

Medical aptitude in fire fighting and hazardous material emergencies

Medical implications on AFS 1995:1



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Medical aptitude in fire fighting and hazardous material emergencies

Medical implications on AFS 1995:1

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Summary

The use of breathing apparatus (BA) in fire fighting or at the scene of hazardous material (Haz Mat) emergencies is difficult and demanding work for a firefighter. In such situations he must work with heavy equipment at high temperatures and under great mental stress. The nature of the job also involves taking different types of unavoidable risks. As a result, in 1986, Arbetskyddsstyrelsen, the Swedish National Board for Occupational Safety and Health (ASS) issued regulations for the use of BA in fire fighting (AFS 1986:6). These regulations included requirements regarding, for example, medical examination, exercise ECG, physical working capacity and physical and mental health. These regulations have since been revised as AFS 1995:1 The use of BA in fire fighting and at the scene of Haz Mat emergencies.

The present regulations state that it is the responsibility of a doctor to assess whether an employee is suitably fit to work with BA in fire fighting or at the scene of a Haz Mat emergency. An employer may not use an employee for such tasks unless the individual has undergone an examination and has been declared suitably fit. It is the responsibility of the employer to decide which medical authority should make the appropriate assessment of occupational fitness.

The reason for the present report is that officials at the Swedish Rescue Services Agency (SRSA) have received enquiries regarding the assessment of occupational fitness associated with different medical conditions. On investigation of these enquiries, it has become apparent that there is a variation in the implementation of the ASS regulations. A project group within the SRSA has produced the present report with the aim of attaining a more standardised implementation of the relevant regulations regarding the assessment of occupational fitness associated with different medical conditions.

The members of the project group and the reference group are listed in Appendix 1.

The following problem areas are analysed in the report:

1. The concept "fully fit" as used in paragraph 4 of the regulations AFS 1995:1.
2. The investigation process and the assessment of occupational fitness in the case of an established medical condition.
3. Standardised forms for documentation of medical examination.

In the course of the literature study conducted within the framework of the project, it was discovered that no study has been made of the physical working capacity required for the active use of breathing apparatus in fire fighting or at the scene of hazardous chemical emergencies. However, several studies have analysed the physical demands of working with BA in different test situations. Some of these studies have shown that certain tasks in these test situations demand greater physical capacity than that required by the regulations AFS 1995:1. Several of the studies have shown that working with BA in fire fighting involves a considerable heat load. However, an examination of the relevant literature has failed to find any case report where a great increase in body temperature during the active use of BA in fire fighting has caused any medical problems. The effects of age on working capacity have been

clearly documented in a comprehensive literature study in England, where the risks of certain medical conditions associated with increased age have been particularly analysed. From the age of 25-30, increasing age is always related to a successive decrease in physical working capacity which may, however, be compensated for by increased experience. The dominant types of medical problems among firefighters are, in common with the rest of the population of comparable age, cardiovascular diseases.

The literature study is summarised in Appendix 2, and the reference list is presented in Appendix 3.

The project group interprets the concept "fully fit" (AFS 1995:1, paragraph 4) as a condition lacking both subjective and objective signs of disease or any other deviations from the normal status which could limit suitability for work using BA in fire fighting or at the scene of Haz Mat emergencies.

In addition, recommendations have been made regarding how occupational fitness should be assessed in the case of various medical conditions.

The medical conditions dealt with are mainly those in which there is a risk of serious complications associated with the use of BA in fire fighting or at the scene of Haz Mat emergencies. However, it should be emphasised that in the overall assessment of occupational fitness, the individual's health-related capacity to cope with work using BA in both the short and the long term, should be taken into account.

A standardised form for the documentation of the medical examination has been produced. The reason for this standardised form is to ensure that relevant questions are thoroughly covered during the examination. In addition, it is recommended that the exercise ECG should be performed as a maximal test, in order to reveal any irregular heart activity as a result of physical effort.

The report also deals with the degree of physical effort required when working with BA in fire fighting. It has been established that the physical strain imposed by certain tasks in test situations is greater than the requirements laid down in the regulations AFS 1995:1. This means that the lower limit for physical working capacity could probably be raised, and that greater demands may be placed when assessing occupational fitness in conjunction with various medical conditions. However, the task of the project group did not include the formulation of recommendations regarding demands on physical working capacity. In addition, there have been no investigations to show what demands operational work with BA places upon physical working capacity. This means that there is no material upon which to base an assessment of how well different test situations, such as those in container systems, actually reflect real-life operations with BA.

In addition to the shortage of studies regarding physical working capacity in real-life situations, there is also a lack of information about serious health effects and serious illness in conjunction with and after working with BA in fire-fighting situations. It is the unanimous opinion of the working group that these areas require further study.

The contents of the report have been approved by the various reference groups and by the relevant specialist groups within the Swedish Society of Medicine. The final report was presented at a meeting of the reference groups in October 1997, and was subsequently presented at a seminar at the SRSA college at Rosersberg on the 10th of February 1998.

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THE BACKGROUND AND IMPLEMENTATION OF THE PROJECT

Background

The Swedish National Board for Occupational Safety and Health (ASS) has produced and at a later date also revised regulations for the use of BA in fire fighting and at the scene of Haz Mat emergencies. The reason for the publication of the first regulations during the 1980's was that there were previously no rules about the demands to be placed upon personnel working with BA. Similarly, there were no regulations concerning operational safety. The accident statistics during the first half of the 1980's were unfavourable, showing 1-2 fatalities per year.

Comparatively comprehensive research was carried out by what was at that time the research department of the Swedish National Board for Occupational Safety and Health (ASS), resulting in material upon which to base regulations concerning the use of BA in fire fighting and at the scene of Haz Mat emergencies, and the demands to be placed upon individuals carrying out such work. The first regulations were published in 1986, establishing the demand for medical examinations including an exercise ECG, tests of physical working capacity and mental health, and the requirement of full health. These regulations are based upon the Occupational Safety and Health Act, chapter 4, paragraph 5, where the aims of medical tests in working life are described. The aim is to prevent individuals suffering from various medical conditions from being subjected to an increased risk of ill-health or accidents in connection with their working life, in both the short and the long term.

With regard to physical working capacity, a minimum requirement of 200W for 6 minutes on a cycle ergometer was established in order for an individual to be allowed to work using breathing apparatus. The effects of this regulation were immediate, causing a substantial reduction in fatalities. The revision of the regulations in 1995 included an alternative test of working capacity using a treadmill, something which the personnel may regard as more realistic.

Other medical requirements have not been defined as specifically as those for physical working capacity. The reason for this is that the doctor who is to certify fitness for using BA in fire fighting or at the scene of Haz Mat emergencies should make a personal balanced assessment of whether the individual is suitable for such work. The balanced assessment of occupational fitness should take into consideration whether or not the individual's health is compatible with the work in question in both the short and the long term. The formal medical report on occupational fitness constitutes either permission or prohibition for an employer to employ the individual in work using BA in fire fighting or at the scene of Haz Mat emergencies.

The use of modern treatment principles for various medical conditions means that, in general terms, individuals feel relatively healthy during treatment, and many live a more or less normal life with few or no restrictions, and without feeling that they are suffering from a chronic disease. This is also true of firefighters who are affected by chronic medical conditions during their active years. This often gives rise to a conflict situation between the

employee, who feels healthy, and the doctor assessing occupational fitness, who sees the possible medical risks involved. In addition, the doctor making the assessment can often be uncertain about exactly what kind of physical demands are involved in working with BA in fire fighting or at the scene of a Haz Mat emergency.

The SRSA have received queries from individual firefighters and doctors regarding the assessment of occupational fitness in relation to various medical conditions. Investigations have shown that there is variation in the interpretation of the relevant ASS regulations.

Aim

In the light of the above mentioned background, the SRSA decided in the spring of 1996 to produce a recommended interpretation of the relevant paragraphs in the regulations for working with BA in fire fighting and at the scene of Haz Mat emergencies, AFS 1995:1. Its aim was to increase mutual understanding between the relevant doctors and rescue service personnel with regard to the content of these regulations. The major points concerned were to be the concept 'fully fit' and the assessment of occupational fitness with regard to various medical conditions. The interpretation is intended to aid both parties in the implementation of the relevant sections of the regulations AFS 1995:1.

The standardised form for the documentation of medical examinations, including the statement of occupational fitness, has been produced with the aim of ensuring uniform quality in this respect.

The working group has chosen to present the interpretation of AFS 1995:1, paragraphs 4-6, in the form of a report.

The project group

The members of the project group and the reference groups are shown in Appendix 1. The project group contains professional expertise from the SRSA and professional medical expertise including experience of assessing divers in Naval corps.

The ASS has been provided with information regarding the content, and has been given the opportunity to make comments during the working process.

The present regulations (AFS 1995: 1)

The present ASS regulations are a result of revisions made during 1994 - 1995. One result of these revisions was that it became possible to use a treadmill as a test method for physical working capacity. The requirements regarding physical working capacity were not changed. It also became forbidden to allow pregnant employees to work with BA. Otherwise, the medical content of the regulations was not altered compared to the original AFS 1986:6.

According to the present regulations, employees using BA in fire fighting or at the scene of Haz Mat emergencies must:

- be fully fit
- have a good physical working capacity
- be able to work calmly in difficult situations.

According to paragraph 5, an employee who is to use BA in fire fighting or at the scene of Haz Mat emergencies, must undergo a medical examination within 6 months before beginning such work. Subsequently, annual medical examinations should be conducted. Table 1 shows the relevant requirements.

Table 1

Category	Medical examination	Fully fit	Physical working capacity	Exercise ECG	Mental health
New employee	6 months*	Yes	§ 7*	Yes	Yes
Employee < 40 years	every 12 months	Yes	§ 7	every 5 years	Yes
Employee 40 - 50 years	every 12 months	Yes	§ 7	every other year	Yes
Employee > 50 years	every 12 months	Yes	§ 7	every year	Yes
Out of service > 12 months	before work is resumed	Yes	§ 7	dependent upon age	Yes
Illness/ accident	In the case of increased risk of occupational ill-health	Yes	§ 7	dependent upon age and illness	Yes

* Medical examination should be conducted within 6 months before work begins.

** § 7 states that the test should be conducted with a cycle ergometer or a treadmill.

The regulations also state that any individual who is discovered during the medical examination to have a disease or a weakness which could involve an increased risk of ill-health or accidents in conjunction with the use of BA, may not be employed for such tasks.

The regulations presume that the examining doctor will weigh up all of the test results in order to assess overall occupational fitness. This weighing-up should take into account the individual's ability, from a medical point of view, to participate successfully in work using BA in both the short and the long term.

It is the responsibility of the employer to decide which medical authority (company doctor, local general practitioner, private doctor etc.) should conduct the occupational fitness assessments. An essential requirement for a fair assessment is that the doctor in question is well informed about the physical demands involved in work with BA in fire fighting and at the scene of Haz Mat accidents.

The regulations stipulate precisely how physical working capacity should be tested. Exact requirements for physical working capacity are stated. The limits stated in the regulations are estimated to be the equivalent of an average oxygen uptake capacity of 40 ml/kg body weight per minute. The comments on § 7 point out that the stated limits for physical working capacity should also be fulfilled after many years of service. Taking into account the successive decrease in working capacity with increasing age, it would therefore be suitable to place greater demands on physical working capacity at the beginning of an individual's working life. The test of physical working capacity takes the form of a threshold test; in other words, the individual must achieve the stated level, but the maximum physical working capacity need not be determined. Two types of test are allowed; the cycle ergometer test, and the treadmill test. The cycle ergometer test has been criticised because it does not reflect real-life working situations. For example, it is, relatively speaking, technically easier for a heavy person to undergo the test. Each individual fire and rescue service has the right to place its own demands on physical working capacity, as long as these demands are at least as great as those stated in AFS 1995:1. Each municipal fire and rescue service or fire service association is also free to choose which of the two permitted test methods should be used.

Cardiac health, i.e. the absence of any tendency towards exertion-related cardiac disease, must be tested by means of an exercise ECG test. However, the regulations do not state if this should be done at maximum working capacity, or if a sub-maximum test is sufficient. The individual doctor responsible for the test decides which type of test should be carried out.

The two other basic health requirements of the employee stated in AFS 1995:1 are also left to the judgement of the individual doctor. However, the comments to the regulations state that the aim of the medical examination is to prevent individuals who, due to weakness or disease, risk ill-health or accidents in connection with the use of BA in fire fighting or at the scene of Haz Mat emergencies, from participating in such tasks.

Inventory of problems

The project began after the SRSA received indications that there is a variation in how different doctors have interpreted the regulations AFS 1995:1, and in the assessment of occupational fitness. This results in varying assessments of individual employees' suitability for employment for work with BA in fire fighting and at the scene of Haz Mat emergencies.

The project group judged that further analysis was necessary in the following areas:

- 1. Clarification of the concept "fully fit".**
- 2. Investigative procedure and assessment of occupational fitness in the case of diagnosed medical conditions.**
- 3. Documentation of the assessment of occupational fitness.**

Working methods

The work has been conducted in the form of a literature study, presentations and working meetings. The reference groups and specialist groups within the Swedish Society of Medicine have been given the opportunity of commenting on the project group's proposals (see Appendix 1).

As a result of its work, the project group has concluded that the following situation applies to firefighters using BA in fire fighting and at the scene of Haz Mat emergencies.

General

The work of a firefighter is physically demanding and in situations where BA is being used, it is often performed under great mental pressure and in extreme conditions.

The firefighter, equipped with special protective clothing and apparatus, must often lift and carry heavy equipment both on level ground and up stairs or ladders. Moving equipment vertically increases the physical strain substantially, and the necessary protective clothing makes it considerably more difficult to regulate body temperature. In certain situations the firefighter must make repeated achievements into the fire wearing his protective equipment, without any opportunity to recover (restore fluid balance and body temperature) in between. All of this means a very great strain on both the muscles and the circulatory organs.

The mental strain is caused by the fact that the work is carried out in extreme circumstances, often involves great risks and is aimed at saving human life in a constant battle against time.

Literature studies

The project participants have searched for literature in international databases, and available information from the SRSA has also been provided. A summary of the literature study (Appendix 2) has been written by Dr. Hans Grönkvist of the Naval Medicine; Naval Warfare Centre (MTC). The summary includes an account of the studied literature including the studies referred to below. A reference list is presented in Appendix 3.

The literature search failed to discover any studies describing the demands on physical working capacity in a real-life fire situation using BA.

Studies from both Sweden and Norway were found which analyse the physical working capacity required when working with BA in controlled situations, for example in container systems (11, 15). In these studies, the participants have probably been working at their maximum physical level. Some more recent studies (13) have mapped the working capacity requirements in various test models. The results have shown that certain tasks involved in fire fighting with BA demand greater physical working capacity than that required by the ASS regulations. Various studies have also shown a considerable rise in body temperature (11, 13, 15, 16) and obvious problems with simple intellectual tests after fire fighting using BA.

Articles and case studies regarding patients who have experienced an extreme rise in body temperature in various situations have also been studied (17, 18, 19). There are no case studies of this in connection with real-life fire fighting with BA. Heat tolerance can be increased by training up to a certain limit, and physically well trained individuals appear to have a greater tolerance of heat load. The mechanism behind the increase in body temperature in a firefighter using BA is great physical activity, hot surroundings and the lack of cooling effect through sweating (dense protective clothing). The case histories describe several cases of extreme rises in body temperature in connection with sporting events, with serious complications as a result. The complications have taken the form of muscle damage, disrupted kidney and liver functions and coagulation capacity of the blood.

The effects of age on working capacity and the risks and consequences of various diseases which begin with increased age, have been documented in a comprehensive literature study in England (9). Increased age involves a successive decrease in working capacity, probably due to a reduced oxygen uptake capacity. This may partly be compensated for by the fact that the older individual is more experienced and can therefore work more systematically and utilise his capacity more effectively.

Many diseases become more common with increasing age. Cardio-vascular diseases constitute the dominant category of diseases which make their debut during the individual's active working life, and firefighters are no exception. Certain studies suggest an increased incidence of heart disease among firefighters (9, 20) while others have been unable to confirm this (9). One Swedish study suggests that firefighter who have worked with breathing apparatus show a greater incidence of signs of myocarditis than a control group. The same researcher has also found evidence of an unexpectedly high incidence of fatal heart disease among firefighters in the region who have worked with BA (20).

The risk of contracting heart disease and dying in connection with physical and psychological strain is greatly affected by the physical working capacity (21, 22, 23, 24). A person in poor physical condition runs a considerably greater risk of contracting fatal heart disease in conjunction with extreme physical exertion than a well-trained person.

There is clear evidence to show that maximum physical exertion combined with simple infections such as respiratory tract infections involve an increased risk for myocarditis and its after-effects, and for sudden death (25, 26).

Presentation

The thesis work carried out by P. Foxdahl was presented at an introductory meeting. Foxdahl has studied various test methods for determining physical working capacity and has, among other things, shown deficiencies in the physical working capacity of fire and rescue service personnel, particularly within the part-time brigades.

Working meetings

A representative from ASS has been present as an observer at the working meetings. At these meetings, the background to the ASS regulations AFS 1995:1 has been discussed. Various interpretations of the concept "fully fit" as used in these regulations have also been discussed. One interpretation of "fully fit" excludes individuals dependent on continuous medication for conditions which could increase the risk of illness or accidents in conjunction with the use of BA in fire fighting or at the scene of Haz Mat emergencies. Another interpretation is that the individual lacks any signs of illness and feels fit and healthy.

For obvious reasons, the examination of prospective users of BA concentrates on medical conditions which could suddenly deteriorate in conjunction with extreme physical strain, and conditions which limit the physical working capacity.

THE PROJECT GROUP'S RECOMMENDATIONS

The following recommended interpretation of the concept “fully fit”, recommendations regarding occupational fitness assessment in relation to certain medical conditions and the recommended standardised form for such assessment have been produced by the project group in consultation with the reference groups. *It should, however, be noted that the ASS regulations AFS 1995:1 constitute the underlying and legally binding document regarding the assessment of occupational fitness for the use of breathing apparatus in fire fighting or at the scene of hazardous chemical emergencies.*

1. Interpretation of the concept “fully fit”

A condition lacking both subjective and objective signs of illness or other abnormalities **which are relevant to occupational fitness for the use of breathing apparatus in fire fighting or at the scene of hazardous material emergencies.**

Comments

The above interpretation means that medical conditions or abnormalities, if any, must be seen in relation to the demands placed upon the individual when using breathing apparatus in fire fighting or at the scene of hazardous chemical emergencies.

2. The investigation process and the assessment of occupational fitness in the case of an established medical condition

The following table shows recommendations regarding the effect of certain medical conditions on occupational fitness. An assessment by a specialist is also recommended in certain cases as part of the investigation process. This has been done in order to optimise the assessment and treatment, if any, before a decision is made about occupational fitness. **The final overall assessment of occupational fitness is made by the doctor responsible.**

A. Chronic medical conditions

<u>Disease</u>	<u>Subgroup</u>	<u>Occupational fitness</u>	<u>Comments</u>
Diabetes mellitus	Diet controlled	No impediment to use BA	Possibly check-ups more often. Signs of organ damage (e.g. eye fundus change, hypertension, kidney disease, pathological ECG) entail a ban on fire fighting with BA.
	Tablet controlled	Impediment to use BA or individual assessment depending upon the effects of the medicine in question	A ban is recommended if the patient is being treated with drugs which involve a risk of hypoglycaemia. If the patient has another stable, oral treatment for diabetes, an individual assessment should be made. Signs of organ damage (e.g. eye fundus change, hypertension, kidney disease, pathological ECG) entail a ban on fire fighting with breathing apparatus.
	Insulin treated	Impediment to fire fight using BA.	

Disease	Subgroup	Occupational fitness	Comments
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Lung disease

	Asthma under treatment	Impediment to fire fight using BA.	
	Hyperreact. 0 treatment	Individual assessment	Should be tested (Methacholine/Histamine) Examination and assessment by internal medicine/lung/allergy specialist.
	Chronic obstructive lung disease	Impediment to fire fight using BA.	Examination and assessment by internal medicine/lung specialist.

Cardiovascular disease

	Arrhythmia Stimulation and conduction anomalies	Individual assessment	This refers to abnormalities in the resting ECG or the exercise ECG. Possible examination by internal medicine or cardiology specialist. The examination should cover the heart function and the perfusion of the myocardium.
	Myocardial infarction	Impediment to fire fight using BA	
	Angina pectoris	Impediment to fire fight using BA	

Disease	Subgroup	Occupational fitness	Comments
Suspected angina pectoris		Individual assessment	Examination and assessment by internal medicine/cardiology specialist. The examination should cover the heart function and the perfusion of the myocardium.
Coronary artery operation incl. balloon dilatation		Impediment to fire fight using BA	
Hypertension*		Individual assessment	Examination and assessment by an internal medicine /cardiology specialist. Secondary complications such as signs of effects on the cardiac muscle or other signs of abnormal heart function entail a ban on fire fighting with BA.
Pacemaker		Impediment to fire fight using BA.	
Salicylate treatment (cardio-pulmonary disease)		Individual assessment	Occupational fitness assessment depends on the reason for the treatment. Examination and assessment by an internal medicine /cardiology specialist.
Cardiomyopathy		Impediment to fire fight using BA.	

Disease	Subgroup	Occupational fitness	Comments
	Heart operation for organic heart defect	Individual assessment	Examination and assessment by an internal medicine/cardiology specialist.
	Other heart disease	Individual assessment	Examination and assessment by an internal medicine/cardiology specialist
	Anticoagulants	Impediment to fire fight using BA.	Blood-thinning therapy
Neurological disease**		Individual assessment	Specialist assessment
	Epilepsy	Individual assessment	Specialist assessment. Driving licence requirements are a guiding principle.
Orthopaedic disease**		Individual assessment	Possibly specialist assessment.
Psychiatric disease**		Individual assessment	Possibly specialist assessment.
Hearing/Balance**		Individual assessment	Possibly specialist assessment. Fire fighting with breathing apparatus should be avoided in the case of unilateral deafness Complete deafness entails impediment to fire fight using BA. Balance abnormalities should be observed. Driving licence requirements are a guiding principle***.

<u>Disease</u>	<u>Subgroup</u>	<u>Occupational fitness</u>	<u>Comments</u>
Eyesight		Individual assessment	Driving licence requirements are a guiding principle. Contact lenses should be avoided due to the risk of dislocation.
Immunosuppression		Impediment to fire fight using BA.	Reduction in immunity to infection.

* Beta-blockers should be avoided due to reduced peripheral circulation and inability to adapt circulation to current strain.

** Neurological, orthopaedic and psychiatric diseases must not be of the type or extent which entail an obstacle to the individual's ability to work, or entail a risk that the patient's condition could suddenly deteriorate, negatively influencing occupational fitness.

*** "Professionalism for professional traffic", regulations published by the National Road Administration (Vägverkets författningssamling VVFS 1996:2). Requirements for a C-class driving licence, or requirements for driving an emergency vehicle should be guiding principles.

B. Acute illness and accidents

Employees affected by illness or accidents which reduce occupational fitness must, according to the regulations AFS 1995:1, § 5, be examined by a doctor before returning to duties involving the use of breathing apparatus in fire fighting or at the scene of hazardous chemical emergencies.

Acute infections are particularly emphasised because they are very common and are therefore often regarded as irrelevant. In recent years the risk of myocarditis in connection with, for example, respiratory infections has been observed.

<u>Disease</u>	<u>Subgroup</u>	<u>Occupational fitness</u>	<u>Comments</u>
Acute infections		Individual assessment	Great physical strain should be avoided during active infection and during the recovery phase. Transfer to alternative posts should be used freely. Assessment by doctor in uncertain cases.
	Myocarditis	Temporary impediment to fire fight using BA	The patient must wait for three months after recovery from myocarditis before resuming duties involving fire fighting with breathing apparatus. New occupational fitness assessment should be made after examination by an internal medicine /cardiology specialist, and possibly a heart function analysis.
Accidents		Individual assessment	Occupational fitness assessment depends upon the nature of the injury and rehabilitation process.

Comments

Assessment of the above conditions has taken into consideration that they all involve a risk of acute deterioration during physical strain in extreme conditions. They can therefore, in pronounced cases, be expected to affect occupational fitness. The importance of taking these conditions into account is due to the fact that acute deterioration may involve the need for emergency assistance. This entails immediate consequences for the outcome of an initiated fire fighting operation using breathing apparatus, and involves risks for other firefighters.

Individual assessment is recommended for certain medical conditions because these conditions cannot generally be said to constitute an obstacle to working with breathing apparatus. In such cases, an individual assessment should be made. Examination by a specialist is recommended for certain conditions, because the assessment of these may require an expert opinion about the diagnosis, the seriousness of the disease, etc.

3. Documentation of occupational fitness assessment

Background

The aim of the recommendation of a standardised form for documentation is to ensure that all the relevant questions are raised during the medical examination and the occupational fitness assessment. In addition, it is recommended that the exercise ECG and the test of physical working capacity are conducted separately, especially as the latter is tested using a treadmill.

The exercise ECG should be conducted as a maximum test, i.e. the individual ends the test due to fatigue, maximum pulse or other limiting symptoms. If the limiting symptoms consist of arrhythmia tendencies, dyspnoea, signs of obstruction or other symptoms, the individual should be remitted to a specialist for examination and assessment before a final decision is made about occupational fitness.

The test of physical working capacity should be performed either as a threshold test or as a maximum test. In the latter case, a doctor and cardiopulmonary resuscitation equipment should be present in accordance with ASS circular 622.1 T 2080/86 regarding the performance of tests in connection with the medical examination of firefighters using BA. The testing of physical working capacity by way of a threshold test may be delegated to a qualified test leader under the responsibility of a doctor.

With regard to the fact that physical working capacity diminishes with age, it is reasonable to demand a greater physical working capacity, equal to that stated in the comments on § 7 of AFS 1995:1, of individuals less than 35 years old.

The following pages contain an assessment form and a standardised documentation form to be used in occupational fitness assessment and medical examination according to AFS 1995:1.

The occupational fitness assessment summary and standardised documentation of the medical examination with regard to assessment of occupational fitness for the use of BA in fire fighting and at the scene of hazardous Haz Mat are also presented separately in Appendix 4.

Occupational fitness assessment summary:

Date	National identity number	Employee no.
Name	Phone no.: (home)	Phone no.: (work)
Address	Postal code	City
Place of work	Profession/Title	Group
Years of service	Full time	Part time

According to § 6 of the Swedish National Board of Occupational Safety and Health's regulations regarding the use of BA in fire fighting and at the scene of Haz Mat emergencies (AFS 1995:1), the above mentioned individual is assessed to be fit for such work

YES Date for next scheduled examination according to
 NO AFS 1995:1:

Comments (For the employer's information. Please observe the relevant laws regarding confidentiality):

.....

.....

.....

.....

.....

.....

Place:.....date:.....

.....
 Examining doctor (Signature and clarification of Signature)

Copy to the fire and rescue service. Date:..... Signature:.....

Standardised documentation of medical examination regarding assessment of occupational fitness for the use of BA in fire fighting and at the scene of Haz Mat emergencies

Medical history

Have you sought medical attention or other forms of treatment (e.g. physiotherapist or chiropractor) due to illness or the equivalent according to the following list **during the past year?**

- | Yes, for: | No <input type="checkbox"/> |
|--|-----------------------------|
| Result of accident or incident at work | <input type="radio"/> |
| Other injury/accident | <input type="radio"/> |
| Hospital treatment | <input type="radio"/> |
| Neck or shoulder problems | <input type="radio"/> |
| Chest or lumbar problems | <input type="radio"/> |
| Hip or knee problems | <input type="radio"/> |
| Other skeletal, muscle or joint problems | <input type="radio"/> |
| High blood pressure | <input type="radio"/> |
| Low blood pressure | <input type="radio"/> |
| Fainting | <input type="radio"/> |
| Cardiovascular disease | <input type="radio"/> |
| Lung disease/asthma | <input type="radio"/> |
| Other respiratory tract problems/diseases,(e.g. coughing, increased mucous production) | <input type="radio"/> |
| Headaches | <input type="radio"/> |
| Other neurological diseases (paralysis, epilepsy, chronic pain) | <input type="radio"/> |

- | | |
|--|-----------------------|
| Hearing loss or other problems with hearing/balance | <input type="radio"/> |
| Impaired vision or other vision problems | <input type="radio"/> |
| Vertigo | <input type="radio"/> |
| Nerve/psychological problems (especially claustrophobia) | <input type="radio"/> |
| Head injury/unconsciousness | <input type="radio"/> |
| Discomfort when diving or flying | <input type="radio"/> |
| Eczema/dermatological problems | <input type="radio"/> |
| Allergy | <input type="radio"/> |
| Stomach or intestinal disease | <input type="radio"/> |
| Liver or gall bladder disease | <input type="radio"/> |
| Kidney or urinary tract disease | <input type="radio"/> |
| Gynaecological problems | <input type="radio"/> |
| Diabetes/goitre/hormonal disease | <input type="radio"/> |
| Sought medical attention for reasons other than those stated above | <input type="radio"/> |

Other questions:**Yes****No**Do you use spectacles or contact lenses? Do you smoke? Have you tried drugs? Do you drink alcohol? Have you been absent from work
due to illness during the past year?

If yes, state:

No. of days (in total):.....

No. of occasions when
absent from work:.....Do you take any medicine regularly? If yes, state below which
medicines you take (name
and dose).Do you feel fully fit? **Present medication:**

Name of drug:

Strength:

Dose:

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I certify that I have answered the above questions truthfully.

Place:

Date:

.....
Signature/Signature clarification

Laboratory and physiological tests

Height:..... cm.

Weight:.....kg. BMI:.....

Urine test:	glucose	0	+	++	+++
	protein	0	+	++	+++
	erythrocytes	0	+	++	+++

Vision:	Visual acuity	left	right
	- without correction
	- with correction

		Yes	No
Hearing:	Audiogram:	no problem <input type="radio"/>	<input type="radio"/>
Exercise ECG		no problem <input type="radio"/>	<input type="radio"/>

Present state of health

Field of vision

Double vision Yes
 No

	No problem/Problem			No comment/ Comment	
Skin	<input type="radio"/>	<input type="radio"/>	Mouth and throat	<input type="radio"/>	<input type="radio"/>
Muscles	<input type="radio"/>	<input type="radio"/>	Thyroid gland	<input type="radio"/>	<input type="radio"/>
Locomotor system	<input type="radio"/>	<input type="radio"/>	Superficial lymph glands	<input type="radio"/>	<input type="radio"/>
			Thorax	<input type="radio"/>	<input type="radio"/>
Neurological state	<input type="radio"/>	<input type="radio"/>	Lungs	<input type="radio"/>	<input type="radio"/>
			Auscultation of the heart	<input type="radio"/>	<input type="radio"/>
Eyelids/ conjunctiva	<input type="radio"/>	<input type="radio"/>	Heart rate beats/minute		
			Cardiac rhythm	<input type="radio"/>	<input type="radio"/>
Ears/ eardrums	<input type="radio"/>	<input type="radio"/>	Blood pressure	/.....	mm Hg
Peripheral pulses	<input type="radio"/>	<input type="radio"/>	Abdomen	<input type="radio"/>	<input type="radio"/>
			Hernial orifices	<input type="radio"/>	<input type="radio"/>
Mental health	<input type="radio"/>	<input type="radio"/>	General state of health	<input type="radio"/>	<input type="radio"/>

Comments:

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Discussion

The aim of this report has been to create a joint platform for doctors who have to assess the occupational fitness of fire and rescue service personnel, and to promote an increased understanding within the fire and rescue service for the problems involved in such assessments. In addition, the individual firefighter will hopefully gain greater protection due to the fact that unnecessary risks in connection with illness will be avoided.

The report also deals with the degree of physical effort required when working with BA in fire fighting. It has been established that the physical strain imposed by certain tasks in test situations is greater than the requirements laid down in the regulations AFS 1995:1. This means that the lower limit for physical working capacity could probably be raised, and that greater demands may be placed when assessing occupational fitness in conjunction with various medical conditions. However, the task of the project group did not include the formulation of recommendations regarding demands on physical working capacity. In addition, there have been no investigations to show what demands operational work with BA places upon physical working capacity. This means that there is no material upon which to base an assessment of how well different test situations, such as those in container systems, actually reflect real-life operations with BA.

In addition to the shortage of studies regarding physical working capacity in real-life situations, there is also a lack of information about serious health effects and serious illness in conjunction with and after working with BA in fire-fighting situations. It is the unanimous opinion of the working group that these areas require further study.

The report is based on the regulations published by the ASS (AFS 1995:1). These regulations constitute the basic and legally binding laws, whereas this report includes recommended interpretations and assessments based on the ASS regulations. The list of medical conditions is not exhaustive, but the recommendations to be found there will probably be useful in the assessment of other conditions.

The interpretation of the concept "fully fit" in the report is based on what is relevant in connection with the use of BA in fire fighting and at the scene of Haz Mat emergencies. Therefore, health disorders or abnormalities which are assessed as having no effect on occupational fitness and do not involve an increased risk of illness or accidents should be accepted.

The standardised form for the occupational fitness assessment contained in the report should ensure that all the relevant matters are covered during the medical examination. It is important to observe the relevant laws about confidentiality when the overall assessment of occupational fitness is sent to the employer.

The contents of the report have been approved by the various reference groups and by the relevant specialist groups within the Swedish Society of Medicine. The final report was presented at a meeting of the reference groups in October 1997, and was subsequently presented at a seminar at the SRSA college at Rosersberg on the 10th of February 1998.

APPENDIX 1

Project organisation

A project group was appointed, and in order to attain widespread support within the profession, a relatively large reference group was also appointed. For practical reasons, the reference group was divided in to two sections.

Project group:

Swedish Rescue Services Agency (SRSA), project leader	Monica Andersson
”	Tom Thörn
”	Håkan Kruse
” , medical consultant	Jonas Holst
Naval Warfare Centre, specialist in naval medicine	Hans Grönkvist

Bengt O Persson from the National Board of Occupational Safety and Health has been an advisor to the project group.

Reference group 1:

The Swedish Corporate Doctors' Association	Gunnar Andersson
The Institute for Working Life, Solna	Désirée Gavhed
Göteborgshälsan	Lena Ehrenström
The Association of District Medical Officers	Carl-Erik Thors
The Rescue Services' sports and test leader	Jan Hansson
The SRSA's medical consultant group	Helge Brändström
”	Agneta Larsson
”	Karin Sedig
”	Bertil Månsson
”	Bo Söderström

Reference group 2:

Firefighter 2000, Södertörn Fire Service Association	Henri Leray
Fire fighting at sea, Öckerö	Erling Eriksson
Physiological demands of fire fighting using breathing apparatus, SRSA	Dan Carlsson
Stockholm Fire and Rescue Service	Håkan Ragell
Gothenburg and Mölndal Fire and Rescue Service	Lars Adrian
Ekerö Fire and Rescue Service	Christer Gunnarsson
Malmö Fire and Rescue Service	Erling Johansson
SRSA's sport and health teachers	Susanne Jidesten
”	Calle Moberg
”	Lars Norén
”	Robert Badics

The Swedish National Board of Health and Welfare and the Swedish Association of Local Authorities have received continuous information and have been given the opportunity to express opinions about the project.

Other bodies to which the report has been referred for consideration

The SRSA has received statements about the report from the following bodies:

The Swedish National Board of Health and Welfare,
The Swedish National Defence Health Centre,
The cardiology clinic at Malmö General Hospital,
The Swedish Lung Medicine Association
The Swedish Clinical Physiology Association,
The Swedish Internal Medicine Association,
The Swedish Diabetology Association,
The Swedish Corporate Doctors' Association,
Göteborgshälsan,
The Association of District Medical Officers,
The Institute for Working Life,
The Swedish Association of Local Authorities,
The SRSA's sport and test leaders.

Literature study; physical requirements for the use of breathing apparatus (BA) in fire fighting and at the scene of hazardous materials (Haz Mat) emergencies

The basic physical and medical requirements for working with BA in fire fighting and at the scene of Haz Mat emergencies are regulated in AFS 1995:1. Due to the fact that the doctors responsible for examination have varying knowledge of the demands involved in the use of BA, there is a need for a recommended interpretation of AFS 1995:1.

There are two main questions to be dealt with:

1. What is meant by the concept "fully fit"?
2. The requirement for physical working capacity can be regarded as rather low (200 W for 6 min). Is there a case for recommending that this requirement should be raised?

The following literature study has been carried out in order to provide a background for a discussion regarding the requirements for physical capacity and cardiopulmonary health for the use of BA in fire fighting and at the scene of Haz Mat emergencies.

Background

The fire fighting profession can be assumed to be very demanding, partly because the work is physically tough and must be carried out in a race against time, and partly because it involves considerable mental strain. If, on top of this, the firefighter has to work in protective clothing which causes a reduction in the body's own heat regulation by preventing the evaporation of sweat, and use BA which increases the work of breathing and limits maximum ventilation, there is reason to assume that the work is extremely demanding. The use of such equipment can reduce the physical working capacity by 20% (9).

Several studies have shown that a firefighter reaches maximum pulse when fighting fires, even without the added strain of using BA (7, 9, 11, 13). These studies also show that the body temperature during fire fighting with BA is high, > 40° C, although the central body temperature has, in general, not been measured continuously.

Heat stress

General heat reactions are most commonly divided into heat cramp, heat exhaustion and heat-stroke (1).

Heat cramp is characterised by painful tonic contractions in the skeletal musculature as a result of a disturbance of fluid balance and electrolytes after excessive sweating. The condition is treated with rest and restoration of fluids and electrolytes. No sequelae.

Heat exhaustion is believed to be due to the fact that cardiac output is insufficient to meet the demand for thermoregulatory blood flow to the skin which increases with the rise in temperature. Two subgroups are mentioned.

1. Heat exhaustion due to fluid deficiency. This form is generally acute, and can be expected to affect firefighters, also as a preliminary stage of heat-stroke.
2. Heat exhaustion due to electrolyte imbalance. This condition often appears successively after a long period of work in a hot environment. This cannot be regarded as a problem for fire-fighting personnel in Sweden.

Heat-stroke is the most serious form of heat reaction, and also the most relevant for fire-fighting personnel. It is characterised by the elimination of the temperature regulation system, with tissue damage as a result. Mental and neurological functions are disturbed and cardiovascular collapse can follow, with unconsciousness, fatality or permanent injury as a result. Here, there are also two subgroups:

1. Individuals who have a damaged heat regulation capacity due to illness or treatment with medicine are affected by one of the forms.
2. Heat-stroke as a result of exhaustion is the form relevant to fire-fighting personnel. This is probably initiated by heat exhaustion due to liquid deficiency. Physical work creates body heat which the body has difficulty in getting rid of, for example due to a high surrounding temperature and/or protective clothing. The human body also absorbs heat energy from hot surroundings. This results in too high a body temperature, and fluid deficiency due to sweating. There is a risk of this condition at central body temperatures greater than 41°C (1).

The following sequelae are common for this type of heat-stroke:

- a. Rhabdomyolysis: A breakdown of the skeletal musculature which can be irreversible. The breakdown can also continue even when the body temperature is lowered. Breakdown products from the muscles can cause kidney damage which may be permanent.
- b. Disseminated intravascular coagulation. The blood coagulates in, among other places, the vascular system of the lungs. Can be fatal. Requires intensive care, often in a respirator.
- c. Acute kidney failure as a result of, among other things, rhabdomyolysis.

Cardiovascular disease

The documented high level of psychological and physical exertion during fire fighting (7, 9, 11, 13, 14), in combination with the fact that the blood volume is often reduced as a result of fluid deficiency, constitutes an increased risk of acute cardiac infarction during or immediately after a fire-fighting operation.

The results of injuries

Documentation regarding the results of injuries sustained while fire fighting with BA is limited. In the RBK project in Umeå, 1996 (10), 395 occupational injuries to firefighters are recorded. Three of these are noted as being directly related to the use of BA; two cases of trauma and one of burns. There is no documentation regarding illness, e.g. heart attack or arrhythmia, after a fire-fighting operation.

However, documentation from several sources suggests that firefighters have a higher general incidence of heart disease and premature death than individuals in other professions involving comparable risks (3, 4, 5). At the same time, we know that individuals with a high physical working capacity have a lower incidence of cardiovascular-related disease and death (6). There are also studies where an increased mortality rate among firefighters due to cardiovascular or respiratory disease cannot be shown (12).

Physiological requirements

Theoretically there are convincing arguments for the fact that the use of BA in hot environments involves great risks. These risks can probably be minimised with a good physical working capacity (9, 13). The present requirement regarding physical working capacity for Swedish firefighters is 200W for 6 minutes on a cycle ergometer or a treadmill (AFS: 1995:1). AFS:1986:6 contained the same requirement for VO₂. This is stated as the equivalent of a *statistical average* of VO₂ of approximately 40 ml/min x kg or 1,146 W (13).

Gledhill & Jamnik 1992 (2) have produced a suggested health standard for firefighters. Here, the defined requirements are based on the fire-fighting profession in general, without taking special account of the use of BA. Maximum VO₂ is chosen as a measurement of physical working capacity. The measurement should be made using a cycle ergometer or a treadmill. The latter is preferred because walking on a treadmill involves larger muscle groups and also requires the support of the body mass. This recommendation is now common, for example in AFS 1995:1.

The most demanding elements of fire-fighting work require a maximum VO₂ of 41.5 ml/min x kg (7). No further comments are made about the fact that it is probably easier for a heavy person to carry equipment, because it is of more or less the same weight regardless of the size of the carrier. In other words, the relative weight compared to the weight of the carrier is less. Neither are any comments made about the fact that the heavy individual, at least at high VO₂ levels, probably has greater difficulty in reaching a certain relative maximum VO₂ because firefighters, at high levels, are approaching the limit for maximum oxygen uptake capacity (l/min).

In order to work for longer than 10 minutes, the firefighter cannot utilise more than 85% of his maximum VO₂ (8). The oxygen uptake capacity demand will then be 49 ml/min x kg. If it is taken into account that the demands are only this high during a very short period of the whole operation, and the value is correlated to what seems to be reasonable in relation to the available population, a requirement of a VO₂ maximum of 45 ml/min x kg is recommended on application (2).

In 1996, Haisman presented a study discussing the retirement age for firefighters, and physical requirements in relation to age. The requirement of a VO₂ maximum of 45 ml/min x kg at application is supported here. However, the report notes that this requirement may be difficult for women to achieve.

In a study which excluded particularly well-trained men, it was shown that the VO₂ maximum for men decreases by 0.4 ml/min x kg/year. The corresponding decrease for women is stated as 0.3 ml/min x kg/year.

The capacity to cope with extreme heat stress in combination with heavy physical work is also stated to decrease with age. However, a well-trained person generally has greater tolerance.

Danielsson and Berg (13) who studied, among other things, oxygen consumption during fire fighting using breathing apparatus, and also evaluated to what extent work carried out during such operations could be regarded as satisfactorily completed, discovered that the capacity to carry out such work with a satisfactory result was correlated to the physical capacity measured on the treadmill. The report also shows that full-time firefighters close to the borderline of the requirements for physical working capacity stated in AFS 1995:1, carried out fire-fighting operations using BA with a satisfactory result in 58% of the cases. However, several older firefighters who met the requirements did not take part in the test, and therefore the real figure is somewhat lower.

The report also shows that the energy available for coping with work is not in itself affected by the temperature when fire fighting using BA.

The authors of the study conclude that in order to carry out fire fighting with BA in hot conditions as described in the report (13), and in order to reduce the risk of heat exhaustion, the requirement for physical working capacity should be 10-15% higher than that stated in AFS 1995:1.

Another interesting finding in the report (13) is that it is unclear whether age is an advantage or a disadvantage for working with BA in hot conditions. The average firefighter of between 50 and 60 years of age lies close to the accepted limit for physical working capacity, but has, on the other hand, a great deal of experience, which could be an important advantage. However, many older firefighters have voluntarily chosen not to work with BA.

An average rise in temperature of the eardrum of 2.5°C is noted for one group after an operation. Unfortunately, the maximum value and distribution are not presented.

The study (13) primarily deals with physical performance during fire fighting using BA and it is consequently difficult to draw any conclusions about cardiopulmonary and, to a certain extent, thermal risks of ill-health.

Summary

In theory, fire fighting using breathing apparatus in hot conditions involves great strain, including cardiopulmonary strain and in the form of heat stress. These pressures do not manifest themselves in the form of occupational injuries according to the available, probably incomplete, statistics.

The literature in the reference list deals to a large extent with conditions in other countries. Apparently, fire-fighting techniques abroad are somewhat different to those techniques used in Sweden, where we use BA to a greater extent for fire fighting and not just for saving lives. Requirements for physical working capacity vary between VO_2 42 and 49 ml/min x kg. The most common requirement seems to be 45 ml/min x kg.

In Sweden we have traditionally very high standards of occupational safety. It would appear that international requirements for physical working capacity for firefighters are greater than those in Sweden, at the same time as we possibly use BA to a greater extent than other countries. It can therefore be argued that Sweden should at least not have lower requirements for physical working capacity than other countries.

It is questionable whether the requirements for physical working capacity should be reduced with increasing age. The work burden remains the same, although an older firefighter may work more effectively due to his long experience. It is possible that he may be more relaxed about the operation. On the other hand, the risk of a heart attack increases with age. Our knowledge about this area is insufficient to allow us to draw any well-founded conclusions.

In Sweden, we would appear to have more specific demands for physical training during working hours for firefighters than in other countries. There is no doubt that the risk of heat- or exertion-induced illness decreases with increased physical working capacity. Consequently, part-time firefighters with limited access to physical training during working hours could be a risk group, which is also shown in Danielsson and Berg's report.

Conclusion

With regard to the above and my own (Hans Grönkvist's) experience of medical examinations of divers of different categories and ages, my opinion is that a requirement of a maximum VO_2 of $45 \text{ ml/min} \times \text{kg}$ is reasonable, and should be recommended as a requirement for the use of BA in fire fighting, regardless of age. Whether or not this requirement will be difficult for female firefighter trainees to achieve is somewhat unclear, but the demands for physical performance during an operation remain the same, regardless of the firefighter's gender.

Danielsson and Berg (13) suggest 200 W for 8 minutes on a cycle ergometer or a treadmill. This is a practical suggestion, because it avoids conversion and measures performance directly. In addition, the concept of VO_2 , which is an artificial value, is avoided.

It is important that a ramp-type exercise ECG with maximum strain, preceded by a medical assessment, is carried out at the intervals recommended in AFS 1995:1.

It is, naturally, important to emphasise that when placing physiological and medical demands on personnel, the demands must be in reasonable proportion to the capacity available within the given population. If the requirements cannot be fulfilled, the working methods must be adapted to suit the human capacity available.

It is also very important to have routines to ensure that personnel do not begin a fire-fighting operation with a liquid deficit.

It should also be pointed out that a firefighter who serves as a diver should not participate in fire fighting using BA if there is a possibility that he may have excess nitrogen remaining in his body after a diving operation. There would then be an increased risk of decompression sickness.

Hans Grönkvist, Registered Physician, Naval Warfare Centre.

APPENDIX 3

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APPENDIX 4

Occupational fitness assessment summary:

Date	National identity number	Employee no.
Name	Phone no.: (home)	Phone no.: (work)
Address	Postal code	City
Place of work	Profession/Title	Group
Years of service	Full time	Part time

According to § 6 of the National Board of Occupational Safety and Health's regulations regarding the use of BA in fire fighting and at the scene of Haz Mat emergencies (AFS 1995:1), the above mentioned individual is assessed to be fit for such work

YES Date for next scheduled examination according to
 NO AFS 1995:1

Comments (For the employer's information. Please observe the relevant laws regarding confidentiality):

.....

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Place:.....date:.....

.....
 Examining doctor (Signature and clarification of Signature)

Copy to the fire and rescue service. Date:..... Signature:.....

Standardised documentation of medical examination regarding assessment of occupational fitness for the use of BA in fire fighting and at the scene of Haz Mat emergencies

Medical history

Have you sought medical attention or other forms of treatment (e.g. physiotherapist or chiropractor) due to illness or the equivalent according to the following list **during the past year?**

Yes, for:

No

- Result of accident or incident at work O
- Other injury/accident O
- Hospital treatment O
- Neck or shoulder problems O
- Chest or lumbar problems O
- Hip or knee problems O
- Other skeletal, muscle or joint problems O
- High blood pressure O
- Low blood pressure O
- Fainting O
- Cardio-vascular disease O
- Lung disease/asthma O
- Other respiratory tract problems/diseases,(e.g. coughing, increased mucous production) O
- Headaches O
- Other neurological diseases (paralysis, epilepsy, chronic pain) O

- | | |
|--|-----------------------|
| Hearing loss or other problems with hearing/balance | <input type="radio"/> |
| Impaired vision or other vision problems | <input type="radio"/> |
| Vertigo | <input type="radio"/> |
| Nerve/psychological problems (especially claustrophobia) | <input type="radio"/> |
| Head injury/unconsciousness | <input type="radio"/> |
| Discomfort when diving or flying | <input type="radio"/> |
| Eczema/dermatological problems | <input type="radio"/> |
| Allergy | <input type="radio"/> |
| Stomach or intestinal disease | <input type="radio"/> |
| Liver or gall bladder disease | <input type="radio"/> |
| Kidney or urinary tract disease | <input type="radio"/> |
| Gynaecological problems | <input type="radio"/> |
| Diabetes/goitre/hormonal disease | <input type="radio"/> |
| Sought medical attention for reasons other than those stated above | <input type="radio"/> |

Laboratory and physiological tests

Height:..... cm.

Weight:.....kg. BMI:.....

Urine test:	glucose	0	+	++	+++
	protein	0	+	++	+++
	erythrocytes	0	+	++	+++

Vision:	Visual acuity	left	right
	- without correction
	- with correction

			Yes	No
Hearing:	Audiogram:	no problem	<input type="radio"/>	<input type="radio"/>
Exercise ECG		no problem	<input type="radio"/>	<input type="radio"/>

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ISBN 91-7253-049-9