

Development of a new exposure assessment tool within the FP7 BROWSE project



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INTRODUCTION

Exposure assessment is a crucial element in the risk assessment of Plant Protection Products (PPPs). BROWSE (Bystanders, Residents, Operators and WorkerS Exposure models for PPPs) is a European 7th Framework Program 3-year project (www.browseproject.eu) which started on 1st January 2011. The project consists of seven Work Packages (WP) and five key cross-cutting themes (Figure 1) and one of its aims is to develop improved models for the assessment of operator, worker, resident and bystander exposure to PPPs.

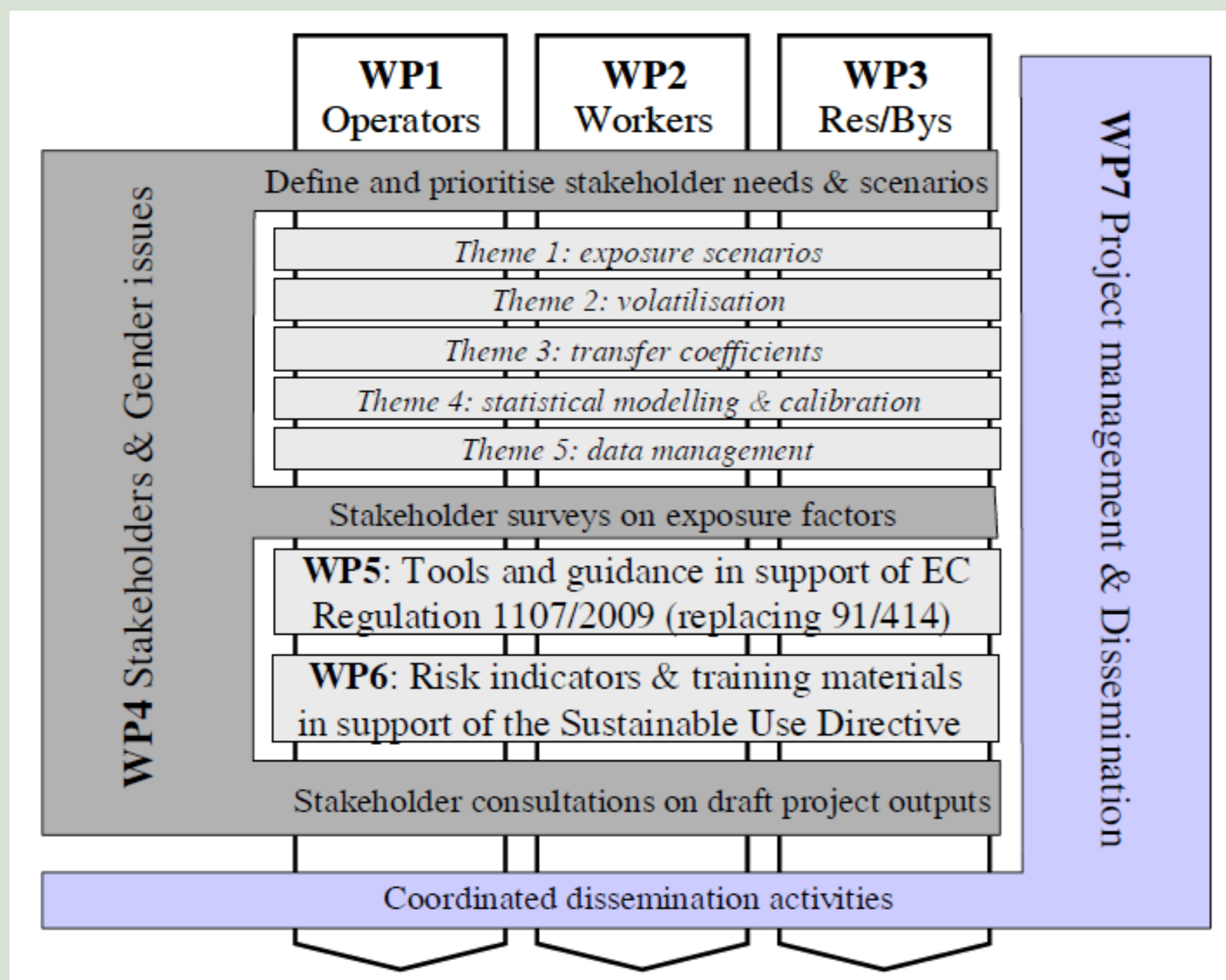


Figure 1: BROWSE project concept including Work Package structure and Cross-Cutting Themes

Operator exposure assessment: First priorities for modeling

Within WP1 of the BROWSE project, new models for the estimation of operator exposure levels during mixing/loading of liquid formulations and application by tractor mounted boom spraying will be developed in 2012.

- The new models will be based on the conceptual model developed during the first year of BROWSE taking into account not only dermal and inhalation but also oral exposure.
- The cross-cutting theme of transfer factors is a key component of the mechanistic models that are developed for the two scenarios.
- The major exposure determinants have been identified and all available exposure data will be entered into the BROWSE operator & worker exposure database if the set inclusion criteria are met (Figure 2).

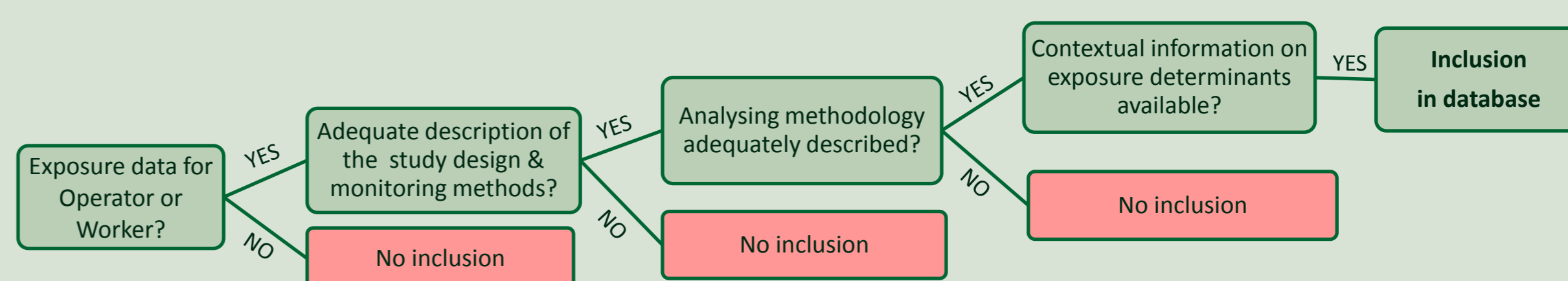


Figure 2: Decision tree for the acceptance of exposure data

Inhalation exposure: example of determinants (boom spraying)

Principle modifying factor	Example of potential underlying determinants
Substance emission potential	Concentration, formulation type
Activity emission potential	Total amount sprayed, hectares sprayed, droplet size, operating pressure, nozzle type, vehicle speed, boom height
Localised control	Boom shields / screens
Dispersion	Wind speed, wind direction, temperature
Worker orientation	Operator-to-boom distance and orientation to boom & wind
Personal enclosure	Use of tractor cabin
Respiratory protective equipment (RPE)	RPE factor

Modeling

Initial modeling steps:

- Select scenarios to be modeled.
- List inputs – factors influencing exposure
- Classify them according to what is known
- Create the conceptual models, describing relationships → create emulators of mechanistic models, combine with statistical data models

At least four types of input parameters have been identified:

- ✓ parameters specific for each exposure scenario that cannot be changed by the user (fixed)
- ✓ parameters for which the user will select from various default values
- ✓ parameters for which the users will input an appropriate value for their case (e.g. application rate, dermal absorption etc.) and
- ✓ parameters for which a distribution will be specified to represent uncertainty and/or variability.

Next steps

- Additional information on the operator behavior and key exposure parameters (e.g. application duration and work rate) will be provided by surveys conducted in Greece, Italy and UK during 2012.
- Finalization of the operator/worker exposure database
- Complete first priority models, represent realistic variability of the scenarios, using the survey & input data collected + probabilistic modeling

Acknowledgement

The research leading to these results has received funding from the European Union's Seventh Framework Programme ([FP7/2007-2013]) under grant agreement n° 265307 (BROWSE).

Operator Exposure Assessment

The Commission Regulation (EU) No 546/2011 implementing Regulation (EC) No 1107/2009 as regards uniform principles for evaluation and authorization of PPPs states that *the Member States shall evaluate operator exposure to the active substance and/or toxicologically relevant compounds in the PPP likely to occur under the proposed conditions of use (including in particular dose, application method and climatic conditions) using by preference realistic exposure data and, if such data are not available, a suitable, validated calculation model.*

An extensive review of the available operator exposure assessment models and tools has been produced in the BROWSE project. The review has served as input for the prioritization of scenarios to be modeled within the BROWSE modeling framework, and furthermore will serve as a starting point in the model development.

Prioritization of Operator Exposure Scenarios

A set of specific exposure scenarios at EU level has been prioritized following an extended review of all the available models/tools for the estimation of operator exposure levels during mixing/loading and application of PPPs:

- Mixing/loading liquid formulations
- Outdoor Application
 - ✓ Tractor mounted with hydraulic nozzles (boom sprayer)
 - ✓ Tractor mounted air-assisted (broadcast sprayer)
 - ✓ Knapsack sprayer
 - ✓ Lances connected *via* hose to a tank [spray gun]
- Indoor Application
 - ✓ Knapsack sprayer
 - ✓ Lances connected *via* hose to a tank [spray gun]
- Seed treatment
 - ✓ Dipping/immersing at industrial scale (not closed system if realistic) different tasks (loading, calibration, bagging, cleaning etc.)



The new operator exposure model will reduce the uncertainty in exposure estimations and contribute to a more realistic risk assessment of PPPs.