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**TECHNISCHE
UNIVERSITÄT
DRESDEN**

UV-monitoring at outdoor workplaces

—

A base for well-balanced health prevention regulations

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Background

Existing limit values to artificial UV exposures

 not applicable to solar exposed workplaces.

Drawing up of health care regulations for outdoor workplaces

Request:

Relationships between occupational UV exposures and non-occupational UV exposures (leisure time; holidays)

BAuA Project F1777

(Federal Institute for Occupational Safety and Health /FIOSH; German acronym BAuA)

**„Personal Monitoring of the UV exposure
in groups of outdoor workers”**

Aims and Uses

Arms:

Registration and evaluations of individual exposures to UV radiation for employees with a solar exposition during their work process in relation to population groups with normal level of exposure

Biometrics for distribution of exposure within and between the different work groups, or groups with specific kinds of behaviour

Uses:

- Basic data for health protection during work
- Reference data for risk assessment in the case of future significant changes in UV radiation climate
- Basic data for investigation of possible relations between dose and effect for relevant skin tumors.

Purpose

- Measurement and assessment of *individual solar UV exposures* within different *outdoor professions* in *relation to* „*normal UV exposure level*“ in groups of indoor workers.
- *Biometric analysis* of the exposure distribution *within* and *between* the different *profession groups* and analysis of the influence of *behaviour factors*.

Investigated occupational groups

(BAuA project: F1777)

Person group	Characterization	1)	2)	
		'96-'98 n =	'00-'01 n =	'03-'04 n =
Pre-school age	Kindergarten	15	75	-
Pupils	Primary school	8	70	-
Students	Grammar school	24	-	-
	Sporting group / rowers	13	-	-
Students	University	15	-	-
Indoor worker	Outdoor active in leisure time	11	140	3
	Less outdoor active in leisure time	15		
Outdoor worker	Road constr. worker,	12	120	-
	Gardener	10		
	Roofer	10		
	Postman; Traffic warden			15
	Construction worker			15
	Agricultures worker	-	-	15
	Dustman			15
Working indoors and outdoors	Window cleaner	-	-	15
	Kindergarten teacher	-	7	15
	Trainer (school)	-	-	15
Not in employment	Housewife	10	-	-
	Beginning retirement age	10	-	-
	Old people's home	13	-	-



¹⁾ Knuschke P, Krins A. (2000) Personal UV dosimetry using Polysulphonfilm as UV sensor. Final Report on BMBF-Project 07UVB54B, TIB Hannover F 00 B 1544

²⁾ Knuschke P, Kurpiers M, Koch R, Kuhlisch W, Witte K. (2004) Mean individual UV-exposures in the population. Final Report on BMBF-project 07UVB54C/3, TIB Hannover F05B898

Investigated occupational groups

(BAuA project: F1777)

- 3 groups of outdoor workers (n = 15 per group)
 - construction workers (building construction)
 - agricultural worker (plant cultivation)
 - garbage worker
- 3 occupational groups working outside and inside (n = 15 per group)
 - nursery school teachers
 - Physical Education (PE) teachers
 - window cleaners
- indoor workers n = 3 persons (simultaneously)
(n = 150: data from previous studies: BMBF-projects: 07UVB54B, 07UVB54C3)

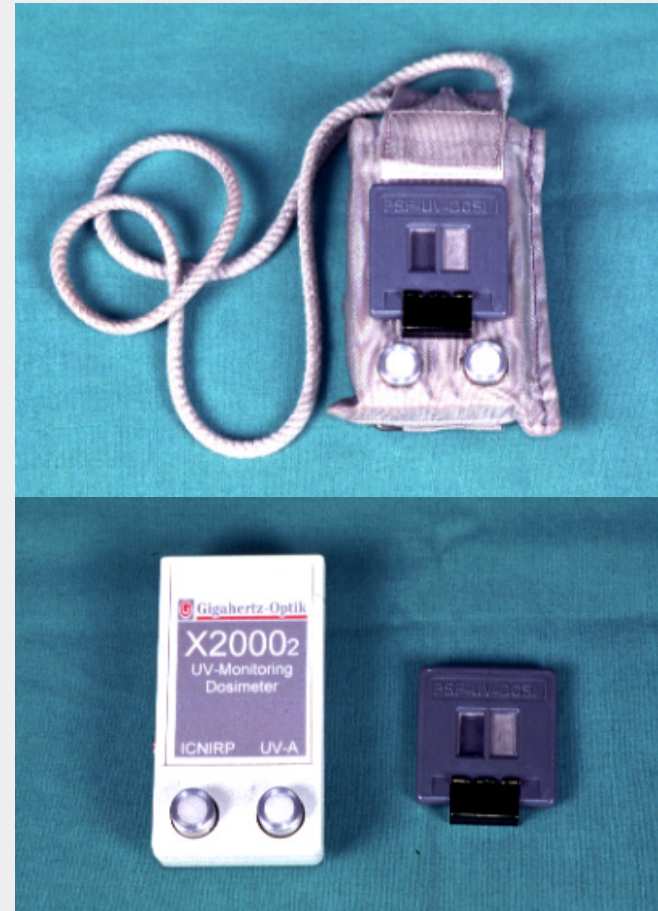
Existing results of previous personal UV monitoring

(BMBF-project: 07UVB54B, 07UVB54C2) n = 150:

road construction workers, gardeners, horticulture and landscape gardening, postmen, traffic wardens

Personal UV dosimeter

- **Polysulphone film (PSF)**
(Dept. of Dermatology /
Dresden University of Technology)
 - cumulative measured data
 - biological weighted read-out
- **Data logger UV dosimeter X2000**
(Fa. Gigahertz-Optik GmbH)
 - time-resolved measurements
every 1 minutes
 - storage capacity up to 2 monthes



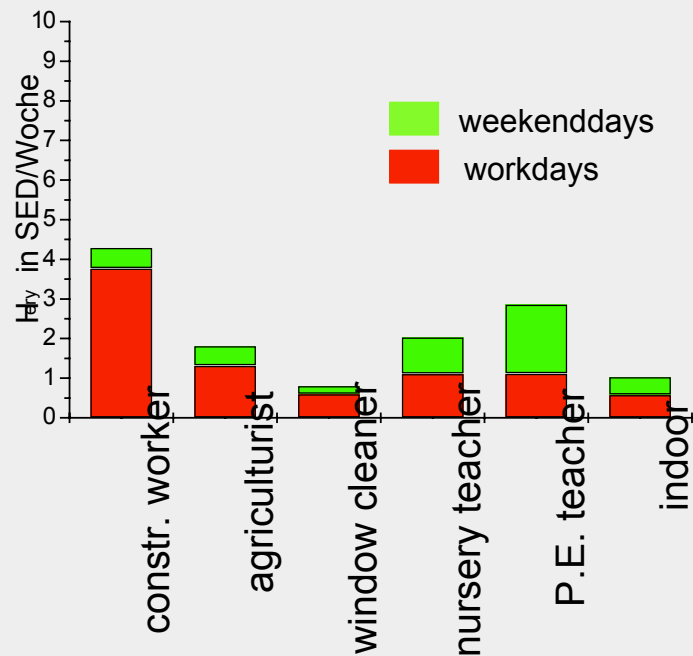
Personal UV Monitoring

- Measurement periods
 - A: 16 days in each season of the year
 - B: 52 weeks of the year (daily)
- Personal UV dosimetry:
(separate for)
 - workdays
 - leisure time (weekend days)
 - holiday time
 - body distribution of UV exposure (exemplary)
- Documentation of UV exposure-relevant personal data:
 - UV skin type-relevant data
 - volunteer diaries on outdoor behaviour:
 - time spent outside,
 - status of clothing, SPF when used sunscreen,
 - hobbies, travel to workplace
- Measurement of the **global influences** to the individual UV exposure level*)
 - biological effective global UV radiation (erythemal, ICNIRP, UVA)
 - meteorological data
(provided by DWD/German Meteor. Service)

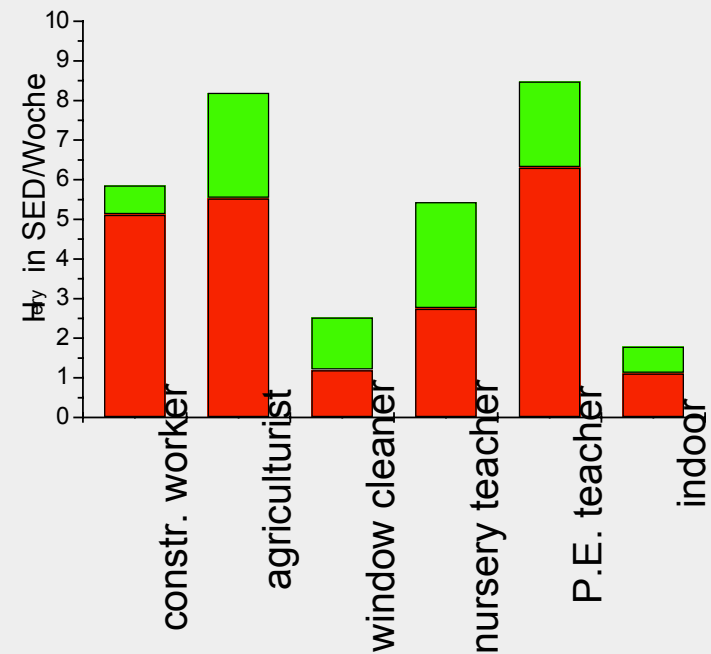
Meteorological influence on measurement results of the personal UV dosimetry

Weekly UV exposure H_{er}

measuring period: 37.KW 2003



measuring period: 38.KW 2003



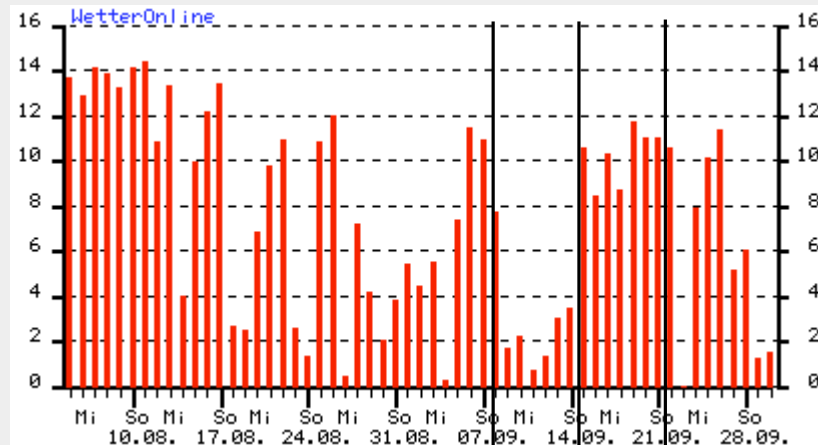
1 SED = 100 J/m²

2.5 SED ≈ 1 MED (skin type II)

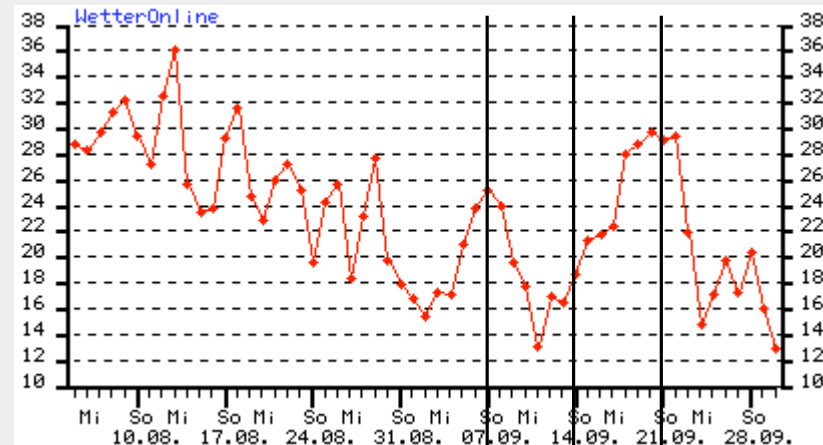
Weather Data for Measurement Periods 03KW37, 03KW38

(Source: www.wetteronline.de)

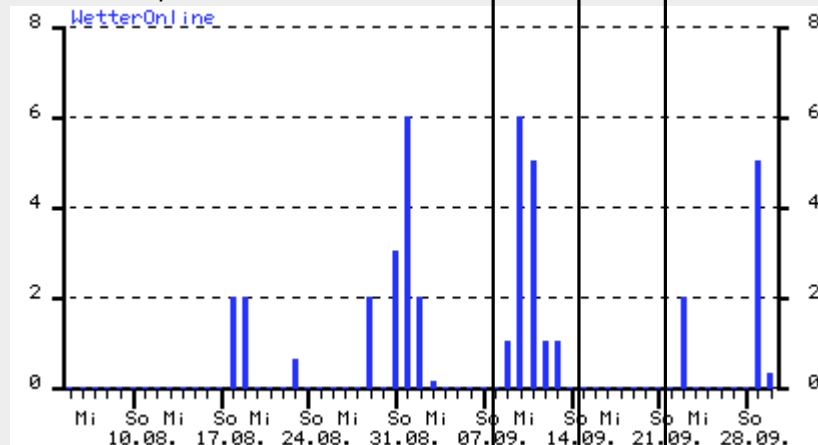
Hours of Sunshine



Maximum Temperature



Precipitation



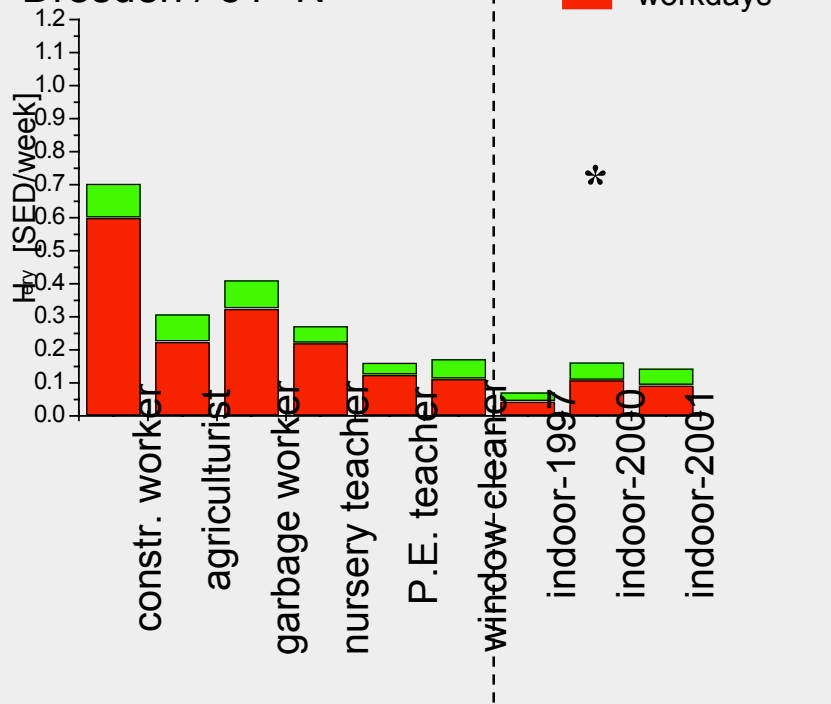
37.KW 38.KW

37.KW 38.KW

Results I

Weekly UV exposure Dec 2003

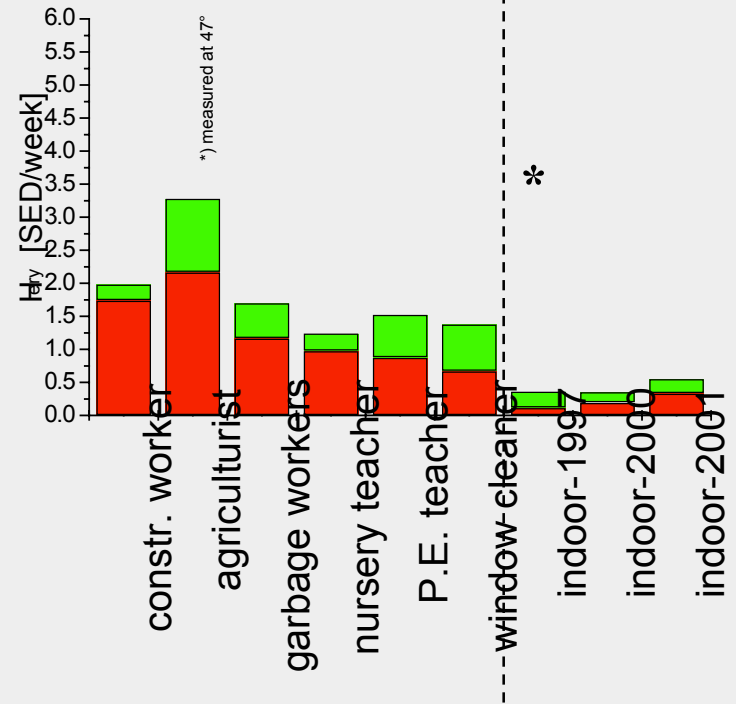
solar noon elevation $\gamma_s = 15^\circ$
 Dresden / 51° N



Remark: 1 SED = 100 J/m² erythema-weighted

Weekly UV exposure Feb 2004

Dresden $\gamma_s = 30^\circ$

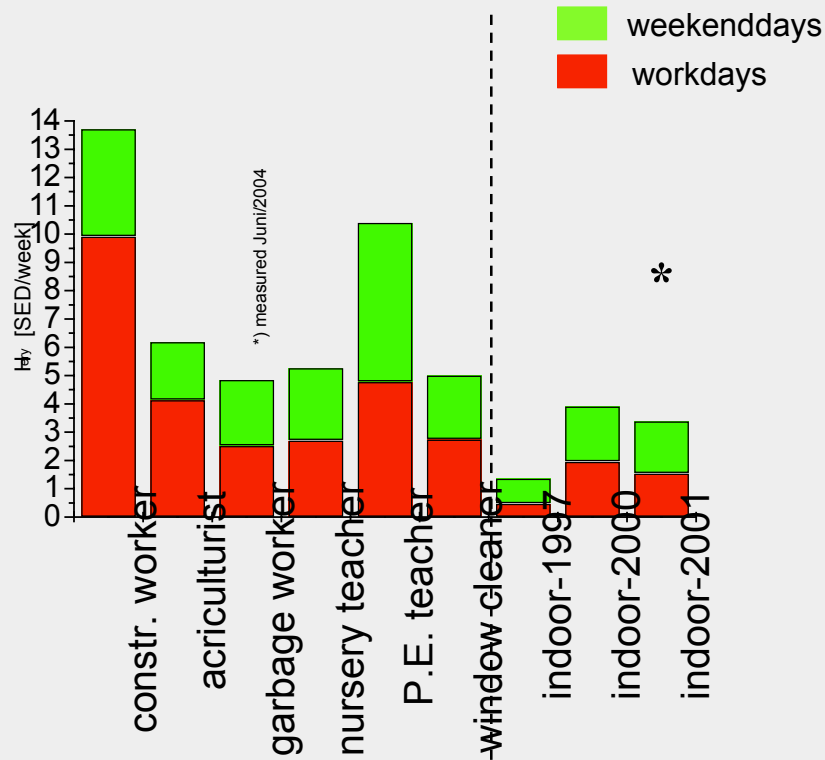


* global radiation as in 2003 / 2004

Results II

Weekly UV exposure May 2003

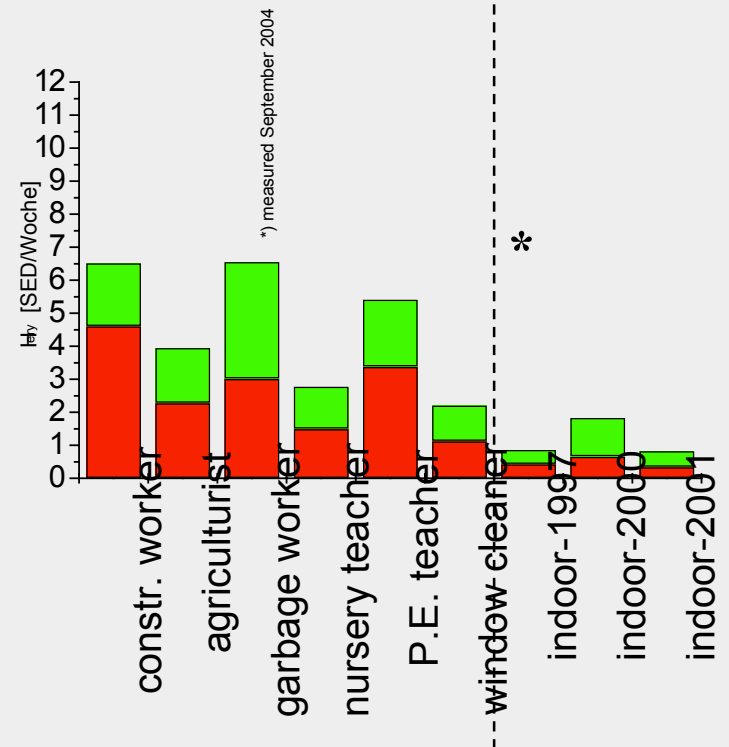
Dresden $\gamma_s = 60^\circ$



Remark: 1 SED = 100 J/m² erythema-weighted

Weekly UV exposure Sep 2003

Dresden $\gamma_s = 42^\circ$



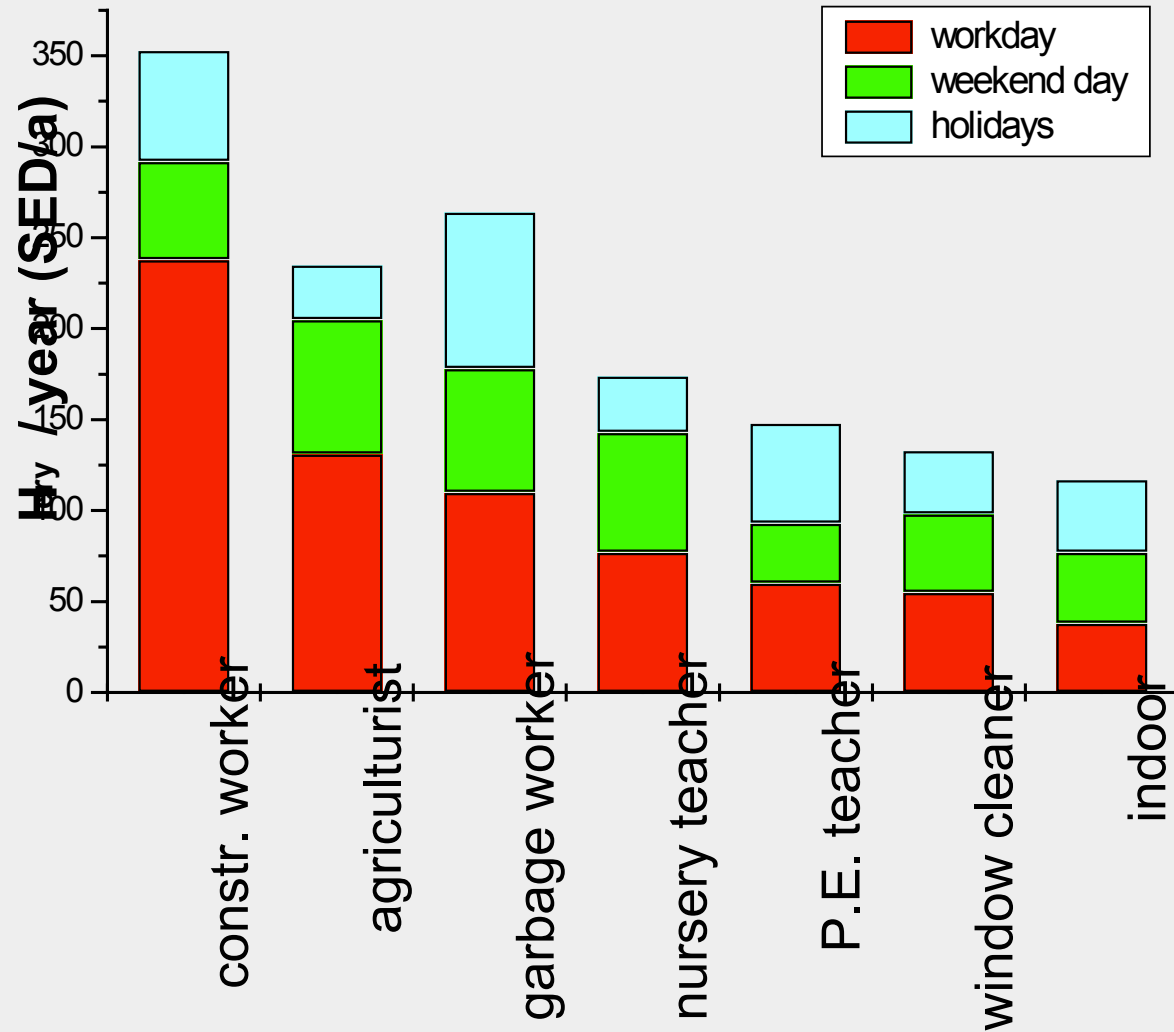
* global radiation as in 2003



Results III

Annual UV exposure 2003

Measurement period: 52 weeks of the year

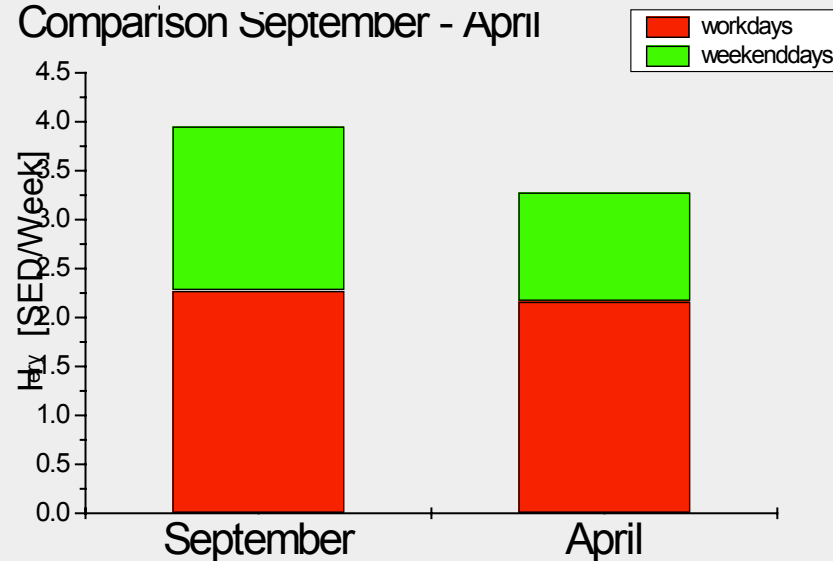


Results IV

Characteristics for agricultural workers:

- Mar – Oct:
depending on weather conditions
and specific tasks
→ work continues
through weekends and holidays
- Nov – Feb: no agricultural work is
done in this time in general
- The activities of the agricultural
workers are very varied (i.e. hard to
classify)
- Ca. 80% of the work time includes
being in a vehicle

Results: Agricultural worker
Comparison September - April



Summary

- Exposure proportion between the occupation groups
 - mainly constant during the course of the year
 - exception: P.E. teachers (season depending outdoor work)

- Outdoor profession induced increase of UV exposure on workdays:

- depends on season
- mean \approx 300%

relation to indoor workers		
	Sommer	Winter
construction workers	500 – 1000%	400 – 600%
agriculturists	250 – 500%	
garbage workers	200%	300%
nursery teacher	150 – 300%	200 %
P.E. teacher	350 – 700%	100%
Window cleaners	250%	100%

- Annual UV exposure = [workday + leisure time + holiday] exposure

Occupational percentage:

- construction worker, agricultural worker: 50...70 %
- other outdoor professions: \approx 50 %
- indoor professions: \approx 30 %

Conclusion

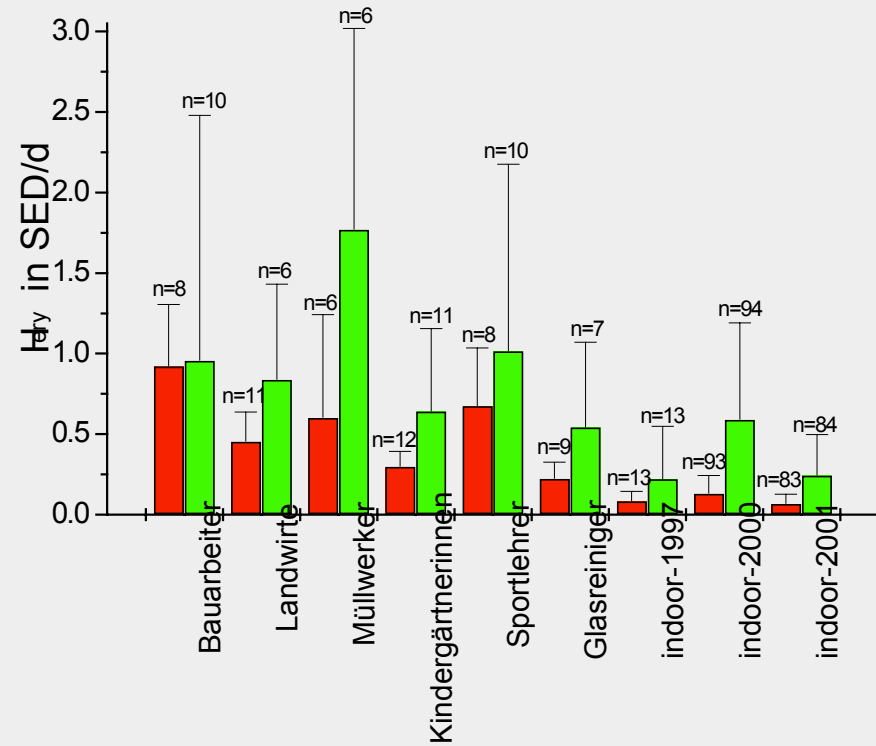
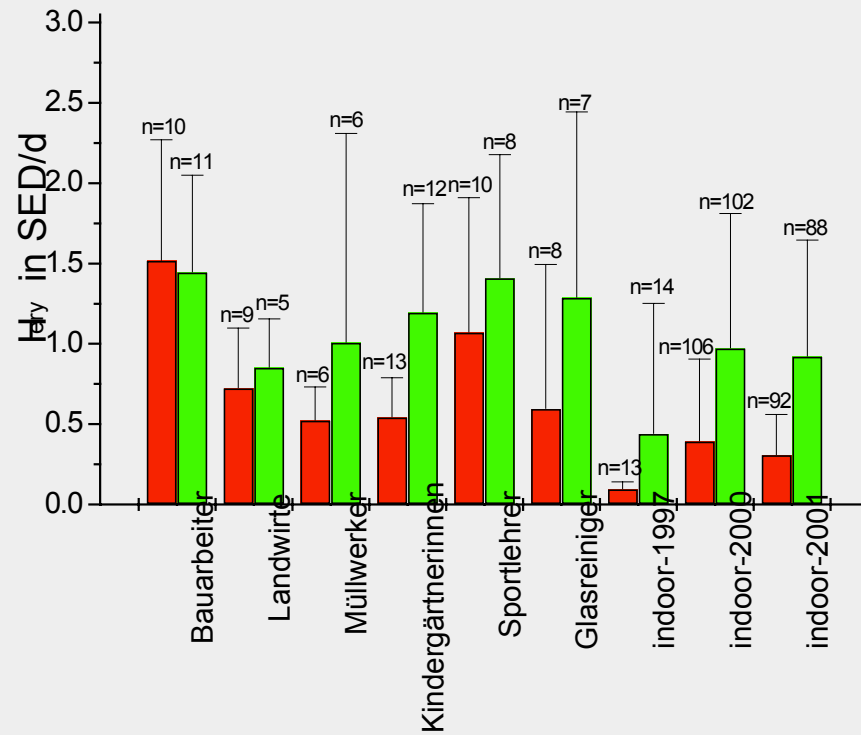
- Personal UV Monitoring is tool to measure individual biological effective UV exposure in occupational groups of outdoor worker or indoor workers.
- Annual UV exposure of outdoor workers is mainly determined by workday UV exposures.
- Health prevention concepts should be orientated to the UV exposure level in indoor workers.

*Thank you very much
for your attention!*

Backup: March - October

Sonnenhöhenwinkel 60° in Dresden 2003

Sonnenhöhenwinkel 42° in Dresden 2003

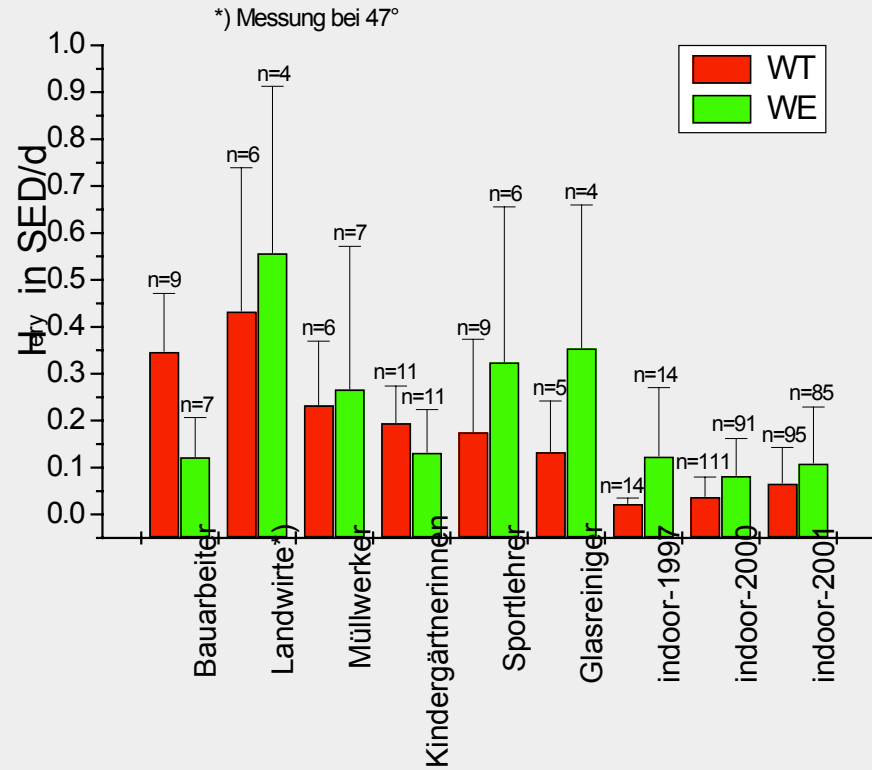
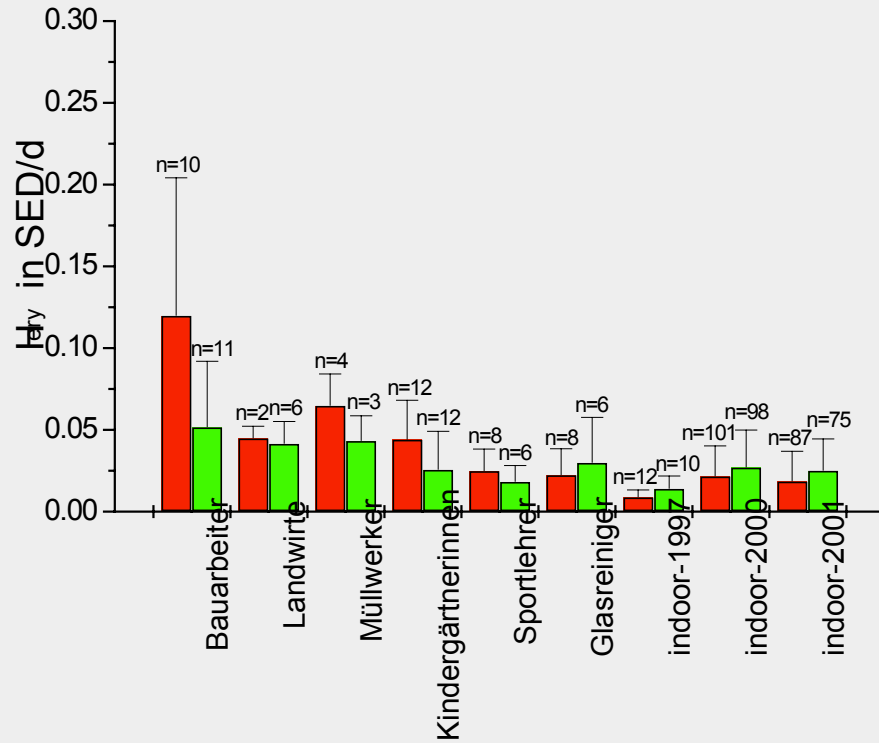


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Backup: November - February

Sonnenhöhenwinkel 15° in Dresden 2003

Sonnenhöhenwinkel 30° in Dresden 2004



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