(Barents Interreg IIA-Programme)

RISK ASSESSMENT AND MANAGEMENT OF COLD RELATED HAZARDS IN ARCTIC WORKPLACES:

Network of scientific institutes improving practical working activities

PROJECT REPORT

TO THE READER

Cold exposure may have significant adverse effects on human occupational performance and health affecting work safety and productivity (e.g. amount and quality). These effects cause harm both to the employee as well as employer. The effects of cold in outdoor occupations are more significant in the Barents area compared with the southern parts of the Nordic countries and Europe because the duration of winter is long and cold conditions more severe. However, cold may also be a significant risk factor in indoor working climates within e.g. the food industry broadening the category of cold work.

It was recognised between the scientific institutes that there are no existing comprehensive set of methods and model how to assess and manage cold in a complementary way in the northern workplaces. Therefore, it was decided to start a joint co-operation project, which focuses on producing practical tools and principles for the workplaces, as well as occupational health care. The European Regional Development Fund (ERDF) and its specific programme Barents Interreg IIA supported the project from December 1999 to May 2001.

Project co-ordination/Oulu Regional Institute of Occupational Health (ORIOH), Finland

Professor Juhani Hassi, since 12.4 (Centre of Arctic Medicine, Thule Institute, University of Oulu)
Researcher Tiina Mäkinen, ORIOH, Cold Work Action Program
(Administrative supervisor, Director Lauri Pyy, ORIOH since 12.4. 2001)

Researcher Anita Hicks
Program Secretary Riitta Laitila
Statistician Jouko Remes
Co-ordinator of development projects Liisa Toivonen
Educational trainer Maire Huurre
Researcher Veli-Pekka Raatikka
Research Engineer Tanja Risikko
Educational Planner Tiina Tervaskanto

Sweden/Luleå University of Technology and National Institute for Working Life (Stockholm)
Associate Professor John Abysekera, Luleå Technical University
Reseacher Lina Giedraityté, Luleå Technical University
Professor Ingvar Holmér, National Institute for Working Life
Researcher Kalev Kuklane, National Institute for Working Life

Norway/THELMA AS Trondheim
Managing Director Arvid Påsche
Senior Engineer Bård Holand

Russia/Kola Research Laboratory of Occupational Health, Kirovsk
Professor Valery Tchachtchine
Med.doc/Researcher Natalie Nikitina
Epidemiologist/Researcher Alexander Nikanov

Project supervisor:
Tuomo Molander, Regional Council of Lapland, Rovaniemi, Finland

ABSTRACT

Background: A cold environment may cause several adverse effects on human performance and health. In the Barents region there are several occupational activities where employees are significantly exposed to cold. It was recognised between the participating scientific institutes that there are no existing comprehensive set of methods and model how to assess and manage cold in a complementary way in the northern workplaces. Therefore, it was decided to produce practical tools and principles for the workplaces, as well as occupational health care.

The strategy: The cold related existing standards were applied and tested in real working conditions. Based on the results it was realised that they are not at present applicable as such for the personnel of the workplaces. Therefore, new practical methods and principles of operation based on scientific knowledge were produced related to cold risk assessment, management and occupational health care. The methods were tested in a similar way by the key persons of the target companies who also provided information of their usability. In addition to the identical testing of the methods each country conducted specific research and development work. The development work was realised in a context bound manner on the basis of a present state analysis. The personnel and management of the enterprises participated as active members in development work.

The results: 1) Practical methods and model of cold risk assessment, management and occupational health care for cold working environments. The methods were tested by the key persons operating in the target companies of the Barents region 2) A functional transnational co-operation network between the scientific institutes which activities are continuing after the project 3) Improvement of cold knowledge. The project produced and tested different types of educational courses for occupational health care personnel in Finland, Sweden and Norway. The material produced in the project consisted of the Nordic cold guide, which includes practical instructions of how to manage cold hazards in cold work. The guide is especially suitable for the company management and occupational safety and heath experts. The project also produced practically oriented short information material for workplaces and occupational health care.

The exploitation of the results: The results will be presented and proposed to be included to the standard proposal ISOWD157543 (Strategy for cold risk assessment, management and working practices in cold environments). The methods and model have been utilised for the Nordic cold guide which is under preparation. The results of the project will be published in scientific journals. As future activities it is recommended to produce an entity of instructions for the workplaces of appropriate working practices in cold environments.

CONTENTS

1. BACKGROUND AND ORIENTATION

1.1. CLIMATE OF THE BARENTS REGION

CLIMATIC CONDITIONS

The climates of Nordic countries are controlled by westerly airstreams, which are often interrupted by meridional circulations that persist for longer or shorter periods and bring extremes of hot or cold, and also spells of drought or above-average precipitation. This transfer of heat is so effective that Nordic countries show one of the world's highest temperature anomalies. The Atlantic influence is in some degree modified by Scandinavian mountains and by the Baltic Sea and its gulfs, too.

The lowest winter temperatures occur in northern Finland and Sweden. Minimum temperatures in January are below freezing point: -4 º C on western coasts, -13- -19 º C in the interior and on the Gulf of Bothnia and -20 º C in the north and north-east Scandinavia. The absolute minimum is -15 º C on Atlantic coasts, from -15 to -20 º C in southern Norway, -25 º C in the southern Gulf of Bothnia, -40 º C in the northern part of the Gulf, and readings below -50 º C have been recorded in northern Sweden and in north-east Finland.

In northernmost Finland and Sweden, as well as in the highest parts of the Fennoscandian mountains, the winter, when mean temperature is below 0 º C, lasts for more than seven months. Its length decreases rapidly in Norway towards the Atlantic so that at the Norwegian west and south coast the duration of winter is less than a month or does not occur at all. In Sweden and Finland there is a slow decrease in the length of winter from north to south: it lasts for about four months in the central Swedish lake district, also the situation in southern Norway, and four to five in southern Finland. In southernmost Sweden winter lasts for only about a month.

The distribution of precipitation in Nordic countries is uneven because of the varied relief. The barrier of the Scandinavian mountains retains large quantities of the precipitation brought by always-moist west and Southwest winds. Precipitation decreases eastwards and most of it falls on the western slopes of the mountains between Bergen and Bødo. The lowest amounts are recorded in south and central Finland. In winter, precipitation usually falls as snow. In the high mountains of Norway and northern Sweden the snow cover lasts for more than half the year. In the Arctic, snow covers the ground for eight and half months, and in southern Norrland, central Finland and south-east Norway for six and half months.

In the Barents region the climate in the area is also influenced by the Gulf Stream, which flows up along the Norwegian coast and the Kola Peninsula before turning north alongside Novaya Zemlya, brings warm, humid air, ensuring that the sea is ice free all year round. The inland climate in northern Norway is typically continental with little precipitation, short warm summers and long cold winters. Along the coast, there is an oceanic climate with more precipitation and smaller fluctuations in temperature between summer and winter.

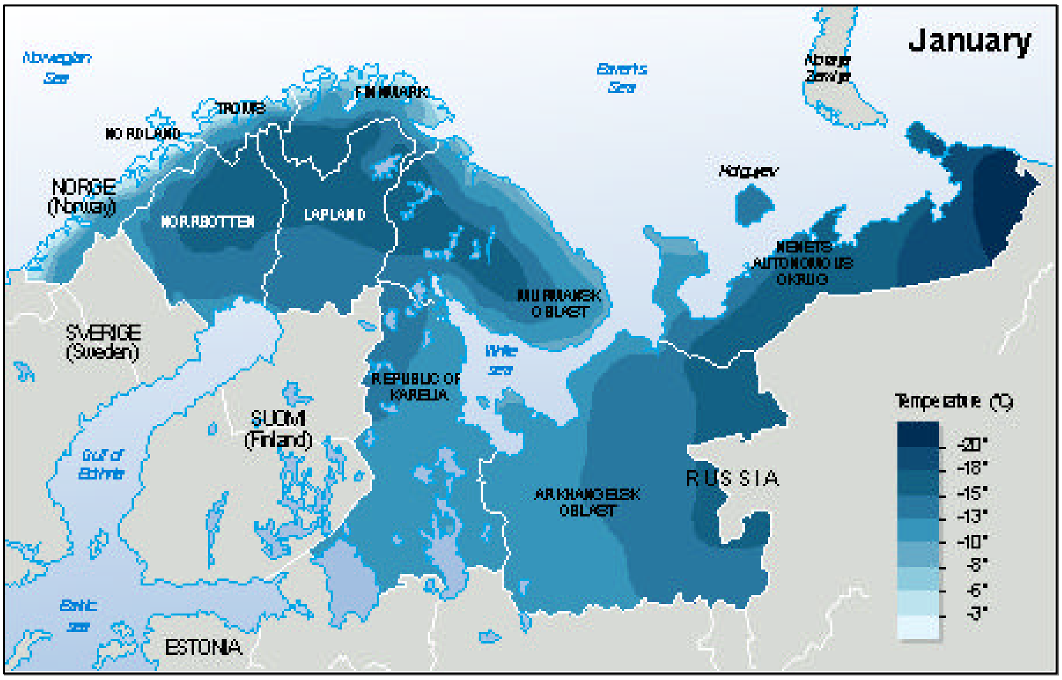


Fig. 1. Mean daily temperatures during January in the Barents region (Barentswatch 1998)

1.2. HUMAN OCCUPATIONAL COLD EXPOSURE IN THE BARENTS REGION

In the Barents region the occupational distribution differ from country to country. In the northern parts of the Nordic countries different services for societies' infrastructure and tourism frequently involve cold exposure. Furthermore, carpenters, reindeer herders and different safety occupations are traditional "cold work" occupations in these regions. In the Russian Barents region occupational cold exposure occurs often in mining and metallurgy (Tchachtchine 1998). The fish industry represents an important part of the industry in northern Norway and in Russia too. It is well known that the fishermen are frequently exposed to cold work exposure, but a less emphasised problem in this industry is the cold exposure experienced by the workers involved in delivery of the catch from the fishing vessels, and the further processing of the fish. These work sites may not necessarily be extremely cold, but is a cold and wet work site, for which the workers are likely to be exposed for longer periods.

In the northern parts of Sweden and Finland, nearly three million inhabitants are living in conditions, where winter lasts over five months. In the northern Finland the number of days when the environmental temperature is less than 10°C is 220-270. In Sweden, the majority of the inhabitants are living in areas, where mean daily temperature is below freezing point no more than four months during the year (table 1). Eventually in Lapland and in the Northeast region of Finland 200 000 inhabitants are experiencing winter that lasts over half a year. Considering Norway similar estimation is difficult to make, because three quarters of the population lives less than 15 kilometres from the sea, and the average duration of winter varies strongly in short distance on the coast. Another point of view is to examine the number of days when ambient temperature is below +10ºC, which is close to the definition for cold work (12°C) suggested by the British standard BS7915 (1998). Now mean daytime (e.g. 8–20) temperature is annually in Finland below this reading from southern part's seven to northeast's ten months.

Table 1. Estimated number of people in millions living in different areas defined by the duration of winter, when mean temperature is below 0 ºC.

Annual number of winter months	Sweden	Finland
1–2	0.3	
2–3	2.1	
3–4	3.8	
4–5	1.8	3.2
5–6	0.7	1.9
6–7	0.1	0.1

COLD EXPOSURE BY OCCUPATION

According to questionnaires made in Sweden and Finland proportions of workers doing mainly cold work, in other words spending at least half of their work time in cold conditions either outdoors in winter or indoors, are high in farming, forestry, horticulture, fishing and construction work. In Sweden especially workers in scavenging service, freighters and miners are reporting working mainly in cold (Westman). Overall in Sweden (somewhat less than in Finland) clearly over one third of employed persons is working in cold for short times repeatedly.

EXAMPLE OF OCCUPATIONAL COLD EXPOSURE IN FINLAND

In Finland between the duration of weekly cold exposure at work is greatest among construction workers, assemblers and repairers, slightly over 20 hours (Figure 2). Also above average (13 hrs.) exposure times are reported in farming, where farmer's weekly exposure to cold is 20 hours. Miscellaneous workers, soldiers and process workers, as well as workers in the transportation experience on the average about 15 hours work in cold circumstances. However, it is worth to mention that average occupational exposure time in cold is 5 hours (median), which roughly equals one hour daily cold exposure and variation 1-8 hrs/day. Variation in cold exposure during leisure time is only marginal by gender and age, farmers showing higher exposure than other occupations.

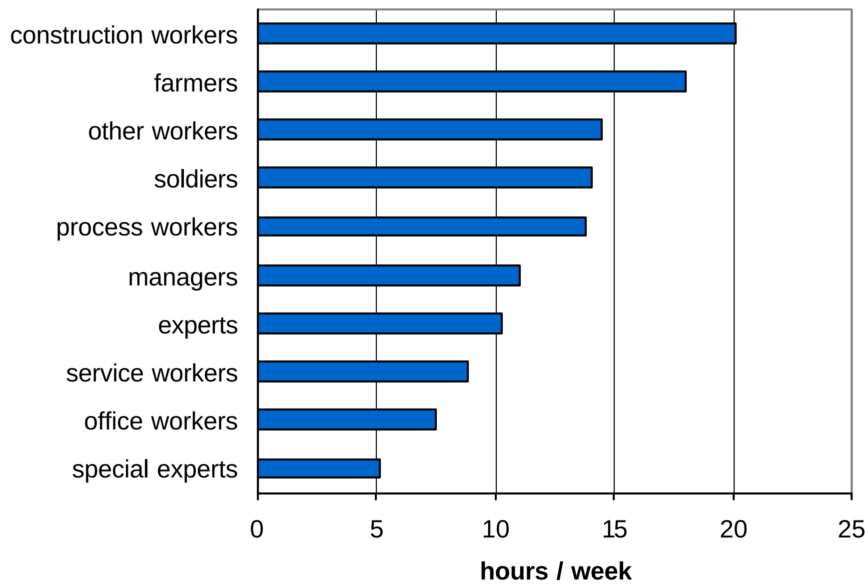


Figure 2. Weekly cold exposure in Finland at work by occupation (FINRISKI'97 survey, Hassi et al. 1998)

1.3. THE EFFECTS OF COLD ON HUMAN

The effects of cold on human are dependent mainly on the basic parameters of environmental factors (temperature, wind, humidity), the degree of activity (e.g. light or heavy work) and the clothing used (Fig. 3). Depending on the interaction of these variables cold stress causing local or whole body cooling may occur. This cold stress may result in a variety of different effects from discomfort to cold injuries. The actual risk of these effects is largely dependent on individual factors.

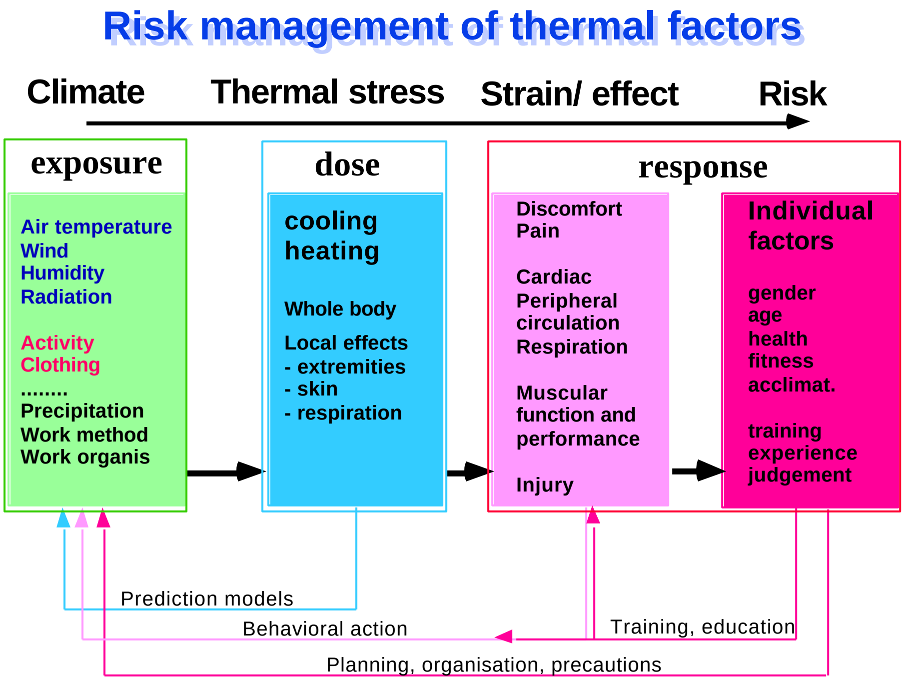


Fig 3. Relation between climate, stress, strains and risks assessment (Holmér 2000)

Cold and performance

Depending on the level of local or whole body cooling different levels of performance degradation may occur. The term 'performance' includes physical (e.g. muscular), manual and cognitive (e.g. mental) performance.

Mild cold stress causes thermal discomfort resulting in complaints of cold, unpleasantness and even pain. Discomfort may represent a distracting factor that can reduce mental alertness, increasing the reaction times and amount of errors and consequently diminish work quality and even result in accidents.

Cooling affects all components of muscular performance: endurance, force, power, velocity and co-ordination. It has been shown that even a relatively mild level of cooling of the muscles may significantly affect the physical performance (Oksa 1998). This type of cooling may occur relatively frequently when working in the cold.

Cooling decreases manual performance in several ways. This results in an impaired dexterity (clumsiness) and ability to perform especially fine movements of the hand. Critical skin temperature for tactile sensitivity appears to be at a skin temperature of 6-8 °C. Finger dexterity decreases slightly at finger skin temperature of 20-22 °C. A strong decrease appears at finger skin temperatures of 15-16 °C where some people experience pain (Enander 1984).

Cold may affect the cognitive performance of human. Especially complex tasks performed in the cold are susceptible to body cooling. Under severe cold exposure even long-term memory and consciousness may be affected.

As a conclusion it might be said that the effects of cold on human are dependent on the basic parameters of environment, activity and clothing. However, the net effects show strong individual variation (Holmér 1998).

Symptoms and cold related diseases

Cold exposure has been shown to involve a variety of different complaints ranging from subjective uncomfortable sensations to symptoms related to diseases (Hassi et al. 1998). Cold related diseases are defined as diseases which are either caused by cold or which symptoms are aggravated during cold exposure. Therefore, these include many of the most common chronic diseases like respiratory and cardiovascular diseases. The worsening of symptoms of musculosceletal diseases has also been commonly reported in association to cold work.

Certain individuals may also be especially susceptible to cold exposure. In these persons certain ‘hyperreactions’ to cold may occur. These include for example an exaggerated constriction of blood vessels in hands (Raynaud’s phenomenon), internal organs (e.g. kidney, lung, heart) or eyes due to cold exposure. Cooling of the tissues may also provoke cold urticaria. These reactions may cause different types of functional disturbances of varying severity in human. Furthermore, persons having different cold symptoms are very sensitive to cold discomfort, too.

Cold injuries

Recent studies have shown that Incidences of frostbites occur relatively frequently during occupational duties (for a review see Hassi & Mäkinen 2000). For example 12% of Finnish farmers and 21-29% of employees in seafaring have reported having at least one frostbite during their lifetime (Hassi et al. 2000, Juopperi et al. 2000). Frostbites result often in different functional disadvantages, some of which can lead to a temporary or permanent disability to work. Different types of sequelae are commonly (>65 %) associated with frosbite injuries (Ervasti et al. 2000). Further, frostbites cause often sequelae lasting from a few weeks to a lifetime.

Whole body cooling below body temperature 35°C is defined as hypothermia and is a type of cold injury. Severe whole body cooling occurs seldom in occupational situations.

Cold associated injuries

As a consequence of direct or indirect effects of cold, the total injury rate may be changed in relation to environmental conditions (Hassi et al. 2000). A study of mining industry in the USA showed that especially the rates of slip and fall accidents increased with decreasing ambient temperature. It is worth noting that cold associated injuries are not always caused solely due to alterations in the work environment (e.g. ice and snow). Body cooling may result in impaired performance, which may increase the risk for accidents (Fig 4). The unsafe behaviour of workers seems to be minimal at an environmental temperature of +20ºC and a shift to colder or warmer temperatures increases the risk for accidents (Ramsey et al. 1983).

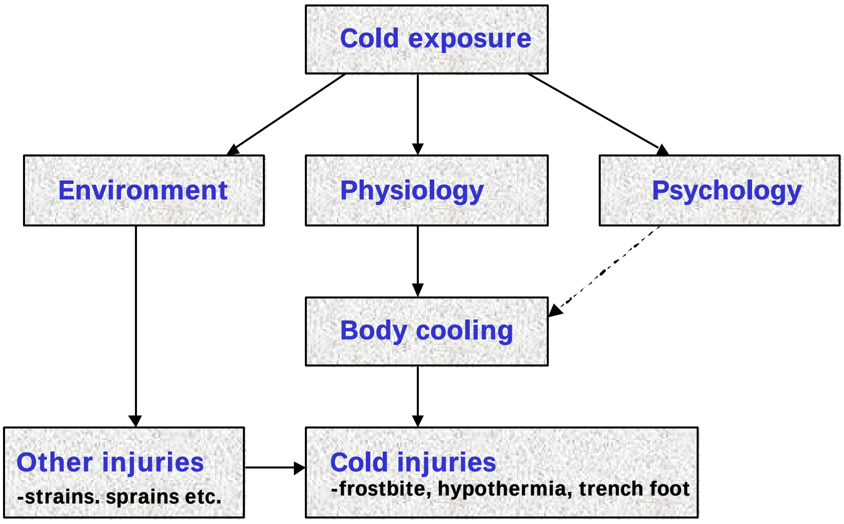


Fig. 4. Association between cold exposure and cold associated injuries (Hassi et al. 2000).

1.4. RISKS ASSOCIATED WITH COLD WORK

What is causing the cold risks at workplaces?

Cooling of the hands and feet is probably the most common problem with regards to work in the cold. Touching cold materials (e.g. tools) or while standing, sitting, kneeling or lying on cold surfaces causes heat loss by conduction from man to the environment. A frequent complaint in cold work is also that handling wet materials or wetting of clothing causes cooling mainly of the extremities (hands, feet). This is due to the fact that heat loss from man to the environment is increased due to the thermal conductivity of water, which is ca. 25 times higher than that of air. Of the environmental factors wind markedly increases heat loss from human both during rest and exercise (Mäkinen et al. 2001).

Work with frequently shifting activity from heavy to light or between warm and cold environments involve higher risk for cooling. Increased sweating under heavy activity causes an enhanced cooling during light activity or rest due to continued evaporation and diminished heat production. Lowered insulation of moist clothes accelerates body cooling.

Cold indoor work (e.g. food industry) is associated with more constant and regulated ambient conditions. The indoor temperature is generally kept at approximately 0- +10°C but work may be conducted also in cold storage rooms were the temperature is between 0- -30°C. Special problems related to cold indoor work are associated with frequent touching of cold, even frozen materials. Cold indoor work may also be predominantly of low physical activity, where inadequate protection of the extremities cause local cooling with subsequent consequences. Cold indoor work may also involve asymmetrical thermal conditions where e.g. upper body of the employee feels comfortable while at the same time the feet are cooling. Draughts in association to door/openings can cause sensations of discomfort.

The most important characteristics of cold protective wear are the thermal insulation, as well as protection against wind and wetness. Heavy winter clothing may increase the energetic cost of working in the cold. Furthermore, the clothing itself may restrict movements and in the worst case increase the risk of occupational accidents.

For protection from occupational hazards in the cold environment workers have to wear personal protective clothing and devices (PPD) for work hazard protection as well as cold protective clothing. This may create problems of incompatibility. The non-use or inadequate use of PPD renders the protective effects against work hazards almost worthless.

What are the consequences?

As far as workers are concerned the main effect of cold exposure is its negative impact on occupational health and safety. In the cases where these adverse effects are suspected to occur, the employer is always obliged to carry out risk assessment and related preventive measures to reduce or eliminate the risks (89/391/EEC).

A decreased performance in cold work due to discomfort or a reduction in physical, manual or cognitive performance may significantly affect work productivity and quality. This may have an impact on the competitive strength of the enterprise. A recent study in Finland concerning construction work showed that building during the winter causes additional personnel costs (Juopperi et al. 2000). These costs were attributable to the longer working times needed under cold conditions and the decrease in work efficiency, assessed in terms of the earnings of individual employees. Therefore, cold had a negative impact economically both to the employer as well as the employee. Working in the cold was estimated to increase personnel costs in the construction industry annually by FIM 300 million, which represents 3 % of the industry's annual personnel costs.

1.5. PURPOSE OF THE PROJECT

The effects of cold and associated climatic factors have not been recognised in northern workplaces in a systematic and comprehensive way. Cold is an environmental hazard on its own with specific risks of impaired performance and health effects. It also interferes and interacts with most factors in the work place, e.g. chemical and physical factors eventually modifying or aggravating the risk of these hazards. In addition, protective measures against cold may introduce new risk factors as for example work methods, clothing and equipment may change the normal behaviour of the worker making him more prone to error making and accidents.

It was recognised in the project that a systematic, rationally based strategy and methodology was needed to be produced in order to incorporate due attention to the cold factor in workplace management.

The project is connected more widely to the ideology of constant improving occupational health and safety systems at work. Therefore the produced methods and models of the present project are in agreement with the principles of OHS standards (BS8800, OHSAS18001). Concerning with occupational health care in cold work there are no previous methods or model for assessing and managing individual related health risks.

ISO standardisation

ISO thermal standards (Fig. 5) provide guidelines of assessment and evaluation methods for thermal environments (hot, moderate or cold). Although many of the standards are self-contained (can be used independently), in a comprehensive workplace assessment they should be used in conjunction with each other in a complementary way. Concerning the risk assessment and design of work in cold environments there are no comprehensive guidelines how to systematically assess the effects of cold on human health and performance.

The preparation of the standard ISOWD15743 "Strategy for risk assessment, management and working practices in cold environments" aims at providing information and guidelines of the appropriate assessment and management practices of cold related health and performance risks in cold work. This includes guidelines how to apply different existing thermal standards and other accepted scientific methods in practical risk assessment and design of cold workplaces. In order for the standard to be a successful instrument for cold related risk assessment, it has to be practically oriented and usable at workplaces. To achieve this goal, information of the validation and practical application of thermal standards in cold workplaces is required. The purpose of the project was to conduct preliminary practical testing of the methods at workplaces.

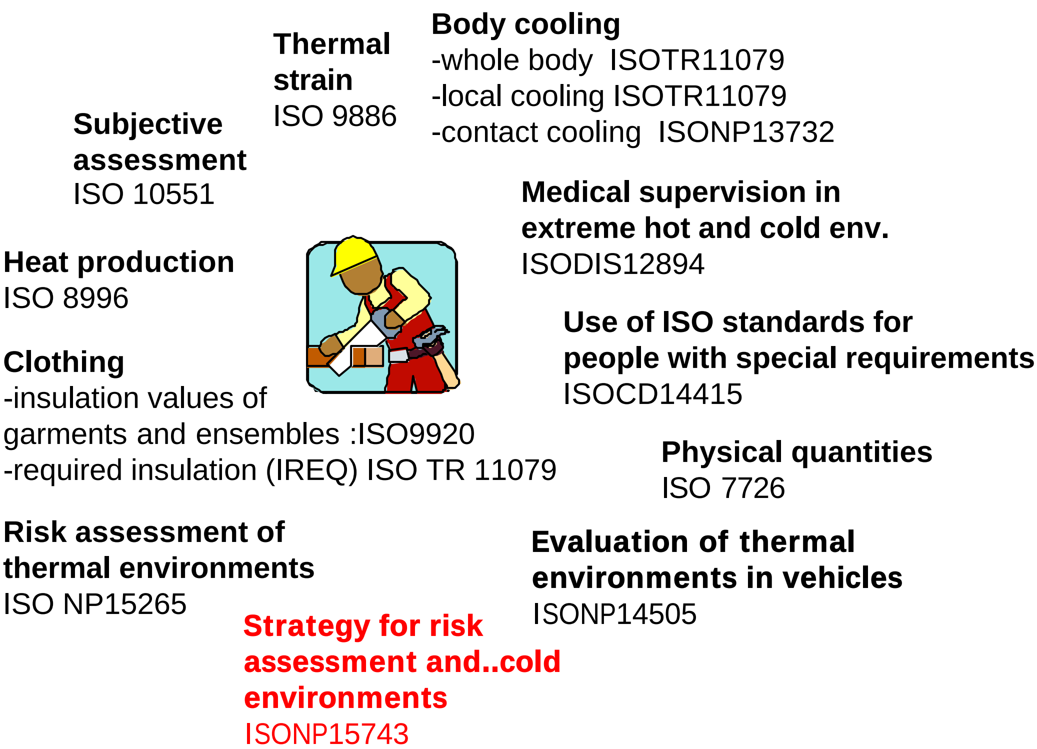


Fig 5. ISO thermal standards relevant for assessing cold environments

2. DETAILED AIMS

2.1. AIMS OF THE PROJECT

2.1.1. BARENTS REGION

The main aim of the project was to help workplaces to improve their competence to act in cold environments of the Barents region. This can be achieved by improving work safety and health of employees working in these areas.

The more detailed aims of the project was to:

1) elaborate a protocol for assessment, control and prevention of risks associated with cold exposure at workplaces and with the cold factor as the main or contributing hazard to workers' health and safety
2) produce a functional transnational co-operation network between the research institutes and representatives of the working life

2.2.2. NATIONAL AIMS

The national aims deviated somehow from each other depending on each country's special expertise. As a summary the aims of the project at the target workplaces was to:

- improve performance and productivity during cold work
- reduce cold related occupational injuries and diseases
- produce practical tools for assessing and managing cold hazards
- improve the competitiveness of enterprises in arctic environment
- improve cold knowledge of personnel
- produce an educational entity and supporting material
- develop in the target enterprises model work places where the cold related risks are reduced/eliminated

Finland

In the Finnish subproject the target enterprise (YIT-Construction Lapland) was asked to indicate its aims with regards to the development work. The company's aims were to:

1) Develop practical tools for cold risk management. The aim of the company was to identify which cold hazards were most essential in different construction projects and how to prepare to manage those.
2) Receive information of what are the methods to improve the working performance when the temperature is approximately 0°C: how to prevent wetting of clothing, elimination of the combined effects of wind and wetness
3) What are the methods to improve the working performance when the temperature is below –15°C
4) Improve the cold knowledge of the employees for protection against cold. How to dress in different circumstances, what kind of equipment are available, how cold affects human
5) How to protect oneself against wind

Sweden

The Swedish subproject had the following aims to be fulfilled under this project:

1) To develop a procedure for assessment, control and prevention of risks specifically associated with cold exposure at workplaces in the northern part of Sweden, i.e. Norrbotten.
2) To validate the procedure and methods in actual workplaces in the construction industry in the field.
3) To develop a model of preventive measures for the target construction workplaces, where cold related disadvantages to human's working and functional abilities are diminished/ prevented. To pass information about the preventive measures to the workers at the target workplaces and to follow up the effect of the recommended measures.
4) To provide recommendations how to choose the proper personal protective devices (PPDs) and how to avoid incompatibility problems when PPDs are used with cold protection wear for better performance and protection in the cold.

Norway

The Norwegian subproject aimed to:

1) Perform a risk assessment analysis for the different work categories involved in the fish receiving and processing activities, and to evaluate the health preventive actions implemented, with the aim of reducing the health hazards linked to these activities.
2) To assist in the development of functional solutions to ensure and optimise work performance together with representatives of the companies involved.
3) To increase the workers' knowledge of personal protective equipment (in particular clothing) by offering instructions/educational sessions on these topics.
4) To establish a close working relationship with the local health care personnel as they should be those who carry on with the activities at the factory level when the project to test out the risk assessment tool has been completed.

Russia

1) The Apatit company is to improve the preventive strategy for workers highly exposed to environmental cold including its organizational as well as technical aspects.
2) As a result of the project there will be organized a model outdoor workplace in the open pit for educational purpose to transfer the experience obtained to other Russian companies.
3) Alternatively the local sport/tourist company finds beneficial its participation in the project as well. Importance of prevention of cold injures is broadly true in respect to those going in for outdoor sports and winter tourism which are being developed well enough in Kirovsk area. Results of the project can be readily implemented in improving the cold protection strategy (risk management) when arranging winter sports as well as tourism in the Kola Peninsula.
4) It has been officially confirmed that revising of the Murmansk local labour legislation (viz. The Labour Protection Law) is also expected to be an outcome of the project.

In the project Russian partners were offered a possibility to participate in the planning and development processes of the risk assessment and management protocol. The outcomes and experiences were passed to Russian occupational health and safety experts. In addition, all the information received during the project was be distributed to Russian partners.

3. PROJECT ORGANISATION

3.1. PROJECT ADMINISTRATION AND SCIENTIFIC EXPERTISE

Project co-ordinator: Oulu Regional Institute of Occupational Health/Cold Work Action Program

The national action program of FIOH, Cold Work Action Program (1997-2000) focused on cold related strategic (e.g. epidemiological studies) as well as applied research (e.g. ISO standardisation) and development work. The development work was carried out in a context bound manner in active co-operation with the target companies participating in the different projects. The Cold Work Action program provided multiskilled expertise to the development work as well as professional pedagogic support for planning and establishing the cold related information and training material and practices. The director of the Cold Work Action Program, professor Juhani Hassi has been participating in the International Organisation for Standardisation (ISO) and has been responsible for preparing the standard ISOWD15743 (Strategy for cold risk assessment, management and working practice in cold environments).

Sweden

The co-operative partner from Sweden was Luleå University of Technology, Department of Human Work Sciences, Division of Industrial Ergonomics. A major area of doctoral research carried out by the IE Division has been on cold environments and its effect on humans, and specifically with the use of personal protective devices in the cold. The IE division worked in close co-operation with the National Institute for Working Life, Department of Occupational Medicine and its Climate Research Group. The director of the group, Professor Ingvar Holmér, is responsible for producing cold related standards within the ISO and CEN standardisation. The special expertise of the Climate Research Group is dealing with strategies and procedures for risk assessment in adverse thermal environments. Furthermore, the activities include development of test methods for thermal properties of personal protective clothing, in particular for cold work and development of mathematical models for evaluation of human heat balance under climatic stress.

Norway

The Norwegian participant in the project was SINTEF Unimed/Extreme Work Environment in Trondheim, Norway. SINTEF performs contract research and development for industry and the public sector in the fields of technology and the natural and social sciences. During the course of the project the experts involved in the project established a new company, THELMA AS. Thelma is engaged in a number of R&D projects focusing on improvements of personal protective equipment. A number of the national projects being carried out are related to cold protection clothing systems, covering usage areas from normal work to the extreme accident survival situation. Thelma is also heavily involved in work on the European standards for protective equipment. Arvid Påsche, Managing Director of Thelma, is the convenor for the preparation of prEN 13921-4, "Personal protective equipment - Ergonomic principles - Part 4 : Thermal characteristics".

Russia

Russian expertize to the project was provided by The Kola Research Laboratory of Occupational Health (KLH) in Kirovsk City (Murmansk region). The KLH focuses on the development of a scientific basis for occupational medicine and hygiene in the industries of the north. The main lines include development and implementation of new effective means for individual safety and protection of workers against the combined effects of harmful agents and severe climatic conditions, as well as epidemiological investigations and assessment of risks related with contaminated environments in the northern regions.

Fig. 6. Illustration demonstrating the project organisation and personnel.

3.2. TARGET ENTERPRISES

Finland

YIT Corporation is a versatile service company that offers a wide spectrum of implementation, maintenance and operation services for residential, real estate, industrial and infrastructure investments both in Finland and on the international market.YIT Construction Lappi is belonging to the YIT Building Construction Ltd. Its estimated annual turnover in 2001 is 105 million FIM. Altogether 25 officials and 60-70 employees are employed in the Lapland area. It is a general principle of the company to aim at scheduling the building operations so that they are mainly conducted in the warmer season. However, it is estimated that approximately 30% of the projects occur so that the framework of the buildings is built in the winter.

Construction work is one of the occupations where workers are most exposed to cold. The effect of cold are mainly due to cold weather, where wind is an aggravating factor, but may also frequently be related to handling cold materials (e.g. tools) or by wettening of clothing due to precipitation and snowfall.

Sweden

The construction workers (in NCC and Lindfors Bygg AB) carry out their activities in the unheated indoor or cold outdoor environment. Two fifteen minutes coffee breaks and one-hour lunch break let workers to warm up during the working day. The workers can stop their activities if they think the temperature is too low (usually if the temperature is below -25°C) to operate outdoors. In construction work the employees are exposed to the contact cooling when they handle (e.g., carry, move, lift, etc) various objects. The precision work (especially in the carpeting activities) is done with bare hands and the contact with small cold objects (e.g., screws) is very common.

The forestry workers employed by Skogsvårdsstyrelsen spend outdoors about 6 hours of an 8-hour working day. The time schedule for a working day is approximately as follows: 6 hrs of cold exposure with an hours lunch break. If the temperature is very low or it is very windy the workers would warm up in the heated cabins and take warm drinks every one or one and half hour. If the working day starts with the travel by scooter to the actual workplace they would warm up in the cabin as well before even starting to work. Their exposure to cold is completely dependent on the environmental conditions: air temperature, snow/rain or wind. The contact cooling usually occurs if the tools are used e.g., chain saw.

The workers in the Vägverket Produktion are exposed to cold intermittently. Most of the day they spend in heated cabins of a vehicle. The exposure to cold usually occurs when the vehicle maintenance work is carried out during such activities as clearing the road of snow, gritting, etc

Norway

Both of the Norwegian companies are located in Båtsfjord, Finnmark. Båtsfjords community is almost totally dependent of the fish processing. The West Fish - Aarsæther Group owns 5 shore-based production facilities, strategic located close to the rich fisheries in the Barents Sea and the North sea. Aarsæther Båtsfjord AS produces frozen fillets, IQF fillet portions, frozen blocks, salt fish, lightly salted fillets and fresh fish. Capacity: 12,000 tonnes. 145 employees. AS Båtsfjordbruket is a fish processing company with approximately 60 employees. Its main activities deal with buying and processing of fish and fillets. Approximately 5 million kilograms of fresh fish is bought annually. During one working shift up to 2,5 million kilos of processed products may produced.

The work sites of the fish processing industry may not be extremely cold, but involves a combination of cold and wet work, for which the workers are likely to be exposed for longer periods. The work activity may be quite different for the workers involved, from very strenuous for some, to quite static low-force demanding activities for others. It is particularly the light activity work where the extremities (hands and feet) of employees are likely to cool.

4. PROJECT MAIN ACTIVITIES

4.1. DURATION OF THE PROJECT

The project started on the 5th of December 1999 and terminated on the 31st of May 2001.

4.2. ACTIVITIES IN CHRONOLOGICAL ORDER

4.2.1. JOINT ACTIVITIES

- Project start, accepting main activities, schedule and responsibilities (January 2000)
- Preparing the methods and model for cold risk assessment, management and OHC (February-August 2000)
- Workshop for project personnel and key persons on producing risk assessment and management methods and model: agreements of the practical testing in each country (Luleå, August 2000)
- Further preparation of methods and models (- October 2000)
- Practical testing in target workplaces (Dec 2000-Mar 2001)

  Risk check (n=163)

  Health check (n=130)

  Collecting usability information
- Educational courses for key persons in each country (September 2000-March 2001), three separate courses lasting between 1-3 days
- Information sessions at workplaces (winter 2000-2001)
- Results analysing (April 2001)
- Preparation of the Nordic cold guide (March-May 2001)
- Preparation of the international closing seminar
- Project closing seminar 14th of May 2001, joint presentations of the results
- Project ends 31st of May 2001
- Last steering group meeting 18th of June 2001, project final report

4.2.2. NATIONAL MAIN ACTIVITIES

Finland

- Field study for evaluation of usability and coverage of present ISO thermal standards in workplace cold risk assessment (February-March 2000)
- The management of YIT Construction Lapland indicated its specific aims with regards to cold (see national aims) (February 2000)
- A present state questionnaire for the management of the workplaces was conducted. This included questions related to present activities with regards to cold risk assessment and management, as well as the existing problems.
- The foremen (n=3) of the workplaces filled in the workplace-specific cold work plan. Consultation advice was given from the project personnel (September-October 2000)
- Keypersons from OHC (n=3) were provided education during a three-day course. Instruction how to conduct the health check was given (November 2000)
- Equipment testing was conducted (see results 5.2.1.), evaluation from the employees was collected (winter 2000-2001)
- OHC-activities for the target worksites and employees (winter 2000-2001)
- Short information sessions (n=6) were held in the workplaces both by project and OHC-personnel (winter 2000-2001)
- The project tools were presented to all the foremen (n=15) of the company (January 2001)
- Key persons of the company were trained to test the cold risk check
- Testing of the risk check (December 2000-March 2001)
- Key persons participated to a course for protection of the extremities (January 2001)
- Presentation of the results of the project to the management and personnel (May 2001)

Sweden

- Participation in project meetings meeting (January 2000- May 2001)
- training course for project personnel in Luleå (August 2000)
- meeting with Skanska (October 2000)
- Checklist testing in Jokkmokk (Novermber 2000-April 200
- Introductory meeting with NCC (December 2000)
- Checklist testing in NCC (December 2000-April 2001)
- Checklist testing in Vägverket Produktion (December 2000-2001)
- Information sessions (winter 2000-2001)

- Training course for the OHS (March 2001)

Norway

- Contacting the target companies in the fish processing industry of which two participated in the project
- Initial meeting and presentation of the project to the company management. The orientation of the management was that they felt that any cold work problems had already been taken care of through technical installations recently implemented. From the workers side it was expressed some scepticism at their experience with work environment studies that they resulted in paper work and nothing else.
- Due to the high percentage of Finnish speaking employees in Båtsfjord all questionnaires and written information had consequently to be prepared in both languages.
- A course was held for occupational health care personnel in Karasjok, Finnmark (October 2000). The course, which involved scientists from ORIOH, covered cold risk assessment, cold management and a number of related topics.
- The cold risk checklists were tested in both work sites in Båtsfjord. Furthermore, the health check establishing the worker's own evaluation of their health status related to the cold work environment was used at two factories. The answers given in this questionnaire indicated that a high percentage of the workers had problem with the cold, and that this problem affected their work efficiency and motivation.
- A total of three different information sessions at each factory were given covering selected items of personal protective equipment against cold. All workers attended these sessions (a total of 180), as the management closed down the work in the factory for the duration of the sessions.
- Temperature monitoring of air temperatures in the filet-hall was performed in both factories, and revealed high variations (12-15°C). Monitoring of skin temperatures on different body location was further performed for a number of workers in work positions identified as critical with regards to cold problems.
- Results of the measurements were presented for the management and the workers and corrective actions were discussed.
- The management of both factories responded quickly by replacing the footwear used at some of the most exposed work sites. A follow-up temperature monitoring of the workers at these work sites demonstrated that the change in footwear represented a dramatic improvement.
- Clothing trials (winter-spring 2001)
- The preparation of a common Nordic guide for cold work sites is considered an important task for the project.

- Participation in project meetings

PROJECT MEETINGS

Altogether 9 joint meetings were held during the project.

Fig 7. Luleå workshop for project personnel and key persons (August 2000)

- 17.1. First project meeting, Kastelli Research Centre, Oulu, Finland (11 participants)

  -detailed project plan of activities, agreeing on role of co-ordinator and project partners, agreeing on main project activities, agreeing on schedule for activities

- 27.-28.4 National Institute for Working Life, Solna, Sweden (8 participants)

  -contents of risk assessment and management protocol: cold risk assessment, management, occupational health care, information and traning in cold work

- 9.6. Harstad, Norway (during 11th Millenium meeting of the IUCH) (5 participants)

  -reparation of the checklist, preparation on the II-level assessment, decision of training of OHC-personnel in each country, principles on the Luleå training and workshop, principles of evaluation

- 16.8. Luleå Technical University, Luleå, Sweden (15 participants)

  -practical preparation and finalising of cold risk assessment and management methods and protocol

- 9.10. National Institute for Working Life, Solna, Sweden (8 participants)

  -principles of evaluation of the project, agreeing of producing the Nordic cold guide

- 24.11. Kastelli Research Centre, Oulu, Finland (during the 2nd Kastelli Symposium) (12 participants)

  -similar testing of the produced methods, preliminary structure and responsibilities of the Nordic Cold Guide, presentation of preliminary structure of the closing symposium

- 12.2. National Institute for Working Life, Solna, Sweden (8 participants)

  -Editorial Board of the Nordic Cold Guide, contributors of the guide, costs, schedule

- 18.-20.3. Båtsfjord, Norway (continued during Hurtigruten) (9 participants)

  -Nordic Cold Guide: processing, completing cold risk assessment and management methods + model, final report: preparation, closing symposium: realisation

- 14.5. Rovaniemi district, Finland (during the closing symposium) (11 participants)

  -contract for producing the layout of the Nordic cold guide, preparation and completing the final report

STEERING GROUP MEETINGS

The members of the steering group: Juhani Hassi, Director FIOH/Cold Work Action Program (Lauri Pyy, Director of ORIOH since 12.4.), Researcher Tiina Mäkinen, FIOH/Cold Work Action Program, Associate Professor John Abeysekera, LUTH/Div. of Industrial Ergonomics, Professor Ingvar Holmér, National Institute for Working Life/Programme for Respiratory Health and Climate, Managing Director Arvid Påsche, THELMA AS, Professor Valery Tchachtchine, Kola Research Laboratory of Occupational Health. The supervisor of the project, Tuomo Molander from Lapinliitto was also a member of the steering group.

Altogether 7 steering group meetings were held. The meetings dealt with the administration of the project.

- 17.1. First steering group meeting, Kastelli Research Centre, Oulu, Finland (6 participants)
- 28.4 National Institute for Working Life, Solna, Sweden (5 participants)
- 16.8. Luleå Technical University, Luleå, Sweden (5 participants)
- 9.10. National Institute for Working Life, Solna, Sweden (5 participants)
- 18.12. Telephone meeting (5 participants)
- 19.3. Båtsfjord, Norway (5 participants)
- 18.6. Telephone meeting: Project end

5. RESULTS

5.1. JOINTLY PRODUCED METHODS AND MODELS

5.1.1. COLD RISK ASSESSMENT

5.1.1.1. Identifying the needs for assessment methods by a field study

Aims and realisation: In the Finnish subproject a field was conducted which aimed to test and evaluate the usability and coverage of available ISO thermal standards in cold related risk assessment of workplaces. The workplace assessments were conducted in construction and seafaring industry in the Oulu region, Finland. The tested methods included observation methods, which were assumed to be relatively simple to use or belonged to the lowest level of categorisation within the method. The more analytical assessments included measurements. Occupational nurses and a work safety representative who were not earlier familiar with the methods were trained in order to be able to conduct the assessments. At the observation level the following methods were tested: ISONP15265, ISO8996 and ISOTR11079. When measuring the following ISO thermal standards were tested: ISO7726, ISO8996, ISO10551, ISO9920, ISO9886 and ISOTR11079. The observations were repeated on three different occasions and 5 different workers were observed by 5 observers (n=75). The measurements were conducted by four different persons and repeated for four times (n=16). In the end of each assessment a questionnaire assessing the usability and coverage of cold related risks of the specific method was filled in.

Results: The methods of the observation level were considered easy to adopt, the duration of each assessment was short, and the results were easy to analyse. The amount of training provided was considered adequate and there was no need for special instrumentation. However, the coverage of cold related risks was considered small at this level.

The measurement methods were considered more laborious to perform, required special instrumentation and involved constant interruptions of the work. Furthermore, the provided training was not considered totally sufficient and additional instructions were frequently asked especially when analysing the results. The measurements provided a larger coverage in the assessment of cold related risks, e.g. the degree of cooling, subjective comfort and risk of cold injuries.

Conclusion: It was recognised that there is a clear need within the project to develop a new observation method for cold risk assessment to be conducted by the workplaces. Furthermore, it was suggested that e.g. occupational health care experts could conduct the more analytical assessments in the future. However, the methods should not require too complex analysing or instrumentation. Usable elements from ISO thermal standards were recognised, which could be used at the second level risk assessment (see annex C). A scientific publication will be produced of the results of the study.

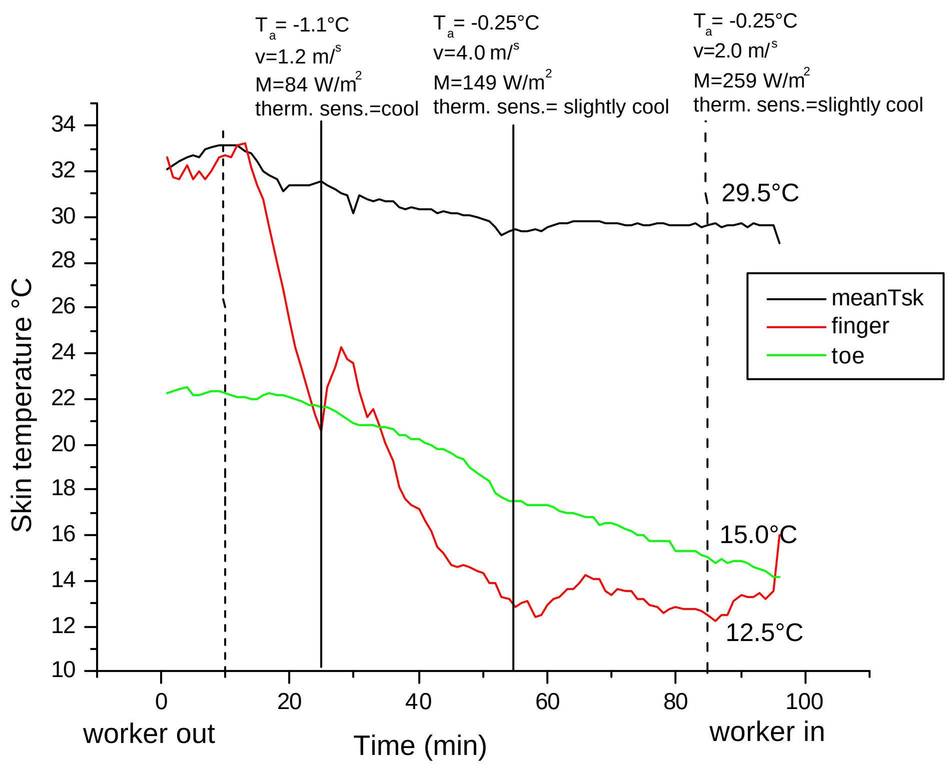


Fig. 8. Example of measurements of a carpenter at YIT Construction Oulu conducted according to the thermal standards (ISO 9886, ISO8996, ISO7726, ISO10551, ISO9920). The results show that at temperatures of approximately –1°C and a slight wind there is significant cooling of fingers and toes.

5.1.1.2. Producing the cold risk check for identification of problems at workplaces

The cold risk check for workplaces was produced in the project in order to be able to <u>identify</u> potential hazards to the workers health and safety (Annex B). As a result of the assessment appropriate preventive measures can be taken into account in order to reduce or eliminate these problems.

The risk check is an observation method that does not require comprehensive training or knowledge in e.g. ergonomics. Furthermore, for a person at the workplace who is well aware of the contents of the work, conducting the observation does not necessarily require a long time. Therefore, it is recommended that for example foremen, work safety delegates or workers representatives could conduct the observation.

The following problems are identified (see Annex B):

- exposure to cold air
- exposure to wetness
- degree of contact with cold materials
- degree of exposure to wettness
- problems related to the overall cold protective clothing
- problems related to protecting the extremities (hands, feet and head)
- problems related to using personal protective equipment (e.g. hearing equipment) together with cold protective clothing
- other problems related to cold (e.g. varying thermal environments, varying workload, slipperiness, insufficient lighting)

The factors to be observed are categorised in the following way:

0=no problem, does not require an immediate preventive action

1=slight problem, preventive actions to improve the situation should be considered in the long run

2=serious problem, preventive action related to reducing or eliminating the problem should immediately be conducted

Whenever, any of the checkpoints show a serious problem this should be dealt with at the workplace. These include organisatorial arrangements, technical applications or protective clothing. Each workplace should choose the preventive measures that are best suited for their case. After choosing a preventive action it is important to select a responsible person to deal with it. Furthermore, a date should be set for a re-check to find out whether the preventive action has been sufficient to correct the problem. The more thorough instructions of how and when to use the cold risk check are indicates in Annex B.

Identified cold related problems and usability of the method

The risk checks were tested among all the target companies in Finland, Sweden and Norway. In addition, in the Finnish subproject the check was tested also in the shipping industry in association with another development project. The observed worktasks showed large variation representing a broad category of cold exposure situations. When testing the check the following problems with regards to cold were recognised (Table 2)

Table 2. Identified cold related problems in workplaces of the Barents region. The workplaces include construction work, fish processing, road construction, winter travelling, forestry and shipping. The number of observations is indicated in parentheses (total number 163).

Factors	0=No problem	1=Slight problem	2=Serious problem
1. Cold air	25.8% (42)	**61.3% (100)**	12.9% (21)
2. Air movements/wind	27.0% (44)	**61.3% (100)**	11.7% (19)
3. Contact with cold surfaces	21.5% (35)	**66.9% (109)**	11.7% (19)
4. Exposure to water/ humidity	33.1% (54)	**49.1% (80)**	17.8% (29)
5. Protection against cold	**73.6% (120)**	20.2% (33)	6.1% (10)
6. Extremity protection	**49.4% (81)**	39.0% (64)	11.6% (19)
7. Use of PPDs	**60.1% (98)**	36.8% (60)	3.1% (5)
8. Other factors			
Long term exposure to cold	**50.3% (74)**	33.3% (49)	16.3% (24)
Very light physical activity	**55.1% (75)**	36.0% (49)	8.8% (12)
High variation in physical activity	36.5% (54)	**51.4% (76)**	12.2% (18)
High variation in thermal env.	**49.7% (72)**	34.5% (50)	15.9% (23)
Slipperiness	39.6% (59)	**45.0% (67)**	15.4% (23)
Insufficient lighting	**64.1% (93)**	26.2% (38)	9.7% (14)
Other factor, what?		(3)	(5)

The majority of the categories showed either a slight or no problem with regards to cold. The category slight problem indicates that improvements in a company's OHS policy should be made in the long run. The more detailed analysis of the results of the risk checks will be processed and published in scientific journals. This includes for example the comparison between the different industries.

Results from Sweden were analysed according to the identified factors with regards to temperature. The different temperature ranges: between 0 and - 8 ºC (n=14); for -10…-18 ºC (n=21) for -22 ºC and lower (n=6). Table 3 shows the score most frequently given for a particular problem within each range of temperatures. The percentage indicates how many respondents chose the particular alternative.

Table 3. Results from checklist testing in Sweden.

Problem/Inconvenience	Temperature 0… -8 ºC		-10… -18 ºC		-22 ºC and lower	
	Score	%	Score	%	Score	%
Cold air	1	57	1	48	1	83
Air movements/wind	1	71	1	48	1	100
Contact with cold surfaces	1	78	1	76	1	83
Exposure to water/ humidity	1	57	1	62	1	83
Protection against cold	0	78	0	43	2	50
Extremity protection	0	93	1	48	2	100
Use of PPDs	1	57	1	76	0	67

The majority of problems/inconveniences scored 1. Two specific problems draw attention to their score at the very low temperatures. The protection of the whole body and of the extremities against cold is not sufficient at these temperatures. The fact that the 'Use of PPDs' has scored 0 for temperature of -22 ºC or lower suggests that they are not used at all (due to incompatibility problems) rather than that there are no problems. A scientific publication will be produced of the results of the risk check testing.

Usability of the method

Table 4. Duration of conducting the risk check and following procedures.

Stages	**Duration min±SD (n)**
Preparation	7.77±7.45 (94)
Observation	10.77±6.96 (94)
Results analysing	7.06±8.21 (94)
Further procedures	3.92±6.15 (94)
Total	**29.37±19.95 (94)**

The usability questionnaires were conducted in association with 94 of the observations. Based on the results it can be concluded that conducting the check does not require a long time, which makes it a usable method. The provided instructions were considered adequate in a majority of cases (91.5%). The check itself was considered easy to use in a majority of cases (83.2%) and required a few rehearsals according to 16.8% of the respondents. When asking the opinion of who should conduct the risk check in the future it was indicated that these could be workers, foremen or work safety representatives. A scientific publication will be produced of the results.

Alternative checklist focusing on PPEs and cold protective clothing/Sweden

The Swedish team developed a modified checklist (see in the annex B) where along with the questions included in the common checklist special questions were added on integration of cold protective clothing and personal protective wear. The modified checklist provides more information on the combined use of cold protective clothing with PPDs, which is important for taking counter measures. The PPDs checking is very relevant to problem of cold exposure and the modified checklist includes checks on each type of PPDs separately. The other major difference between the common and the modified checklists is the answer categories as follows.

Common checklist		Modified checklist (Sweden)
1 – Cold does not cause any problem	vs.	Yes
2 – Cold causes certain problems	vs.	No
3 – Cold causes considerable problems	vs.	If YES whether PRIORITY measure needed

5.1.1.3. More advanced cold risk assessment

The second level of cold risk assessment aims at analysing and estimating the cold related effects (see Annex C) which have been observed as problems based on the cold risk check (step 1). The need for a further analysis in the workplace may also originate from the needs and definitions of the occupational health care experts in order to assess specific health-related problems in real working situations.

Principles for assessment at step 2 are:

- follow-up on step 1 checklist
- focus on identified problems
- finding direct cost-effective solutions
- allow decision about possible need for specialist assessment (Step 3)

It is important to notice that this level of cold risk assessment should not require specific instrumentation or require too complex analysing. The assessments include simple measurements and use of tables and criteria values (Annex C). Regarding the preventive measures and problem solutions, appropriate sections of the Cold risk management document are to be used (Annex D).

If the implementation of the management methods requires even more specific detailing, the need for further analysis is indicated. Based on this the risk assessment will proceed to the expert level (step 3). This level aims at quantifying, analysing and estimating cold risks. The assessments should be performed by e.g. occupational health care units, occupational hygienists or other expert institutes with adequate competence. The duration of an individual assessment is up to one day or more and includes more complex analysing 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.

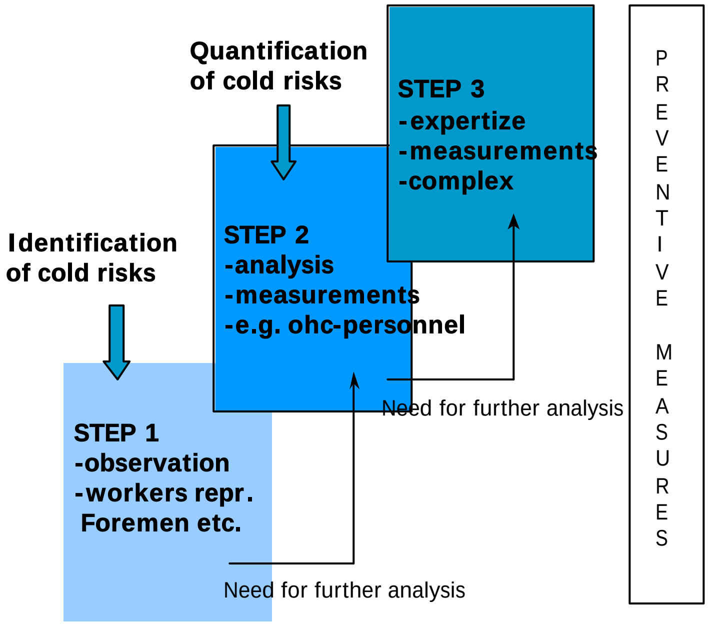


Fig 9. Model for cold risk assessment.

5.1.2. COLD RISK MANAGEMENT

5.1.2.1. Cold risk management model for workplaces

An action model was developed for assessing and managing the cold induced occupational health and safety risks at work (Fig. 10). The main responsibility of producing the model was carried out by the Finnish team in co-operation with the other project partners. The model the tools (e.g. cold risk management plan) and examples for implementation are included in annex D.

The cold risk management model should be fully integrated into the occupational health and safety (OHS) management system and practices of the company, in order to ensure the implementation and continuance of the activities. This kind of system may be established according to e.g. OHSAS 18001 Occupational health and safety management systems - Specification, which has prepared to be compatible with the standard ISO 9001 for quality management system and standard ISO 14001 for environmental management system.

The model and methods for implementing it have been developed and tested in context with target industries. The workers, foremen, safety delegates as well as occupational health care personnel shall be educated for identifying, assessing and managing the cold related risks at work.

The Swedish team investigated the problem of incompatibility between PPDs and cold protection wear. The Swedish team has prepared the recommendations to be followed in the combined use of PPDs and cold protective clothing that are presented in the annex E.

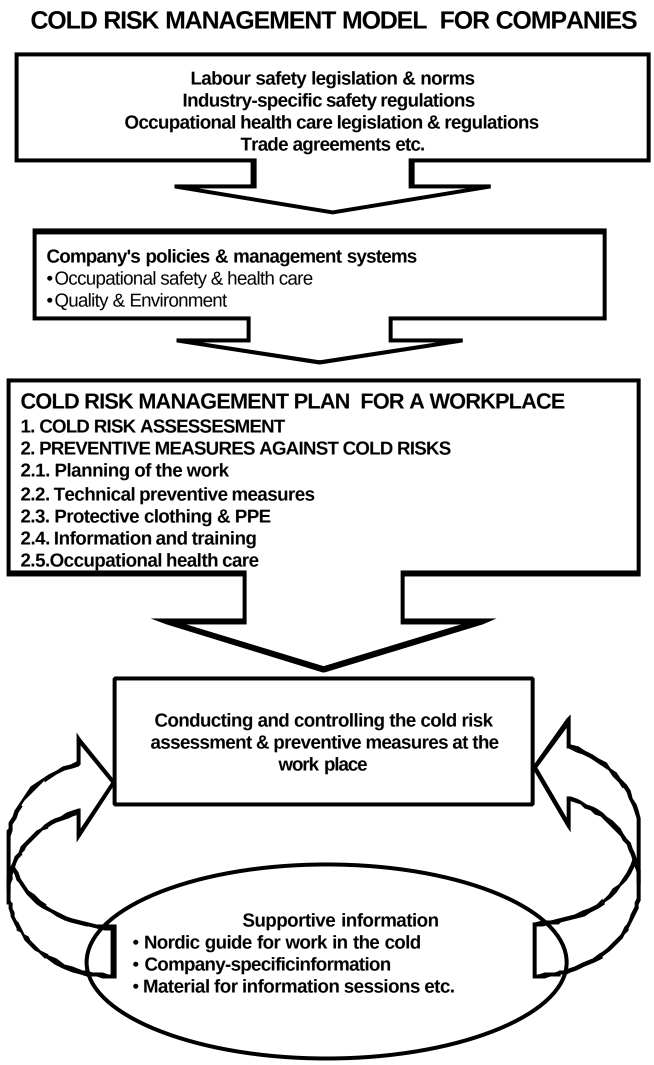


Figure 10. Cold risk management model for companies /workplaces

5.1.3. OCCUPATIONAL HEALTH CARE PRACTICES IN COLD WORK

5.1.3.1. Background

International Labour Organisation's Occupational Health Services Convention (No. 161) and Recommendation (No. 171) from 1985 advice all employers to arrange work and environment dependent services to prevent occupational diseases and injuries, and confirming the working ability. These services shall be arranged with medical personnel having special training for occupational health care. EEC's Framework Directive 89/391 details these advises for countries of the European Union. This is confirmed in the member countries by the national legislation. Occupational health care (OHC) practices are structured differently in each country. In Finland activities are based on OHC-law but in other Barents-countries on lower level advises and recommendations. ICOH, international professional co-operative organisation for OHC-experts, has published a "International code of ethics for occupational health care professionals".

Cold environments cause special needs for OHC as a consequence of cold exposure to an individual as well as due to changes in work environments and tools. In addition to this, basic needs for OHC are still required in cold work like in any other working circumstances. In this text is described only the special features of OHC related on cold environments. International Organisation for Standardisation has prepared special standards for Medical Supervision of individuals exposed to extreme hot or cold environment, as well as a standard for the application of international thermal standards for people with special requirements. Furthermore, there are some industry specific international recommendations for OHC-practices in cold environments.

Human responses to cold e. g. complaints, symptoms, attacks of diseases, cold injuries and decrease of performance show large individual variation. Health consequences can be weakly predicted based on the level or duration or intensity of cold exposure. The only way to identify these responses is to interview the individuals. This information is needed for the medical selection of employees to work in cold environments and for individual content of OHC for those who have light personal limitation to overcome working in the cold environments.

The main content of OHC is based on the result of cold related risk assessment in working environment (see 5.1.1.) and health check of working individuals. Commonly needed OHC-activities are sickness or other health limitation based advice and training, possible treatment, medication and rehabilitation. Depending on the needs and agreements with workplaces OHC-professionals may be utilised for providing common information for the employees how to manage cold in occupational situations.

The knowledge about why, what and how, to arrange OHC for workers in cold environment, is not known commonly by OHS-professionals. This causes a need to train OHS-professionals and to offer them supportive material for their practices related on cold exposed employees. The co-operation between OH-professionals and occupational safety personnel is highly recommended because of the partly analogical activities.

5.1.3.2. Identifying the needs for development of OHC practices

A basic purpose of OHC is to confirm workers health and working ability in their work. An equal importance of OHC to employers is to confirm workers ability to fulfil the needs that different worktasks demand in order to reach a target. OHC is responding to these demands by the selection of workers based on their ability to stay healthy and be able to reach target results while working in cold environments.

The lack of methodology and practices to collect this information in OHC caused the need to develop a selection procedure in this project. Furthermore, also the other OHC-practices needed attention with regards to cold. The limitation of the time as well as resources of the project did not allow a more detailed development work.

Aim and realisation:

The aim was to develop a checking practice to identify symptoms, complaints, diseases, injuries and performance degradations related to the employee's cold exposure. More advanced selection based on the results of this health check was aimed to be realised in further development work.

The first model of the health check was structured largely based on questionnaires from population studies fulfilled earlier by Oulu Regional institute of Occupational Health. This model was tested in another project of Cold Action Program as an interview method in 1999 and 2000. The evaluation of the result in the project meeting of this Barents-project concluded that the methods is too wide and time consuming. Therefore, it was decided to produce checking-practice for selecting those employees who need a more advanced interview and other OHC practices.

The health check was developed by the Finnish team and commented by the other national teams. The method was tested in the two Finnish workplaces of this project and in six workplaces of the other projects in Cold Work Action Program. Furthermore, additional valuable information was gained from two Norwegian target workplaces. The OHC-practices were structured in harmony with the internationally accepted OHC practices as well as the other activity models developed in this project (Fig. 11).

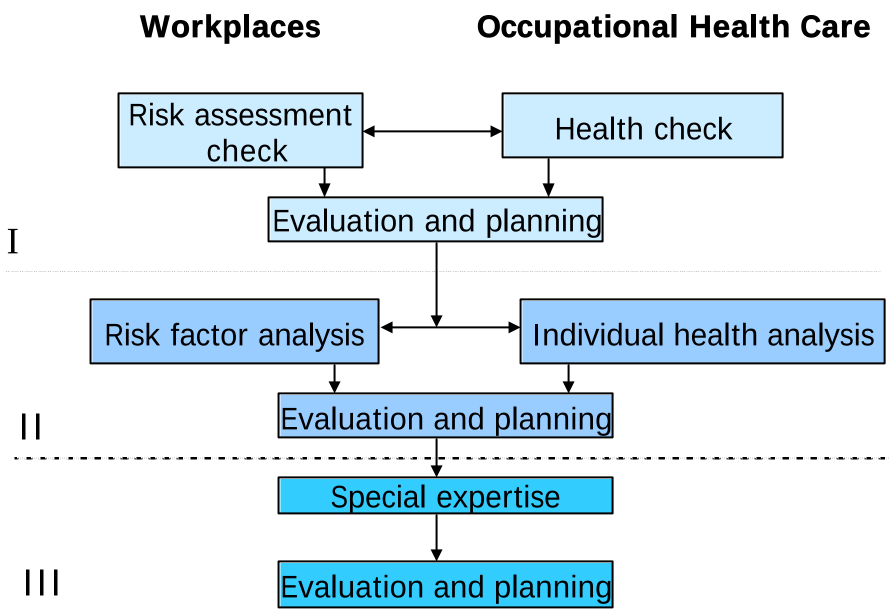


Fig 11. Relationship between workplace cold risk assessment and occupational health care activities.

OHC-personnel of the target enterprises were trained the basics of cold related health and in OHC-practices for occupations in cold environments. The usability of the developed method and model was evaluated by the participating OHC-professionals by questionnaires and by interviewing by the OHC-specialists of the project. In the end of the testing the developed stepwise model of OHC-practise was processed in the workshop of OHC-specialists from the target workplaces and team of this project. The final form and model seen in the Annexes F and G of this report were modified from the results of these evaluations.

5.1.3.3. Results

Model for OHC practices in cold work

Selection was practised as a part of medical screening at three different levels of activity. Each level involves identification of cold related health risks both in the workplace as well as health of individuals. The first level consists the health check (Annex G) and the risk check of the workplace (see cold risk assessment in 5.1.1.). The purpose of health check is to find all potential individuals having cold related diseases or cold related personal working limitations. As a result of the information in the first stage those individuals are differentiated with no personal need for any further analysis with regards to cold.

The second level of the activities in medical screening is largely formed by the interview and of the clinical status of persons suspected to have a cold related individual health problem. The content of interviews and clinical investigations are dependent on the results of the preliminary questionnaire and are symptom or disease specific. If cold related diseases or working limitation are recognised, an additional risk evaluation in the workplace might be needed (see Annex C). If there still are some open questions in the health status or other cold consequences, more detailed analysis in expert units in hospitals or provocation laboratories might be needed.

As a result of the selection OH-professionals accept or reject employees to work in cold environment. Accepted persons need different kind of individual advice, training and information for optimal health and working result. (Annex F).

The repetition of the screening is needed if the occupational or exposure situation changes or is anticipated to change. Periodical repetition of health screening in a static situation is recommended about every 3rd year for all employees and sickness or limitation dependently for those who have cold related disease or other cold related health or performance limitations.

5.1.3.2. Cold health check: identified individual related cold complaints/symptoms and usability of the method

The Health Check is:

- a medically based uniform standardized questionnaire to screening for health hazards of cold in northern workplaces
- Factors to be identified: cold sensitivity, cold urticaria, respiratory symptoms, cardiovascular symptoms, symptoms related to peripheral circulatory disturbances, symptoms related to white fingers, musculoskeletal symptoms, local cold injuries, the effect of cold on performance
- It emphasises cold symptoms

Results

Table 5. Number of respondents

Industry	
Fishing industry (Norway)	52
Construction (Finland)	68
Maintenance (Finland)	10

Total	130

Results from the cold risk check

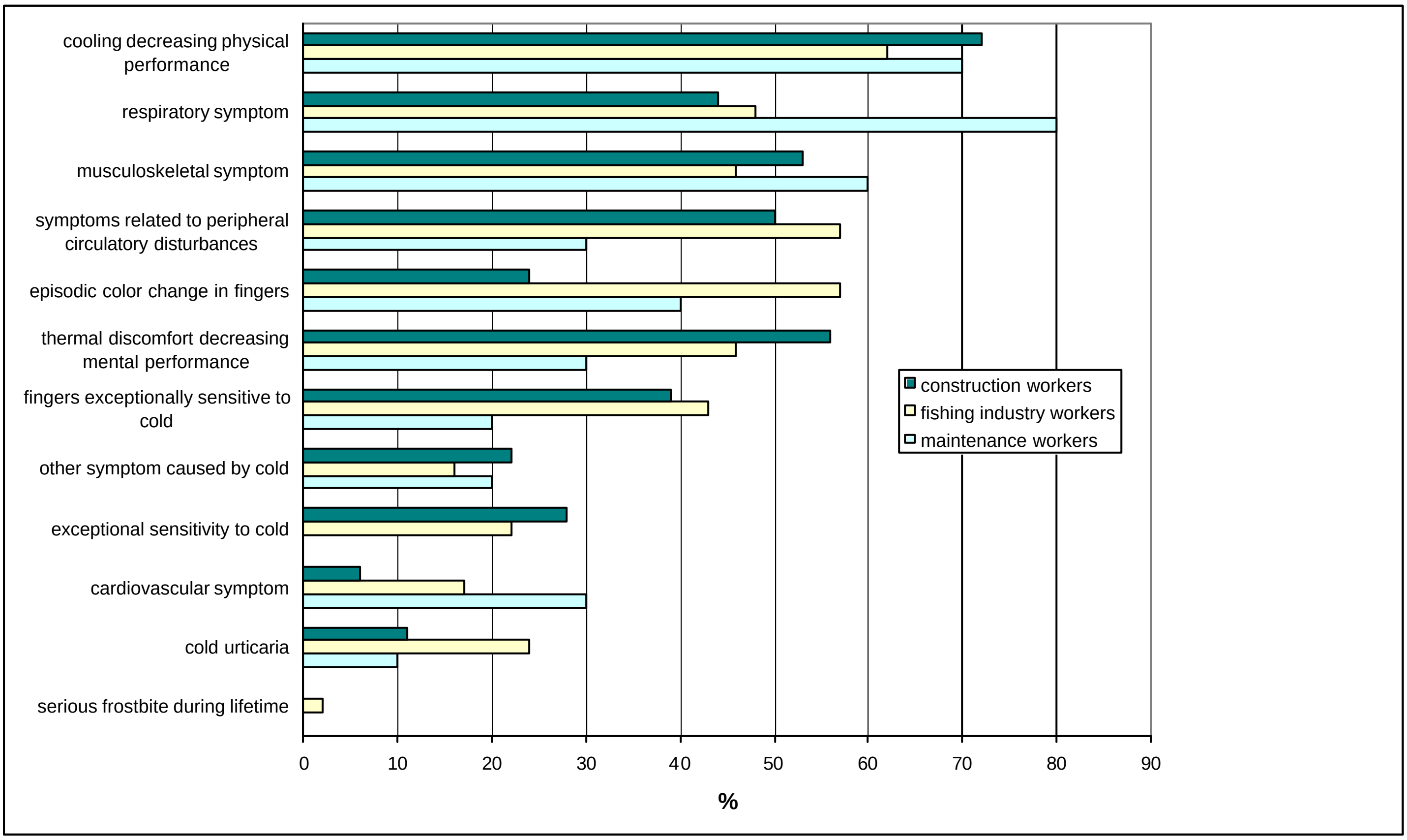


Figure 12. Cold related health effects and symptoms in different industries in Finland and Norway.

The results show the presence of various cold related symptoms in the employyes of the target workplaces. Furthermore, in a large number of cases individuals have reported that the effects of cold decreases performance in cold work. These results will be further analysed in more detail and published in scientific journals.

Usability of the health check

A usability questionnaire was filled in by the OHC-units testing the health check. The results are indicated in table

Table 6. Evaluation of the usability indicated by Finnish OHC-units (n=5)

Adopting the method	• Instructions rather sufficient • more detailed instructions for evaluation are needed • more detailed training for using the check
Duration/complexity	• 15 min-2 hrs (planning, realisation, results evaluation, further procedures) • sufficiently short
Sources of error	• subjectiveness of cold sensations • understanding the term “exceptionally sensitive) • understanding the term “episodic” • answers of respondents not always truthful (different motives)
Meaningfulness	• systematic method for identifying individual cold related problems • important in maintaining working ability and health
Further procedures	• distribution of advice for clients produced by the Cold Work Action Program • discussions with clients detailing the problems • client directed to medical examination
Shortages	• further procedures after diagnosis undefined (roles of OHC) • instructions for the clinical trials
Preferred implementation	• during health examinations • can be distributed to the employees • can be used as an interview method

The questionnaire and the related information material were considered easy to use and understand. It selected a large share of the employees for further investigation. However, many “positive” respondents were in the further interview excluded from the more advanced investigations. The more accurate, wider questionnaire was rejected in the first part of this project as being too time consuming. More development work is still needed to find optimal sensitivity and accuracy for the first level selecting procedure. The developed first level identification could be included as a part of health investigations which OHC experts practice in their selection and treatment work.

Usefulness of the given training

The given training was evaluated as being useful according to the participating OHC specialist. A lack of detailed written information was still indicated about activities in the second and third level of OHC for cold exposed workers. Such material is not available even today. More information about cold related diseases and injuries was hoped. It was mentioned, that the above listed education needs are not possible to cover only in the regular OHC training, but should be included as a part of the basic medical and health education.

Usefulness of given information material for workers

The OHC–experts of the project team produced disease and symptom spesific information material as instructions for clients who are susceptible to cold. These information sheets were evaluated by the OHC –personnel to be very useful in explaining the medical background of the symptoms to the employees.

5.1.3.3. Conclusion

The OHC model was evaluated by OHC specialists of the target companies as a valuable tool in itself. In the future these practices should be merged to form a part of the main OHC-practices. OH-professionals need to know and be able to manage the substance, available information, forms and advice as well as OH practices for employees in cold environments. The common OHC-model for working in cold environments and recommendations for practices are still under development. The developed training courses and information material produced in this project are usable in any OHC for cold exposed workers. The Nordic Cold Guide which is under preparation will help to fulfil the above mentioned activities.

5.1.4. INFORMATION AND TRAINING

5.1.4.1. Principles of information and training in cold work

Model for information and training in cold work

The model for information and training is realised in a three-step manner (See Annex H). The target group for information and training practices at step 1 are the employees. The purpose of step 1 is to improve cold related knowledge of employees so that they are able to recognise their own responsibilities in cold management. This could be for example identifying personal warning signals of cold exposure or the selection of appropriate clothing according to the climatic conditions. The material to be distributed should be practically oriented and not too extensive. Specific booklets, like the construction worker's cold guide, as well as the information session material could be used. It is also important that new employees receive training with regards to cold work.

The second step information and training would concern the key persons of the workplaces, as well as occupational health care and safety personnel who are closely linked to the workplace. The key persons would be strongly involved in the practical assessment and management of cold related hazards. Therefore, one part of the training practices would include instructions how to use the produced methods (e.g. risk check, health check, cold work plan). For the optimal use of these tools also some additional basic information related to cold is needed. This information may be provided in the form of courses specially arranged for key persons that were realised in different forms in this project (see below). The supportive material could include for example the Nordic Cold Guide, which is partly produced in the project (see 5.1.4.2.). Workplace key persons (e.g. foremen) could be provided with supportive material, like an information folder, which was utilised in the Finnish subproject.

The third step of information and training would involve experts. Step 3 would be conducted largely in active co-operation between companies, scientific institutes and possible also educational units. Each unit would have members who are responsible for constant uptodating of cold related knowledge. This expert level would also be responsible for planning and implementing the education of key persons. The third step of information and training would involve active implementation of scientific information into practical working activities.

Development work in the cold work

The principles of the development work in the companies is initiated by the need for a change (e.g. improving working activities with regards to cold). Reaching this goal requires a joint orientation and commitment of the company. The company could be motivated by explaining the adverse effects of cold to human performance and health as well as indicating the cost benefits that can be obtained by reducing these effects. The development work is initiated by a present state analysis: what are the present problems with regards to cold, what are the existing management practices, what is the orientation of the employees etc. For this purpose the project used a joint present state questionnaire (Annex H). After defining a mutual goal the actual development process starts. The actual process should be conducted in an active and mutual co-operation involving open communication between the employer, the possible outside co-operative partners as well as the employees. A joint orientation and commitment and multiskilled participants enables a new good operation model with regards to cold.

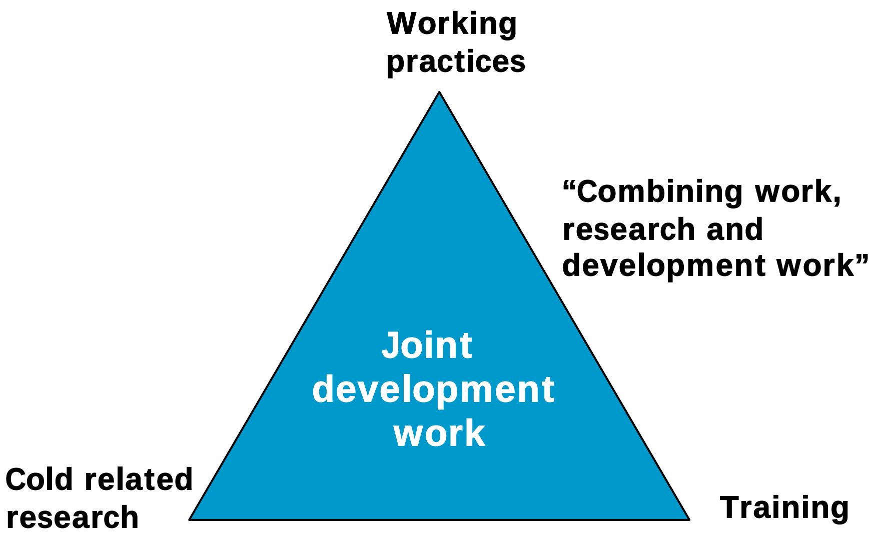


Fig. 13. Development work in the cold.

5.1.4.2. Construction workers guide to the cold

The Finnish team distributed the Finnish version of the construction worker's cold guide to approximately 70 employees in the Lapland area. This guide has been produced in a previous development project conducted in co-operation with the YIT Construction Ltd/Oulu. A version in English of the same guide was translated within the project.

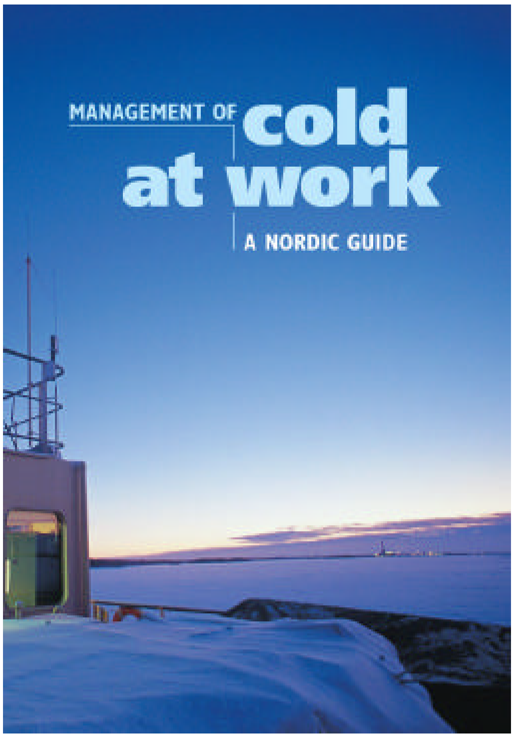
5.1.4.3. Nordic cold guide

It was recognised in the project that there are no existing practical instructions/information available concerning how to assess and manage cold hazards in workplaces. Furthermore, it was considered important to include the new methods produced in the project. Therefore, it was decided to jointly produce a practically oriented guide that can be used in all the Nordic countries.

The guide provides instructions how to assess and manage cold related hazards at work. It is especially suitable for work safety personnel, occupational health care personnel, work safety officials, company management and for vocational education

Contents of the guide:

- Cold exposure
- The effects of cold on human thermoregulation
- The effects of cold on health and performance
- Cold risk assessment and management at workplaces
- Occupational health care in the cold
- Information sources, research and development work related to cold



The manuscript of the guide has been written in co-operation with the project partners. It will be completed as a publication of the Finnish Institute of Occupational Health in November 2001

5.1.4.3. Information session material

Previous experience has shown that short and concise information sessions are an effective way of disseminating information to the employees (Risikko et al. 2000). These information sessions may be held in association with a coffee or lunch break without the need to interrupt the work. The best outcome of these sessions can be achieved when the topics are chosen according to the present needs of the company. For example clothing information should be given in association with providing new winter clothing or in association with an equipment trial (Risikko et al. 2000).

The produced information session material (Annex I) was distributed to the target companies in Finland, Sweden and Norway. In Finland they were provided in conjunction with a more comprehensive information folder. The strategy was that the project personnel provided an example to the key persons of the company of how to keep an information session. Altogether x information sessions were held at x workplaces for approximately x employees. The material was then left to the key persons of the company to be used independently in the future.

5.1.4.4. Improving cold knowledge of key persons in the project: examples of courses

It was recognised in the project that key persons of the companies as well as occupational health care personnel need basic information about cold as well as how to assess and manage it. Therefore country specific courses for key persons were arranged in Finland, Sweden and Norway. The strategy was that the courses would basically include similar contents. The structure of the different courses was the following:

- Project presentation, Different types of cold exposure, Cold and performance, Cold related symptoms and diseases, Cold risk assessment, Cold risk management methods

General courses:

- Hyvä työterveyshuoltokäytäntö kylmässä (1 ov), Oulu, Finland 1.11., 2.11., 29.11. + distant teaching (3 participants from the project) = 5 x 3 = 15 trainee days
- Risikovurdering av arbeidsplasser med kaldt arbeidsmiljø, Karasjok, Norway 2-3.10. 2000 (7 participants) = 2 x 7 = 14 trainee days
- Riskbedömning vid arbete I kallt klimat, Luleå, Sweden 7.3. 2001 (6 participants) = 1 x 6 =6 trainee days

Specific courses for key persons of the project:

- Käsi-jalka-pää. Ääreisosien suojaaminen kylmässä. Oulu 10.1. 2001 (2 participants from the project) = 1 X 2= 2 trainee days

Improving cold knowledge of employees:

Information sessions at workplaces:

Norway: 3 x 20 min x 180 persons

Finland 6 x 15 min x 6 persons

Sweden 3 x 15 min x 3 persons

5.1.5. NETWORKING

The networking between the scientific institutes was active. The main communication occurred by e-mail. The co-ordinator submitted or received altogether 600 e-mail messages during the course of the project. During the project altogether nine project meetings were held (see chapter 4).

The networking between the scientific institutes and the representatives of the working life was achieved at the national level. Altogether 7 different companies were involved in the project directly.

One important channel of communication was through the project www-pages http://www.occuphealth.fi/ttl/osasto/oattl/interreg/index.htm. The pages were uptodated constantly and included information of joint meetings (agendas/minutes), produced methods as well as project administration broschures.

One important platform of the Interreg-project was the International Kastelli Symposium activity arranged in Oulu in November 1999 and 2000. The core aim of the symposium is to improve co-operation in the Barents region (Mäkinen & Hassi 2000). The more specific objectives of the symposium is to provide a scientific forum for training of doctoral students, to arrange co-operative meetings between senior scientists, as well as a possibility for information exchange and co-operation between development and training professionals. Two project meetings were held during the symposia. The Interreg project was presented to the other participants during both symposia (see chapter 7.3.3.)

5.2. RESULTS OF THE NATIONAL DEVELOPMENT WORK

5.2.1. Finland

In the Finnish subproject it was decided to concentrate the development work to two different worksites in the Lapland area. The first workplace was a three-storey blockhouse to be built in the city of Kemi. The second site involved industrial building at the factory area of Avesta Polarit in Tornio.

Planning of the work

A cold work plan (Annex D) was conducted by the foreman of each target site. The plan was made to be suitable to the specific site. Issues taken into account were

- planning (before the construction work has started and during it)
- technical preventive measures
- protective clothing
- work supervision and orientation.

The aim of the plan was to make the right decisions at the right time and indicate the person responsible for each action.

The Finnish subproject collected usability information about conducting the cold work plan from three foremen. The plans were filled in for existing workplaces. Both written and oral instructions were given to the key persons. The written instructions included the information folder produced in a previous development project for YIT. The results showed that the duration to fill in the plan was 45-90 min. The instructions and material provided was considered adequate. It was indicated that the plan required some getting into but was considered meaningful. However, it was also indicated that the practical implementation of the activities indicated in the plan need motivation and commitment from the personnel in order to be fulfilled.

Following a few examples of management practices that were implemented that were indicated in the plan:
-risk assessment (by using the checklist)
-purchasing of winter clothing
-technical measures: testing a wind shelter for bricklayer, using heaters in toolboxes
-focusing on removing ice and snow, gritting
-using ladders suitable for winter

-distributing the construction worker's cold guide for the employees

Equipment trials

Worker clothing trials were conducted as part of the development work. The objective of these trials was to:

1. motivate the workers by letting them feel the positive effects of good cold protection
2. find out the suitability of some garments for this type of work
3. help YIT Construction Lapland to make decisions about future purchases

The clothes to be tested were chosen on the basis of analysis done at YIT construction sites in a previous development project (Risikko et al. 2000). The principle of these trials was that the workers were given information about each garment and its maintenance when the garments were distributed. At the same time it was made clear that everyone was committed to give feed back about each garment. Distribution was usually linked to information sessions about relevant topics. The garments tested and the objective of each testing can be seen in table 7.

Table 7. Equipment trials in the Finnish subproject.

Garment	Nro of trials	Objective of testing
Thermal underwear (pp/wo)	5	whole body thermal comfort, multilayer clothing
socks and insoles	5	protection of feet
Windproof undercap	6	protection against wind, effect of wind on cooling
Innergloves (pp)	10	prevention of contactcooling
winter workgloves	3	protection against wind, manual performance

The feedback about all garments were, that they were better than the ones previously used. Especially the underwear and inner gloves proved out to be very good. Remarks about socks and insoles depended on what had been used before. Care must be taken when choosing winter boots, that enough space is left for thick socks and insoles without the shoe becoming to tight. The windproof undercaps were found good for work in temperatures not colder than -15°C, when wind would otherwise bee a problem. However, a balaclava is required in addition for colder weather. Ratings of innergloves can be seen in figure 14.

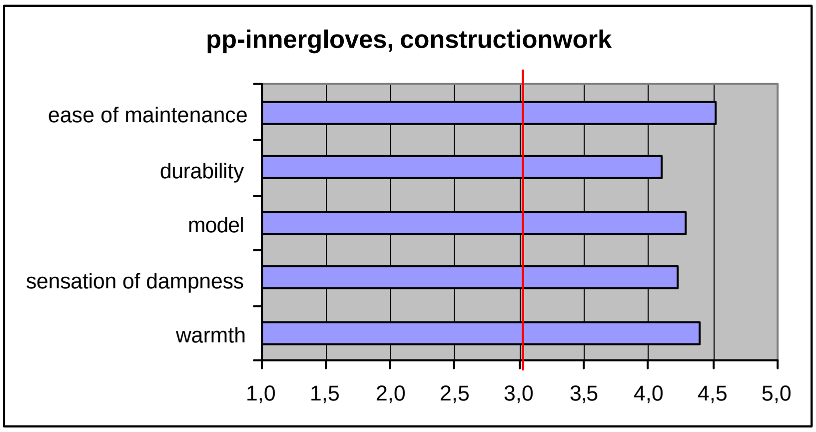


Fig. 14. Construction worker's opinions about inner gloves (n=42) on the scale of 1 = worse, 3 = same as before, 5 = much better than previous gloves.

Occupational health care activities

The occupational health care personnel participated in the training arranged specially for OHC-specialists. The purpose of the training was to provide basic information of cold on human health and performance, as well as introduce the methods available for assessing and managing cold.

The OHC personnel (occupational nurses) tested and provided feedback of the cold risk and health check assessment methods (see results in chapters 5.1.1 and 5.1.3.). The cold risk checks were conducted in the workplaces and the health checks in association with health examinations.

The occupational health care experts of the project were visited in Kemi and Rovaniemi and asked about their experience related to the developed model for occupational health care in cold work, as well as the usability of the produced methods. The purpose of the visits was to identify what had been the procedures following the realisation of the health check (e.g. possible further examinations etc.). Following these discussions it was recognised that some further planning related to the occupational health care model is still needed. Therefore, a workshop was arranged in Oulu in the spring 2001 together with the occupational health care experts of the target workplaces in order to amend and complete the model. The model is presented in Annex F.

5.2.2. Sweden

A total of 42 risk checks were tested. Results from these are presented in 5.1.1.3.

Personal protective devices and c old protection

The Swedish team investigated the problem of incompatibility when personal protective devices are used together with cold protection wear. The modified checklist with emphasis on the use of personal protective devices was tested by 10 NCC workers (for the example of the modified checklist see annex B).

The employees in the two target companies were also interviewed on integration of cold protective clothing and personal protective wear as well as on other problems of cold protection. Ten respondents having from 20 to 40 years of outdoor work experience during the cold season have answered the questions of the structured interview.

It was revealed that the most important problem of incompatibility is due to the use of protective gloves. The mittens with inside lining were used for the most of the time. However, the work periods with bare hands occurred quite often while for example performing precision work, using power saw, fuelling it etc. The workers prefer to work bare hand than with gloves because of glove clumsiness or in order to avoid getting the gloves oily.

It was reported by the workers that the safety shoes with a steel toecap are cold during the winter because of the metal cap built in the shoes. The insulation properties of the shoes were not good enough so the workers had to wear two pairs of socks which were both cotton pairs or one pair of cotton and one pair of woollen socks.

The safety trousers with fibreglass fabric have to be worn if any activities with power saw are performed. However, these trousers are made of a very thin material with no lining and are not suitable to give protection from the cold during winter season.

The workers preferred to use only winter caps during winter and not the safety helmets even if impact protection of the head is needed. The workers used various kinds of knitted caps under the safety helmets to increase its insulation properties when it was not possible to neglect the use of helmet.

5.2.3. Norway

The results from the Norwegian subproject can be summarized as follows:

- Factory management have been demonstrated and convinced that further improvements is required for the cold work problems.
- The workers have been made aware of their responsibility and possibilities to improve on the cold work problems.
- The workers have had a demonstration that a project focusing on environmental problems is being followed up by immediate actions to improve identified problems.

- The workers have confirmed that the information sessions given together wit the written material have enhanced their knowledge on how to select proper clothing, and have actually resulted in practical changes in their own selection of clothing to be used.
- The temperature monitoring in the factories has demonstrated unacceptable variations in air temperatures (12-15°C) and provides a tool for corrective actions.
- Temperature monitoring of the workers have confirmed that their complaints about cold fingers and cold feet are justified.
- The temperature monitoring performed confirms the problem indications from the checklists.
- The results from the temperature measurements have resulted in replacement of better thermal protective footwear for several workers particularly bothered with cold feet.
- A test of alternative woollen socks (wool terry cloth) gave as a result a significant improvement of thermal comfort for the feet.
- A test of alternative gloves confirmed that the cold finger problems could be reduced although no optimal solutions have been found.
- The project demonstrated that such a project could be satisfactorily performed for a group of workers without a common language (two languages: Finnish and Norwegian
- A good relationship has been established with the local company for workers health care.

Results from the measurements

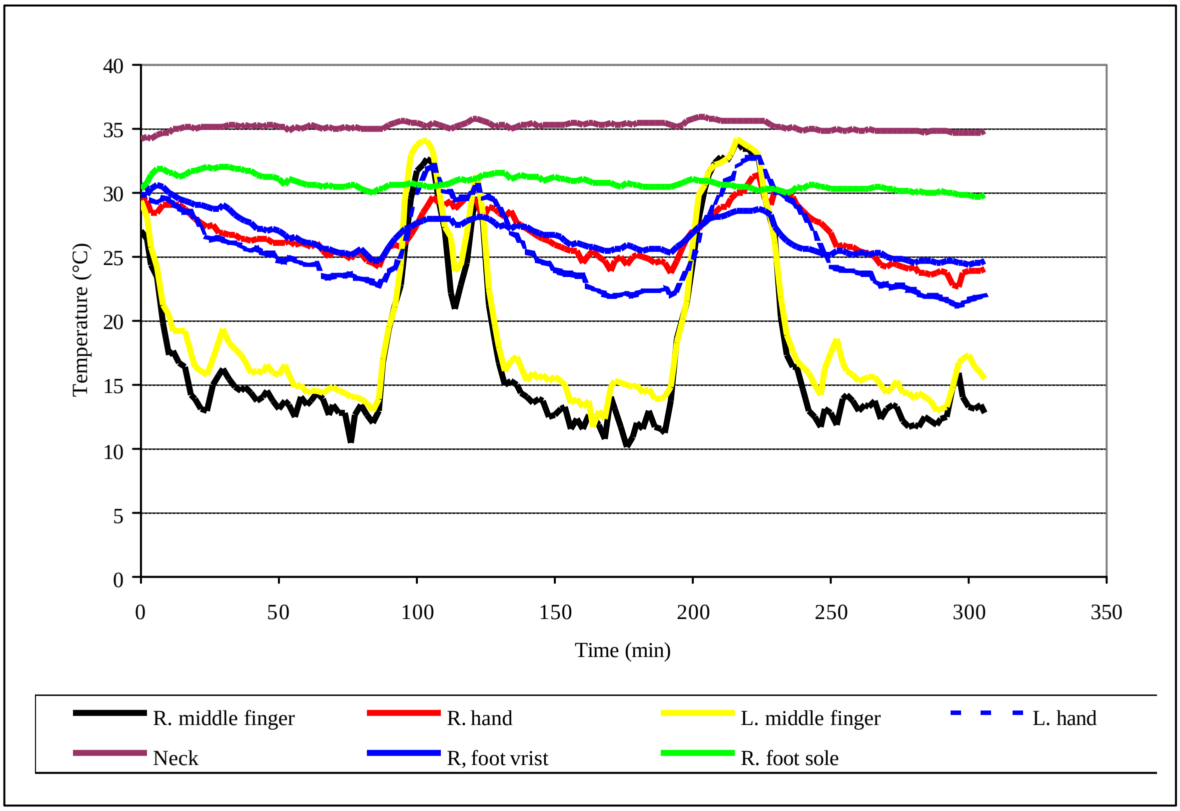


Figure 15. Skin temperatures measured for a filet controller positioned at the end of the filet cutting line.

The measurements confirmed that cold fingers and cold feet were frequent and represented significant problems in the fish processing industry. Some persons exhibit pain at a skin temperature of 15°C. A typical graph of the skin temperature for a worker during the work shift is presented in Figure 15.

Equipment trials

In collaboration with a manufacturer of woollen socks all the workers at the two factories were equipped with alternative socks (wool terry cloth), which they used for a three-week period. They then evaluated these socks in a questionnaire comparing the new socks to what they had been using before. The results state clearly that the new socks improved the thermal comfort and that they were preferable to the older ones.

A total of three different types of alternative gloves were tested out. The subjective evaluation performed by the workers stated that they were better than the cotton gloves they regularly use underneath the rubber glove. Temperature monitoring confirmed the subjective evaluation although it cannot be concluded that the cold finger problem has been solved - only improved.

5.3. ISSUES THAT THE ACHIEVED SUCCESSFULLY

Co-ordinator

The project produced new practical usable tools for cold risk assessment, management and occupational health care. These included the cold risk check, the cold health check, as well as a form and instructions for making a cold work plan at workplaces. These methods improve the company's independence to identify cold related problems and manage those at the workplaces.

The project succeeded to produce a comprehensive set of information material. Workplaces were provided with information session material, which contents were jointly produced in co-operation with the scientific institutes. A new information folder was adopted well in the target companies in Finland. During the project a manuscript for the Nordic cold guide was written. This guide will provide practical instructions how to assess and manage cold related risks and is especially suitable for occupational safety and health experts.

The networking between the different scientific institutes was active and has created new ideas how to continue the co-operation in the future. Altogether 600 e-mail messages between the co-ordinator and project partners were submitted. Furthermore on the average 9 persons attended the nine different project meetings held in the Nordic countries. The networking between the scientific institutes and representatives of the economic life was achieved at the national level.

The dissemination of information about the project succeeded very well. The project was presented at several international scientific meetings. Furthermore, the basic structure and principles of cold risk management was included to the proposal for an international standard and presented for ISO working group (ISO/TC159/SC5/WG1). In addition, these ideas were also presented for a wider platform in a workshop in Brussels.

Finland

- Development of OHC methods and model in active co-operation with the key persons
- Identification of the usability and limitations of present ISO thermal standards
- The target enterprises adopted the given information material succesfully
- The national dissemination of information succeeded very well in Finland. This was achieved both through national public events concerning occupational health and safety, as well as

through arranging courses for OHC specialists. In addition, information was disseminated through the public media and reached a considerable amount of Finns

Sweden

The training course for the OHS

- The response provided by the participants after the training was very positive. It was indicated that there was a lack of information for the OHS in the area of cold risk assessment and management. The participants expressed a wish an additional course to be arranged after the closing of the Interreg project.

Specific problems that we brought up to light

- The incompatibility problems of integrating PPDs with the cold protection make workers to neglect PPDs in the favour of protection against cold.
- The comparative results from different workplaces enable to look at the specific problems with cold work related to particular industries.

Norway

The cold risk checklists used at the work sites clearly pointed at certain problem areas, and in particular to the problems with cold feet and cold fingers. The temperature measurements confirmed these problems areas, and confirmed at the same time the usefulness of the checklist.

The local Occupational Health Care Company in Båtsfjord performed a number of interviews among the management and the workers at the two participating factories evaluating the Interreg project about to be completed. This evaluation conclude:

- The management found the project most useful, as it provided practical means to improve on the cold related problems. It had emphasised the necessity of trying to minimize, and to replace some of the personal protective equipment used. The management also considered it important that someone, from the outside had pointed out the workers own responsibility for certain improvements.
- The workers clearly appreciated the project, which had a better follow-up than any other project. It had provided something more than just paperwork, as temperatures had been recorded. They had been kept informed about the results, and they had seen actions taken by replacement of equipment as a consequence of the findings in the study. The information

sessions given were considered particularly important, and had been an eye opener for many of the workers.

5.4. PROBLEMS RELATED TO THE REALIZATION OF THE PROJECT

Due to the national deviation in occupational health care practices some modifications/adaptation of the methods and principles of their use were needed.

Russian participation was not accomplished to the extent that was originally planned. There were two participants from Russia to the joint workshop in Luleå for finalising the methods and agreeing on the joint testing. Else, all material produced within the project were submitted by e-mail to the Russian partners.

There was deviation in the economical administration practices between the different countries, which caused that more working time had to be used than initially planned to summarise and harmonise the information. The project was not able to use the budgeted costs to the extent as originally planned.

Due to the relatively short project period it was not possible to activate and affect the attitudes within the target companies to the extent as initially aimed. Therefore, it was also difficult to evaluate the impact of the project with regards to altered working practices.

The project activities and testing of methods required translating to the different languages which required more working time as initially predicted.

6. PROJECT ECONOMY

6.1. BUDGETED AND REALISED COSTS

TOTAL EXPENCES **Annex 4**

FINLAND

Type of cost	Realized period I 5.12.99-5.4.00	period II 6.4. - 5.8.00	period III 6.8. - 5.12.00	period IV 6.12.00 - 28.2.01	period V 1.3. - 31.5.2001	Realized cumulative	BUDGETED	Difference (budgeted-realized)
Project personnel	123 554,73	158 018,23	255 119,74	110 408,54	271 242,69	918 343,93	914 651	-3 692,93
Apartment costs	2 840,00	2 840,00	2 840,00	2 130,00	1 980,00	12 630,00	12 630	0,00
Material costs	8 812,03	3 439,74	3 900,97	21 417,56	39 500,47	77 070,77	83 969	6 898,23
Travelling costs	731,00	14 273,17	41 871,61	5 842,47	55 093,63	117 811,88	123 750	5 938,12
Other								0,00
Repair and service	0,00	0,00	0,00			0,00	0	0,00
TOTAL	135 937,76	178 571,14	303 732,32	139 798,57	367 816,79	**1 125 856,58**	1 135 000	9 143,42
Swedish costs			86 017,82	57 564,08	0,00	143 581,90		
Not accetable EU-costs	1 737,00	0	165,00	0	125,00	2 027,00		
EU	67 968,88	89 285,57	151 866,16	69 899,28	183 908,40	**562 928,29**		

SWEDEN

Type of cost	Realized period I 5.12.99-5.4.00	period II 6.4. - 5.8.00	period III 6.8. - 5.12.00	period IV 6.12.00 - 28.2.01	period V 1.3. - 31.5.2001	Realized cumulative	BUDGETED	Difference (budgeted-realized)
Project personnel	32 969,36	94 837,16	113 866,62	70 482,50	86 190,81	398 346,45	409 133	10 786,19
Apartment costs	0,00	5 849,77	7 451,07	6 068,99	8 451,38	27 821,21	32 783	4 962,22
Material costs	10 150,50	2 371,13	486,69	534,66	18 498,70	32 041,68	85 570	53 528,25
Travelling costs	3 723,86	18 651,46	13 036,93	10 822,24	43 367,76	89 602,25	134 616	45 013,75
Other	0,00	433,49	131 005,77	1 043,73	2 101,12	134 584,11	202 898	68 313,89
Repair and service								0,00
TOTAL	46 843,72	122 143,46	265 847,08	88 952,11	158 609,77	**682 395,69**	865 000	182 604,31
Not accetable EU-costs	17 243,12	0	0,00	0		17 243,12		
EU	23 421,86	61 071,73	132 923,54	44 476,06	79 304,89	**341 197,85**		

SWEDEN Kr (1 Kr = 0,67 mk)

Type of cost	Realized period I 5.12.99-5.4.00	period II 6.4. - 5.8.00	period III 6.8. - 5.12.00	period IV 6.12.00 - 28.2.01	period V 1.3. - 31.5.2001	Realized cumulative	BUDGETED	Difference (budgeted-realized)
Project personnel	49 208,00	141 548,00	169 950,18	105 197,76	128 643,00	594 546,94	610 646	16 098,79
Apartment costs	0,00	8 731,00	11 121,00	9 058,19	12 614,00	41 524,19	48 930	7 406,30
Material costs	15 150,00	3 539,00	726,40	798,00	27 610,00	47 823,40	127 716	79 892,91
Travelling costs	5 558,00	27 838,00	19 458,10	16 152,60	64 728,00	133 734,70	200 919	67 184,70
Other	0,00	647,00	195 531,00	1 557,80	3 136,00	200 871,80	302 833	101 961,04
Repair and service								0,00
TOTAL	69 916,00	182 303,00	396 786,68	132 764,35	236 731,00	**1 018 501,03**	1 291 045	272 543,75
Not accetable EU-costs	25 736,00	0				25 736,00		

Realised costs: Finland + Sweden

TOTAL EXPENCES (Finland+Sweden)

Type of cost	Realized period I 5.12.99-5.4.00	period II 6.4. - 5.8.00	period III 6.8. - 5.12.00	period IV 6.12.00 - 28.2.01	period V 1.3. - 31.5.01	Realized cumulative	BUDGETED	Difference (budgeted-realized)
Project personnel	156 524,09	252 855,39	368 986,36	180 891,04	357 433,50	1 316 690,38	1 323 784	7 093,62
Apartment costs	2 840,00	8 689,77	10 291,07	8 198,99	10 431,38	40 451,21	45 413	4 961,79
Material costs	18 962,53	5 810,87	4 387,66	21 952,22	57 999,17	109 112,45	169 539	60 426,55
Travelling costs	4 454,86	32 924,63	54 908,54	16 664,71	98 461,39	207 414,13	258 366	50 951,87
Other	0,00	433,49	131 005,77	1 043,73	2 101,12	134 584,11	202 898	68 313,89
Repair and service	0,00	0,00	0,00	0,00	0,00	0,00		0,00
TOTAL	182 781,48	300 714,15	569 579,39	228 750,68	526 426,56	1 808 252,27	2 000 000	191 747,73
Payable 50 %	91 390,74	150 357,08	284 789,70	114 375,34	263 213,28	904 126,14	1 000 000	95 873,86
Not accetable EU-costs	18 980,12	0	165,00	0	125,00	19 270,12		

Realised costs Norway

Specification of costs: Norway (NOK)	
SINTEF	
Project personnel	269395
Material	2009
Travel	52418
TOTAL	323822
THELMA	
Project personnel	1067610
Consultancy	22527
Material	7552
Travel	170390
TOTAL	1268079
TOTAL: ALL COSTS	1591901
Own financing	887976
Interreg/Norway	703925

The following budget changes were proposed in March 2001 and accepted by the financer.

	Transferred amount (FIM)	**%change compared to budgeted**
Project personnel:	+ 78 184 FIM	6,3 %
Apartment costs:	-12 309 FIM	21,3 %
Travel costs:	-30 500 FIM	10,6 %
Material costs	-24 692 FIM	12,7 %
Repair and Services	-10 683 FIM	100 %

Explanation for the budget changes exceeding 12% from the original budget:

Apartment costs: The rent of premises in the Swedish subproject were not charged from the Interreg- project as the Swedish project contact person (J.Abeysekera) was also engaged in other research projects. *Material costs:* During the project it was also recognized that in order to achieve the aims for producing the material that was planned, the Finnish subproject was able to partially cover some of the costs related to the Nordic Cold Guide from the Editorial Office of the Finnish Institute of Occupational Health. *Repair and Services:* The budgeted repair and services costs of the Finnish subproject were not realised as was initially anticipated.

The economical figures demonstrate that approximately 9.6% of the budgeted costs is not realised within the project. Following are detailing for some costs types that were not realised and allocated to the Swedish subproject:

1. Material Costs: (Money left unused 79,892.912 Kr). The material costs (100,000 Kr) were reserved mainly for the Nordic Cold Guide to complete the translation and printing 1000 copies in Swedish. This calculation was reached at the meeting in Båtsfjord, Norway. Only layout costs were realised during the project period (24 000 Kr).

2. Travel costs: (Money left unused 55,777.30 Kr.). There are some journeys (e.g. Rovaniemi closing seminar and Jokkmokk) done by project personnel before May 2001 but the travelling claims have not been able to be paid during the project period and are therefore not included in the total costs.

3. Other costs: (Money left unused 66,814.30 Kr). According to economical department of Luleå Technical University the overhead costs were never reimbursed. The University has a rule that wage costs should always accompany overheads. Since this money has not been approved overhead costs will remain unused.

6.2. BUDGETED AND REALIZED YIELDS/PROFITS ACCORDING TO FINANCER

Accoding to the financer the project was implemented reasonably well.

7. EXPLOITATION OF THE RESULTS AFTER THE PROJECT

7.1. PROPOSAL FOR FUTURE ACTIVITIES

- Presentation of the results for the ISO standardisation workgroup (ISOTC159/SC5/WG1). Results of the present study are proposed to be integrated to the standards proposal ISOWD15743
- The completion of the Cold Guide for Industrial work sites is highly important, as it is clearly a need for such information at many different work sites as well as for occupational health care and safety experts. The guide will be published in the winter 2001 as a publication of FIOH
- Scientific articles will be published concerning the results from the testing of the present ISO thermal standards, as well as the produced risk check and health check
- Different types of education for occupational health care and safety experts will be organised in Finland, Sweden and Norway
- Informing about the project in the “Northern dimension”
- The northen workplaces of the Barents region would need an entity of instructions how to use the produced methods and models

Sweden

- The Swedish team will continue to investigate the problem of the use of PPDs in the cold and make recommendations on new designs of PPDs for the cold and on measures to reduce exposure of extremities to cold.
- Training course for the OHS is planned to be organised in the coming autumn 2001.
- The valuable source of information on how to manage the cold risks and to ensure good working practices in the cold are the workers themselves spending the large part of the working day outdoors. Therefore in the future Swedish team will try to collect this valuable information by interviewing the outdoor workers.

Norway

- The two fish processing factories involved in Norway must have a follow-up, as the use of the cold risk checklist is not yet sufficiently well established. Cold risk management is not yet firmly incorporated in the work planning and work procedures. Without a follow-up most of that has been gained on these two work sites could consequently very easily be lost again.
- The experience and the positive evaluation of the project at the two fish processing industry in general, aiming to have the whole industry to adopt this work method to reduce the cold related problems.
- The experience and the positive evaluation of the project within the fish processing industry should be beneficial to get access to other industrial areas facing similar problems. It is also possible to see that the same methodology should not be limited to only cold work environment, but cold easily with minor modifications also cover heat exposed work places.

7.2. DISSEMINATION OF INFORMATION OF THE PROJECT

The dissemination of information of the project occurred both during joint international occasions as well as separately in each country. The main responsibility of the distribution has been by the co-ordinator, ORIOH/Cold Work Action Program.

7.3.1. JOINT EVENTS AND PUBLICATIONS

International scientific meetings

- Hassi J, Tervaskanto- Mäentausta T, Mäkinen TM, Huurre M. Good occupational health care practices in cold work. In: Abstracts of the 11th International Congress on Circumpolar Health, Harstad, 2000 June 4-9, Harstad, Norway.
- Holmér I. Risk assessment model for work in cold environments. In: Abstracts of the 11th International Congress on Circumpolar Health, Harstad, 2000 June 4-9, Harstad, Norway.
- Holmér I A Risk assessment Strategy for work in the cold. Winter Cities Conference, Kiruna, 12 February, 2000.
- Mäkinen T M. Usability and coverage of ISO thermal standards in assessing cold related risks at workplaces. In: Abstracts of the 11th International Congress on Circumpolar health; 2000 Jun 4-9; Harstad, Norway. Anchorage, Alaska: International Union of Circumpolar Health, 2000.

- Hassi J, (presented by Ingvar Holmér): Good working practices in the cold. ICOH 2000 26th International Congress on Occupational Health, Aug 27th –Sep 1st 2000, Singapore
- Giedraityté L & Abeysekera J (1999) The impact of the cold environment on performance among outdoor workerks. . In: Abstracts of 1st Kastelli Symposium, Living and working in the North; 2000 Nov 24-25; Oulu, Finland.
- Giedraityté L Identification of cold risks in the arctic workplaces using an observational checklist. In: Abstracts of 2nd Kastelli Symposium, Living and working in the North; 2000 Nov 22-23; Oulu, Finland. Oulu: Oulun aluetyöterveyslaitos, 2000.
- Mäkinen T M. Usability and coverage of ISO thermal standards in assessing cold related risks at workplaces. In: Abstracts of 2nd Kastelli Symposium, Living and working in the North; 2000 Nov 22-23; Oulu, Finland. Oulu: Oulun aluetyöterveyslaitos, 2000.

ISO standardisation

- Hassi J Practical use of standards for workplace risk assessment and design. WORKLIFE 2000-Workshop on standards "Control of risks in the workplace: Application of International Standards".25th .-26th September 2000, Brussels, Belgium (Ennals 2001).
- Project ideology and practices have been presented during workgroup meetings of the ISO standardisation concerning thermal environments (ISOTC159/SC5/WG1) in Copenhagen (May/2000) and London (Dec/2000).

Joint publications:

- Hassi J & Mäkinen T: How to assess and manage cold-related risks in northern workplaces? A European Barents Interreg II-project improving practical working activities. Barents Newsletter on Occupational Health and Safety 2000 (1-2): 23-26.
- Hassi J & Mäkinen T: How to assess and manage cold-related risks in northern workplaces? (manuscript will be sent to Northern Dimension in June 2001)
- Risikko T, Mäkinen T, Hassi J (2001) Assessment and management of cold risk in construction industry. Barents Newsletter on Occupational Health and Safety 4 (in press)
- Påsche A (2001) Occupational health in the fish processing industry - An activity to improve the work environment by preventing cold exposures. Barents Newsletter on Occupational Health and Safety 4 (in press)

Dissemination of information in the international project closing seminar 14th of May 2001

The purpose of the closing seminar was to present the results of the EU-project as well as distribute information about cold. The target group of the seminar was the decision makers of the Barents region as well as representatives of the target enterprises. Altogether 140 invitations were sent and approximately 25 persons attended the seminar.

- Presentation of the results of the project and the national project activities
- Poster presentations: cold risk assessment, management, occupational health care and information & training
- Information material of cold: guides, publications ect.
- Press conference for the public media

7.3.2. JOINT INFORMATION MATERIAL ABOUT THE PROJECT

- The project produced www-pages, which include information of the project as well as different material related to cold (http://www.occupheatlh.fi/ttl/osasto/oattl/interreg/index.htm)
- project broschures in Finnish, Swedish and Norwegian

7.3.3. DISSEMINATION OF INFORMATION IN EACH COUNTRY

FINLAND

The dissemination of information in the Finnish subproject utilising the principles and information distribution sources of the Cold Work Action Program

National events:

- Työterveyspäivät, Helsinki October 2000, poster presenting the project, broschures
- Closing symposium of the YIT-project (25.1. 2001), presentation of the Interreg project (30 participants)
- Closing symposium of the Cold Work Action Program (February 2001), approximately 30 participants
- Hassi J Työterveyslaitoksen kylmätyöohjelma ja työterveyshuolto. Pohjois-Suomen Työterveyslääkärit ry. Kevätkokous, 17.-18.3. 2001 Rovaniemi
- Raasakka E Kylmätyön terveystarkastukset. Pohjois-Suomen Työterveyslääkärit ry. Kevätkokous, 17.-18.3. 2001 Rovaniemi

Public media:

- Press conference at the Tornio workplace on the 9th of April 2001.

  -Helsingin Sanomat: 10.4. Kylmää torjutaan rakennustyömaalla Torniossa (2 artikkelia + verkkoliite)

  -Kaleva: Ei antautumista ehdoitta 10.4.

  -Pohjolan Sanomat 10.4. Kylmää kyytiä työmailla

  (The amount of readers 1 023752 !)

  -Pohjois-Suomen alueuutiset 9.4. (YLE/TV):

  -Radio Perämeri, Radio Ankkuri, Radio Suomi
- Press conference at the closing seminar in Arktikum 14th of May 2001

  -Lapin Kansa 15.5. Käytännön menetelmiä kylmätyön hallintaan (35 887)

-Pohjolan Sanomat 15.5. Kylmän riskit hallintaan yhteistyöllä (23483)

Karjalainen 15.5. Kylmä ei ole tuttu juttu (47636)

-Satakunnan kansa: Kylmä ei olekaan pohjolassa tuttu juttu (56 781)

(The amount of readers 163 787)

Radio: Lapin Radio, Saameradio

Presentation of the methods and project during courses:

- Hassi J Hyvä työterveyshuoltokäytäntö kylmätyössä. Työterveyshuollon pitkä kurssi, Oulu 21.3. 2000.
- Mäkinen T M Riskien arviointi ja hallinta. Työterveyshuollon pitkä kurssi, Oulu 21.3. 2000.
- Hassi J Työterveyshuollon toimintamalli kylmätyössä. Hyvä työterveyshuoltokäytäntö kylmätyössä, Oulu 2.11. 2000
- Mäkinen T M Kylmäriskien arviointi työpaikoilla. Hyvä työterveyshuoltokäytäntö kylmätyössä, Oulu 1.11. 2000
- Hassi J Hyvä työterveyshuoltokäytäntö kylmätyössä. Työterveyshuollon pitkä kurssi, Oulu 13.11. 2000.
- Mäkinen T M Riskien arviointi ja jatkotoimenpiteet. Työterveyshuollon pitkä kurssi, Oulu 13.11.2000.
- Mäkinen T M ja Hassi J Kylmäriskiseulat. Kylmälääketieteen kurssi (3 ov). Oulun yliopisto, Avoin Korkeakoulu.
- Hassi J, Huurre M. Hyvä työterveyshuoltokäytäntö kylmätyössä –malli, health check-kysely. Työterveyshuollon pitkä kurssi, Oulu 10.5. 2001
- Mäkinen T M. Kylmätyön riskien arviointi, risk check ja jatkotoimenpiteet. Työterveyshuollon pitkä kurssi, Oulu 10.5. 2001

SWEDEN

- The information about the project was passed to the participants of the OHS training course. The majority of them were representatives of consulting companies having close ties with outdoor workers. They were eager to spread the knowledge accumulated in the project to their clients.
- The information folders containing the material producing during the time of the project will be distributed to the target workplaces.
- The project and its activities were described in the university paper HögTrycket

NORWAY

- The Norwegian subproject is being presented in the most recent issue of Barents News. We will attempt to have this particular issue widely distributed also in Norway.
- A presentation (shorter than in the Barents News) has been agreed with the editor of the newsletter for the Norwegian Fishing Industry. This article should be published in the autumn issue.

- A seminar focusing on health problems in the fishing industry is planned to be held in Båtsfjord in September. This seminar, which will involve a number of representatives for the fishing industry, the autorities and occupational health care, has allocated a time for presentation of this Norwegian subproject.
- A meeting has been agreed with representatives for a number of different national industrial societies. The cold risk assessment project will be presented and may result in a presentation in newsletters for these societies.

7.3. CONTACT INFORMATION

Oulu Regional Institute of Occupational Health
Aapistie 1
FIN-90220 Oulu
Finland
Phone: +358 8 527 6111
e-mail: firstname.surname@occuphealth.fi

Luleå University of Technology
Associate Professor John Abeysekera
Department of Human Work Sciences
Div. Industrial Ergonomics
S-97187 Luleå
Sweden
Phone: +46 920 91407
e-mail: john.abeysekera@arb.luth.se

National Insitute for Working Life
Professor Ingvar Holmér
Programme for Respiratory Health and Climate
S-11279 Stockholm
Sweden
Phone: +46 8 7309288
e-mail: ingvar.holmer@niwl.se

THELMA AS
Sluppenveien 10
P. O. Box 6170, Sluppen
N-7435 Trondheim
Norway
Phone: +47 73 968512
e-mail: arp@thelma.no

Kola Research Laboratory of Occupational Health
Dept. of Hygiene and Occupational Health
Professor Valery Tchachtchine
Lenin av. 34
184230 Kirovsk, Murmansk region
Russia
Phone: +8 153191144; 9264
e-mail: valerych@mail.lanck.net

8. References

Barentswatch (1998) Barents Environmental Atlas, Finnish Barents Group.

BS7915 (1998) Ergonomics of the thermal environment-Guide to design and evaluation of working practices for cold indoor environments. British Standards Institution.

BS8800 (1998) Guidelines to occupational health and safety management systems. British Standards Institution.

EC89/391/EEC European Union Directive of Health and Safety at Work.

Ennals (Ed.) The use of international standards for risk assessment at workplaces. In Work Life 2000, Yearbook 3, 2001 Springer,London, 2001

Enander A (1984) Performance and sensory aspects of work in a cold environment: a review. Ergonomics 4: 365-378.

Ervasti O, Hassi J, Rintamäki H, Virokannas H, Kettunen P, Pramila S, Linna T, Tolonen U, Manelius S (2000) Sequelae of moderate finger frostbite assessed by subjective sensations, clinical signs, and thermophysiological responses. Int. J. Circump. Health 59: 137-145.

Hassi J, Gardner L, Hendricks S, Bell J (2000) Occupational injuries in the mining industry and their association with statewide cold ambient temperatures in the USA. Am J Ind Med 38:49-58.

Hassi J, Juopperi K, Remes J, Rintamäki H, Näyhä S, Ervasti O, Juosilahti P, Vartiainen E (1998) FINRISKI'97 Kylmäaltistusalaotos. Tutkimus suomalaisten kylmäaltistuksesta, -haitoista ja kylmältä suojautumisen tavoista. Tutkimuksen toteutus ja perustaulukot. Raportti 4. Oulun aluetyöterveyslaitos. 139 s.

Hassi J, Juopperi K, Remes J, Näyhä S, Rintamäki H: Cold exposure and cold-related symptoms among Finns aged 25–64 years. ICHES-98. Proceedings of Second International Conference on Human-Environment System, 271–274. Yokohama 1998.

Hassi J, Mäkinen T M (2000) Frostbite: occurence, risk factors and consequences. Int J Circump Health 59:92-8.

Holmér I (1998) Risk assessment in cold environment. Barents Newsletter on Occupational Health and Safety 1(3): 77-79.

ICOH International codeof ethics for occupational health professionals (1992).

ILO (1985) C161 Occupational Health Services Convention.

ILO (1985) R171 Occupational Health Services Recommendation.

ISO7726 (1998): Thermal environments-Instruments and methods for measuring physical quantities. Genève: International Organization for Standardization.

ISO 8996 (1990): Ergonomics of the thermal environment-determination of metabolic heat production.Genève: International Organization for Standardization.

ISO 9886 (1992) Ergonomics of the thermal environment - Evaluation of thermal strain by physiological measurements. Genève: International Organization for Standardization.

ISO 9920 (1995) Ergonomics of the thermal environment - Estimation of the thermal insulation and evaporative resistance of a clothing ensemble. Genève: International Organization for Standardization.

ISO 10551 (1995): Ergonomics of the thermal environment - assessment of the influence of the thermal environment using subjective judgement scales. Genève: International Organization for Standardization.

ISOTR 11079 (1993) Ergonomics of the thermal environment- Evaluation of Cold Environments, Determination of Required clothing Insulation, IREQ. Genève: International Organization for Standardization.

ISODIS 12894 (2000) Ergonomics of the thermal environment-Medical supervision of indiviuals exposed to extreme hot or cold environments. Genève: International Organization for Standardization.

ISOWD 13732 (1999) Ergonomics of the thermal environment - Methods for assessment of human responses to contact with surfaces. Part 3. Cold surfaces. Genève: International Organization for Standardization.

ISOWD14505 (1999) Ergonomics of the thermal environment - Evaluation of thermal environments in vehicles. Part 1: Principles and methods for assessment of thermal stress. Genève: International Organization for Standardization.

ISOTS14415 (2000) Ergonomics of the thermal environment - The application of international standards for people with special requirements. Genève: International Organization for Standardization.

ISOCD15265 (2000) Ergonomics of the thermal environment - Assessment of risk of stress or discomfort in thermal working environments. Genève: International Organization for Standardization.

ISOWD15743 (2000) Ergonomics of the thermal environment. Strategy for risk assessment, management and work practice in cold environment. Genève: International Organization for Standardization.

Juopperi K, Hassi J, Risikko T, Hussi T, Ahonen G (2000) Additional personnel costs in the construction industry occasioned by cold conditions (abstract in English). From theory to practice. Report A2. Finnish Institute of Occupational Health, Cold Work Action Program. 30 pp. ISBN 951-802-392-1

Mäkinen TM (2000) Kastelli-Symposium: Living and Working in the North. Barents Newsletter on Occupational Health and Safety 3(3): 32-34).

Mäkinen TT, Gavhed D, Holmér I, Rintamäki H (2001) Effects of metabolic rate on thermal responses at –10°C. Comp. Biochem. Physiol Part A 128: 759-768.

OHSAS 18001 Occupational health and safety management systems - Spesification.

Oksa J (1998) Cooling and neuromuscular performance in man. Doctoral Thesis. University of Jyväskylä.

Ramsey JD, Burford CL, Beshir MY, Jensen RC (1983) Effects of workplace thermal conditions of safe work beahiour. J. Safety Res. 14: 105-114.

Risikko T, Mäkinen T M, Tervaskanto-Mäentausta T, Hassi J, Toivonen L, Huurre M, Remes J. Kylmäriskien hallinta rakennusalalla. Loppuraportti. Teoriasta käytäntöön kylmässä. Oulu: Työterveyslaitos, Kylmätyöohjelma, 2000. Kehittämistyön raportti B1. ISBN 951-802-369-4 (20675) (PROJ. 306370)

Risikko T, Hassi J, Mäkinen T, Toivonen L. Clothing trials as a part of worker training. Ergonomics of protective clothing. NOKOBETEF 6 and 1st European Conference on Protective Clothing; 2000 may 7-10; Stockholm, Sweden. (6545)

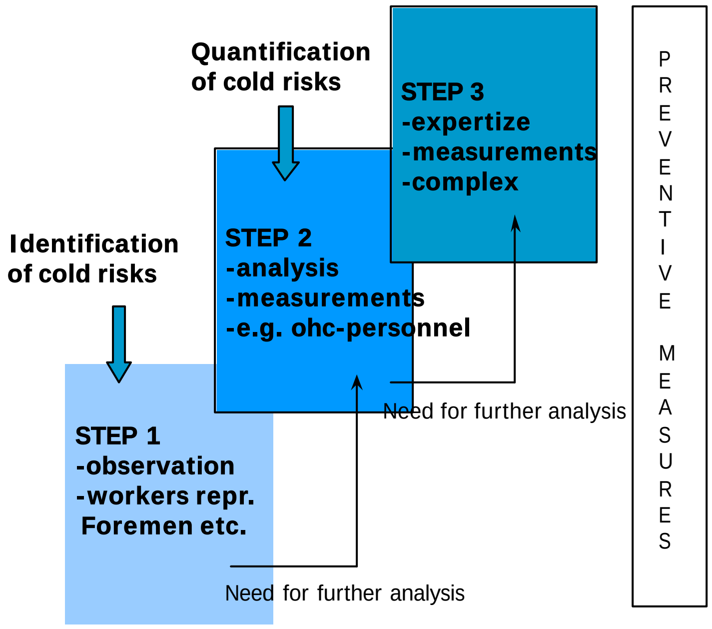
Tchachtchine V (1998) Work in the cold: A review of Russian experience in the North. Barents Newsletter on Occupational Health and Safety 1(3): 80-82.

Westman J (ed): Förstudie om behovet av handbok eller föreskrift om arbete i kyla.

9. ANNEXES: MATERIAL RELATED TO THE PROJECT

A. **MODEL FOR COLD RISK ASSESSMENT**
B. COLD RISK CHECK
C. COLD RISK ASSESSMENT: STEP 2 ANALYSIS
D. **COLD RISK MANAGEMENT: MODEL AND GUIDELINES FOR PLANNING AND EXAMPLES OF PREVENTIVE MEASURES**
E. GUIDELINES FOR THE COMBINED USE OF PPE'S AND COLD PROTECTIVE CLOTHING
F. **MODEL FOR OCCUPATIONAL HEALTH CARE IN THE COLD**
G. COLD HEALTH CHECK
H. **MODEL FOR INFORMATION AND TRAINING IN COLD WORK**
I. INFORMATION SESSION MATERIAL
J. EXAMPLE OF INFORMATION MATERIAL FOR CLIENTS PROVIDED BY THE OHC

MODEL FOR COLD RISK ASSESSMENT **ANNEX A**



Step 1: Identification

The aims of the workplace risk assessment is to identify potential hazards to the workers health and safety. As a result of the assessment appropriate preventive measures should be taken into account in order to reduce or eliminate these problems. Cold risk assessment follows the generally accepted principles of risk assessment where the first step is to identify the problems caused by cold.

How to identify cold related problems at work?
For the identification of cold related hazards the cold risk check should be used (Annex B) where systematic checkpoints related to cold are listed. The observation itself does not require comprehensive training or knowledge in e.g. ergonomics. Furthermore, for a person at the workplace who is well aware of the contents of the work, conducting the observation does not necessarily require a long time. Therefore, it is recommended that for example foremen, work safety delegates or workers could conduct the observation.

Planning
When conducting the observation at the workplace it is important first to plan what are the major different worktasks occurring at the workplace. The purpose of this planning is to group the worktasks or workers which are 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 may exist due to

cold. The planning could be conducted in a team at the workplace by foremen, workers and worksafety exeperts.

The observation

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 the specific observation. Furthermore, environmental conditions should be looked at in a similar way. For example the observer should consider whether the worktask conducted is occurring in a generally windy place which may cause an enhanced peripheral and whole body cooling. If some parts of the check remains unsolved or are difficult to observe, it is recommended to ask the opinion of the worker (e.g. the use of protective clothing)

Whenever, any of the checkpoints show a serious problem this should be dealt with at the workplace. For a specific problem there are usually several possible means of solving them. For example a considerable amount of exposure to wind may be reduced by either improving the protective clothing (e.g. windproof materials) or by applying technical measures (e.g. building a temporary or permanent wind shelter). Each workplace should choose the preventive measures that are best suited for their case. After choosing a preventive action it is important to select a responsible person to fix the problem. Furthermore, a date should be set for a re-check to find out whether the preventive action has been sufficient to correct the problem.

When to conduct the observation?

The observations should be used in outdoor work whenever the ambient conditions change markedly. For example if the content of the work itself does not markedly change, conducting the cold risk check in the autumn, in the mid winter and in the spring is sufficient. In project type of work (e.g. in housebuilding), where the worktasks may change considerably in the course of the work, it is important to conduct the cold risk check whenever these major changes occur. Furthermore, the work environment itself may cause many of the problems that are listed in the checklist. Therefore, whenever the environment changes, a new cold check should be conducted. The problems related to cold indoor work, for example in the foodstuff industry, are often more constant. In these situations it is not necessary to repeat the cold risk check so often, if it is considered that the preventive measures are sufficient.

The checklist may also be utilised by the OHC to receive information from the workplace at the same time when evaluating individual problems (see Annex

How to go on further, if the problem is not solved?

Step 2 Analysis

Some workplaces or worktasks may involve very specific problems (e.g. working at heights, diving etc.) which may not necessarily be easily reduced or eliminated. Furthermore, it may be that is uncertain whether the preventive actions used are really sufficient to guarantee the workers health and safety. In these cases it should be indicated that a further analysis is needed.

This next level of risk assessment would involve quantification of the certain problem indicated by the workplace. For more detailed contents see Annex C. Thus, it is possible to further detail the appropriate preventive measure. The quantification should not be too difficult requiring special instrumentation or complex analysing. It should mainly be achieved by relatively simple measurements and the use of tables and graphs (Annex C).

Step 3: Expertise

If the problem still remains unsolved the risk assessment proceeds to the third step. This level should be performed by experts (e.g. occupational health care units, occupational hygienists, expert institutes) with adequate competence. The duration of an individual assessment is up to one day or more. The assessment is aimed at solving a specific cold related problem based on the needs of the lower levels of cold risk assessment. The analyses require special instrumentation and involve more complex quantitative analysing.

KYLMÄTYÖN TARKISTUSLISTA TYÖPAIKOILLE

KUINKA KÄYTÄN TARKISTUSLISTAA?

1. Muodosta yleiskatsaus työpaikasta. Tee karkea luokitus niistä työkokonaisuuksista, jotka toteutetaan päivittäin tai tulevana ajanjaksona, jos työpaikalla on useita erilaisia työkokonaisuuksia. Täytä jokaiselle työkokonaisuudelle oma tarkistuslista. Mikäli ei ole mahdollista havainnoida kaikkia työkokonaisuuksia toteuta havainnointi myöhemmin. Jos useampi työntekijä osallistuu työkokonaisuuden toteuttamiseen havainnoi työntekijää, jolla on mielestäsi eniten ongelmia kylmään liittyen

2. Katso läpi tarkistuslistan jokainen kohta ja merkitse vaihtoehto, joka parhaiten vastaa tilannetta. **0** osoittaa, että tilanne on kunnossa, **1** tarkoittaa, että tiettyjä ongelmia kylmään liittyen on olemassa, **2** osoittaa, että on ongelmia, joihin voi liittyä alentuneen toimintakyvyn ja terveyden riski.

3. Tee merkintöjä jokaiseen kohtaa, joilla on yhteyttä havainnoitavaan työtehtävään (esim. puutteellinen suojaus tuulelta, käsineitä ei käytetä, tietyt osat kehosta ovat kosketuksissa kylmiin pintoihin) Nämä merkinnät helpottavat tulosten arviointia.

4. Milloin tarkistuslistaa tulisi käyttää?
   a) muutaman kerran talven aikan (esim. kerran kuukaudessa)
   b) ympäristöolosuhteiden muuttuessa merkittävästi
   c) kun työtehtävät muuttuvat merkittävästi
   d) seuratessa ovatko kylmän hallintatoimenpiteet olleet riittäviä.

TARKISTUSLISTA KYLMÄN HAITTATEKIJÖIDEN TUNNISTAMISEEN

Yrityksen nimi:…..……………………...………… **Pvm:**……………...……..

Havainnoitava työtoiminto:……………..………………… **Lämpötila**………..… **°C**

Tuuli………………m/s

Pisteytys, joka liittyy ongelman vakavuuteen:

0 ei tarvetta toimenpiteille	1 Toimenpiteitä suositellaan pitkällä Tähtäimellä	2 tarve välittömille korjaustoimenpiteille

1. Kylmä ilma

0	Ilman lämpötila ei aiheuta mitään ongelmia
1	Ilman lämpötila aiheuttaa tiettyjä ongelmia
2	Ilman lämpötila aiheuttaa selviä ongelmia

Huomautus:____

2. Tuuli/ilman liike

0	Ei ilman liikettä
1	Kevyt ilman liike (esim. vedon tunne, kevyt tuuli)
2	Voimakas ilman liike (esim. voimkas tuuli, joka puhaltaa ajoittain tai toistuvasti)

Huomautus:____

3. Kosketus kylmiin pintoihin käsiteltäessä työkaluja/materiaaleja tai kun istutaan, ollaan polvillaan tai maataan kylmillä pinnoilla

0	Ei juuri ollenkaan
1	Työskentelyä lyhyen ajan ohuilla käsineillä, istuen, polvillaan tai maaten kylmillä pinnoilla
2	Työskentelyä paljain käsi tai pitkiä aikoja istuen, polvillaan, seisten ja maaten kylmillä pinnoilla

Huomautus:____

4. Altistuminen vedelle/nesteille/kastumiselle

0	Ei altistumista
1	Lyhyitä altistumisjaksoja (esim. kylmien materiaalien käsittely, vesi- tai lumisade)
2	Pitkiä altistumisjaksoja (esim. jatkuva kylmien nesteiden tai märkien materiaalien käsittely jne.)

Huomautus:____

5. Kylmänsuojavaatetus (ei kädet, jalat ja pää)

0	Riittävä
1	Osittain riittämätön (esim. vain joitakin talvivaattekappaleita käytössä)
2	Riittämätön (esim. kylmänsuojavaatetusta ei käytetä ollenkaan vaikka niitä tarvitaan)

Huomautus:____

6. Suojautuminen kylmältä: kädet, jalat, pää (arvioidaan vallitsevan olosuhteen mukaan, suluissa esitetyt esimerkit pätevät lähinnä suojautumiseen hyvin kylmässä ilmassa)

0 Riittävä (esim. kintaat ja aluskäsineet; talvisaappaat, jossa paksut pohjat sekä irtopohjalliset tuulenpitävä talvihattu, joka peittää korvat)

1 Melko hyvä (esim. vuorelliset käsineet; talvikengät, jossa paksut pohjat; turvakypärä, jossa alusmyssy tai ei-tuulenpitävä hattu)

2 Riittämätön (esim. vuorettomat käsineet, ei käsineitä; kengät, jossa ohut pohja; pelkkä turva-kypärä tai paljas pää)

Huomautus:____

7. Henkilösuojainten käyttö (kypärä, kuulosuojaimet, jne.)

0 ☐ Ei haittaa
1 ☐ Haittaa jossain määrin (esim. kömpelyys, liikerajoitukset, heikentynyt suoja kylmää vastaan)
2 ☐ Huomattava haitta (esim. huomattavia vaikeuksia yhdistää kylmänsuojavaatetus ja muut henkilösuojaimet tai kylmänsuojavaatetusta/henkilösuojaimia ei käytetä ollenkaan)

Huomautus:____

8. MUUT KYLMÄÄN LIITTYVÄT ONGELMAT

0	1	2	
			Pitkäaikainen kylmäaltistus/työskentely kylmässä (esim. yhtäjakoisesti >yli 2 tuntia)
			Kevyt työ (esim. mittaustyö, valvonta yms.)
			Lämmöntuotoltaan hyin vaihteleva työ (kevyt/raskas)
			Vaihtuvat lämpöolosuhteet (esim. liikkuminen sisä- ja ulkotilojen välillä)
			Liukkaus
			Riittämätön valaistus
			Muu tekijä, mikä? ____

Tarkistuslistan tulosten arviointi sekä hallintatoimenpiteiden valinta

- Merkitse pisteet **(0, 1, 2)** tarkistuslistan kustakin kohdasta**Taulukkoon 1** kohtaan *pisteet.*
- Kohtaan **muut ongelmat** täytetään vain korkein saatu pistemäärä eri osakysymyksistä. Jos useassa kysymykessä/kohdassa on korkein pistemäärä, niin yksi numero riittää. Tulosten arvioinnin ja hallintatoimenpiteiden valinnan osalta tarkistetaan kukin osakohta erikseen tarkistuslistasta.
- **Piste=1** , (vähäinen ongelma) **osoittaa, ettei lisähallintatoimenpiteitä tarvita** juuri nyt. Tulos on kuitenkin syytä huomioida tulevaisuudessa parannettaessa yrityksen työterveys- ja työsuojelukäytäntöjä.
- **Pisteet = 2** (vakava ongelma) tarkoittaa, että **välittömiin korjaustoimenpiteisiin haitan/haittojen vähentämiseksi tulee ryhtyä**. Esimerkkejä eri kylmän hallintakeinoista löytyy esim. kylmäriskien hallintamallista.
- Kirjaa ehdotus toteutettavista hallintatoimenpiteistä **Taulukkoon 1.** Jos ongelmia ei voida ratkaista yksinkertaisesti toteutettavilla keinoilla, rastita kohta *lisäselvitys tarpeen*.
- Arvioitaessa ja valitessa hallintatoimenpiteitä tulee olla tietoinen siitä,**että tiettyjen tekijöiden välillä on yhteisvaikutusta**, esim. *kylmä ilmalla* on yhteisvaikutus *tuulen/ilman liikkeiden*, *kylmänsuojavaatetuksen*, sekä *kylmänsuojauksen (kädet, pää ja jalat* kanssa. Samoin *vedellä/nesteillä/märkyydellä* on yhteisvaikutus *kylmien pintojen kosketettamisen* sekä *kylmänsuojavaatetuksen* kanssa jne. Tämä yhteisvaikutus voi lisätä kylmään liittyviä riskejä
- Keskustele yrityksen johdon kanssa mitkä hallintatoimenpiteistä toteutetaan
- Sovi päivämäärä uudelleentarkistuksen toteuttamiseksi

Taulukko 1: Tulosten yhteenveto ja hallintatoimenpiteet

0 - Ei tarvetta toimenpiteille *1 - Toimenpiteitä suositellaan pitkällä tähätimellä* *2 - Tarve välittömille korjaus- toimenpiteille*		**Pisteet**	**Hallintatoimenpide**	**Toteutus**		**Lisä-selvitys tarpeen**	**Uusinta-tarkastus-pvm**
				Ei	**Kyllä**		
1	Kylmä ilma						
2	Tuuli/ ilman liike						
3	Kosketus kylmiin pintoihin						
4	Vesi/ nesteet/ märkyys						
5	Kylmänsuojavaatetus						
6	Suojautuminen kylmältä: kädet, jalat ja pää						
7	Henkilösuojainten käyttö						
8	Muut ongelmat						

………………………… ………………… ……………………

(Vastuullinen henkilö) (Päivämäärä) (Hyväksyntä)

CHECKLISTA FÖR ATT BEDÖMA PROBLEM MED KYLA

HUR SKA CHECKLISTAN ANVÄNDAS?

1. Skaffa en överblick över arbetsplatsen. Gör en grov uppdelning av de verksamheter som utförs dagligen och kommande tidsperiod. Använd en separat checklista för varje verksamhet. De verksamheter som ej kan observeras, kan bedömas senare.

2. Kolla igenom varje punkt i checklistan och fyll i det poängalternativ som stämmer bäst. 0 visar att läget är bra, 1 visar att det finns vissa problem, men de är inte akuta, 2 visar att finns problem som kan innebära risker vid arbete i kyla och som kan påverka arbetsresultat och hälsa - åtgärder bör snarast vidtagas. Om flera personer deltar i verksamhet, bedöm det värsta fallet.

3. Gör anmärkningar till varje punkt som har samband med den aktuella situationen (t.ex. arbetstagaren har dåligt skydd mot vind; man använder inga handskar alls; kroppsdel som är i kontakt med kalla ytor osv.). Sådana anmärkningar underlättar tolkningen av resultatet.

4. När ska checklistan användas?
   a) några gånger under vintersäsongen (en gång per månad);
   b) vid större förändring av de yttre förhållandena (klimat osv.);
   c) när arbetsuppgifterna förändras påtagligt;
   d) för att följa upp om vidtagna åtgärder har varit effektiva.

Företag/organisation:.. **Datum:**..

Observerad verksamhet **Temperatur (om känd)**

Vind (om känd)

Poäng relaterade till problem: 0 Ingen åtgärd behövs 1 Åtgärd rekommenderas på längre sikt 2 Bör åtgärdas snarast

1. Kall luft

0 ☐ Kylan orsakar inga problem
1 ☐ Kylan orsakar vissa problem
2 ☐ Kylan orsakar betydande problem

*Anmärkningar:*____

2. Vind/ luftrörelse

0 ☐ Vindstilla
1 ☐ Lätt luftrörelse (t.ex. dragkänsla, svag vind)
2 ☐ Stark luftrörelse (t.ex. stark vind blåser hela tiden eller då och då)

*Anmärkningar:*____

3. Kontakt med kalla ytor vid hantering av verktyg/material eller vid sittande eller liggande på kalla ytor

0 ☐ Nästan aldrig
1 ☐ Korta perioder av arbete med tunna handskar, sittande, knästående eller liggande på kalla ytor
2 ☐ Arbete med bara händer, långa perioder av sittande, knästående eller liggande på kalla ytor

*Anmärkningar:*____

4. Utsatt för vatten/ vätskor/ fukt

0 ☐ Nej
1 ☐ Korta perioder (några minuter, t.ex. hantering av våta material eller vid regn eller snö)
2 ☐ Långa perioder (t.ex. långvarig hantering av kalla vätskor/våta material osv.)

*Anmärkningar:*____

5. Skyddskläder mot kyla (ej händer, fötter, huvud)

0 ☐ Tillräckliga
1 ☐ Delvis otillräckliga (t.ex. bara vissa skyddskläder mot kyla används trots att det behövs)
2 ☐ Otillräckliga (t.ex. inga skyddskläder mot kyla används trots att det behövs)

*Anmärkningar:*____

6. Skydd mot kyla: händer, fötter, huvud (bedöms i förhållande till det observerade klimatet; exemplen gäller främst skydd mot riktigt kallt klimat).

0 ☐ Tillräckligt (t.ex., tjocka vantar/handskar med tunna handskar inuti; vinterkängor med tjocka sulor och iläggs sulor; vindtät vintermössa som täcker öronen)
1 ☐ Delvis otillräckligt (t.ex., fodrade handskar; vinterkängor med tjocka sulor; skyddshjälm med hjälmhuva eller icke vindtät mössa)
2 ☐ Otillräckligt (t.ex., ofodrade handskar eller inga handskar; skor med tunna sulor; bara skyddshjälm eller barhuvad)
Anmärkningar:____

7. Användning av personlig skyddsutrustning (PSU: hjälm, öronskydd, förkläde osv.)

0 ☐ Ingen olägenhet
1 ☐ Viss olägenhet (t.ex. ökad klumpighet eller något begränsad rörlighet, sämre skydd mot kyla)
2 ☐ Betydande olägenhet (t.ex. betydande problem att förena personlig skyddsutrustning med skydd mot kyla; skydd mot kyla eller/och skyddsutrustning används inte alls)
Anmärkningar:____

8. Andra problem som har samband med kyla

0	1	2	
			Lång vistelsetid i kyla (>över 2 timmar)
			Lätt arbete (t.ex. stående vid mätningsarbete, vakthållning vid vissa arbeten osv.)
			Varierande lätt och tungt arbete (t.ex. uppvärmning vid tungt och nerkylning vid lätt arbete)
			Varierande omgivningsbetingelser (t.ex. flyttning mellan varma och kalla lokaler)
			Halka
			Otillräcklig belysning
			Andra faktorer, vad? ____

Analys av resultat och åtgärdsförslag

- Fyll i poängen (0, 1, 2) Du fick på varje fråga i **Tabell 1** i kolumn *Poäng*.
- I fältet *Andra problem* fylls bara den högsta poängen i från alla delfrågor. Om det finns fler faktorer som fick högsta poäng, räcker det med en siffra. För analys och åtgärder kollar man respektive frågor i checklistan.
- **1 poäng** (små problem) visar att åtgärder inte behövs just nu. Däremot kan man åtgärda dem i framtiden, när företaget/organisationen planerar förbättring av arbetsmiljö- och skyddsrelaterade rutiner.
- **2 poäng** (stora problem) visar att **förebyggande åtgärder** bör utföras snarast. Exempel på åtgärder finns i separat dokument om "riskhantering i kyla".
- Fyll i förslag på förebyggande åtgärder i **Tabell 1**. Om problemen inte går att lösa med enkla, tillgängliga metoder, kryssa i fält *Behov av vidare undersökning*.
- Vid analys och val av åtgärder ska man vara medveten om att vissa **faktorer påverkar varandra**, t.ex. *Kall luft* samverkar med *Vind/ luftrörelse*, *Skyddskläder mot kyla* och *Skydd mot kyla: händer, fötter, huvud*; *Vatten/ vätskor/ fukt* samverkar med *Kontakt med kalla ytor*, *Skyddskläder mot kyla* osv. Dessa faktorer tillsammans kan öka risken.
- Diskutera med ledningen vilka åtgärder som ska vidtas.
- Bestäm datum för nästa observation för uppföljning av vidtagna åtgärder.

Tabell 1. Sammanfattning och analys.

0 - Inga åtgärder behövs *1 - Åtgärder rekommenderas på längre sikt* *2 - Bör åtgärdas snarast*		**Poäng**	**Förebyggande åtgärder**	**Utförande**		**Behov av vidare undersökning**	**Uppföljningsdatum**
				Nej	**Ja**		
1	Kall luft						
2	Vind/ luftrörelse						
3	Kontakt med kalla ytor						
4	Vatten/ vätskor/ fukt						
5	Skyddskläder mot kyla						
6	Skydd mot kyla: händer, fötter, huvud						
7	Användning av PSU						
8	Andra problem						

………………………… ………………… ……………………

(Ansvarig person) (Datum) (Godkännande)

ANNEX B

ALETERNATIVE CHECKLIST CONCENTRATING ON PERSONAL PROTECTIVE EQUIPMENT

HUR SKA CHECKLISTAN ANVÄNDAS?

5. Checklistan skulle fyllas på arbetsplatsen.
   Gör en grov uppdelning av de verksamheter som utförs dagligen och kommande tidsperiod.
   Använd en separat checklista för varje verksamhet.
   De verksamheter som ej kan observeras nu, kan bedömas vid senare tillfällen.

6. Kolla igenom varje punkt i checklistan och fyll i det alternativ som stämmer bäst:
   'NEJ' betyder att faktorn man observerar orsakar inga problem,
   'JA' betyder att det finns vissa problem, men antingen de är akuta eller inte akuta.
   'Om JA, åtgärd prioriteras' betyder att åtgärder bör vidtagas snarast.
   Om flera personer deltar i verksamhet, bedöm det värsta fallet.

7. Gör anmärkningar till varje punkt som har samband med den aktuella situationen (t.ex. arbetstagaren har dåligt skydd mot vind; man använder inga handskar alls; kroppsdel som är i kontakt med kalla ytor osv.). Sådana anmärkningar underlättar tolkningen av resultatet.

8. När ska checklistan användas?
   e) några gånger under vintersäsongen (en gång om två veckor);
   f) vid större förändring av de yttre förhållandena (klimat osv.);
   g) när arbetsuppgifterna förändras påtagligt;
   h) för att följa upp om vidtagna åtgärder har varit effektiva.

En checklista för att bedöma problem med kyla på arbetsplatser

Datum:………………………………**Företag:** ………………………………………………….
Verksamhet: ………………………………………….……………..……………………

1. Kall luft (ungefärlig temperatur……°C)
Är luften så kall att det kan leda till ett problem?

☐ JA ANMÄRKNINGAR……………………………………….
☐ NEJ …………………………………………………………….
☐ Om JA, åtgärd prioriteras

2. Luftrörelse/vind (……m/s om känd):
Orsakar luftrörelse eller drag till ett problem?

☐ JA ANMÄRKNINGAR……………………………………….
☐ NEJ …………………………………………………………….
☐ Om JA, åtgärd prioriteras

3. Kontakt med kalla ytor
Orsakar kontakt med kalla ytor problem t.ex. vid hantering av verktyg eller material, eller vid sittande, knästående eller liggande på kalla ytor?

☐ JA ANMÄRKNINGAR……………………………………….
☐ NEJ …………………………………………………………….
☐ Om JA, åtgärd prioriteras

4. Kontakt med vatten /vätskor /våthet
Hanteras kallt vatten, andra vätskor eller fuktiga material, så att det orsakar problem?

☐ JA ANMÄRKNINGAR……………………………………….
☐ NEJ …………………………………………………………….
☐ Om JA, åtgärd prioriteras

5. Skyddskläder mot kyla
Är skyddsutrustningen mot kyla otillräckliga för att hålla arbetstagaren varm?

5.1 Hela kroppen

☐ JA
☐ NEJ
☐ Om JA, åtgärd prioriteras

Anmärkningar…..……………………..

5.2 Huvud

☐ JA
☐ NEJ
☐ Om JA, åtgärd prioriteras

Anmärkningar…..……………………..

5.3 Händer

☐ JA
☐ NEJ
☐ Om JA, åtgärd prioriteras

Anmärkningar…..……………………..

5.4 Fötter

☐ JA
☐ NEJ
☐ Om JA, åtgärd prioriteras

Anmärkningar…..……………………..

6. Skyddsutrustning mot kyla och samtidig användning av personlig skyddsutrustning (PSU)
Hindrar skyddet mot kyla användningen av personlig skyddsutrustning (PSU)?

6.1 Huvud vid användning av skyddshjälm?

☐ JA
☐ NEJ

6.2 Händer vid användning av skyddshandskar?

☐ JA
☐ NEJ

☐ Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………

☐ Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………….

6.3 Fötter vid användning av skyddsskor?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..…………………………
………………………………………………
…

7. **Användning av personlig skyddsutrustning (PSU) och samtidigt skydd mot kyla**

Hindrar den personlig skyddsutrustningen användningen av varma kläder, osv.?

7.1 Skyddshjälm med vintermössa?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………

7.2 Vinterhandskar med skyddshandskar?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………
….

7.3 Skyddsskor med vintersocka?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..…………………………
………………………………………………
…

8. **Andra problem med kyla**

8.1. Minskar handskar handens funktion och fingerfärdighet?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………

8.2. Utför man olika moment av precisionsarbete i kyla med bara händer?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………
….

8.3. Finns det risk att halka på snö och is?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………

8.4. Egna anpassningar av skyddet mot kyla försvåras på arbetsplatsen (OBS!)

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..…………………………
.

OBS!: Med anpassningar menas exempelvis: extra varma kläder, användning av inre handskar för precisionsarbete, varma inhägnader för korta raster, tillgång till varm dricka, möjlighet att öka produktion av kroppsvärme genom att öka aktivitetsnivå, osv.

8.5. Riskerar man att bli blöt om händer och fötter?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

8.6. Riskerar man att få kläderna blöta på grund av svettning eller regn?

- [ ] JA
- [ ] NEJ
- [ ] Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..………………………

ANMÄRKNINGAR…..………………………
….

8.7. Utsätts man i omväxlande perioder för kalla och varma miljöer?

- ☐ JA
- ☐ NEJ
- ☐ Om JA, åtgärd prioriteras

ANMÄRKNINGAR…..…………………………
………………………………………………
…

Analys av resultat och åtgärdsförslag

Sammanfatta resultaten av checklistan i tabellen genom att kryssa samma rutor som i checklistan.

	Faktorn	JA	NEJ	Om JA, åtgärd	Åtgärdsförslag	Uppföljnings-datum
1	**Kall luft**					
2	**Luftrörelse/vind**					
3	**Kontakt med kalla ytor**					
4	**Kontakt med vatten /vätskor /våthet**					
5	**Skyddskläder mot kyla**					
5.1	Hela kroppen					
5.2	Huvud					
5.3	Händer					
5.4	Fötter					
6	**Skyddsutrustning och samtidig användning av PSU**					
6.1	Huvud vid användning av skyddshjälm					
6.2	Händer vid användning av skyddshandskar					
6.3	Fötter vid användning av skyddsskor					
7	**Användning av PSU och samtidigt skydd mot kyla**					
7.1	Skyddshjälm med vintermössa					
7.2	Vinterhandskar med skyddshandskar					
7.3	Skyddsskor med vintersocka					
8	**Andra problem med kyla**					
8.1	Minskat fingerfärdighet					
8.2	Precisionsarbete i kyla med bara händer					
8.3	Risk att halka på snö och is					
8.4	Egna anpassningar mot kyla försvåras på arbetsplatsen					
8.5	Risk att bli blöt om händer och fötter					
8.6	Blöta kläderna på grund av svettning eller regn					

8.7	Omväxlande perioder för kalla och varma miljöer					

RISK ASSESSMENT: STEP 2 ANALYSIS ANNEX C

The step 2 checklist provides guidance by questions, assessment methods and information. It is intended to be used by persons with knowledge on the subject and who are familiar with the relevant standards (e.g safety engineers, industrial hygienists).
Principles for assessment at step 2 are

- follow-up on step 1 checklist
- focus on identified problems
- simple workplace evaluation by professionals in co-operation with company staff
- limited number of measurements
- finding direct cost-effective solutions
- allow decision about possible need for specialist assessment (Step 3)

Regarding preventive measures and problem solutions, appropriate sections of the Risk management document are to be used.

The first draft provides guidance on the use of standards for assessment of cold stress and evaluation of heat balance.

The basis document for this level will be the forth-coming ISO standard **ISOWD15743** and **ISOTR11079**

Relevant information for this level can also be found in the **Nordic Cold Guide.**

1. Cold air

1.1 Evaluation of cold stress with IREQ

Measurement or estimation of air temperature
Measurement or estimation of wind speed
Determination of exposure times
Estimation of activity level [ISO-8996, 1990 #2227]
Calculation of IREQ
- by calculation
- by graphs

See Annex 1 for details
Note: This first evaluation is for calm wind conditions only (ce.g. indoor environments)

2. Wind/air movement

2.1 Evaluation of cold stress with IREQ

With the additional data for wind speed a more detailed analysis of cold stress and whole body cooling can be applied. For this analysis the thermal properties of cold protective clothing must be known (see also 5 below). This information can be supplied by the manufacturer or retailer.
Calculation of IREQ
- by calculation
- by graphs

See Annex 1 for details

Note: This evaluation does not require any knowledge of the actually used cold protective clothing. This analysis is carried out in 5.

3. Contact with cold surfaces by handling tools, equipment and machinery or by sitting or lying.

3.1 Evaluation of contact cooling with [ISO/NP-13732, 1995 #5427]
- determine the surface temperature of contacted material
- determine type of material
- determine type of contact (touching or gripping)

See Annex 2 for details

4. Contact with water, liquids or moist materiel.

Liquids have a cooling power much higher than that of air. Wet skin will cool by evaporation and continuous handling of liquids (e,g, water), eventually cools the skin surface to or clos to the temperature of the liquid. This implies that wet and moist conditions also at temperatures between 0 and +15 °C may cause considerable cooling of hands and fingers.
Special attention must be paid to liquids with a freezing point below zero (e.g. gasoline, etanol). They cool
- first by convection due to its low temperature and high cooling power
- second by evaporation of the liquid.
A frostbit may develop in a few seconds if gasoline is spilled on the bare hands at –10 °C.

5. Protective clothing against cold (not hands, feet and head))

The cooling effect on the body in a cold environment is determined by
- thermal insulation of used cold protective clothing ensemble (clo-value)
- body heat available from muscular and metabolic energy production
Thermal insulation of clothing can be determined
- by estimation from tables of similar ensembles [ISO-9920, 1993 #2228].
- by measurements according to [ENV-342, 1998 #6193]
The insulation value is presented as a clo-value or in SI-units (1 clo =0.155 m^2°C/W)
With knowledge about the insulation value for used or available cold protective clothing, the conditions for heat balance during the prevailing climate and activity can be evaluated.

5.1 Evaluation of heat balance with IREQ

Measurement or estimation of air temperature
Measurement or estimation of wind speed
Determination of exposure times
Estimation of activity level [ISO-8996, 1990 #2227]
Estimation or determination of clo-value for selected cold protective clothing
Calculation of heat balance
- by calculation
- by graphs

See Annex 1 for details

6. Protection against cold for hands, feet and head

In addition to whole body cold protection attention must be paid to the protection of hands, feet and head.
Hand protection with gloves or mittens interferes with manual function. Therefore a compromise between requirements for performance and requirements for cold protection must be done.
Evaluation of hand heat balance can be made with knowledge about
- climatic conditions
- body heat production
- thermal insulation of handwear [EN-511, 1993 #3445]
Similarly information about the thermal insulation of footwear can be used for evaluation of cold protection.

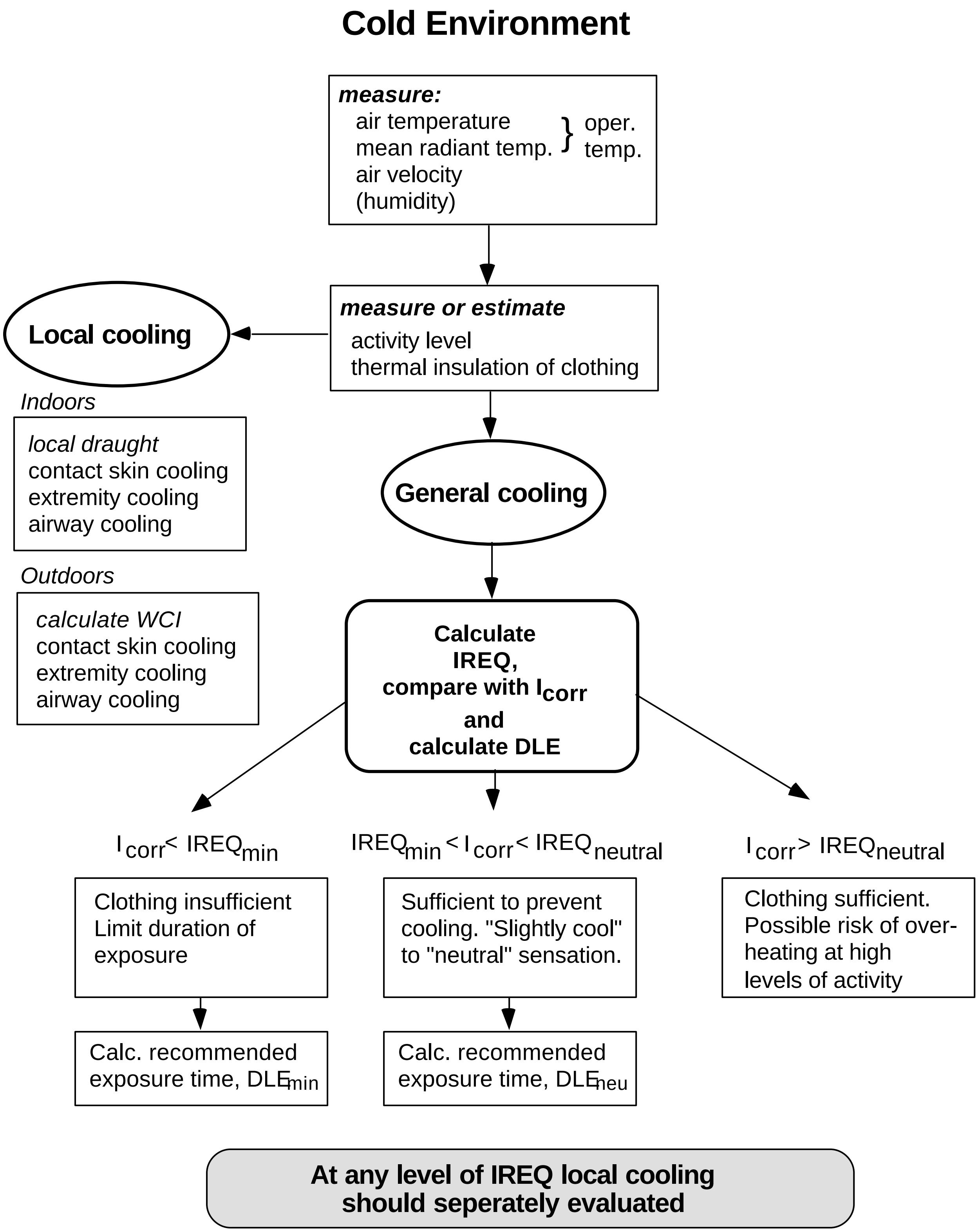
See Annex 3 for details
- examples of glove insulation
- examples of boot insulation
- comments about headwear

7. Use of personal protective equipment (e.g. helmet, ear protectors, apron)

8. Other problems related to cold

ANNEX 1

Figure 1. Schematic illustration of the procedures for evaluation of cold stress using ISO TR 11079.



Point 1

Evaluation of cold stress and heat balance with IREQ.

1. by calculation

A program for calculation of IREQ and associated cold stress factors are available at website www.niwl.se/tema/klimat

Follow the instructions on line.

2. by graphs

A set of graphs illustrating IREQ as function of different climatic and activity values is presented below.

- check the appropriate values for air temperature and activity and read the value of IREQ corresponding to

a) high physiological strain (IREQmin) in figure 2

b) low physiological strain (IREQneutral) in figure 3

Figure 4 allows a comparison of IREQ for the two levels of strain.

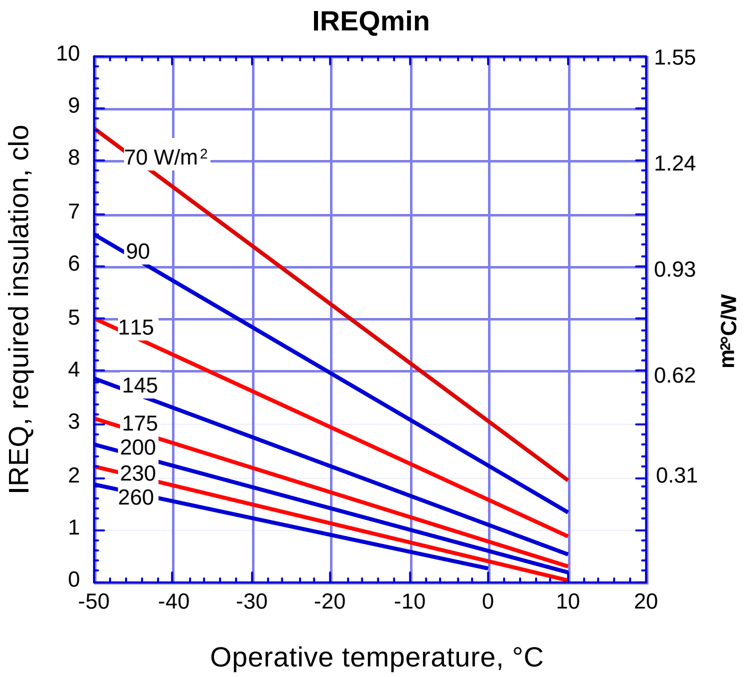


Figure 2. $IREQ_{min}$ as function of ambient operative temperature at eight levels of metabolic heat production. The operative temperature is the integrated value of the air temperature and mean radiant temperature weighted according to values of the convective and radiation heat transfer coefficients, respectively.

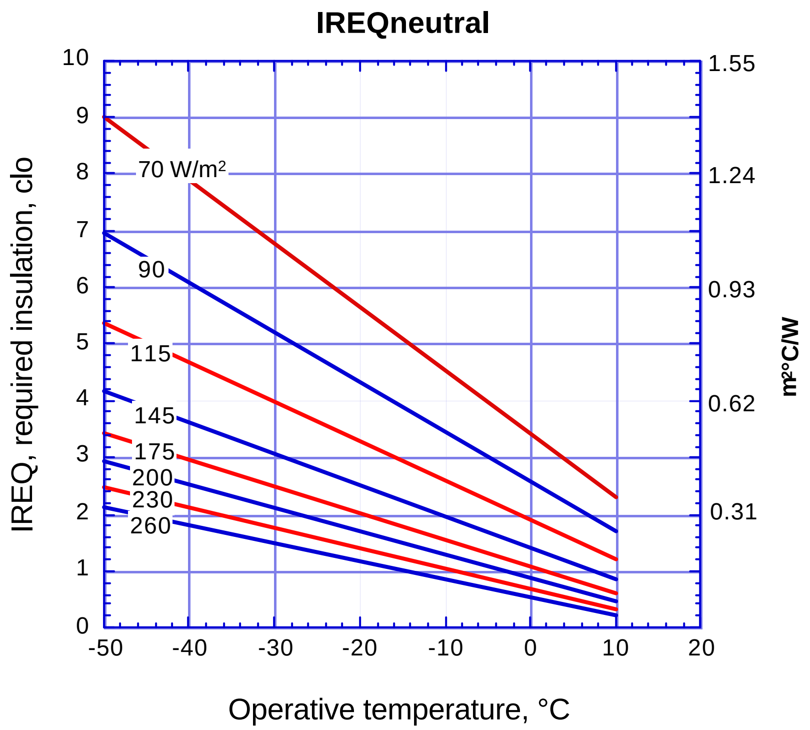


Figure 3. $IREQ_{neutral}$ as function of ambient operative temperature at eight levels of metabolic heat production.

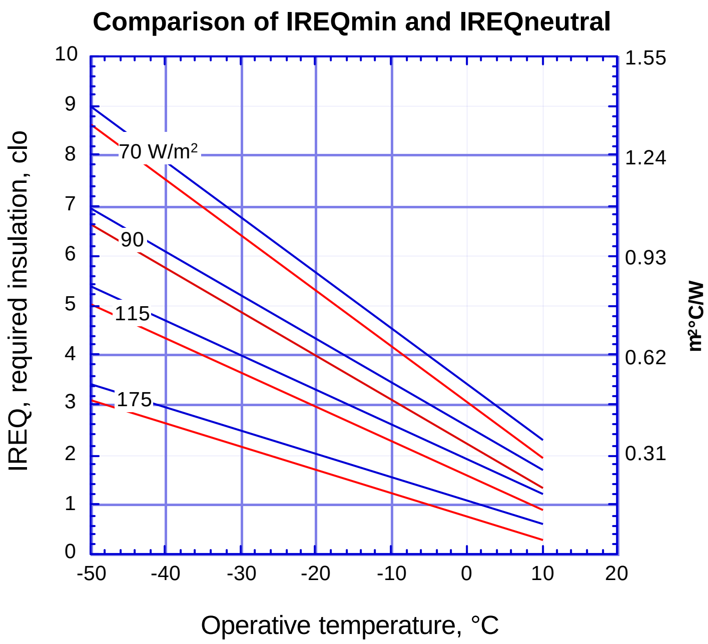


Figure 4. Comparison of $IREQ_{min}$ and $IREQ_{neutral}$ at three levels of metabolic heat production.

Point 2

For the given values for air temperature and wind, the information provided in figure 5, gives an idea about the additional required insulation needed to compensate for the extra cooling effect of wind. The xample is given for light activity at 90 W/m^2 and an assumed outer layer of clothing that provides medium protection against wind.It can be easily seen that a wind of 10 m/s at –10 °C requires a protective clothing ensemble, that is near double as warm, as compared to calm conditions.

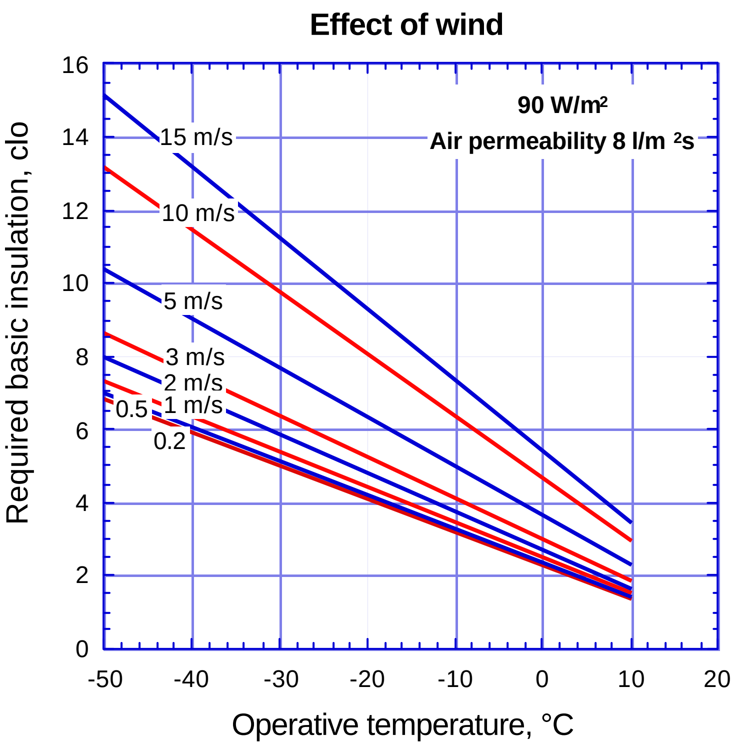


Figure 5. Effect of wind on the required basic insulation value to be provided by an ensemble with an outer layer of medium air permeability (8 l m^{-2} s^{-1}). Values are given for an activity of 90 W/m^2.

Point 5

The graphs presents the relation between air temperature and exposure duration for selected values for the basic insulation to be provided by the cold protective clothing. Graphs are given for four activity levels. All graphs show relations for calm conditions. With the presence of wind, an appropriate correction (increase!) of the clo-value must be made (see figure 5, point 2).

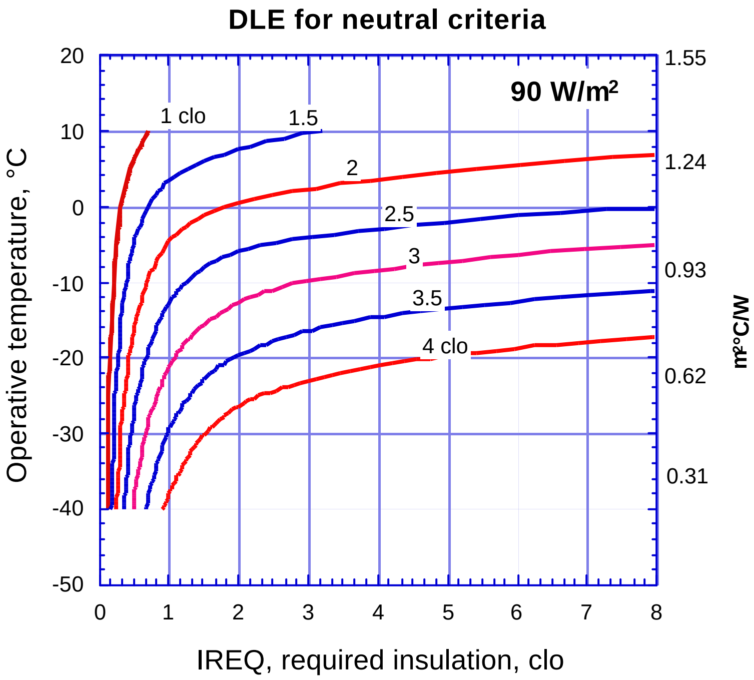


Figure 6. Recommended maximal exposure time (DLE) for low strain (neutral) at an activity level of 90 W/m^2 and for seven values of basic clothing insulation value (cf. table C.2). Air permeability of outer layer is medium (8 l m^{-2} s^{-1}).

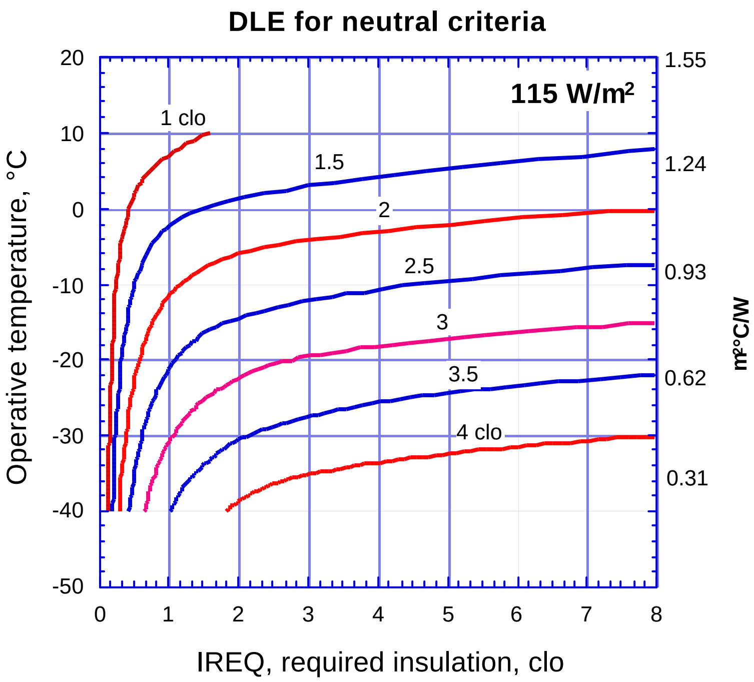


Figure 7. Recommended maximal exposure time (DLE) for low strain (neutral) at an activity level of 115 W/m^2 and for seven values of basic clothing insulation value (cf. table C.2). Air permeability of outer layer is medium (8 l m^{-2} s^{-1}).

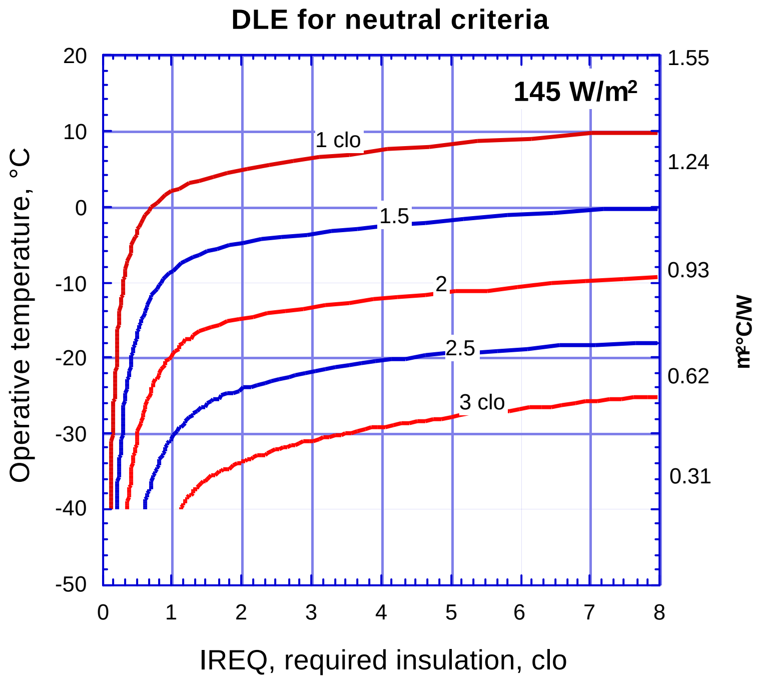


Figure 8. Recommended maximal exposure time (DLE) for low strain (neutral) at an activity level of 145 W/m^2 and for five values of basic clothing insulation value (cf. table C.2). Air permeability of outer layer is medium (8 l m^{-2} s^{-1}).

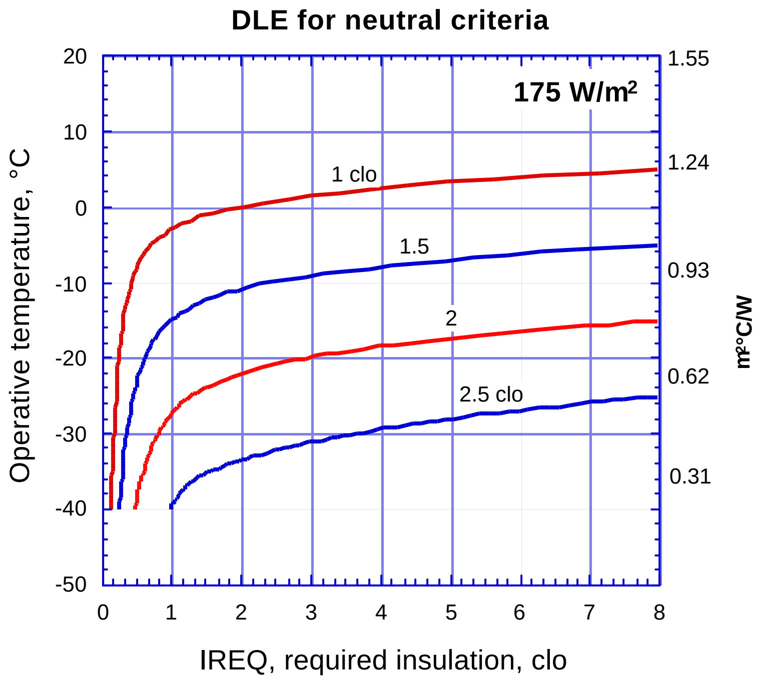


Figure 9. Recommended maximal exposure time (DLE) for low strain (neutral) at an activity level of 175 W/m^2 and for four values of basic clothing insulation value (cf. table C.2). Air permeability of outer layer is medium (8 l m^{-2} s^{-1}).

ANNEX 2

TOUCHING OF COLD MATERIALS (ISO NP 13732, part 3 cold materials)

.
Relations between material temperature and contact duration is given for different type of materials and different effect criteria (pain, numbness or frostnip).
- determine the surface temperature of the material
- select the appropriate material and effect criteria
- determine the corresponding allowed time for contact

Touching conditions:
short contact periods (up to 100 seconds) with a small skin surface area (e.g. finger tip).

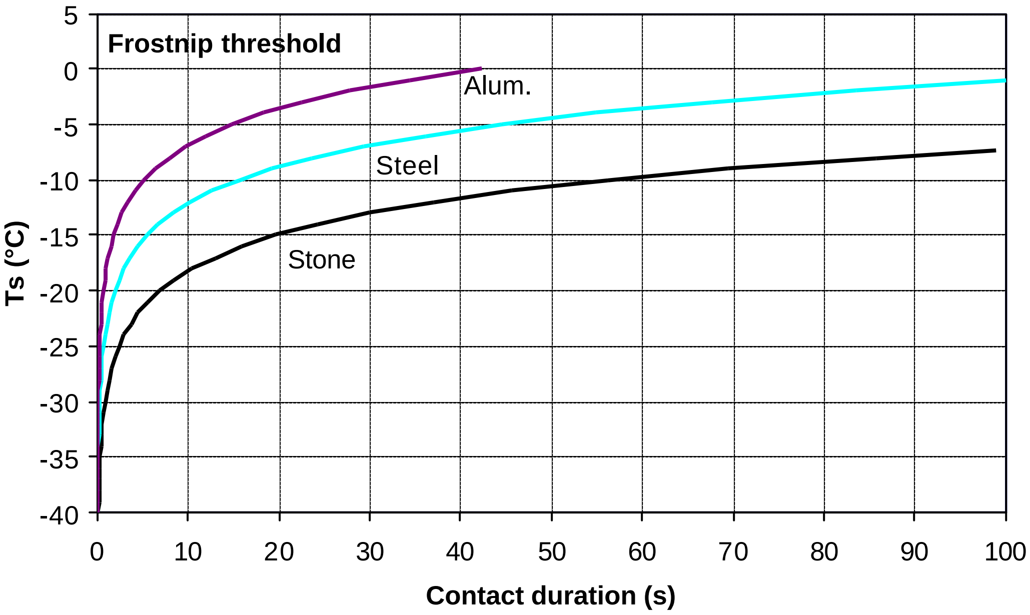


Figure 2. Surface temperature as a function of time for T_C to reach 0 °C (finger touching the cold surfaces between 0.5 and 100 sec.)

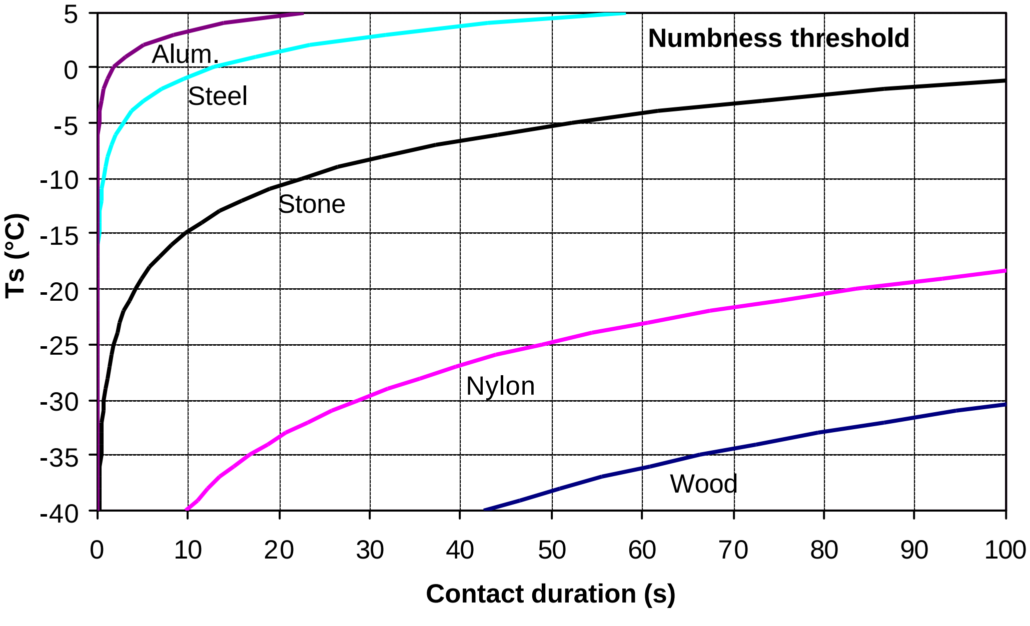


Figure 3. Surface temperature as a function of time for T_C to reach 7 °C (finger touching the cold surfaces between 0.5 and 100 sec.)

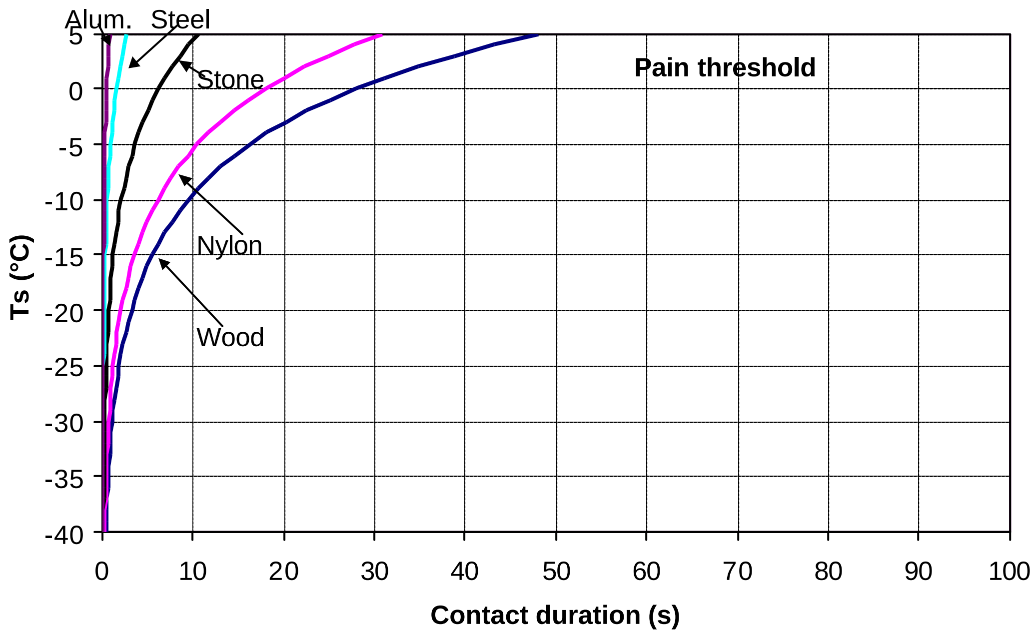


Figure 4. Surface temperature as a function of time for T_C to reach 15 °C for the case of finger touching 5 different materials

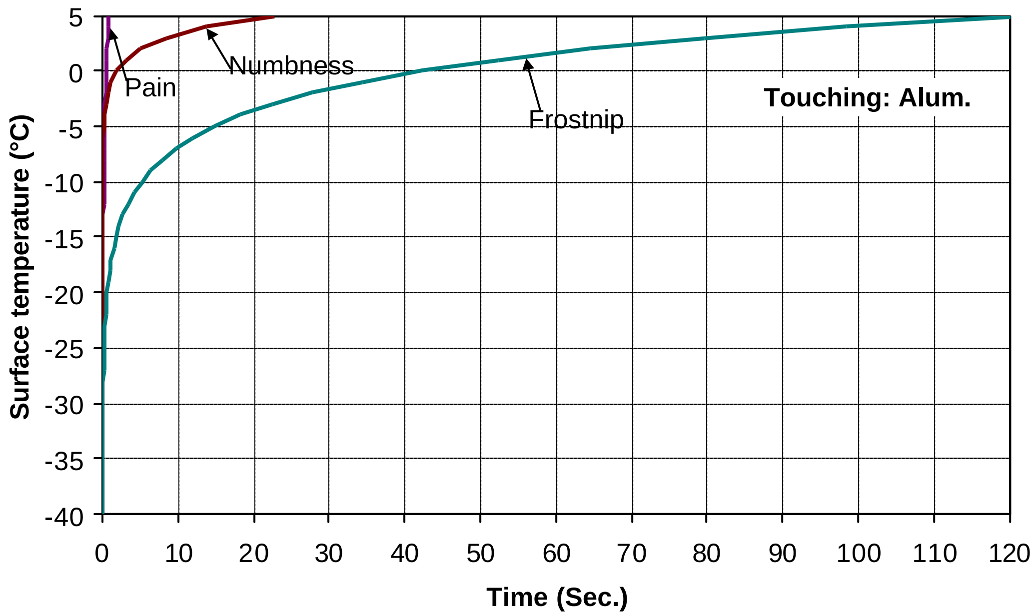


Figure 5. Cooling threshold curves while the finger skin is in contact with a cold smooth aluminium surface

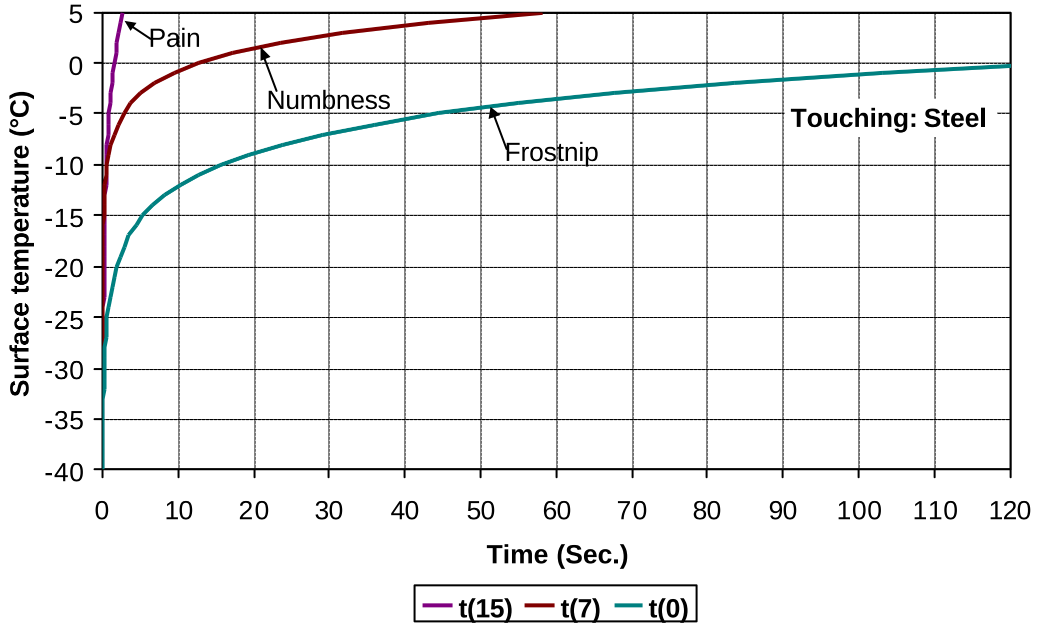


Figure 6. Cooling threshold curves while the finger skin is in contact with a cold smooth steel surface

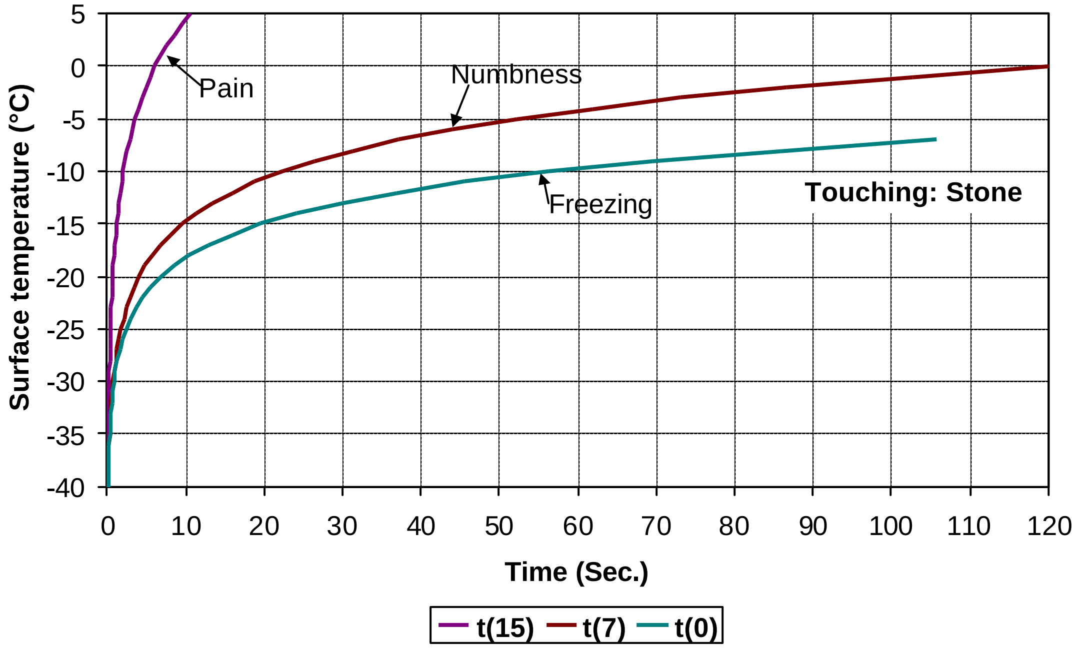


Figure 7. Cooling threshold curves while the finger skin is in contact with a cold smooth stone surface

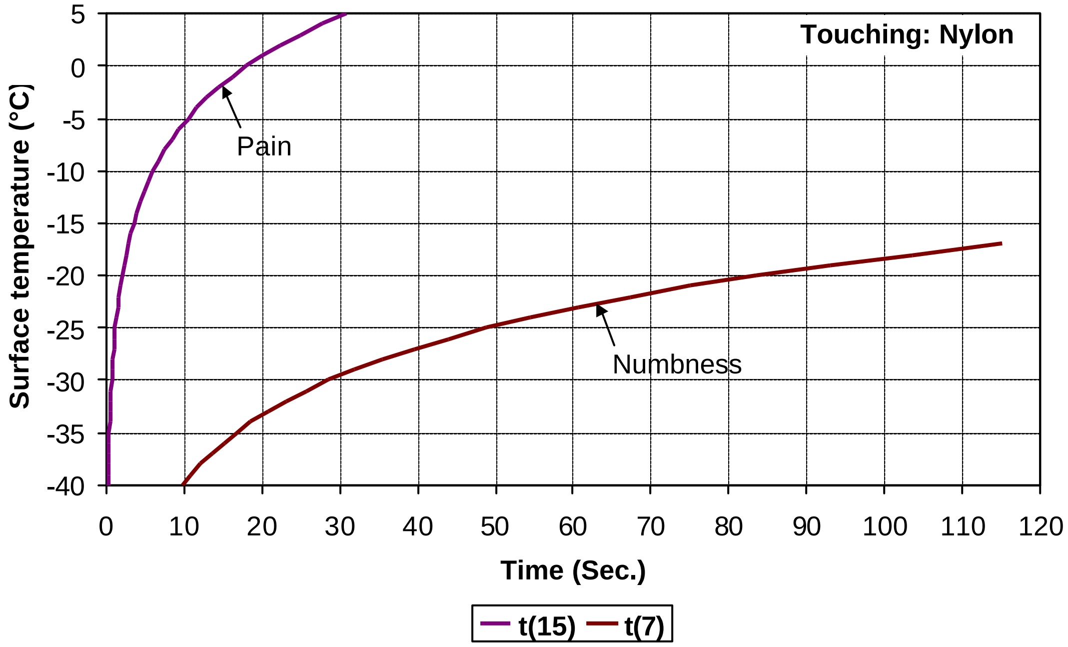


Figure 8. Cooling threshold curves while the finger skin is in contact with a cold smooth nylon surface

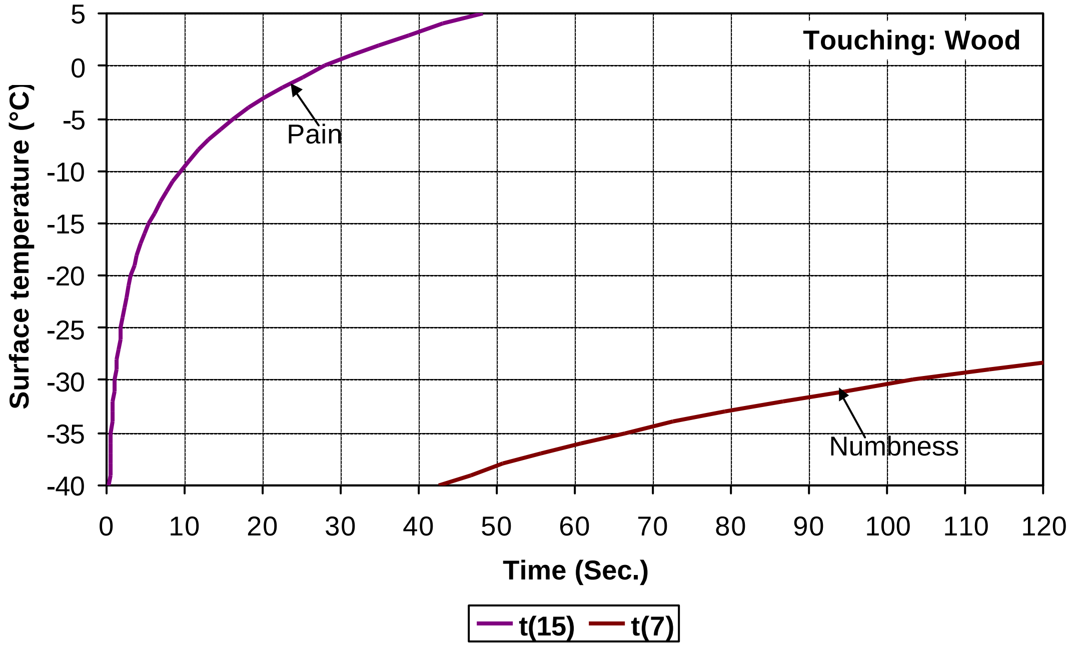


Figure 9. Cooling threshold curves while the finger skin is in contact with a cold smooth wood surface

Gripping conditions:
longer contact periods (up to 10 minutes) with a larger skin surface area in contact (e.g. hand gripping a tool).

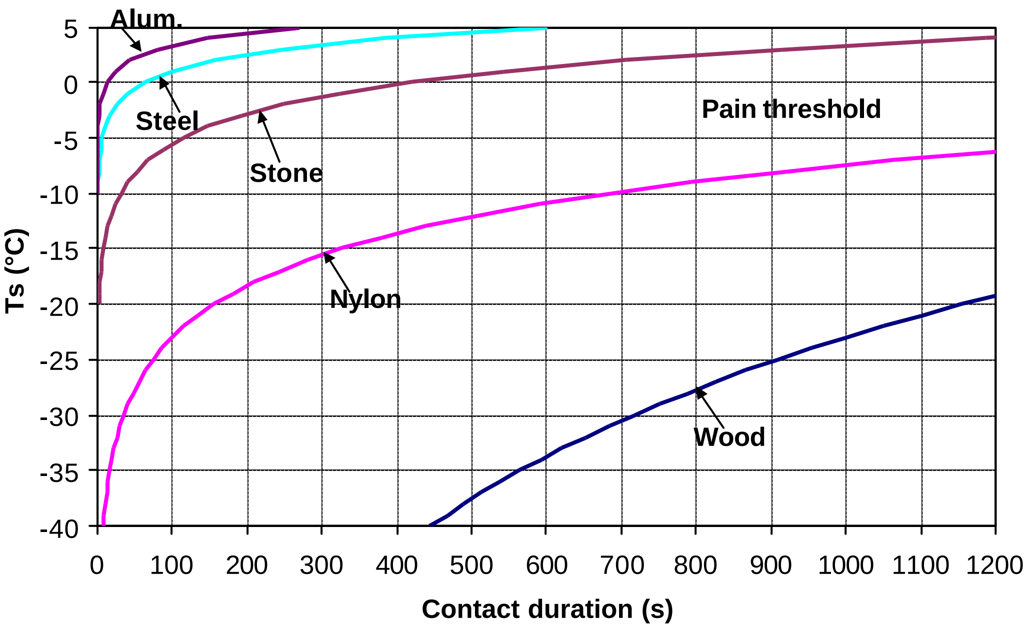


Figure 11. Surface temperature as a function of time for T_C to reach 15 °C for the case of hand gripping non-metals

Annex 3.

HAND HEAT BALANCE IN THE COLD (ISO TR 11079)

Examples of hand cooling for defined conditions are given in the figures.
The worst case is with light work, when body heat production is low. Blood flow is often restricted to extremities and hands and feet cool down. In most cases gloves can slow down the cooling rate but not fully prevent it.
The first graph shows that a very warm mitten (insulation value of 2 clo) cannot prevent a gradual fall in finger skin temperature, when activity is low.
The second graph shows that with higher activity and more warm blood flow to the hands, finger skin temperature is better preserved and falls much slower, despite a less warm glove (insulation value of 1.4.clo) being worn.

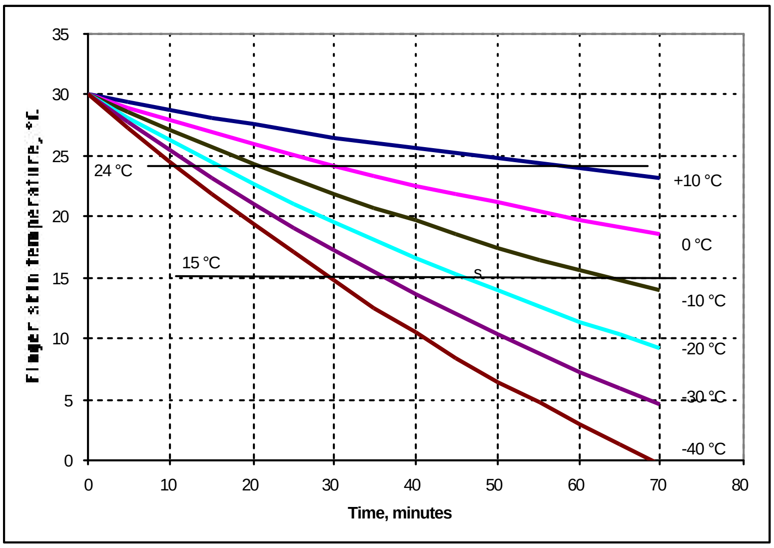


Figure 16. Drop in finger temperature with time at low activity and under conditions of whole body negative heat balance (I_{clr}<$IREQ_{neutral}$). Hand/finger protection according to warmest class (4) in EN511 is assumed (˜2 clo).

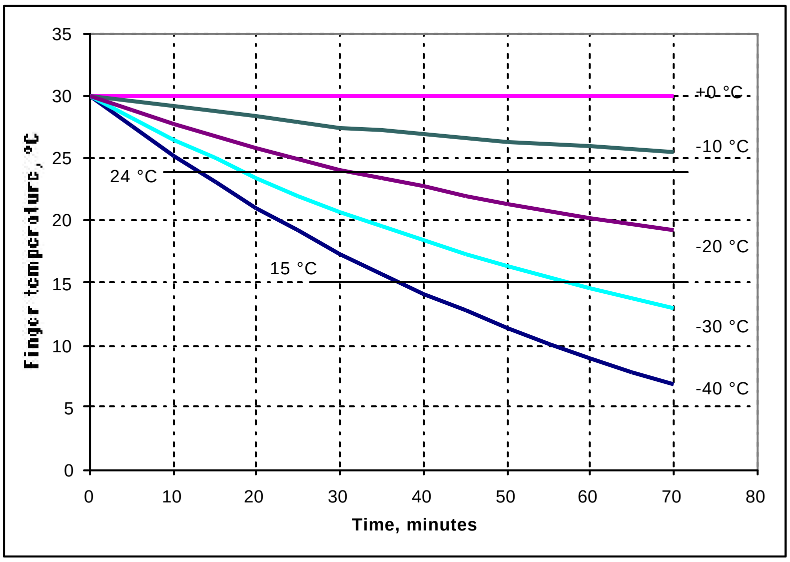


Figure 17. Drop in finger temperature with time at high activity and under conditions of positive heat balance (I_{clr}=$IREQ_{neutral}$). Hand/finger protection according to class 3) in EN511 is assumed (˜1.4 clo).

ANNEX D

GUIDELINES FOR PLANNING AND PREVENTIVE MEASURES

1. Management of the cold risks as a part of the company's policies

The company's OH&S management system contain main policies concerning the occupational health and safety issues. This guidelines follow the approach of the occupational health and safey management system spcification OHSAS 18001, which, in turn, is compatible with with the Quality system ISO 9000-series and Environmental management system ISO 14000-series.

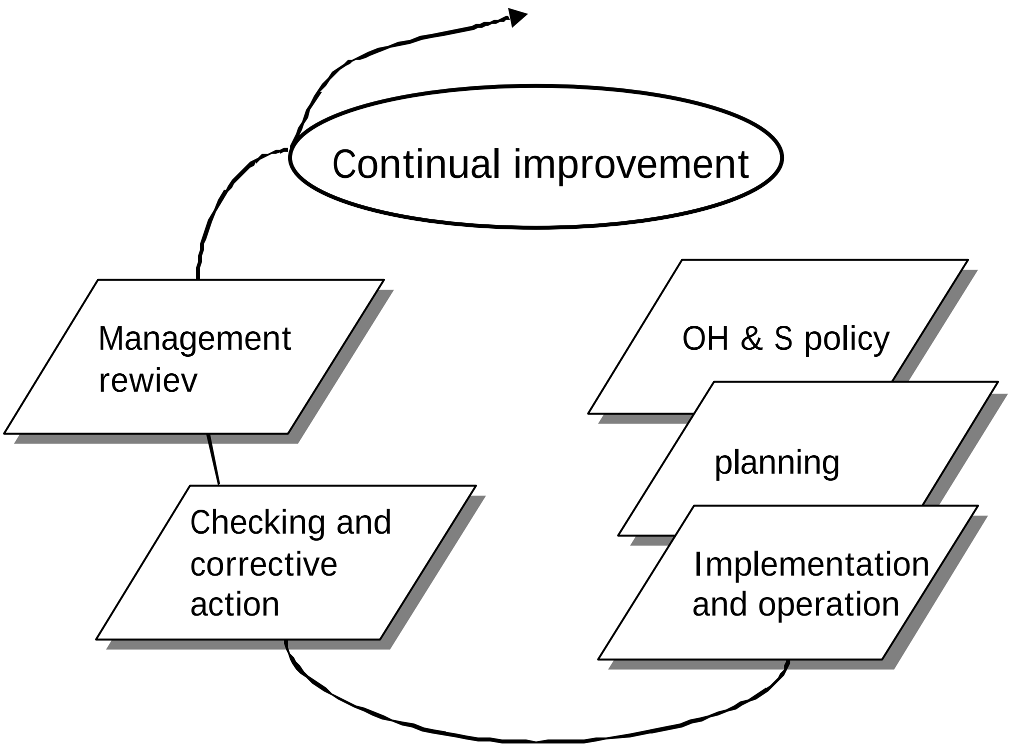


Figure 1. Elements of successful OH&S management (OHSAS 18001)

1. How are the cold risks taken into consideration in our company´s OHS management system?

Measures / documentations to be conducted: ______

______

______

______

Information material needed: ______

______

Responsible persons: ______

2. Assessment of the cold risks at the work place

How are the cold risks assessed at our workplaces?

Measures to be conducted: ______

______

______

Information material / methods needed: ______

______

Responsible persons: ______

3. Management of the cold risks at the work place

Depending of the nature of the industry and the company in question, various preventive measures against cold risks may be conducted. In the following chapters there are lists of different measures to be chosen. The preventive measures are carried out at the work place usually by the occupational safety delegates, supervisors and workers. The worker's participation is strongly recommended. All parts need to be informed about the actions to be made. The company is advised to name the responsible persons in each of the following sections. The questions in the end of each section may be usefull in planning. The activites shall be written down in the Cold risk management plan (in the end of the document).

3.1. Organizational preventive measures against cold risks

In the planning phase of projects

- schedule work for a warmer season (for outdoor work)
- check if work can be done indoors (for outdoor work)
- allow more time per task with cold work and protective clothing
- provide heated space or heated shelter for recovery
- provide training of complex work tasks under normal conditions
- ascertain appropriate knowledge and competence of staff
- seperate goods and worker line and keep different temperature zones
- provide extra manpower to shorten and/or reduce exposure

Before every work shift

- check climatic conditions at onset of work
- schedule adequate work-rest regimens
- allow for individual control of work intensity and clothing
- prepare schedule and control stations (outdoors)
- organize communication system (outdoors)

During the actual work shift

- provide for break and rest periods in heated shelter
- provide for frequent breaks for hot drinks and food
- care for flexibility in terms of intensity and duration of work
- provide for replacement of clothing items (socks, gloves etc.)
- provide access to extra clothing for warmth
- monitor subjective reactions (buddy system)(outdoors)
- report regularly to foreman or base (outdoors)
- provide for sufficient recovery time after severe exposures (outdoors)

How are the cold risks reduced by planning and organizing the work?

Measures to be conducted: ______________________________

____

____

Information material needed: ______________________________

____

Responsible persons: ______________________________

3.2. Technical preventive measures against cold risks

Tools, equipment, machinery
- select tools, equipment and machinery intended and tested for cold conditions
- choose design that allows operation by gloved hands
- store tools, equipment and machinery in heated space, prewarm them
- insulate handles and controls
- conduct the repair and maintenance work indoors

Work area
- protect from heat loss to cold surfaces
- minimize air velocity in work zones
- keep workplace clear from water, ice and snow
- insulate ground for stationary, standing work places
- ensure that the ground is solid before lifting heavy objects

Slippery surfaces
- avoid slippery materials and materials with different friction qualities in the same space
- ascertain that the inclination of floor or ground is adequate for water to flow to drain pit
- prevent building up of snow at entries with open shelters
- remove ice and snow from entries, passages, working floors and planes, machinery
- sand and maintain the passages regularly
- use warning signs, if the surfaces are slippery

Lighting
- measure the lighting and compare to following recommendations
- provide more general lighting or use spot lighting if needed
- avoid shades and straight glare to eyes as well as reflections from bright surfaces

Climbing on stairs and ladders, working at hights
- select stairs and ladders intended and tested for cold conditions
- ascertain that the ladders are firm and inspected according to regulations
- check the contact to the ground and anti-skid devices of the ladders, remember safe declination
- remove ice and snow from working planes
- check that falling is hindered by firm safety fences and the holes are covered up
- prevent motion on areas where falling is not hindered
- use safety belt or harness during work at heights

How are the cold risks reduced by technical measures?

Measures to be conducted: ____________________

____

____

Information material needed: ____________________

____

Responsible persons: ____________________

3.3. Protective clothing, PPEs and other equipment

Clothing

- select clothing you have previous good experience with
- with new clothing, select tested garments
- select insulation level on the basis of anticipated climatic factors and activity level
- care for flexibility in clothing system to allow for great adjustment of insulation
- clothing must be easy to don and doff
- reduce internal friction between layers by proper selection of fabrics
- select size of outer garment to make room for adjustment of the insulative middle layer
- use multi-layer system
  * inner layer for microclimate control
  * in heavy sweating, absorbant layer between inner and middle layer
  * middle layer for insulation control
  * outer layer for environmental protection
- inner layer should be non-absorbent to water, if sweating occurs in work
- inner layer may be absorbent, if no or low level of sweating occurs in work
- inner layer may consist of dual-function fabrics, in the sense that fibers in contact with skin is non absorbing and fibers next to the middle layer is absorbing water or moisture
- middle layer should provide loft to allow stagnant air layers
- middle layer may be protected by vapor barrier layers
- garments should provide sufficient overlap in the waist and back region
- outer layer must be selected according to additional protection requirements, such as wind, water, oil, fire, tear or abrasion
- design of outer garment must allow easy and extensive control of openings at neck, sleeves, wrists etc, to regulate ventilation of interior space
- zippers and other fasteners must function also with snow and windy conditions
- buttons should be avoided
- clothing shall allow operation, also with cold, clumsy fingers
- design must allow for bent postures without compression of layers and loss of insulation

What kind of protective clothing is needed?

Measures to be conducted: ____

____

____

Information material needed: ______________________________________

____

Responsible persons: ____

Handwear

- mittens provide the best overall insulation
- mittens or safety gloves should allow thin gloves to be worn underneath (larger size)
- always keep both thick mittens or gloves and thin gloves available
- insulated thin inner glove and outer safety glove
- wear water-resistant or waterproof handwear in wet conditions
- change wet handwear for dry ones
- outer glove is removed only when doing precision work
- prolonged exposures requiring fine hand work, must be intercepted by frequent warm-up breaks
- pocket heaters or other external heat sources may prevent or delay hand cooling
- sleeve of clothing must easily accommodate parts of gloves or mittens - underneath or on top
- outer garment must provide easy storage or fixing of handwear when taken off

What kind of gloves are needed?

Measures to be conducted: ______________________________

____

____

Information material needed: ______________________________

____

Responsible persons: ______________________________

Footwear

- boots shall provide high insulation to the ground (sole)
- sole shall allow flexion while walking
- sole shall have an anti-slippery pattern and an optimum coefficient of friction to prevent of slipping
- select size of boot so it can accommodate several layers of socks and an insole
- ventilation of most footwear is poor, so moisture should be controlled by frequent replacement of socks and insole
- wear woollen or wool-mixture felt-soled or terry socks, felt liners and thick insoles for moisture absorbance allow boots to dry completely between shifts, footwear drying devices are recommended
- consider the need for waterproof footwear
- legs of clothing must easily accommodate parts of boots - underneath or on top

What kind of footwear is needed?

Measures to be conducted: ______________________________

____

____

Information material needed: ______________________________

____

Responsible persons: ______________________________

Head protection. Use of safety helmet ion the cold

- flexible headwear comprises an important instrument for control of heat and whole body heat losses
- headwear should be windproof
- design should allow sufficient protection of ears and neck
- design must accomodate other types of protective equipment (e.g., ear muffs, safety goggles)
- a windproof undercap shall be worn under the safety helmet
- harness of the safety helmet is adjusted to accommodate also the undercap

Face and respiratory protection

- face mask should be windproof and insulative
- no metallic details should contact skin
- heating and humidification of inspired air can be achieved by special breathing masks or mouth pieces

PPEs used with cold protective clothing

- Ensure the comfort properties and compatibility of the PPEs when used together with cold protective clothing.

Use of chemical protective clothing in the cold

- Use of insulated garments under ther chemical protective clothing
- undergarments shall be permeable to evaporate the sweat that forms over the skin

What kind of headgear, face protection & PPE is needed?

Measures to be conducted: ____

____

____

Information material needed: ____

____

Responsible persons: ____

Training and information, learning and guidance material

- provide education and information on the special problems of cold
- train complex operations under controled cold conditions
- provide information and training in first-aid and treatment of cold injuries

How are the workers trained to work in the cold?

Measures to be conducted: ____________________

Information material needed: ____________________

Responsible persons: ____________________

3.5. Occupational health care actions for cold work

How are the cold related health aspects taken into consideration in the occupational health care for this workplace?

Measures to be conducted: ____________________

Information material needed: ____________________

Responsible persons: ____________________

COLD WORK PLAN ANNEX D

PLANNING THE PREVENTIVE ACTIONS AGAINST COLD INDUCED HEALTH AND SAFETY RISKS AT THE WORK PLACE

COLD RISK MANAGEMENT PLAN FOR WORKPLACE

Workplace:	
Plan is prepared by:	
Responsible persons:	**Name & initial letters:**
foreman of the work place	
occupational safety responsible	
occupatiponal safety delegate	
etc.	
Who is controlling the activities ?	

COLD RISK ASSESSEMENT

Fill in the procedure for cold risk assessment at this particular workplace	**resp. person**	**date**	**control**
Cold risk assessment			
assessment using the checklist			

PREVENTIVE MEASURES AGAINST COLD RISKS

	Fill in the needed cold risk preventive measures		**resp. person**	**date**	**control**
1.	**Planning of the work**	**Measures to be conducted**			
	In the planning phase of project				
	Before every work shift				
	During the actual work shift				
2.	**Technical preventive measures**	**Measures to be conducted**			
	Tools, equipment, machinery				
	Work area				
	Slippery surfaces				
	Lighting				
	Climbing on stairs, work at heights				
	Others				
3.	**Protective clothing & PPE**	**Measures to be conducted**			
	Clothing				
	Handwear				
	Footwear				
	Head protection				
	Face and respiratory protection				
	PPDs / others				

4.	Information and training	Measures to be conducted			
5.	Occupational health care	Measures to be conducted			

ANNEX E

Guidelines to be followed in the combined use of PPDs and cold protective clothing

Hand protection:

- Safety gloves should be insulated
- Double gloving (thinner inner glove for precision work and short exposures)
- Work with bare hands in extreme cold should be discouraged
- Recommendations to be followed on times for handling different types of cold objects, times of exposure of bare hand to cold, glove insulation needs for different air temperatures, work organisation measures (breaks or pauses in warm areas)

Head protection

- Safety helmets with insulated lining
- Winter woollen caps or special winter hoods over or under safety helmets
- Harness of helmet adjusted to accommodate woollen caps or insulated liners
- Allow sweat evaporation from the head
- Work organisation measures (controlled exposure times, warm breaks)

Feet protection

- Safety shoes with insulated lining
- Insulated socks with safety shoes
- Bulkiness avoided
- Large sized shoes to accommodate socks
- Plastic toecap used instead of steel toecap
- Work organisational measures (warm breaks)

Body protection

- Insulated under garments when working with impermeable chemical protection clothing
- Means of evaporation of sweat from under garments
- Multiple layer clothing with insulated undergarments

ANNEX F

MODEL FOR OCCUPATIONAL HEALTH CARE IN COLD WORK

The model

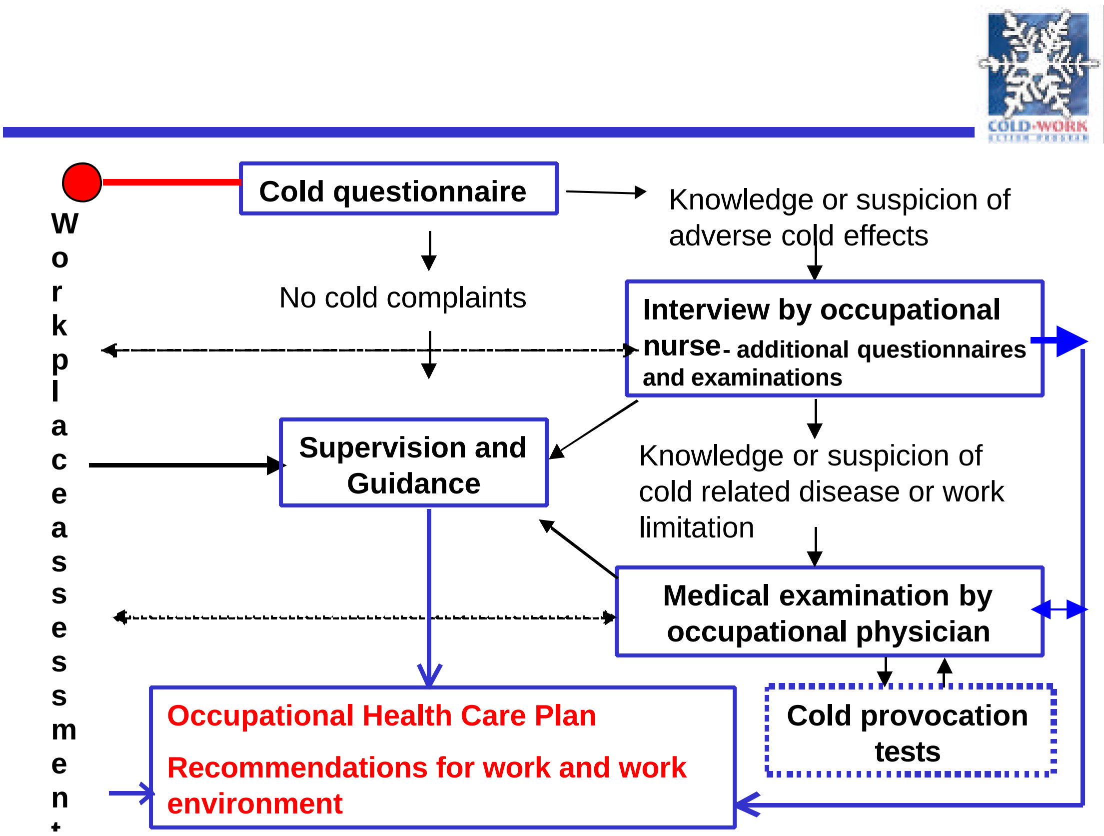


Fig. Occupational Health Care model for cold work

The main content of OHC is based on the result of cold related risk assessment (see Annex A) in the working environment and health check of working individuals. Commonly needed OHC-activities are sickness or other health limitation based advice and training, possible treatment, medication and rehabilitation. Depending on the needs and agreements with workplaces OHC-professionals may be used to provide information and training to the employees about how to manage in occupational cold environments. The close co-operation between OH-professionals and occupational safety personnel is highly recommended because the analogical activities of the both in the work in cold environments.

Selection of the employees

Selection of the employees is a part of medical screening built up by three different levels of activity consisting at each level an identification of cold related health risks in the workplace and the health of individuals. The first level is formed of the health check (Annex G) and the risk check of the work place (see Annex B). The purpose of health check is to find all potential individuals having cold related diseases or cold related personal working limitations. As a result of the the first level it is recognised who are the individuals which need to be further analysed.

The second level of the activities in medical screening is formed by further interviews and clinical status of the employees selected to this level. The content of the interviews and clinical investigations is dependent on the results of the preliminary health check and is symptom or disease specific. If cold related disease or working limitation are recognised, an additional health status based risk evaluation in the workplace may be needed (See Annex C). If there still remain open questions in the health status or other cold consequences, more detailed analysis in expert units in hospitals or provocation laboratories may be needed.

As a result of selection procedures OH-professionals accept or reject employees to work in cold environment. For employees working in the cold different types of advice, training and information is needed to achieve an optimal result in their health and working performance.

The repetition of the screening is needed whenever the occupational or exposure situation changed or is anticipated to change. Periodical repetition of the screening is recommended about every 3rd year for every workers and sickness or limitation dependent for those who have cold related disease or other cold related health or performance limitations (see chapter 5.1.3.).

Information, advise and training

Every employee in cold environments need information for his individual management in that environment, because recently strongly changed knowledge is not today commonly known. The persons having cold related disease or limitations need in addition individual detailed information and training from OH-professional. This includes information about the nature of the limitation, how to manage it, when to stop working, what kind of treatment is needed and when to contact medical personnel. The employer and e.g. foremen need to know what kind of support these workers may need in cold environments because of their health status. If the medical treatment of these persons is in response of some other physician but OH-professionals, these should be informed about the employees health in cold environments. The investigated employee has the right to receive this information for further carrying out.

Competence and skills of OHC professionals

OHC-professionals need to know and be able to manage the substance, available information, forms and advice as well as OH practices for work in cold environments. Furthermore, they have to merge the cold related activities in their other OH-practices. The developed training courses and information material produced in this project are usable in any OHC involved in cold work. The Nordic Cold Guide that is under preparation will help to fulfil the above mentioned activities.

Medical knowledge about health, health limitations in cold environments and cold related disease has been published in high numbers in recent years. The common OHC-model for working in cold environments and recommendations for practices are still under development. Because of these training courses for OH-practices or medical screening may be the most recommendable involvement in this field of expertise. The Nordic cold guideguide mentioned above, gives also rough instruction for daily OH practices.

HEALTH IN COLD WORK

Finnish Institute of Occupational Health, Oulu, Cold Work Action Program, Aapistie 1, 90220 Oulu, tel. +358 8 527 6129, fax +358 8 527 6121

Cold **causes many different adverse health and performance risks in several lines of industries involving work outdoors or in cold indoor conditions. With cold work we mean here either the circumstances when the ambient temperature is less than 0 °C or which cause a sensation of cold.**

In the following questionnaire You are able to describe how You consider the effects of cold on Your health and performance. Based on Your reply the occupational health care unit is able, in co-operation with You, to evaluate the possible needed supportive actions as well as the need to further develop the work and pass information about the usability of the questionnaire to the Cold Work Action Program. Participation in answering the questionnaire is optional.

____
name of respondent

____
date

____
employer

Answer the following questions by circulating the most suitable alternative or by writing the acquired information in the relevant place.

1 How do You generally feel in the cold?

	very unpleasant	unpleasant	slightly unpleasant	pleasant
whole body	1	2	3	4
fingers	1	2	3	4
toes	1	2	3	4

2 Do You have those unpleasant sensations at work?

1 no

2 yes

3 Are You exceptionally sensitive to cold?

1 no

2 yes

4 Do You experience an intense itching of the skin in the cold or after cold exposure which is related to excema resembling urticaria?

1 no

2 yes

5 Do You experience

	not at all	in warm	in cold	in cold during exercise
shortness of breath	1	2	3	4
extended coughing or paroxysms of coughing	1	2	3	4
wheezing of breath	1	2	3	4
increased excretion of mucus from the lungs	1	2	3	4

6 Do You experience

	not at all	in warm	in cold	in cold during exercise
chest pain	1	2	3	4
cardiac arrhythmias	1	2	3	4

7 Do You experience episodic

	not at all	in warm	in cold
blurring of vision	1	2	3
migraine type headache	1	2	3

8 Are Your fingers exceptionally sensitive to cold?

1 no

2 yes

9 Is the colour of Your fingers episodic changing to

	not at all	in warm	in cold
white	1	2	3
blue	1	2	3
red/violet	1	2	3

10 Do You experience repeatedly

	not at all	in warm	in cold
neck/shoulder or upper extremity pain	1	2	3
back or hip pain	1	2	3
pain in lower extremities	1	2	3

11 If You have some other symptom, do You experience it

	in warm	in cold
yes, what symptom? ______________________________	1	2
yes, what symptom? ______________________________	1	2

12 Have You ever received a frostbite of blister grade or more severe?

1 no

2 once

3 several times

13 How does cold affect the following factors describing Your performance at work?

	no effect	due to cooling performance is decreased	due to symptoms named in questions 4–11 performance is decreased	improves performance
concentration	1	2	3	4
motivation	1	2	3	4
manual pressing power/strength	1	2	3	4
musculosceletal endurance	1	2	3	4
other factor, what? ________________		2	3	4

other factor, what? ________________	2	3	4

MODEL FOR INFORMATION AND TRAINING IN COLD WORK **ANNEX H**

III-STEP:EXPERTS

Constant uptodating of new information
Implementation of scientific information
Education of key persons

II-STEP: KEY PERSONS
Workplace/Occupational safety, OHC experts

Training to use the methods (work environment)
Improvement of cold knowledge

Material:
Nordic cold guide   Information material for workplaces

I-STEP: EMPLOYEES
Improvement of cold knowledge of employees
Training of new employees for cold work
Recognising own responsibilities of cold management

Material:
Specific cold guides   Information session material

ANNEX J

EXAMPLE OF INFORMATION MATERIAL FOR CLIENTS PROVIDED BY THE OHC

COLD RELATED DISEASES: FROSTBITES

The freezing of the skin and subcutaneous tissue is called a frostbite. Frostbite occurs when the temperature of the tissue drops below 0°C as a result of being exposed to the cold.

Frostbites are divided into superficial frostbites, when only the skin is frozen and deep frostbites, when the subcutaneous tissue, muscles, blood vessels and nerves as well as the skin are frozen. The extent of the damage is dependent on how deeply the tissue is frozen, how strongly the blood vessels have contracted and how much the blood vessels have been damaged. 90% of frostbites occur in the hands and feet. Bare skin, as on the face, is also susceptible to frostbite.

The environmental conditions, length of cold exposure, personal characteristics and protection from the cold affect the generation of frostbite. Touching a cold metal object with bare skin can cause frostbite in a few seconds. Previous frostbites and peripheral circulatory diseases (white fingers, Raynaud-phenomenon, diabetes) can increase the risk for frostbite. Smoking and heavy drinking are also risk factors.

SYMPTOMS

- As the tissue cools the skin can tickle, feel coarse, be sensitive and change colour.
- Working ability, grade of accuracy, endurance and sensitivity decrease in the cooled part of the body.
- Tingling pain in the tissue is the last recognisable warning signal before numbness.
- Local numbness, stiffness and coldness of fingers and toes, white and waxy or bluish, often marble-like skin are symptoms of frostbite.
- The first signal of frostbite (frostnip) to the face is a white patch, which usually goes away when warmed with a hand.
- In difficult cases the frostbitten area can freeze so it is rock hard.

- Warming causes severe pain and swelling of the frostbitten tissue.
- Blisters can appear in the frostbitten area depending on the severity of the frostbite.

- Sequelae can occur in areas that have outwardly healed from the frostbite.
- Increased sensitivity to the cold, numbness of the fingers, decreased sensitivity, profuse sweating and changes in peripheral circulation are some of the sequelae.
- Severe sequelae can restrict working ability

The quality of a frostbite is difficult to assess during the first 3 to 5 days after the frozen tissue has thawed.

FIRST AID AND TREATMENT

- Warming with your hand and protecting e.g. with a scarf is usually sufficient first aid for frostnip.
- In mild cases a frostbite can be thawed by skin contact e.g. by putting your hand in your armpit.
- If frostbite occurs it is important to prevent it from getting worse. This can be done by seeking shelter and changing into dry clothes.
- It is important to prevent a thawed frostbitten area from freezing again.

- Severe frostbites always need medical care by a doctor and thawing should always happen in a controlled hospital environment !

- The thawing out of a difficult frostbite that has frozen so that it feels hard is prevented during transportation with thermal insulation.
- The patient is placed in a lying position and the frostbitten limb is immobilised. If the patient is conscious warm drinks (not alcohol) are given.

Forbidden actions:

- A thawed frostbite must not be allowed to freeze again.
- A frostbite must not be rubbed by hand or with snow.
- Creams must not be used. Healthy skin will protect you better from the cold without creams.

PERFORMANCE OF THE HAND IN THE COLD

Hand skin temperature °C	Manual performance and sensations
36-32	Optimal function
below 32	Sense of roughness
below 27°C	Decreasing muscular power
20-15	Decrease in tactile sensitivity
18-13	Decrease in manual performance
16-10	**Pain**
below 8	Injury in long term cold exposure
7	**Loss of sense**
0- -2°C	**Freezing of tissue**

(Enander A 1984: Performance and sensory aspects of work in a cold environment: a review. Egronomics 24 84): 365-378)

WINDCHILL INDEX AN RISK OF FROSTBITE

The combined effect of cold air and wind multiplies the cooling effect and the risk for frostbite on bare skin increases.

air temperature, °C

wind, m/s	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
calm	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
2	9	4	-1	-6	-11	-16	-21	-26	-31	-37	-42	-47	-52
4	5	-1	-7	-13	-18	-24	-30	-37	-43	-49	-55	-61	-67
6	3	-4	-10	-17	-24	-30	-37	-43	-50	-56	-63	-69	-76
8	1	-6	-13	-20	-27	-34	-41	-48	-55	-62	-69	-76	-83
10	0	-8	-15	-22	-30	-37	-44	-52	-59	-66	-73	-81	-88
12	-2	-9	-17	-24	-32	-39	-47	-54	-62	-69	-77	-84	-92
14	-2	-10	-18	-26	-33	-41	-49	-56	-64	-72	-79	-87	-95
16	-3	-11	-19	-27	-34	-42	-50	-58	-65	-73	-81	-89	-97
18	-3	-11	-19	-27	-35	-43	-51	-59	-67	-75	-83	-90	-98
20	-4	-12	-20	-28	-36	-44	-52	-60	-68	-76	-84	-91	-99

cold | freezing cold | frostbite risk on bare skin | bare skin freezes in max 30 seconds