EXECUTIVE SUMMARY

Contract n°	EVK1-CT-1999-20001	Reporting period:	1/8/03-31/1/04
Title	**Sensors for monitoring water pollution from contaminated land, landfills and sediment**		

Objectives:

The overall objective is to enhance the development of chemical sensors, biosensors and biomimetic systems for practical applications in the abatement of water pollution from contaminated land, landfills and sediment.

Scientific achievements:

Diffuse pollution inputs from contaminated sediment and other sources needs to be managed to maintain good quality in surface- and groundwater. Contaminated sediments provide a significant source of diffuse pollution of surface waters. SENSPOL supported a Technical Meeting on 'Problems Related to Diffuse Pollution Sources: Characterization of Sediment, Dredged Material'. This meeting that applied modern sensing technologies was organised by German Federal Institute of Hydrology (BfG) and SENSPOL in Koblenz, Germany, in October 2003. Fifteen different instruments were used to measure environmentally sensitive parameters in sediments and waters. 22 organisations from 11 countries brought their newest sensing technologies to the BfG facilities at Niederwerth. Water and sediments from various sites important to the water and shipping authorities in Germany were analysed simultaneously for contaminants and their effects. The sensor data was compared with results of conventional analyses. The tested methods for calcium and chloride were viewed as qualified for the field analysis of surface water and groundwater samples. Generally the methods for determination of heavy metals were sensitive enough to measure concentrations above existing action thresholds. Promising results were obtained with test systems to measure general toxicity and genotoxicity. The speed of data production was fast enough for daily decision making.

SENSPOL and the Network for Industrially Contaminated Land in Europe (NICOLE) worked in partnership on a collaborative project 'Bridging gaps between sensor developers and (end) users in a pragmatic approach'. The consortium members are producing a report on the current status of development for environmentally relevant biosensor and sensor devices. The SENSPOL Sensor Capability Study 2002 (Sesay *et al*, 2003) and recent Technical Meetings (Seville 2002; Koblenz 2003) have identified rapid analyte assessment technologies that are applicable in the field. A field demonstration supported by SENSPOL and industry was held in January 2004 at a site in The Netherlands contaminated with mercury. This included a full field day with five instruments analysing soil samples and samples from settling basins (extracts) and groundwater samples. The useful results were reported in at February 2004 at a project-reporting meeting organised by NICOLE.
Seven short visits were sponsored, involving ten institutions in six countries were sponsored for researchers from European laboratories active in the field to learn sensor techniques, use equipment and consult with other groups.

General information about SENSPOL and the development of sensors for monitoring water pollutants was made available at http://www.cranfield.ac.uk/biotech/senspol.htm. SENSPOL issued three electronic newsletters which contained detailed information useful

to European researchers from various disciplines relevant to sensors and the environment, as well as to manufacturers and end users. Proceedings of the workshops on 'Response to New Pollution Challenges' and a SENSPOL Summary Statement were published. Articles for scientific journals and other communications were published and others were prepared for publication.

Talks were given at scientific and user group meetings to inform the audiences and others of the applicability, state of development and achievements of sensor technologies in the abatement of water pollution. A proposal for a Co-ordination Action on 'Monitoring Pollution' was submitted for EC funding, on behalf of the SENSPOL community.

Socio-economic relevance and policy implications:

Diffuse pollution inputs from contaminated sediment and other sources needs to be managed to maintain good quality in surface- and groundwater. The EU Water Directive aims to achieve a good chemical and ecological status of waters in river basins in the near future. This requires Member States to have a monitoring programme in place by 2004.
Sensing technologies will be especially important in the near future as the expected European Chemical Act will require 30,000 chemicals to be monitored under the REACH Programme. This is needed to protect human health and the quality of the environment. Reliable sensors with a high throughput and covering a wide range of single substances and their effects are urgently needed to help implement and enforce this Act. The attainment of practical monitoring systems will enable stakeholders to provide protection of the public from hazards of contaminated water and land resources.
The SENSPOL network's activity strengthens the economic and social cohesion of the Community through its contribution to Europe's high level of scientific and technical innovation. The new and strengthened scientific and technical links and collaborative activities across Europe and acceleration of technological progress are contributing to the development of the European Research Area.

Conclusions:

The activities undertaken by SENSPOL have accelerated the development of sensor systems for practical applications in the abatement of water pollution from contaminated land, landfills and sediment. The usefulness of new environmental monitoring devices that can be used on site has been demonstrated. Promising results were obtained with measurements of heavy metals, calcium, chloride, general toxicity and genotoxicity. Sensor technologies are sufficiently mature to be used in routine analysis where legislative compliance through a rigid validation and verification process is not required. Many of the instruments are ready for commercial demonstration.

Hindrances to moving from prototype environmental sensing devices to sensor system products remain. Although better analytical technologies, including toxicity sensors, are important to society and public health, the market size is a factor that often seems to deter serious investment. Validation and implementation of the prototype sensing devices requires future mechanisms and funding.

Keywords: Sensors, monitoring, water pollution, soils, sediments, technology implementation