

### **Partners:**

Institute of Physical Chemistry  
University of Tübingen  
Dr. Udo Weimar  
Auf der Morgenstelle 8  
72076 Tübingen, Germany  
udo.weimar@ipc.uni-tuebingen.de

Alfred Wall AG  
Ehrenfried Ehmann  
Grillweg 15  
8053 Graz, Austria  
e.ehmann@wallgroup.com

Gerstel GmbH & Co. KG  
Dipl.-Chem. Eike Kleine-Benne  
Aktienstraße 232-234  
45473 Mülheim an der Ruhr, Germany  
eike\_kleine-benne@gerstel.de

### **EC Scientific Officer**

Dr. Dyanne Bennink  
European Commission  
DG Research - Unit B1.1, SDME 8/18  
Rue de la Loi 200  
1049 Brussels, Belgium  
phone: +32-2-295 9183  
fax: +32-2-296 4322  
e-mail: dyanne.bennink@cec.eu.int

### **Visit our website**

<http://www.escape-project.org>

Institut National de la  
Recherche Agronomique, INRA  
Patrick Mielin  
17, rue Sully  
21065 Dijon, France  
patrick.mielin@dijon.inra.fr

Nestec S.A. / Nestlé Research Center  
André Mandanis  
P.O. Box 44  
1000 Lausanne 26, Switzerland  
andre.mandanis@rdls.nestle.com

AppliedSensor GmbH  
Dr. Heiko Ulmer  
Gerhard Kindler Str. 8  
72770 Reutlingen, Germany  
heiko.ulmer@appliedsensor.com

### **For further information**

Dr. Udo Weimar  
(Co-ordinator)  
Institute of Physical Chemistry  
University of Tübingen  
Auf der Morgenstelle 8  
72076 Tübingen, Germany  
phone: +49-7071 / 29-77 634  
fax: +49-7071 / 29-59 60  
e-mail: udo.weimar@ipc.uni-tuebingen.de

### **Mail to**

[escape@ipc.uni-tuebingen.de](mailto:escape@ipc.uni-tuebingen.de)

# ESCAPE

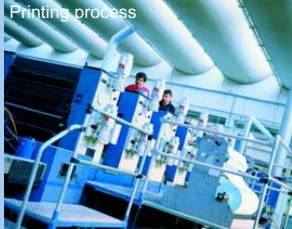
*Electronic Sensor  
System for the  
Characterisation of  
Packaging Emissions*

*A RTD project funded by the  
European Commission under the  
thematic programme  
Quality of Life and Management  
of Living Resources  
KA 1: Food, Nutrition and Health  
(QLK1-CT-2001-02194)*



Version Feb-04





Printing process



Packaging analysis: state-of-the-art  
Human sensory panel

"Sniff" test

10 min  
Packaging

25g Chocolate  
1 hour 40°C

Robinson test

10 min  
Packaging

48 hours 20°C

> 1h  
result

STOP

Instrumental analysis

1 hour 85°C

HSS MS GC

> 1h  
result

STOP

**Modern packaging materials** ensure a long shelf life stability of foodstuffs and protect them from environmental influences. As potential risks microorganisms, light, humidity, oxygen and pollutants can have negative effects on foodstuffs.

Various components are used in modern wrapping materials to fulfil these demands. But the packaging material itself can have negative effects on foodstuff. It can release solvents and various off-odour components. There are certain sources of these undesirable substances, such as solvents from inks, overlacquers, adhesives and varnishes. Food Safety Regulatory Conformity have to be fulfilled in order to protect the consumer. Not only for regulatory reasons, but to satisfy the consumer as well, there is a need to monitor off-odours and residual solvents during the production of packaging materials at an early stage.

**The project** entitled "Electronic Sensor System for the Characterisation of Packaging Emissions" is funded under the Fifth Framework Programme of the European Commission, Thematic programme *Quality of Life and Management of Living Resources*, key action *Food, Nutrition and Health*. Six partners from four countries cooperate in this project (QLK1-2001-02194), which is running from September 2001 to February 2005.

**The project** consists of an industry-dominated consortium of 6 partners with complementary expertise in different fields:

- chemical sensors and sensor systems
- data evaluation software
- system tests
- sampling units
- application and customer specific design and implementation
- quality assurance in the packaging field
- conversion and production of packaging materials
- food processing
- aroma analysis
- marketing and customer contacts

**The objectives** of the ESCAPE project are:

- to develop application driven sensor systems and sampling instruments
- to integrate them in a new instrumentation allowing to make measurements on the factory floor
- to monitor the quality of packaging materials by measuring the amount of out-gassing analytes.

**The EQCS (ESCAPE Quality Control System)** will give the European packaging industry a rapid monitoring tool. The ultimate goal is to establish an at-line test which will replace spot checks. Thus, the processes in the food chain can be controlled at an early stage to save time, manpower and resources.

The EQCS system developed so far can also be equipped with a packed column (or even no column) for realising different options (performance and price wise). The system is actually under test and a first sketch is shown here.

Using the packed column as a separation unit leads to a very encouraging correlation between reference measurements using a FID (Flame Ionisation Detector) and the output of the chemical sensor system (consists of 4 micro-machined metal oxide semiconductor sensors).

Based on these results, a low cost instrument consisting of very few sensors for a quick go/no go analysis on a factory floor for an unskilled operator will be built. A simple system with different options (with or without separation) will do the job as go/no go device by accepting all the samples in the green region, rejecting those in the red one and giving a borderline alert for the yellow region.

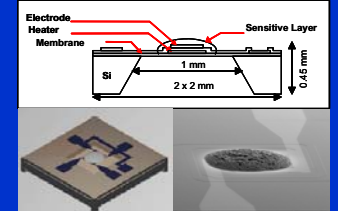
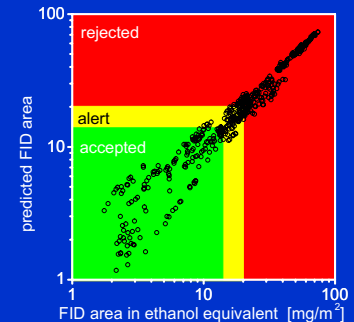
The EQCS approach won't replace neither the human test panel (spot test on a daily/weekly basis) nor the analytical tests using heavy instrumental analysis (in case of complains or doubts). It is much more understood as a support for the manufacturers and users of packaging material for the production control and incoming goods inspection and placed on the factory floor. It doesn't have to be as precise as the instrumental analysis systems but should give a warning (and initiate subsequent actions, like a detailed analysis).

Already **achieved specifications** of the ESCAPE project are:

- Limit of Detection (LOD): 2mg/m<sup>2</sup> ethanol in the packaging material (value might vary depending on material, specifications by users)
- Borderline acceptance value (BAV): 20mg/m<sup>2</sup> total amount of volatiles as an in house standard of users for a selected type of material. Values might vary from type to type.
- Repeatability: < 10% for the complete system
- Recalibration: > 1 week
- Minimum Lifetime of sensor elements ( Maintenance interval): > 1 year
- Minimum sample throughput: > 30 samples per day



EQCS-FFS (Factory Floor System)



μ-MOS sensors (AppliedSensor)