



## Integrated Assessment of Health Risks of Environmental Stressors in Europe

### Introduction

From chemicals in our food to chemicals in our home, a truly integrated assessment will need to understand the health impacts of a wide range of policies.

The first pass assessments done under sub-project three focused on seven areas where integrated assessments would be particularly relevant. Two of these were agricultural land use and chemicals in household products and materials.

Agricultural practices have changed rapidly in the past hundred years, impacted by local, national and European policies. Many of these changes have affected human health, and there is extensive evidence for some of those effects being negative.

Despite this, most agricultural policy decisions are taken without consideration of the impact they may have on public health.

The work package 3.3 team hope

that by performing an integrated assessment and making the data and results available through the toolbox, the impact on health of any policy changes will be taken into account by decision makers in the future.

Researchers in work package 3.5 have a similar desire. Health impact assessments on policies regulating the use of chemicals in household products are rarely done and the research funded by INTARESE is ground-breaking.

### Farming in the European Union

**The health impact of agricultural policies is high on the agenda for a lot of people. From the effects of pesticides to genetically modified crops, the public are aware, but not always fully-informed, of the potential for negative impact on their health.**



Members of work package 3.3

Policy makers must be armed with as much research and evidence as possible when making their decisions.

Policies surrounding agriculture are comprehensive and many. Within the EU, the largest is most certainly the Common Agricultural Policy (CAP). This regulates the agricultural industry through subsidies, support payments, import tariffs and quotas, price support and development grants. In addition a number of environmental policies have been developed more recently, including regulations to remove toxic active substances from the market replacing the older Plant Protection Products (Pesticides) directive.

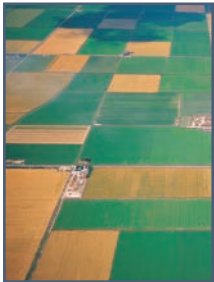
The work package 3.3 team chose to assess the effects of land use change on agriculture

in two countries – England and Greece. For the first phase of the case studies they took different approaches to each country's assessment, depending on the data available.

"We took an epidemiological approach to the UK assessment, and a toxicological approach to the Greek one" explains Professor Anastasios Karabelas of the Centre for Research and Technology Hellas in Greece. "This allowed us to develop a wider range of data sets and methods than we could have done with just a single approach."

#### Farming in England

For England, a comparative assessment was done between the base year of 2000 and a future scenario in 2035 characterised by agricultural intensification, based on



Changes in land use can have significant impact on health

the European Environment Agency 2007 PRELUDE study.

The study modelled the levels of pesticide usage in small areas and used that as an indicator of exposure for both scenarios. Approximate exposure-response relationships were derived from existing systematic reviews and used to calculate the health effects of the pesticide exposure, including cancers and stillbirths.

A slight reduction in the expected number of incident cases of cancer was seen in the 2035 land use change scenario in most areas of England. The study demonstrates the need for integrated assessments of agricultural policies as well as how sensitive the results can be to the initial scenario selection - choosing the right scenario to assess is key to building an accurate assessment.

## Farming in Greece

The Greek stakeholders were very engaged in the assessment process, with experts in regional offices on agricultural development as well as pesticide experts and retailers consulted on the assessment. There are no legal requirements in Greece and many other EU countries for reporting the use of pesticides so stakeholder engagement was crucial to getting the data the team needed.

Whilst the England study compared the base year of 2000 with just one 2035 scenario, the Greek study went one step further, taking two 2035 scenarios from the PRELUDE study. The first had no change in land use and the proportions of the main crops (a 'business as usual' scenario) whilst the second had a different proportion of land use due to CAP restrictions and other restrictions such as water availability.

The Greek study looked at pesticide exposure through inhaling contaminated air. The team took a number of active ingredients considered carcinogenic and used toxicological data to estimate the

health risk associated with the exposure levels for each scenario.

Their assessment showed that in both future scenarios the risk of exposure to carcinogens was generally reduced due to EU policies restricting the use of toxic active ingredients. However the 2035 scenario with land use change due to CAP restrictions showed an even larger reduction in carcinogen exposure compared to the business as usual 2035 scenario due to a reduction in farming pesticide-intensive crops such as cotton.

## Results

The team were aware of the need to analyse uncertainties in their results, and as with all assessments in INTARESE, looked at both the quantitative and qualitative uncertainties.

"There were uncertainties in the datasets" says Professor Karabelas "which we could account for, but there are also less defined uncertainties. The epidemiological results we used, for example, were often based on groups of people who have a higher exposure due to their occupation, such as farmers. We had to generalise this to the entire population."

Both assessments show clearly the impact that agricultural policies can have on health, and the importance of performing full integrated assessments to really understand those impacts.

"We've demonstrated the benefits of an integrated assessment through our different approaches." says Professor Karabelas. "Developing the techniques in the second phase case study will allow us to contribute substantially to the field of integrated health impact assessments and the toolbox."

## Chemical assessment

**Whilst the media is regularly filled with stories of toxic chemicals in everyday items around us, the research into them tends to be narrow in focus. An integrated assessment takes the wider view and by transferring this to the toolbox, policy makers can benefit from this alternative approach.**



The assessment looked at Formaldehyde, a common ingredient

The use of potentially toxic chemicals in household products has long been a cause for concern. In 2005 the European Union limited the use of a number of phthalates, chemicals commonly used to enhance plastics, in the use of toys because they have been linked to reproductive health effects in high doses.

Whilst policies like this are based on solid, thorough research, they do not necessarily show the whole picture. Current risk assessments usually focus on one chemical, from one source, through one exposure route.

Limiting the use of a chemical may be a step in the right direction, but it may not take into account all the ways that someone can be exposed to that chemical, for example if they use multiple products containing it.

“The work we’ve done on integrated assessments for the use of chemicals in household products has hardly ever been done before.” explains Gerlienke Schuur of the Netherland’s National Institute for Public Health and the Environment “Although chemicals are regularly banned because they’re bad for our health, it’s only usually one source and through one exposure route.”

“For a health impact assessment, estimates of the exposure should be as realistic as possible, because we aim to predict the health impact rather than just be protective by assuming a worst-case scenario” she adds.

The issue-framing stage of the integrated assessment methodology was considered

carefully. Along with the choice of which chemicals to assess, the geographical area, time period and target populations were all defined.

Finally, the most critical decision was made - what chemicals to select for assessment. This choice was made in collaboration with the stakeholders - consumer organisations and government bodies such as the French Directorate General for Health - and certain criteria:

- The substance must be present in more than one product, so that exposure over multiple products could be assessed – an aggregated exposure
- At least some exposure data should be readily available
- Toxicity data should be readily available
- The substance should be a national or EU priority

After careful consideration and consultation with the stakeholders, the team settled on looking at three substances – formaldehyde, dibutyl phthalate and toluene.

All of these substances are found in more than one consumer product. Formaldehyde is a common ingredient, acting as a conservative in cosmetics, nail hardeners, shower gel and paint whilst dibutyl phthalate is also found in cosmetics as well as toys. Toluene is a solvent most commonly found in paints and paint thinner as well as polishes.

All three of these substances are known to cause health effects at certain concentrations, ranging from eye irritation to cancer and reproductive effects.



Dibutyl phthalate is found in many cosmetics

## Baseline comparison

The team took a comparative assessment approach to the problem, comparing the health outcomes between a scenario without the current regulations to one with the changes in policy either limiting the use of the chosen substances or banning them altogether.

The team used the modelling software ConsExpo for estimates of the consumer exposure and Analytica to perform the aggregation of exposures. Formaldehyde, for example, is found in shower gels and detergents and the team looked at exposure from both uses.

Traditionally research has looked at the exposure effects of the chemical on its own, but never looked at how consumers might be exposed to that chemical – that their exposure may be increased by taking a shower and cleaning in the same day. Whilst manufacturers may test their product for safe levels on an individual scale, looking at the exposure as a whole through all the products consumers use is not common practice.

As with all integrated assessments, the team encountered problems along the way. There were many sources of uncertainty, ranging from the quantitative, such as background levels, to the qualitative, such as whether the policy could be fully implemented.

Missing data, such as information on the percentage of the substance in a product, or the number of people using the product, was another difficulty, though modelling exposure using software was often possible when no data was available. Linking the exposure levels to health effect through toxicological data derived from animal rather than human studies was also a challenge.

The team found, unsurprisingly, that

aggregated exposure to all three chemicals at the current regulation levels had noticeable health effects. In some cases exposure to Toluene exceeded the 'no-effect' level by up to 30 times, showing just how much of an effect aggregated exposure can have.

By contrast, when a possible policy was compared to the current situation it showed a large reduction in exposure – up to 70% reduction in the case of toluene. The negative impacts on health were reduced accordingly too.

"We've tried to perform an integrated assessment that's as realistic as it could possibly be" says Gerlienke Schuur. "There are obviously uncertainties to account for and some areas that will be improved in the second phase case study, but the work done here is new and the toolbox will benefit from this data and resource."