

## EPA-Funded Research: Air Quality

Reports from completed projects will be available on the EPA website at [www.epa.ie/downloads/pubs/research/air/](http://www.epa.ie/downloads/pubs/research/air/)

During the ERTDI Programme 2000-2006, 33 research projects were funded in the area of Air Quality, including:

- 17 Doctorate projects
  - 5 Fellowships
  - 3 Large-scale studies
  - 4 Medium-scale studies
  - 4 Small-scale studies
- 33 Total projects**

### 33 EPA (2000 – 2006) Projects indexed by

[Year and Content](#)                      [Lead Organisations](#)                      [Project Leaders](#)

#### Year and Content:

2000-LS-6.1-M1	<a href="#"><u><i>Air Quality: Transport Impacts and Monitoring Networks Nature and Origin of PM10 and Smaller Particulate Matter in Air</i></u></a>
2000-LS-6.2-M1	<a href="#"><u><i>Air Quality: Transport Impacts and Monitoring Networks - Designation of Monitoring Networks</i></u></a>
2000-LS-6.3-M1	<a href="#"><u><i>Air Quality: Transport Impacts and Monitoring Networks Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions</i></u></a>
2001-MS-14-M1	<a href="#"><u><i>Environmental Quality Objectives – Noise</i></u></a>
2001-PHD-3-M1	<a href="#"><u><i>Evaluation of Options for Reducing Irish Diesel Particulate Emissions- Utilising Measurement and Modelling Methods</i></u></a>
2001-PHD-7-M1	<a href="#"><u><i>Simulation and Modelling of Exhaust Emissions</i></u></a>
2001-PHD-10	<a href="#"><u><i>Reaction of Nitrate Radicals with Dimethylphenols under Atmospheric Conditions</i></u></a>
2001-PHD-11-M1	<a href="#"><u><i>Determination of Natural Non-methane Hydrocarbon Fluxes in Ireland</i></u></a>
2002-PHD2-1	<a href="#"><u><i>Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions</i></u></a>
2002-PHD2-41	<a href="#"><u><i>Satellite Remote Sensing of Aerosols in the Eastern North Atlantic Region</i></u></a>
2002-PHD2-42	<a href="#"><u><i>Modelling the Role of Clouds in Forming PM2.5 Aerosol</i></u></a>

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2002-PHDe-2/5	<a href="#"><u>Life Cycle Analysis of Emissions Management for Irish Livestock Production Systems</u></a>
2002-SS-9-M1	<a href="#"><u>Bio-aerosol Emissions from Composting Facilities - Literature Review</u></a>
2003-SS-12-M2	<a href="#"><u>Study Addressing Priority Areas Necessary for the Implementation of the Solvents Emissions Directive in Ireland</u></a>
2003-SS-20	<a href="#"><u>Investigation into the Emissions Reductions Achieved by IPC Licensing</u></a>
2003-SS-21	<a href="#"><u>Identification of Industrial Activities Likely to be Involved in Greenhouse Gas Emissions Trading and Estimation of their Current Output of Carbon Dioxide</u></a>
2003-TXB-FS9-M4	<a href="#"><u>Air Quality and Acidification Linked to Transboundary Pollution - Analytical Chemistry</u></a>
2004-AE-FS-20	<a href="#"><u>Air Emissions Analyses</u></a>
2004-CCTXB-FS-18	<a href="#"><u>Transboundary Air Pollution Fellowship</u></a>
2004-CoE-AQM-M4	<a href="#"><u>Air Quality Modelling and Forecasting for Ireland</u></a>
2004-PHD4-1	<a href="#"><u>Linking Urban Field Measurements of Particulate Matter to Their Chemical Analysis and Effects on Health</u></a>
2004-PHD4-9-M1	<a href="#"><u>Data Assimilation - Enabling an Irish Component of GMES Atmosphere</u></a>
2005-AQ-MS-50-M4	<a href="#"><u>Integrated Analysis of Trends and Changes in Ozone Levels over Ireland and their Implications</u></a>
2005-EE-FS-26-M4	<a href="#"><u>Enviro-economic Analyses and Modelling</u></a>
2005-TXB-MS-25-M	<a href="#"><u>Pilot Study of Trace Gases at Carnsore Point</u></a>
2006-FS-AQ-39-M4	<a href="#"><u>Integrated Systems for Analysis of Air Pollution and Acidification Issues</u></a>
2006-PHD-AQ-2	<a href="#"><u>Quantifying Seasonality in CO<sub>2</sub> fluxes over the North-East Atlantic</u></a>
2006-PHD-AQ-3	<a href="#"><u>The Effect of NO<sub>x</sub> Traps on the Combustion and Size Distribution of Carbonaceous Particulate Matter Emitted from Diesel Engines</u></a>
2006-PHD-AQ-4	<a href="#"><u>Total Carbon Balance of a Blanket Peat Catchment</u></a>
2006-PHD-RCA-17	<a href="#"><u>Communicating Environmental Risk: Waste, Incineration and Dioxins</u></a>
2006-PHD-RCA-18	<a href="#"><u>Advanced Systems for Biological Assessment of Toxicity of Industrial Chemicals</u></a>

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- 2006-PHD-RCA-19 [Post-genomic Approaches to Assess the Nanotoxicity Risk of Nanoparticles](#)
- 2006-PHD-RCA-20 [Development of a Risk Assessment Methodology for Evaluating Ecological Dispersion and Human Risks from Nanoparticles through Environmental Pathways](#)

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## **Lead Organisations:**

### **Cambridge Environmental Research Consultants Limited**

2000-LS-6.2-M1 [Air Quality: Transport Impacts and Monitoring Networks - Designation of Monitoring Networks](#)

### **Circa Group Europe**

2003-SS-20 [Investigation into the Emissions Reductions Achieved by IPC Licensing](#)

### **Clean Technology Centre**

2003-SS-12-M2 [Study Addressing Priority Areas Necessary for the Implementation of the Solvents Emissions Directive in Ireland](#)

### **Composting Association of Ireland – Cré**

2002-SS-9-M1 [Bio-aerosol Emissions from Composting Facilities - Literature Review](#)

### **Dublin City University**

2003-TXB-FS9-M4 [Air Quality and Acidification Linked to Transboundary Pollution - Analytical Chemistry](#)

### **Mica Management Consulting Limited**

2003-SS-21 [Identification of Industrial Activities Likely to be Involved in Greenhouse Gas Emissions Trading and Estimation of their Current Output of Carbon Dioxide](#)

### **NUI Galway**

2000-LS-6.1-M1 [Air Quality: Transport Impacts and Monitoring Networks Nature and Origin of PM10 and Smaller Particulate Matter in Air](#)

2001-PHD-7-M1 [Simulation and Modelling of Exhaust Emissions](#)

2001-PHD-11-M1 [Determination of Natural Non-methane Hydrocarbon Fluxes in Ireland](#)

2002-PHD2-41 [Satellite Remote Sensing of Aerosols in the Eastern North Atlantic Region](#)

2002-PHD2-42 [Modelling the Role of Clouds in Forming PM2.5 Aerosol](#)

2004-AE-FS-20 [Air Emissions Analyses](#)

2004-CCTXB-FS-18 [Transboundary Air Pollution Fellowship](#)

2004-PHD4-9-M1 [Data Assimilation - Enabling an Irish Component of GMES Atmosphere](#)

**NUI Galway (continued)**

- 2005-AQ-MS-50-M4 [Integrated Analysis of Trends and Changes in Ozone Levels over Ireland and their Implications](#)
- 2006-PHD-AQ-2 [Quantifying Seasonality in CO<sub>2</sub> fluxes over the North-East Atlantic](#)

**South Western Services**

- 2001-MS-14-M1 [Environmental Quality Objectives – Noise](#)

**Trinity College Dublin**

- 2000-LS-6.3-M1 [Air Quality: Transport Impacts and Monitoring Networks Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions](#)
- 2002-PHD2-1 [Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions](#)
- 2006-FS-AQ-39-M4 [Integrated Systems for Analysis of Air Pollution and Acidification Issues](#)
- 2006-PHD-RCA-17 [Communicating Environmental Risk: Waste, Incineration and Dioxins](#)

**University College Cork**

- 2001-PHD-10 [Reaction of Nitrate Radicals with Dimethylphenols under Atmospheric Conditions](#)
- 2004-PHD4-1 [Linking Urban Field Measurements of Particulate Matter to Their Chemical Analysis and Effects on Health](#)
- 2006-PHD-AQ-4 [Total Carbon Balance of a Blanket Peat Catchment](#)
- 2006-PHD-RCA-18 [Advanced Systems for Biological Assessment of Toxicity of Industrial Chemicals](#)

**University College Dublin**

- 2001-PHD-3-M1 [Evaluation of Options for Reducing Irish Diesel Particulate Emissions- Utilising Measurement and Modelling Methods](#)
- 2002-PHDe-2/5 [Life Cycle Analysis of Emissions Management for Irish Livestock Production Systems](#)
- 2005-EE-FS-26-M4 [Enviro-economic Analyses and Modelling](#)
- 2006-PHD-AQ-3 [The Effect of NO<sub>x</sub> Traps on the Combustion and Size Distribution of Carbonaceous Particulate Matter Emitted from Diesel Engines](#)
- 2006-PHD-RCA-19 [Post-genomic Approaches to Assess the Nanotoxicity Risk of Nanoparticles](#)

**University College Dublin (continued)**

2006-PHD-RCA-20 [Development of a Risk Assessment Methodology for Evaluating Ecological Dispersion and Human Risks from Nanoparticles through Environmental Pathways](#)

**University of Bristol**

2005-TXB-MS-25-M [Pilot Study of Trace Gases at Carnsore Point](#)

**University of Cologne**

2004-CoE-AQM-M4 [Air Quality Modelling and Forecasting for Ireland](#)

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## **Project Leaders:**

**Basir, Dr Wasim**

2003-TXB-FS9-M4

[Air Quality and Acidification Linked to Transboundary Pollution - Analytical Chemistry](#)

**Broderick, Dr Brian**

2002-PHD2-1

[Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions](#)

**Carruthers, Dr David**

2000-LS-6.2-M1

[Air Quality: Transport Impacts and Monitoring Networks - Designation of Monitoring Networks](#)

**Cummins, Dr Enda**

2006-PHD-RCA-20

[Development of a Risk Assessment Methodology for Evaluating Ecological Dispersion and Human Risks from Nanoparticles through Environmental Pathways](#)

**Davies, Dr Anna**

2006-PHD-RCA-17

[Communicating Environmental Risk: Waste, Incineration and Dioxins](#)

**Dawson, Prof. Kenneth**

2006-PHD-RCA-19

[Post-genomic Approaches to Assess the Nanotoxicity Risk of Nanoparticles](#)

**Holden, Dr Nick**

2002-PHDe-2/5

[Life Cycle Analysis of Emissions Management for Irish Livestock Production Systems](#)

**Jackobs, Dr Hermann**

2004-CoE-AQM-M4

[Air Quality Modelling and Forecasting for Ireland](#)

**Jennings, Prof. S. Gerard**

2000-LS-6.1-M1

[Air Quality: Transport Impacts and Monitoring Networks Nature and Origin of PM10 and Smaller Particulate Matter in Air](#)

2001-PHD-11-M1

[Determination of Natural Non-methane Hydrocarbon Fluxes in Ireland](#)

2002-PHD2-41

[Satellite Remote Sensing of Aerosols in the Eastern North Atlantic Region](#)

2005-AQ-MS-50-M4

[Integrated Analysis of Trends and Changes in Ozone Levels over Ireland and their Implications](#)

**Kelly, Dr Andrew**

2005-EE-FS-26-M4 [Enviro-economic Analyses and Modelling](#)

**Kelly, Dr David**

2003-SS-20 [Investigation into the Emissions Reductions Achieved by IPC Licensing](#)

**Kiely, Prof. Gerard**

2006-PHD-AQ-4 [Total Carbon Balance of a Blanket Peat Catchment](#)

**Leinert, Dr Stephan**

2004-CCTXB-FS-18 [Transboundary Air Pollution Fellowship](#)

**Misstear, Prof. Bruce**

2000-LS-6.3-M1 [Air Quality: Transport Impacts and Monitoring Networks Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions](#)

**O'Donoghue, Dr Roland**

2006-FS-AQ-39-M4 [Integrated Systems for Analysis of Air Pollution and Acidification Issues](#)

**O'Dowd, Prof. Colin**

2002-PHD2-42 [Modelling the Role of Clouds in Forming PM<sub>2.5</sub> Aerosol](#)

2004-PHD4-9-M1 [Data Assimilation - Enabling an Irish Component of GMES Atmosphere](#)

2006-PHD-AQ-2 [Quantifying Seasonality in CO<sub>2</sub> fluxes over the North-East Atlantic](#)

**O'Doherty, Dr Simon**

2005-TXB-MS-25-M [Pilot Study of Trace Gases at Carnsore Point](#)

**O'Leary, Ms Eileen**

2003-SS-12-M2 [Study Addressing Priority Areas Necessary for the Implementation of the Solvents Emissions Directive in Ireland](#)

**Papkovsky, Prof. Dimitri B.**

2006-PHD-RCA-18 [Advanced Systems for Biological Assessment of Toxicity of Industrial Chemicals](#)

**Prasad, Dr Munro**

2002-SS-9-M1 [Bio-aerosol Emissions from Composting Facilities - Literature Review](#)

**Roddy, Dr Aodhagan**

2004-AE-FS-20 [Air Emissions Analyses](#)

**Simmie, Dr John**

2001-PHD-7-M1 [Simulation and Modelling of Exhaust Emissions](#)

**Sodeau, Prof. John**

2004-PHD4-1 [Linking Urban Field Measurements of Particulate Matter to Their Chemical Analysis and Effects on Health](#)

**Sullivan, Dr James**

2006-PHD-AQ-3 [The Effect of NOx Traps on the Combustion and Size Distribution of Carbonaceous Particulate Matter Emitted from Diesel Engines](#)

**Timoney, Dr David**

2001-PHD-3-M1 [Evaluation of Options for Reducing Irish Diesel Particulate Emissions- Utilising Measurement and Modelling Methods](#)

**Waugh, Mr Declan**

2001-MS-14-M1 [Environmental Quality Objectives – Noise](#)

**Wenger, Dr John**

2001-PHD-10 [Reaction of Nitrate Radicals with Dimethylphenols under Atmospheric Conditions](#)

**Weymes, Mr Kevin**

2003-SS-21 [Identification of Industrial Activities Likely to be Involved in Greenhouse Gas Emissions Trading and Estimation of their Current Output of Carbon Dioxide](#)

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**PROJECT TITLE**

*Air Quality: Transport Impacts and Monitoring Networks Nature and Origin of PM10 and Smaller Particulate Matter in Air (2000-LS-6.1-M1)*

**LEAD ORGANISATION**

NUI, Galway

**START DATE**

01/11/2000

**CONTACT**

Prof. S. Gerard Jennings

**STATUS**

Completed (ERTDI Report 48)

**PROJECT TYPE**

Large-scale study

**TOTAL BUDGET (€)**

522,517.54

**PROJECT DESCRIPTION**

The dramatic increase in the volume of traffic, resulting in regular congestion and gridlock on our city streets is an increasing cause of frustration as well as air pollution. There are other air pollutants however, and although traffic is an important source, its contribution to air pollution levels is not yet quantified for Irish cities. This major three-year project will investigate the impact of various factors, including transport on air quality.

The main objective of the research will be to determine the principal sources of particulate matter (PM) emitted to urban air, by obtaining the chemical composition of the air pollution particles. Primary sources such as road traffic and industry and secondary sources, resulting from chemical reaction of vehicle exhaust gases, will be identified. Urban pollution also comes from rural sources. Air pollution knows no boundaries, and so it is important to obtain the contribution of trans-boundary air pollution to urban levels. Compliance must to be reached by 2005 with stringent air quality standards for aerosol particulate levels, laid down by the European Union. These standards are measured in terms of mass concentration of particles smaller than 10 micrometers in diameter, the so-called PM10. It is hoped to identify areas vulnerable to exceedances of PM limits and to understand the causes of these exceedances and their potential impact on air quality and health-related issues.

Five sampling sites will be used in the study, with two sampling locations in Dublin City (College Street and the Civic Offices, Dublin Corporation) and one in Cork City (near Angelsea Street). A rural site in east Galway (near Ballinasloe) and a site on the east coast complete the measurement network.

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**PROJECT TITLE**

***Air Quality: Transport Impacts and Monitoring Networks - Designation of Monitoring Networks (2000-LS-6.2-M1)***

**LEAD ORGANISATION**

Cambridge Environmental Research  
Consultants Limited

**START DATE**

01/11/2000

**CONTACT**

Dr David Carruthers

**STATUS**

Completed (Report pending)

**PROJECT TYPE**

Large-scale study

**TOTAL BUDGET (€)**

154,708.70

**PROJECT DESCRIPTION**

This project aims to determine the optimum distributions of air quality monitoring equipment within the cities of Dublin and Cork. The approach to this task is to determine both the current air quality and likely future air quality in both cities and from this information identify both the number and locations of monitoring sites needed to meet the requirements of the EU Directives on air quality.

This project will be undertaken in two stages.

In the first stage detailed information on traffic, domestic, industrial and other emissions will be obtained for both cities together with currently available air quality monitoring data and meteorological data. This stage will be carried out in conjunction with Envirocon Limited and will result in an emissions inventory, monitoring and meteorological data suitable for a detailed air quality modelling exercise to be carried out for both Dublin and Cork.

In the second stage modelling will be undertaken using the ADMS-Urban modelling system. In the first instance, this will be a verification exercise to compare predicted air quality with the available monitoring. Once agreement has been achieved modelling will be carried out for a 'current' base case across both cities and, using suitable modified emissions, for 2010. These citywide results will then be used to derive the optimum monitoring networks and, finally, a detailed report will be produced covering the whole study.

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**PROJECT TITLE**

***Air Quality: Transport Impacts and Monitoring Networks Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions (2000-LS-6.3-M1)***

**LEAD ORGANISATION**

Trinity College Dublin

**START DATE**

01/11/2000

**CONTACT**

Prof. Bruce Misstear

**STATUS**

Completed (**ERTDI Report 44**)

**PROJECT TYPE**

Large-scale study

**TOTAL BUDGET (€)**

279,342.38

**PROJECT DESCRIPTION**

Motor vehicles emit a variety of pollutants into the atmosphere. As a result, air quality in the vicinity of major roadways and in urban areas can be poor. The concentrations of individual pollutants close to the roadside depend on a range of factors describing traffic flow on the road and local meteorological conditions. Hence, air quality varies continuously, and may differ greatly from one day to the next or indeed, from one hour to the next.

One way of assessing this variation, and of detecting an associated air pollution problem, is through air quality monitoring. In this approach measurements of the concentrations of different pollutants are made at carefully selected times and locations in the vicinity of the pollutant source. While such monitoring allows air quality to be evaluated accurately, it is also expensive and, consequently, only limited monitoring is feasible at any one site. Moreover, monitoring cannot predict the changes in air quality associated with proposed developments.

An alternative approach involves the use of computer-based air quality models to determine likely ambient pollutant concentrations. In the case of road transport, available models take into account the flow, composition and speed of the vehicles on a road, as well as meteorological conditions such as wind speed and direction, to calculate concentration levels at a number of locations close to that road. The most commonly applied models attempt to capture the dispersion of pollutant downwind of the roadway. The accuracy of a dispersion model's results clearly depends on the theoretical or empirical bases of the equations on which the model's calculations are based, but also on the validity of the input data. This objective of this project is to investigate the accuracy and reliability of these models when applied to an Irish situation, where distinct vehicle and meteorological characteristics apply.

The approach followed is to continuously monitor air quality, traffic flow and meteorological conditions at two roadside sites, and to compare the results of dispersion models with these measurements. The two sites to be investigated will be a motorway or dual carriageway in East of Ireland, and a roundabout in Galway. A number of atmospheric pollutants will be monitored including carbon monoxide, oxides of nitrogen, small particulate matter and a range of

atmospheric hydrocarbons. The models investigated will be those currently employed in Environmental Impact Studies in Ireland, and consequently the project results should be of immediate interest to environmental and engineering consultants working in this field.

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**PROJECT TITLE**

**Environmental Quality Objectives – Noise  
(2001-MS-14-M1)**

**LEAD ORGANISATION**

South Western Services

**START DATE**

08/02/2001

**CONTACT**

Mr David Waugh

**STATUS**

Completed (**ERTDI Report 17**)

**PROJECT TYPE**

Medium-scale study

**TOTAL BUDGET (€)**

257,852.06

**PROJECT DESCRIPTION**

Sustainable development requires that society reduce and control anthropogenic noise pollution, prepare environmentally appropriate protective use of resources (such as soundscapes), allow development in appropriate locations and encourage environmentally sound planning. Preservation of relatively quiet areas must be supported in order to protect areas for people to enjoy solitude and tranquillity, to preserve the aural footprint and characteristics of an area and finally to protect biodiversity. Protection of the acoustic environment in Ireland means that we will have to introduce accountable noise abatement development programmes and related noise monitoring systems to continuously assess and inform on whether one is making progress or not.

Through the establishment of this research project the Environmental Protection Agency (EPA) has sought to establish baseline data for relatively quiet areas (as defined in the proposed EU Environmental Noise Directive) in order to establish the baseline noise environment in Ireland. This project through the use of Best Available Information (BAI) and state of the art technologies will support improvements in the acoustical environment and deliver reliable, objective and comparable information on the acoustical environment at a European, National and Local level. As part of this project extensive environmental noise monitoring over a twelve-month period is currently ongoing throughout Ireland.

Monitoring sites include a selection of ecological habitats. Reference locations were selected geographically around the country to include as many diverse and regionally separated reference sites as possible. Special consideration is given to natural heritage areas (NHAs), special protection areas (SPAs), Ramsar sites and places of high amenity value with regard to their natural soundscape. It is also aimed to utilise the extensive monitored data to provide the basis for developing methodologies for environmentally sound planning guidelines through anthropogenic noise modelling and impact assessment utilising Geographic Information Systems (GIS) technology.

The project will develop a noise planning methodology model for the EPA and planning authorities. The project will model the impacts of anthropogenic noise sources such as quarries, mines, road developments, energy plants, industry, etc and provide integrated noise planning methodology focused on sustainable development. The capabilities of this system will allow for strategic environmental noise assessment for noise and provide an integrated environmental planning methodology for noise control. The monitored data will be utilised to elaborate on and recommend Environmental Quality Objectives (EQOs) and Environmental

Quality Standards (EQSs) for noise in relatively quiet areas. The integration of a Geographic Information System (GIS) will help to monitor, review and inform the public on the acoustic environment in a manner that is more understandable. It will relate noise measurements of the geographic locations and assist in the public understanding of the environment using the Best Available Technology.

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**PROJECT TITLE**

*Evaluation of Options for Reducing Irish Diesel Particulate Emissions-  
Utilising Measurement and Modelling Methods  
(2001-PHD-3-M1)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

01/12/2001

**CONTACT**

Dr David Timoney

**STATUS**

Completed

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

76,184.28

**PROJECT DESCRIPTION**

Exhaust emissions from newly manufactured vehicles and diesel engines are heavily regulated by EU Directives but very little data is currently available to indicate quantities of diesel particulates emitted from actual vehicles in service. This is especially the case for older, poorly maintained diesel vehicles still in service on Irish roads.

This project aims to refine and use a novel measurement device to collect real world particulate emissions data from a variety of used vehicles, with a view to identifying and targeting heavy polluters. The data gathered will then be used, in combination with localised pollution dispersion modelling techniques, to determine the peak doses of particulate matter that city pedestrians might typically be exposed to. This and other data will be used subsequently in cost-benefit analyses so as to evaluate alternative policy options aimed at reducing emissions and improving Irish urban air quality.

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**PROJECT TITLE**

*Simulation and Modelling of Exhaust Emissions  
(2001-PHD-7-M1)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/10/2001

**CONTACT**

Dr John Simmie

**STATUS**

Completed

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

75,301.82

**PROJECT DESCRIPTION**

The question of energy use underlies virtually all environmental issues. However there is a tension arising from the benefits obtained by our industrial civilization and the environmental costs of human energy consumption. This project, on the simulation and modelling of exhaust emissions from an ideal internal combustion engine (ICE), addresses one aspect of the problem.

The burning of fossil fuels in internal combustion engines constitutes, and will for the foreseeable future, the principal source of energy for both transport and power generation. Practical and affordable fuel cell technology in large production volumes is still many years away and no other option seems to be in the offing. Instead variants of the traditional ICE such as the homogeneous-charge compression-ignition engine are being actively worked on.

At the moment, Ireland does not have any municipal waste incineration facilities but the present landfill policy is unsustainable and incineration will be brought in as one of the options. This project will also contribute to the understanding of problems that arise during the high-temperature combustion of a range of materials.

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**PROJECT TITLE**

*Reaction of Nitrate Radicals with Dimethylphenols under Atmospheric Conditions  
(2001-PHD-10)*

**LEAD ORGANISATION**

University College Cork

**START DATE**

01/12/2001

**CONTACT**

Dr John Wenger

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

76,184.28

**PROJECT DESCRIPTION**

Aromatic hydrocarbons, such as benzene, toluene and the xylenes, are one of the most important classes of primary pollutants and have a huge impact on air quality. They are highly reactive in the atmosphere and contribute greatly to the formation of secondary pollutants such as ozone and nitrates, which are found in photochemical smog. The atmospheric oxidation of xylenes also produces dimethylphenols. However virtually nothing is known about the fate of these species in the atmosphere.

The aim of this project is to investigate the atmospheric degradation pathways for dimethylphenols. The reactions of nitrate radicals with a series of dimethylphenols will be studied in large volume environmental chambers at UCC. A wide range of state-of-the-art instrumentation will be used to measure rate coefficients, reaction products, and the yield of secondary organic aerosol. The end result will be a set of chemical mechanisms suitable for incorporation into models that are used to predict secondary pollutant formation.

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**PROJECT TITLE**

***Determination of Natural Non-methane Hydrocarbon Fluxes in Ireland  
(2001-PHD-11-M)***

**LEAD ORGANISATION**

NUI Galway

**01/05/2002**

**STATUS**

Completed

**CONTACT**

Prof. S. Gerard Jennings

**TOTAL BUDGET (€)**

74,800.00

**PROJECT TYPE**

Doctorate

**START DATE**

**PROJECT DESCRIPTION**

The determination of diurnal and seasonal natural emissions of C<sub>2</sub> - C<sub>8</sub> non-methane hydrocarbons (NMHC) in Ireland are currently unknown and are essential for the compilation of an ozone budget for Ireland. Biogenic emissions from the major natural vegetation types such as grasslands, heathers and peat bogs as well as cultivated lands are not well characterised. The project involves the continuous measurement of natural non-methane C<sub>2</sub> - C<sub>8</sub> hydrocarbons and selected hydrocarbon fluxes in Ireland.

These data will permit air mass origin characterisation and also allows model estimates of ozone production with polluted plumes to be made. In addition further modelling studies will be carried out, which will permit inter-comparison between model predictions of NMHC levels and observations for winter and summer seasons. This study will provide important data for air quality legislation.

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**PROJECT TITLE**

*Validation of Air Pollution Dispersion Modelling for the Road Transport Sector under Irish Conditions (2002-PHD2-1)*

**LEAD ORGANISATION**

Trinity College Dublin

**START DATE**

01/11/2002

**CONTACT**

Dr Brian Broderick

**STATUS**

Completed

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

31,787.30

**PROJECT DESCRIPTION**

Air dispersion modelling is used in Environmental Impact Assessments of road Projects. The accuracy of modelling predictions is dependent not only on data quality, but also on both model and user methodologies. The models in common usage in Ireland were developed and validated abroad. The main aims of the project are to carry out a validation study of models currently in use in Ireland, to critically assess their use in air quality prediction and to establish the minimum monitoring of air quality, traffic and meteorological conditions, required for air quality modelling.

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**PROJECT TITLE**

**Satellite Remote Sensing of Aerosols in the Eastern North Atlantic Region  
(2002-PHD2-41)**

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/11/2002

**CONTACT**

Prof. S. Gerrard Jennings

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

74,100.00

**PROJECT DESCRIPTION**

Satellite remote sensing provides the only wide scale coverage of aerosols. The proposed work will provide important aerosol optical depth data (used as a parameter in climate forcing modelling) retrieved from satellite sensors such as AVHRR and AATSR. The main objective of the work is to retrieve aerosol properties over the North Atlantic region and to validate the satellite retrieved data with ground truth optical depth data at Mace Head. Through this work, expertise in satellite remote sensing will be built. In addition the validated remotely sensed data will be available for use as input to Regional Climate Models as well as being archived in a national aerosol database and at the World Data Centre for Aerosols at the EU Environment Institute at Ispra.

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**PROJECT TITLE**

**Modelling the Role of Clouds in Forming PM2.5 Aerosol  
(2002-PHD2-42)**

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/10/2002

**CONTACT**

Prof. Colin O'Dowd

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

73,909.00

**PROJECT DESCRIPTION**

In terms of predicting PM2.5 aerosol formation, which can adversely affect public health and general environmental conditions, the most non-linear aspect of this pollutant production relates to secondary aerosol production in clouds. Primary PM2.5 particles are produced by mechanical disruption of the Earth's surface and combustion processes and are relatively well quantified in terms of emission inventories. Secondary PM2.5 particles are produced by condensation and aqueous-phase chemical processes (such as the oxidation of SO<sub>2</sub> and NO<sub>x</sub> to aerosol sulphate and nitrate).

The rate at which these processes proceed accelerates rapidly in the presence of cloud. As mentioned above, the massively non-linear nature of these processes (O'Dowd *et al.*, 2000) require detailed modelling studies to accurately determine the rate of production under different conditions. It is proposed to develop a new-generation aerosol-cloud-chemistry model to quantify the contribution of SO<sub>2</sub> and NO<sub>x</sub> produced in cloud to the PM2.5 ambient level. Studies will be performed in marine, rural and urban environments, including evaluation of down wind PM2.5 formation from power plants.

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**PROJECT TITLE**

*Life Cycle Analysis of Emissions Management for Irish Livestock Production Systems  
(2002-PHDe-2/5)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

01/09/2002

**CONTACT**

Dr Nick Holden

**STATUS**

Completed

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

63,950.00

**PROJECT DESCRIPTION**

This project will use Life Cycle Analysis (LCA) to establish whether proposed methods of reducing emissions from livestock production will have a net reduction impact or merely transfer the emission to another part of Ireland's 'emissions basket'. LCA is a defined methodology for examining an entire system and assessing the impact of changes to the system in terms of an environmental marker (in this case, radiative forcing emissions).

This project will define Irish livestock production in terms of a system, create an inventory of inputs and outputs and then assess the impact of changes to the system in terms of emissions from livestock production. Such an approach has not been applied to Irish agriculture before and is in line with international methodology for system impact assessment.

Having integrated this project with existing research, the main objectives will be to:

- 1) Define the system limits of livestock production with respect to Ireland's 'emissions basket';
- 2) Define a system inventory of all input and outputs;
- 3) Define the relevant measures of environmental impact and select the best one;
- 4) Assess current emissions in terms of the LCA framework, and
- 5) Assess specific measures (derived from literature and current Irish research) that address reduction of emissions in terms of net decrease in emissions or transfer the emission to elsewhere in the system.

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**PROJECT TITLE**

*Air Quality and Acidification Linked to Transboundary Pollution - Analytical Chemistry (2003-TXB-FS9-M4)*

**LEAD ORGANISATION**

Dublin City University

**START DATE**

17/11/2003

**CONTACT**

Dr Wasim Bashir

**STATUS**

Completed (Report pending)

**PROJECT TYPE**

Fellowship

**TOTAL BUDGET (€)**

134,001.84

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**PROJECT TITLE**

*Air Emissions Analyses (2004-AE-FS-20)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/12/2004

**CONTACT**

Dr Aodhagan Roddy

**STATUS**

Ongoing

**PROJECT TYPE**

Fellowship

**TOTAL BUDGET (€)**

188,687.49

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**PROJECT TITLE**

*Transboundary Air Pollution Fellowship  
(2004-CCTXB-FS-18)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

10/05/2004

**CONTACT**

Dr Stephan Leinert

**STATUS**

Ongoing

**PROJECT TYPE**

Fellowship

**TOTAL BUDGET (€)**

158,750.29

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**PROJECT TITLE**

*Air Quality Modelling and Forecasting for Ireland  
(2004-CoE-AQM-M4)*

**LEAD ORGANISATION**

University of Cologne

**START DATE**

01/12/2004

**CONTACT**

Dr Hermann Jackobs

**STATUS**

Ongoing

**PROJECT TYPE**

Medium-scale study

**TOTAL BUDGET (€)**

275,000.00

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**PROJECT TITLE**

*Linking Urban Field Measurements of Particulate Matter to Their Chemical Analysis and Effects on Health (2004-PHD4-1)*

**LEAD ORGANISATION**

University College Cork

**START DATE**

01/10/2004

**CONTACT**

Prof. John Sodeau

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

75,000.00

**PROJECT DESCRIPTION**

The main scientific aim of the programme is to characterise the processes that produce 'fine' (PM<sub>2.5</sub>) particles in urban air and determine the chemical composition and toxicological importance of the different source categories. The project objectives will be directed toward emissions associated with the Cork City Council urban air monitoring station and also its landfill site. The PhD student is embedded with a complementary set of 4 postdoctoral associates funded by the EU Marie Curie (Transfer of Knowledge) programme and will be trained in field techniques, analytical science and the development of appropriate biochemical protocols for the assessment of metabolic effects.

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**PROJECT TITLE**

*Data Assimilation - Enabling an Irish Component of GMES Atmosphere  
(2004-PHD4-9-M1)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/01/200

**CONTACT**

Prof. Colin O'Dowd

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

74,950.00

**PROJECT DESCRIPTION**

This work programme proposes to assimilate satellite-derived parameters responsible for the production of marine aerosol (parameters to include: SeaWifs chlorophyll concentration and seawater organic fraction; scatterometer data - used to quantify whitecap coverage). Mechanisms for efficient data assimilation will be developed and tested using a regional climate model. The assimilated data will improve quantification of the background marine contribution to air quality levels. This is important in the attribution of different sources to PM levels. This Fellowship will serve to initiate and enable an Irish atmospheric component of Europe's GMES 1 (Global Monitoring for Environment and Security) capability with particular attention to aerosol fields.

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**PROJECT TITLE**

*Integrated Analysis of Trends and Changes in Ozone Levels over Ireland and Their Implications  
(2005-AQ-MS-50-M4)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/02/2007

**CONTACT**

Prof. S. Gerrard Jennings

**STATUS**

Ongoing

**PROJECT TYPE**

Medium-scale study

**TOTAL BUDGET (€)**

398,440.47

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**PROJECT TITLE**

*Pilot Study of Trace Gases at Carnsore Point  
(2005-TXB-MS-25-M)*

**LEAD ORGANISATION**

University of Bristol

**START DATE**

20/11/2005

**CONTACT**

Dr Simon O'Doherty

**STATUS**

Ongoing

**PROJECT TYPE**

Medium-scale study

**TOTAL BUDGET (€)**

165,240.00

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**PROJECT TITLE**

*Enviro-economic Analyses and Modelling  
(2005-EE-FS-26-M4)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

01/10/2005

**CONTACT**

Dr Andrew Kelly

**STATUS**

Ongoing

**PROJECT TYPE**

Fellowship

**TOTAL BUDGET (€)**

149,148.00

**PROJECT DESCRIPTION**

This research project responds to a specific call from the EPA. The purpose of the fellowship as outlined in the terms and conditions is to assist in the collation and subsequent contribution of accurate emissions figures for Ireland to be used in the calibration of the RAINS model. Additionally, reasonable forecast emissions are to be provided for model simulation with due attention to technical and economic assumptions. In tandem with this work, the research will progress knowledge in an Irish context with regard to the activities and origins of the relevant categories of acid rain precursors such as nitrogen, sulphur oxide, ozone, particulate matter, and ammonia.

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**PROJECT TITLE**

*Integrated Systems for Analysis of Air Pollution and Acidification Issues  
(2006-FS-AQ-39-M4)*

**LEAD ORGANISATION**

Trinity College Dublin

**START DATE**

01/01/2006

**CONTACT**

Dr Roland O'Donoghue

**STATUS**

Ongoing

**PROJECT TYPE**

Fellowship

**TOTAL BUDGET (€)**

159,575.00

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**PROJECT TITLE**

*Quantifying Seasonality in CO<sub>2</sub> fluxes over the North-East Atlantic  
(2006-PHD-AQ-2)*

**LEAD ORGANISATION**

NUI Galway

**START DATE**

01/01/2007

**CONTACT**

Dr Colin O'Dowd

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

89,954.00

**PROJECT DESCRIPTION**

Globally, the ocean provides a net sink for atmospheric CO<sub>2</sub>, however, on the regional scale, the ocean can be either a net sink or a net source, depending on biological activity and meteorological conditions. It is proposed to conduct continuous measurements of CO<sub>2</sub> fluxes over the coastal NE Atlantic to quantify the relationship between plankton activity, meteorological parameters and CO<sub>2</sub> flux on a seasonal basis - the NE Atlantic having one of the most biological active oceans with one of the strongest seasonal cycles in plankton activity. In addition to determining the seasonality of CO<sub>2</sub> fluxes, the transfer coefficient will be evaluated in terms of functions of wind-speed, white-cap-coverage, and bio-indicators (SST/C-a).

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**PROJECT TITLE**

*The Effect of NO<sub>x</sub> Traps on the Combustion and Size Distribution of Carbonaceous Particulate Matter Emitted from Diesel Engines (2006-PHD-AQ-3)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

15/01/2007

**CONTACT**

Dr James Sullivan

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

88,096.00

**PROJECT DESCRIPTION**

We will study the catalytic combustion of carbonaceous particulates released to atmosphere from mobile power sources such as gasoline and diesel engines. Specifically, we will study what effects a catalyst containing a NO<sub>x</sub> trapping component (coupled with the required changes in the engine cycle required for deNO<sub>x</sub> activity) has on both the combustion of carbonaceous particulates to CO<sub>2</sub> and what effects such a system has on the particle size distribution of the particulates. Experiments mimicking real situations will be carried out within a laboratory scale reactor while optimised catalysts and cycles will be tested using a bench-mounted diesel engine.

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**PROJECT TITLE**

**Total Carbon Balance of a Blanket Peat Catchment  
(2006-PHD-AQ-4)**

**LEAD ORGANISATION**

University College Cork

**START DATE**

01/04/2007

**CONTACT**

Prof. Gerard Kiely

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

90,000.00

**PROJECT DESCRIPTION**

An assessment of the carbon sink source potential of peatlands should include the losses of carbon in streamwater in addition to the biosphere-atmosphere exchange of CO<sub>2</sub> and CH<sub>4</sub>. The aim of the project is to determine the total carbon balance of a blanket peatland. This will be achieved by determining CO<sub>2</sub> exchange using eddy covariance field measurements, CH<sub>4</sub> emissions using static chambers and dissolved organic carbon input in rainfall and loss in streamwater. A model will be developed to assess the effect of changing climate scenarios on the carbon balance of a pristine peatland in the west of Ireland.

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**PROJECT TITLE**

*Communicating Environmental Risk: Waste, Incineration and Dioxins  
(2006-PHD-RCA-17)*

**LEAD ORGANISATION**

Trinity College Dublin

**START DATE**

02/10/2006

**CONTACT**

Dr Anna Davies

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

75,000.00

**PROJECT DESCRIPTION**

Despite the reassurances of regulators, politicians and industry concerns remain in society about the risks to human health and the environment associated with waste incineration and with the toxicity of the by-products that incineration creates. This project will examine and evaluate the ways in which debates about risks related to incineration have been conducted. This will facilitate a better understanding of how incineration risk communication is produced and received and enable the development of a core set of principles for more effective risk communication.

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**PROJECT TITLE**

*Advanced Systems for Biological Assessment of Toxicity of Industrial Chemicals  
(2006-PHD-RCA-18)*

**LEAD ORGANISATION**

University College Cork

**START DATE**

01/10/2006

**CONTACT**

Prof. Dmitri B. Papkovsky

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

90,000.00

**PROJECT DESCRIPTION**

The project is to develop and validate new analytical systems for the assessment of industrial chemicals defined under the REACH directive, for their biological risk and hazard to the environment. The approach is based on the analysis of toxicological impact of chemicals on a panel of test organisms ranging from eukaryotes, prokaryotes, small invertebrates and vertebrates, by monitoring changes in organism oxygen consumption by optical oxygen sensing. It is expected to provide simple, rapid, sensitive, cost-effective respirometric screening systems with high sample throughput, and relevant and information rich data output.

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**PROJECT TITLE**

*Post-genomic Approaches to Assess the Nanotoxicity Risk of Nanoparticles  
(2006-PHD-RCA-19)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

01/11/2006

**CONTACT**

Prof. Kenneth Dawson

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

90,000.00

**PROJECT DESCRIPTION**

As nanotechnology develops and more nanotechnology enabled products appear on the market, environmental exposure to nanoparticles will increase. Due to their small size, nanoparticles will certainly enter humans, and indeed may even enter individual cells, although their effects on cellular functioning are as yet unknown. This project will begin to address this question and generate data relating to the effect of nanoparticles on intra- and inter-cellular signalling pathways. The project will combine excellence in nanoparticle synthesis and characterization with state-of-the-art proteomics and transcriptomics to determine the effects of nanoparticles on the most complete range of biological processes yet explored.

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**PROJECT TITLE**

*Development of a Risk Assessment Methodology for Evaluating Ecological Dispersion and Human Risks from Nanoparticles through Environmental Pathways  
(2006-PHD-RCA-20)*

**LEAD ORGANISATION**

University College Dublin

**START DATE**

01/09/2006

**CONTACT**

Dr Enda Cummins

**STATUS**

Ongoing

**PROJECT TYPE**

Doctorate

**TOTAL BUDGET (€)**

75,000.00

**PROJECT DESCRIPTION**

This project will address the public expectation and scientific need for an assessment of the risks associated with the growing uses of nanoparticles. The project will create a risk assessment framework model for evaluating ecological dispersion and resulting human risks for selected nanoparticles of environmental concern (e.g. cerium oxide and Iron nanoparticles). The project will model exposure pathways by which humans may be exposed to selected nanoparticles while accounting for the impact of various production and environmental factors and their influence on the dispersion/agglomeration of nanoparticles. Methods will focus on qualitative or semi-qualitative techniques given the lack of scientific data. The methodology will allow ranking of the exposure routes and of human risks and will be sufficiently universal to be able to apply to other nanoparticles outside of the ones selected for study in this project. The methodology developed will be of particular use to policymakers for regulating future uses of nanotechnology.

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## **Small-scale studies:**

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**PROJECT TITLE**

*Bio-aerosol Emissions from Composting Facilities - Literature Review  
(2002-SS-9-M1)*

**LEAD ORGANISATION**

The Composting Association of Ireland  
- Cré

**START DATE**

01/01/2003

**CONTACT**

Dr Munro Prasad

**STATUS**

Completed

**PROJECT TYPE**

Small-scale study

**TOTAL BUDGET (€)**

6,348.00

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**PROJECT TITLE**

*Study Addressing Priority Areas Necessary for the Implementation of the  
Solvents Emissions Directive in Ireland  
(2003-SS-12-M2)*

**LEAD ORGANISATION**

Clean Technology Centre

**START DATE**

24/03/2003

**CONTACT**

Ms Eileen O'Leary

**STATUS**

Completed

**PROJECT TYPE**

Small-scale study

**TOTAL BUDGET (€)**

11,071.50

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**PROJECT TITLE**

*Investigation into the Emissions Reductions Achieved by IPC Licensing (2003-SS-20)*

**LEAD ORGANISATION**

Circa Group Europe

**START DATE**

11/08/2003

**CONTACT**

Dr David Kelly

**STATUS**

Completed

**PROJECT TYPE**

Small-scale study

**TOTAL BUDGET (€)**

7,681.08

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**PROJECT TITLE**

*Identification of Industrial Activities Likely to be Involved in Greenhouse Gas Emissions Trading and Estimation of their Current Output of Carbon Dioxide (2003-SS-21)*

**LEAD ORGANISATION**

Mica Management Consulting Limited

**START DATE**

11/08/2003

**CONTACT**

Mr Kevin Weymes

**STATUS**

Completed

**PROJECT TYPE**

Small-scale study

**TOTAL BUDGET (€)**

7,681.08

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**End of listing of EPA [2000-2006] Air Quality Projects**