COMPARISON OF POTENTIAL DERMAL EXPOSURE TO ENDOSULFAN IN CARNATION GREENHOUSES USING PATCH AND WHOLE BODY METHODS.

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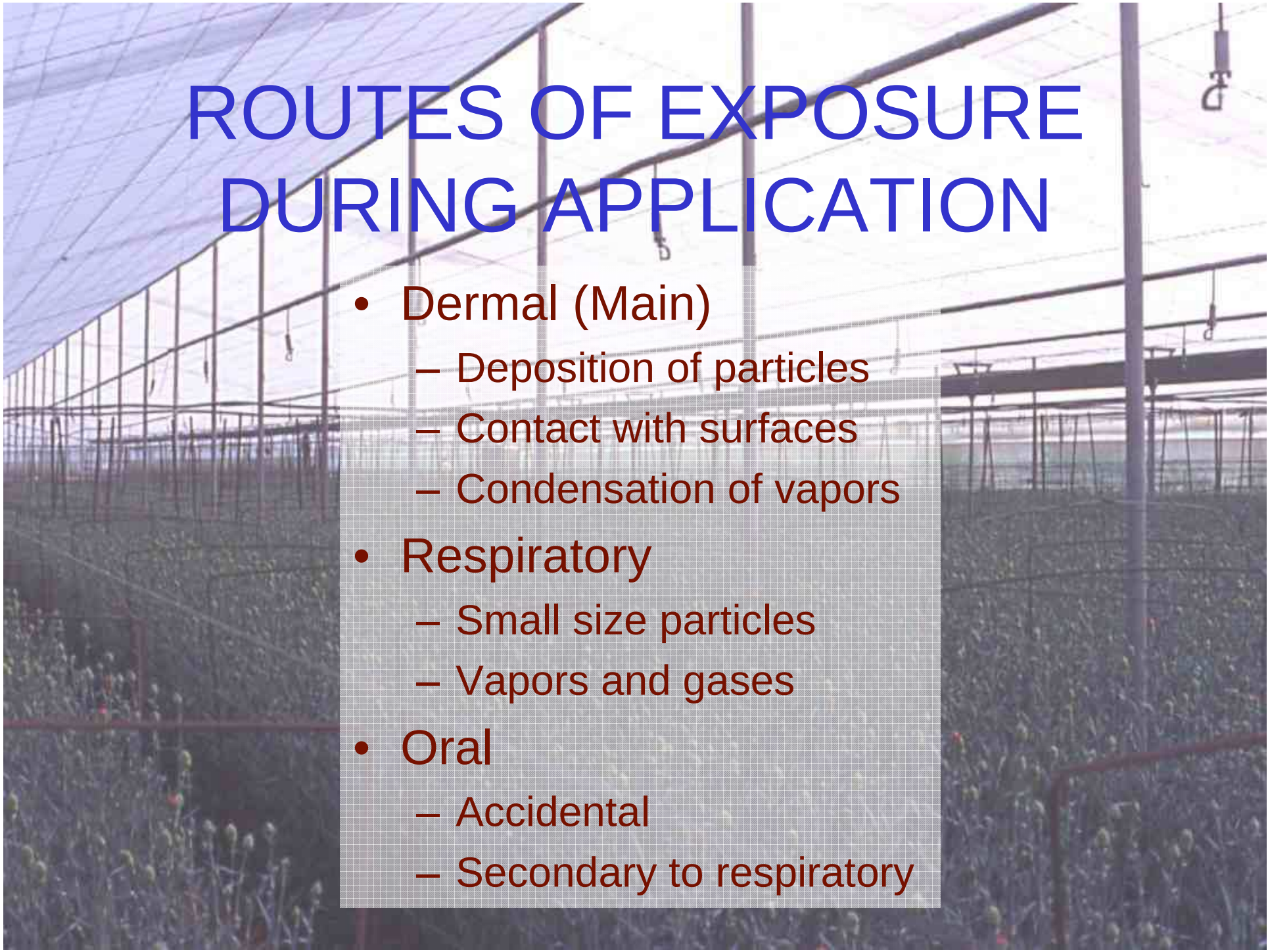
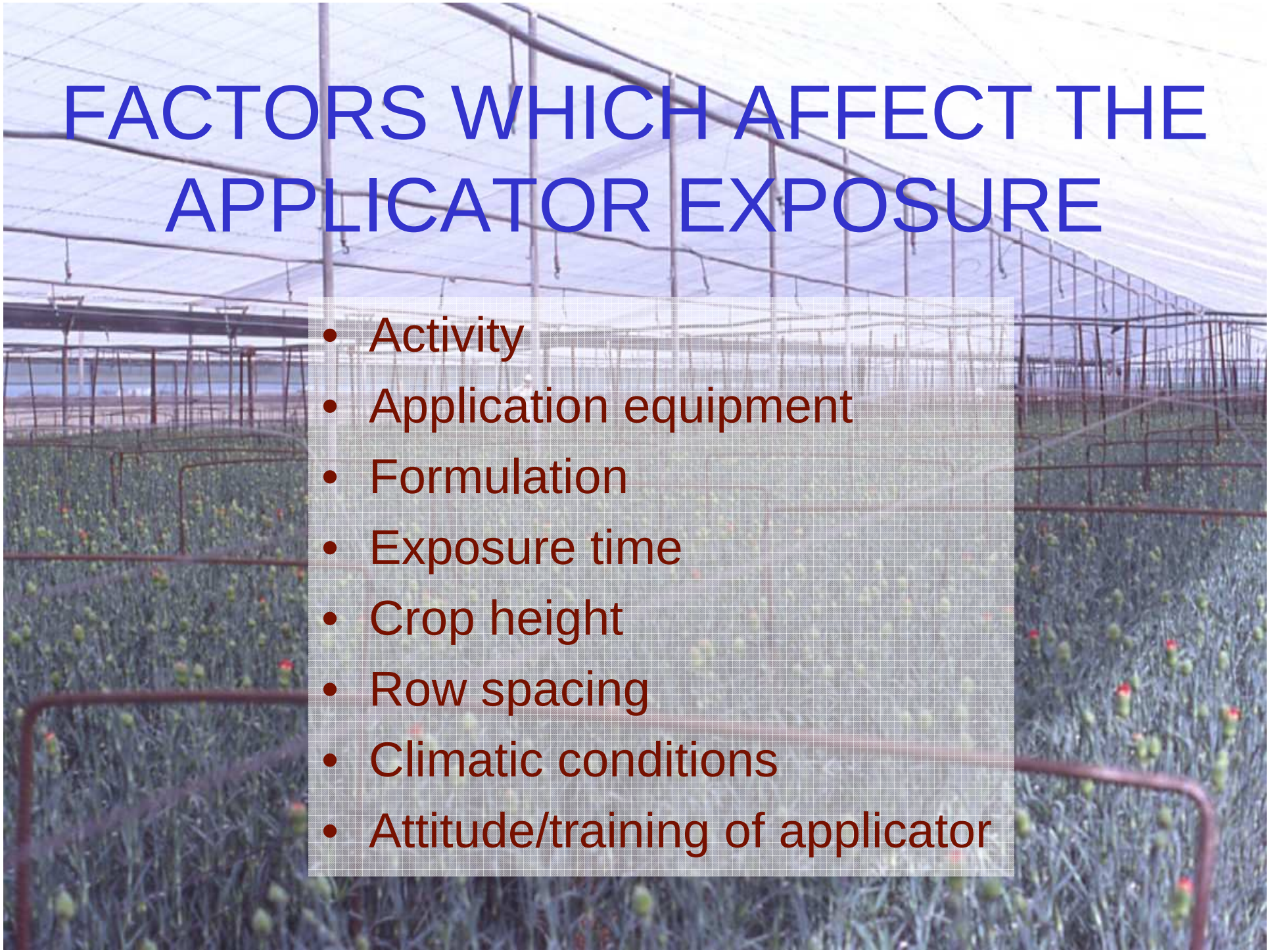
SOURCES OF EXPOSURE

- Mixing and loading
  - Exposure to the concentrate
- Application
  - Direct
  - Indirect
- Cleaning of application equipment
- Re-entry
  - Deposits on plants
  - Pesticide in the air
  - Other contaminated areas



ROUTES OF EXPOSURE DURING APPLICATION

- Dermal (Main)
  - Deposition of particles
  - Contact with surfaces
  - Condensation of vapors
- Respiratory
  - Small size particles
  - Vapors and gases
- Oral
  - Accidental
  - Secondary to respiratory



FACTORS WHICH AFFECT THE APPLICATOR EXPOSURE

- Activity
- Application equipment
- Formulation
- Exposure time
- Crop height
- Row spacing
- Climatic conditions
- Attitude/training of applicator

MAIN PROTOCOLS/GUIDANCES TO MEASURE POTENTIAL DERMAL EXPOSURE TO PESTICIDES

Year	Protocol/Guidance	Source
1982	Field Surveys of Exposure to Pesticides. Standard Protocol	WHO
1986	Guidelines for Conducting Mixer-Loader-Applicator studies	NACA
1987	Pesticide Assessment Guidelines. Subdivision U. Applicator Exposure Monitoring	US EPA
1997	Guidance Document for the Conduct of Studies of Occupational Exposure to Pesticides During Agricultural Application	OECD

PATCH METHOD

PATCH METHOD

SURFACE AREAS FOR REGIONS OF BODY

Region of body	Surface area (cm^2)	Patch location
Head & face	1300	Head (front of cap, hood)
(Face)	(650)	----------
Back of neck	110	Back
Front of neck	150	Chest
Chest/stomach	3550	Chest
Back	3550	Back
Upper arms	2910	Each upper arm
Forearms	1210	Each forearm
Upper legs	3820	Each upper leg
Lower legs	2380	Each lower leg (shin)
Feet	1310	----------
Hands	820	----------

Note: Surface areas include both arms, both legs, both hands

US EPA, 1987

WHOLE BODY METHOD

MAIN ADVANTAGES AND LIMITATIONS OF THE METHODS FOR ESTIMATING DERMAL EXPOSURE OF THE BODY

Method	Advantages	Limitations
PATCH	Ease of analysis	Assumes uniform deposition
WHOLE BODY	No body region size or surface area correction necessary	Analysis may be more cumbersome
	Less time-consuming in the field	May be uncomfortable for operator

CARNATION GREENHOUSES DATA

Total area (ha)	Spray volume applied (l/ha)	Final spray conc. (g a.i./l)	Time exposed (h)	Crop height (m)	Row spacing (m)	Temp. (^{o}C)	Hum. (%)
0.125	**1120**	**0.875**	**0.63**	**0.8**	**0.6**	**24**	**85**
0.125	**1120**	**0.875**	**0.63**	**1.05**	**0.6**	**24**	**85**
0.145	**931**	**1.09**	**0.32**	**1.3**	**0.5**	**19**	**63**
0.145	**931**	**1.09**	**0.37**	**1.05**	**0.5**	**19**	**63**

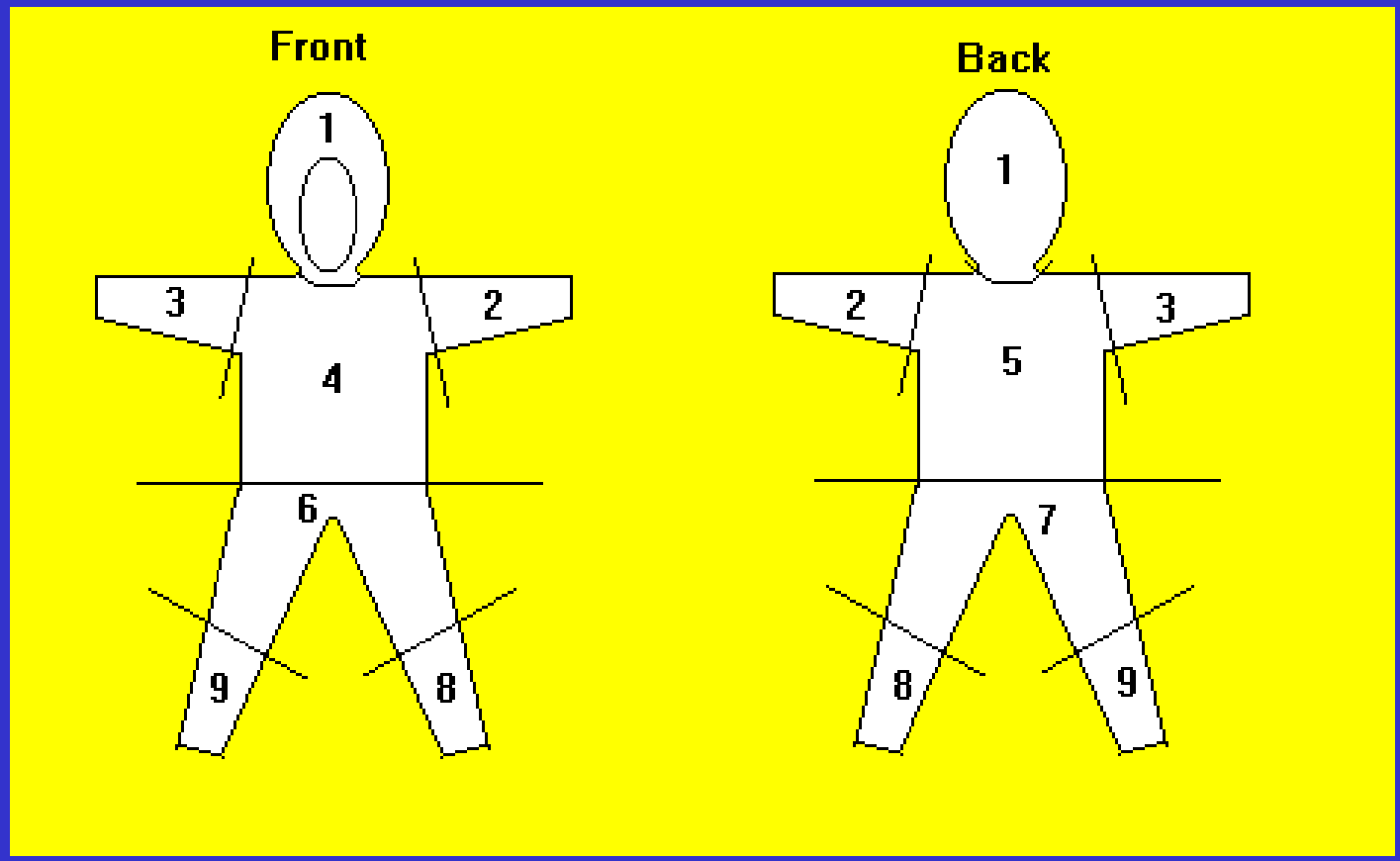
MIXING/LOADING

COVERALLS
OF
SONTARA
AND TYVEK

MARKED
PATCH

APPLICATION

WHOLE BODY METHOD SECTIONS



PATCH METHOD CALCULATIONS

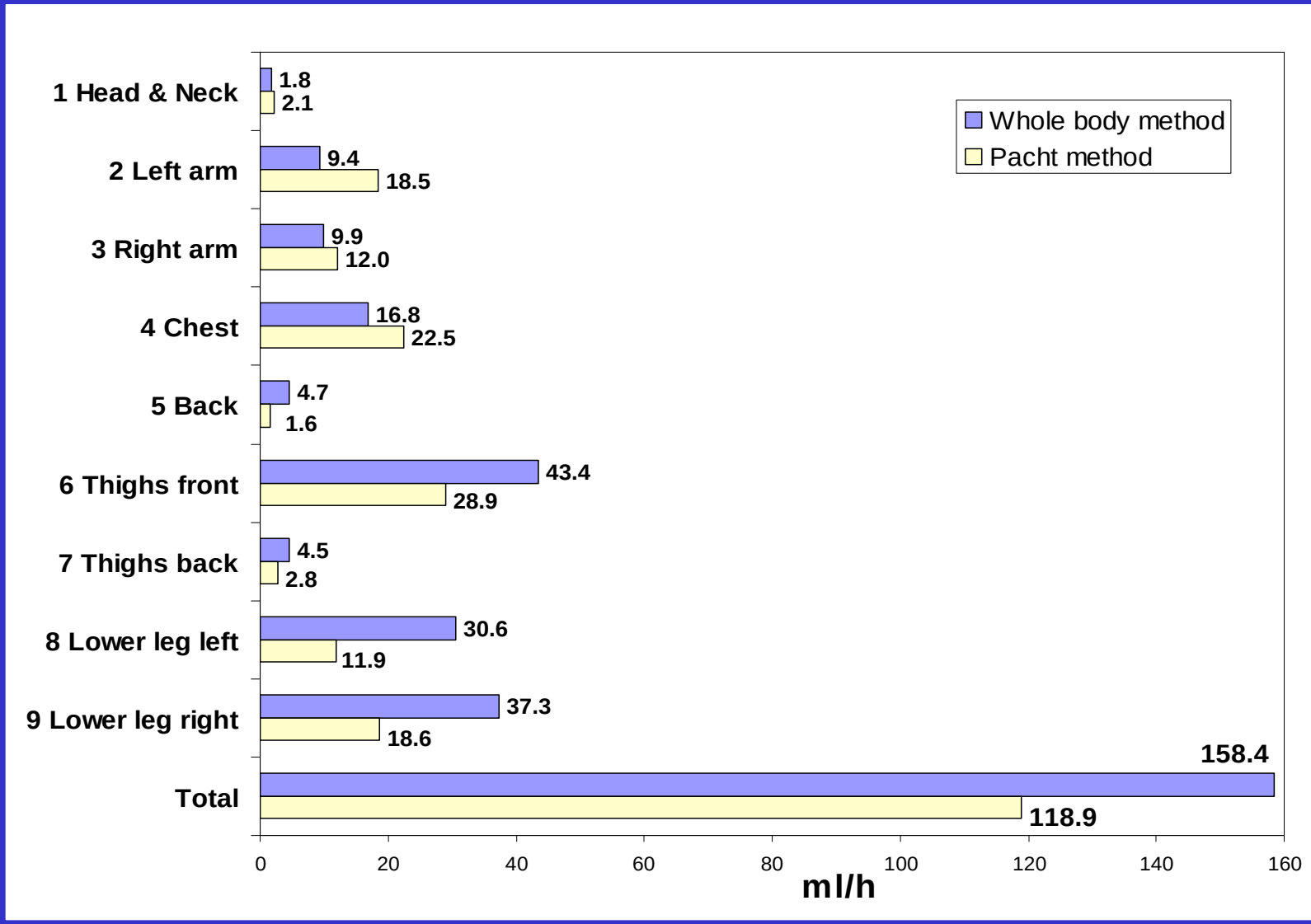
µg/100 cm² —Time→ **µg/cm²/h** —Area→ **mg/h**

mg/h —Final spray concentration→ **ml/h**

POTENTIAL DERMAL EXPOSURE TO THE SPRAY MIX (n=4)

Section number	Whole body method (ml/h)	Number of patches per section	Patch method (ml/h)
1 Head & Neck	1.8	1	2.1
2 Left arm	9.4	2	18.5
3 Right arm	9.9	2	12.0
4 Chest	16.8	1	22.5
5 Back	4.7	1	1.6
6 Thighs front	43.4	2	28.9
7 Thighs back	4.5	2	2.8
8 Lower leg left	30.6	2	11.9
9 Lower leg right	37.3	2	18.6
Total	**158.4**	**15**	**118.9**

COMPARISON OF POTENTIAL DERMAL EXPOSURE (n=4)



CONCLUSIONS

- The potential dermal exposure values calculated with the patch and whole body methods gave different results. ***The difference among the mean values is approximately 25%.***
- This was considered to be due to the ***contact between the lower body part of the applicator and the dense carnation crop.***
- Such contact with the crop gave rise to a ***non-uniform distribution of contamination*** (higher in the lateral parts) and therefore sampling error by the patches.