
**Ergonomics of the thermal
environment — Cold workplaces — Risk
assessment and management**

*Ergonomie des ambiances thermiques — Lieux de travail dans le
froid — Évaluation et management des risques*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15743 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment*.

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Introduction

This International Standard is one of a series of thermal standards (see Clause 2 and the Bibliography) intended to be used in the assessment and management of work in the cold, i.e. in conditions that cause uncomfortable sensations of cool or cold. In light physical work, these conditions can occur at 10 °C or below.

A number of industries, types of commerce and occupations involve substantial cold exposure, outdoors or indoors, where individual workers can also be exposed to windy and/or wet conditions. Working in cold environments can involve several adverse effects on human performance and health: thermal discomfort, increased strain, decreased performance and cold-related diseases and injuries. Cold can also interfere with several other factors in the workplace, modifying or aggravating the risk of common hazards and increasing the risk of cold-associated injuries.

Due to the negative impact of cold on human health and performance, as well as on work productivity, quality and safety, a comprehensive strategy of risk assessment and management practices and methods is needed for work in cold environments.

Even though some of the standards referred to above describe specific methods (instruments and indices) to be used to assess the required insulation of clothing for different cold exposures (see ISO 11079), or physiological and psychological consequences related to different thermal exposures, an instruction of practical application for cold working environments is lacking.

This International Standard was created to specify methods and practices for assessing and managing occupational health and performance risks in cold work. The choice of when these are to be used is at the discretion of those responsible for occupational health and/or safety.

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Ergonomics of the thermal environment — Cold workplaces — Risk assessment and management

1 Scope

This International Standard presents a strategy and practical tools for assessing and managing cold risk in the workplace, and includes

- models and methods for cold risk assessment and management,
- a checklist for identifying cold-related problems at work,
- a model, method and questionnaire intended for use by occupational health care professionals in identifying those individuals with symptoms that increase their cold sensitivity and, with the aid of such identification, offering optimal guidance and instructions for individual cold protection,
- guidelines on how to apply thermal standards and other validated scientific methods when assessing cold-related risks, and
- a practical example from cold work.

This International Standard supports good occupational health and safety (OHS). It is applicable to both indoor and outdoor work situations — indoor work includes work done inside vehicles, outdoor work both inland and offshore work — but is not applicable to diving situations or other types of work performed underwater.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9886:2004, *Ergonomics — Evaluation of thermal strain by physiological measurements*

ISO 12894, *Ergonomics of the thermal environment — Medical supervision of individuals exposed to extreme hot or cold environments*

ISO 13731, *Ergonomics of the thermal environment — Vocabulary and symbols*

ISO/TS 14415, *Ergonomics of the thermal environment — Application of International Standards to people with special requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13731 apply.

4 Strategy for assessment and management

4.1 Cold risk assessment

Cold risk assessment in the workplace follows the principles of risk assessment presented in ISO 15265 and generally accepted principles of risk assessment presented in, for example, BS 8800. It consists of three stages.

- a) In stage 1 (observation) possible cold-related hazards at work are identified. This includes collecting qualitative information by an observation method (see 5.2 and Annex A). Based on the observed problems, management methods should be implemented in order to eliminate or reduce the source of harm. A further analysis should be conducted if the problem at work is not easily reduced or eliminated, or whenever it is uncertain whether the preventive actions have been sufficient to guarantee worker health and safety.
- b) Stage 2 (analysis) aims at quantifying, analysing and estimating the cold-related effects observed in stage 1 and considered problems (see 5.3 and Annex B). The need for a further analysis in the workplace can also originate from the needs and definitions of occupational healthcare professionals, in assessing specific health-related problems in working situations. It is recommended that occupational health care or safety professionals conduct this analysis. To be able to perform the assessment, these persons should be provided with basic training related to cold, e.g. how to use the methods and estimate the risks. Based on the estimated cold risk, appropriate cold risk management methods should be applied. If it is still uncertain as to whether the management methods are adequate to ensure the worker's health and safety, a further analysis should be conducted (stage 3).
- c) Stage 3 (expertise) aims at quantifying, analysing and estimating cold risks. It will deal with highly complex thermal working circumstances and require sophisticated or special measurements. This level should be conducted by the same persons as those involved in stage 2, with the additional assistance of highly specialized experts. The duration of an individual assessment is one day, or more, if necessary. The assessment is aimed at solving any specific cold-related problem found during stages 1 and/or 2. See 5.2.3.

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See Figure 1.

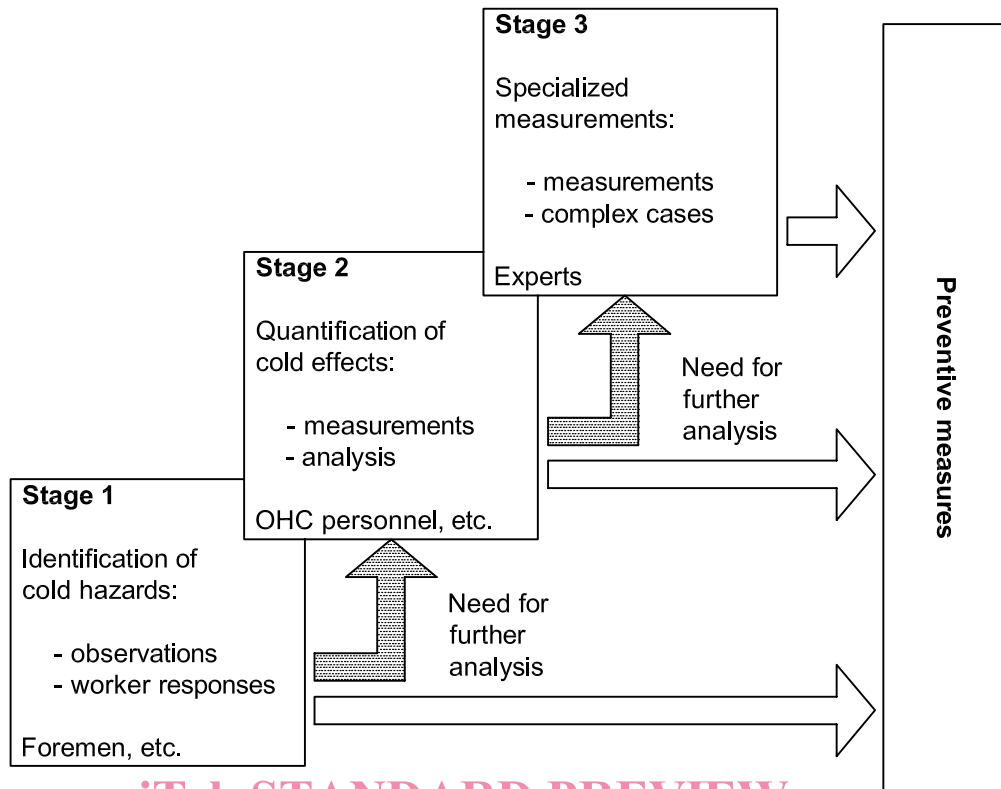


Figure 1 — Model for cold risk assessment in the workplace

4.2 Health assessment

Human responses to cold include complaints, decrease in performance, symptoms, attacks of diseases and cold injuries. The responses show a great individual variation and their presence is difficult to predict from the level of duration and intensity of cold exposure. The only way to identify these responses is to collect information from the individuals.

Cold-related health assessment is a three-stage medical screening conducted by occupational health professionals. Each stage involves identification of cold-related health risks both in the workplace as well as assessing the health of individuals.

- Stage 1 consists of a health check (see Annex D). The method used is a medically-based questionnaire whose purpose is to identify potential individuals having cold-related diseases or cold-related personal working limitations. The factors to be identified are, for example, cold sensitivity, cold urticaria, respiratory symptoms, cardiovascular symptoms, peripheral circulatory disturbances, symptoms related to white fingers, musculoskeletal symptoms, the effect of cold on performance and the occurrence of local cold injuries. As a result of stage 1 of the assessment, those individuals with no personal need for any further analysis with regards to cold are identified.
- Stage 2 is largely taken up by an interview and a clinical investigation of persons suspected of having a cold-related individual health problem. The content of the interview and clinical investigation is dependent on the results of the preliminary questionnaire and is symptom- or disease-specific. If cold-related diseases or working limitation are recognized, an additional risk evaluation (Annex B) in the workplace might be needed.
- Stage 3: if there are still some open questions on the individual's health status or other cold consequences, a more detailed analysis in a hospital expert unit or units or a provocation laboratory might be needed. When evaluating health aspects, it is important also to utilize the information obtained from the workplace risk assessment, e.g. the risk check at stage 1 and possibly more quantitative information from stages 2 and 3.

See Figure 2.

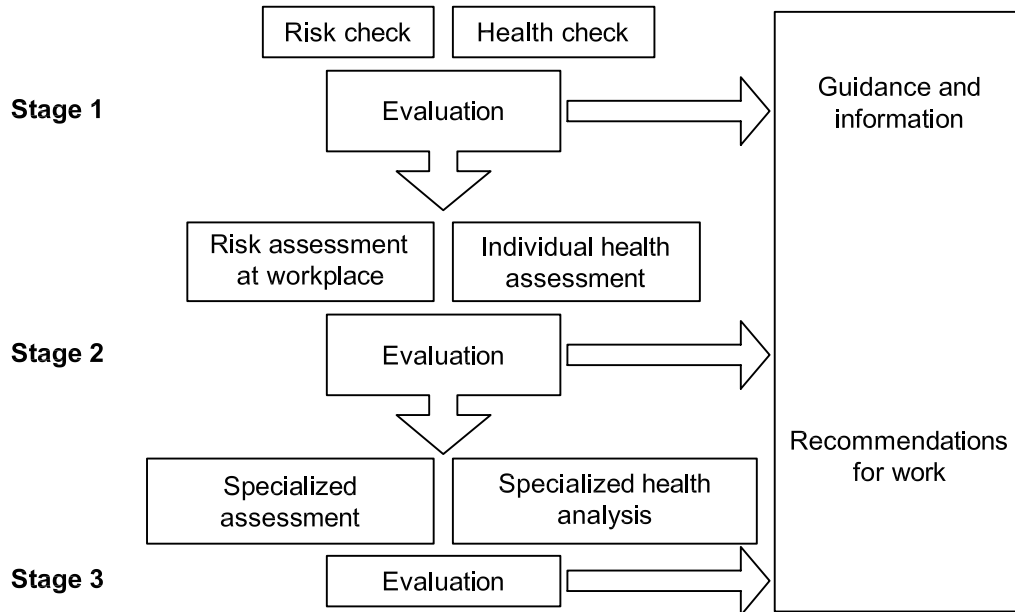


Figure 2 — Relationship between cold risk assessment and health assessment

The health assessment made by the occupational health professionals helps people to conduct their working activities in cold environments. Usually, as a result of the screening, only very few persons have severe limitations for working in a cold environment. However, it is very common that individuals have minor limitations or complaints. As a result of the selection, the occupational health professionals accept or reject employees for work in a cold environment. Those accepted need particular advice, training and information in order to ensure their optimal health and performance in cold work. The content of the information is dependent on the conditions in the workplace, and on an individual's cold-related diseases or limitations.

ISO 12894 provides guidance for the medical supervision of individuals exposed to extreme hot or cold environments and ISO/TS 14415 for the application of International (thermal) Standards for people with special requirements. Use them, as appropriate, when acting on the results of the health assessment. They advise health professionals on how to manage those individuals having an identified disease or limitation but not the majority of subjects having cold-related complaints, symptoms or working limitations without recognized disease.

During stage 3 of the risk assessment (see 4.1), and possibly already at stage 2, follow the guidelines given in ISO 9886 for the evaluation of thermal strain by physiological measurements.

4.3 Cold risk management

The cold risk management model (see Figure 3) and practices presented in 5.3 and Annex C should be fully integrated into the OHS management system and practices of the company/organization carrying out the assessments, in order to ensure the implementation and continuance of the activities. This kind of system may be established according to, for example, OHSAS 18001, which is compatible with the ISO 9001 quality management and ISO 14001 environmental management systems.

The workers, foremen and safety delegates, as well as the occupational health care professionals involved, should be trained to identify, assess and manage the cold-related risks at work.

5 Practices for cold risk assessment and management

5.1 Responsibilities

The employer is primarily responsible for the assessment and management of potential cold-related risks to health and safety in the workplace. A responsible person should be nominated to conduct these activities in the department or section of the company. This person should be provided with adequate training. Collaboration and consultation with occupational health professionals is useful.

5.2 Cold risk assessment

5.2.1 Stage 1: Observation

For the assessment of cold-related hazards, an observation method should be used (see Annex A). The method does not require comprehensive training. Furthermore, for a person at the workplace who is familiar with the contents of the work, conducting the observation does not take long. Therefore, it is recommended that, for example, foremen, work safety delegates or workers conduct the observation.

The checklist given in Annex A contains checkpoints related to the type of cold exposure, use of cold protective clothing, use of personal protective equipments (PPE), as well as environmental factors. Each factor is categorized into three different classes according to its seriousness: “no problem”, “slight problem” and “serious problem”. No immediate preventive measures are needed for the first two classes (scoring 0 and 1). However, a slight cold-related problem (scoring 1) indicates that improvements to reduce or eliminate the source of harm could be made in the long run to improve workers' occupational health and safety.

When conducting the observation at the workplace it is important first to identify the major tasks being carried out there. The purpose of this planning is to group the tasks or the workers exposed to cold in a similar way. Each of these groups should be then observed separately. It is important to include all the different problems that can exist due to cold. The planning may be conducted in a team at the workplace by a manager and/or foremen, workers and safety experts.

When conducting the actual observation, it is important to remember to observe the “average work situation”. This means that the observer should consider whether, for example, contact with cold materials is usually a problem in the work that is observed and not just during a specific observation. Environmental conditions should be looked at in a similar manner. If some parts of the check remain unresolved or observation is difficult, it is recommended that the opinion of the worker be sought, for example, in respect of use of protective clothing.

In outdoor work the observation should be conducted whenever the ambient conditions, work tasks or work environment markedly change. In cold indoor work it is not necessary to perform the observation so frequently because the climatic conditions and work tasks are often relatively constant.

5.2.2 Stage 2: Analysis

The main actions at this stage are

- follow-up on the stage 1 checklist,
- focus on identified problems,
- find direct cost-effective solutions, and
- allow decision about possible need for specialist assessment (stage 3).

It is important to note that this level of cold risk assessment ought not to require specific instrumentation or too complex analysis. The assessments include simple measurements and the use of tables and criteria values (see Annex B).

5.2.3 Stage 3: Expertise

Stage 3 aims at quantifying, analysing and estimating cold risks. The assessments should be performed by, for example, occupational healthcare professionals, occupational hygienists or other expert institutes with adequate competence. The duration of an individual assessment is one day or more and includes more complex analysis involving special instrumentation. The assessment is aimed at solving a specific cold-related problem based on the needs of the lower levels of cold risk assessment.

5.3 Cold risk management

Whenever any of the checkpoints show a serious problem, this should be taken into consideration at the workplace. For a specific problem there are usually several possible solutions. Each workplace should choose the preventive measures that are best suited for its own situation. After choosing a preventive action, it is important to select a person who will be responsible for applying the solution. After a corrective action has been taken, a re-check should be conducted to evaluate its sufficiency to reduce or eliminate the source of harm.

Depending on the type of the industry and company/organization, various preventive measures against cold hazards can be implemented. Annex C provides lists of different possible measures. The occupational safety delegates, supervisors and workers should carry these out at the workplace. The worker's participation is strongly recommended. All participants need to be informed about the actions to be made. The company/organization is advised to name the responsible persons in each of the following sections. ISO 12894, ISO/TS 14415 and ISO 9886 may be used, as applicable. The questions at the end of each section can be useful in planning. The selected activities should be indicated in the cold risk management plan. An example for a form for making such a plan is given in Annex C. The purpose of planning is to systematically take into account different aspects related to cold, as well as guarantee successful timing for implementing different management activities.

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