Uncertainty matrix showing both Greece and England case study

Sources of uncertainty	Dimensions of uncertainty				
	Direction of uncertainty	**Level of uncertainty**	**Appraisal of knowledge base**	**Justification - Greece**	**Justification – Great Britain**
Scenarios considered & Assumptions made					
One pathway considered: exposure via inhalation	Not applicable	Not applicable	Not applicable	For simplicity we selected only this pathway	Same
Current and future agricultural practices are kept the same	U	L	L	We didn't take into account changes to the future agriculture practices	Same
Enhancement of ATEAM land use maps with the ESYE crops	U	L	L	Based on LAU2 estimates from ESYE we aggregated data to the 16x16km grid (ATEAM native) where we made the correction at cell by cell level	
Future land use scenarios based on ATEAM 16x16km & disaggregation to the 4x4km grid	U	L	L	Uncertainty from the ATEAM and from the disaggregation of data from 16x16km grid to 4x4km (smoothing)	
Spatial variability in crop cultivation (main crop and energy crops) at 4x4km	U	L	L	Uncertainty introduced via the disaggregation of data from 16x16km grid to 4x4km	
CAP policy: changes in crop projections	O	L	L	Based on the historic trends and taking into account past CAP policies and any changes in weather conditions we decided upon the crop projections	
Scenario land use database based on REGIS 5x5km	U	L	L		Uncertainty in matching REGIS crop groups with those in JAR and PU. Attribute values (i.e. percent crop area) from REGIS also available only as categorical data with 10 categories.
Source & Exposure					
Data suppression in agricultural census data	U	L	L		Iterative area-weighting process from the next highest known level aggregation
Prefecture pesticide sales data	U	L	L	Data collected from local survey after expert elicitation	
County pesticide usage data	U	M	M		Survey is representative of regional usage, though provided at county level. Parameter uncertainty in that cannot distinguish between missing and no data (i.e. unreported ASs were assumed to mean no data)
Active substance (AS) typology (list) is kept the same in all prefectures for the regions of study	U	L	L	The survey was localized to the Thessaloniki and Larisa prefecture: it is likely that some pesticides may be area dependent (e.g. insecticides)	
AS usage rates for the baseline year	O	M	M	model uncertainties regarding the computed pesticide applications (mainly the rates) as compared to the actual ones.	
Future Pesticide AS list – same AS and application rates as baseline year	H	H	L	Scenario /Model Uncertainty: we are not in a position to know what the future AS would be	Same

Pesticide disaggreagation: areal – weighting method	U	M	H	The assumption made that depending on the area of crop all AS (list) will be used. Equal probability of AS per crop for baseline and future	
Pesticide disaggreagation: stochastic method	U	M	M	This method, tries to identifies usage patterns based on the objective function supplied by the user	
Crop, livestock and pesticide disaggregation – mask area weighting (proportioning sources to 250m grid)	U	L	L		Assume agricultural land cover classes in Corine accurately depict size and location of agricultural parcels used as the mask in weighting JAR (ward) or PU (county) to REGIS (5km)
Lack of toxicity characterization for some pesticides	U	H	L	For some AS toxicity characterization was unknown based on U.S. EPA Carcinogens list	Same
Box-volume model	U	L	L	the wind speed and mixing height are calculated using the CALMET model, introduced parameter uncertainty.	
Focal sum model	U	L	L	introduces parameter uncertainty due to assumption made that all weather conditions are similar	Same
Time invariant (yearly average) estimates of concentration and uniform distribution of concentration across grid cell	U	M ?	L	Simplifications made to the estimation of concentration. Pesticides are used during specific months and not the entire year.	Same
PM emission factors	U	L	L	EFs for whole of Greece rather than representative of local conditions	Specific country-based emission factors were used where possible. If no emission factors were available, emission factors that highly match country-specific conditions were applied.
Endotoxin Emission factors	U	M	L	Not country specific Different types of feeding and ventilation systems in animal housing Mean animal body weight	Same
Pesticide Emission factors	U	M	L	Use of the Dutch emission factors, generalization made (different climatic conditions, agricultural practices etc)	Same
Gap filling in pesticide emission factor database				EFs for AS not available were derived by interpolating on basis of vapour pressures of other similar AS	Same
Exposure – health effects					
Modelled exposure	U	M	L	computed human intake, for all AS, involves significant uncertainty: AS physical properties (e.g. volatility, half life) differ significantly, and it is uncertain to what extent these assumptions represents reality.	Same; in addition: annual exposures computed to correspond to annual EFs for pesticides, PM and endotoxin; concentrations used as proxy for exposure
Duration of exposure	U	M?	L	The duration of exposure is unique for each person any generalizations made introduce high uncertainty.	Same
Generalizations made to the human intake by inhalation	U	M?	L	Deficiencies caused by neglecting significant exposure pathways as well as the effect of population behavioural patterns	Same
application of toxicological data	U	L	M	uncertainties due to the extrapolation of dose response functions from animals to humans and from large to small doses, experimental conditions in toxicological studies that do not resemble actual conditions of human exposure to pollutants, etc	Same

Potential exposure misclassification – grid resolution	U/O	L	L		Modelling on a fine (250m) grid with postcode point locations used to assign exposures. Some postcode areas in rural areas are likely greater than 250x250m.
Exposure misclassification - definition	O	H	H		Definition of exposed and non-exposed groups for pesticide attributable burden calculations (absence of valid ERFs)
ERFs for PM	U	L	L	Average measures of PM concentrations Extrapolation from different population and from different source (i.e. mainly traffic related)	Same
Endotoxin ERFs	U	L	L	Small size population Different climatic conditions and animal husbandry practices Exposure to early life Occupational exposure	Same
Intake rates	U	H	L	No adequate data to establish individual exposure profile; intake fraction is assumed to be constant between people	Same
Population data disaggregated from LAU-2 level to 4x4km grid	O	L	L	Population data are redistributed to a 4x4km grid using mask areal weighting method which generates parameter uncertainty	
Future population projections for the scenarios	O	L	L	Based on ESYE estimates we took the median scenario, country average stratified by age and gender	Linear model to apply county trend-based projections, with assumptions about births, deaths and migration from ONS
Uniform distribution of population in a grid cell	O	L	L	Simplification made for the needs of the 4x4km grid	
Estimation of farmers at the 4x4km grid	U	L	L	Simplification made, estimated via area weighting from prefecture data at 4x4km grid	
Risk estimates based on intake rates: pesticides	U	M	L	Based on calculation from intake rates and dose response: there is an identified variability	Same; limited slope factors were available
Attributable health impact from PM and pesticides	O	L	L	Variability in calculations of concentration and estimates of relative risk	exposure misclassification due to lack of valid ERFs
Background rates of disease	U/O	L	L		Use of national rates instead of regional for some health outcomes