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| [Billedresultat for WMO logo official](http://www.google.dk/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjBnMSq6snVAhWH1hQKHaCHDBoQjRwIBw&url=http://www.wmo.int/pages/prog/amp/mmop/jcomm_partnership_en.html&psig=AFQjCNEnwyvAyWmD7XOLi_e79KIPCthkew&ust=1502356819880810)  Billedresultat for ilo logo officialBilledresultat for WHO logo official | August 2017  OUTLINE for TECHNICAL REPORT IN COLLABORATION BETWEEN HEAT-SHIELD, WHO, WMO and ILO. |

Working title:

**Occupational heat stress, health and human productivity impacts in the context of current and future climate scenarios**

Draft ideas by Tord Kjellstrom and Lars Nybo (others to join in)

**Background**

Environmental heat is a well-known and very serious health hazard with mortal consequences across large parts of the world each year, and the heat levels will increase as climate change progresses. People carrying out physical work in their daily activities (either in employment or in daily household tasks) are at particular risk of health effects of heat as their physical activities create heat inside their bodies, which adds to the external heat stress. Cooling systems and other preventive adaptations are widely applied, where they can be afforded, but millions of people in hot areas of the world need to carry out their daily tasks at times and in places where cooling approaches cannot easily be applied.

Heat as a health hazard has been highlighted by WHO and WMO as key components of the threats to human health that climate change will bring. HEAT-SHIELD, the WHO occupational health program, and ILO have special focus on working people. Combining expert knowledge from WHO and WMO with ILO (if they join) and HEAT-SHIELD will provide a very solid basis for an overview on occupational heat stress with focus on the impact of current and future heat stress on productivity and health. The report will provide an overview of consequences and the potential for counter-actions (at the global, local and individual level), taking into consideration different age groups, gender effects, and socioeconomic aspects.

The report will consider measures to assess heat-stress and describe the associated impact on humans – consider how heat warning advice and counter-measures may be implemented (taking feasibility – sustainability – economic costs/benefits – health effects into account) – i.e. the report will deliver an up-to-date evidence-based overview on health prevention and promotion of well-being in the face of foreseen increased heat stress levels.

In order to assess the current and future health risks from environmental and workplace heat, there is need for detailed quantitative data on heat exposure levels, exposure-effect and exposure-response relationships for the different types of health effects, and data on likely impacts of prevention methods. There are still substantial gaps in the scientific evidence and available reviews on the topic have not covered some key issues of importance for the assessment of climate change impacts on working people. WHO produced a Technical Report in 1969 on this topic, so it is considered timely to prepare an up-to-date new report, which will include the emerging knowledge about climate change trends and can be used as a global evidence source for government agencies, communities, enterprises and scientists in their work to protect people's health. The main report will contain the details of relevant science, in a similar way to the earlier series of WHO Environmental Health Criteria (the Appendix below shows the typical table of contents of such reports), and will be a joint product of WHO, WMO, HEAT-SHIELD and other partner organizations. It will be complemented by shorter information materials for different target groups. The work will start in September 2017 and can be completed by April 2019. The scientific review and writing work will be carried out primarily by experts involved in the HEAT-SHIELD project and will not require financial support from the other agencies involved.

**Table of Contents and brief synopsis of text to be drafted on Heat, Work and Health**

Executive summary

*This will summarize (4-6 pages) the key elements and conclusions related to heat exposure and the associated (potential) impact on health and productivity, suggested (best practice verified) approaches to health and productivity protection; projections for the future as climate change progresses.*

*We may also suggest versions for more practical advisory materials for selected target groups as identified by partner organizations in this report production.*

1. Introduction, background/aim overview for readers (brief update on current knowledge – considering age, gender etc.)

2. Heat stress, the environmental, physical and physiological fundamentals

*This will describe the four physical components of environmental heat in air (temperature, humidity, air movement and heat radiation) and the role played by clothing and physical activity (metabolic rate) and their combined impact on human heat balance and associated thermoregulatory aspects.*

3. Sources of environmental and workplace heat exposure

Overview: *current heat conditions with global and local maps as well as reference to studies of workplace heat exposures. This will make it possible to put the heat stress text into the context of what working people are facing.*

4. Studies of heat effects in experimental animals and domestic and agricultural animals

*This short section is included to highlight the importance of linking environmental health analysis of human health risks to relevant animal studies. It will not be a detailed analysis of all effects on animals, but it will highlight potential links to human health effects. In the case of heat effects on human health, there is surprisingly few references to animal studies while the basic physiological conditions may be similar for certain species. The heat impacts on agricultural animals during extreme heat waves is one source of evidence to explore in order to find new information on physiological indicators of risk.*

5. Studies of heat effects on people carrying out work or other physical activities

Experimental studies

Epidemiological studies

*Here we refer to published studies over the long time period that heat has been studied as a health hazard. This will identify quantitative exposure-response relationships that will be of importance for health impact assessments.*

6. Physiological and clinical health effects of heat stress

Basic physiology of heat exposure and heat stress, body temperature, dehydration

Clinical effects

Physical capacity loss

Other effects

*The findings in studies will be summarized in a clear manner, so that all potential health and productivity impacts can be understood.*

7. Social and economic impacts of current and future occupational heat stress

*The health and productivity impacts of heat at work will have important consequences for the social and economic situation at the individual level, family level, community level and national level. Impact of gender, influence on migration and risk reductions will be considered*

8. Heat stress indices; measuring and calculating heat exposure and stress

*A large number (170+) of heat stress indices have been proposed during the last 100 years and only a few of them can be considered valid exposure variables for workplace application. A comparison will show advantages and disadvantages of selected indices.*

9. Current workplace heat exposures and risks

*Studies and assessments of current heat at work problems will be highlighted.*

10. Occupational health impact assessments, methods and outputs

*The basic methods developed by WHO for occupational health impact assessments will be presented, and additional guidance from professional networks or international agencies included for overview).*

11. Climate change trends for workplace heat exposures

*Published climate model outputs and assessments of links to workplace heat exposures will be summarized.*

12. Prevention of health effects of heat at individual level

cooling systems at local workplace

cooling clothing

reduced physical input, mechanisation, more breaks, more rest

basic occupational health programs, hydration, electrolyte replacement

warning systems, heat measurements, phone apps, etc

*All available heat reduction and health protection methods at the work place/individual level will be described/evaluated* (considering feasibility – sustainability – economic costs/benefits)*.*

13. Current heat protection via regulatory or community based policies and actions

regulations, standards, guidelines

Decent Work principles

*This section focuses on population level protective actions.*

14. Future heat protection by actions for climate change mitigation

green house gas limitations

green economy approaches

*This section puts the protective actions into the context of ongoing and future climate change.*

15. Role in prevention of Health sector, Labour sector and Meteorological services

*Advices for relevant government sectors will be listed and discussed.*

References, websites for further information

**Tentative time table**

2017 July Decision by WHO, WMO and Heatshield to proceed, linking with ILO

2017 August Heatshield writing team drafting of plans and report content; engaging other partner agencies

2017 September Short meeting in Geneva to agree on process and time table

2017 October Detailed drafting, writing and analysis for report initiated

2018 April First draft completed, start of review by partner agencies and experts;

consultation with agency Regional Offices

2018 June Short meeting in Geneva to give input on text for official review meeting

2018 September Official review meeting with appointed experts from different global regions and different sectoral affiliations

2018 December Submission of final version from Heatshield writing team to WHO

Drafting of information/promotion materials

2019 April/May Official release of the technical report and linked information/promotion materials

after this ...... promotion of the joint report to all stakeholders.

**Appendix**

**Table of contents of earlier WHO Technical Report and of Environmental Health Criteria**

**WHO (1969) Health factors involved in working under conditions of heat stress. Techn Rept Series No 412, 32p.**

**Table of contents**

General introduction

Man's responses to heat

General considerations

Personal factors

Heart rates

Deep body temperature

Sweat loss

Heat stress indices

Introduction

The corrected effective temperature scales

The predicted four-hour sweat rate

Heat balance indices

Recommendations for research

Annex: Convention and recommendations of ILO with sections relating to work in heat

**Environmental Health Criteria, example of Cadmium, published by WHO in 1992**

**Table of contents**

ENVIRONMENTAL HEALTH CRITERIA FOR CADMIUM

1. SUMMARY AND CONCLUSIONS

2. IDENTITY, PHYSICAL AND CHEMICAL PROPERTIES, AND ANALYTICAL

METHODS

2.1 Physical and chemical properties

2.2 Analytical methods

2.3 Quality control and quality assurance

2.4 Conclusions

3. SOURCES OF HUMAN AND ENVIRONMENTAL EXPOSURE

4. ENVIRONMENTAL TRANSPORT, DISTRIBUTION, AND TRANSFORMATION

5. ENVIRONMENTAL LEVELS AND HUMAN EXPOSURE

6. KINETICS AND METABOLISM IN LABORATORY MAMMALS AND HUMANS

6.1 Uptake

6.2 Transport

6.3 Distribution

6.4 Body burden and kidney burden in humans

6.5 Elimination and excretion

6.7 Biological indices of cadmium exposure, body

burden, and concentrations in kidneys

6.9 Conclusions

7. EFFECTS ON LABORATORY MAMMALS AND  *IN VITRO* TEST SYSTEMS

7.1 Single exposure

7.2 Repeated and/or long-term exposure

7.3 Fetal toxicity and teratogenicity

7.4 Mutagenicity

7.5 Carcinogenicity

7.6 Host and dietary factors; interactions with other

trace elements

7.7 Conclusions

8. EFFECTS ON HUMANS

8.1 Acute effects

8.2 Chronic effects

8.2.1 Renal effects and low molecular weight

proteinuria

8.2.2 Disorders of calcium metabolism and bone

effects

8.2.3 Respiratory system effects

8.2.4 Hypertension and cardiovascular disease

8.2.5 Cancer

8.2.5.1 In industry

8.2.5.2 In the general environment

8.2.6 Mutagenic effects in human cells

8.2.7 Transplacental transport and fetal effects

8.2.8 Other effects

8.3 Clinical and epidemiological studies with data

on both exposure and effects

8.3.1 Studies on respiratory disorders

8.3.2 Studies on renal disorders in industry

8.3.3 Studies on renal disorders in the general

environment

8.3.3.1 Health surveys in Japan

8.4 Conclusions

9. EVALUATION OF HUMAN HEALTH RISKS

9.1 Exposure assessment

9.2 Dose-effect relationships

9.2.1. Renal effects

9.2.2 Bone effects

9.2.3 Pulmonary effects

9.2.4 Cardiovascular effects

9.2.5 Cancer

9.2.6 Critical organ and critical effect

9.3 Critical concentration in the kidneys

9.3.1 In animals

9.3.2 In humans

9.4 Dose-response relationships for renal effects

9.4.1 Evaluation based on data on industrial

workers

9.4.2 Evaluation based on data on the general

population

9.4.3 Evaluation based on a metabolic model and

critical concentrations

10. CONCLUSIONS AND RECOMMENDATIONS FOR PROTECTION OF HUMAN HEALTH

10.1 Conclusions

10.1.1 General population

10.1.2 Occupationally exposed population

10.2 Recommendations for protection of human health

11. FURTHER RESEARCH

12. PREVIOUS EVALUATIONS BY INTERNATIONAL BODIES

REFERENCES