Sunscreens: Current Test requirements

June, 2013

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OVERVIEW

- The regulatory setting
- In vivo SPF testing
- Photostability of sunscreens
- Sun protection Factor (SPF) and UVA test status

The Regulatory Setting - SA

- The Medicines & Related Substances Control Act (Act 101 of 1965 as amended)
- The Cosmetics , Foodstuffs and Disinfectants Act (Act 54 of 1972 as amended in 1981, 1986 and 2007 (Act 39 of 2007)

- SABS test standards (SANS 1557)
- The Advertising Standards Association of South Africa Code (ASA SA)
- The Cosmetics, Toiletry and Fragrance Association of South Africa (CTFA SA) Guidelines

The Regulatory Setting
Definitions: cosmetics vs medicines

- Cosmetic - SA & EU: Preparations…placed in contact with external parts (& mouth)…with a view to cleaning, perfuming, changing appearance, protection, keeping in good condition

- Cosmetic - USA: articles…introduced or applied to the human body or any part thereof for cleansing, beautifying…altering appearance. [not soaps or sunscreens]

- Medicine – SA: substance used or purporting to be suitable for a) diagnosis, mitigation or prevention of disease…b) restoring, correcting or modifying any organic function in man

The Regulatory Setting Cosmetics versus medicines
(simplified)

Cosmetic	Medicine
External use apart from mouth	Internal or external
Cleaning, protection, keeping in good condition	Restoring, correcting or modifying any organic function
Beautifying	Treating

The Regulatory Setting - SA

- ASA (SA) (Code of Practice)
  http://www.asasa.org.za
  - "Advertising is any visual or aural communication... display material, labels and packaging fall within the definition."
  - Substantiation – "Advertisers shall hold within their possession documentary evidence as set out in Clause 4.1 to support all claims.. direct or implied, that are capable of objective substantiation" e.g. survey data or based on research

The Regulatory Setting - SA

CTFA Cosmetic Compendium: Substantiation

- Claims must have appropriate scientific substantiation
- Supplier information is acceptable if a single active is used in same concentration & formulation type *[but SPF must be substantiated]*
- Claims that ingredients have special properties should be supported by acceptable scientific evidence
- Evidence judged according to international standards
- Safety assessments are required

The Regulatory Setting - Internationally

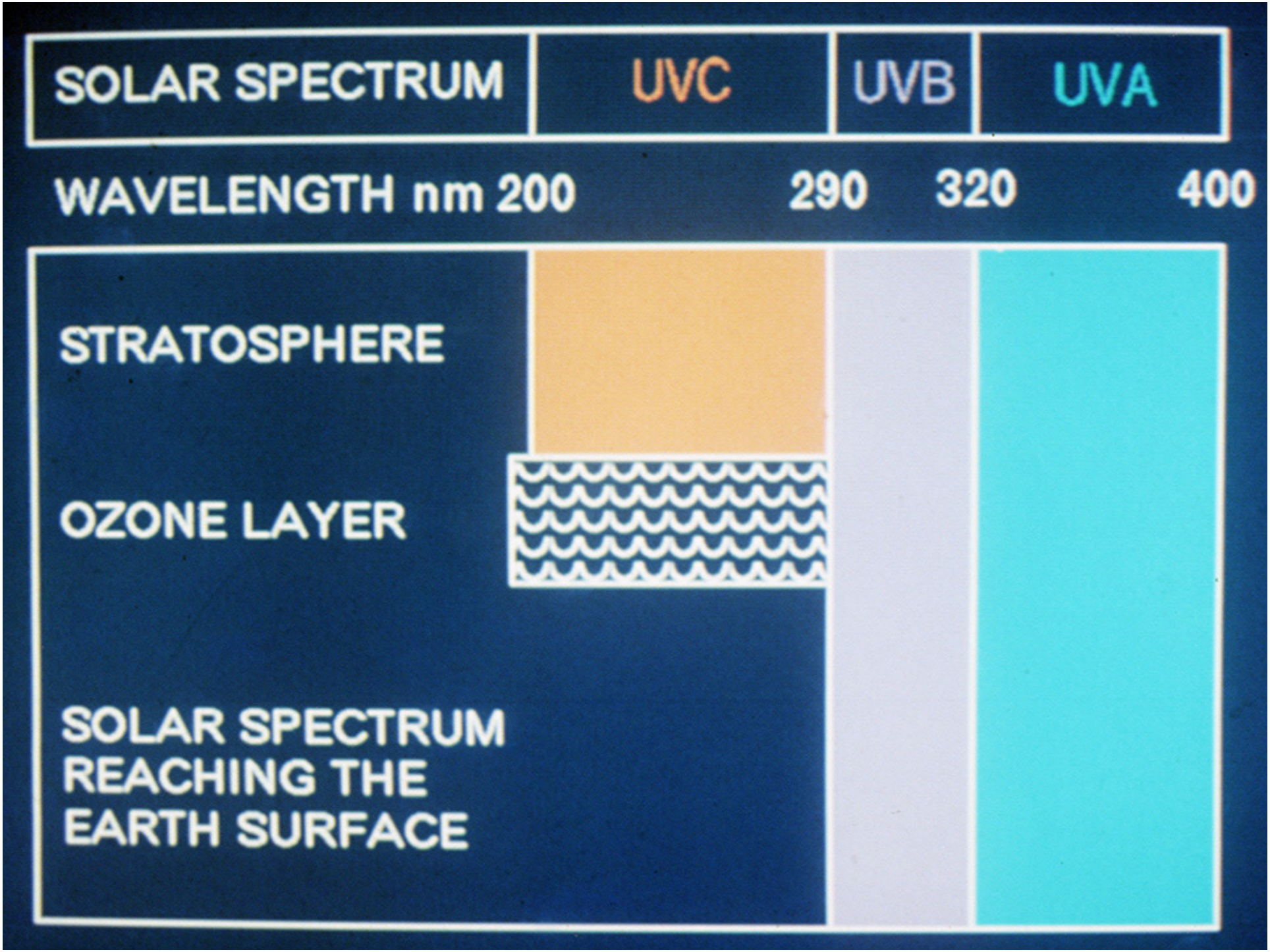
USA

- Claims must "have… reliable…substantiating data … of the type and quantity appropriate.."

UK

- Committee for Advertising Practice has strict and detailed regulations including EU safety dossier

SUNSCREEN TESTING


SOLAR SPECTRUM
UVC
UVB
UVA
WAVELENGTH nm 200
290
320
400
STRATOSPHERE
OZONE LAYER
SOLAR SPECTRUM
REACHING THE
EARTH SURFACE

in vivo SPF TEST

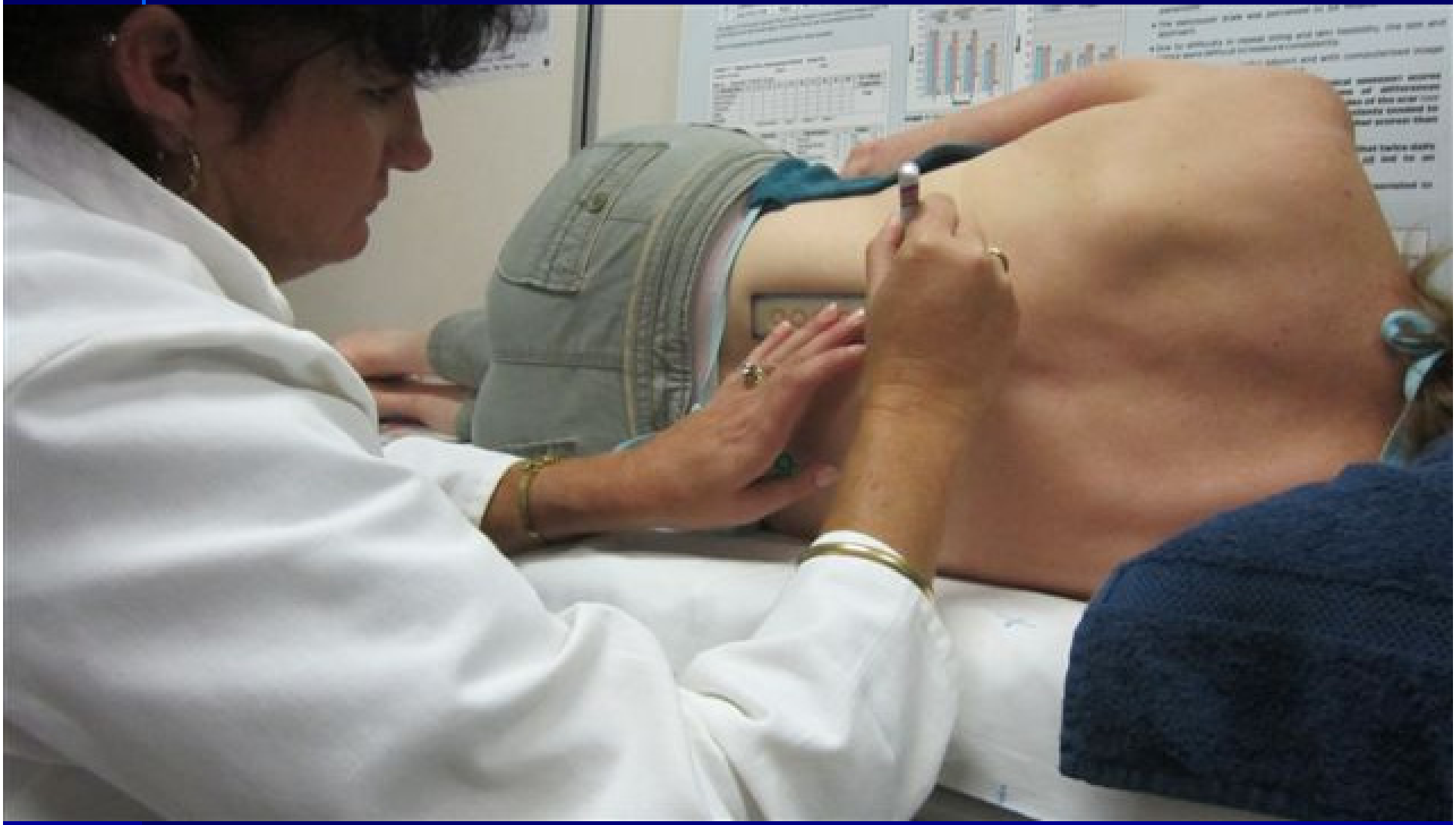
- 10 (to 25) volunteers - Phototype I-III
- application quantity - 2 mg/sqcm
- light sources - xenon arc lamps
- Irradiation through 6 incremental port settings (x1.12 around 1 MED) with lamp output measured for each test
- SPF 15 reference standard
- read 16 - 24 hours later

in vivo SPF =

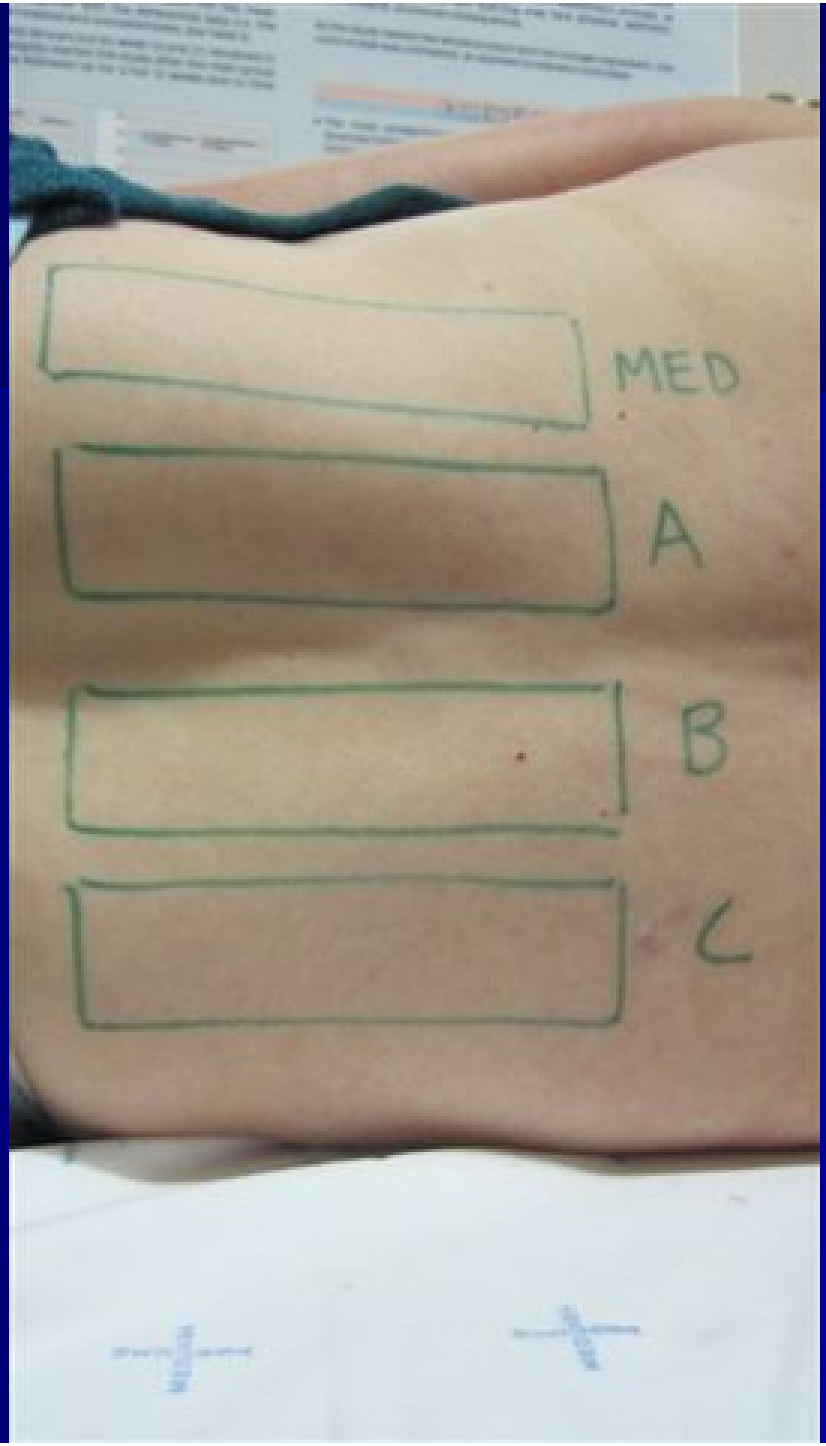
$$\frac{\text{MED protected skin}}{\text{MED unprotected skin}}$$

e.g. $\frac{150 \text{ mins}}{10 \text{ mins}}$ = SPF 15

Mark test site on untanned skin between waist and shoulder blades

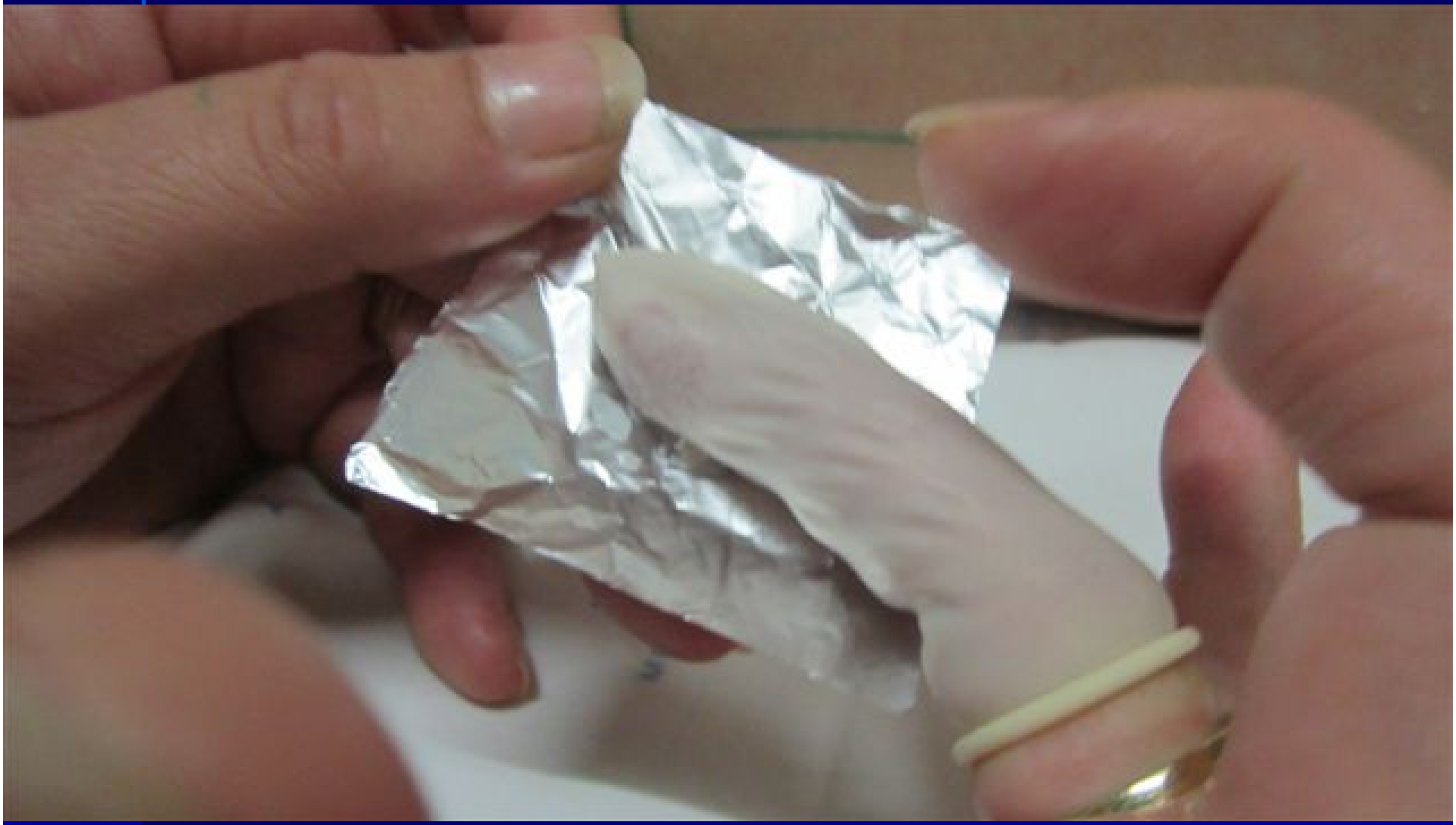


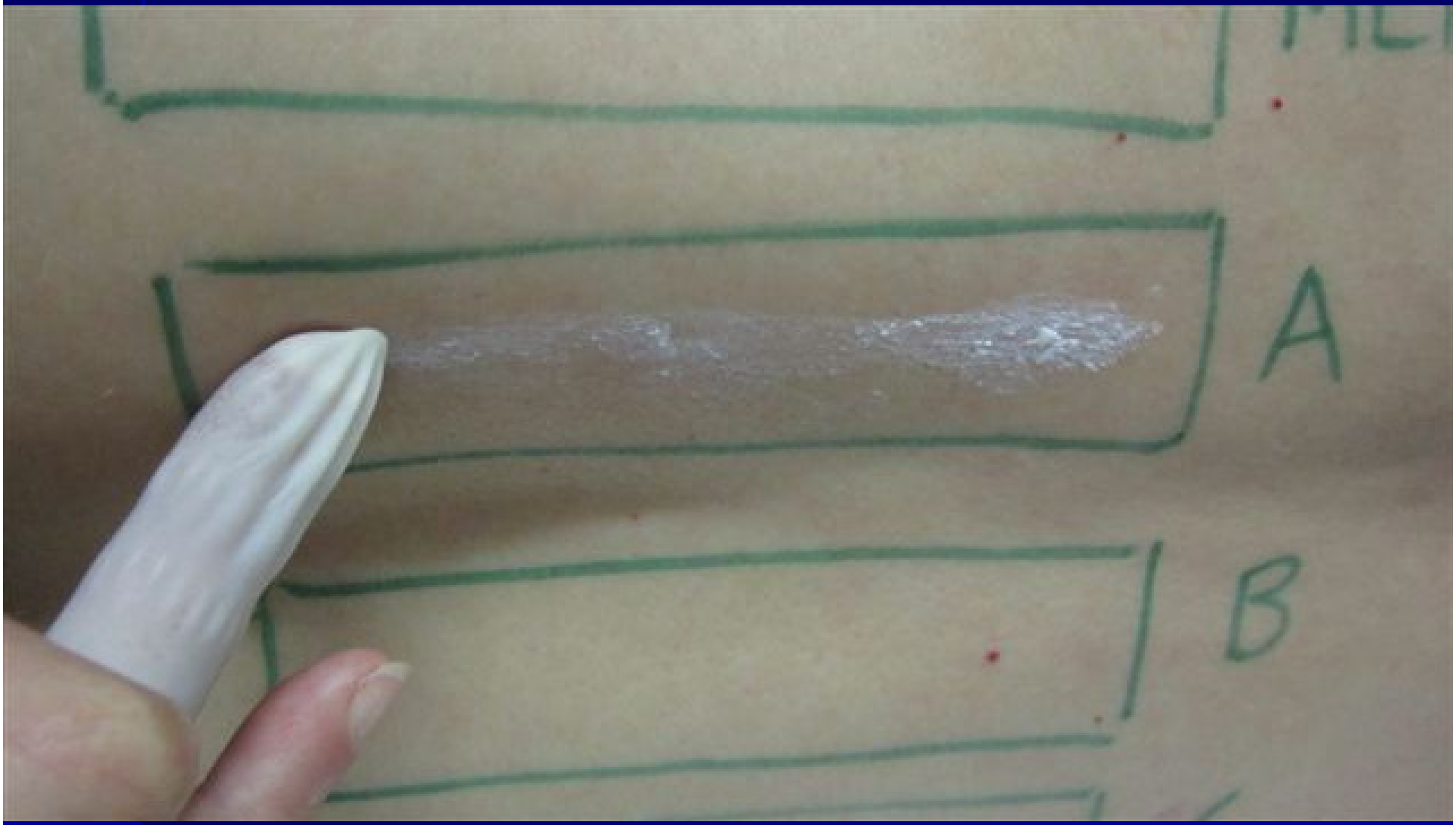
MED = untreated
Standard
Test product(s)

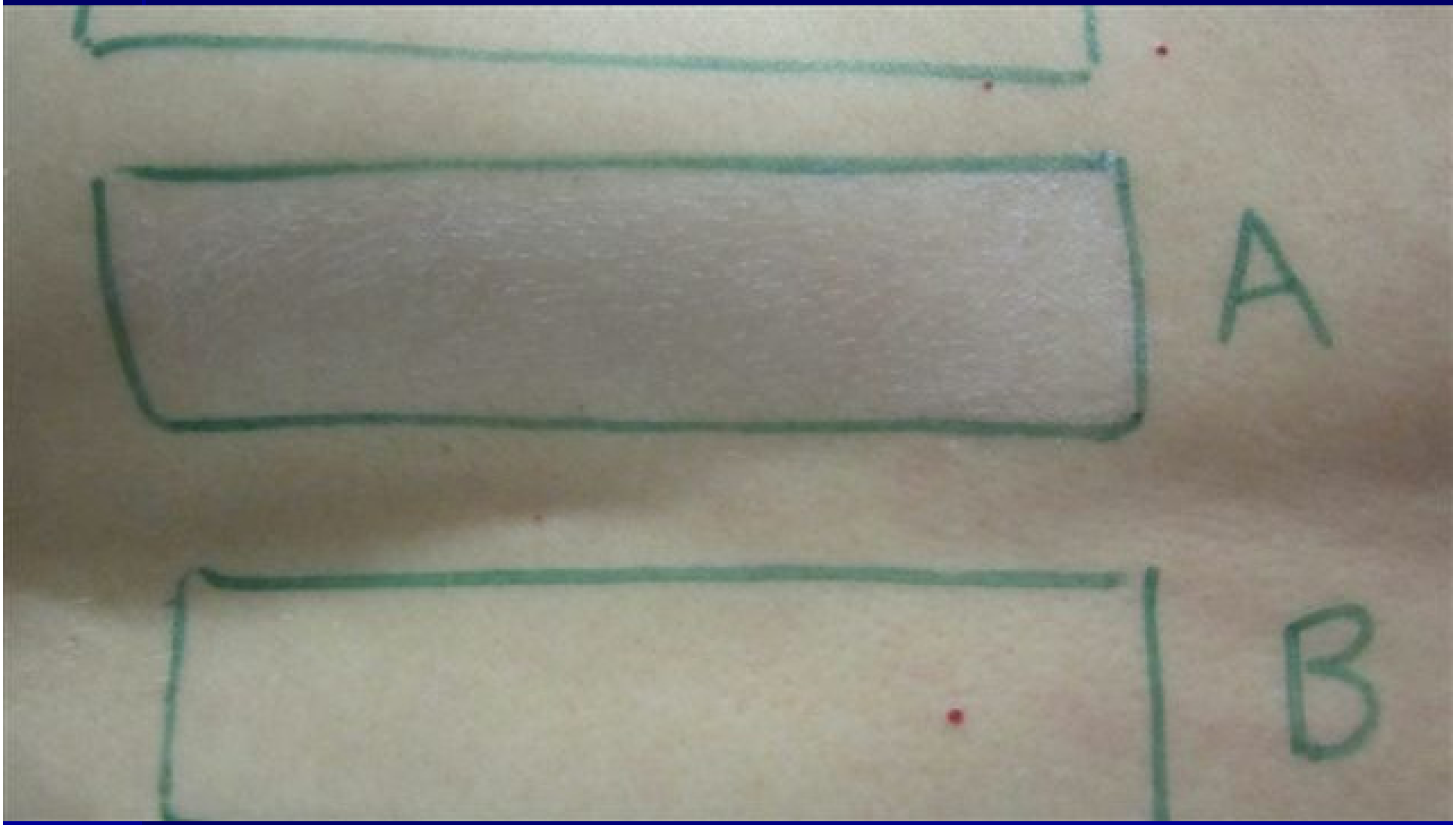


'Tare' finger cot and weighing foil

Weigh 72mg for application at 2mg/cmsq to 36 sqcm test site



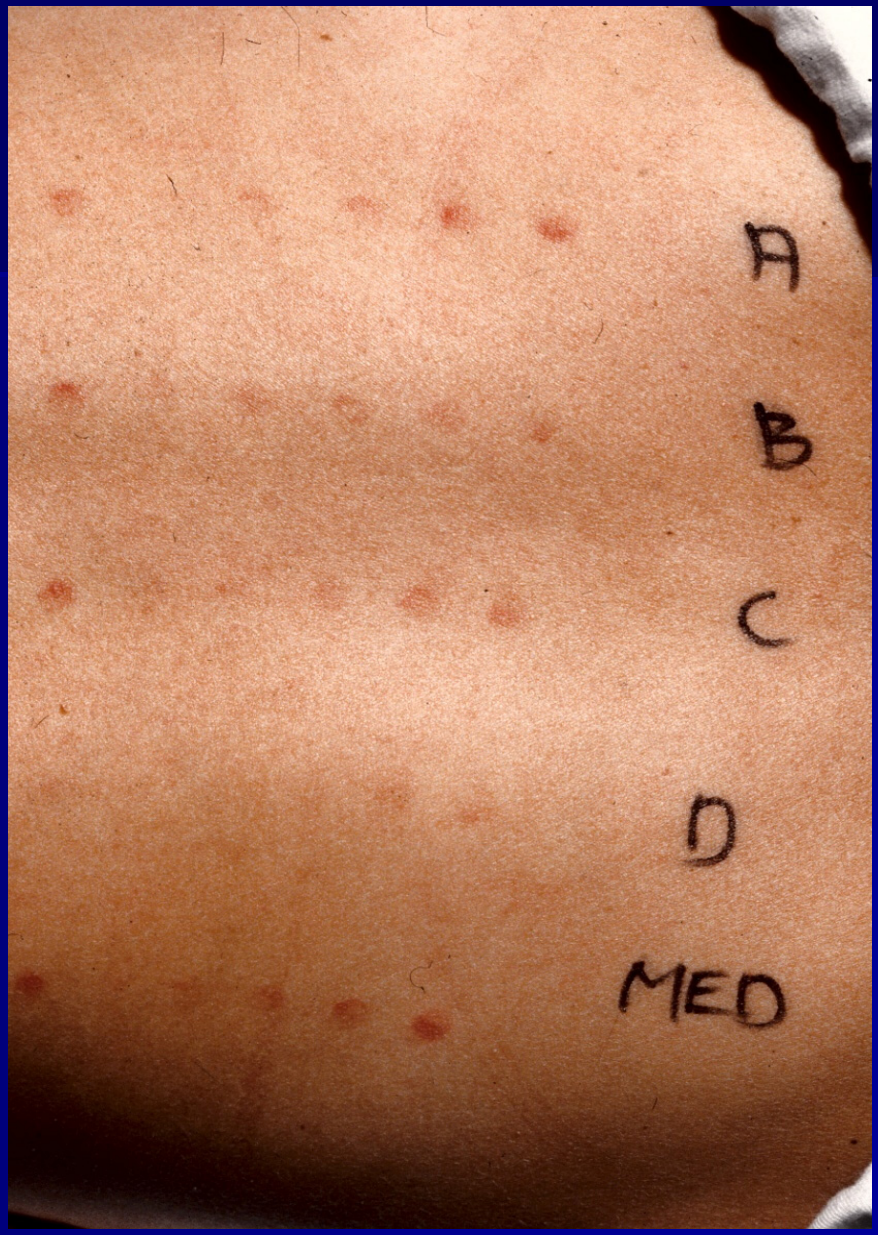

A
B


A
B

Irradiation phase


M
A
B

Assess erythema 16-24 hours later



SPF TEST CERTIFICATE
PHOTOBIOLOGY LABORATORY
UNIVERSITY OF LIMPOPO (MEDUNSA CAMPUS)

This is to certify that the formula described as

LIP BALM SPF15

supplied by

[redacted] *(PTY) LTD*

has undergone the SPF-testing procedure described in South African Standard SANS 1557/ European Colipa Standard

This product has an SPF of
16 DRY

Mean 16.6 SD 3.1 SEM 1 [5.9% of mean]
CI (95%): 14.4 18.8

Data to support this result are on file

Date: Monday, February 20, 201 **Consultant: DR BEVERLEY SUMMERS**

Certificate No.: 1841 **Signature:** BSummers

Product code: 1487

SPF in vivo test report **Photobiology Laboratory, Medunsa**

Product ID: **1487 LIP BALM SPF15** [redacted] **(PTY) LTD**

ExpectedSPF: 0

Date	Technician	Reader	Panellist ID	Gender	Age	Skin ITA	Phototyp	Dry MED (sec)	Dry Applied (g)	Dry Lamp Intensity MED (u)	Dry Lamp Intensity MED (p)	Dry SPF	Water Lamp Intensity MED (u)	Water Lamp Intensity MED (p)	Water SPF	Standard * = Water test Lamp Intensity MED (u)	Standard Lamp Intensity MED (p)	Standard SPF
13-Feb-12	ML	CM	MV	F	44	0.0	I	40	0.0712	0.81	[15x 0.81=] 12.15	15.0				0.81 [15x 0.78=]	11.70	14.4
13-Feb-12	ML	CM	CVS	F	55	0.0	II	60	0.0715	0.78	[15x 0.79=] 11.85	15.2				0.78 [15x 0.79=]	11.85	15.2
13-Feb-12	ML	CM	SB	F	39	0.0	II	60	0.0712	0.78	[15x 1.31=] 19.65	25.2				0.78 [15x 0.78=]	11.70	15.0
14-Feb-12	ML	CM	SJ	F	46	0.0	II	60	0.0716	1.00	[15x 1.03=] 15.45	15.4				1.00 [15x 1.01=]	15.15	15.1
14-Feb-12	ML	CM	MDP	F	55	0.0	II	60	0.0751	1.03	[15x 1.04=] 15.60	15.1				1.03 [15x 1.05=]	15.75	15.3
15-Feb-12	ML	CM	VN	F	41	0.0	II	60	0.0709	1.02	[15x 1.03=] 15.45	15.1				1.02 [15x 1.05=]	15.75	15.4
15-Feb-12	ML	CM	AP	F	34	0.0	II	60	0.0727	0.76	[15x 0.85=] 12.75	16.8				0.76 [15x 0.76=]	11.40	15.0
20-Feb-12	ML	CM	NJ	F	40	0.0	II	60	0.0707	0.78	[15x 0.83=] 12.45	16.0				0.78 [15x 0.82=]	12.30	15.8
20-Feb-12	ML	CM	VS	F	38	0.0	II	60	0.0709	0.76	[15x 0.83=] 12.45	16.4				0.76 [15x 0.83=]	12.45	16.4
21-Feb-12	ML	CM	MF	F	50	0.0	II	60	0.0718	0.77	[15x 0.8=] 12.00	15.6				0.77 [15x 0.83=]	12.45	16.2

Reasons for exclusion:

SPR: Spreading difficulty
LA: Low application mass
M: Panellist moved
PI: Power interruption
UP: Uneven pressure (skin curvature)
L: Outside limits
ALL: Allergic reaction
NSQ: Non-sequential pres of spots
PS: Photosensitivity reaction
CT: Cold Test affected results
O:Other
MED: erratic or not showing

n (Dry) = 10
t (Dry) = 2.262
n (Water) = 0
t (Water) =

	Product (Dry)			Product (Water)	Standard (Dry)	Standard (Water)
n	10			0	10	0
Mean	16.6				15.4	
SD	3.08				0.58	
CI(95%)	14.4	18.8			15.0	*15.80*
c(% of Mean)	*13.3%*				*2.7%*	

Water resistant test

- As per dry test BUT two sites on same person on same day or on two consecutive days
  - One dry (static) pre-immersion
  - Immersion
  - One test post immersion

Water resistance (old requirements)

- Retains 70% of dry SPF after 2 x 20 mins in water (spa bath 26-30 deg C)

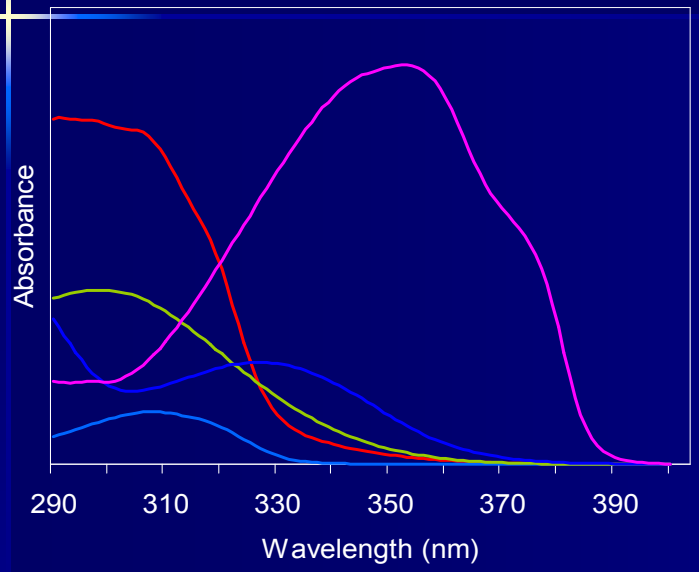
Water resistance (in SANS 1557)

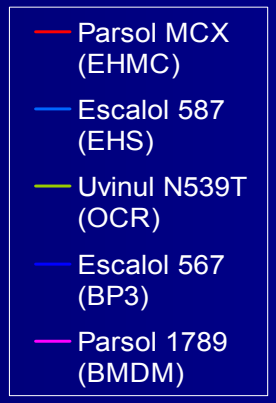
- Water-resistant - Two periods of 20 minutes. The value for the 90% lower CI must be >=50% of mean dry SPF
- Very Water resistant - Four periods of 20 minutes. The value for the 90% lower CI must be >=50% of mean dry SPF

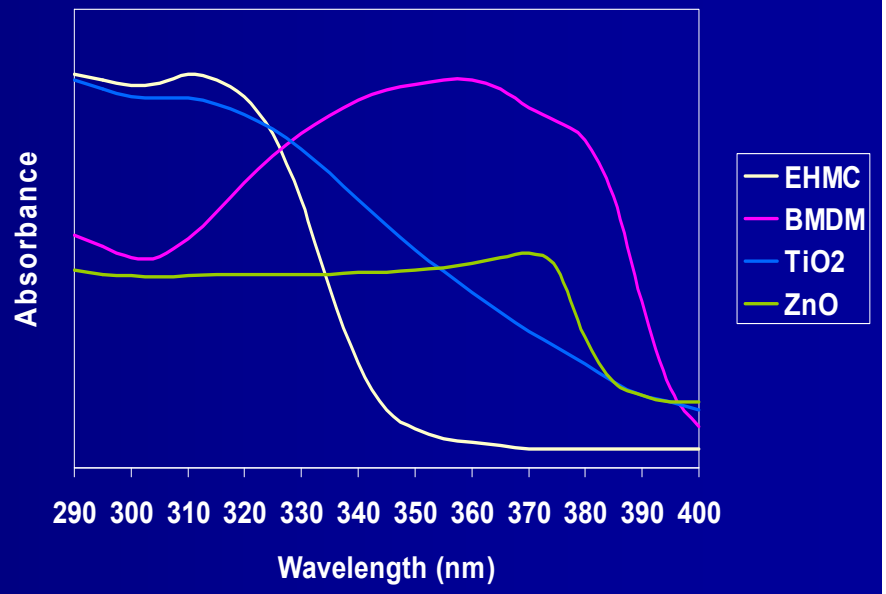
What about UVA:B balance?

- Tested via the *in vitro test (*spectrophotometry)
- The issue is photostability

UV organic filters (absorbers) and inorganic pigments (reflectors)





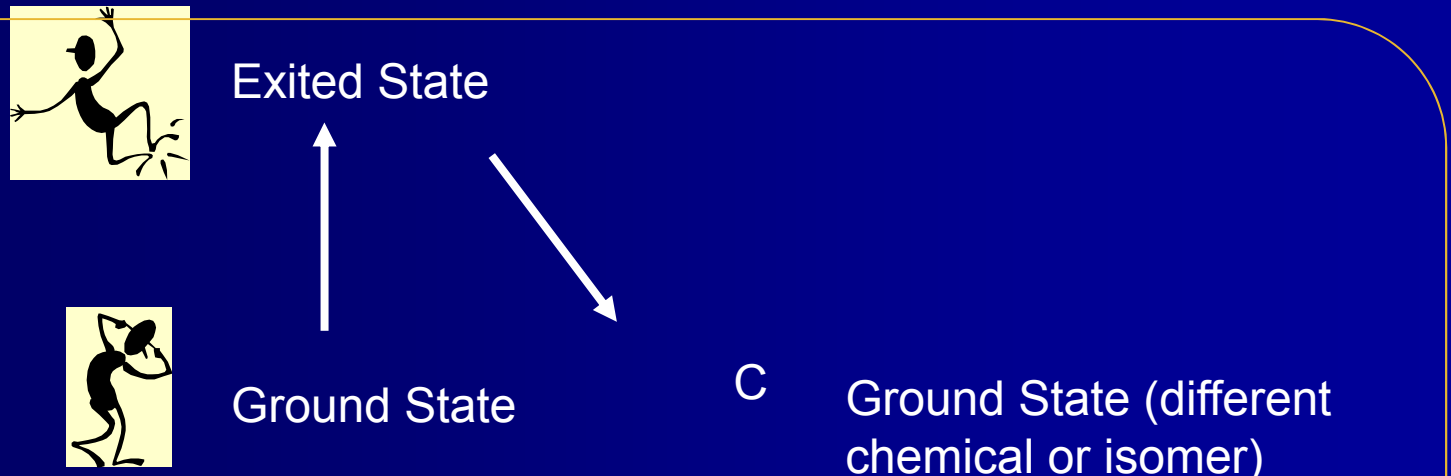


RECENT ISO UVA *in vitro* TEST TAKES PHOTOSTABILITY INTO ACCCOUNT

HOW PHOTOSTABLE ARE SUNSCREENS?

What happens to the energy that is absorbed?

Substances that undergo change are not photostable



PHOTOSTABILITY

Excellent photostability:

Octocrylene

- Phenylbenzimidazole Sulfonic Acid
- Benzophenone-3 / Oxybenzone
- **4-Methylbenzylidene Camphor**
- Ethylhexyl Salicylate

Good photostability;

Ethylhexyl p-Methoxycinnamate (Octyl methoxycinnamate)

Poor photostability:

Butyl Methoxydibenzoylmethane

PHOTOSTABILITY

Options to stabilise BMDM

UVA **Butyl Methoxy Dibenzoyl Methane**

UVB

OCTOCRYLENE
photostable
- patented*
  (L'Oreal)

Me Benz Camph
photostable
- non patented - when used below 4%
- NOT APPROVED IN US and Japan

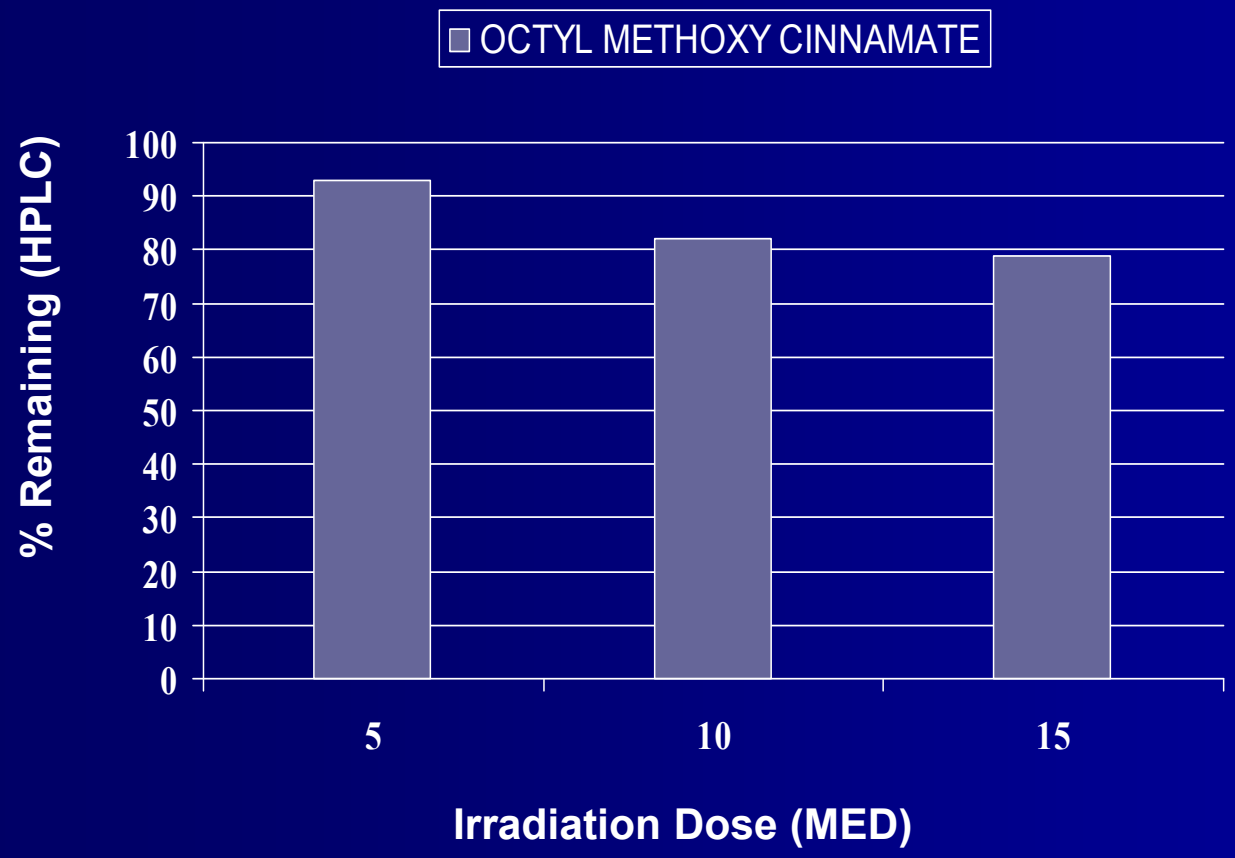
Diethylhexyl naphthalate
photostable
- Symrise patented
  (WO 91/11989)

*Patent is revoked since November 2004 in Europe

Or - Use pigments
- which do not photodegrade

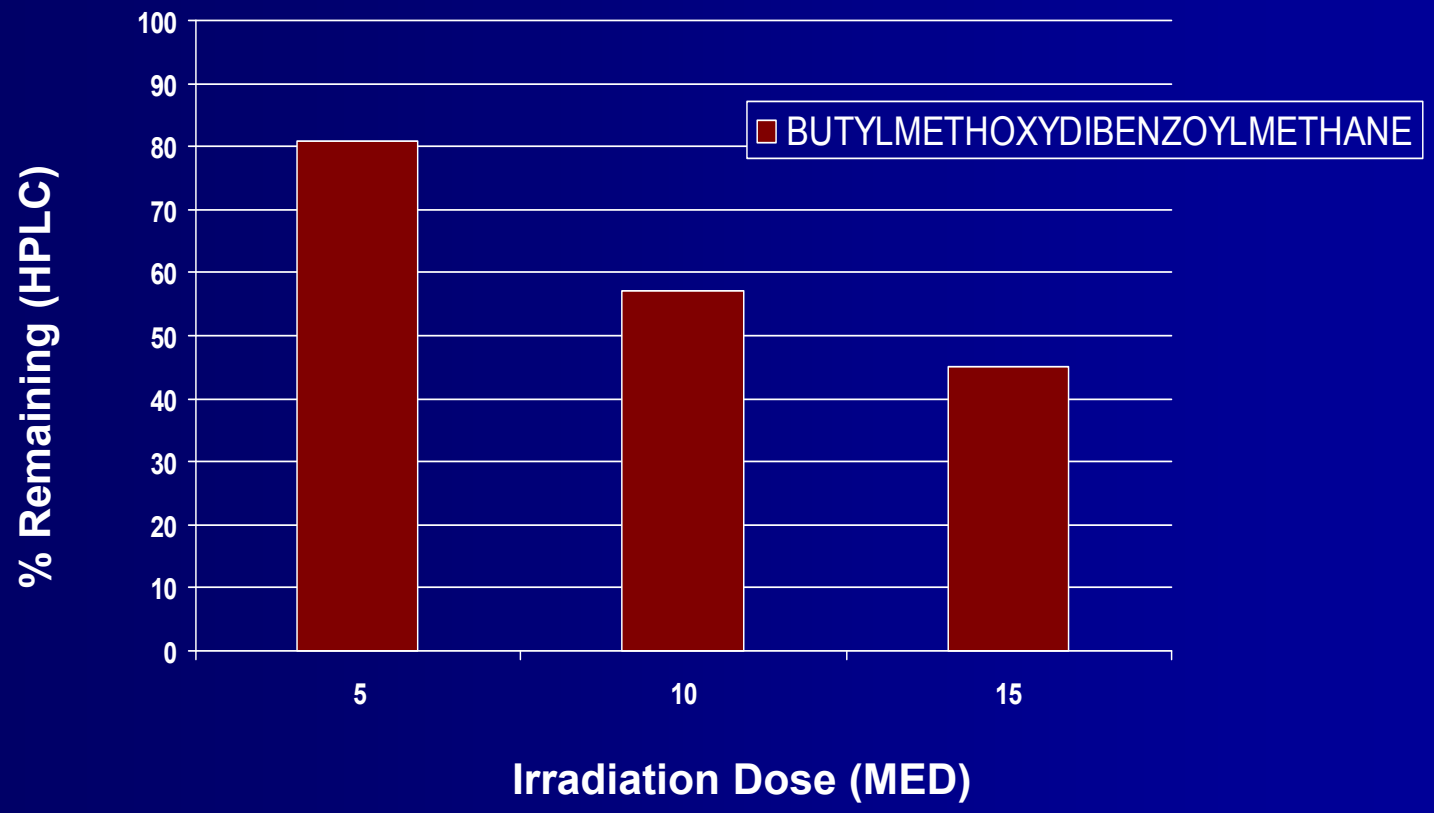
PHOTOSTABILITY

Example of a UV aborber with good (but not excellent) photostability



PHOTOSTABILITY

Example of a UV absorber with poor photostability



SUNSCREEN TESTING IN PRACTICE in SA

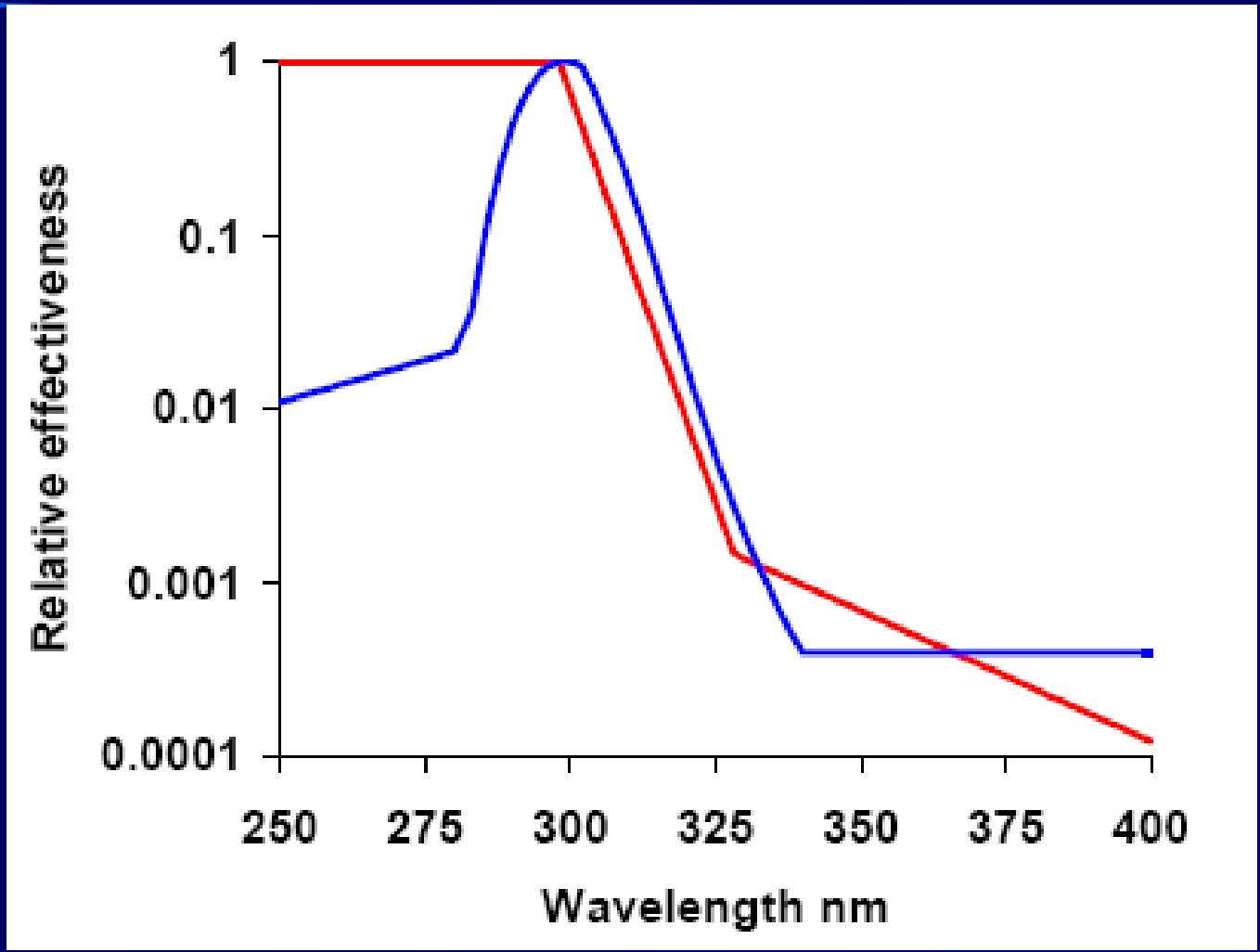
- ***in vivo* SPF static/dry** (SANS 1557/ ISO 24444)
- ***in vivo* SPF water** (SANS 1557/ "COLIPA")
- ***in vitro* A** (old method SANS 1557) will soon be replaced by SANS 24443

In vitro UVA test : SANS 1557

- Test method used to be in SANS 1557:2009.
  - No longer in SANS 1557:2012, due to ISO approach of separate tests in separate standards.

- SANS 1557:2009 (in place at time CANSA UVA tests were performed) only stated re UVA that:
  - UVA protection claim must be substantiated by documented results
  - **'Broad spectrum' UVA:UVB at least 0.4:1**

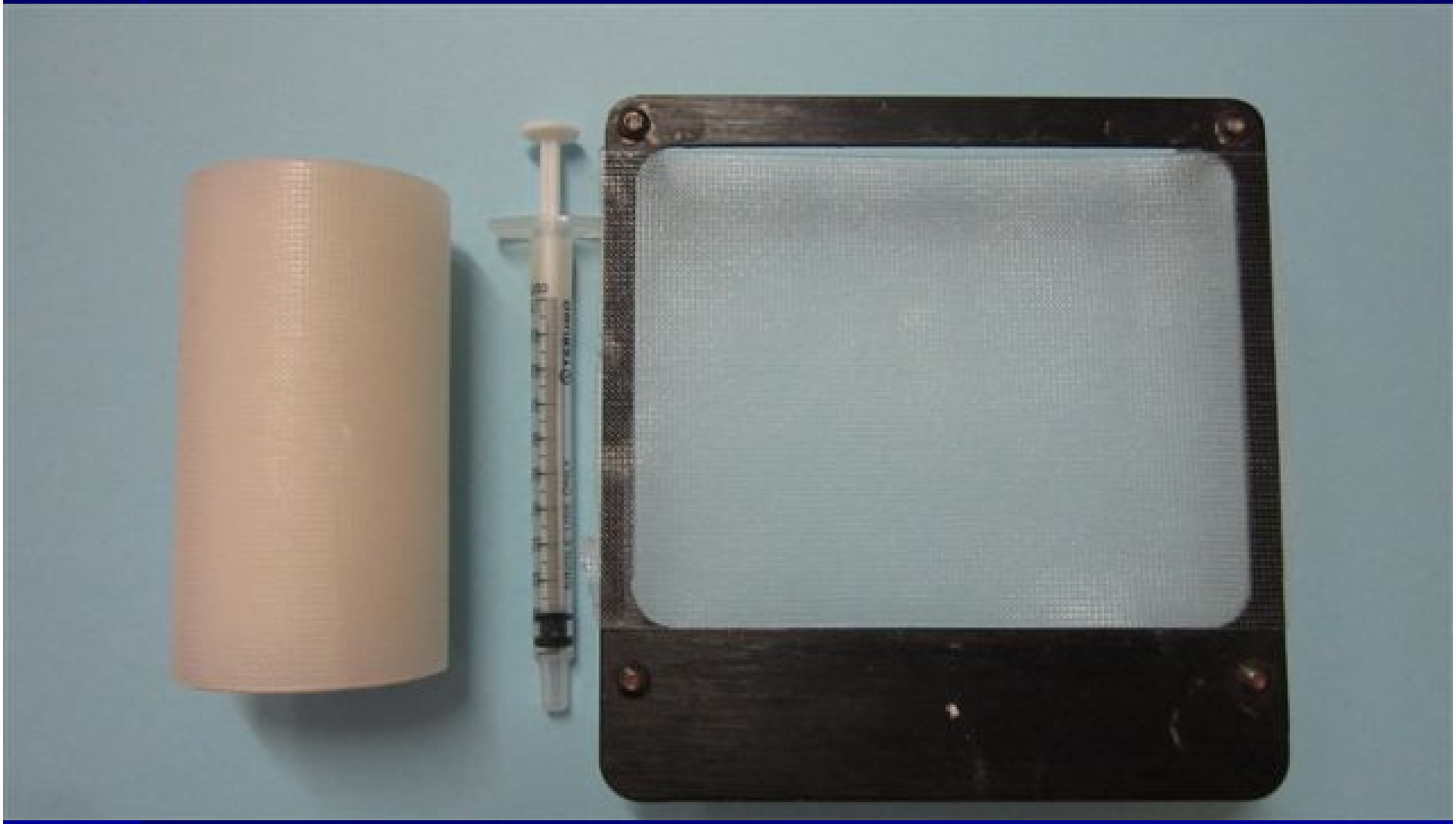
UVA tests *in vitro* - use a calculation based on the mathematical integration of the UV radiation strength (transmission) at a given wavelength with the erythema induced per unit of energy at that wavelength



Sunscreen testing (*in vitro A*) 'old' method

Scan Transpore ™ blank, then with applied product – four scans on each of three plates (12 scans in total)

Transpore tape as substrate



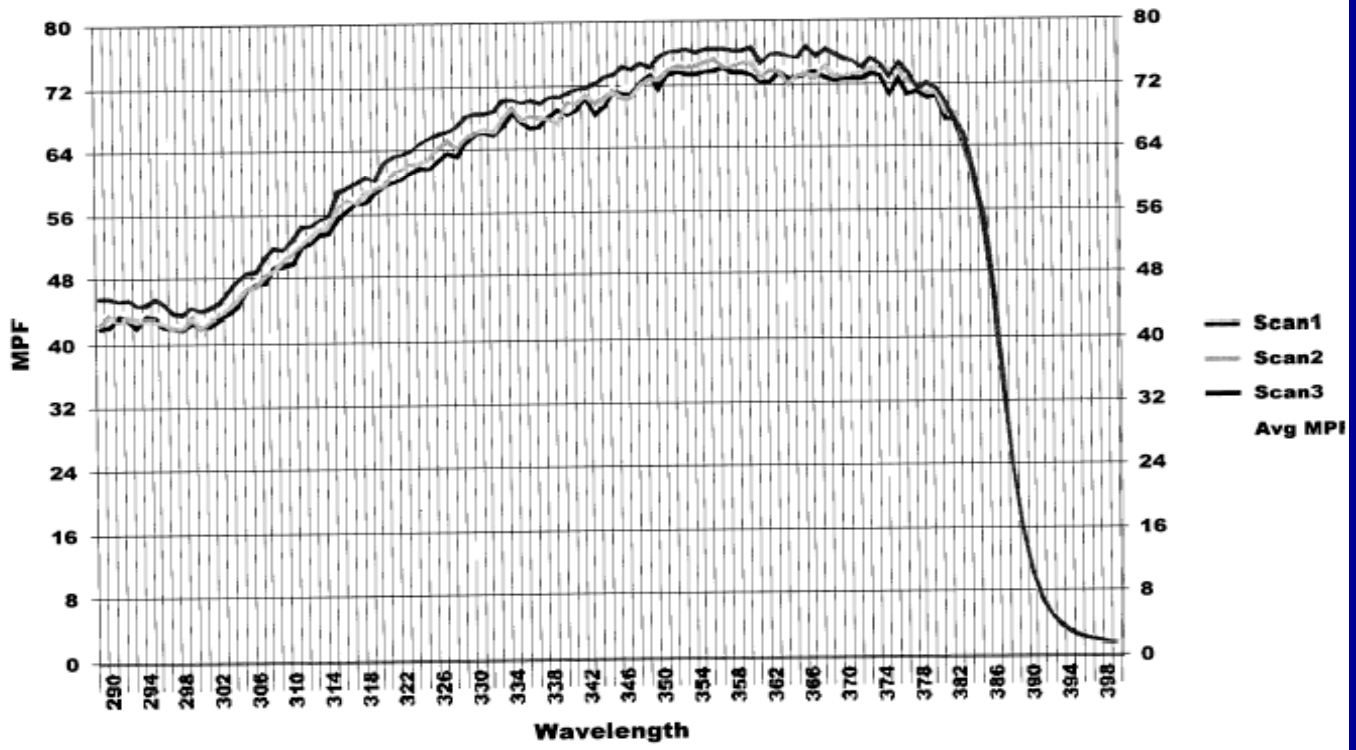
Software calculates :
UVA:UVB ratio, Average UVAPF, Critical Wavelength, Area under curve, Star rating

Summary Results

	Value	STDV
Solar Protection Factor:	46.45	1.11
UVA/UVB ratio:	0.991	0
Boots Star Rating:	5	Ultra
Average UVA PF:	57	1.03
Erythemal UVA PF:	39.32	0.58
Critical Wavelength:	383.1	0
Curve Area:	183.64	0.9

Measurement Parameters

Parameter	Value
SPF STDV:	Classical
Excluded Runs/Scans:	
Operating Mode:	Standard
Assay STDV:	N/A
Assay Skip Ref:	N/A
Time-Based Mode:	N/A
Time-Based Delay:	N/A



LIP BALM SPF15 **Our ref:** **1487 / 1849**

IN VITRO **SPF TEST RESULT**

The product has undergone the in vitro SPF testing procedure as developed by Diffey and Robson, on the Optometrics SPF 290 Analyser, with the following result:

Solar protection factor: 45.9; standard deviation: 13.4

This result cannot be used to support advertising claims for Sun Protection Factor(SPF) purposes, only for broadspectrum or UVA claims.

UVA/UVB Ratio:	UVA/UVB Ratio: 1; standard deviation: 0
Boot's Star Rating:	5
Average UVA PF:	60.7; standard deviation: 18.2
Erythemal UVA PF:	39.2; standard deviation: 6.7
Critical Wavelength:	382; standard deviation: 0.3

Please note: The in vitro SPF test data should ideally be used as an indication of UVA protection and as a quality assurance tool. For some products the in vitro SPF correlates well to the in vivo SPF, but for many products this is not the case. Therefore, the in vitro test result can safely be used for checking UVA protection and batch-to-batch variation, but not as a predictor of in vivo SPF.

Yours sincerely

B Summers

DR BEVERLEY SUMMERS

MANAGER: PHOTOBIOLOGY LABORATORY

Monday, February 20, 2012

BUT NOW WE MUST TEST FOR UVA PHOTOSTABILITY

- i.e. Scan, irradiate, scan, calculate
- Instead of previous test i.e. scan, calculate

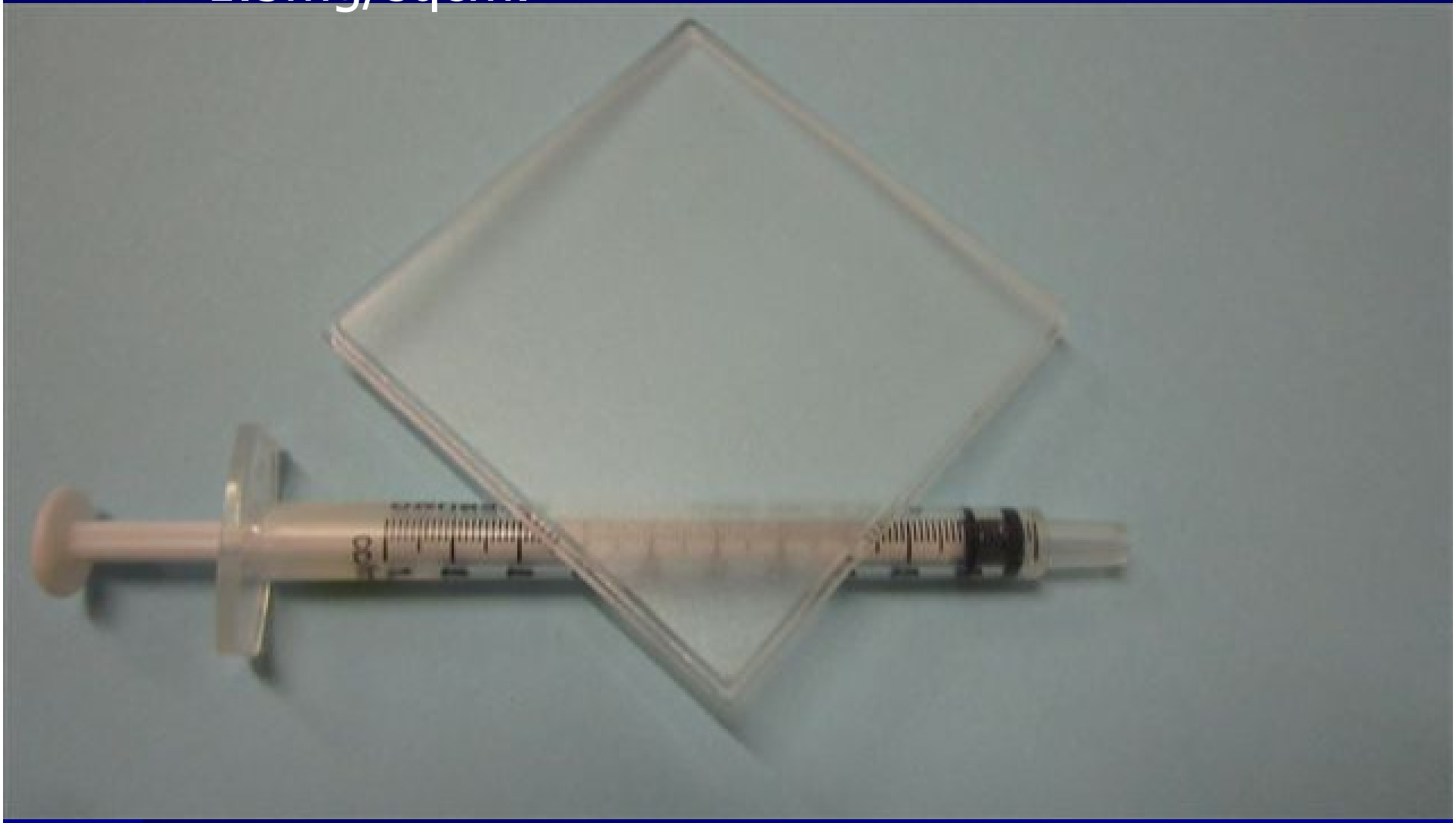
Sunscreen testing (*in vitro A*) new ISO 24443 method

(refinement of old COLIPA test)

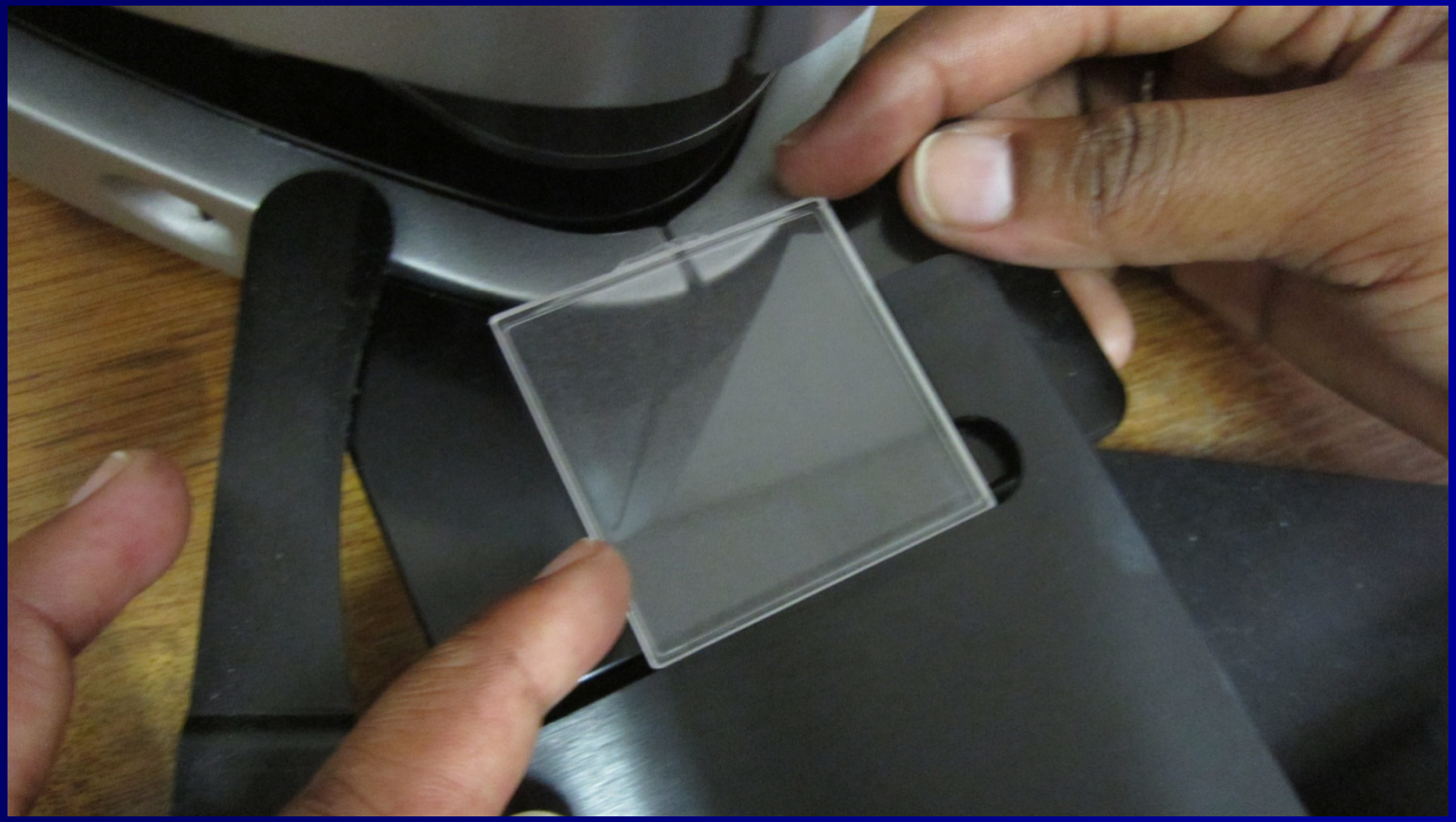
- Pre-treat PMMA plate with glycerin and scan (Labsphere)
- To a new PMMA plate, apply product at 1.3mg/sqcm. Dry in dark for 15 mins. Scan 3 plates in 5 positions (15 total)
- Calculate UV radiation level (computerised calculation related to **in vivo SPF** of test sunscreen)
- Irradiate product-treated plates with calculated amount of UV
- Scan 3 product-treated plates (5x each) post-UVA irradiation.
- Calculation of UVA/UVB protection based on above process.
- **NB** *This method pre-supposes that we have a known in vivo SPF for the product*

ISO 24443 in vitro SPF test (using Labsphere)

To a new PMMA plate, apply product at 1.3mg/sqcm.



Dry in dark for 15 mins. Scan



UV irradiation level

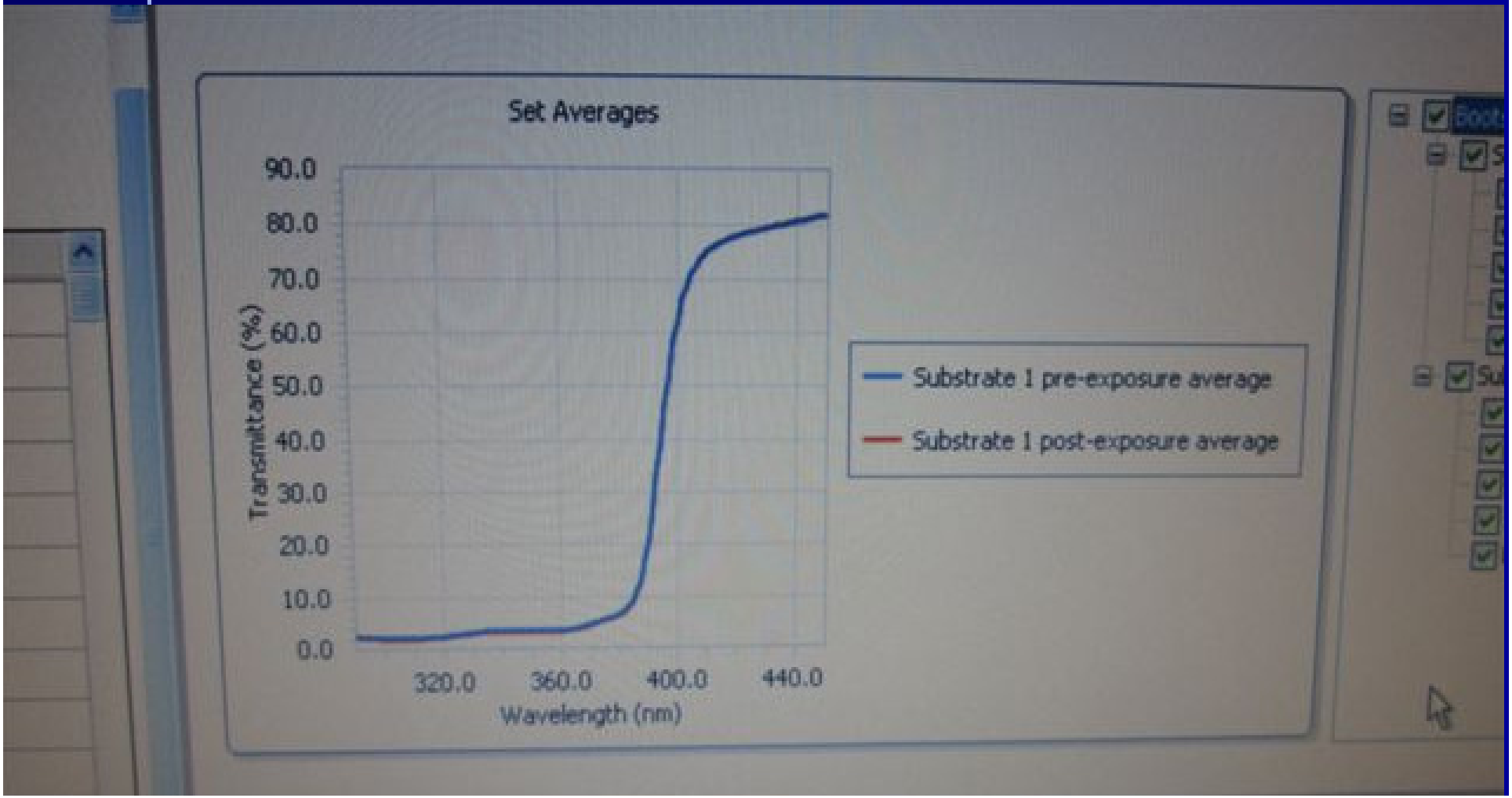
- equivalent to that for expected *in vivo* SPF of the sunscreen

Irradiate product-treated plate with calculated amount of UV in each scan position (3 plates x 5 scans)

Scan product-treated plate post-UVA irradiation.

Calculation of UVA/UVB protection based on above process

Final UVA-PF must be at least 1/3 of SPF i.e UVB:UVA ratio = 1:>0.33



PROGRESS with sunscreens

- 1965 Sunscreens were classified as medicines (Act 101)
- 1972 List of permitted filters
- 1973 Registration call
- 1984 1st survey - no info on tested products
- 1989 COSLAG formed + local lab.
- 1991 54% products claimed tested
- 1992 SABS sunscreen standard. SANS 1557
- 1993 70% products claimed tested
- 1994 CTFA/ASA codes
- 1997 87% products tested (42% provided certificates)
- 2000 Intl. test harmonisation proposed by CTFA SA
- 2002 Intl. test method agreed by COLIPA, CTFA SA, JCIA
- 2006 ISO process started

ISO/SABS current sunscreen test situation

ISO process: NWIP→Tech Report→WD → DIS→FDIS →ISO Std

- ***in vivo* SPF (ISO 24444)** (Full IS - Nov 2010. *N.B.* dry test only). Adopted in SANS 1557 Dry *+ WR from old SANS*
- ***in vivo* A (ISO IS 24442)** based on PPD. IS but NOT SANS – no demand in SA
- ***in vitro* A (ISO IS 24443)** (originally based on COLIPA test) Full International Standard , late May 2012. Due to be SANS 24443 (voting closed early 2013)
- ***in vitro* SPF (ISO WD 24445)** stopped – out of time
- **Water-resistance (NWIP 208**). *(SANS 1557 updated to align with COLIPA requirements*)
- Irritancy Patch Test no longer in any standard but required by CANSA

"Sunscreens should be registerable as medicines" ???

- Sunscreens were classed as medicines in SA and called up for registration in 1972 but no follow up from MCC. Not one product was registered. No standards for efficacy. Only after PASA action in late 1980s that an SA test lab opened and SABS standard was developed. Product protection levels and spectra quality subsequently improved via 'policing' from ASA and CANSA.
- Sunscreens are medicines in Australia (TGA) and USA (FDA). Changes to permitted filter lists are slow in USA (NDA) – BMDM only allowed on list decades after available in Europe & SA.
- Australia – registration process has cost implications and changes to Australia/NZ standards slow.
- Medicines are expensive – so is medicine route advisable?

Declaring my interests in sun protection

Thank you

"Outrageous.. CANSA allow their logo to be used by products that don't meet standards"

- The products met the SPF standard AND the 1:>0.4 UVB:UVA ratio (SANS 1557) – but not the May 2012 ISO UVA *in vitro test* post-irradiation UVB:UVA ratio of 1:>0.3 (and we don't know by how much they failed)
- It is impossible to obtain high SPF without substantial UVA protection
- No hard data on what UVA-PF is required in SA (What are UVA radiation levels in SA?)
- ISO UVA test uses product SPF (30 or 50) for irradiation – but max MEDs/day in SA is 35 (dawn to dusk) even in summer. Would a sun-conscious person use one application of sunscreen and stay out for whole day without re-applying?

CONCLUSIONS

- Products tested had SPF and UVA test data that complied with the existing requirements.
- They were not tested for photodegradation, which occurs with a limited number of UV filters (esp. UVA filter butylmethoxydibenzoytlmethane)
- Photodegradation does NOT occur with the inorganic sunscreen pigments.
- Daily UVAPF required is not known. UVA levels in South Africa not thought to exceed 7 UVAPFs a day (SPF 30 product would have to have UVAPF of >7.5. to pass ISO test)
- **Unlikely that the products posed any danger in their use, if re-applied regularly as recommended.**