PHOTOBIOLOGICAL HAZARDS OF INFRARED WARMING CABINS

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ABSTRACT

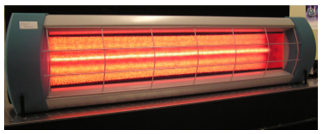
Infrared warming cabins (also sometimes referred to infrared saunas) employ varying types of infrared radiators, sometimes with intense exposure levels. Manufacturers often claim a long list of beneficiary effects. The potential hazards for the skin and the eyes are not yet fully studied. Typical measured exposure levels are compared with exposure limits for the damage of the eye and the skin. Not all potentially negative effects of the exposure can be accounted for by current international exposure limits for optical radiation as specified by ICNIRP. This particularly is the case for Erythema ab igne, co-cancerogenous effects, and heat stress.

THE SOURCES

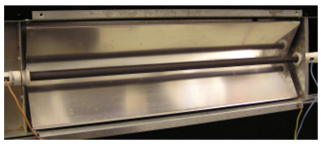
The radiators are usually heating rods and for low temperature versions also plates. The (predominant) emission wavelength range depends on the surface temperature:

Main wavelength range	Temperature	Penetration depth
IR-A (700 nm to 1400 nm)	High tempeature filtered incandescent filaments	deepest penetration
IR-B (1400 nm to 3000 nm)	Filtered incandescent filaments	medium penetration depth
IR-C (> 3000 nm)	rods: 350 ° C to 450 ° C, Large area plates: 50 ° C	superficial absorption

IR-A radiator



IR-B radiator



IR-C radiator

ERYTHEMA AB IGNE (EAI)

Chronic effect when skin temperature is, repeatedly, close to pain threshold. Once often found when fireplaces were used. Also found for excessive use of hot water bottles. EAI is sometimes location of skin cancer (turf fire cancer, kangri cancer).

Exposure levels in IR warming cabins may be high enough (hot spots) to cause concern, but so far no case was reported.

Exposure limit to prevent skin burn is not sufficient to prevent EAI, however, when exposure is discontinued, especially after the initial stages, EAI disappears after some time. EAI is mainly a cosmetic issue. Future research is needed to determine risk and exposure limit.

Hazard	Exposure limit	Comparison with typical exposure level	
Skin burn	3550 W m-2 for up to 10 s	Limits is not exceeded	Protection by pain response for prolonged exposure
Eye damage	Retina	Limit not exceeded	
	Lens-cornea: 100 W m-2	May be exceeded for IR-A and IR-B sources at closer distances	Can be protected against with welding eye glasses
Heat Stress	No simple limit	not only irradiance dependent, but also by air movement, temperature and humidity – special evaluation	In part intended (elective hyperthermia)
Erythema ab igne	No limit exists	Exposure may be high enough to cause EAI but so far no case reported	
Co-carcinogenesis	No limit exists	Elevated skin temperature may impede DNA repair	

SKIN CANCER PROMOTER

Infrared radiation is not believed to be able to directly cause DNA damage, however, elevated epidermal temperatures may be seen as promoter by reducing efficiency of DNA repair.

Elevated temperatures result in production of heat shock proteins, which may activate cytokines responsible for inducing cell division. If DNA was previously damaged, for instance by exposure to UV radiation, and not fully repaired, induction of cell division may be detrimental.

Thus elevated temperatures (not only from IR radiation, also from hot baths, etc.) may promote (accelerate) skin cancer formation induced by other agents.

However, to some extent, the IR or UV stress may also be positive in the sense that DNA is checked for lesions in the process of cell division. Further studies are needed to characterize the increased risk.

CONCLUSIONS

- The risk for skin burn or eye damage is relatively small, as long as natural aversion responses (heat pain) functions.
- Excessive use of warming cabins (especially when they have hot spots) may induce erythema ab igne. When exposure is discontinued following observation of persistent erythema, development should be prevented.
- Use of warming cabins after exposure to UV radiation (sun beds, solar sun bathing) should be discouraged.

ACKNOWLEDGEMENTS

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Pleas note: This poster was originally published under our company's former name Austrian Research Centers.