



**Institute of Nuclear Chemistry and Technology (INCT)**  
**Dorodna 16, 03-195 Warsaw, Poland**

**MARIE CURIE HOST FELLOWSHIPS FOR THE TRANSFER OF KNOWLEDGE**  
**Advanced Methods for Environment Research and Control (AMERAC)**  
Contract No MTKD-CT-2004-509226

The project addresses multi-disciplinary aspects of environment research, control and protection. Scientific and technological approach of the project concerns important domains of air and water research and control, as well as environmental monitoring by use of nuclear methods like isotopic ratio measurements by mass spectrometry, neutron activation analysis and developed and constructed in INCT monitoring systems.

The scientific part of the project consists of tasks:

- *New methods for environmental monitoring based on nuclear analytical methods*

On the basis of stable isotope ratio (D/H,  $^{15}\text{N}/^{14}\text{N}$ ,  $^{18}\text{O}/^{16}\text{O}$ ,  $^{13}\text{C}/^{12}\text{C}$ ,  $^{34}\text{S}/^{32}\text{S}$ ) measurements in environmental studies by use of sophisticated techniques like isotope ratio mass spectrometry with combination of elemental analysing and some advanced chemical analyses, like HPLC and GC systems are carried on. These accurate methods provide with a broad knowledge about the environment and environmental pollution of air, water and soil. The integrated methods allow studying the environmental impact in industrial exploited regions on air, soil and water by periodical measurements. Stable isotopes analysis are coupled with radon, tritium, and C-14 measurement in water and air.

- *Development of methods and instruments for environmental measurements*

The work package includes some basic research concerning elaboration of the new methods for environmental monitoring, followed by designing the complete systems equipped with instruments produced in INCT, like ambient dust monitors, radon meters, field and industrial radiometers, etc. The work includes the elaboration of calibration methods, as well as new methods of wireless communication between the monitoring systems and the central station.

- *Membrane processes for environment control and for nuclear applications*

With application of novel membrane processes, as well as different integrated methods like membranes combined with sorption, chelation or complexation the new technologies for wastewater pollution control are developed. The work leads to elaboration of modern purification technologies that can be implemented in different branches of industry to treat wide range of polluted streams. Special emphasis is done to the nuclear applications of these methods.

- *Advanced methods in water pollution control, including tracer studies combined with numerical methods and computational fluid dynamics (CFD)*

The other part of the work concerning water pollution control is related to the use of tracer methods for examination of various apparatuses, which form wastewater treatment plants. The data coming from the tracer experiments allow determination of the residence time distribution (RTD), flow rate and other technological parameters for each apparatus. By use of the MATLAB, and the other software available the sophisticated models of flow structure are proposed. Mixed methodologies, based on radiotracer measurements combined with computational fluid dynamics (CFD) methods, are used.

- *Development of the modern methods of air pollution reduction*

The studies concern purification of combustion gas by electron beam (EB) generated in accelerator. The method was developed in the INCT for  $\text{SO}_2$ , and  $\text{NO}_x$  removal from flue gas from power stations. Experiments showed, that the method can be also applied for removal of volatile organic compounds, among them polycyclic aromatic hydrocarbons and chlorinated VOC. The other part of the work will concern fly ash control, especially small granulation fraction which is not effectively removed by ESP ( $\text{PM}_{2.5}$ ,  $\text{PM}_{10}$ ).

Exchange of information between leading centres in Europe in scope of the Marie Curie project, transfer of knowledge via personal contacts, workshops and seminars, as well as common research provide host institution with new investigation possibilities, create new areas of competence and broaden the field of research which result in new industrial and environmental applications. Advanced knowledge transfer and integration of activities strengthen scientific potential of the INCT, supplement its research abilities and integrate the Institute with European research and academic centres.