Solvent transfer – Effectiveness of selected risk management measures (RMMs) on airborne solvent exposure

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RMMs

Determination of Effectiveness:

- Worst case scenario
- Number of RMMs
- Combination of RMMs
- Level of skills
- Speed
- End points (e.g. mild, severe)
- Number of volunteers
- etc.

Chemical Substances

- REACh Regulations: Exposure assessment for consumers, workers and environment → demonstrating safe use
- Development of exposure scenarios for workers: e.g. solvent transfer including RMMs

Exposure Assessment:
e.g. ECETOC TRA model

↓

Not all typical solvent transfer RMMs are available/have efficiency values in the models

Generation of applicable and reliable data on effectiveness of exposure control measures

Starting Point

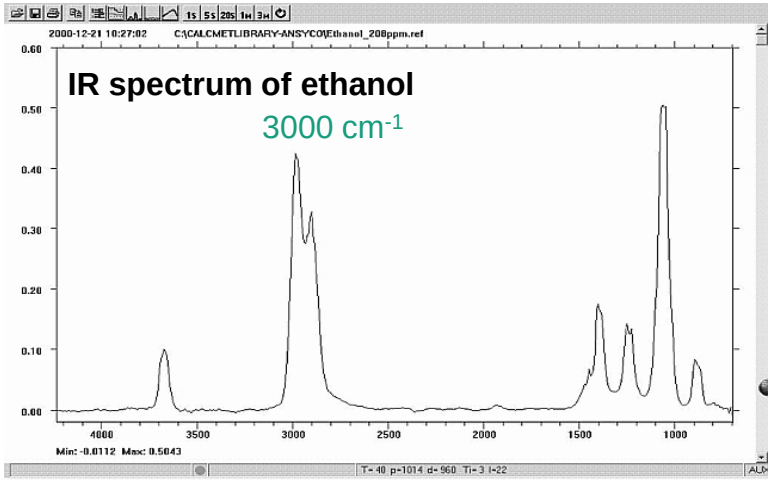
- ESIG identified RMMs that are commonly encountered and applied in practice:
  - Various levels of containment in combination with ventilation
  - Use of drum pumps
  - Draining and flushing procedures for maintenance operations
- RMMs are described by Standard phrases available in the European Chemical Industry Exposure Scenario Phrase Library (part of the ESCom - ES for Communication - Package)

Approach

1. Literature review and interviews with representatives of the solvent industry
   → insufficient data available
2. Set-up of solvent transfer simulations (gravity transfer, drum pump transfer, drain and flush application)

Experimental

- Model compound: Ethanol
- Artificial wind channel (approx. 1.5 m/s)
- Fume hood (approx. 1100 – 1200 m³/h)
- Room ventilation (inlet: approx. 1000 m³/h; outlet: approx. 600 m³/h)



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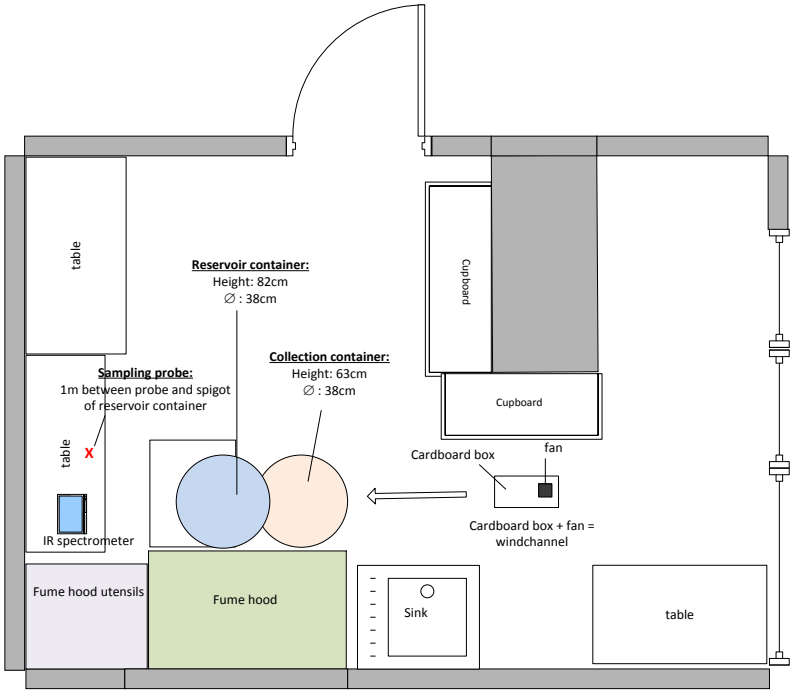

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Gravity transfer – Splash loading

#	RMMs / Cefic ESCom Phrase	EtOH [ppm]	RMM Effectiveness [%]
1	**Baseline / Worst case**	454	NA
2	**E60:** Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings	6	98.8
3	**E61**: Minimise exposure by extracted full enclosure for the operation or equipment	NoE	> 99
4	**E54:** Provide extract ventilation to points where emissions occur**;** **or E66:** Ensure material transfers are under containment or extract ventilation	13	97.1

Scenarios:

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Drum pump transfer – Submerged loading

#	RMMs / Cefic ESCom Phrase	EtOH [ppm]	RMM Effectiveness [%]
1	**Baseline / Worst case**	454	NA
5	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment	29	93.5
6	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment; **E66:** Ensure material transfers are under containment or extract ventilation	2	99.5
7	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment; **E66:** Ensure material transfers are under containment or extract ventilation or **E54** Provide extract ventilation to points where emissions occur.	5	98.5

Scenarios:

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Draining & Flushing

#	RMMs / Cefic ESCom Phrase	EtOH [ppm]	RMM Effectiveness [%]
8	**Baseline** (drained container, no flushing, no exhaust and ventilation system in place)	53	NA
9	**E55:** Drain down and flush system prior to equipment break-in or maintenance	2.5	95.2

Conclusion

#	RMMs / Cefic ESCom Phrase	RMM Efficiency (est.) [%]	RMM Efficiency (exp.) [%]
2	**E60:** Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings	80/90	98.8
3	**E61**: Minimise exposure by extracted full enclosure for the operation or equipment	90/95	> 99
4	**E54:** Provide extract ventilation to points where emissions occur**; or E66:** Ensure material transfers are under containment or extract ventilation	(75-95 LEV, 30/70 GV, ECETOC TRA)	97.1
5	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment	80	93.5
6	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment; **E66:** Ensure material transfers are under containment or extract ventilation	-	99.5
7	**E53:** Use drum pumps; **E68:** Restrict area of openings to equipment; **E66:** Ensure material transfers are under containment or extract ventilation or **E54** Provide extract ventilation to points where emissions occur.	-	98.5
9	**E55:** Drain down and flush system prior to equipment break-in or maintenance	90	95.2

- **Effectiveness > 90% in all cases**
- **Good agreement with ESIG estimates**

Conclusion

- Findings were obtained in laboratory based simulations
  - intended to reflect the nature of RMMs encountered in practice
  - exposure reduction effectiveness might be lower at many workplaces
- Careful consideration regarding implementation of RMMs

Take home message

- **Default ESIG values are reasonable and achievable**
- **Careful consideration regarding implementation of RMMs**

Thank you for listening

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ESIG - European Solvent Group

The European Chemical Industry Council

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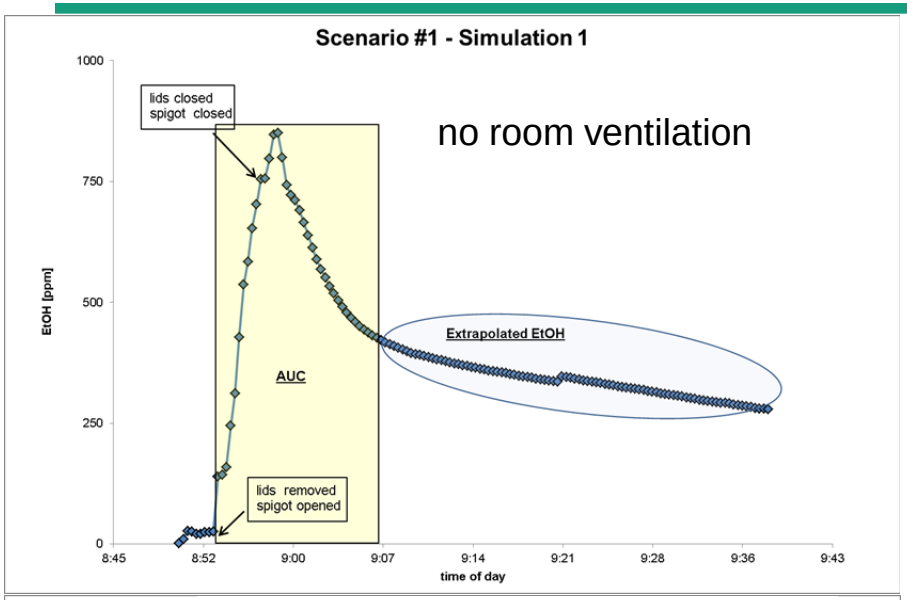
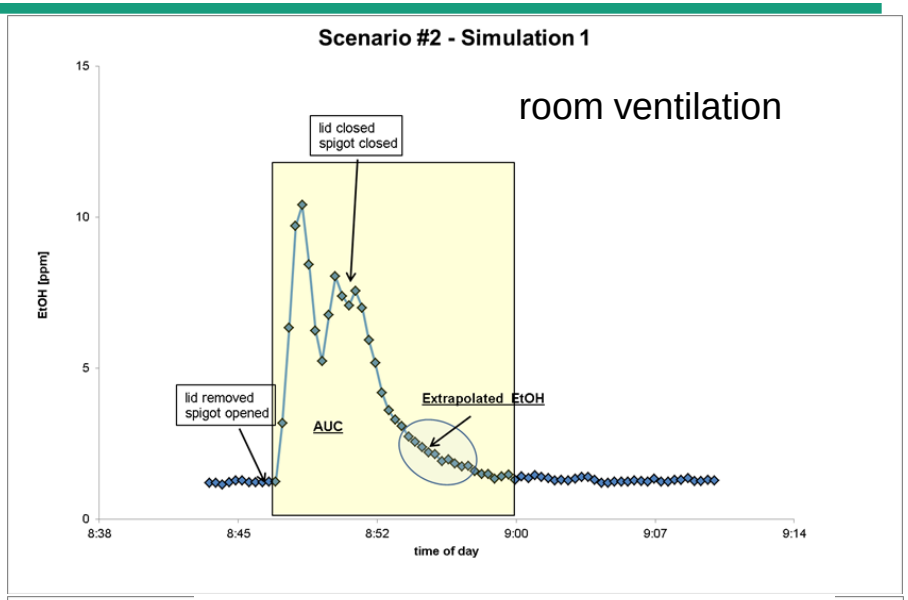
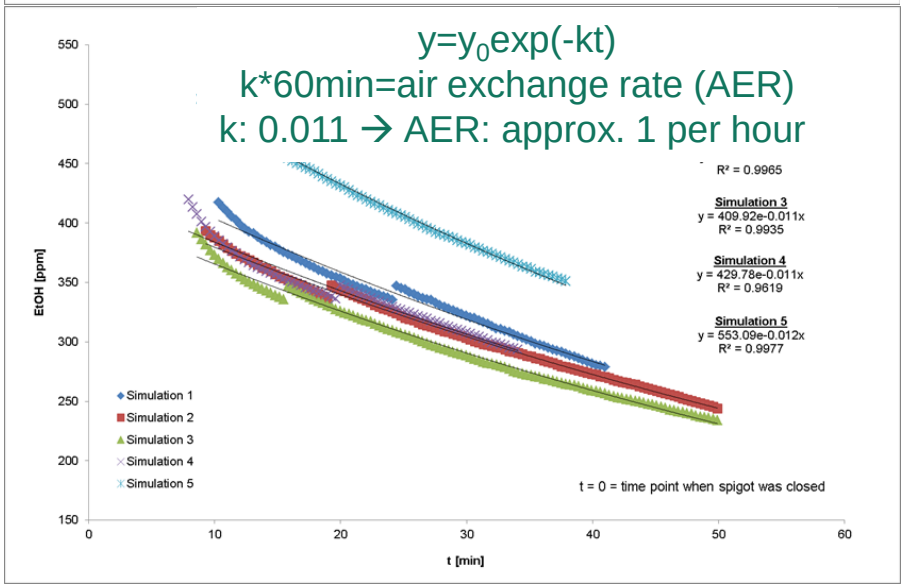
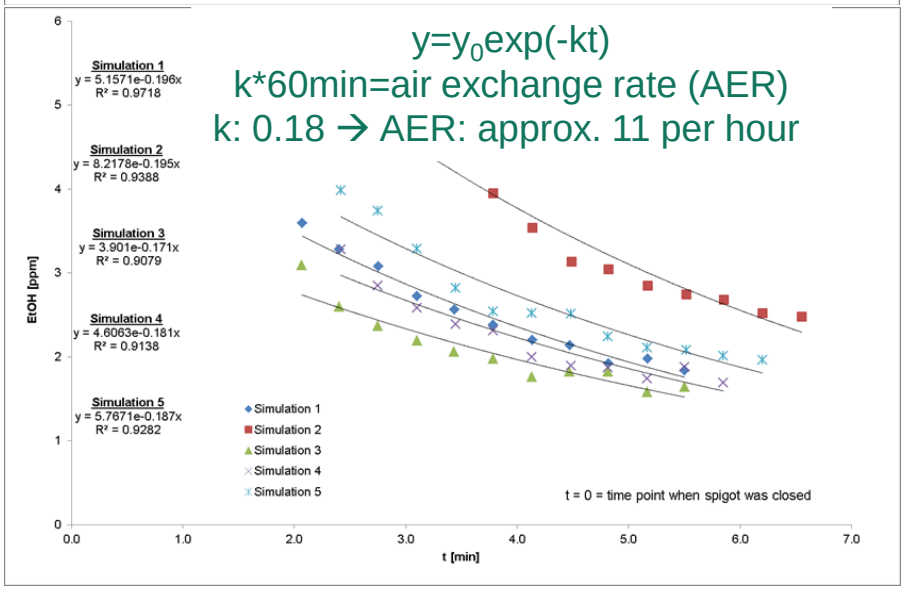
Just in case slide









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