GOBIERNO DE ESPAÑA
MINISTERIO DE EMPLEO Y SEGURIDAD SOCIAL
INSTITUTO NACIONAL DE SEGURIDAD E HIGIENE EN EL TRABAJO

# Challenges in worker exposure assessment in Europe

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# Summary

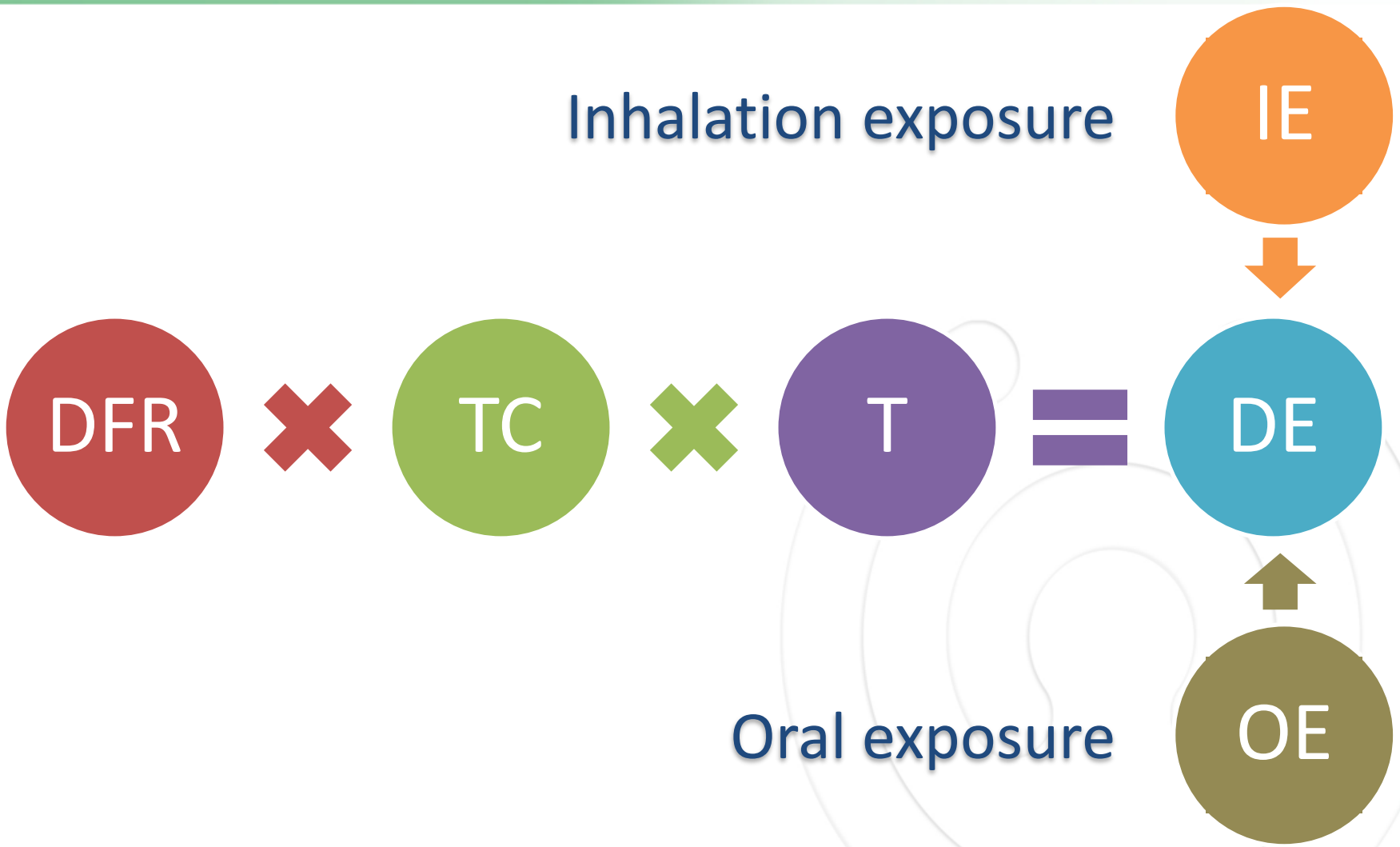
Methodology

INSHT exposure studies

Mitigation measures

# Methodology

Inhalation exposure




Oral exposure

# DFR factors

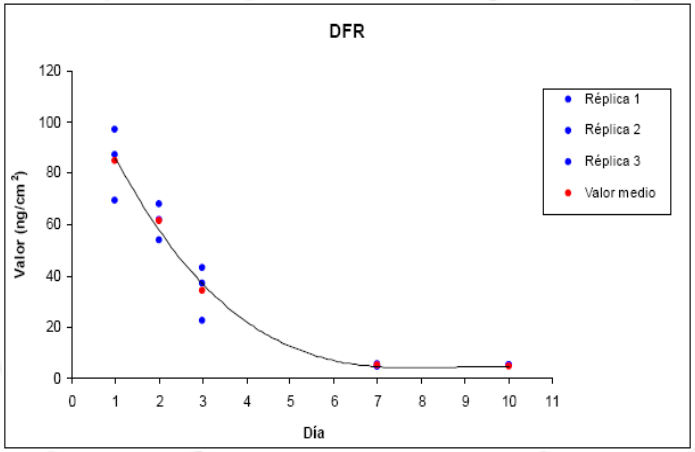
- Dose
- Application equipment
- Foliar structure
- Growth stage
- Dissipation
- Timing and Nº of applications

## Default 3 µg/cm$^2$ (per kg a.s./day)

- Based on EUROPOEM II (90$^{th}$ %ile)
- Overprotective?
  New DB: 2.8 µg/cm$^2$ (75$^{th}$ %ile)
- Appropriate for a wide variety of crops?
  See DFR factors
- Normalization based on mass per unit area better than mass per volume applied?

# DFR dissipation factors

- Climatic factors (T, %RH, rain, sunlight)
- Active substance
- Type of formulation
- Leaf texture
- Crop metabolism
- Timing and Nº of applications



# DFR dissipation

## Default dissipation: $T_{1/2}$ = 30 days

- Conservative approach followed
- Based on published data (Willis and Mac Dowell, 1987 and USDA ARS)
- Decay curve. Sometimes complex curves
  **$\log(DFR_t) = \alpha - \beta t$**; $\log (DFR_t) = \alpha - \beta[\log (t)]$; etc.
- Data is needed

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# DFR Higher Tier. Ad hoc studies

- Active substances
- Formulations
- Crops
- DFR or dissipation from other parts of the crop
- Dissipation from other studies (soil, water, etc.)

# DFR Higher Tier. Ad hoc studies

## Tier 3. Ad hoc studies

- Europoem II reentry report (Annex I). DFR Data (from ARTF)
- US EPA Series 875 - Occupational and Residential Exposure Test Guidelines, Group B - Post-application Exposure Monitoring Test Guidelines. US Environmental Protection Agency. Office of Prevention, Pesticides and Toxic Substances. Washington, DC.;
- OECD. Guidance Document for the Conduct of Studies of Occupational Exposure to Pesticides During Agricultural Application. OECD Series on Testing and Assessment, No 9 OECD/GD(97)/ 148, Paris, 1997.
- CEN/TR 15278:2005, Workplace exposure - Strategy for the evaluation of dermal exposure;
- CEN/TS 15279:2005, Workplace exposure - Measurement of dermal exposure- Principles and method;
- Scientific Issues Associated with Worker Reentry Exposure Assessment presented jointly to the FIFRA Scientific Advisory Panel By US Environmental Protection Agency, Health Canada and California Environmental Protection Agency, 2008.

# TC factors

## Degree

- Height and density of the crop

## Frecuency and nature

- Activities: pruning; thinning; leaf pulling; harvesting, etc.
- Worker behavior

# TC on Guidance of EFSA

| Crop | Nature of task | TC ($cm^2/h$) |
|---|---|---|
| Vegetables | Reach/pick | **2.500** |
| Tree fruits | Search/reach/ pick | **4.500** |
| Grapes | Harvesting and other activities (e.g. leaf pulling and tying) | **10.100** |
| Strawberries | Reach/pick | **3.000** |
| Ornamentals | Cut/sort/ bundle/carry | **5.000** |
| Golf course, turf or other sports lawns | Maintenance | **2.500** |
| General | Inspection, irrigation | **1.400** |

# Time of exposure

## GUIDANCE OF EFSA (Journal 2014;12(10):3874)

- 8 hours for activities such as harvesting, cutting, thinning, etc.
- 2 hours for crop inspection or irrigation activities

## CFT/EFSA/PPR/2010/04 (CAPEX)

- 7 hours ; BROWSE project
- Pilot surveys

## US EPA

- 8 hours
- ARTF / NAWS / Exposure rate / Multiday exposure

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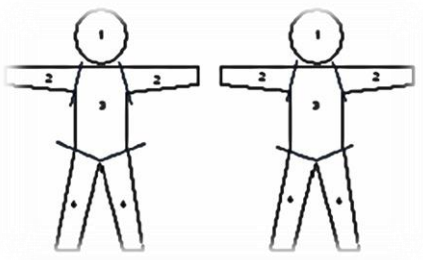
# INSHT worker exposure studies

Tying and pruning tomato in greenhouses

Harvesting cucumber in greenhouses

Tying and harvesting eggplant in greenhouses



LAB
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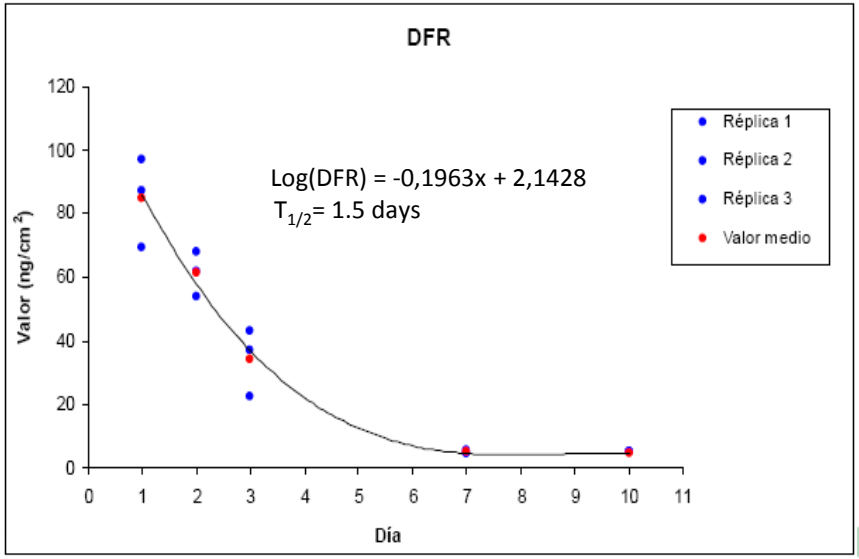
# INSHT worker exposure studies

## Tying and pruning tomato

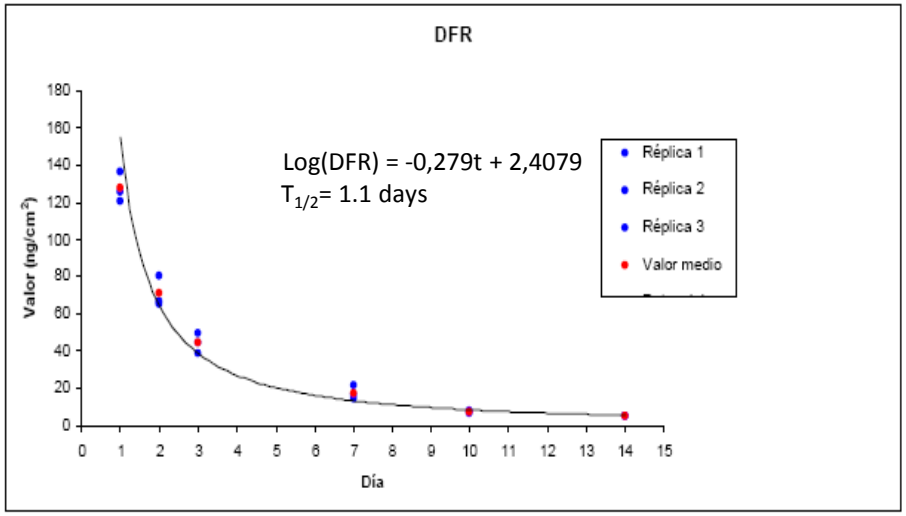
- Active substance: Spiromesifen
- T = 4 hours
- Quantifiable exposure results only in outer samples (Day 1 workers 2 and 10 excluded)
- Higher contact during prunning
- E hands >E lower legs > E chest> E forearms. Non exposure on head




# INSHT worker exposure studies

## Harvesting cucumber

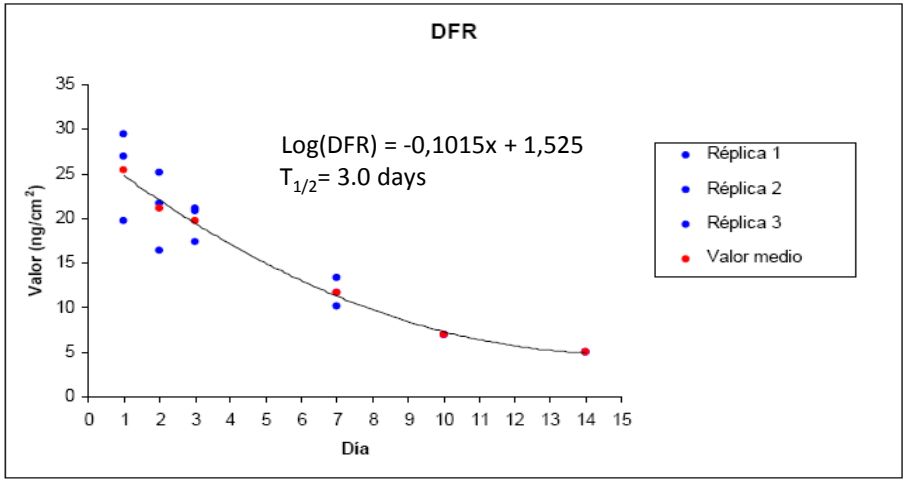
- Active substance: Piridaben
- T = 4 hours
- Highest $DFR_0$ results
- Quantifiable exposure results only in outer samples
- E upper body > lower body (Crop height=2,5m)




# INSHT worker exposure studies

## Tying and harvesting eggplant

- Active substance: Clorantraniliprol
- T = 6,5 hours
- Lowest $DFR_0$ results
- Highest contact (crop height, leaf area and fruit location). Highest exposure results
- Quantifiable exposure results only in outer samples

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# INSHT worker exposure studies

| CROP | TASK | EUII. PTL | STDY. PTL | EUII.TBE | EPA TBE | STDY. TBE |
|---|---|---|---|---|---|---|
| Tomato | Tying | 5800 | 1500/1989 | 2500 | 1100 | 660 / 750 |
| Tomato | Pruning | | 2981 | | 70 | 2094 |
| Cucumber | Harvesting | | 804/1002/1676 | | 550 | 471/608/727 |
| Eggplant | Tying | | 3624 | | 550 | 2660 |
| Eggplant | Harvesting | | 6416/7685 | | 550 | 3520/4536 |

| | |
|---|---|
| EUII. PTL. | Potential exposure from EUROPOEMII report. |
| EUII.TBE. | Total body exposure (arms, body and legs covered) from EUROPOEMII report. |
| EUII.TBE. | Total body exposure (arms, body and legs covered) from EUROPOEMII report. |
| EPA TBE. | Total body exposure (arms, body and legs covered) from ExpoSAC 2011. US EPA. |
| STDY. PTL. | Potential exposure from INSHT studies. |
| STDY. TBE. | Total body exposure (arms, body and legs covered) from INSHT studies |

# INSHT further initiatives

Post-harvest worker exposure

Worker exposure during leaf pulling and harvesting grapes

# Post-harvest exposure. Current approach

DFR × TC × T = DE

Nº/Kg
Área($cm^2$)

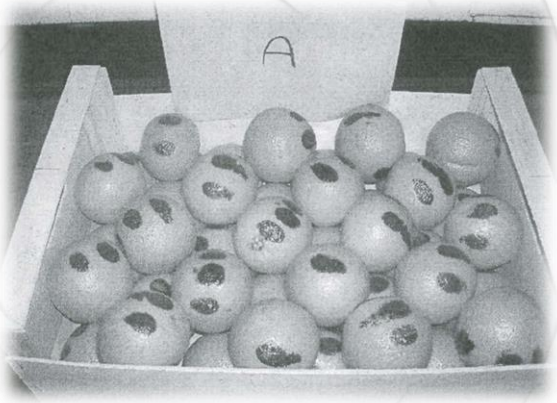
Nº/h
% in contact

MRL × TC × T = DE

5
201,1 $cm^2$

1800/h
4.2 %

5 µg/$cm^2$ × 15200 $cm^2$/h × 8 h = 600 mg/day



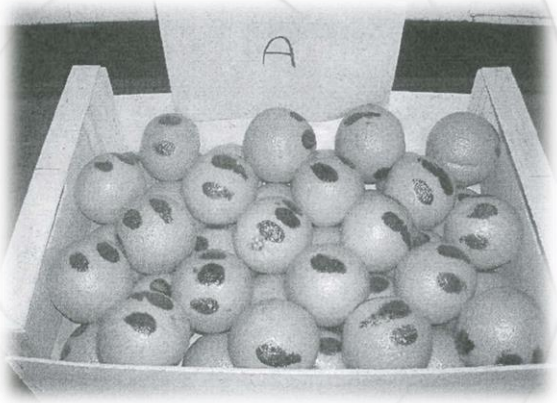
# Post-harvest exposure. Current approach-Pilot study

DFR × TC × T = DE

| DFR | TC | T | DE |
|---|---|---|---|
| Nº/Kg Área($cm^2$) | Nº/h % in contact | | |
| 5 $\mu g/cm^2$ | 15200 $cm^2/h$ | 8 h | 600 mg/day |

Pilot study

| | | | |
|---|---|---|---|
| 0.91 $\mu g/cm^2$ | 370 $cm^2/h$ | 8 h | 2.69 mg/day |



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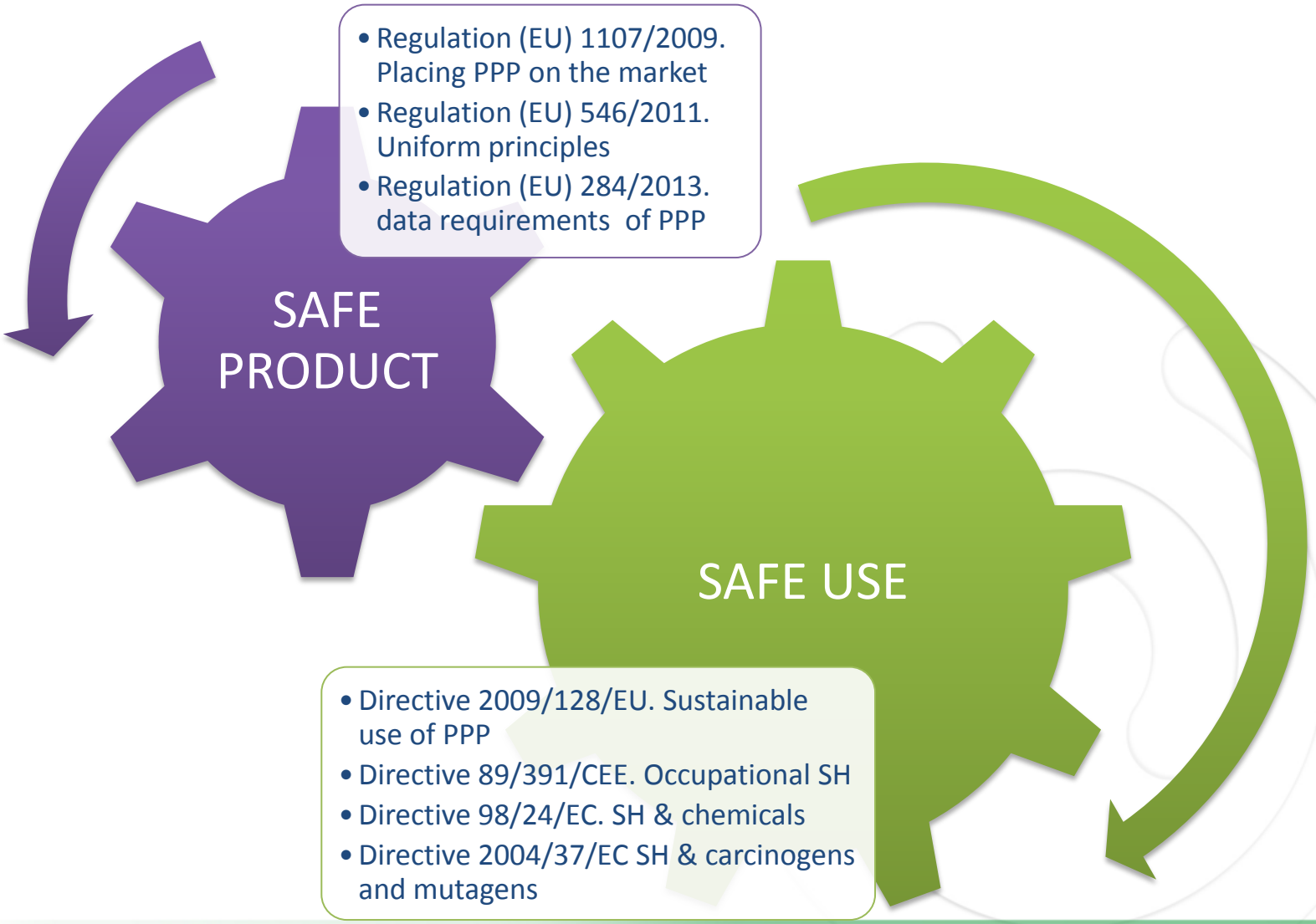
# Preventive aspects in EU legislation related to worker exposure



# Preventive aspects in EU legislation related to worker exposure

## Regulation 1107/2009. Placing PPP on the market

- High level of protection of human health: a priority over the objective of improving plant production

## Regulation 546/2011. Uniform principles

- Re-entry periods must be realistic

## Regulation 284/2013. Data requirements of PPP

- PPE should be effective and readily obtainable, feasible to be used and will be worn habitually by workers

# Preventive aspects in EU legislation related to worker exposure

## Directive 128/2009

- Whereas 12. Sustainable use related to workers safety and health legislation
- Article 12. Use of pesticides minimised or prohibited when accessible to agricultural workers

## Real Decreto 1311/2013

- Deposits on leaf surfaces completely dried
- Information when workers are allowed to re-enter
- Sings in GH and stores and in unclosed areas for bystanders and residents

# Mitigation measures

## Personal Protective Equipment

- CFT/EFSA/PPR/2010/04 (CAPEX)
- Chemical protective gloves? (Martin Roff (HSL), 2014)
- Common assessment errors: PF applied to TC (body covered)

## Reentry period

- The minimum time (hours or days) following application of a pesticide at which workers may safely re-enter agricultural fields
- Reentry period calculator
- Multiple reentry periods

## Duration of exposure

- Multiple task could be done per shift in some crops

# Challenges

- Collection/production of data on specific TC and DFR values
- DFR default values for each crop/growth stage group
- DFR normalization based on mass per volume applied
- Higher tier assessment. DFR and dissipation extrapolations
- Data on inhalation and oral exposure
- Data on crop activities (duration, how and when, PPE used, etc.)
- Dermal absorption of PPP dried dilutions
- Awareness training programs for workers and advising programs to employers

# THANK YOU FOR YOUR KIND ATTENTION

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