

ART
Advanced REACH Tool

TNO | Knowledge for business

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Logos: IOM, NRCWE, baa: (BAuA), TNO

Collaborative project...

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TNO logo

Funding so far

- CEFIC LRI



- AFSSET



- HSE



- Dutch Ministry of Social Affairs and Employment

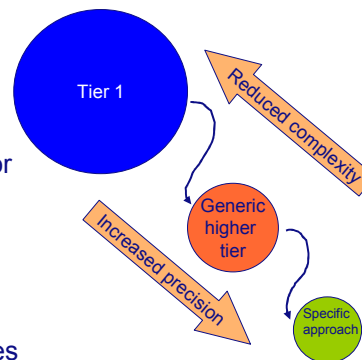


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Need for higher Tier approach

- First Tier inherently conservative
 - *Simple, easy-to-use, inexpensive*
- Higher Tier approaches needed for subgroups
 - *As simple as possible, but not simpler*
- A generic higher Tier tool increases cost-effectiveness and speed of RA
 - *Case-by-case approach is alternative*



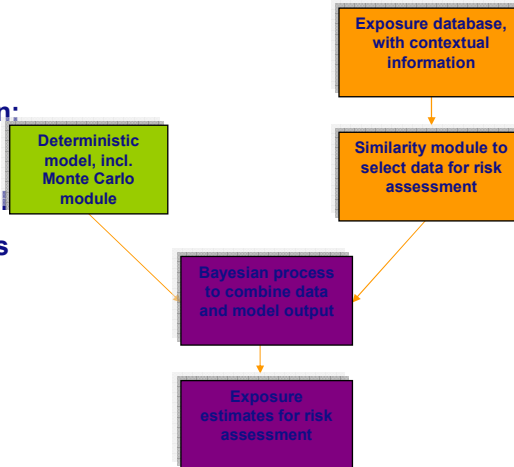
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ART approach

New developments on:

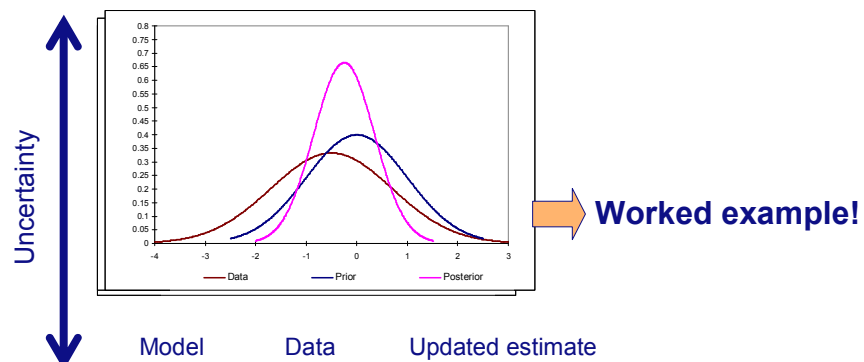
- Mechanistic model
- Bayesian statistics
- Databases
- Software
- Validation



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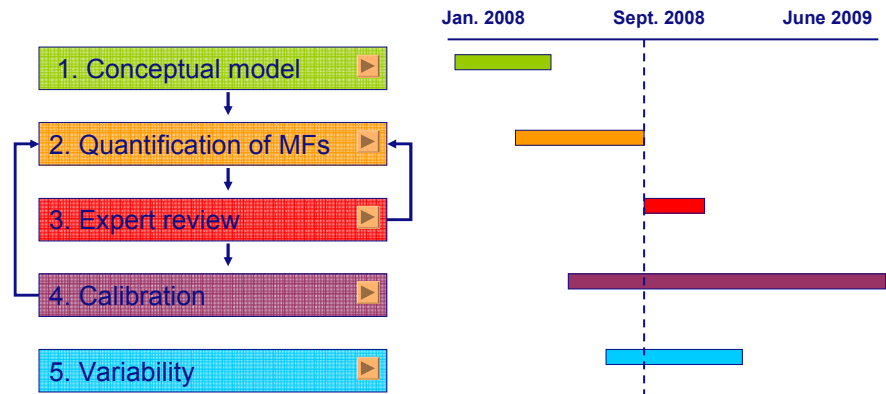
Making full use of all information



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Mechanistic model



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Source-receptor model

Cherrie *et al.* Ann Occup Hyg; 1999; 43: 235-245
Tielemans *et al.* Ann Occup Hyg; In Press



9 Modifying Factors (MF):

- Intrinsic emission potential (E)
- Activity emission potential (H)
- Local controls (LC)
- Separation (Sep)
- Segregation (Seg)
- Surface contamination (Su)
- Dilution (D)
- Personal behavior (P)
- RPE

$$C_t = (C_{nf} - C_{ff}) \cdot RPE$$

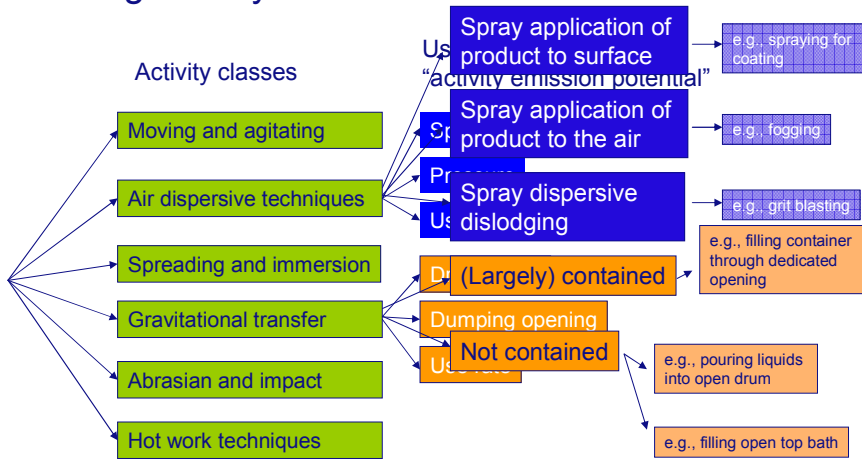
$$C_{nf} = (E_{nf} \cdot H_{nf} \cdot LC_{nf} \cdot P_{nf} + Su_{nf}) \cdot D_{nf}$$

$$C_{ff} = (E_{ff} \cdot H_{ff} \cdot LC_{ff} \cdot Seg_{ff} + Su_{ff}) \cdot D_{ff} \cdot Sep_{ff}$$



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Defining activity classes



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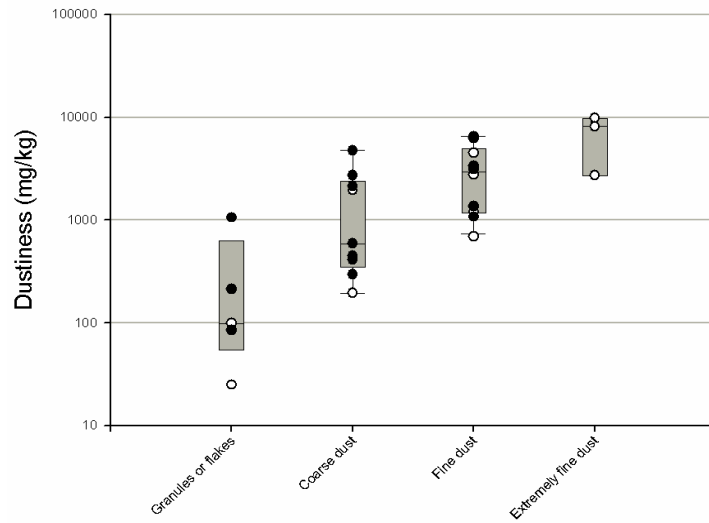
Quantification of Modifying Factors (MF)

- Defining classes for each MF
- Assignment of scores for each class
- Based on 'first principles', empirical evidence, simulations, and expert judgment

Localized control	
12 classes	
1	No control
0.1	Wet suppression
0.01	LEV and partial enclosure
0.001	LEV and complete enclosure
.....	

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Dustiness test results

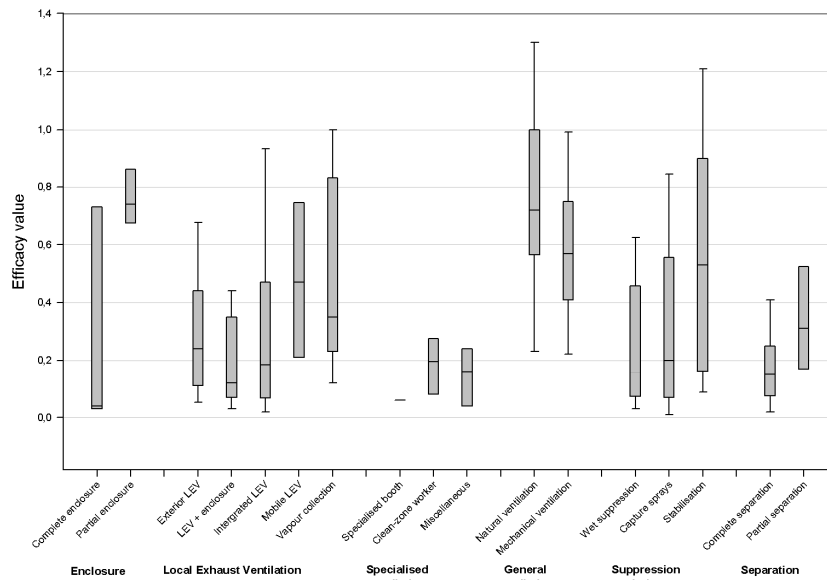


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ECEL-database

Fransman et al. Ann Occup Hyg, 2008



Expert review

- Selection of 3 external experts for each MF
 - *From industry, academia, government*
 - *Review of available evidence*
 - *Review of assigned scores*
- Input from Steering Committee
- Workshops on specific topics
 - *Local controls (RMM)*
 - *Activity classes / activity emission potential*
 - *Mechanistic model overall (BOHS, DOHS)*
 - *Other.....*

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Calibration

- From relative scores to concentration unit (e.g. mg m^{-3})
- Collation of exposure data:
 - *STEAMbase-TNO*
 - *CEMAS-IOM*
 - *HSE (MSc project)*
 - *GSK (PhD project)*
 - *Consortium*
 - *Other stakeholders*

First 500 measurements
have been
analyzed

Large numbers
reduce uncertainty

+
_____ +
> 5,000 measurements

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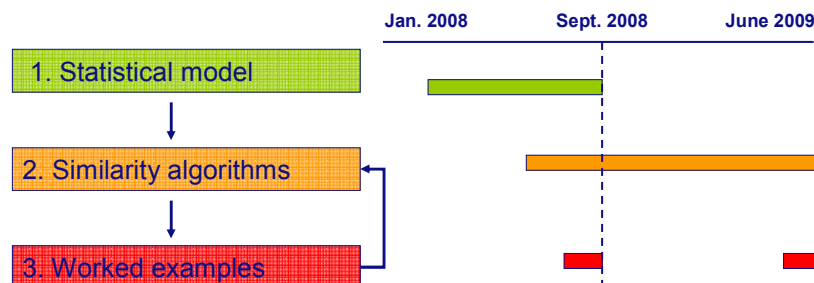
Exposure variability

- Mechanistic model predicts median exposure
- Exposure may vary within-workers, between-workers, and between sites
- Prediction of exposure variability based on large databases
 - Kromhout *et al.*, Ann Occup Hyg, 1993
 - Symanski *et al.*, Ann Occup Hyg, 2006

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Bayesian approach

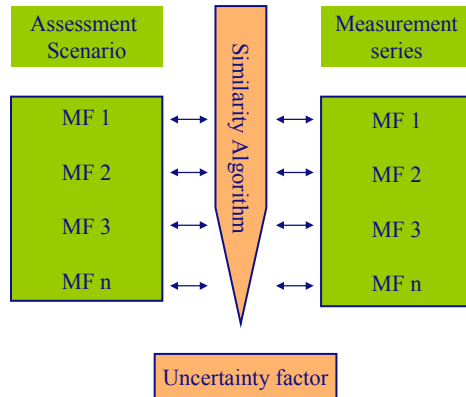


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Similarity algorithm

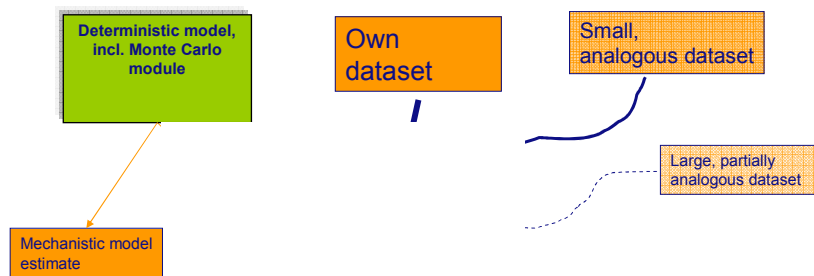
ART will explicitly incorporate uncertainty of exposure data arising through sample size and level of similarity with 'assessment scenario'



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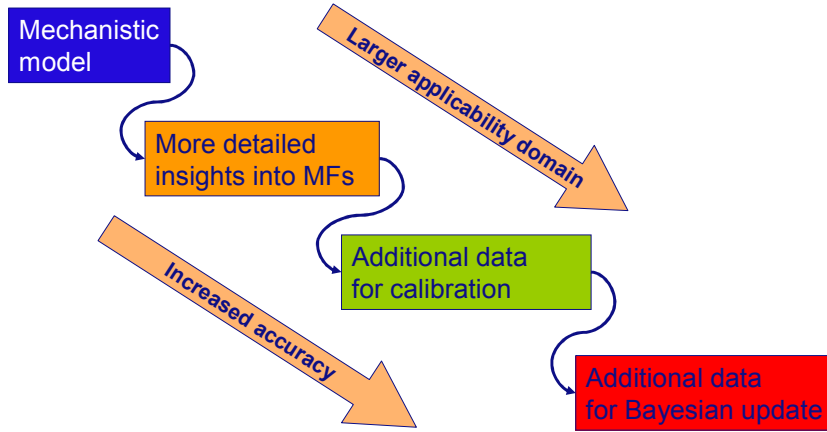
The overall picture



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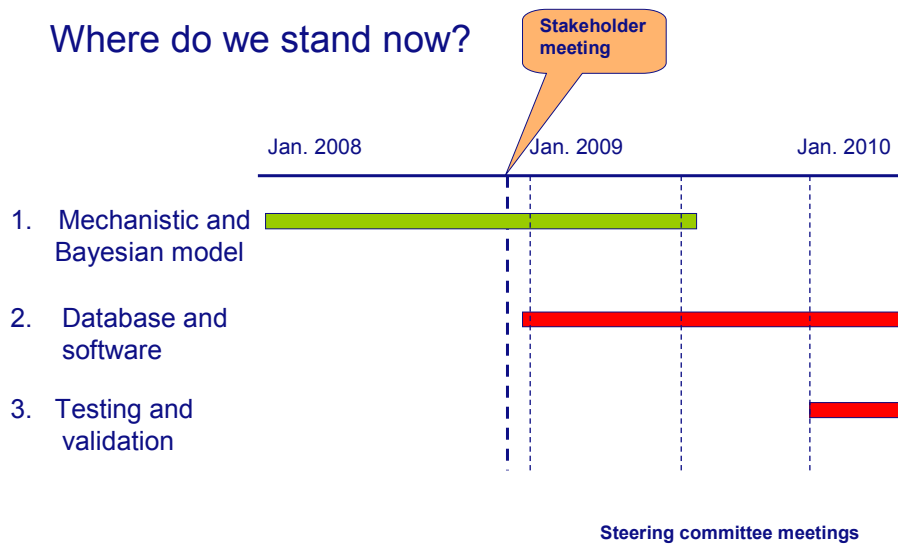
Evolving system



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Where do we stand now?



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Summary

- Research project is up and running
- Approach makes use of modelled estimates and measurements
- ART facilitates higher tier exposure assessment under REACH
 - *Provides estimates of whole distribution*
 - *Allows inclusion of any new data that becomes available*
- Approach facilitates sharing of exposure data down and up the supply chain

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Challenges

Science:	<ul style="list-style-type: none">- <i>Phase 1 is on schedule</i>- <i>First papers are accepted for publication</i>
Available data:	<ul style="list-style-type: none">- <i>Collation of data for calibration is on schedule</i>- <i>Filling of database requires further stakeholder engagement</i>
Software:	<ul style="list-style-type: none">- <i>Earlier experience with comparable tools</i>
User-friendliness:	<ul style="list-style-type: none">- <i>In consultation with Steering Committee</i>
Acceptance:	<ul style="list-style-type: none">- <i>Industry and member states are involved</i>- <i>Continuous stakeholder engagement</i>
Funding:	<ul style="list-style-type: none">- <i>Additional funding is required!</i>



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Thank you for your attention

- Questions?

