INTERNATIONAL STANDARDS AND HUMAN PERFORMANCE - I

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INTRODUCTION

In the *1980's* a series of standards for the assessment of the thermal environment and it's influence on people have been proposed by ISO (International Organization for Standardization). These include standards for cold, hot and moderate **environments** together with supporting standards for estimation of the thermal insulation and evaporative resistance of clothing ensembles, **estimation** of the metabolic rate, performing subjective assessment and measurements of the thermal environment. While standardization related *to* the thermal environment is well developed only few standards related to indoor *air* quality and ventilation has been published. The present presentation deals with standards related to cold and moderate thermal environments, subjective assessments, measurement of the thermal parameters, indoor air quality and ventilation.

STANDARDS **FOR** THERMAL ENVIRONMENTS

Moderate Thermal Environments

ISO 7730 (1), provides a method of assessing the thermal environment using the PMV PPD thermal comfort index. **The** PMV index is calculated from the air **temperature,** mean radiant temperature, air velocity and humidity of the environment and estimates of metabolic rate and clothing insulation. The PMV-value is a **number** on a 7-point thermal sensation scale (+3 hot, +2 warm, +1 slightly warm, 0 neutral, **-1** slightly cold, -2 cool and -3 cold). The PPD index is calculated **from** the **PMV** index and provides the predicted percentage of thermally dissatisfied persons. The standard provides also guidelines on how to **asses** the **risk** for local thermal discomfort, i.e. radiant temperature asymmetri, draught (air temperature, air velocity) vertical air temperature differences and cold *or* warm floors. **Similar** recommendation is found in **ASHRAE** Standard **55-81** (3).

Cold Environments

While there has been published many suggestions for a heat ***stress*** index only few methods have been proposed for evaluation of cold environment A new method, **IREQ** (Required Clothimg **Insulation)** is being proposed by ISO in a technical report (3). The index is based on a calculation of the thermal insolation required for being in heat balance under the given environment (air temperame, mean radiant temperature, **air** velocity, humidity) and actively level. The calculated **IREQ** value can be used to select a clothing ensemble for work in a cold environment It can also be **used as** a cold **stress** index. The higher the value of **IREQ,** at any given activity level, the greater is the cooling power of the environment If the persons at a given work place is wearing **less** clothing than required, then the method provides a procedure for calculating the recommended max. exposure-time.

Subjective Assessment

ISO/DP 10551 **(4) presents** subjective scales for assessment of the influence of the thermal environment. The standard provides ***scales*** for thermal sensation (cold-hot), thermal preference (colder-wanner) and acceptability.

Instruments and Measurement

ISO 7726 (5) provides a description of the parameters which should be measured *(air* temperature, mean radiant temperature, plane radiant temperature, air velocity, humidity). Together with methods of measurements and specifications for the instruments (accuracy, respond time, measuring range).

Clothing

ISO/DIS *9920* (6) provides a large database of thermal insulation values, which have been measured on ***a*** standing thermal manikin. One **set** of tables give the insulation values for a large number of ensembles. Another set of tables give insulation values for individual garments, based **on** which the insulation for a whole ensemble can be estimated. The **data** on evaporative resistance is not so extensive. A few data are given in the standard and a method to calculate the evaporative resistance based on the thermal insulation is also given.

STANDARDS FOR INDOOR AIR QUALITY AND VENTILATION

For industrial air pollution the TLV's (Threshold Limit Values) have existed for many years, while there has only been limited standards or guidelines for non-industrial environments. Due to increasing problems in non-industrial spaces (homes, schools, offices, etc.) more emphasis is now being paid on the required ventilation rate and air quality at these places. The most important standard is ASHRAE 62-1989 (7). One procedure in the standard is the ventilation rate procedure, where the ventilation rate in l/s per person is given for a large number of spaces. Another method is the indoor air quality procedure, where the concentration of containments are restricted and the required ventilation rate is calculated by a delution model. Recently the CEC (Commission of European Communities) has started a project to develop a guideline for ventilation requirements, COST 613 (8). In this proposed guide the ventilation rate is based on the perceived indoor air quality and the use of the new units for perceived air quality, "decipol" and for source strength of pollution sources, "olf". This guide also introduces the efficiency of the ventilation.

CONCLUSION

The package of standards for evaluation of the thermal environment presented here and in the following presentation provides a valuable tool wherever problems have to be solved.

Regarding standards for indoor air quality there is a need for more information on dose-response relationships for many pollution sources.

REFERENCES

1. ISO 7730: 1984, Moderate thermal environments - Determination of the PMV and PPD indices and specification of the conditions for thermal comfort

2. ASHRAE/ANSI Standard 55-81: Thermal Environmental Conditions for Human Occupancy. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, GA 30329, 1981

3. Evaluation of cold environments - Determination of required clothing insulation, IREQ, ISO/TC159/SCS/WG1, 1989

4. ISO/DP 10551: 1989, Assessment of the influence of the thermal environment using subjective judgement scales.

5. ISO 7726: 1985, Thermal environments - Instruments and methods for measuring physical quantities.

6. ISO/DIS 9920: 1990, "Ergonomics of the thermal environment - Estimation of the thermal insulation and evaporative resistance of a clothing ensemble.

7. ASHRAE Standard 62-1989. Ventilation for Acceptable Indoor Air Quality. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Atlanta, GA, 1989

8. COST 613: "Indoor Air Quality and its impact on Man", Working Group 6: Ventilation Requirements. Commission of European Communities, 1990