sense, comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land use and transportation, industry, and agriculture. The protection of human health is a fundamental aspect of environmental protection. The level of environmental public health protection in Ireland is widely regarded as being high, although some issues continue to cause concern. For example, while considerable investment has been made in improving drinking-water quality, high microbiological levels are still found in not only many of the smaller private rural water schemes but also in public water supplies. In late 2008, the issue of drinking-water supplies found to contain elevated lead levels came to public attention and required immediate action both on the part of the home owner and the legislative authorities.

Innovation is essential to ensure that we are not confronted in the future with health problems that are not yet apparent. Research is one important mechanism in avoiding such health problems. A new impulse is therefore needed for research into the relationship between environment and health.

Current thinking is to invest in research that aims to understand human behaviour and its relationship to disease and health. In addition, as the border between public health and medicine becomes increasingly blurred, there is a greater need for disciplines to work with and understand each other. Challenges exist with regard to environmental health, in that there is a critical need to form stronger partnerships between the various specialists in activities that will further the science, education, and health of the broader community. The traditional model of local government is not well suited to the challenges facing local authorities, particularly when examining approaches to

collaboration and identifying lessons for future practice (Hambleton et al., 1996).

Collaboration receives universal recommendation as a mechanism for optimising resources, avoiding duplication, exploiting individual strengths and internal capacity building. Collaboration may be seen as an effective way of resolving a social, economic or environmental concern that is essential and urgent.

Researchers are beginning to understand the benefits that can be achieved by working together in partnership. Partnerships are formed where two or more organisations make a commitment to work together on something that concerns both, to develop a shared sense of purpose and agenda, and to generate joint action towards agreed targets (Stern and Green, 2005). While partnership may be referred to as a 'slippery concept' (Audit Commission, 1998), there is no agreed definition and the settings may be different within the sector in which they occur. Working in collaboration or partnership rather than working in parallel can invigorate people and result in new ways of dealing with many impasses. Terms such as collaboration, cooperation, coordination, coalition, network, alliance and partnership are often used interchangeably (Huxham, 1996). Where collaborations are used, an evaluation of the process is central as it can both increase and also evolve learning. The purpose of systematically collecting, analysing and interpreting information in response to critical questions is to inform a programme, and/or organisational decision making, judgement, and learning. Evaluation provides the focus, feedback and learning to support continuous progress and ongoing adaptations.

Following controversial licensing decisions by the Environmental Protection Agency (EPA) in 2005, a series of meetings was held between the EPA and the Health Service Executive (HSE) in an effort to improve cooperation between the two organisations in the general area of environment and health. The objective of the HSE is to use the resources available to it in the

most beneficial, effective and efficient manner to improve, promote and protect the health and welfare of the public. The EPA has responsibilities for a wide range of licensing, enforcement, monitoring and assessment activities associated with environmental protection.

The EPA also had discussions with the Institute of Public Health (IPH) and with the Food Safety Authority of Ireland (FSAI) on a similar theme.

The meetings with the HSE/IPH focused on the following areas:

- Developing joint position papers on selected topics;
- Health Impact Assessment (HIA);
- Databases and the use of Geographical Information Systems (GIS) tools;
- Possibilities for human biomonitoring (HBM);
- Prioritising environment/health issues for Ireland;
- Research needs in the area of environment and health;
- Issues raised in the European Environment Agency (EEA) *Environment and Health* report (EEA, 2005); and
- Possible role of the Environmental Research Centre (ERC).

Arising from this series of meetings, a Memorandum of Understanding (MOU) (see End of Project Report) was agreed and signed by both the HSE and the EPA. Also, in order to advance some of the other topics discussed, the EPA, through the ERC, agreed to fund a postdoctoral research fellowship. A research component for the fellowship was also contracted, which was an evaluative case study of the Silvermines inter-agency group (IAG) collaborative process.

### **1.1 Objective of the Fellowship**

The objective of this environment and health research fellowship was to explore the research needs, national and regional policy options, and practical project

initiatives that should be mobilised to deliver better public health through environmental protection functions. The emphasis of this fellowship was on interaction and exchange of information among the main stakeholders such as the EPA, the HSE and the IPH.

### **1.2 Methodology**

- A case study of the collaborative process used following the invocation of the *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997) to investigate the presence and influence of lead in the Silvermines area of North Tipperary was undertaken using a combination of qualitative and quantitative research methods known as triangulation.
- Interaction and exchange of information among the stakeholders involved in Integrated Pollution Prevention Control (IPPC) licensing and HIA were fostered through a series of face-to-face meetings and telephone and email contact and discussions (see End of Project Report).
- Interaction and exchange of information among the stakeholders involved in GIS within the EPA and the HSE Health Atlas Team were fostered through face-to-face meetings and telephone and email contact and discussions (see End of Project Report).
- Published and otherwise available documents relating to environment and health research were collated and explored, coupled with liaison and contact with other agencies involved in similar research activities, in order to make recommendations to the ERC on allocating funding for research projects under the environment and health strand.
- The role of HBM in Ireland has been followed by continuous liaison with the Expert Team to Support BIOmonitoring in Europe (ESBIO) and the Environmental Health Unit (EHU) at the Department of Health and Children (DOHC).

### 1.3 Report Structure

The primary goal of this EPA research fellowship entitled *Understanding the Links between the Environment, Human Health and Well-Being* was to undertake translational research to provide knowledge to assist in the development and implementation of effective policy actions to reduce environmental impacts on human health. A second goal was to bring together a truly multidisciplinary assemblage of theoretical perspectives and research that contributes to the understanding of the interface between the environment and human health.

This report describes the nine main components of the research fellowship. [Chapter 1](#) provides an introduction to the area of environment and health and the background to the need for research and development within an Irish context, the objective of the fellowship and the methodologies used. The report is then divided into eight further chapters. Each chapter provides a context for the relevant issue, the methodology employed in this fellowship, conclusions and, finally, policy implications.

[Chapter 2](#) outlines the background events which culminated in the invocation of the *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997) with the establishment of an inter-agency group (IAG), which was tasked with investigating the presence and influence of lead in the Silvermines area of North Tipperary. As part of this fellowship, a research project was conducted involving an evaluative case study of the collaborative process used to carry out the investigation, draw conclusions and, finally, make recommendations on findings. A summary is presented of the methodology used in this case study, conclusions and policy implications.

[Chapter 3](#) provides the background to the development of the MOU between the EPA and the

HSE. This resulted in the development of an agreed process to collaborate on future position papers and the drafting of some in priority areas agreed with the EPA and the HSE. A list of position papers drafted to date as part of this fellowship is provided.

[Chapter 4](#) provides the background to EPA licensing obligations under current relevant European legislation; EISs and HIA are discussed with suggested rewording, and additional requirements that were identified as part of this fellowship are described.

[Chapter 5](#) introduces databases and the use of GIS in the area of environment and health. Recent developments within an Irish context are provided and the use of GIS data among EPA and HSE public health professionals is explored. As part of this fellowship, the need to discuss areas of mutual interest between the two lead organisations (EPA and HSE) in the area of GIS, environment and health was advanced through meetings and discussion of future collaboration and research projects.

[Chapter 6](#) introduces HBM and the background to Ireland's involvement in a future European HBM project.

[Chapter 7](#) explores the priority areas for Ireland within an environment and health context. The key objectives of the Irish draft *National Environment and Health Action Plan* (NEHAP) are reviewed and the policy implications discussed.

[Chapter 8](#) explores future research and the need for multidisciplinary research on interactions of environmental risk factors and human health to support the NEHAP.

Finally, [Chapter 9](#) discusses the role of the ERC with emphasis placed on the need to continue with current inter-agency collaborations in the field of environment and health.

## 2 Case Study: Silvermines Inter-Agency Group Collaboration

In early 1999, three cattle died from lead poisoning on a farm adjacent to the Gortmore Tailings Management Facility (TMF). The deaths of the cattle from lead toxicity were confirmed by post-mortem. Local concern was compounded by experiences in the 1980s which centred on dust-blow from the TMF and by an EPA-published report in January 1999 (EPA, 1999). These circumstances led to the activation of a protocol (*Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997)) for collaboration between public agencies dealing with issues such as human and animal health and the environment.

The need for such a coordinated and early response system had been highlighted during a previous environmental investigation of animal health problems in the Askeaton area of Co. Limerick. In the final report of the investigation (EPA, 2001), it was acknowledged that the state agencies did not become involved in a co-coordinated way for some years after the problems were first manifested and, consequently, the opportunity to make observations at the most critical period was limited. This experience gained in the investigation of the animal health problems in Co. Limerick in the 1990s emphasised the need for early intervention and for a systematic and co-coordinated approach to any similar problems in the future.

The most important requirement of this Protocol is the early reporting of any similar health problems to the state agencies and the subsequent establishment of an IAG that would have the authority to study the situation and undertake necessary interventions in a timely manner. This Protocol was applied in the Silvermines area of North Tipperary investigation. The Protocol was in contrast to the traditional fragmented approach whereby state agencies dealt unilaterally with any health issue. Adoption of this Protocol was agreed by the Department of Agriculture and Food (DAF), the DOHC, the Department of Environment and Local Government (DOELG), Teagasc and the EPA.

The agreed Protocol was intended to encourage and ensure that a variety of disciplines within state agencies worked together to investigate health issues, which could be multifactorial.

Following the cattle deaths in Silvermines and invocation of the Protocol, an IAG was established. The primary goal of this IAG collaboration was to investigate the presence and influence of lead in the Silvermines area and to ensure that any risks to human and animal health, as well as to the environment, from elevated levels of lead and other metals were minimised and that the Silvermines area remained a safe place in which to live and work. The longer-term goal of the group was to achieve a successful and sustainable rehabilitation of the main mining sites identified in the area and to reduce the risks to health and the environment. The Mid-Western Health Board (now part of the HSE) became involved because of widespread local concern that if environmental factors were found to be the cause of adverse effects on animal health then these could also have implications for human health. There was also a perception locally of increased incidences of actual health problems such as cancer (Fahy, 2001). Thus, in summary, the impetus for the Silvermines environmental investigation arose because of the recognition that there might be health impacts caused by an environmental hazard (lead) in the Silvermines area. A case study of the effectiveness of the IAG collaborative process (stipulated by the Protocol) to conduct an investigation provided an opportunity for the exploration of the value and limitations of the approach.

The aims of the case study were to:

1. Identify those factors most important to, and essential for, successful IAG collaboration;
2. Identify options for more successful interaction and coordination of government departments, state and local agencies in their efforts to promote

environmental and public health goals in contaminated communities;

3. Evaluate or suggest initiatives to further enhance successful IAG collaboration; and
4. Ascertain from participants if modifications to the current *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* were required.

The case study used both qualitative and quantitative methods, known as triangulation, and it was conducted in three phases.

1. **Phase One (Archival)** included review of minutes of meetings and reports from the agencies that chaired the groups at different stages in the investigation and associated newspaper articles.
2. **Phase Two (Qualitative)** included organising and carrying out a series of one-to-one semi-structured interviews with the main stakeholders. Such interviews were the most appropriate approach for case studies involving multiple participants. A purposive sample of the main stakeholders/actors was identified from all participating agency members. An interview guide was developed and provided to the interviewees in advance of the scheduled interviews.
3. **Phase Three (Quantitative)** included the distribution and administration to members of all participating stakeholders of a modified version of the Borden and Perkins (1999) collaboration checklist self-evaluation tool.

The goal of the case study was to gain information which would assist individuals participating in collaborative efforts investigating human or animal health issues. Most qualitative researchers not only believe that there are multiple perspectives or views of any case study that need to be represented, but that there is no way to establish beyond contention which is the best or the most valued view (Stake, 1995).

The report centres mainly on articulating the views and opinions of the participating stakeholders concerning their perceptions of the value of and key factors influencing progress and success in collaboration.

Specific outcomes were not the focal point. Despite the many challenges faced by IAG collaboration, it appears that the overwhelming consensus was that collaboration is a more effective way of achieving results, and that taking time to gather the evidence before making decisions is accepted as more efficient. The evaluation of the Silvermines IAG collaborative process explored the substance of using collaboration to address the issues faced by the local community. The evaluation was based on a series of one-to-one semi-structured interviews with former IAG members. The case study endeavoured to accurately express what multi-stakeholder collaboration believed to be the main successes and challenges of the collaboration effort. It also explained what the interviewees believed to be the overall value of using IAG collaboration to address complex local issues. In addition, it is expected that this case study will provide a better understanding of IAG collaboration in terms of what was achieved, factors that contributed to advancement and successes, and organisational barriers that may have limited the success of the collaboration. The full report on the case study is provided in the End of Project Report.

An evaluation is a process to systematically collect, analyse and interpret information in response to critical questions in order to inform a programme, and/or organisational decision making, judgement, and learning (Patton, 1980; Atkin, 1990; Weiss, 1990). An evaluation can both increase and evolve learning and it can provide focus, feedback and support for continuous progress and improvements (Extension Office, 1998). This evaluation provides information on how to identify and overcome obstacles common in the collaborative process and how to enhance efforts in the future.

## 2.1 Conclusions

- The overall score obtained on the Borden and Perkins (1999) collaboration checklist self-evaluation tool indicated a successful collaboration.
- The IAG collaboration accomplished tasks more efficiently.

- A shared vision and an agreed objective for collaboration achieved a satisfactory outcome.
- Insufficient resources were found to be the biggest challenge to the work of the IAG collaboration.
- Community participation in, but not necessarily on, the IAG collaboration from its inauguration was a vital element to its success.
- The IAG collaboration, which established a strong commitment to identifying problems and formulating solutions, reduced intra-community conflicts, thus channelling opposing interests into an acceptable outcome.
- By prioritising communication with the affected community, the IAG collaboration established trust and addressed personal and local concerns.
- Public meetings between the IAG collaboration and the public provided an important forum for intra-community communication.
- The level of complexity and interdependence of the modern world means that no community or society exists in isolation. People and their organisations are more aware of the importance of working together with others to achieve common goals.
- Huxham (1996) coined the term 'Collaborative Advantage' which is of relevance to all forms of collaboration, and by which she means "*the creation of synergy between collaborating organisations*" which refers to something 'unusually creative' being achieved that no organisation could have achieved on its own. The Silvermines IAG collaboration was one such 'Collaborative Advantage'.
- Existing communication measures used within and between coordinating agencies need to be reviewed or a third party with these requisite competencies should be hired for process design and facilitation of communication.
- A collaboration model for effective communication, based on principles of consultation, participation and timeliness between the main government departments and state agencies, needs to be developed or a third party with these requisite competencies should be hired for process design and facilitation of communication.
- A model for consultation that removes barriers and advocates consistency between coordinating agencies needs to be developed or a third party with these requisite competencies should be hired for process design and facilitation of communication.
- Use of the *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997) in future planning should be promoted by ensuring that it is disseminated and actively promoted across government departments, government agencies and local authorities or a third party with these requisite competencies should be hired for process design and facilitation of communication.
- Sufficient resources must be allocated prior to establishing any future IAG collaboration to ensure satisfactory functioning.
- The chairperson of any future IAG collaboration must be politically independent, a skilled convenor and have the respect and authority of all the member agencies in the group.

## **2.2 Policy Recommendations**

- The *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997) notification process requires a formal systematic approach.
- Following each invocation of the *Protocol for the Investigative Approach to Serious Animal/Human Health Problems* (EPA and DAFF, 1997), a review should be undertaken by the relevant lead agencies, in this case the Department of Agriculture, Fisheries and Food (DAFF) and the DOHC.

### 3 Developing Joint Position Papers

Under the MOU between the HSE and the EPA, signed in October 2006, it was agreed that joint position papers or statements on selected topics would be developed. Position papers provide programmatic guidance and influence public health policy on national, state and local levels. As part of this fellowship, a protocol for writing position papers was first developed (see End of Project Report). The purpose of establishing a writing protocol was to ensure good communication between the EPA and the HSE and agreement on the layout and content of a series of position papers on issues identified. Each agency is responsible for ensuring that the information included is factual and well researched. Position papers are usually one to one-and-a-half pages in length. The position paper should include a brief introduction followed by a comprehensive breakdown of Ireland's position on the topic being discussed. A good position paper will not only provide facts but also make proposals for resolutions.

Contact was established with the nominated environment and health representative from the HSE. A protocol for writing position papers was drafted by the research fellow and circulated in June 2007 to the EPA and the HSE. The research fellow also drafted the first position paper on *Nitrates in Drinking Water* and circulated it in June 2007 to the HSE. A meeting between the HSE, the EPA and the IPH was held on 11 January 2008 to discuss HIA, position papers and other areas of mutual interest. The outcome of the meeting was that the HSE agreed to provide input to the prepared position papers and the IPH agreed to review the draft position papers and give feedback and comment. A list of priority position papers was agreed upon and drawn up at this meeting and these are listed in [Table 3.1](#).

#### 3.1 Conclusions

- Position papers or statements are seen as a key tool to ensure a consistent response from the HSE Departments of Public Health and the EPA

**Table 3.1. List of position papers and status as of November 2008.**

| Name                                                                                              | Status November 2008                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Nitrates in Drinking Water</i>                                                                 | The final draft awaiting agency sign-off                                                                                                                                               |
| <i>Mechanical and Biological Treatment of Waste (includes composting and anaerobic digestion)</i> | Draft with the HSE                                                                                                                                                                     |
| <i>Co-Incineration of Waste in Cement Kilns and Power Plants</i>                                  | Draft with the HSE                                                                                                                                                                     |
| <i>Lead in Drinking Water</i>                                                                     | Draft with the HSE                                                                                                                                                                     |
| <i>Intensive Farming Waste Management and Pollutants (pig &amp; poultry)</i>                      | Not yet in draft form                                                                                                                                                                  |
| <i>Arsenic and Chromium in Drinking Water</i>                                                     | The HSE already has work done in this area and one member of the HSE staff has expressed an interest in the position paper and has been contacted and requested to formulate HSE input |
| <i>Trihalomethanes</i>                                                                            | The HSE already has work done in this area                                                                                                                                             |
| HSE, Health Service Executive                                                                     |                                                                                                                                                                                        |

Environment and Health Section in responding to queries from the public. They are an efficient way of delivering commonly needed advice at national level.

- Collaborative approaches, where stakeholder groups respect each other's role, play an important part in combating issues of multiparty interest, e.g. public/private partnerships, civil society/private sector cooperation.

### **3.2 Policy Implications**

- Policies are needed that foster the continued development of position papers related to environment and health.
- Policies are needed that support cooperative networks and effective assimilation of an increasing amount of data.

## 4 Human Health and Planning

The global industrial society has had profound effects on human health and the environment. Human activities are causing ecological disruption on a global scale. It is now becoming increasingly clear that development can have adverse, as well as beneficial, effects on health and well-being. Governments recognise the need to strengthen the role of environmental and health considerations in decision-making processes.

*“Health depends on our ability to understand and manage the interaction between human activities and the physical and biological environment. We have the knowledge for this but have failed to act on it.” (WHO, 1992).*

Perspectives in and knowledge about health have improved and it is now accepted that health is much more than the absence of disease and includes social and psychological well-being as well as the capacity to respond to the changing circumstances and conditions of life. Human health has been described as an overarching goal of sustainability, lying at the intersect of its environmental, economic and social pillars (Hancock, 1990).

Economic development is a central focus for analysing health benefits and costs. It can benefit health by improving standards of living, providing jobs, and yielding tax revenues to help pay for health, educational and social services. But development can cause adverse effects on health and well-being such as:

- Effects on physical health due to mortality and morbidity arising from communicable and non-communicable diseases and injuries;
- Effects on psychological well-being such as stress, anxiety, alienation and feelings of loss of control over one's life; and
- Effects on social and community health such as the loss of cultural identity and quality of life, social

disruption and violence and a breakdown of community and family support networks.

According to the WHO (1992), health is rarely seen as an explicit priority in decisions about development. Assessments provide an opportunity to give health considerations a greater priority in all aspects of development decision making.

### 4.1 Integrated Pollution Prevention and Control

The European Community Directive 96/61/EC on IPPC aims to achieve integrated pollution prevention and control arising from certain activities across the European Union (EU). It lays down measures designed to prevent or, where that is not practicable, to reduce emissions to the air, water and land from these activities, including measures concerning waste, in order to achieve a high level of protection of the environment as a whole. This means that regulators must set permit conditions so as to achieve a high level of protection for the environment, including human health.

The EPA has been licensing certain large-scale industrial and agricultural activities since 1994. Originally the licensing system was known as Integrated Pollution Control Licensing, governed by the Environmental Protection Agency Act, 1992. The Act was amended in 2003 by the Protection of the Environment Act, 2003, which gave effect to the IPPC Directive. Detailed procedures concerning the IPPC licensing process are set out in the EPA Acts 1992 to 2007 and the associated licensing regulations. The IPPC licences aim to prevent or reduce emissions to air, water and land, reduce waste, and use energy/resources efficiently. An IPPC licence is a single integrated licence that covers all emissions from a facility and also its environmental management. All related operations that the licence holder carries out in connection with the activity are controlled by this licence. The EPA protects public health through licensing of industrial and waste activities. Before a

licence is granted, the EPA must be satisfied that emissions from the activity will not cause environmental pollution. However, information on the existing environment and the impact of the proposed activity on the environment is required in the form of an Environmental Impact Statement (EIS). The results of the EIS are compiled in a document known as an Environmental Impact Assessment (EIA), which is submitted with a planning application.

The extent of the information required is dependent on the nature and magnitude of the emission and should be discussed in advance with the EPA. The EPA plays a health protection role by restricting what may be released from licensed facilities so that standards in the ambient environment are respected. These licences are actively enforced to ensure that those who flout environmental law and cause environmental pollution as a result of their actions are held to account. The EPA sends a copy of all relevant IPPC applications associated with activities sited within a HSE area marked for the attention of the Director of Public Health. The EPA is required to send this within 14 days of receipt of the licence application. The HSE then has 28 days in which to acknowledge and respond as appropriate with any comments. The EPA is then required to have regard to any comments received and to place any such response from the HSE on its public register. There is, however, no statutory requirement in terms of the nature of the response required from the HSE.

The health involvement in planning needs to be strengthened and this is an issue that may be addressed by County Development Boards in their Local Environmental Health Partnerships as they produce their Local Environmental Health Action Plans. The process of considering potential effects on human health is complex and can be very costly and time consuming. Each Member State should, however, consider health under the IPPC Directive and should aim for internal consistency. Approaches that can be adapted to aid consistency include producing national guidance and ensuring regular exchange of information between regional organisations, including discussion meetings to address topics of interest (IMPEL, 2005).

## **4.2 Environmental Impact Assessment**

In the ratification of the Maastricht Treaty (1993) and the Amsterdam Treaty (1999), health protection across all public policies in the EU emerged as a common health policy theme (EU, 1995). Directive 85/337/EEC, as amended by Directive 97/11/EC, on the effects of certain public and private projects on the environment, introduced uniform EIA requirements to all EU Member States (EPA, 2002). This Directive was not substantially implemented in Ireland until the *Local Government (Planning and Development) Regulations* came into force on 1 February 1990. The introduction of EIA to Ireland has wielded some influence in creating an increased emphasis on the environment among developers, community associations and the public.

The primary objective of the EIA Directive is to ensure that projects that are likely to have significant effects on the environment are subject to an assessment of their likely impacts. An EIA is an important procedure for ensuring that the likely and significant effects of new development on the environment are fully understood and taken into account before the development is allowed to proceed. It is being increasingly used by decision makers to examine the ecological and related health, social, economic and cultural implications of proposed human activities. While a significant change is occurring within environmental assessment in recognising that the assessment of human health effects is an important component of environmental assessment, it is not mandatory and not always given the priority required.

Whilst the majority of developments are not subject to the EIA process, there is still a need within the planning process for various agencies, in addition to local authorities, to have an input and consultative role that enables their particular expertise and concerns to be taken into account. For the planning authority and other public bodies with environmental responsibilities, an EIA provides a basis for better decision making. More thorough analysis of the implications of a new project before a planning application is made, and the provision of more comprehensive information with the application, should enable authorities to make quicker decisions. This requirement for an EIA needs to be

balanced against the need for an efficient and timely method of dealing with planning issues.

Environmental assessment has been increasingly used by decision makers to examine the ecological and related health, social, economic and cultural implications of proposed human activities. A significant change, which has occurred, or is occurring, within environmental assessment is the clear recognition that the assessment of human health effects is an important component of environmental assessment. As a result, health professionals are being called upon at a much greater frequency to participate in the environmental assessment process. As part of the application process for an IPPC licence, the EPA is required to seek comments from various consultees, including HSE Boards, local authorities, the Food Standards Agency, water authorities, harbour authorities, the Natural Heritage Council and the Health and Safety Authority. The aim of seeking input from consultees is to assist the EPA in making a fully informed determination as to whether or not to grant a licence and as to the nature of any conditions that may be specified therein.

The 1992 Environmental Protection Agency Act (Section 72) provides for the preparation by the EPA of *Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA, 2002). The Act further provides that those preparing and evaluating EISs shall have regard to such guidelines. Guidelines were prepared following wide consultation, with the benefit of a number of years in circulation as 'Draft Guidelines'. These guidelines note that emission and environmental standards are based upon medical and scientific investigation of the direct effects on health from a substance, effect or risk and provide robust and reliable health protectors for analysis relating to the environment.

Experience has shown that the quality (sufficiency and relevance) of the information in EISs is closely related to the methods and procedures employed by the participants. For this reason, additional guidance has been provided to address the process that gives rise to the information contained in an EIS. At all times, the EPA has attempted to stress that EIA is a practical and dynamic process of environmental protection. The

specialist studies and professional evaluations used for an EIA should principally aim to anticipate and avoid impacts. The greatest value occurs when the site/route is being selected and while the project is still being designed; it is first and foremost a process. Ideally the resultant EIS is a document that records this process – showing how environmental consideration helped the project to achieve the most sustainable and least disruptive integration with the local environment. The guidelines were written with the primary objective of improving the quality of EISs in Ireland. Quality improvements will result from better scoping and a closer integration of EIA into both the design and development control processes and should facilitate public participation in the EIA process. The guidelines address a wide range of project types and potential environmental issues. It must be stressed that all of these issues are unlikely to apply to every project. Each EIS is a unique result of specific site issues interacting with the effects of the proposed development. In 2003, the EPA published *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA, 2003), designed to accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* (EPA, 2002).

As part of this fellowship, these advice notes were examined to see if the document could be updated to include information on the human health component for developers or licence applicants required to submit an EIS with their planning application.

### 4.3 Health Impact Assessment

Health Impact Assessment is a combination of procedures, methods and tools that systematically assesses the potential effects of a proposal on the health of a population. It is an interdisciplinary process and its purpose is to influence decision making to consider health. The procedures, methods and tools that are used in HIA include policy analysis, demography, collation and analysis of evidence of health impacts, quantitative and qualitative research, and community consultation. The HIA process attempts to draw these elements together to enable a systematic identification of health impacts. It also considers the distribution of those effects within the

population and can be a useful mechanism for highlighting where the health of some groups may be affected more than others if the proposal is implemented (WHO, 1999). This definition is known as the Gothenburg Consensus (EHP, 1999), developed by a group of HIA practitioners and outlines the main concepts and suggested approach to HIA and is identified as a first step towards creating a common understanding of HIA. The purpose of HIA is to influence decision making in favour of health. By completing a HIA, decision makers should have evidence-based recommendations to maximise the positive and minimise the negative health impacts of proposals.

The *National Health Strategy: Quality and Fairness: A Health System for You* (DOHC, 2001) and the Chief Medical Officer's Annual Report (CMO, 2001) indicate that HIA will be included in the new Population Health Divisions of the DOHC. The National Health Strategy also outlines the establishment of an independent Health Information and Quality Authority (HIQA) that will promote formal HIA programmes. One of the objectives under the 2001 National Health Strategy is that *"the health of the population is at the centre of public policy"*. The Health Strategy states that *"many agencies and government departments whose role may appear more peripheral or indirect have a vital contribution to make in achieving an integrated strategic approach to promoting and improving the health of the whole population. This objective is concerned with ensuring a joint approach, co-ordinated under one coherent strategy, to maximise the impact on health of existing policies, structures and initiatives"*. Health Impact Assessment is expected to play an important role in promoting this joint approach. A further objective in the Health Strategy states that HIA *"will be introduced as part of the public policy development process"*.

The HIA process identifies the factors that have a potential impact on health. Accordingly, it is a means for all sectors to determine the effects of their policies and actions on health and it has the potential to bring greater transparency to the decision-making process by clarifying the nature of trade-offs in policy. It states that the DOHC will develop the *"procedures, methods and tools by which a policy, programme or project may*

*be judged as to its potential effects on the health of the population and the distribution of those effects within the population"* and will have a key role in supporting other departments and agencies in carrying out HIA. Health authorities are statutory consultees of the EPA so it is within their power to bring forward information or concerns regarding a project that might influence the EPA in relation to the granting or refusal of a licence or to the conditions of any such licence.

The IPH works with a range of partners to bring people and organisations from across the island together to promote collective action for sustained improvements in health. In 2001, the IPH produced *Health Impact Assessment: an introductory paper* which focused on HIA and public policy (IPH, 2001). A series of HIA desktop tools have been developed by the IPH to support HIA in practice. These include an online screening and scoping tool (IPH, 2008). Screening is the first step in a HIA and its purpose is to determine whether or not to proceed further with HIA. It does so by quickly and systematically highlighting the potential impacts of the proposal on health. Screening may be undertaken by a single person or as a group exercise. The length of time required for screening will depend on the scale of the proposal and the amount of information available. If screening is undertaken by a group, this should ideally include stakeholders (those likely to be affected by the proposal) and decision makers. The IPH screening tool comprises three sections:

- Section one records the background and context;
- Section two considers the potential impact of the proposal on a range of health determinants, for the population as a whole and for groups within the population; and
- Section three documents the outcome of screening.

A meeting between the HSE, the EPA and the IPH was held in January 2008 to discuss HIA and each agency's role in the EIA process, joint position papers and other areas of mutual interest. The meeting was informative and it was agreed that the IPH would review the EPA guidelines and advice notes on EISs and report back with suggested changes. Following

discussions and a further meeting with the IPH, suggested text was submitted for inclusion in the EPA *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA, 2003). This would, in the opinion of IPH members, give greater scope for more attention to be paid to the potential impact of the proposal or project on the broad range of factors influencing health in its entirety.

- Under the paragraphs headed *Land Use* and *Health and Safety*, reference should be made to the fact that the proposal might have the ability to enhance aspects of character and surroundings (*Land Use* paragraph) and the capacity to enhance health (*Health and Safety* paragraph) and not just be detrimental to these aspects as currently stated.
- Under the paragraph headed *Context*, consideration should be given to the following sentiments: the EIS should give due cognisance to the holistic nature of human health and allow for recognition that the proposal could impact on mental, physical or social health or in some cases on all three.
- In this regard it is important to acknowledge that health is determined not only by the degree of access to, or the quality of, the health service, or by individual lifestyle choices but also critically by the social, economic and environmental conditions in which people live, work and play.
- The EIS should also seek to highlight the distributional impacts of the proposal on subgroups within the population, as negative impacts, when they occur, are frequently experienced disproportionately by the least well-off in society, thus adding to the health inequalities burden.

Health Impact Assessment is the combination of procedures, methods and tools that systematically assesses the effects of a proposal on the health of a population or a subset of that population. Aspects of the HIA process could add rigour to the EIS with significant benefits for population health. The latest version of the IPH Desktop Screening Tool was submitted for inclusion in the suggested changes (see End of Project Report). All of these suggestions were then forwarded to the EPA headquarters in Wexford to

be disseminated to relevant EPA Programme Managers. A meeting was held at the EPA in September 2008 to discuss the progress, with suggested amendments to the *Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* as proposed by the IPH. The submitted text has been forwarded to the relevant EPA personnel for review and comment. This will then be submitted to be included in an EPA Board meeting for consideration. Future possibilities for dissemination of the new text and HIA Desktop Screening Tool were discussed. Consideration will be given by the EPA that the suggested text submitted by the IPH and the IPH HIA desktop tool could be added to the EPA website or to a new environment and health web page.

#### 4.4 Conclusions

- Assessment of the potential impacts on health of a proposal should include consideration of physical, mental and social health.
- The global industrial society has had profound effects on human health and the environment. It is now becoming increasingly clear that development can have adverse, as well as beneficial, effects on health and well-being.
- Awareness of HIA is growing and many governments and international agencies have become interested in including HIA as a component of environmental assessment. Trials and publications of new tools continue and while some countries, such as Canada, Sweden, the Netherlands and Australia, have institutionalised HIA processes, its utility and effectiveness continues to be questioned elsewhere.
- Protecting human health is a key starting point and element of environmental policy, and health should be an explicit consideration when evaluating all public policies.
- Public and political decision makers are faced with a steady flow of new reports and information on substances in the environment that are injurious to health and on other anthropogenic environmental pollution.

- Health policy on the other hand continues to focus on the organisation and funding of medical care.
- In the EU, the Amsterdam Treaty makes provision for HIA in policy making.
- The WHO has developed a HIA programme and has set targets for Member States to develop HIA mechanisms by 2010.
- The IPH has developed tools to support HIA in practice.
- While public health is protected through EPA licensing, there is scope for better guidance and better transparency in the role played by health professionals in the licensing process.
- Local authorities should systematically incorporate the health component into their studies.
- Sufficient guidance and expertise should be available to all health consultees in order for them to ensure adequate consideration of health issues in EIA.
- Involvement of the local public health professionals is of paramount importance in EIA applications as they retain an advisory role.
- An established framework of integrated environmental assessment should attract a number of government agencies that as yet need to be convinced of the benefits of HIA.

#### **4.5 Policy Implications**

- Legislation should make explicit provisions to ensure adequate consideration of health issues if they are to be properly incorporated in EIA.
- The two most important priorities are to strengthen the role of health considerations in EIA and to ensure that the scope of the health issues addressed is consistent with, and takes account of, currently accepted definitions of health and the known determinants of health.
- The creation of a single organisation or unit to assess all HIA is recommended.
- The *EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)* (EPA, 2003) should be updated and should include the suggested text input from the IPH.
- Regular exchange of information between regional organisations involved in the consideration of human health in the planning process should be encouraged and developed.

## 5 Databases and the Use of Geographical Information Systems

The use of GIS in public health has risen to prominence with the recognition that health surveillance practices and health service allocations need to become more sensitive to the needs of people in local geographic areas. The collection, storage and manipulation of geographic information have undergone a revolution in recent years with the development and widespread availability of GIS software. Many health professionals can benefit from further education in this area and, with their new knowledge, they can influence the progress of health surveillance, environmental health assessment and the geographic allocation of health resources.

Development of GIS can significantly add value to environmental and public health data in areas such as exploratory data analysis, hypotheses generation, confirmatory data analysis, and decision making. For instance, mapping disease rates geographically and temporally may shed light on previously unrecognised patterns, which will suggest causes, or at least provide a focus and direction for further study. Geographical Information Systems can also be used to select case-study areas meeting specific criteria and to create and test hypotheses relating to environmental risk factors. They can combine health outcomes on the individual level with exposure data aggregated at the geographic unit level and then model potential exposures for use in overlaying the disease incidence data. The Health for All policy framework for the WHO European Region (WHO, 1998) has a research and knowledge for health target which states that:

*“By the year 2005, all Member States should have health research, information and communication systems that better support the acquisition, effective utilization, and dissemination of knowledge to support health for all”* (adopted by the WHO Regional Committee for Europe at its forty-eighth session, Copenhagen, September 1998).

A recent development, in the Irish context, has been the development of the *Health Atlas Ireland* (Johnson et al., 2007) by the HSE. It is a national initiative and it is web enabled which allows people from around the country to have access to the system. Some examples of the functions of the *Health Atlas Ireland*, which is based on raw data, are listed below.

- In the case of an emergency event such as a water or chemical contamination incident or serious infectious disease outbreak, it can map out the area at risk and the population potentially exposed.
- It has incorporated the National Roads Authority (NRA) database which allows the display of the location of fatal, serious and minor collisions across the country, and the analysis of the data by the type of causality, e.g. age, sex, type of vehicle involved, and admission to hospital.
- Data on infectious disease trends can be monitored by the Health Protection Surveillance Centre via the *Health Atlas Ireland*.

The changes in the health service and the health intelligence function on the island, both north and south, continue and the first All-Ireland Health Intelligence Conference was held in 2008. The theme was *Better Intelligence, Better Decisions, Better Health* and the event concentrated on the practical issues associated with the development of health intelligence and its translation into more effective health policies and practice.

In order to explore the possible uses of GIS data among the EPA and the HSE, a meeting was organised to discuss areas of mutual interest and to explore the possibility of collaborating in using available databases. At the meeting in January 2008, the EPA extended an open invitation to the IPH to avail of the many databases held by the EPA and made available its expertise in GIS technical support. Following a meeting with the Health Atlas Team, it was

agreed to set up a meeting between the EPA GIS Team and the Health Atlas Team to explore future data-sharing possibilities.

As part of this fellowship, this first meeting between the two GIS teams was organised and facilitated in June 2008. The meeting opened with introductions and a background to the purpose and function of convening the meeting between the HSE Health Atlas Team and the EPA GIS Team. This was followed by a presentation on the background to the Health Atlas and a demonstration. Following the demonstration, there was a question and answer session with a discussion. The second part of the meeting involved a GIS database presentation by the EPA using the EPA web interface. The outcome was that a small email-based network was created for those present to assist in communications and direct contact.

Following this meeting, the EPA subsequently distributed a document *Data Disseminated by EPA* which outlined the data available for distribution by the EPA, the restrictions that apply and the data release forms that apply to each data set. It stipulated that Ordnance Survey of Ireland (OSi)-related data can only be released to holders of the OSi vector licence agreement. In order for the EPA to disseminate these data a form must be completed and the applying agency must clearly list its licence agreement number (<http://www.epa.ie/downloads/data/corinedata>). The EPA can then release the data to the agency with whom the agreement has been signed once the paperwork is complete. The HSE has acknowledged receipt of the notification and information and is in the process of discussing same in-house.

The challenge facing those with responsibility for assuring the health and quality of life for residents of Ireland, such as planners, architects, engineers and

public health practitioners, must integrate the concepts of public health issues with urban planning issues. All these major stakeholders must appreciate that the built environment influences public health as significantly as water quality or control of infectious diseases.

## **5.1 Conclusions**

- The meeting between the EPA and the HSE Health Atlas GIS teams provided valuable information and background to the two systems in existence. There are still some queries outstanding regarding compatibility and access to live databases to be discussed by both the HSE and the EPA.
- The possibility of a future collaboration for an environmental module was discussed in detail and it was agreed that contact should be made with the ERC and monies or funding may be sought through the Science, Technology, Research and Innovation for the Environment (STRIVE) Programme. The Health Atlas Team agreed to examine this possibility further and to look at writing a proposal for a small desktop study initially, with the possibility of extending the project in the future.

## **5.2 Policy Implications**

- Funding for a desktop project facilitating collaboration between the HSE Health Atlas Team and the EPA GIS Team should be made available.
- The links now forged between the HSE Health Atlas GIS Team and the EPA GIS Team should be supported and developed. Support within each of the organisations is of paramount importance in order to continue the relationship and expand data exchange and mutual interests in the area of environment, health and GIS.

## 6 Human Biomonitoring

Human biomonitoring is an effective tool for assessing human exposure to environmental pollutants and the potential health effects of such pollutants and is an essential element in a strategy aiming to integrate health and environment. Human biomonitoring results integrate the contribution of the different routes of exposure and take into consideration the differences between individuals with regards to uptake (which are due to differences in hygiene, breathing characteristics, genetic factors, etc.). It is crucial to integrate HBM data with toxicological, ecotoxicological, environmental and health monitoring data in a multidisciplinary setting for an efficient translation of biomarker results into intervention strategies or sentinel features aiming at minimising the effects of environmental pollution on human health.

In general, the objective of HBM is to increase knowledge on the relationship between human health and the environment and to use this knowledge to improve environmental health. Biomonitoring utilises analytic methods that permit the accurate measurement of low levels of environmental chemicals in human tissues. Biomonitoring programmes for assessing exposure to environmental chemicals generally require the measurement of the relevant analytes at much lower concentrations than needed in human clinical or animal toxicology studies, thus posing considerable challenges. However, depending on the intended use, biomonitoring, like all exposure tools, may not be a stand-alone exposure assessment tool for some of its environmental public health uses. While biomonitoring data demonstrate that many common chemicals are absorbed in human tissues, uncertainty exists regarding if and at what concentrations many of these chemicals cause adverse health outcomes.

The European Commission (EC) adopted in 2003 an EU strategy on environment and health (COM, 2003a,b), with the overall aim of reducing diseases caused by environmental factors in Europe. This was followed up by the action plan or EEHAP (*The European Environment & Health Action Plan 2004–*

2010) (COM, 2004a,b) which proposed an integrated information system on environment and health as well as a coordinated approach to HBM between Member States to render the assessment of the environmental impact on human health more efficient. Human biomonitoring has been defined in the preparation of the EEHAP as “*monitoring activities in human beings, using biomarkers that focus on environmental exposures, diseases and/or disorders and genetic susceptibility, and their potential relationships*” (COM, 2004a,b). The aim is to support environmental policy as well as public health policy by better data comparability and accessibility within and between countries and more effective use of resources through shared development of scientific tools and appropriate strategies. The value of HBM as an essential tool to assess relevant exposure of the population and the relevance and importance of coordination of HBM programmes in Europe are recognised throughout the EU.

The adoption of the EEHAP was strongly supported by the EU Parliament Committee on the Environment, Public Health and Food Safety. The aim of Action 3 of the EEHAP was to develop a coherent approach to HBM in Europe in cooperation with the Member States. Initially an Implementation Group (IG) was established followed by the expert team to support biomonitoring (ESBIO).

In October 2006, a workshop was held to discuss an environment and health research strategy for the EPA Environmental Research and Technological Development and Innovation (ERTDI) Programme, which became the Science, Technology, Research and Innovation for the Environment Programme for 2007–2013. One of the guest speakers at the conference was a member of ESBIO and presented *A Regional and European Perspective on HBM*. He informed the group that there were eight active Member States in the programme, 10 ad hoc Member States, and seven missing, one of which was Ireland. On a positive note, he informed the group that it was

not too late for Ireland to join and be part of the future HBM programme.

In December 2007, the Council (Environment) of the EU invited the Commission to ensure adequate funding for the EU pilot project on HBM in order to implement this project as early as possible, thus fulfilling the commitment established in the EEHAP 2004–2010, providing, therefore, data to develop, adapt and evaluate environmental policies. While plans for EU-funded activities are made, experiences of HBM programmes at national level show that beyond the need for harmonisation there is still a need to demonstrate the added value of HBM as a policy tool and as support to public health interventions.

An ESBIO report showed that while significant resources are spent collecting HBM data, comparison between countries and within each country remains difficult as implemented methodologies differ (COM, 2003a,b; Casteleyn et al., 2007; ESBIO, 2008). Working towards a more coherent approach, ESBIO has already produced guidelines in the different areas of HBM with a view to:

1. Providing mutual support to countries which have planned to develop national HBM programmes; and
2. Preparing the European pilot study.

Step by step, the political basis for a coordinated approach to HBM in Europe is growing (CESE, 2004; ECC, 2007). The pilot phase is meant to focus on capacity building and harmonisation of procedures, on the future policy role of HBM, and on appropriate communication at individual and at Community levels. For the post-pilot phase, the EC is exploring the possibility of embedding future HBM activities in an established framework such as the *European Health Examination Survey* (Tolonen et al., 2008) and will ensure that HBM is linked to the existing regulatory frameworks.

A conference was held in Paris in November 2008 which brought together stakeholders in the area of HBM. A wide range of topics was covered based on HBM programmes and activities implemented in different European countries and in North America

(USA and Canada). The aim of the conference was to demonstrate the usefulness and added value of HBM as a tool for policy and for public health actions. As part of the Irish submission to this HBM conference, results from the 3-year blood lead level screening programme carried out in the Silvermines area of North Tipperary were presented.

## **6.1 Conclusions**

- Human biomonitoring is a scientific technique for assessing human exposure to natural and synthetic compounds in the environment. It is based on analysis of human tissues and fluids and provides the only direct method of determining if people have been exposed to particular substances, what the magnitudes of their exposures are, and how these may be changing over time.
- Human biomonitoring has become a more useful tool in recent years as a result of advancements in the capability to measure increasingly minute amounts of chemicals in the human body.
- Human biomonitoring programmes will provide baseline information that can be used to identify which compounds are present and in what amounts, to determine the background levels of these compounds and, after repeated monitoring, to detect trends in exposures.
- Human biomonitoring results can help to suggest which environmental compounds are of most importance, what the background and reference levels for these compounds are, and which segments of the population may be the most highly exposed.
- Human biomonitoring outcomes can lead to further study aimed at refining estimates of exposure, identifying sources, identifying population segments most highly exposed, and assessing the impacts of steps taken to reduce exposure.
- Human biomonitoring can contribute to research that alerts scientists, regulators, and the public to possible risks and can also allay fears that might arise from the knowledge that large numbers of

natural and synthetic chemicals are present in our bodies.

- Human biomonitoring for environmental chemicals provides a framework for improving the use of biomonitoring data, including developing and using biomarkers, research to improve the interpretation of data, ways to communicate findings to the public, and a review of ethical issues.

## **6.2 Policy Implications**

- Ireland should participate in the European HBM

harmonisation project.

- Human biomonitoring data can be used to provide evidence-based direction for future research.
- Human biomonitoring data should be used to provide direction for policy making.
- Human biomonitoring data should be used to evaluate the health impacts of selected control policies on reducing chemical exposures.

## 7 Prioritising Environmental Health Issues for Ireland

*“In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment. This includes not only the study of the direct pathological effects of various chemical, physical, and biological agents, but also the effects on health of the broad physical and social environment, which includes housing, urban development, land-use and transportation, industry, and agriculture” (WHO, 1993, 1997).*

Environmental health can be defined as *“the aspect of public health concerned with all the factors, circumstances and conditions in the environment that can exert an influence on human health and well-being”* (Last, 1987). Environment and health issues by definition encompass a broad policy and research agenda and constitute a cross-disciplinary focus for developing integrated approaches that link biophysical, social and economic factors in assessment (Health Canada, 1997). The goals of environmental health are to maintain a healthy, liveable environment for humans and other living species – an environment that promotes well-being and a high-quality mental and physical health for its inhabitants. Responsible leadership requires that policy makers, health professionals, industry representatives and the general public all carry an expanded and enhanced vision of environmental health forward in the 21st century. New approaches towards building environments that actively improve health will be required, including strategies to deal with waste, unhealthy buildings, urban congestion, suburban sprawl, poor housing, poor nutrition, and environment-related stress (Institute of Medicine, 2001).

Human health ultimately depends on a society's capacity to manage the interaction between human activities and the physical, chemical and biological environments. The challenge to protect and promote human health must endeavour to protect the integrity of the natural systems on which a healthy environment depends. The physical and biological environments

include everything from the immediate home and work environments to those at regional, national and global levels. The continued functioning of the natural systems receiving waste produced by societies is of paramount importance in order to mitigate against exposure of people to pathogens and toxic substances and without compromising the well-being of future generations. Human exposures to hazardous agents in the air, water, soil and food and to physical hazards in the environment are major contributors to illness, disability and death worldwide. Poor environmental quality has its greatest impact on people whose health status may already be at risk.

Environmental factors play a central role in human development, health and disease. Broadly defined, the environment, including infectious agents, is one of three primary factors that affect human health. The other two are genetic factors and personal behaviour. Because the impact of the environment on human health is so great, protecting the environment has long been a mainstay of public health practice. National and local efforts to ensure clean air and safe supplies of food and water, to manage sewage and municipal wastes, and to control or eliminate vector-borne illnesses have contributed a great deal to improvements in public health. Environmental health hazards, which are beyond the control of a community, may result in industrial pollution, poor drinking-water and sanitation services, poor housing and town planning, inadequate control of the food industry, poor-quality roads and workplace conditions.

Physical and social environments play major roles in the health of individuals and communities. Scientists are just beginning to evaluate how biological, social, cultural, environmental and economic factors overlap and combine in such a way as to influence the rate of disease spread and in some cases the outcomes of disease in certain populations.

The **physical environment** includes the air, water, and soil through which exposure to chemical, biological, and physical agents may occur and food

safety, global warming, a reduction in air quality, and availability of housing are all areas of growing public concern. Trends in the area of food production, many brought forward by the commercial pressures to intensify production, raise questions about food safety and the transference of disease from animals to humans. The continuing pressures on the environment affecting water and air quality are concerns that are shared globally.

The **social environment** includes housing, transportation, urban development, land use, industry, and agriculture and results in exposures such as work-related stress, injury, and violence. Where and how a society chooses to grow and develop affect the quality of life by determining how long people spend travelling to work, shopping, or going to school. Where and how a society builds its houses, schools, parks, and roadways can also limit the ability of some people to move about and lead a normal life. Often research in environmental health has been based on limited information. More is known about the interactions between specific genetic variations among individuals and specific environmental factors provide enormous opportunity for further developing modifications in environmental exposures that contribute to disease. According to the US Agency for Toxic Substances and Disease Registry (ATSDR), further research is required to address these and other problems and to improve the science and management of health effects on people exposed to environmental contaminants (ATSDR, 1993).

In 1997, the World Health Assembly (WHA, 1997) resolved that the main social target of governments and the WHO in the coming decades should be *“the attainment by all citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life”*. To this aim, many countries have developed goals and strategies to achieve health for all. National Environment and Health Action Plans (NEHAPs) are government documents that address environmental health problems in a comprehensive, holistic and inter-sectoral way. The development of NEHAPs across Europe was first agreed in Helsinki in 1994, following the publication of the *Environment and Health Action Plan for Europe* (EHAPE, 1994); then, in June 1999,

environment and health ministers committed themselves to endorsing and strongly supporting the implementation of NEHAPs in the London Declaration, at the Third Ministerial Conference on Environment and Health.

*“A NEHAP is an inter-sectoral action plan needed to deal with Environment and Health issues in a country”* (WHO, 1994).

In many countries, NEHAPs are seen as a tool for achieving sustainable development and for implementing integrative approaches and local actions to the benefit of the population. In many cases, the implementation process has strengthened the partnership between health and environment sectors and commenced the involvement of other governmental agencies also. By 2002, 43 countries had developed NEHAPs and were beginning to implement them. They are usually drawn up in cooperation with a wide range of partners, including professional and technical experts, national, regional and local authorities and non-governmental organisations. At the Fourth EU Ministerial Conference on Environment and Health, held in June 2004, ministers of health and environment from across the EU committed their countries to updating their NEHAPs.

The Irish draft NEHAP (DOHC, 1999) process adds a health dimension to the environmental issues. The implementation of an Irish draft NEHAP has been underpinned by the commitment of the Irish government in the National Health Strategy (DOHC, 2001). The Irish draft NEHAP lays down the broad, but focused, strategy, which must be pursued at national, regional and local levels in order to optimise health gain and maximise social capital for all sectors of the population of Ireland. The first goal of the National Health Strategy (DOHC, 2001) is concerned with promoting and improving health and reducing health inequalities. To address this imbalance, the government is committed to implementing a NEHAP, which will assist all government departments to recognise and assess the potential impact of their policies on the health of the population. The purpose of the Irish draft NEHAP document is to provide a strategic plan, which aims to improve the quality of life

of the population of Ireland. This concept of quality of life clearly fits with the National Health Strategy's determinants of health: *"To develop an effective health system, the determinants of health, that is the social, economic, environmental and cultural factors which influence health, must be taken into account"* (DOHC, 2001).

A European report on environment and health (EEA, 2005) concluded that air pollution, radon, organic chemicals, noise, endocrine disruptors and climate change are the main environmental factors of greatest concern with regard to the impact on health in Europe. The list varies slightly to that contained in the Irish draft NEHAP where emerging issues outlined include:

- The implications of biotechnology and genetic engineering;
- Emerging diseases and new micro-organisms, e.g. *Escherichia coli* 0157, where a small number of organisms can be fatal;
- Old diseases formerly under control and which are re-emerging or becoming increasingly difficult to treat due to the emergence of antibiotic resistance, e.g. tuberculosis; and
- The emergence and spread of antibiotic-resistant infections threatens the success of infectious disease treatment and prevention.

The key objectives of the Irish draft NEHAP are:

- To promote the influence of environmental health factors on quality of life in Ireland and to protect and enhance the environment and living conditions in order to promote human health;
- To provide a strategic framework for the development and implementation of a multi-sectoral and ongoing partnership at local, regional and national levels in the field of environmental health; and
- To ensure policy and executive cohesion in implementing, monitoring and reviewing all agreed national and local action plans.

Improvements in health status and reduction in health inequalities can only be achieved by committed multi-

sectoral collaboration. Given the wide range of stakeholders influencing the environment and health conditions, securing improvements in standards will be best achieved where there is effective collaboration. A high degree of coordination and communication also supports more sustainable improvements in environmental health status. Inter-sectoral collaboration is the principle that lies at the heart of effective environment and health management. Several secondary objectives can be identified as contributing to the above and these include:

- Development and enforcement of legislation;
- Promoting public participation and involvement;
- Influencing policy development; and
- Supporting practical and academic research.

The Irish draft NEHAP is designed to engage health, environment and other partners in a collaborative manner. From the local perspective, the transfer of the social partnership model to county level is positive, whilst also maintaining agreed national principles of sustainability. This government-backed approach has provided possibilities for partnerships to be set up which can address environment and health issues on a local or regional level in a spirit of mutual understanding. The Irish draft NEHAP should be regarded as being for and about each and every person and organisation in Ireland. The concept of environment and health is, by its very nature, a multifaceted, wide-ranging and complex subject. For this reason, there is a need to address certain key core areas of environment and health identified in the Irish draft NEHAP:

- Water;
- Food safety;
- Chemicals;
- Air quality;
- Radiation;
- Noise;
- Spatial and land-use planning;

- Energy and climate change;
- Built environment/housing;
- Waste management;
- Occupational health and safety;
- Accidental injuries; and
- Lifestyle issues.

## **7.1 Conclusions**

- A NEHAP is a government statement of actions needed to closely link the health planning processes and environmental planning programmes.
- Human health depends on a healthy environment, and health concerns and their relation to environmental degradation and economic development must continue to be given consideration in national development processes.
- Human health is no longer concerned only with the toxicity of physical agents, but also explores the effects of lifestyle, social and economic factors, and the built environment on human health.
- Health is not the mere absence of disease as the human being is affected by the surrounding physical and biological environment. Alteration of either the physical or biological environment will have either a direct negative or positive impact on human health. Society is responsible for management of the interaction between human activities and the physical and biological environment.
- Unsustainable development places undue burdens on the natural resources of the environment, thus damaging human health.

## **7.2 Policy Implications**

- A strong consultative and organisational process, formal and flexible, should be established at government level to sustain systematically a continued dialogue among all concerned.
- Projects and policies for sustainable development should be subjected to systematic appraisal. A mechanism for strategic environmental assessment needs to be instituted at the highest policy formulation level.
- Intimidated by the exclusive scientific process, the public are often excluded from important public health decisions. A public interest liaison group should be established to allow members of advocacy groups who previously had little access to decision makers to provide input on research directions and translation to disease prevention and treatment.
- Government departments should assist the assessment of risk to health by ensuring that people are given information on health that is accurate, understandable and credible.
- Government departments should consider environmental health as a reason for closer collaboration with each other in formulating their individual policies.
- Collaboration is necessary between stakeholders in order to identify new and challenging areas of environmental risk.
- A more structured approach to health input in policy making is necessary.
- Implementation of the Irish draft NEHAP should require partnership between all health and environment sectors and the involvement of other governmental agencies.

## 8 Future Research

The relationships between pollution, the environment and health are often complex. A greater understanding is needed of the links between exposure to pollution and the effect it has on health, as well as of the impacts on health of mixtures of chemicals, microbes or physical changes in the environment. This information will help to develop policies that will benefit both the environment and health. More research is also required to improve our knowledge of the effects of chemicals on health, particularly for low-level exposures over a lifetime. Concern for human health has traditionally underlain much of the political priority given to environmental issues within the EU and Member States. It is a primary driver for policy actions that target air quality, water quality, soil quality and chemicals. The Sixth EEHAP highlights the connection between environmental quality and human health (COM, 2004a). Government departments, government agencies, health authorities and local authorities need to support the EEHAP and its prioritisation of research into diseases and substances of concern (COM, 2004a). It is recognised that multidisciplinary research on interactions of environmental risk factors and human health is needed to support the EEHAP and the integration of public health concerns and disease characterisation related to emerging environmental risks. This research will focus on:

- Identifying multiple exposures via different exposure routes;
- Identifying main pollution sources;
- Identifying new or emerging environmental stressors (e.g. indoor and outdoor air);
- Supporting research into the health effects of electromagnetic fields;
- Conducting health-related noise effect research;
- Supporting research on exposure to toxic substances and their potential health effects;
- Integrating research activities on HBM regarding scientific aspects;
- Developing methodologies and tools to develop a coordinated and coherent approach;
- Participating in European cohort studies;
- Supporting research with specific attention to vulnerable population groups;
- Developing methods and tools for improved risk characterisation;
- Conducting risk assessment in the area of environment and health;
- Supporting research on comparisons of risks and health impacts;
- Developing biomarkers;
- Developing modelling tools that take into account combined exposures, variations in vulnerability and uncertainty;
- Delivering methods and decision-support tools (indicators, cost-benefit and multi-criteria analyses);
- Conducting HIA; and
- Quantifying the burden of disease and sustainability analysis for risk analysis, management and communication, and for policy development and analysis.

From a national perspective, research must be prioritised and coordinated to take full advantage of research by health professionals nationally and internationally. It is important to ensure that research into the relationship between environmental factors and health currently taking place in a number of research institutions in Ireland is supported into the future. It is equally important that research is organised and coordinated effectively to highlight the importance of the relationship between environmental factors and

health. This will also ensure efficient use of results achieved. Research initiatives should elucidate aspects such as the occurrence, fate and distribution of environmental factors in the environment, the working environment, the indoor climate and in food. Research should also elucidate the extent of human exposure to environmental factors, including exposure of vulnerable groups of the population. The following sections include descriptions of a number of areas in which research can form the basis for targeted and preventive initiatives.

## 8.1 Children's Health and the Environment

It has been estimated that around 20% of the total burden of disease in industrialised countries can be attributed to environmental factors (Smith et al., 1999), with the bulk of this affecting children and vulnerable groups such as the poor and women of reproductive age. Starting at the foetal stage, the close physiological relationship between a pregnant woman and the foetus she carries makes the foetus vulnerable to dangerous agents to which the mother has been exposed, especially those affecting development. Many toxic or allergenic agents present in maternal blood may also be present in mother's milk and a number are capable of crossing the placental barrier. This potential for transfer of environmental contaminants from the mother to the foetus and the neonate further reinforces the need to protect pregnant and breastfeeding women from environmental contamination as a way of ensuring a healthy start to a child's life. Children have a unique vulnerability. The recognition that children have unique and specific vulnerabilities to certain environmental risks has resulted in increased attention among the scientific community, policy makers and the public.

Children are not little adults – relative to their size, children breathe more air, eat more food and drink more water than adults and thus may have a relatively higher exposure to contaminants per body weight. In addition, children have unique exposure patterns and behaviours, such as putting things in their mouths, that may put them in contact with different contaminants (USEPA, 2003). Reducing the presence of contaminants in different media with which children

may come into contact is an important step in protecting children's health. It has been estimated that some 20% of the burden of disease in industrialised countries is attributable to environmental factors (Smith et al., 1999), with the bulk of this affecting children.

The magnitude of the problem is also perceived by the public as demonstrated in a recent survey in which some 89% of Europeans indicated that they are worried about the potential impact of the environment on their health (Flash Eurobarometer EB123, 2002). The theme of the Fourth Ministerial Conference on Environment and Health (2004) was *The Future for our Children* and it placed in the spotlight the measures that Member States can take to address the impact that a contaminated environment has on children's health. It was emphasised that children were the most vulnerable to the dangers of pollution and this, together with their influential status on adults, meant that they were not only the victims of environmental problems but also ambassadors for a more healthy environment for all.

*"A healthy environment should be not a privilege but a basic human right. Children and young people were at the very heart of sustainable development and were allies in creating a healthier Europe. They were the generation that would be responsible in the future for tackling the environmental problems left behind by the world of today"* (Europa, 2003).

Over the last few decades, asthma and allergies have increased throughout Europe. On average, 10% of children suffer from asthmatic symptoms. For 1995–1996, the International Study of Asthma and Allergies (ISAAC Committee, 1998) found an 11.5% annual average prevalence of self-reported asthma symptoms in children aged 13–14 years. Western lifestyle is associated with allergic diseases in childhood. In a 2004 report, experts assessed for the first time the overall impact of the environment on child health in the WHO European Region (Valent, 2004): 100,000 deaths and 6 million years of healthy life lost, Disability Adjusted Life Years (DALYs), every year in children and adolescents from birth to 19 years of age are caused by outdoor and indoor air pollution, unsafe water, lead and injuries. This accounts for 34% of

deaths from all causes and 25% of DALYs from all causes in this age group.

Higher rates of respiratory infections are associated with indoor air pollution related largely to household solid-fuel use and possibly to second-hand tobacco smoke, as well as outdoor air pollution. An estimated 20% of such infections are attributable to environmental causes (WHO, 2006). Indoor allergens, such as from house dust mites, cockroaches, mould, rodents, and pets, can worsen symptoms of respiratory conditions, e.g. asthma and allergies. These allergens are an important public health issue because most people spend the majority of their time indoors, both at

home and at work. In addition, effective methods exist to reduce exposure to some of these allergens (e.g. placement of impermeable covers on mattresses and pillows reduces dust mite allergen exposures in beds).

Where there are knowledge gaps, more resources should be put into research to improve our knowledge of causal links, the nature and magnitude of effects and effective interventions. Simultaneously, measures based on the precautionary principle should be applied so as not to delay the implementation of policies that may protect children's health and minimise the risk of severe and irreversible health effects. Recommended research under this theme is outlined in [Table 8.1](#).

**Table 8.1. Recommended research – Children's Health and the Environment.**

| Theme                               | Objective of research                                                                                                                             | Recommended research                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Indoor air pollution (IAP)</b>   | <ul style="list-style-type: none"> <li>Prevent and reduce pregnant women's and children's exposure to IAP</li> </ul>                              | <ul style="list-style-type: none"> <li>Measure implementation of minimum indoor air quality requirements in schools and public buildings where children spend their time</li> </ul>                                                                                                                                                                                    |
| <b>Outdoor air pollution (OAP)</b>  | <ul style="list-style-type: none"> <li>Prevent and reduce exposure to OAP</li> </ul>                                                              | <ul style="list-style-type: none"> <li>Establish and monitor smog alert systems in cities to let care givers and school personnel know when the risk due to OAP levels is high</li> </ul>                                                                                                                                                                              |
| <b>Lack of clean drinking water</b> | <ul style="list-style-type: none"> <li>Prevent and reduce children's exposure to contaminated drinking-water supplies</li> </ul>                  | <ul style="list-style-type: none"> <li>Monitor the biological chemical contaminants of water and soil that are most hazardous to children, such as heavy metals, organochlorine pesticides and polychlorinated biphenyls (PCBs), <i>Cryptosporidium</i> and verotoxigenic <i>Escherichia coli</i></li> </ul>                                                           |
| <b>Unsafe buildings</b>             | <ul style="list-style-type: none"> <li>Prevent and reduce children's exposure to unhealthy and unsafe building standards and materials</li> </ul> | <ul style="list-style-type: none"> <li>Audit public buildings where children spend their time to see if they meet health and safety requirements (for cold, heat, humidity, light, risk of falls)</li> <li>Quantify the proportion of the nation's housing built prior to 1960</li> <li>Quantify the proportion of the nation's housing built prior to 1990</li> </ul> |
| <b>Hazardous chemicals</b>          | <ul style="list-style-type: none"> <li>Protect children and adults in the reproductive period from exposure to hazardous chemicals</li> </ul>     | <ul style="list-style-type: none"> <li>Carry out biomonitoring of lead, PCBs and organochlorine pesticides in at-risk infants and mothers</li> <li>Monitor reproductive health indicators, including birth weight, congenital malformations and time to pregnancy (TTP), to detect potential hazards to reproductive health</li> </ul>                                 |
| <b>Noise</b>                        | <ul style="list-style-type: none"> <li>Prevent and reduce exposure to hazardous and disruptive noise and noise injuries</li> </ul>                | <ul style="list-style-type: none"> <li>Incorporate measures to reduce exposure to noise in urban and infrastructure planning, considering the needs of school zones</li> </ul>                                                                                                                                                                                         |
| <b>Transport/Mobility</b>           |                                                                                                                                                   | <ul style="list-style-type: none"> <li>Assessment of children's needs in all planning of human settlements, transport, and infrastructure</li> <li>Conduct risk assessment of the speed limits and use speed-limiting devices for traffic around schools, in order to achieve appropriate vehicle speeds using proven traffic-calming measures</li> </ul>              |

## 8.2 Water Quality and Health

### 8.2.1 Safe drinking water

Access to a sufficient supply of clean water for drinking, sanitation and recreational purposes is essential for maintaining public health. Worldwide, water quality is second only to malnutrition as a human health issue. Within the EU, water quality is generally good although pathogenic micro-organisms remain a hazard in drinking and recreational water (EU, 2007).

Providing drinking water free of disease-causing agents, whether biological or chemical, is the primary goal of all water supply systems. During the first half of the 20th century, the causes of most water-borne disease outbreaks were bacteria; beginning in the 1970s protozoa and chemicals became the dominant causes (Craun, 1986) but in 1993 more than 403,000 people in the USA became sick during a single episode of water-borne cryptosporidiosis (CDC, 1995). Outbreaks have also been reported from Ireland where *Cryptosporidium* oocysts were detected in both raw and treated water, and in the environment surrounding a lake (Pelly et al., 2007). Linking cryptosporidiosis infection to drinking water can be difficult as the contamination event may be over by the time the illness comes to light. An amendment to the Infectious Diseases Regulations 1981 (Infectious Diseases (Amendment) (No. 3) Regulations 2003, SI No. 707 of 2003) revised the list of notifiable diseases and introduced a requirement for laboratory directors to report infectious diseases. Food- and water-borne illnesses are now specified individually (e.g. campylobacter infection, cryptosporidiosis, listeriosis), whereas previously there was a category of 'food poisoning (bacterial other than salmonella)'.

The National Disease Surveillance Centre (NDSC) receives data on notifiable infectious diseases from around Ireland. In 2007, 609 cases of cryptosporidiosis were notified in Ireland, a 66% increase on the number of cases notified in 2006, and was the highest annual number of cases reported since the disease became notifiable in 2004. Typically, the highest reported incidence rates are in children under 5 years.

One problem in evaluating the relationship between drinking water and infectious diseases is the lack of adequate technology to detect parasitic contamination

and to determine whether the organisms detected are alive and infectious. The development of new molecular technologies to detect and monitor water contamination will enhance water quality monitoring and surveillance.

In Ireland, the quality of drinking water was brought forcefully to the attention of the Irish public with the outbreak of cryptosporidiosis in Galway in 2007, which caused illness in 240 people, and led to the imposition of a boil water notice in Galway for a period of 5 months during the peak tourist season. While many have taken the quality of drinking water in Ireland for granted in the past, this can no longer be the case (EPA, 2007). The EPA has identified 339 public water supplies, representing 36% of all public drinking water supplies, that require detailed profiling because they have either failed to meet standards, have inadequate treatment, exceedances of chemical or indicator parameters, lack of operational control at the treatment plant, failure to meet standards or have been identified by the HSE as requiring improvement (EPA, 2007).

Recommended research under this theme is outlined in [Table 8.2](#).

### 8.2.2 Other water quality issues

The recent EPA State of the Environment Report (EPA, 2008) stated that remediation of unsatisfactory quality in groundwater, rivers, lakes and estuaries is one of the main environmental challenges facing Ireland. The Water Framework Directive (WFD) marks a new approach for the protection and improvement of water resources. Commencing in 2009, a 6-year cycle of river basin management plans will be implemented by the EPA for the purpose of protecting and enhancing all waters – groundwater, rivers, lakes, transitional waters (estuaries) and coastal waters, including protection for related terrestrial ecosystems and wetlands.

Microbiological hazards associated with the use of poorly maintained spa pools and whirlpool baths are recognised worldwide. Spa pools are becoming more commonplace throughout Europe and Ireland. The warm water temperature, large numbers of bathers compared with water volume, together with other factors in spa pools can provide the perfect conditions for water-borne pathogenic micro-organisms to grow,

**Table 8.2. Recommended research – Safe Drinking Water.**

| Theme                                         | Objective of research                                                                                                      | Recommended research                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Drinking water – biological monitoring</b> | <ul style="list-style-type: none"> <li>Reduction of water-borne disease outbreaks</li> </ul>                               | <ul style="list-style-type: none"> <li>Support research into routine monitoring which should include testing for <i>Cryptosporidium</i>; this could include research into background levels of this parasite in the different raw water sources used in Ireland (e.g. upland streams, upland lakes, lowland rivers, springs, etc.)</li> <li>Support research and development for water supply filtration systems. For example: <ul style="list-style-type: none"> <li>Using renewable energy to power small disinfection systems such as ultraviolet treatment</li> <li>The development of robust and easy-to-install barrier systems for small supplies in order to protect against <i>Cryptosporidium</i></li> <li>Research into the risk of operation of filter systems above design capacity</li> </ul> </li> <li>Consider research into verotoxigenic <i>Escherichia coli</i> (VTEC) and occurrence of outbreaks of VTEC associated with drinking water from private wells</li> <li>Consider research into <i>Giardia</i> and drinking water in Ireland and its presence in raw water sources</li> </ul>                                                                                      |
| <b>Drinking water</b>                         | <ul style="list-style-type: none"> <li>Identify links/primary prevention of outbreaks</li> </ul>                           | <ul style="list-style-type: none"> <li>Investigate linkages between presence of <i>E. coli</i> and turbidity in water with outbreaks of <i>Cryptosporidium</i></li> <li>Investigate linkages between levels of <i>Cryptosporidium</i> oocysts detected and danger to human health from the drinking water</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Drinking water</b>                         | <ul style="list-style-type: none"> <li>Quantification/Primary prevention of outbreaks</li> </ul>                           | <ul style="list-style-type: none"> <li>Quantify the percentage of children without access to treated water</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Drinking water – heavy metals</b>          | <ul style="list-style-type: none"> <li>Quantification/Primary prevention</li> <li>Quantification/Identification</li> </ul> | <ul style="list-style-type: none"> <li>Quantify the percentage of children living in areas served by public water systems in violation of European Directive Standards to include areas with inadequate <i>Cryptosporidium</i> treatment and areas where there is not adequate disinfection or areas with lead pipes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Heavy metals</b>                           | <ul style="list-style-type: none"> <li>Quantification/Primary prevention</li> <li>Quantification/Identification</li> </ul> | <ul style="list-style-type: none"> <li>Support research to identify the potential health impact of elevated lead levels in drinking water in light of elevated levels in public water supplies</li> <li>Quantify the proportion of the nation's housing stock with leaded piping</li> <li>Support research to identify the potential health impact of elevated iron levels in drinking water in light of elevated incidence of haemochromatosis in Ireland</li> <li>Support research that focuses on the development and evaluation of innovative methods and cost-effective technologies for improving the assessment and control of arsenic contamination in drinking water</li> <li>Support research that focuses on the development and evaluation of innovative methods and cost-effective technologies for improving the assessment and control of cadmium contamination in drinking water</li> <li>Support research that focuses on the development and evaluation of innovative methods and cost-effective technologies for improving the assessment and control of trihalomethanes (THMs) as an area for research as the limit has reduced and the level of compliance is poor</li> </ul> |

**Table 8.3. Recommended research – Other Water Quality Issues.**

| Theme                                | Objective of research                                                   | Recommended research                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Water-borne disease outbreaks</b> | <ul style="list-style-type: none"> <li>Protect public health</li> </ul> | <ul style="list-style-type: none"> <li>Develop new molecular technologies to detect and monitor water contamination that will enhance water quality monitoring and surveillance</li> <li>Continue efforts to develop methodology to trace sources of faecal contamination</li> </ul>                                                                                                                                        |
| <b>Water conservation</b>            | <ul style="list-style-type: none"> <li>Protect public health</li> </ul> | <ul style="list-style-type: none"> <li>Examine the potential health impact of pharmaceutical residues in waters caused by release of products into sewage systems following ingestion or external application (e.g. release of triclosan from toothpastes)</li> <li>Consider a project on the estimation of standards for new water contaminants that could potentially be detected in drinking water in Ireland</li> </ul> |
| <b>Surface water health risks</b>    | <ul style="list-style-type: none"> <li>Protect public health</li> </ul> | <ul style="list-style-type: none"> <li>Develop research to support the new EU Directive on bathing water quality, which proposes to eliminate the tests for pollutant parameters with two bacteriological measurements – intestinal enterococci and <i>Escherichia coli</i> – which focus specifically on protection of human health</li> <li>Identify trace elements speciation in fresh waters</li> </ul>                 |

including species of *Legionella*, *Pseudomonas aeruginosa*, *Mycobacterium avium*, other mycobacteria and amoebae. In addition, the air and water jets create an aerosol at head height level, providing ideal conditions for the transmission of Legionnaires' disease if the water contains legionellae. The risk of infection can be greatly reduced if spa pools are properly designed, installed and maintained. Guidelines are required to set out the specific responsibilities of those who design, install and manage commercially run spa pools to ensure staff working at the pool and recreational users are protected. Users should also be informed of precautionary measures they may take to reduce health risks.

Recommended research under this theme is outlined in [Table 8.3](#) above.

## 8.3 Air Quality, Noise and Health

### 8.3.1 Harmful air pollutants

Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or to cause adverse environmental effects. Poor air quality contributes to respiratory illness, cardiovascular disease, and cancer. It is generally agreed that air pollution is the environmental factor with the greatest

impact on health in Europe. Air pollution has long been considered a source of exacerbation of asthma and other respiratory conditions; however, recent studies of the effects of air pollution on children's health suggest that air pollution is associated with infant mortality and the development of asthma, and may influence lung development, causing lasting effects on respiratory health (Schwartz, 2004). Asthma can be triggered or worsened by exposure to ozone and environmental tobacco smoke (ETS). Exposure to ETS, or second-hand smoke, among non-smokers, which can occur in the home environment, is increasing the risk of heart disease and respiratory infections, particularly in children.

Key air pollutants that have a strong association with diseases include particulate matter, ozone, nitrogen oxides and sulphur dioxide, while polycyclic aromatic hydrocarbons, benzene and heavy metals present further potential health impacts. The WHO recently recognised that there have been significant reductions in concentrations of air pollutants across Europe over recent decades but that major concerns still exist relating to particulate matter and ozone. In Ireland, air quality is generally regarded as being good. The recent Irish EPA fourth environment report (EPA, 2008), which evaluates the state of the environment across a number of themes including, climate change, water

quality, air quality and emissions, waste, chemicals, land, soil, biodiversity and environmental noise, stated that air quality in Ireland is generally of a high standard across the country. However, there is no room for complacency. Within urban areas the main threat to air quality is emissions of particulate matter and nitrogen oxides arising primarily from vehicles. Cleaner vehicle emissions technology has curbed individual transport emissions in recent years, but the growth in the number and size of vehicles has offset any cumulative benefits for air quality. The control of transport air emissions, against a strong upward trend in vehicle numbers in Ireland, will continue to be a key issue for

Ireland – that emissions from road traffic are the primary threat to the quality of air and are increasing. Other sources of airborne pollution in Ireland include energy production, industrial/agricultural activity and contributions from transboundary sources.

In the context of air pollution and health in Ireland, it is essential to have baseline knowledge of the exposure of the Irish population to air pollution, after which the health effects of these exposures can be considered and dose–response relationships established. Recommended research under this theme is outlined in [Table 8.4](#).

**Table 8.4. Recommended research – Harmful Air Pollutants.**

| Theme                               | Objective of research                                                                          | Recommended research                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Indoor air pollution (IAP)</b>   | <ul style="list-style-type: none"> <li>Prevent and reduce exposure to IAP</li> </ul>           | <ul style="list-style-type: none"> <li>Investigate links between air pollution and adverse effects on human health</li> <li>Investigate the neuropsychological effects of carbon monoxide in indoor air</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Outdoor air pollution (OAP)</b>  | <ul style="list-style-type: none"> <li>Prevent and reduce exposure to OAP</li> </ul>           | <ul style="list-style-type: none"> <li>Model and measure the particle size distribution of nanoparticles in the atmosphere</li> <li>Investigate the links between air pollution and adverse effects on human health</li> <li>Examine exposure under a range of typical conditions and activities (e.g. transport/commuting, typical building environments, etc.)</li> <li>Model air dispersion using mathematical models to estimate the air concentrations and deposition arising from substances released to the air in the past, present and future – air quality modelling</li> <li>Examine the relationship of ambient monitoring measurements to typical exposures – air quality conformity</li> <li>Estimate local/transboundary contributions and relative pollutant toxicity – Environmental Impact Statements in transportation</li> <li>Develop Geographical Information Systems (GIS)-based exposure assessment tools for Ireland, in the context of providing exposure-reduction strategies</li> <li>Support a companion panel health study in conjunction with an exposure assessment to allow the establishment of dose–response functions for major pollutants</li> </ul> |
| <b>Airborne hazardous chemicals</b> | <ul style="list-style-type: none"> <li>Protect from exposure to hazardous chemicals</li> </ul> | <ul style="list-style-type: none"> <li>Support studies of temporal trends in human exposure to lead and its sources</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Transport/Mobility</b>           | <ul style="list-style-type: none"> <li>Protect from exposure to airborne particles</li> </ul>  | <ul style="list-style-type: none"> <li>Develop baseline data on modes of transport</li> <li>Identify sources' apportionment of urban airborne particles, with particular emphasis on the contribution of road traffic</li> <li>Support research on emission reduction (transportation strategies)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### 8.3.2 Noise pollution

Hearing loss leading to deafness can be caused by occupational exposure to high levels of noise. The attributable fraction for the disease burden of occupational deafness was estimated to be 16% of the global average disease burden for all deafness (WHO, 2004; Nelson et al., 2006). Pollution experts and environmental toxicologists constantly warn us about chemical and other airborne factors that can be a danger to health, but one problem that is rarely mentioned in the context of environmental hazards is noise-induced hearing loss. It is time to seriously consider the dangers of exposure to excessive and chronic noise, and the growing evidence that it can cause irreversible hearing loss (Harrison, 2006). Other potential noise dangers for children include powered garden and domestic equipment such as mowers and leaf blowers. To assist in the implementation of the Environmental Noise Directive (2002/49/EC) (END) and the development of a National Ambient Noise Strategy (NANS), recommended research under this theme are outlined in [Table 8.5](#).

## 8.4 Quantifying Environmental Health Impacts

### 8.4.1 Health assessment

To prevent disease and injury it is essential that their underlying causes (health risks) are quantitatively attributed. Together with information on the costs of interventions, their effectiveness and the socio-economic context, such knowledge provides a rational basis for policy setting. While quantitative studies have been performed for some health risks, few have assessed the disease burden from environmental risk factors and, traditionally, the studies have focused on a single risk factor. To assess a disease burden, the health impact of disease and injury needs to be assessed quantitatively at population level.

Environmental burden of disease (EBD) studies assess the disease burden attributable to environmental risk factors, and are closely linked to assessments of the disease burden for individual diseases and injuries. Indeed, the burden of disease from disease and injury has been assessed at global level, and national-level data are becoming available,

**Table 8.5. Recommended research – Noise Pollution.**

| Theme                                   | Objective of research                                                                | Recommended research                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Noise assessment</b>                 | <ul style="list-style-type: none"> <li>Exposure assessment</li> </ul>                | <ul style="list-style-type: none"> <li>Develop Geographical Information Systems (GIS)-based exposure assessment tools for Ireland</li> <li>Assess exposure to noise and related health effects to support implementation of the Environmental Noise Directive (END)</li> </ul>                                                                                                            |
| <b>Noise controls</b>                   | <ul style="list-style-type: none"> <li>Research and development</li> </ul>           | <ul style="list-style-type: none"> <li>Develop engineering controls to reduce the generation of noise at source</li> </ul>                                                                                                                                                                                                                                                                |
| <b>Attitudes to environmental noise</b> | <ul style="list-style-type: none"> <li>Assessment of attitudes</li> </ul>            | <ul style="list-style-type: none"> <li>Assess current levels and attitudes to environmental noise</li> </ul>                                                                                                                                                                                                                                                                              |
| <b>EU Directives</b>                    | <ul style="list-style-type: none"> <li>Noise mapping</li> </ul>                      | <ul style="list-style-type: none"> <li>Develop expertise that will be required under the END relating to the assessment and management of environmental noise, such as noise mapping and action planning</li> </ul>                                                                                                                                                                       |
| <b>Entertainment noise</b>              | <ul style="list-style-type: none"> <li>Quantification of the problem</li> </ul>      | <ul style="list-style-type: none"> <li>Assess current levels and attitudes to environmental noise</li> </ul>                                                                                                                                                                                                                                                                              |
| <b>Neighbour noise research</b>         | <ul style="list-style-type: none"> <li>Neighbourhood noise exposure study</li> </ul> | <ul style="list-style-type: none"> <li>Support research into domestic noise and the effectiveness of existing legislation</li> <li>Support research into neighbour noise, which is a key quality-of-life issue. The nature and extent of neighbour noise and its significance based on public opinion should be researched in order to make recommendations for future actions</li> </ul> |

which can be used in EBD studies. The results of disease burden studies are generally presented by gender and by age group, and are measured in terms of deaths and DALYs. The actual calculations for an EBD assessment are relatively simple once the input data (exposure and health outcomes) have been collected in a suitable format.

While much progress has been made in the last few decades in improving the evidence base, much work remains to be done. The current evidence does not allow us to develop estimates of the disease burden for risk with long latency periods or factors with non-specific outcomes. The magnitude of the health problem from environmental factors needs to be estimated for standard setting and policy development. It takes a wide range of skills, knowledge and information to effectively communicate on health issues to the public. Organisations with roles and responsibilities for public health protection need to work closely together in dealing with environment and health issues.

The Organisation for Economic Co-operation and Development (OECD) notes that health impacts from environmental degradation affect quality of life but also expenditure on health care, loss of productivity and loss of income and so potential economic benefits from

environmental policy should be considered (OECD, 2001). Recommended research under this theme is outlined in [Table 8.6](#).

#### 8.4.2 EPA-licensed activities

Any person or company involved in certain large-scale or complex industrial processes with significant polluting potential is required to be licensed by the EPA. The basis of this licensing is the protection of human health as well as the protection of the wider environment. Efficient waste management (including collection, transport, and treatment/disposal) is a basic requirement for public health and quality of life. Waste may arise from a variety of sources (household, commercial, industrial, etc.), may be hazardous or non-hazardous, and may be treated in a variety of different ways (recycling, landfill, incineration, composting, etc.). For both industrial processes and waste management operations, it can be expected that there will be some level of environmental impact which in turn could lead to a potential health impact. The development of monitoring and hazard/risk assessment tools to estimate the impacts associated with current and emerging waste management practices would assist policy making and regulation to minimise health impacts. Recommended research under this theme is outlined in [Table 8.7](#).

**Table 8.6. Recommended research – Quantifying Environment Health Impacts.**

| Theme                                       | Objective of research                                                                                                              | Recommended research                                                                                                                                                                                                                                                                                |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental health indicators</b>      | <ul style="list-style-type: none"> <li>Develop estimated burden of disease (EBD) studies – developing the evidence base</li> </ul> | <ul style="list-style-type: none"> <li>Support EBD at national or local level for selected environmental and occupational risk factors, including unintentional injuries, respiratory diseases, pedestrian infrastructures, road traffic accidents, using WHO guidance notes<sup>1</sup></li> </ul> |
| <b>Children's health</b>                    | <ul style="list-style-type: none"> <li>Develop EBD studies using children's environmental health data</li> </ul>                   | <ul style="list-style-type: none"> <li>Investigate specific factors for consideration in the context of children's environmental health</li> </ul>                                                                                                                                                  |
| <b>Environmental health policy analysis</b> | <ul style="list-style-type: none"> <li>Analysis of policy protection</li> </ul>                                                    | <ul style="list-style-type: none"> <li>Analyse the protection afforded by environment–health-relevant policies to people at high risk, such as children, immuno-compromised and elderly people</li> </ul>                                                                                           |
| <b>Cost–benefit analysis</b>                | <ul style="list-style-type: none"> <li>Prioritisation of environmental policy actions – value for money</li> </ul>                 | <ul style="list-style-type: none"> <li>Conduct cost–benefit analysis of health issues associated with current (and proposed) environmental policy actions</li> </ul>                                                                                                                                |

<sup>1</sup>WHO (World Health Organization), 2003. *Introduction and Methods: Assessing the Environmental Burden of Disease at National and Local Levels*. [http://www.who.int/quantifying\\_ehimpacts/publications/9241546204/en/index.html](http://www.who.int/quantifying_ehimpacts/publications/9241546204/en/index.html)

**Table 8.7. Recommended research – Environmental Protection Agency (EPA)-Licensed Activities.**

| Theme                                                                              | Objective of research                                                                                             | Recommended research                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Public health risk assessment project</b>                                       | <ul style="list-style-type: none"> <li>Identify current and future environmental risk to public health</li> </ul> | <ul style="list-style-type: none"> <li>Identify and rank environmental risks to public health in Ireland, the options for control of those risks and cost–benefit analysis of the options, including a specific examination of the relative risk posed by licensable activities</li> </ul> |
| <b>Development of a decision support system for Health Impact Assessment (HIA)</b> | <ul style="list-style-type: none"> <li>Sound and objective decision-making policies</li> </ul>                    | <ul style="list-style-type: none"> <li>Develop a decision support system for use in considering and interpreting health impact associated with activities that are subject to environmental licensing</li> </ul>                                                                           |
| <b>HIA and waste treatment and disposal</b>                                        | <ul style="list-style-type: none"> <li>Implementing HIA</li> </ul>                                                | <ul style="list-style-type: none"> <li>Develop a pilot HIA for waste treatment/disposal systems such as landfill, incineration, composting anaerobic digestion, mechanical biological treatment, etc., and development of guidance for conduct of HIA</li> </ul>                           |
| <b>Bio-aerosols and environmental and human health impact</b>                      | <ul style="list-style-type: none"> <li>Impacts of bio-aerosols on health</li> </ul>                               | <ul style="list-style-type: none"> <li>Support detailed research on monitoring of production and impacts of bio-aerosols from certain waste management facilities</li> </ul>                                                                                                               |

## 8.5 Conclusions

- The field of environment and health has matured and expanded to become one of the most comprehensive and humanly relevant disciplines in science.
- Multidisciplinary research on interactions of environmental risk factors and human health is needed to support the National Environmental Health Plan, the integration of public health concerns and disease characterisation related to emerging environmental risks.

## 8.6 Policy Implications

- Noise policy must be developed in the context of protecting the environment and enhancing quality of life and public health. Research is necessary to underpin this aim. The EPA should support research that will inform ministerial decisions, guide the development of policy, develop action programmes, monitor the achievement of policy goals, stimulate and promote innovation, and encourage the spread of good practice and technology.

- Policies in the area of environment and health should emphasise the need to bring all interested parties, such as the government, industry, academia and the public, into discussion on complex and often controversial environmental health issues.
- Innovative research and risk assessment centres should be created within the EPA and the HSE, comprising representatives from all the main stakeholders.
- The support network of EPA-funded environmental and health projects that emphasise multidisciplinary research collaboration and coordination should be expanded.
- To ensure community involvement, it should be mandatory for each EPA-funded project to have a community outreach and education programme that is responsive to local environmental health problems, particularly those in disadvantaged populations.

## **9 Role of the Environmental Research Centre**

Since it was established in 1994, the EPA has become an important promoter of environmental research and, under the draft Irish NEHAP ([http://www.euro.who.int/eehc/implementation/20050606\\_1](http://www.euro.who.int/eehc/implementation/20050606_1)), there will be strong support for more scientific research and meaningful compilation of information data sets, which should further strengthen the interrelationships between the environmental and health fields. This would lead to better informed evaluation and decision making, particularly in the area of risk assessment and risk communication. Research is vital for developing the capacity to identify and effectively respond to newly emerging hazards and to provide the evidence base for best practice environment and health management. Environment and health research involves several disciplines and faculties, research bodies and institutions. There are many agencies directly and indirectly involved in research relevant to environment and health. It is important that the national environment and health partnership explores ways in which partnerships between these agencies can be developed.

Since 1994, the EPA has supported research and development activities in a range of environmental areas. This work was carried out by researchers in third-level institutions, state agencies, government departments, local and regional authorities, the private sector and individuals. Projects are funded through open calls for research proposals, which address a broad range of environmentally related issues. The ERC was established under the National Development Plan 2000–2006 to allow for a more structured approach to environmental research and to provide stronger environmental support to the Plan. Its overall purpose is to help ensure that development is environmentally sustainable. The aims of the ERC may be stated as follows: to allow for a more structured approach to environmental research through the development of advanced innovative techniques and systems, and to address priority environmental issues, thereby supporting environmentally sustainable development.

The ERC is now part of the STRIVE Programme. It is distinguished from the rest of the STRIVE Programme:

- (a) In that its research, including technological development and innovation, is implemented mainly within EPA facilities in cooperation with third-level colleges and other research bodies; and
- (b) In its emphasis on developing information and related systems as a key environmental component of the knowledge economy.

Overall, the ERC may be regarded as a service provider for the EPA, channelling the knowledge and experience of the research sector to provide tools and systems for enhanced environmental protection. The activities of the ERC may be considered under the two main themes of (i) pooling, sharing and advancing knowledge, and (ii) advanced monitoring and assessment methods (EPA, 2009). The ERC comprises researchers working closely with the EPA to facilitate a more structured approach to environmental research. The Centre aims to provide easy access to information, and integrated environmental assessment tools and systems.

There appears to be plenty of scope for collaboration between researchers in the fields of environment and health, including toxicology and epidemiology. There is a need to strengthen and coordinate current research efforts in the field of environment and health. Development work is also needed on effective environment and health monitoring and data collection.

### **9.1 Conclusion**

- The exchange of research information is important. Making the information available and understandable to stakeholders is, in particular, closely linked to the risk assessment–management–communication continuum. It is vital that a strong link is formed between the ERC and the NEHAP steering group in order to strengthen research topics/areas of national importance and to inform policy. A nominated member of the ERC

Team should attend NEHAP meetings and be a vital link to informing on priority areas of research for Ireland.

## **9.2 Policy Implications**

- The ERC must foster interdisciplinary exchange and collaborative interaction.
- Endorsing a closer working relationship between the public health community and the EPA personnel is central to the ERC role.
- The ERC could be central to the formation of a group of environment and health specialists who are involved in responding to IPPC licensing and who could also continue to produce priority position papers. This would be of mutual benefit to both the HSE and the EPA. This group would have a focus on and an identity with environment and health issues only and provide a link not only between the two main government agencies but also between others involved in similar activities.

## 10 Summary

The precept that human health protection is a fundamental aspect of environmental protection was essential to the work undertaken through this fellowship. A key element was the need to develop a framework to enhance the institutional interface between environmental protection and human health. The fellowship strove to develop and facilitate networks that would facilitate key policy makers, researchers and stakeholders in taking action to proactively address surveillance and other health issues as they relate to environmental concerns, such as conservation and exposure to toxic substances and other pollutants.

One of the tasks of the fellowship was to establish collaborative alliances, within the context of a recently negotiated MOU, between the EPA and the HSE, because best international practice suggested that collaborative alliances are a central stratagem for organisations with issues of mutual interest – in this case to pool both time and resources in addressing and managing complex interactions between environment and health issues.

While it is fully acknowledged that there was a significant investment of time by the participants, the skill and persistence of the research fellow contributed significantly towards what both the HSE and the EPA now consider to be an effective collaboration between the two organisations in working towards the resolution of threats to public health and the advancement of shared visions. It is clear that a continuing collaborative process between the EPA and the HSE will result in more successful resolution of environmental contamination problems and matters pertaining to the environment and health, and may be expected to result in additional initiatives to develop and extend the scope of such collaboration. Initiating such collaboration can be problematic, requiring leadership skills, patience, and the ability for creative thinking. The research fellow was successful in

effective stakeholder communication and initial bridge building, which are crucial for a successful collaboration to be established in such a way that it may grow in future.

This fellowship drew together a range of relevant literature that addresses ways in which the state of the environment affects human health, and explored the interface between the environment and human health. Emphasis was placed on learning about current field activities to address this connection, as well as to explore emerging issues. In each section of the End of Project Report, relevant literature is first reviewed, conclusions are drawn, and policy implications indicated. However, a strength of the fellowship was in the collaboration established with both the HSE and the IPH, which resulted in achievement of agreement on a template for a set of position papers on issues of mutual interest and concern, as well as the recognition of the need to consider HIA, in addition to EIA, in all spatial planning decisions where an impact on health is predicted. The IPH feedback indicated that the process has been very beneficial to it in generating interest in both training and involvement from government agencies in the HIA process and it plans to continue to work on the process in the coming year.

In order to gain knowledge about current research activities and priorities in the area of environment and health, a systematic review of the literature was undertaken and, based on the review, a list of research needs for environment and health was drawn up. Many of the current research activities in the area of environment and health are underpinned by EU directives and by the need to protect human health from not only the direct pathological effects of various chemical, physical and biological agents but also the effects of the broader physical and social environment, embracing housing, urban development, land use and transportation, industry, and agriculture.

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## **Acronyms and Annotations**

|              |                                                                                                                                                                     |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ATSDR</b> | Agency for Toxic Substances and Disease Registry                                                                                                                    |
| <b>COM</b>   | Communication from the Commission to the Council, the European Parliament                                                                                           |
| <b>CSO</b>   | Central Statistics Office Ireland                                                                                                                                   |
| <b>DAF</b>   | Department of Agriculture and Food                                                                                                                                  |
| <b>DAFF</b>  | Department of Agriculture, Fisheries and Food (formerly Department of Agriculture and Food (DAF) and Department of Agriculture, Food and Rural Development (DAFRD)) |
| <b>DAFRD</b> | Department of Agriculture, Food and Rural Development                                                                                                               |
| <b>DALYs</b> | Disability Adjusted Life Years                                                                                                                                      |
| <b>DEHLG</b> | Department of the Environment, Heritage and Local Government                                                                                                        |
| <b>DOELG</b> | Department of Environment and Local Government                                                                                                                      |
| <b>DOHC</b>  | Department of Health and Children                                                                                                                                   |
| <b>EBD</b>   | Estimated Burden of Disease                                                                                                                                         |
| <b>EC</b>    | European Commission                                                                                                                                                 |
| <b>ECC</b>   | European Council Conclusions                                                                                                                                        |
| <b>EEA</b>   | European Environment Agency                                                                                                                                         |
| <b>EEHAP</b> | European Environment & Health Action Plan                                                                                                                           |
| <b>EHAPE</b> | Environment and Health Action Plan for Europe                                                                                                                       |
| <b>EHU</b>   | Environmental Health Unit                                                                                                                                           |
| <b>EIA</b>   | Environmental Impact Assessment                                                                                                                                     |
| <b>EIS</b>   | Environmental Impact Statement                                                                                                                                      |
| <b>END</b>   | Environmental Noise Directive                                                                                                                                       |
| <b>EPA</b>   | Environmental Protection Agency                                                                                                                                     |
| <b>ERC</b>   | Environmental Research Centre                                                                                                                                       |
| <b>ERTDI</b> | Environmental Research and Technological Development and Innovation                                                                                                 |
| <b>ESBIO</b> | Expert Team to Support BIoMonitoring in Europe                                                                                                                      |
| <b>ETS</b>   | Environmental tobacco smoke                                                                                                                                         |
| <b>EU</b>    | European Union                                                                                                                                                      |
| <b>FSAI</b>  | Food Safety Authority of Ireland                                                                                                                                    |
| <b>GIS</b>   | Geographical Information Systems                                                                                                                                    |
| <b>HBM</b>   | Human Biomonitoring                                                                                                                                                 |
| <b>HIA</b>   | Health Impact Assessment                                                                                                                                            |

|                |                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HIQA</b>    | Health Information and Quality Authority                                                                                                                                                                                                                                                                                                                            |
| <b>HSE</b>     | Health Service Executive                                                                                                                                                                                                                                                                                                                                            |
| <b>IAG</b>     | Inter-Agency Group was established to conduct an investigation into the presence and influence of lead in the Silvermines area. Chaired by the DAFRD, it first met on 22 June 1999. The final report of the IAG was published in June 2000 – <i>Report of the Investigation into the Presence and Influence of Lead in the Silvermines area of County Tipperary</i> |
| <b>IAP</b>     | Indoor Air Pollution                                                                                                                                                                                                                                                                                                                                                |
| <b>IG</b>      | Implementation Group                                                                                                                                                                                                                                                                                                                                                |
| <b>IPH</b>     | Institute of Public Health                                                                                                                                                                                                                                                                                                                                          |
| <b>IPPC</b>    | Integrated Pollution Prevention Control                                                                                                                                                                                                                                                                                                                             |
| <b>MOU</b>     | Memorandum of Understanding                                                                                                                                                                                                                                                                                                                                         |
| <b>NANS</b>    | National Ambient Noise Strategy                                                                                                                                                                                                                                                                                                                                     |
| <b>NDP/CSF</b> | National Development Plan/Community Support Framework 2000–2006                                                                                                                                                                                                                                                                                                     |
| <b>NDSC</b>    | National Disease Surveillance Centre                                                                                                                                                                                                                                                                                                                                |
| <b>NEHAP</b>   | National Environment and Health Action Plan                                                                                                                                                                                                                                                                                                                         |
| <b>NRA</b>     | National Roads Authority                                                                                                                                                                                                                                                                                                                                            |
| <b>OAP</b>     | Outdoor Air Pollution                                                                                                                                                                                                                                                                                                                                               |
| <b>OECD</b>    | Organisation for Economic Co-operation and Development                                                                                                                                                                                                                                                                                                              |
| <b>OSi</b>     | Ordnance Survey of Ireland                                                                                                                                                                                                                                                                                                                                          |
| <b>PCB</b>     | Polychlorinated biphenyl                                                                                                                                                                                                                                                                                                                                            |
| <b>STRIVE</b>  | Science, Technology, Research and Innovation Programme                                                                                                                                                                                                                                                                                                              |
| <b>Teagasc</b> | Agriculture and Food Development Authority Ireland                                                                                                                                                                                                                                                                                                                  |
| <b>TMF</b>     | Tailings Management Facility                                                                                                                                                                                                                                                                                                                                        |
| <b>TTP</b>     | Time to pregnancy                                                                                                                                                                                                                                                                                                                                                   |
| <b>VTEC</b>    | Verotoxigenic <i>Escherichia coli</i>                                                                                                                                                                                                                                                                                                                               |
| <b>WFD</b>     | Water Framework Directive                                                                                                                                                                                                                                                                                                                                           |
| <b>WHA</b>     | World Health Authority                                                                                                                                                                                                                                                                                                                                              |
| <b>WHO</b>     | World Health Organization                                                                                                                                                                                                                                                                                                                                           |

# An Gníomhaireacht um Chaomhnú Comhshaoil

Is í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) comhlachta reachtúil a chosnaíonn an comhshaol do mhuintir na tíre go léir. Rialaímid agus déanaimid maoirsiú ar ghníomhaíochtaí a d'fhéadfadh truailliú a chruthú murach sin. Cinntímid go bhfuil eolas cruinn ann ar threochtaí comhshaoil ionas go nglactar aon chéim is gá. Is iad na príomh-nithe a bhfuilimid gníomhach leo ná comhshaol na hÉireann a chosaint agus cinntiú go bhfuil forbairt inbhuanaithe.

Is comhlacht poiblí neamhspleách í an Gníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil agus Rialtais Áitiúil a dhéanann urraíocht uirthi.

## ÁR bhFREAGRACHTAÍ

### CEADÚNÚ

Bíonn ceadúnais á n-eisiúint againn i gcomhair na nithe seo a leanas chun a chinntiú nach mbíonn astuithe uathu ag cur sláinte an phobail ná an comhshaol i mbaol:

- áiseanna dramhaíola (m.sh., líonadh talún, loisceoirí, stáisiúin aistrithe dramhaíola);
- gníomhaíochtaí tionsclaíocha ar scála mór (m.sh., déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta);
- diantalmhaíocht;
- úsáid faoi shrian agus scaoileadh smachtaithe Orgánach Géinathraithe (GMO);
- mór-áiseanna stórais peitreal.
- Scardadh dramhuisce

### FEIDHMIÚ COMHSHAOIL NÁISIÚNTA

- Stiúradh os cionn 2,000 iniúchadh agus cigireacht de áiseanna a fuair ceadúnas ón nGníomhaireacht gach bliain.
- Maoirsiú freagrachtaí cosanta comhshaoil údarás áitiúla thar sé earnáil - aer, fuaim, dramhaíl, dramhuisce agus caighdeán uisce.
- Obair le húdaráis áitiúla agus leis na Gardaí chun stop a chur le gníomhaíocht mhídhleathach dramhaíola trí chomhordú a dhéanamh ar líonra forfheidhmithe náisiúnta, díriú isteach ar chiontóirí, stiúradh fiosrúcháin agus maoirsiú leigheas na bhfadhbanna.
- An dlí a chur orthu siúd a bhriseann dlí comhshaoil agus a dhéanann dochar don chomhshaol mar thoradh ar a ngníomhaíochtaí.

### MONATÓIREACHT, ANAILÍS AGUS TUAIRISCIÚ AR AN GCOMHSHAOIL

- Monatóireacht ar chaighdeán aer agus caighdeán aibhneacha, locha, uisce taoide agus uisce talaimh; leibhéil agus sruth aibhneacha a thomhas.
- Tuairisciú neamhspleách chun cabhrú le rialtais náisiúnta agus áitiúla cinntiú a dhéanamh.

### RIALÚ ASTUITHE GÁIS CEAPTHA TEASA NA HÉIREANN

- Cainníochtú astuithe gáis ceaptha teasa na hÉireann i gcomhthéacs ár dtiomantas Kyoto.
- Cur i bhfeidhm na Treorach um Thrádáil Astuithe, a bhfuil baint aige le hos cionn 100 cuideachta atá ina mór-ghineadóirí dé-ocsaíd charbóin in Éirinn.

### TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Taighde ar shaincheisteanna comhshaoil a chomhordú (cosúil le caighdeán aer agus uisce, athrú aeráide, bithéagsúlacht, teicneolaíochtaí comhshaoil).

### MEASÚNÚ STRAITÉISEACH COMHSHAOIL

- Ag déanamh measúnú ar thionchar phleananna agus chláracha ar chomhshaol na hÉireann (cosúil le pleananna bainistíochta dramhaíola agus forbartha).

### PLEANÁIL, OIDEACHAS AGUS TREOIR CHOMHSHAOIL

- Treoir a thabhairt don phobal agus do thionscal ar cheisteanna comhshaoil éagsúla (m.sh., iarratais ar cheadúnais, seachaint dramhaíola agus rialacháin chomhshaoil).
- Eolas níos fearr ar an gcomhshaol a scaipeadh (trí cláracha teilifíse comhshaoil agus pacáistí acmhainne do bhunscoileanna agus do mheánscoileanna).

### BAINISTÍOCHT DRAMHAÍOLA FHORGHNÍOMHACH

- Cur chun cinn seachaint agus laghdú dramhaíola trí chomhordú An Chláir Náisiúnta um Chosc Dramhaíola, lena n-áirítear cur i bhfeidhm na dTionscnamh Freagrachta Táirgeoirí.
- Cur i bhfeidhm Rialachán ar nós na treoracha maidir le Trealamh Leictreach agus Leictreonach Caite agus le Srianadh Substaintí Guaiseacha agus substaintí a dhéanann ídiú ar an gcrios ózóin.
- Plean Náisiúnta Bainistíochta um Dramhaíl Ghuaiseach a fhorbairt chun dramhaíl ghuaiseach a sheachaint agus a bhainistiú.

### STRUCHTÚR NA GNÍOMHAIREACHTA

Bunaíodh an Gníomhaireacht i 1993 chun comhshaol na hÉireann a chosaint. Tá an eagraíocht á bhainistiú ag Bord lánaimseartha, ar a bhfuil Príomhstíúrthóir agus ceithre Stíúrthóir.

Tá obair na Gníomhaireachta ar siúl trí ceithre Oifig:

- An Oifig Aeráide, Ceadúnaithe agus Úsáide Acmhainní
- An Oifig um Fhorfheidhmiúchán Comhshaoil
- An Oifig um Measúnacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáide

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag ball air agus tagann siad le chéile cúpla uair in aghaidh na bliana le plé a dhéanamh ar cheisteanna ar ábhar imní iad agus le comhairle a thabhairt don Bhord.

The EPA's Environmental Research Centre (ERC) was established as a centre of excellence under the National Development Plan (NDP) to build capacity in environmental data handling, modelling, assessment and guidance. The objective of the ERC is to allow for a more structured approach to environmental research, through the development of advanced innovative techniques and systems to address priority environmental issues and thereby support environmentally sustainable development.