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 Worker’s 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.

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.)

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

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

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.

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

Figure 2: Decision tree for the acceptance of exposure data

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experts in the field from the EU founding countries and elsewhere

...sustainable agricultural practices. The BROWSE project aims to improve the understanding of occupational and environmental exposures to PPPs, by developing and validating new exposure assessment tools.

Figure 1 illustrates the BROWSE project concept, including the Work Package structure and the cross-cutting themes. The project is divided into several work packages, such as WP1 (Operators), WP2 (Workers), WP3 (Residues), WP4 (Stakeholders & Gender Issues), WP5 (Project Management & Dissemination), and WP6 (Risk Indicators & Training Materials). Each work package focuses on different aspects of the exposure assessment process, ranging from the identification of key factors to the development of practical tools and methods.

Interpretation of Data

The data collected through the operator exposure assessment process are crucial for understanding the risks associated with PPPs. This information can be used to refine existing models, develop new ones, and optimize the application of PPPs. The BROWSE project aims to create a database of exposure data that can be used for further research and for regulatory purposes.

Collaboration and Networking

The BROWSE project fosters collaboration among experts from different countries and disciplines. This interdisciplinary approach is essential for addressing the complex issues related to PPPs. By bringing together experts from academia, industry, and regulatory agencies, the project aims to create a network of experts who can share knowledge and resources.

Translation of Results

The results of the BROWSE project will be translated into practical tools and methods that can be used by practitioners in the field. These tools will help to reduce exposure levels and improve occupational and environmental safety. The project also aims to raise awareness among stakeholders about the importance of exposure assessment and the need for sustainable agricultural practices.