Sun Safety at Work…with a focus on skin cancer prevention

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Presentation Overview

- Adverse health effects of solar UV
- Occupational skin cancer & heat stress
- Occupational sun exposure – exposure #'s, levels, etc.
- Control of occupational sun exposure
- Sun safety programs & Sun Safety at Work Canada
- Conclusions & future challenges

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Adverse Health Effects of Solar UV

Skin:

- Erythema (S)
- Chronic sun damage (V)
- Photodermatoses (S)
- Basal cell carcinoma (S)
- Squamous cell carcinoma (S)
- Malignant melanoma (S)

(Based on: Armstrong, 1994; Armstrong & Kricker, 2001; Oliva & Taylor, 2005)

Eyes:

- Climatic droplet keratopathy (L)
- Pinguecula (L)
- Pterygium (L)
- Photokeratitis (S)
- Cortical Cataract (S)
- Solar retinopathy (S)
- Uveal melanoma (S)
- AMD (I)

Weight of evidence: S = sufficient, L = limited (suggestive, not conclusive), I = inadequate, V = variable

Occupational Sun Exposure & Skin Cancer

- Non-melanoma: 78,300 new cases expected in 2015
- Melanoma: 6,800 new cases expected and 1,170 deaths expected in 2015; rates are increasing
  (Canadian Cancer Society, 2015)
- Most important risk factor is exposure to ultraviolet (UV) radiation (Elwood, 2004)
- Most important factor in determining level of UV exposure is outdoor work
  (Kimlin & Tenkate, 2007)
- Skin cancer is largely preventable (Canadian Cancer Society, 2014)


Basal Cell Carcinoma


Melanoma

(Photo source: Emery, in: Slevin (2014))

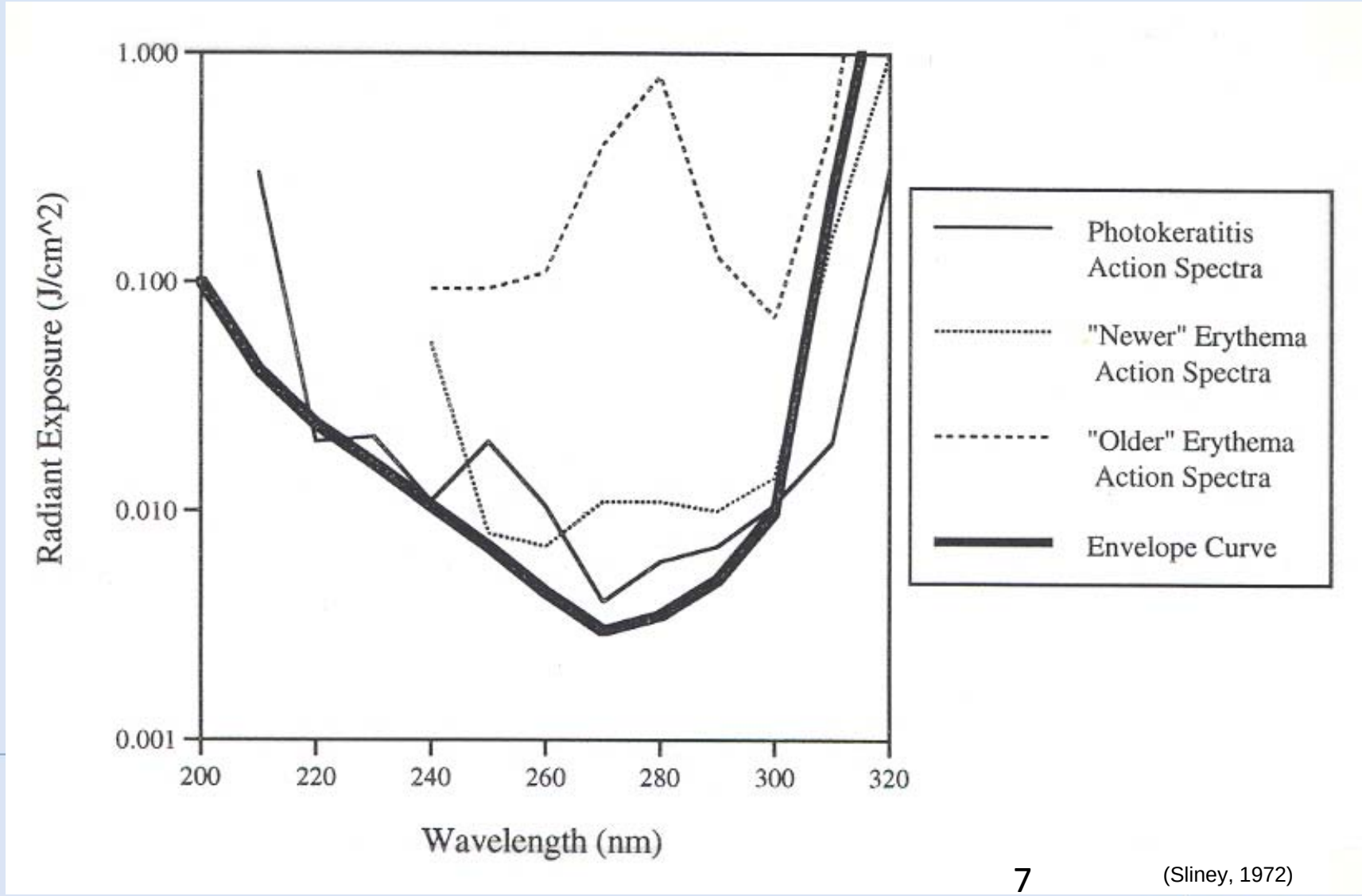
Occupational Sun Exposure & Skin Cancer

- NMSC:
  - Occupational sun exposure is a significant risk factor (Green etal, 1988; Beral etal, 1981; Marks etal 1989)
  - SCC: pooled OR (95% CI) = 1.77 (1.40-2.22) (p<0.001) (Schmitt etal,2011)
  - BCC: pooled OR (95% CI) = 1.43 (1.23-1.66) (p=0.0001) (Bauer etal,2011)
  - 34,000 new cases in each in Australia from occupational exposure (Fritschi & Driscoll, 2006)
- Melanoma:
  - Chronic exposure weakly associated with increased risk, occupational exposure not associated (Gallagher & Lee, 2006)
  - ↑ risk for intermittent exposure; ↓ risk for heavy occupational exposure/outdoor workers or chronic exposure (Vagero etal, 1986; Elwood & Jopson, 1997; Gandini etal, 2005)
- Variable results for skin cancer and outdoor work, possibly due to fair skinned people self-selecting for indoor work (Green etal, 1996)
- BC *Workers Compensation Act* provides a presumption of employment causation in favour of a workers who has developed skin cancer where there is prolonged exposure to solar UV.

Occupational Sun Exposure & Heat Stress

- Heat stress is a spectrum of disorders that can occur because of sun exposure, heat, and physical activity (CDC, 2013)
- Most serious form is heat stroke, which as irreversibly damage the heat, kidney, and liver, and can result in death (Chao et al., 1981)
- Heat stress is more common in outdoor workers (CDC, 2008)
- Solar radiation is the primary source of heat stress for outdoor workers (Ontario Ministry of Labour, 2012)

Occupational UV Exposure Standard – ACGIH



(Sliney, 1972)

Application of ACGIH TLV

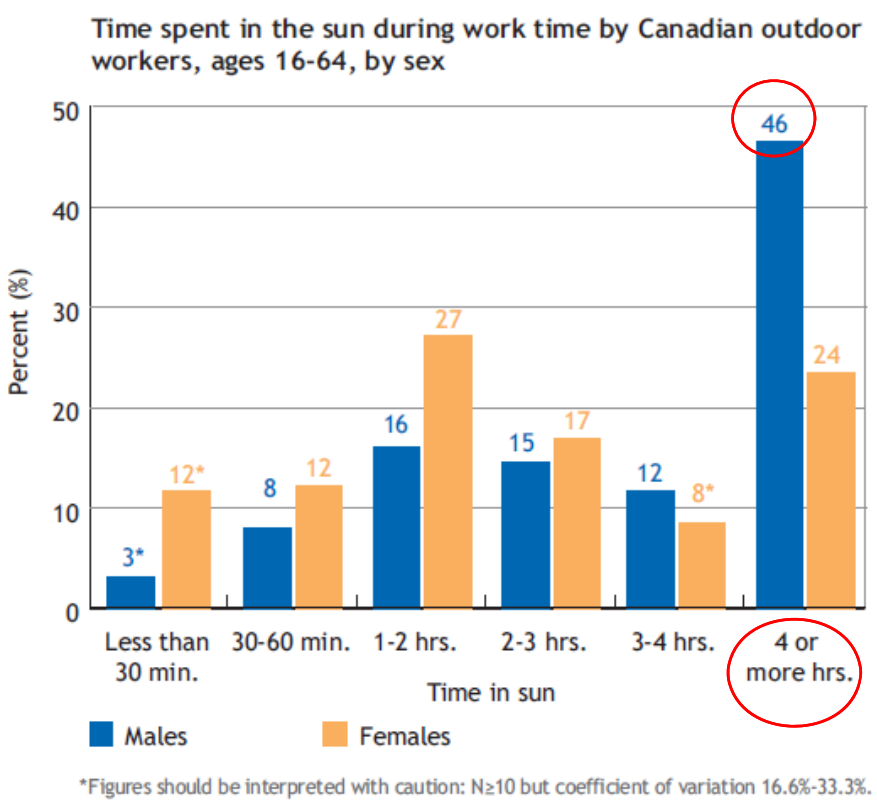
- Ontario: the Ministry of Labour applies the ACGIH threshold limit values (TLVs); no differentiation between sun & artificial sources; limits are enforced under section 25(2)(h) of the *Occupational Health and Safety Act*.
- BC: Worksafe BC…applies ACGIH TLVs for artificial sources (s7.19(5) of the OHS Regulation), but "ultraviolet radiation from the sun is not included within the scope of this requirement". "Nevertheless, workers and employees should be aware of the hazards associated with solar radiation…" (G7.19(5)).

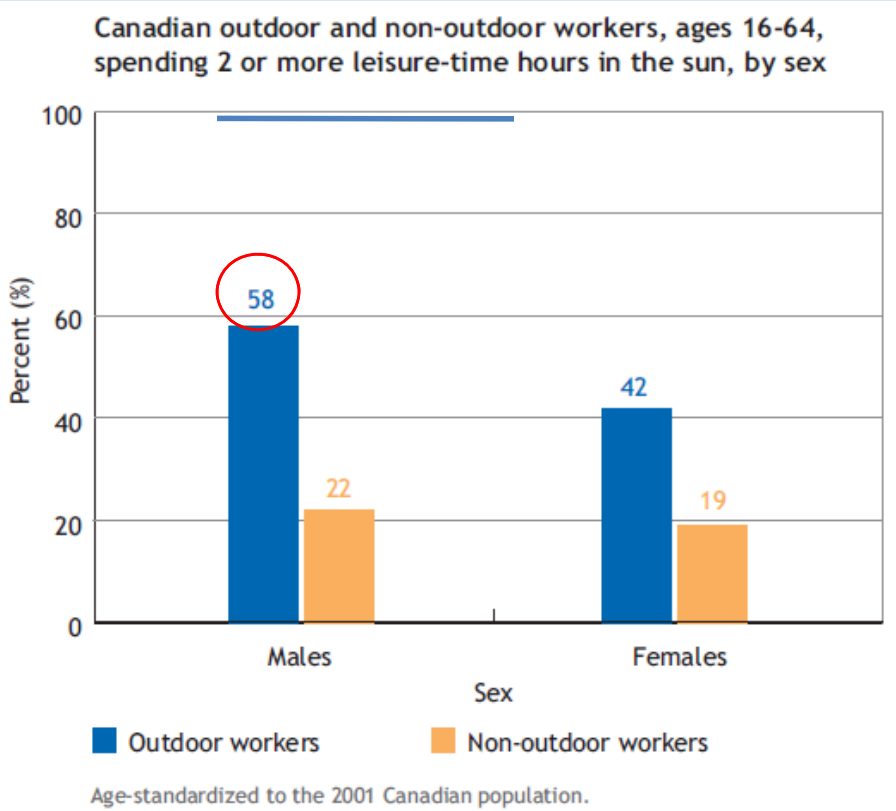
(http://www.labour.gov.on.ca/english/hs/pdf/uv_radiation_workplace.pdf)
(https://www2.worksafebc.com/Publications/OHSRegulation/GuidelinePart7.asp#SectionNumber:G7.19_5)

Occupational Sun Exposure

- There are over 1.5 million outdoor workers in Canada (CAREX Canada, 2012)
- Canada – Levels of Exposure: (Peters etal, 2012)
  - Low: almost never exposed – truck & delivery drivers,
  - Moderate: indoor/outdoor mix – crane operators, carpenters, maintenance labourers, couriers.
  - High: >75% outside – farmers, construction; 61% (897,000 workers)
- Australia (NHEWS, 2010):
  - Average daily exposure = 4.4 hrs, 12.2 hrs weekly
  - Agriculture: 5.5hrs/day, 22hrs/wk
  - Construction: 5.5hrs/day, 19hrs/wk

Two thirds of outdoor workers spend two or more hours per day of work time in the sun. Over half of outdoor workers spend at least two hours per day of leisure time in the sun.





Outdoor workers: spend more time in sun during work and leisure than other adults; more likely to get burnt

(CPAC 2010 – 2006 2nd National Sun Survey)

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Occupational Sun Exposure

Study	*Category*	*% of Ambient*
Larko and Diffey (1983)	Outdoor workers	10 – 70%
Holman etal (1983)	Physical Education Teachers	30 – 50%
	Gardner, Carpenter, Bricklayer	44 – 85%
Gies and Wright (2003)	Construction workers (median, all)	26%
	Pavers-Tilers	114%
	Traffic controllers	69%
	Roofer	45%
Leach etal (1977)	Indoor workers	2 – 4%
Larko and Diffey (1983)	Indoor workers	6%
Holman etal (1983)	Classroom Teacher	7 – 11%

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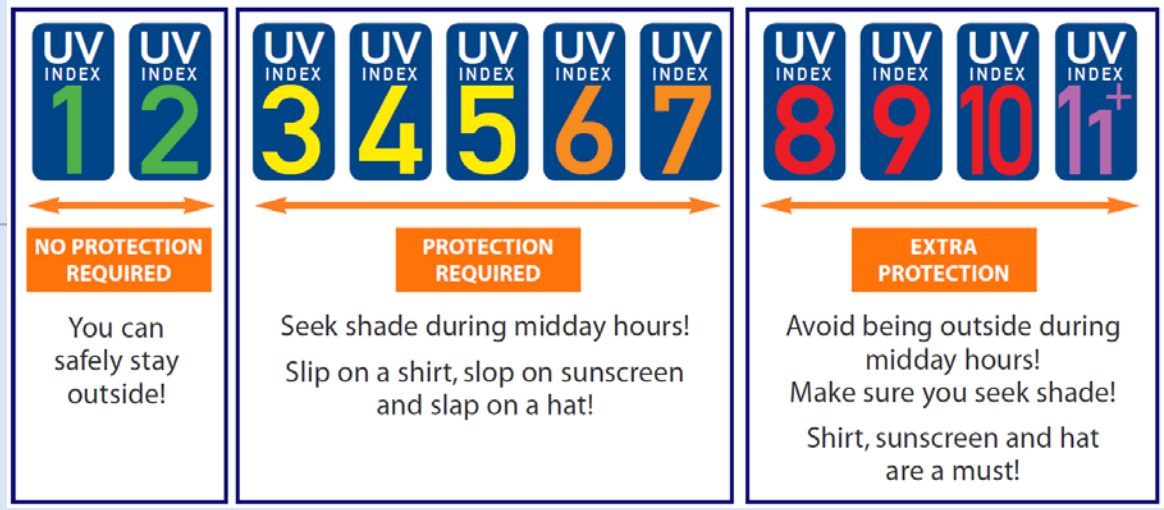
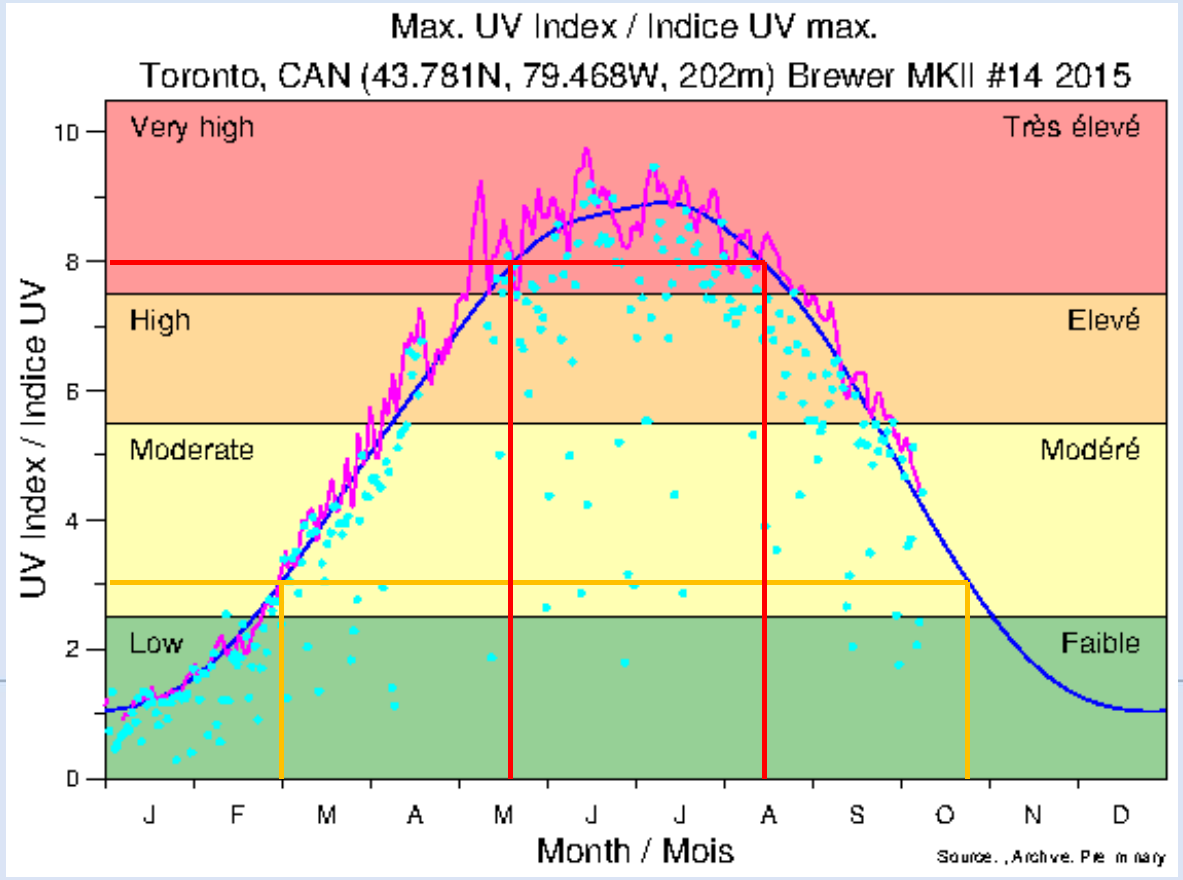
‘Personal’ UV Exposure of Outdoor Workers

- Exposures are often many times the TLV/OEL.
- Construction workers in Qld (Gies and Wright, 2003):
  - Below OEL: 10%; 1 to 2x OEL: 13%
  - 2 to 3x OEL: 16%; 3 to 4x OEL: 14%
  - >4x OEL: 47%; >10x OEL: 7.3%
- Lifeguards in 4 locations in USA (Gies etal, 2009):
  - 74% exceeded OEL; 39% > 4x OEL; 65% sufficient for sunburn
- Vineyard workers in Italy:
  - all workers > OEL for all seasons; in spring all workers >10x OEL at back of neck (Siani etal, 2011)
- Building, horticulture, road workers in NZ:
  - all workers > OEL; mean exposure was 5x OEL (Hammond etal, 2009)
- No exposure measurements in Canada (CAREX, 2011)



(WHO, 2003 – INTERSUN Guide & Compendium)



(http://exp-studies.tor.ec.gc.ca/ozone/uvgraph/Preliminary/max/STN065/uv/dailymaxuv-Brewer-014-2015.gif)

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Table 1. The variation of time to exceed the ICNIRP[5] guidelines T_{max}, time to achieve erythema $T_{erythema}$ and the equivalent SED per hour for solar UVR of various UV Indices

UV index	T_{max} (min)	$T_{erythema}$ (min)	UVR_{eff} (SED h^{-1})
2	39.5	66.6	1.8
4	19.8	33.3	3.6
6	13.2	22.2	5.4
8	9.9	16.7	7.2
10	7.9	13.3	9.0
12	6.6	11.1	10.8
14	5.7	9.5	12.6
16	4.5	8.4	14.4

Summer in Toronto

(Gies & Wright, 2003)

UV Exposures – Various Sources

Source	Eeff (W/cm^2)	Exposure time		
		TLV	Photokeratitis	Erythema
Welding, GMAW, Steel	$1.3x10^{-3}$	2.3 sec	3.1 sec	4.6 sec
Welding, GMAW, Al	$1.25x10^{-3}$	2.4 sec	3.2 sec	4.8 sec
Welding, GTAW, Steel	$7.09x10^{-5}$	42.3 sec	56.3 sec	84.6 sec
Phototherapy lamp, type A, unenclosed	$2.5x10^{-5}$	120 sec	160 sec	240 sec
UVR curing unit	$4.2x10^{-7}$	120 min	160 min	240 min
Solar UVR:				
- Darwin,12.4º, summer	$5.5x10^{-6}$	9 min	12 min	18 min
winter	$2.6x10^{-6}$	19 min	25 min	38 min
- Hobart 42.8º, summer	$3.6x10^{-6}$	14 min	19 min	24 min
winter	$1.1x10^{-7}$	450 min	600 min	900 min

(Tenkate, 1999)

Controlling Occupational Sun Exposure

- Legislative obligations/duties (Ontario OHS Act, s 25(2)(h), s28(1)):
  - Employer: risk management; protecting employees from excessive exposure.
  - Employee: comply with instructions of employer, re: workplace health and safety, e.g. wearing of PPE.
- Hierarchy of control measures:
  - Elimination
  - Substitution
  - Isolation (of the hazard from human exposure)
  - Engineering controls
  - Administrative controls
  - Use of PPE

Controlling Occupational Sun Exposure

- Measures: scheduling of work activities; shade provision; PPE; clothing; hats; sunglasses; sunscreen; worker training.
  - Minority (i.e. 8 – 10%) of outdoor workers 'fully protected' – use all of: protective clothing, hat, sunscreen, work in shade for ½ time outdoor (Carey etal, 2014; Gies & Wright, 2003)
  - Face and lower arms the least protected sites, use of sunscreen and wide-brimmed hats is low

    (Borland etal, 1991; Girgis etal, 1994; Shoveller etal, 2000; Stepanski & Mayer, 1998; Salas etal, 2005; Pichon etal, 2005).

  - Reasons: forgetting to use PPE, feeling that sun protection is inconvenient, wanting to get a tan, unconcerned with sun exposure (Shoveller etal, 2000)

Risk Management for Occupational UV Exposure

- Workplace policy on UV exposure
- Employee training & information
- Risk Management Framework
  - Identification of hazards: identification of sources.
  - Assessment of risk: estimate exposure levels, compare to OEL.
  - Choose appropriate control measures: control hierarchy = elimination, substitution, engineering controls, administrative controls, use of PPE.
  - Implement appropriate control measures.
  - Monitoring and review effectiveness of control measures.
- Post-incident exposure management

(Source: ARPANSA, 2006)

Sun Safety Programs

- Apart from *Be Sunsible* in AB (www.besunsible.ca), there are no occupational sun safety programs delivered in Canada (CDA and some PHUs have resources)
- 'Interventions in outdoor occupational settings to prevent skin cancer' are 'recommended' based on 'strong evidence of effectiveness in increasing outdoor workers' sun protective behaviors and reducing sunburns' (Community Preventive Services Taskforce, 2013)
- There are no occupational sun safety programs in Canada that address both skin cancer and heat stress

Effective Sun Safety Programs

- Must address both individual and organizational factors
- Have active engagement of workers
- Must be tailored/customized to the specific characteristics of each workplace
- Must be able to be implemented progressively and independently
- Must be embedded in existing OHS policies, procedures and practices
- Have an enthusiastic ‘workplace champion’
- Must have visible support from management
- Should have a sound theoretical base that informs the intervention approaches identified

Implementation of a Sun Safety Program by Dyno Nobel

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Sun Safety at Work Canada

Funder: Canadian Partnership Against Cancer's: Coalitions Linking Action and Science for Prevention (CLASP2) grant (2014-2017).

Objective: To develop a nationally-applicable, effective and sustainable sun safety program for outdoor workers, that will address both skin cancer and heat exposure, and can be implemented by individual workplaces.

SUN SAFETY AT WORK

CANADIAN PARTNERSHIP AGAINST CANCER | PARTENARIAT CANADIEN CONTRE LE CANCER

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The Team

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Colin Murray, Worksafe BC

Staff:
Audrey Gardner, Project Coordinator (Ryerson)
Rivka Kushner, KTE Broker (OCRC); Emily Gross & other data analysis support at OCRC
5 Sun Safety Advisors in 4 provinces (2 in ON)

Sun Safety at Work Canada Project Overview

Objectives

1. Improve the sun safety knowledge, attitudes and behaviors of outdoor workers.
2. Improve employer understanding of the importance of sun safety.
3. Assist workplaces in developing policies that support sun safety practices for outdoor workers.
4. Implement customized and effective sun safety strategies with individual workplaces.
5. Develop resources for broader use for workplaces with outdoor workers.
6. Expand stakeholder engagement in occupational sun safety practices and policies.
7. Contribute to the body of evidence specific to sun safety policy and program interventions.
8. Explore the transferability of the project model to other workplace chronic disease risk factors.

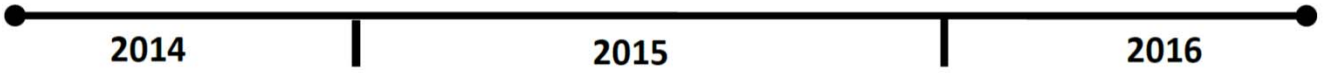
Sun Safety at Work Canada is developing nationally-applicable heat and sun safety processes and resources for workplaces to help them implement Heat and Sun Safety programs for outdoor workers.

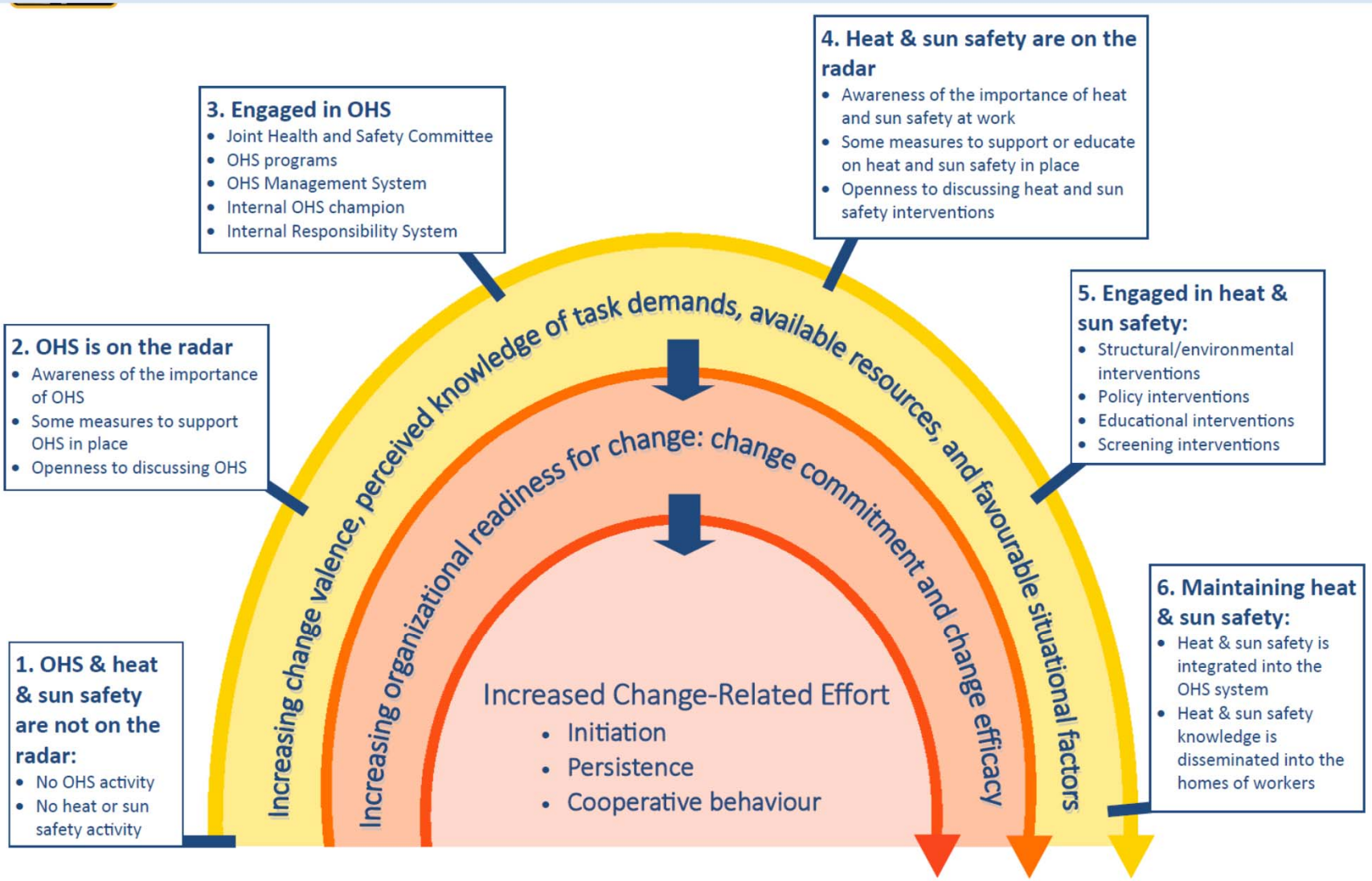
Phase I—Workplaces

Develop, implement, and evaluate theoretically-driven and evidence-based heat and sun safety (HSS) interventions that build capacity for HSS in 17 parks and utilities workplaces in three regions in Canada (BC, ON, NS/NB). Along with existing evidence-based research, the 3-point evaluation will inform Phase II.

Phase II– Broader Reach

Develop website-hosted tools and resources to help outdoor workplaces implement HSS programs. Raise awareness of the need for HSS programs for outdoor workplaces. Communicate through engagement with workplaces, industry decision makers, and policy advocates. The website includes: Interactive planning tool with staged resources; project reports; summaries HSS and effective prevention strategies; policy briefing notes; video(s) about worker and employer experiences with HSS.





Adapted from Shea, C. M., Jacobs, S. R., Esserman, D. A., Bruce, K., Weiner, B. J., Organizational Readiness for implementing change: a psychometric assessment of a new measure. *Implement Science*, 2014, 9: p. 9. OHS refers to occupational health and safety.

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Phase I: Workplace Interventions

Pilot interventions at outdoor workplaces:

- Three regions: Ontario, British Columbia, Nova Scotia/New Brunswick
  - 17 public sector workplaces in parks or utilities
- Sun Safety Advisors – key contact with workplaces
- Intensive engagement with workplaces
- Baseline Assessment → Action Plan → Intervention Activities
- Intervention materials informed by previous sun safety programs
- Tailoring intervention to each workplace
- Multiple strategies for sun safety:
  - Structural/environment interventions
  - Policy interventions
  - Educational interventions
  - PPE interventions

Phase II: Broader Reach

Dissemination of sun safety to all outdoor workplaces in Canada:

- Development of materials informed by Phase I
- Creation of website:
  - Interactive tools for sun safety program planning & implementation
  - Plain language project summaries and reports
  - Policy briefing notes
  - Video on workplace experiences with sun safety
- Regional workshops on website/project learnings
- Engagement with industry decision makers & provincial policy advocates

Conclusions & Future Challenges

- Outdoor workers are frequently exposed to UV levels well above the current OEL; this is a large proportion of the workforce
- Outdoor workers are at additional risk of developing skin cancer and are at risk of heat stress
- Range of control/protection measures available, but some have variable effectiveness (e.g. sunscreen) and many outdoor workers do not use some/many of the measures.
- Limited data on occupational UV exposures in Canada
- Workplaces are an effective setting to implement sun safety programs; however, results vary & limited resources/tools available
- Risk management approach & integration with OHS management system/policies is critical