

ART
Advanced REACH Tool

TNO | Knowledge for business

Erik Tielemans

Logos: IOM, NRCWE, bauer, TNO

Collaborative project...

HSL
Nick Warren
Kevin McNally

IOM
John Cherrie
Martie van Tongeren
Peter Ritchie

TNO
Wouter Fransman
Jody Schinkel
Joop van Hemmen
Erik Tielemans

NRCWE
Thomas Schneider

UU
Hans Kromhout

BAuA
Martin Tischer

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TNO logo

Funding so far

- CEFIC LRI



- AFSSET



- HSE



- Dutch Ministry of Social Affairs and Employment

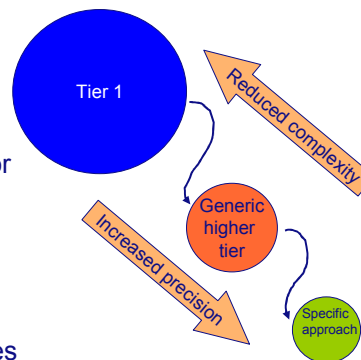


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Need for higher Tier approach

- 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*



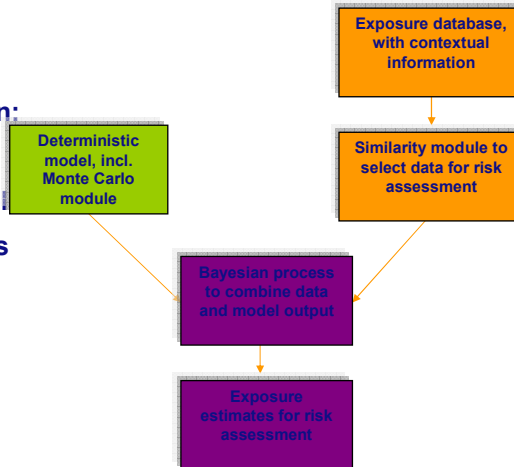
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ART approach

New developments on:

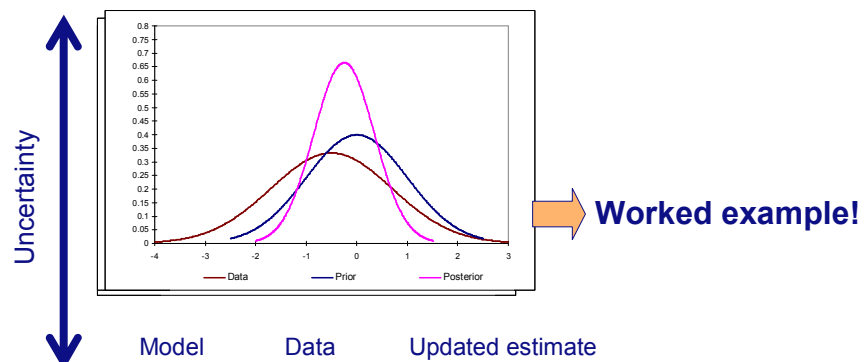
- Mechanistic model
- Bayesian statistics
- Databases
- Software
- Validation



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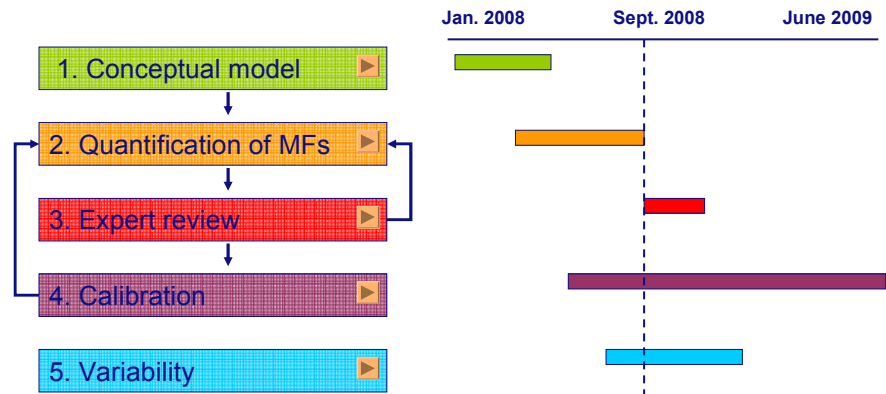
Making full use of all information



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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

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

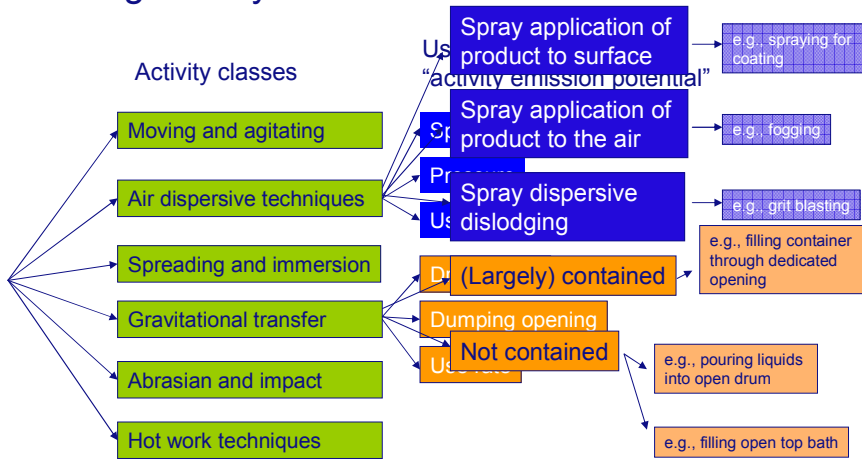
$$C_{nf} = (E_{nf} \cdot H_{nf} \cdot LC_{nf} \cdot P_{nf} + Su_{nf}) \cdot D_{nf}$$

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



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Defining activity classes

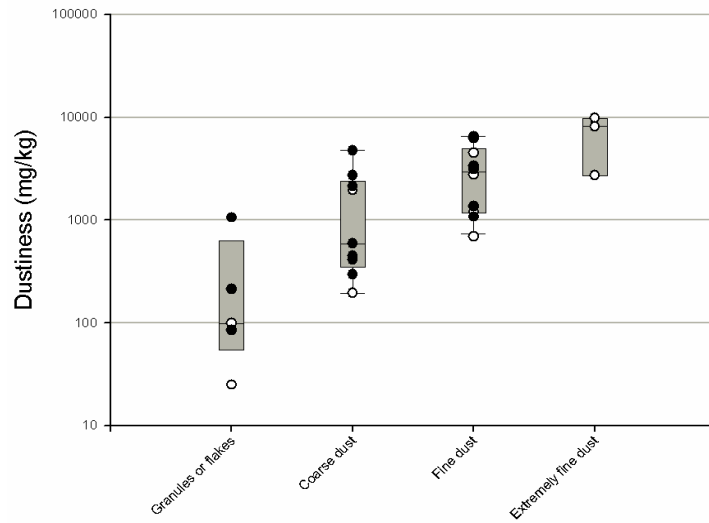


Quantification of Modifying Factors (MF)

- 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
.....	

Dustiness test results

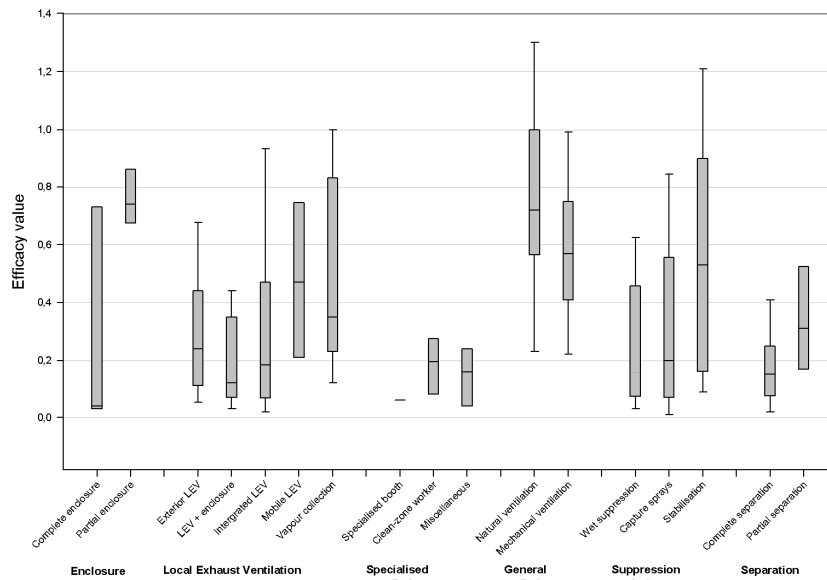


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ECEL-database

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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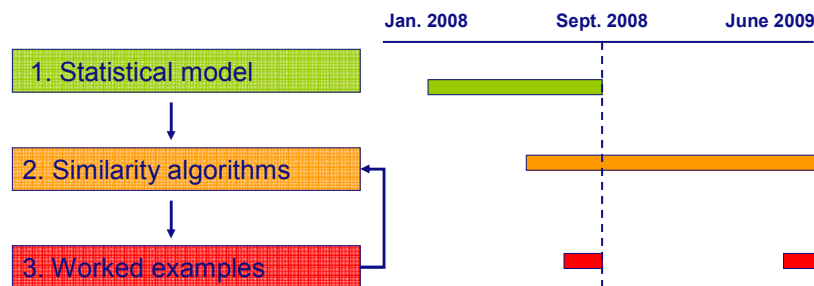
Exposure variability

- 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

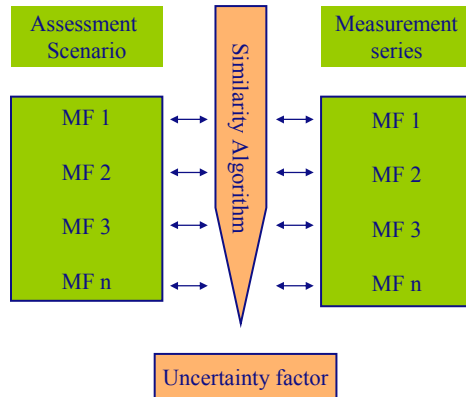


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Similarity algorithm

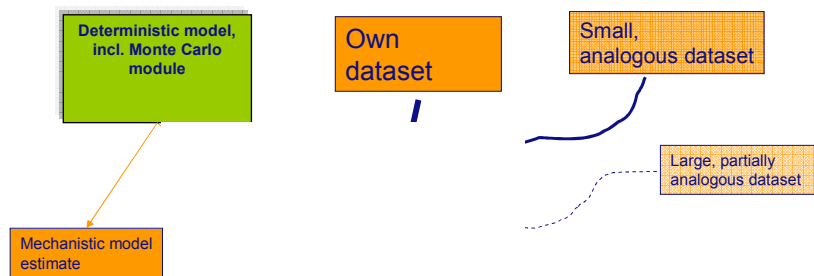
ART will explicitly incorporate uncertainty of exposure data arising through sample size and level of similarity with 'assessment scenario'



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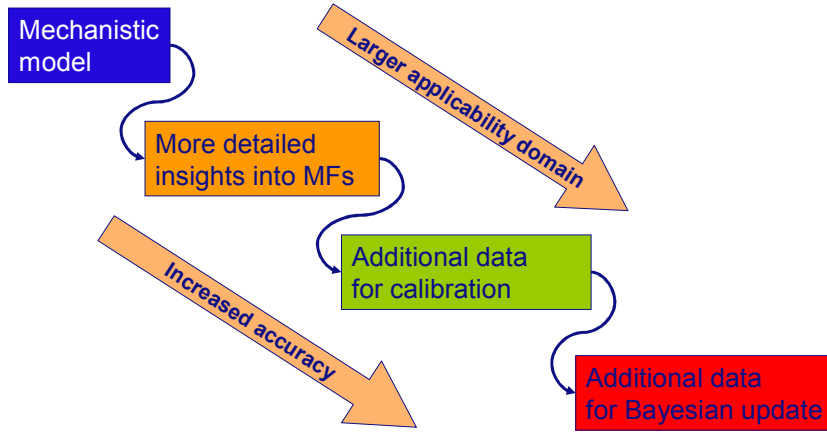
The overall picture



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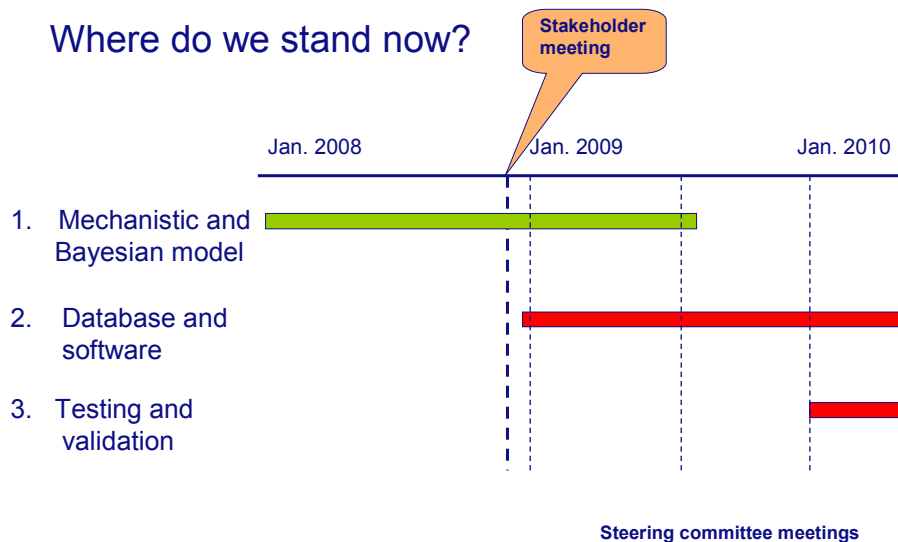
Evolving system



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



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Thank you for your attention

- Questions?

