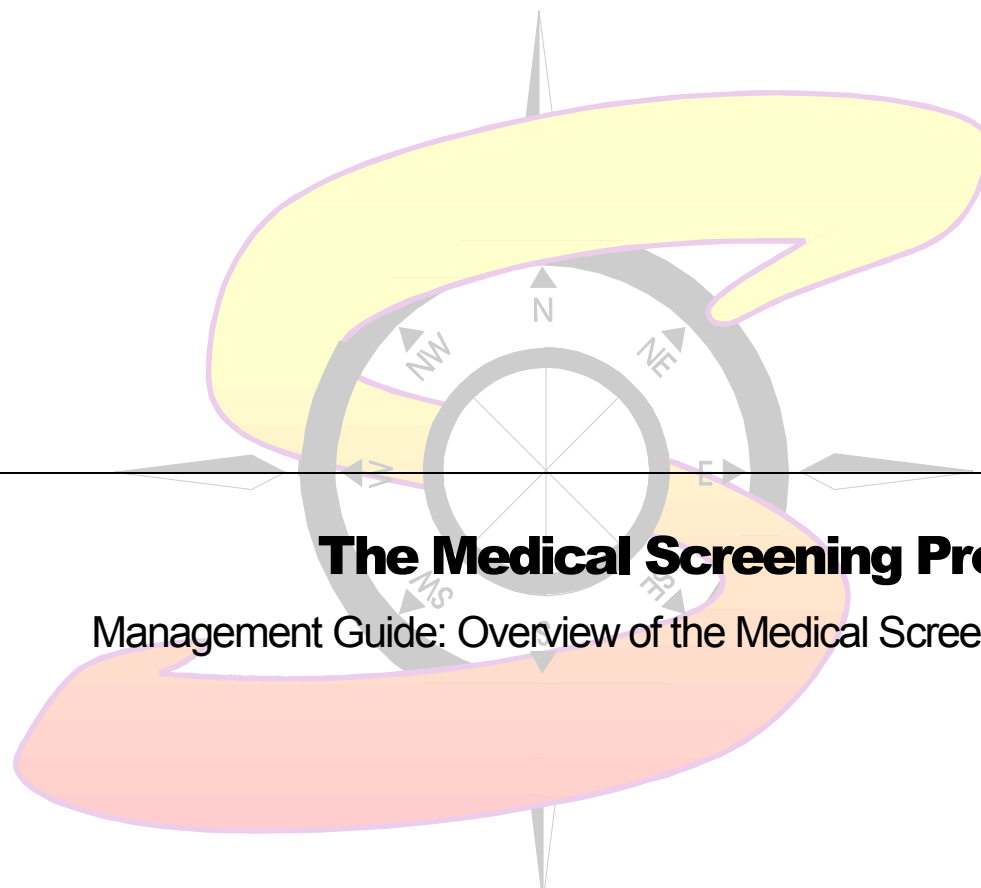
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The Medical Screening Programme

Management Guide: Overview of the Medical Screening Program



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1 INTRODUCTION

Medical screening is an important part of the Company's risk management program. It supports the Company's recruitment strategy by ensuring appropriate deployment, and by detecting occupational disease early. Some medical examinations are prescribed directly by law, whereas others are driven by good corporate risk management (see section on certification standards).

This document provides a guideline for the design & implementation of these medical surveillance programs.


2 PURPOSE

The purpose of a medical screening program is to minimise the likelihood of employee injury and illness.

3 OBJECTIVES

The objectives of medical surveillance programme are:

- To ensure that employees are fit for and suited to the work they are to do, and meet the inherent health requirements for their relevant occupations. This ensures that the health status of employees does not does not place their own health & safety, or that of any other employees, at increased risk ("fitness adjudication").
 - Employees found to be unsuitably employed are assisted in appropriate steps to either improve their medical status, such that they are able to return to their work, or are assisted in a genuine attempt to seek appropriate alternative occupations.
 - Employees with injuries and illnesses, that render them unable to return to their work, are assisted with rehabilitation and workplace re-integration. Where relevant, these employees may need to attempt suitable alternative placement. Where appropriate, assistance should be given to enable compensation of workers with occupational diseases and/or injury.
- To identify early adverse effects of exposure to hazards in their work or working environment thereby determining the efficacy of hazard control measures ("biological effect monitoring").
 - This early identification process allows interventions (medical or logistic) that have the best likelihood for excellent outcomes.
 - Through the analysis of the medical surveillance data, high-risk areas in need of environmental intervention can be identified.
 - This regular interaction with employees should ensure that they are adequately informed of the risks of their work (education) and the results of all medical examinations.
- To monitor actual exposure to certain hazards through the measurement of the hazards (or their metabolites) in the body fluids of exposed workers ("biological monitoring")

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- To establish reference points for the medical information on all employees, especially those exposed to health hazards; notably baseline data on entry, job transfer, and exit data when the leave against which work-related changes may be identified more readily and the employer's obligations are understood.
- To promote optimal health status of employees through identifying:
 - Treatable medical conditions that may render them temporarily unable to perform their work
 - Chronic illnesses that may have no bearing on their fitness to work, but which threaten their personal long-term health
 - By referring them for remediation.

4 DESIGN OF THE MEDICAL SURVEILLANCE PROGRAMME

This is a complex process but can be summarised as follows:

Step1: Determine which employee groups require medical surveillance.

The key determinants of who should be required to undergo medical surveillance are:


- Whether or not there are health risks that require monitoring for early adverse effects
- Whether or not there are minimum inherent requirements (medical standards of fitness) requiring medical testing to determine fitness to work.

Hence the first step in the design of the medical surveillance programme, is that the OREPs are consulted, and the data therein is transferred to the medical screening protocols ("Worker-Allocated Screening Protocols", or "WASP"s). This is done as follows:

- The Inherent Requirements standards of the OREPs are transferred to the Job Fitness page of the WASPs
- The Exposure Effect levels (values) are transferred to the corresponding places in the Effect Monitoring page in the WASPs.
- The data entered into these two pages of the WASPs are summarised on the Summary Page of the WASPs, for easy reference.

Step 2: Determine which tests are required: TEST SELECTION.

Using the reference tables in appendices, this step is made relatively painless. The tests comprise combinations of questionnaires, clinical examination and special investigations (x-rays, laboratory tests, audiograms, etc.). It is important that the selected tests carry validity. This is determined by their sensitivity and specificity, and the availability of reliable testing facilities (laboratories and testing

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equipment (including CXR's, audiograms, PFT's, etc.). For further information on Sensitivity and Specificity, page to [Appendix 6](#).

Step 3: Determine the required STANDARDS for medical adjudication.

The following standards are to be considered:

- **Job fitness standards:** The medical standards that must be met to “pass” the examination. These are determined by the inherent requirements of the job. Suggested standards are listed in Table .
- **Exposure standards:** The action criteria that must be triggered when exposure levels are exceeded or exposure effects are identified (“These are determined by the legally prescribed limits
- **Certification standards:** The minimum qualifications of the health professionals that are required to sign off the certificates of fitness. These are described in [Appendix 1](#).

The extensive reference tables in the WASP SOP assist the examining health team in this task. It is not possible to establish every permutation that would constitute a reason for excluding an employee in a single document. Instead, lists of relevant cautions are flagged in the reference tables, to assist the medical professionals in their adjudication. Usually it is a combination of factors that would result in the exclusion of an employee from a particular occupation.

Step 4: Determine the TEST FREQUENCY.


This is determined by:

- The degree of risk faced by the employees (the severity of the hazards, and the degrees of exposure to them)
- The individual vulnerability of employees (the presence of impairments that reduce organ function or reserve capacity)
- The outcomes of the medicals themselves (the identification of work-related abnormalities lend themselves to more frequent testing).
- The prescription in law (certain certificates are valid for prescribed periods only)

Hence, the higher the risk, the more frequent the tests; the more adverse the outcomes, the more frequent the tests, etc. Test frequencies usually vary from quarterly to every 5 years, but the most common is annual.

Step 5: The ethics of medical testing should be considered, with special regard to:

- Confidentiality.

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This is particularly sensitive when test outcomes are computerised, which increases the risk that these results may get into the wrong hands. However, even paper records go astray. It is a temptation to flag records by means of the use of markers on the outside of the medical folders – a practice that should be implemented with caution, as this may constitute a breach of confidentiality (when the “coded” flags are interpreted (correctly, or, worse, incorrectly) by the employees.

(ie: the diabetics could be flagged by means of a pink coloured sticker, the hypertensives by means of a blue one, etc. The employees may interpret a certain sticker as marking those with HIV (correctly or incorrectly), which could spark an industrial relations crisis.

- Communication of results.

This is regarded as an important part of the medical surveillance programme, as it not only provides employees with the results of their tests, as is their constitutional right, but also allays fears that the company is hiding information deliberately. The feedback may be verbal or written, but the written route is favoured. The Synergiee System provides re-written letters that ease the burden of communicating in writing to every employee.

- Education and Training


Whilst employee education is not a direct responsibility of the medical team, the annual medical provides an ideal opportunity to provide the employees with a further reminder of the issues which they need to be aware in their occupations, with particular reference to the effective use of their PPE, as well as safe work practices.

5 CORPORATE STANDARDS FOR THE PROGRAMME

- The company follows a “fit for purpose” policy, which may include the employment of disabled people. However the following health impairments may exclude applicants from employment:
 - A medical disorder that may constitute a danger to the employee or others, because of safety requirements (“Inherent requirements of the Job”).
 - A progressive disease or disability which may limit the ability to perform the job, for which the applicant is hired, for an unreasonable length of time (“Capacity to provide suitable work performance”);

Hence, where minimum medical standards are prescribed for occupations, passing the medical evaluation is a condition of employment.


- Medical examinations must be carried out by appointed occupational health workers who are properly trained and qualified in occupational health and who comply with the national laws and regulations, using medical equipment that is properly maintained and regularly calibrated according to accepted standards. Guidelines are available to assist their work (see policies and procedures for these programmes).
- These medical examinations should be conducted free of charge to the employees and as far as possible during working hours.

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- The content of the medical screening program should always be directed by the inherent requirements of the occupation, and the health risks to which the employee will potentially be exposed.
- The written protocols should provide clear definitions regarding the interpretation of abnormal results for tests (ie. standards of “normal/acceptable”).
- If an employee does not wish, for personal reasons, to undergo medical examination, he must confirm this in writing for personnel records. The question of dismissal or transfer must then be considered.
- Medical testing should be done with written (signed) informed employee consent.
- Employees must be informed of the results of their medical examinations, preferable in writing. The medical records of each employee must be treated confidentially and may not be communicated to third parties without the employee’s consent.
- Where the company has engaged the services of mandatories (“Contractors”), the company insists that these comply with similar standards as the company. Therefore, the mandatories shall provide acceptable medical certificates of fitness to perform work for all relevant occupations on site. By acceptable is meant that the same standards shall be applied as for the rest of the company’s program (**Job fitness standards, Exposure standards, Certification standards**). Failing this, the mandatories will be absorbed into the company’s own medical surveillance programme.
- The program should be subjected to external audit from time to time.
- The tests used in the medical screening program should be appropriate (Cochrane and Holland criteria)
 - Simple
 - Acceptable
 - Accurate
 - Cost-effective
 - Precise (repeatable)
 - Sensitive
 - Specific

5.1 Important general comments about the program

- A pre-placement medical examination has benefits to both the employer and the employee. From the employee’s point of view it means that he/she has a full medical examination and will be informed as to his/her current health status. Should there be any problems detected, these may be further investigated, after consultation with the employee, by the employee’s own doctor or the OHS, depending on which is appropriate.

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- A pre-placement examination also means that the employee's baseline health status is determined. If at a later stage it is shown that a health problem has developed (eg a hearing test shows a pattern of noise induced hearing loss) then the health problem may be more easily attributed to a workplace exposure.
- The baseline examination also protects the employer in that where a worker comes in with a pre-existing problem this will be documented, and cannot at a later stage be attributed to working at the present company. By having this examination by the employer is also assured that, from a medical point of view, the employee is capable of doing his/her assigned work (e.g. a driver passed as fit will not have serious vision abnormalities).
- Should biological monitoring demonstrate levels greater than the desired norm, or medical surveillance indicate that an employee is suffering from an occupational disease as a result of exposure at the workplace, the employee should be removed from that workplace on a temporary or permanent basis. The employee should be fully counselled as to the reasons for this.
- At the request of the employee, his medical records, including x-rays, may be made available for examination by the employee's personal physician, subject to strict measures being taken to prevent documents being mislaid.
- The evaluations include comprehensive medical history taking and clinical examination.
- Many tests, such as lung function tests, are most useful when they are done serially over a number of years rather than as single "one off" tests. This is because with serial testing the medical services are able to detect changes with time and easily pick up a deterioration from the baseline whether this is caused by an occupational exposure or by other disease processes.
- A medical Certificate of Fitness should always be issued at the end of the evaluation, by the authorised Medical Examiner (as per outcomes discussed in the section on [medical adjudication](#)).
- Should the applicant be found to be unfit for employment, it is the ethical responsibility of the Doctor to inform the applicant of the medical reason. In cases where the Doctor is unwilling to divulge the reason to the applicant, this should be communicated to the applicant's own Doctor.
- The outcomes of the medical evaluation should be recorded in full on the appropriate company medical forms.
- If additional investigations, other than those required for prescribed positions are requested, they must be authorised by the Regional Medical Advisor.

6 TYPES OF MEDICAL EXAMINATIONS

Medical Surveillance comprises the following types of Medical Examinations:

6.1 Compulsory Examinations

These may be required by law (see [appendix 1](#)) or by company policy (good risk management)

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They are driven by:

- Tasks (eg. drivers, construction workers, operators of lifting equipment, laboratory workers, etc.)
- Hazards (eg. hazardous chemical substances, lead, asbestos, hazardous biological substances, noise, etc.)


Examples include employees in the following prescribed positions.

- Drivers of hazardous self-propelled mobile equipment
 - Category 1 Drivers: **Heavy duty truck drivers**, and other personnel who are in possession of a heavy duty licence and who may be required to drive trucks from time to time, as well as those who are required to transport **passengers** (eg. Those who are required to be in possession of a “PrDP” in terms of the National Road Traffic Act).
 - Category 2 Drivers: Forklift drivers and other drivers of specialised equipment that does not usually entail entering the public roads (e.g. mobile plants, loaders, diggers, etc)
 - Category 3 Drivers: Light Motor Vehicles, delivery vans, etc. (e.g. company car-owned drivers)
- Workers potentially exposed in terms of the OHSA:
 - Hazardous Chemical substances, Hazardous biological Agents, asbestos, lead, noise, heat, cold.
- Workers potentially exposed in terms of the Hazardous Substances Act: radiation
- Workers potentially exposed in terms of the Mines Health & Safety Act, and the Occupational Diseases in Mines and Works Act:
- Workers required to wear a respirator

The contents, frequency and other requirements of these examinations shall be recorded in specific protocols.

6.2 The circumstances requiring medical testing:

- Ad hoc: pre-employment, pre-placement (transfer) or at termination of service
 - All new applicants for permanent and short-term positions and apprentice contractors are required before joining the Company to undergo a medical evaluation.
 - In general if the periodic evaluation is still valid (<6months), signing off is adequate. If not, appropriate tests to be performed as per periodic guideline.
- Regular: periodic (annual) medical examinations (eg: lead, noise exposure)
- Other medical examinations

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- Return to work (post injury or post illness)- eg. employees in any safety-sensitive position returning to work after more than 10 days continuous absence for whatever reason (e.g. category 1 drivers);
- When uncertainty exists as to an employee's fitness to return to or perform his/her duties;
- Short term hazard exposure e.g. (employees or contractors engaged in tank cleaning operations or where assisted respiration systems may be required to be worn).
- Incapacity assessment due to health impairment;
- Disability retirement / insurance
- Physical fitness, determination of
- Foreign Travel / Frequent travellers
- And many others – as per written medical protocols.

6.3 Voluntary Examinations

- The purpose of these examinations is to promote the attainment of optimum health through the periodic assessment of health status, and the identification and correction of any adverse medical or lifestyle factors.
- Directors and senior management should be required to undergo such examination on an annual basis.
- Other employees are to be encouraged to undergo examination on a voluntary basis, annually for employees over age 40 years, and every three years for those under 40 years.
- These examinations should be at the Company's expense, but the costs of subsequent treatment or investigations arising from such examinations should be borne by the employee.

6.4 Contractors and Visitors


The decision regarding what medicals are required, and their frequency intervals, is determined by the same factors as company employees, PLUS:

- The length of time that the employee will be performing the work.

Note the following regarding contractors & visitors:

- The inherent minimum medical requirements of the job

If the job has any minimum medical requirements in order to perform the job safely or effectively, then that employee should be in possession of a valid certificate of fitness in order to perform the work - even if the contractor is on site for quick job of a few hours! The certificate will only have to be renewed (ie. will need another medical) if the certificate has expired.

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This same logic should be applied to visitors. A medical will only be relevant if there are certain minimum medical standards required of the visitor on the mine. It would be unusual for this, but it is theoretically possible. Sometimes all that is needed is an informed "Declaration of Fitness", if the minimum medical standards can be addressed by a simple questionnaire. (ie. absence of certain diseases that may be of concern at the workplace to be visited).

- The hazards to which the employee may be exposed

Medical testing is only required if there will be exposure to hazards. Hence office workers do not need to be tested for noise or dust if there is no exposure to these.


Contractors should keep a record of these examinations, as part of their Certificate of Fitness. If these are up to date, then short term contractors (up to a month) should be allowed to proceed. Should the employment contract exceed a month, it is recommended that the following be conducted, as a minimum:

- For those exposed to noise, an "initial" audiogram, to provide a record of any pre-existing hearing loss.
- For those exposed to airborne irritants/chemicals, and an "initial" spirogram to record any pre-existing lung disease. Consider an "initial" chest radiograph if the hazard may cause a pneumoconiosis.

Visitors who are to be at hazard-exposed workplaces for less than a month should not be required to undergo testing, as this duration of exposure will not lead to an occupational disease, especially if they conform to required safe work practices (ie. wear hearing protection).

The important documents to consider for all contractors include the following:

- 1 A mandatory agreement between the company and the contractor.
This document allocates the responsibility for compliance with the Occupational Health and Safety Act and its regulations to the employer of the contractor company. (see sample contractor agreement)
- 2 A letter of good standing from the Compensation Commissioner.
This document assures the company that, in the event of an accident or occupational disease, employees of the contracting company will be covered by the Compensation Commissioner.
- 3 Evidence of a Risk Assessment.
This document should confirm that the contractor has conducted a risk assessment on the tasks to be performed, and has established mitigating steps to minimise these risks. This need not be in great detail – just enough to enable the work to be conducted safely.
- 4 Letter of training.
This document should confirm that the contractor company's employees have been given suitable and adequate induction training to assure that they are conversant with the hazards of the work

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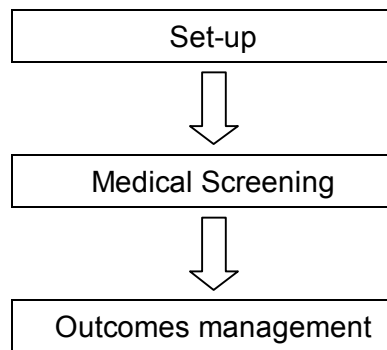
for which they are to be employed. This training should include knowledge on how to protect themselves from any such hazards.

- 5 Permits to Work as applicable.
Certain tasks are inherently hazardous and require a “permit to work”. This should be signed by an authorised manager at the company.
- 6 Medical Certificate of Fitness.
Should the work to be performed on our site be of such a nature that it could either pose a health risk to employees or requires minimum medical standards (inherent requirements), the contracting company should supply proof that their employees have been examined by a suitably qualified occupational medicine practitioner, and have been declared fit for their work. (see above)

It is important that these documents and/or procedures are in place to minimise the risk to the the company, of employing contractors (or other similar engagements). *Bear in mind that a contractor or visitor is not limited from (civil) legal action against the company, as the usual protection afforded by the COID Act does not apply.* This protection is only available for actions from employees of the company.

7 IMPLEMENTING A MEDICAL SURVEILLANCE PROGRAM

Every Medical Surveillance Programme, regardless of the hazards to which the programme is linked, has the following core of three parts, each part with its own specific series of steps.




These are illustrated graphically in flow charts in the following appendices:

[Appendix 1](#): Overall approach to Medical Surveillance.

[Appendix 2](#): The steps of medical screening (phase two, part two).

[Appendix 3](#): Dealing with the outcomes of screening: adverse exposure effects.

[Appendix 4](#): Dealing with the outcomes of screening: medical adjudication.

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7.1 Part One (“Program Set-up”): Objective – “Standard Setting”

The three key objectives here are to:


1. Establish the risks to which occupations are exposed
2. Determine the inherent requirements appropriate to all occupations
3. Design the matched medical screening programs for these occupation groups

Steps 1 & 2 are accomplished by the completion of the OREP (“Occupational Risk and Exposure Profiles”) forms. This is described in detail in the [Guidelines on OREP design](#). Once the OREPs have been established, step 3 is the design of the matched medical surveillance strategy (“Worker Allocated Surveillance Program”, or “WASP”).

The OREP is the key that determines the tests to be selected for a particular occupation (Job Category). It comprises a section that refers to the standards of fitness required of the occupation (“inherent requirements”) and a section that describes the hazard exposures associated with the occupation. These are placed as follows:

Figure 1: The OREP and Test Selection

This side of the OREP covers the standards and risks associated with the *Capability Requirements* of the Occupation.



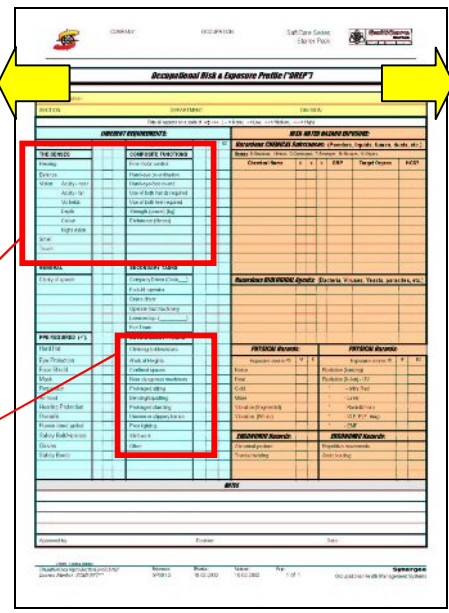
It therefore determines the fitness standards of the WASP for the particular occupation.

These are to be found in:


[Table 1](#) – list of tests & matched capability standards

[Table 2](#) – list of specific exclusions for the environment / tasks section of the OREP.

The OREP:



This side of the OREP covers the matters concerned with the *Hazardous Exposures* of the Occupation.



It therefore determines the effect monitoring requirements of the WASP for the particular occupation.


These are to be found in:

[Table 3](#) - by hazard

[Table 4](#) - by target organ


This side of the OREP also determines the factors that influence required fitness standards that allow the person to work in the presence of these hazards. ([Table 3](#)).

The most important and demanding exercise in the development of individual medical surveillance programmes is the selection of the appropriate tests. This demands an understanding of the pathophysiology of the effects of exposure, as well as knowledge of the application and limitations of the

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tests themselves. Certain tests are only of value as screens, and others only as diagnostic procedures, whilst some can be used as either. Some are best as part of a battery of tests.

Even the definition of a “test” is sometimes unclear. For the purposes of medical surveillance, a “test” is defined as any activity that is aimed at deriving information pertaining to employee fitness, or hazard effect. So, even an interview (or questionnaire) is a “test”. Hence “interview” is used in the following tables, to indicate the asking of questions, either by formal questionnaire, or informal discussion.

 **Point to Ponder:**

Medical tests are divided into:

- screening tests - tests that are quick, inexpensive, easy and have a high sensitivity
- diagnostic tests - these tests can be more complex and expensive, with a high specificity

These correspond with the Synergie Medical Surveillance strategy;

- Phase one (case identification, or screening) - best suited to screening tests
- Phase two (case confirmation, or diagnosis) - best suited to diagnostic tests


7.1.1 Notes on Tests for Fitness Adjudication:

Note that there are two kinds of “Fitness to Work”, which are determined by the requirements established in the OREP. These comprise:

- “Capability” Fitness (functional capabilities that are required in order to be able to perform the required tasks) (left side of the OREP)
- “Exposure” Fitness (degree of tolerance to hazard exposure) (right side of the OREP)

The key issues regarding “capability fitness” relate to:

- Inclusive requirements: the *presence of functional requirements* (such as vision, dexterity, cognitive functions, etc.), in order for the tasks to be conducted safely. Fitness evaluation in these circumstances is aimed at excluding people that do not meet the requirements as recorded in the OREPs. The relevant tests are determined by the requirements. These are listed in [Table 1](#).
- Exclusive requirements: the *absence of conditions* that may (note!) unexpectedly cause an important functional impairment whilst performing critical tasks (such as uncontrolled diabetes may result in hypoglycaemia, with consequent impaired thinking). This is sometimes an ethically difficult decision, as it is based on a prediction (the likelihood of the failure taking place), which may lack measurable “certainty”. Fitness evaluation in these circumstances is aimed at excluding

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people with these medical problems. The relevant tests are determined by the medical problems. These exclusions are listed in [Table 2](#).

Minimum standards for liability risk (“capability fitness”) are influenced by:

- The presence of a specific legal standard, such as for drivers. There are very few of these.
- The presence of national (industry) standards (SASOM).
- The presence of multiple risk factors.
- The consequence of a potential adverse event (accident), should it occur.


It is simply not possible to include all these permutations of capability fitness in a pre-constructed table of options – they must be applied in each circumstance by the responsible practitioner (nurse or doctor). *The objective of the WASP is to highlight the requirement and the “importance” rating, which alerts the user to the degree of consequence of compliance failure – the higher the degree of importance, the higher the standard required.*

The key issues regarding “exposure fitness” relate to:

- Functional reserve: the *presence of minimum “reserve”* organ function (ability beyond that which is required for normal circumstances), which can be called upon to enable safe work performance in the presence of a known hazard. A good example of work requiring good functional reserve includes working in heat, which requires good cardiac reserve. Fitness evaluation in these circumstances is aimed at excluding people with unacceptably low degrees of organ reserve to tolerate the known hazard. This can be by interview, clinical examination, or by the performance of other specific tests. The relevant tests are determined by the medical conditions, [Table 3](#) lists the relevant conditions to be identified by the medical screens, arranged by hazard.
- Vulnerability: the *absence of conditions* that make the person more vulnerable to a known hazard. A good example of this is a person with asthma who applies to work in a workplace with agents that may trigger or aggravate asthma. Pregnancy in the presence of known teratogens is a special example of *temporary* vulnerability. Fitness evaluation in these circumstances is aimed at excluding people with unacceptably high levels of vulnerability to the known hazard. This can be by interview, clinical examination, or by the performance of other specific tests. The relevant tests are determined by the medical conditions, [Table 3](#) lists the relevant conditions to be identified by the medical screens, arranged by hazard.

Minimum standards for exposure risk (“exposure fitness”) are determined by:

- The presence of exclusion factors (“vulnerability”), and the degree of severity of the exclusion – the more significant the consequence, the lower the tolerance (e.g. pregnancy & teratogenesis, life-threatening asthma, etc.)

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- The presence of pre-existing exposure effects, and the presence of deteriorating test-to-test variance for the applicable exposure effect (any deterioration reduces tolerance for continued exposure). The rate of decline will further influence the fitness decision.
- The presence of high exposure (the higher the exposure, the less tolerance for vulnerability)

As for the capability standards, it is simply not possible to include all these permutations of exposure fitness in a pre-constructed table of options – they must be applied in each circumstance by the responsible practitioner (nurse or doctor). *The objective of the WASP is to highlight the exclusion factors and the exposure effects – the rest is up to the responsible practitioner.*



Point to Ponder:

Test selection for fitness adjudication is largely determined by:

- Failure to comply with a capability standard (including the presence of a medical condition that increases the likelihood that this failure may take place, even if only temporarily). This relates to the legal concept, “fitness to perform work, which for which capability standards have to be met”.
- Conditions (medical or otherwise) that increase vulnerability to exposure. This relates to the legal concept, “fitness to work in the presence of a known hazard”.
- Characteristics of the test (specificity and sensitivity, etc.)

7.1.2 Notes on Tests for Effect Monitoring

Test selection for effect monitoring is largely determined by:


- The target organs and the biological effects of the hazard exposure
- Characteristics of the test (screening versus diagnostic)

In this reference document, for ease of use, the tests in [Table 3](#) are grouped by hazard. This makes the compilation of the WASPs more efficient, as they are also organised by hazard, as are the OREPs.



Point to Ponder:

It is not possible to list all hazards here. For example, there are many hundreds of thousands of *individual chemicals* and *biological agents* that exert biological effects, and which may be encountered in the workplace. Not only is it logistically impossible to reference all of these, the attempt would make this

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document unwieldy.

However, a solution to this open situation is to follow the following test selection steps:

Step 1: Identify the agents' toxicological profiles and their key target organs (See Synergie SOP).

Step 2: Select the appropriate screening and diagnostic tests according to biological effects and target organs. These tests can be selected in accordance with [Table 4](#).

Step 3: Record these tests in the WASP, and the Risk Matrix.



Point to Ponder:

These tables are provided as a guideline. They are intended to provide a reference from which to work whilst following decision algorithms for designing WASPs. The user is encouraged to apply due thought to other combinations, if these are required. This is especially necessary when combinations of hazards are under consideration.

It is inherent to working documents such as these, that new information continues to influence its content. Therefore updates will continue to become available, as necessary.

7.2 Part Two (“Medical Screening”): Objective – “Case-finding”

The objective here is to screen the target group for signs of work-related adverse health effects or for the presence of exclusion factors. This always comprises three phases.

7.2.1 Phase One (“Case Identification”): Objective – “Normal or not”

The chosen medical tests are applied, and the outcomes evaluated. Cases that are normal or which show no work-related adverse health findings are excluded from further action, and are offered referral to a medical practitioner (facility) of their choice, for follow-up.


Those who progress to Phase Two are those with adverse health effects thought to be work-related. By this is meant:

- adverse health effects that may be attributed to hazard exposure (occupational disease)
- an abnormality that may lead to a workplace restriction or even an exclusion.

7.2.2 Phase Two (“Case Confirmation”): Objective – “Work related or Not”

The objective here is to:

- confirm the presence of an occupational disease
- confirm the medical condition which may be an exclusion an employee's job.

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The appropriate tests are applied as necessary, and specialist expertise may be enlisted. These tests are usually more specific for the occupational disease being evaluated, in order to confirm the diagnosis.

To determine the presence of an occupational disease, consider:

- Is there exposure to a known cause of the illness (Hazard x Exposure = Risk)?
- Is the timing + disease onset appropriate?
- Is there an improvement on removal from exposure?
- Have you excluded known non-occupational causes of the illness

Remember that occupational disease may have any of the following associations with the hazard:

- Directly attributable (the hazard is the primary or only cause)
- Indirectly attributable (the hazard is partly responsible)
 - Aggravation (the hazard aggravates a pre-existing medical condition) (eg. workplace chemical plus pre-existing asthma)
 - Contribution (the hazard is a co-contributor of the illness) (eg. cigarettes & workplace dust)

As with Phase One, those with confirmed work-related abnormalities move on the Phase Three, the rest are referred to their own healthcare providers.

7.2.3 Phase Three (“Case Definition”): Objective: - “Classify the condition”

This phase is required to proceed to outcomes management. It’s purpose is to fully define the severity and nature of the cases identified as work-related problems during screening. Every work-related case identified should be classified according to its severity (borderline, mild, moderate and severe).

If the finding is an exposure effect (occupational disease), the professional should also determine:


- Progression (is it getting worse?)
- Whether it meets the requirements for compensation

The severity of the conditions are classified according to the coding system (discussed below, and in the Health Information System Guideline).

The appropriate actions (Outcomes management), are thereby in accordance with these parameters.

7.3 **Part Three (“Outcomes Management”): Objective: - “Optimal Re-integration”**

This is the final and most crucial component of the programme. It focuses on those employees with confirmed work-related health problems (both adverse effects as well as conditions incompatible with their jobs).

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7.3.1 Adverse Effects Management: (ACTION PLAN IF AN OCCUPATIONAL DISEASE IS DISCOVERED)

This comprises:

- Investigation. Investigate to establish cause of exposure and deviation from standard.
- Communication. The task of the examining team is to communicate the results of the medical screen to the employees (feedback form), the employer (certificate of fitness) and, where relevant, the Department of Labour (WCL documents). This step is a statutory obligation (OH&SA, section 25, as well as the General Administrative Regulations).
- Compensation. In the event that an employee is found to have an occupational disease that meets the requirements for compensation, the attending doctor should submit the case to the Offices of the Compensation Commissioner. This matter will require the co-operation of the employer. The employee should receive appropriate treatment, funded by the Compensation Commissioner, as per the provisions of the COID Act.
- Re-Integration. The affected employee(s) are returned to the work environment. This is done, cognisant of the requirements of the jobs to which they return, ensuring they are fit for duty, thereby not endangering their own, or other's health and safety.

Note:

- This step ends with a return to work fitness assessment, to ensure that the employee with an occupational disease is suitable to return to his previous job.
- If the incident investigation confirms the presence of an occupational disease, seek ways to reduce the exposures by implementing the hierarchy of controls, as applicable - namely:
 - Hazard substitution or elimination
 - Engineering Solutions (isolation & ventilation)
 - Administrative Solutions (job rotation, safe work procedures, hazard communication, etc.)
 - Training and education
 - Personal Protective Equipment
- Initiate measures to identify employees from similar exposure profiles that may also have acquired the occupational disease.
- Employee Care:
 - If necessary, remove employee from ongoing exposure
 - If necessary, provide necessary medical therapy and rehabilitation
 - Establish a follow-up schedule to monitor the employee's progress into the future

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Point to Ponder: Statutory Obligations

7.3.2 Case Reporting:

Should an employee be found to be suffering from an occupational disease, it is required that the attending practitioner (nurse or doctor) notify the employee directly, the employer and the local offices Department of Labour (as prescribed by Section 25 in the Occupational Health and Safety Act.

Statutory reporting requires the completion of a large number of documents, and a thorough understanding of the statutory mechanisms that govern these submissions. It is strongly advised that an Occupational Medicine Practitioner with the necessary experience is contracted for this component of the programme.

7.3.3 Case Submission:

This comprises further data collection to satisfy the requirements of the Workmen's Compensation Commissioner, and the submission of a claim. This includes the completion of the following documents as a minimum:

“Employer’s Report of an Occupational Disease” (WCI 1(e)), by the company

“First Medical Report of an Occupational Disease” (WCI 22), by the attending medical doctor


“Notification of an Occupational Disease” (WCI 14), by the employee

Frequently there are also a number of other (more specific) documents, too detailed to list here. These are further prescribed in the Internal Instructions published by the COID Commissioner.

7.3.4 Fitness Adjudication: (ACTION PLAN WHEN EMPLOYEES IS DECLARED “UNFIT”)

At the end of the examination, the medical team will provide a **certificate of fitness** for the worker that will make clear whether the worker is:

- Fit for the job assigned with no restrictions
- Fit for the job assigned with certain restrictions
 - Can do the job with lower efficiency.
 - Can do the job, but requires more regular medical review
- Unfit for the job assigned and therefore needs to be reassigned into another job (if available)
 - Can do the job, but is a danger to himself.
 - Can do the job, but is a danger to others.
 - Cannot do the job.
- The DURATION of the restrictions or “unfitness” should be stated (ie. permanent or temporary)

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The responsible manager will consider the duration and extent of the incapacity, so as to determine the possibilities for: (temporary/permanent)

- Accommodation
- Re-deployment (with or without re-training)
- The need to access Employee Benefits / Entitlements (according to available incapacity / disability provisions made by the company)

The status, “unfit”, can be considered in the same way as for INCAPACITY, under two qualifiers:

Extent – the significance of the failure to meet the inherent requirements in the light of the possible consequences of the person continuing in that occupation. Many of the inherent job requirements, particularly the exclusions, are *relative* exclusions rather than *absolute*.

- Relative exclusion: this is a failure to meet the minimum standard of fitness, but the consequences of which do not automatically render the applicant unfit. A measure of decision latitude exists, according to circumstance.
- Absolute exclusion: this is a failure to meet the minimum standard of fitness, the consequences of which automatically renders the applicant unfit. No decision latitude exists.


Hence, should hypertension be an exclusion for a particular occupation, it is reasonable to regard varying levels of raised blood pressure with commensurate levels of exclusion from that work. For example, a blood pressure which is slightly over the normal limit requires a different reaction to a blood pressure which is life threatening. The employee with the slightly raised blood pressure could be allowed to return to work with the restriction that he is required to return for regular monitoring, *and* that the blood pressure is seen to return to normal, with the passage of time. By contrast, the employee with the critically raised blood pressure would be required to cease working in the relevant occupation immediately.

Duration – the length of time that the person will remain or is likely to remain unable to meet the requirements of the occupation.

- Temporarily unfit: this is the situation in which the employee fails to meet the requirement of the job on the grounds of a medical condition that is temporary, or treatable.
- Permanently unfit: this is the situation in which the employee fails to meet the requirement of the job on the grounds of a medical condition that is permanent, or untreatable.

The permutations for action in the circumstances described above depend upon the interplay between the duration of the disability and its extent.

All reasonable attempts should be made to enable the employee to recover, and return to some form of work. The first objective is to apply whatever medical treatment options are available to restore normal (or

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optimal) function. Should this not be possible, it is incumbent upon the employer to attempt to find other suitable work for the affected employee in the company.

This requirement applies to all affected employees – whether the underlying cause for the problem is work-related or not. However, the Labour Relations Act makes special provision for those that have been injured on duty or have an occupational disease – there is a further requirement on the company to make every effort to find other suitable work for the affected employee. However, (work-related or not), should no suitable alternative work be available, the employee is regarded as *incapacitated* and the subsequent sequence of events for incapacitated employees is initiated (“incapacity management”).

The details of fitness adjudication are covered more completely in the [Guideline on Fitness Certification & Adjudication](#).

8 MANAGEMENT OF DATA

One of the most important components of a medical surveillance programme is the methodology for capturing and analysing the outcomes of the medical tests. The key information required in a data management system includes a capability to analyse:

Outcome Data:

- Normal versus abnormal
- The severity of the abnormal findings
- Test-to-test progression (deterioration or improvement)
- Compensatable or not

Comparative Data:

- Trends and clustering

Tracking Data:

- Programme progress (percentage completion)
- Missed programme elements (employees may have missed certain tests due to their absence at the time of the screen)
- Referrals, and the outcomes.
- Submissions the Compensation Commissioner, and the outcomes.

8.1 The Synergie Coding System

In order to enable this, outcomes of the evaluations are categorised according to groups, coded as follows.

Synergie Coding System



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A	Findings within normal limits.
B (1-4)	Abnormal findings – Occupational : (1-4 = Borderline – Mild – Moderate – Severe)
BP (1-4)	Abnormal findings – Occupational, but pre-existing (from prior workplace) : (1-4 = as above)
C (1-4)	Abnormal findings - Non-occupational : (1-4 = Borderline – Mild – Moderate – Severe)
D (1-4)	Unclear reasons for findings: (1-4 = Borderline – Mild – Moderate – Severe)
E	Employee is exempt from the test or examination.
X	This test was missed or skipped for some reason, and is outstanding.

A useful [aide memoir](#) has been drawn up, to act as a quick reference for application of these codes to various medical screening situations.


Further modifying codes (“modifiers”) are used to indicate two other vital pieces of information:

PROGRESS MODIFIERS	
+/-3	Change by more than a full category
+/-2	Change by a category
+/-1	Change, but still within the same severity category.
P0	No test-to-test change
PX	No prior test available (a “Baseline”)
-	Indicates a test to-test deterioration
+	Indicates a test to-test - improvement

COMPENSATION INDICATORS	
C	Indicates an occupational disease that meets the requirements for a submission to the Compensation Commissioner
NC	Indicates an occupational disease that meets the requirements for a submission to the Compensation Commissioner

This coding system provides a useful tool by means of which to examine risk profile the group under evaluation, and is also a ready reference by which to designate appropriate actions by categories. Given some flexibility for isolated individual cases, a generic follow-up plan for these categories is as follows:

Group	Suggested actions
CAT A, B1, C1 & D1	Inform employee. Take special note of borderline cases. Routine follow-up.
CAT B2 (occupational)	Investigate & record as an incident. Inform employee, management and Department of Labour, as required by Occupational Health and Safety Act. Careful follow-up (6-monthly if necessary). Consider issuing more

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	effective risk controls (See hierarchy of controls).
CAT B3 (occupational)	As for CATB2, plus: requires direct attention of the risk control team, with a view to immediate exposure reduction.
CAT B4 (occupational)	As for CATB3, plus: this may require submission to the Compensation Commissioner for possible award. Provide maximum exposure protection – seriously consider a move to a non-exposed job.
CAT C2, C3 & 4	Inform employee only (not management). Intensity of follow-up depends upon the severity of the disorder and on-going exposure. (6-monthly if necessary). Refer for ongoing medical management and follow-up as necessary (usually at own cost).
CAT D	The “D” code is the flag that indicates “Case Management in progress”. Make every attempt to define the underlying cause and allocate a code from those above. In borderline or mild cases, careful follow-up may suffice.

In this way, there is consistency in the way in which the medical programmes flow and are reported. Interpretations are more rapid and key performance indicators more transparent. The procedure, the documentation and the underlying IT data gathering process all knit tightly together to form an integrated system, minimising information loss and optimising efficiency.

The spreadsheets provided by Synergie allow normal numeric data entry too, (actual results of tests), not exclusively the coded outcomes. This is particularly useful for tracking data that is not easily and immediately attributed to work exposure, such as lung function tests, lab tests, etc. The actual values can be recorded, for subsequent analysis.

The analytical tools built into the Synergie spreadsheets enable analysis of the data in many ways. This is by means of sophisticated filters, data sorts and proportionate analysis. The results are depicted numerically and graphically.

9 AUDIT REQUIREMENTS

The Medical Surveillance Programme must be subjected to an audit and evaluation from time to time.

10 DOCUMENTS

Various documents are used throughout the Synergie Medical Surveillance programmes. The core documents comprise:

- Examination Forms:
- Pre-Placement Medical
- Periodic Medical
- Exit Medical
- Brief (“Rapid”) medical screen



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- Other documents are designed to improve the precision of the evaluation, and include questionnaires and targeted examinations, such as:
 - Noise Exposure Questionnaire
 - Lung function questionnaire
 - Solvent medical
 - Dermatitis questionnaire
 - Occupational Disease Investigation Questionnaire
 - Communication Forms:
 - Consent for Disclosure of Medical Information
 - Declaration with the Medical Evaluation
 - Consent for medical testing / Refusal of medical testing
 - Exit Medical Examination waiver
 - Certificate of Fitness (Generic) and Return to Work letter
 - Feedback to employee letter (English, Afrikaans & Xhosa)
 - Management referral form, for Medical Adjudication
 - Referral letter (blank, with place for reply) to other medical service providers (also a Memo sheet included)

11 Document History

Version Number	Change	Date
04	Integration of management guide on the design of WASPs with main medical screening management guide.	14/04/2009
05	COIDA requirement added to section on statutory Certifications required in occupational health.	07/06/2009
06	Appendix 1 removed - What qualifications are required to adjudicate on fitness to work (was in the medical surveillance guideline – now in the Guideline on Roles & Responsibilities of the OH Team)	09/06/2009
07	Addition of Contractors & Visitors	26/11/2009
08	Additional material under contractor medicals	05/02/2010

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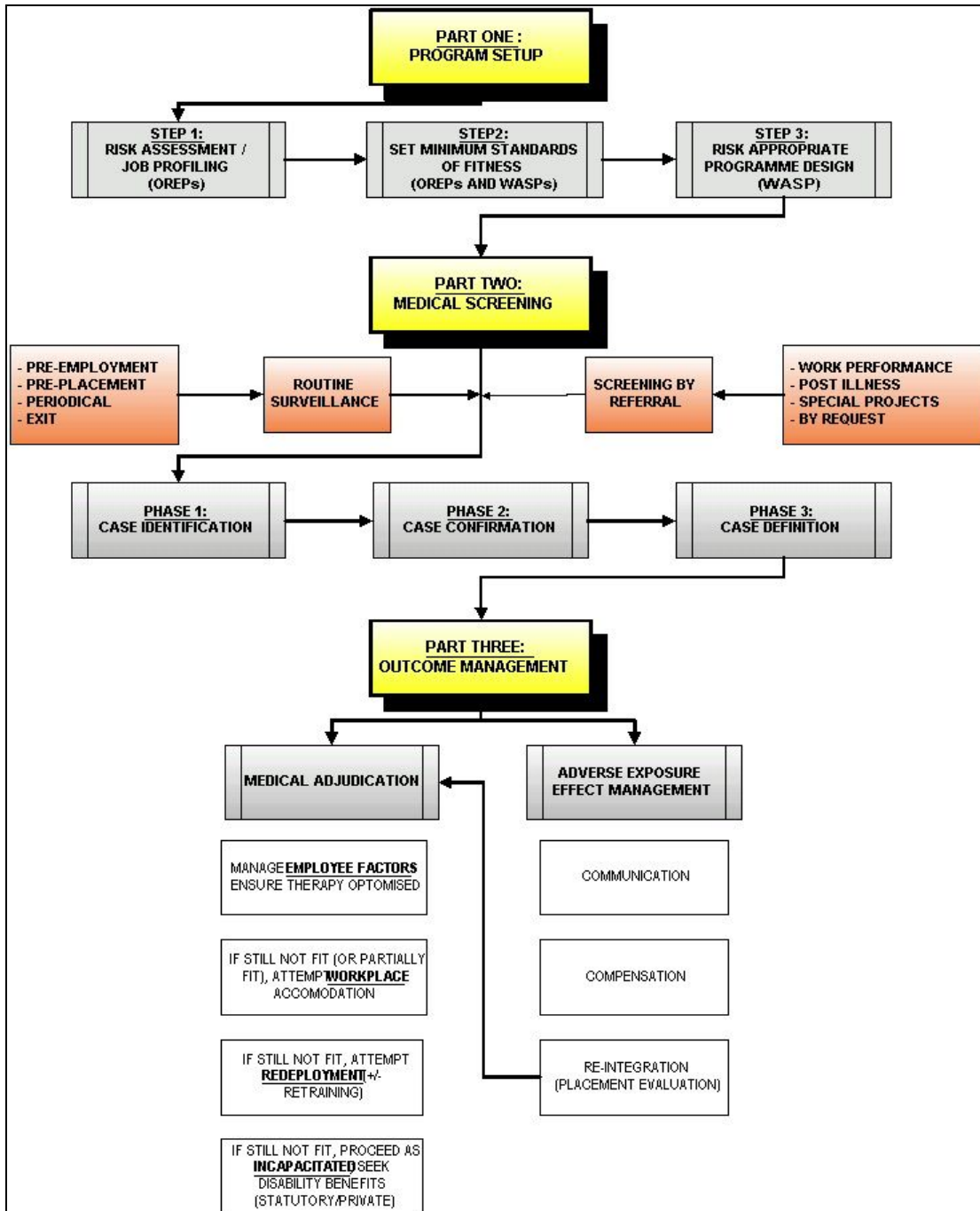
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12 Appendix 1: The required qualifications for certifying fitness to work

This is now covered in the [Roles & Responsibilities of OH staff](#) Guideline.

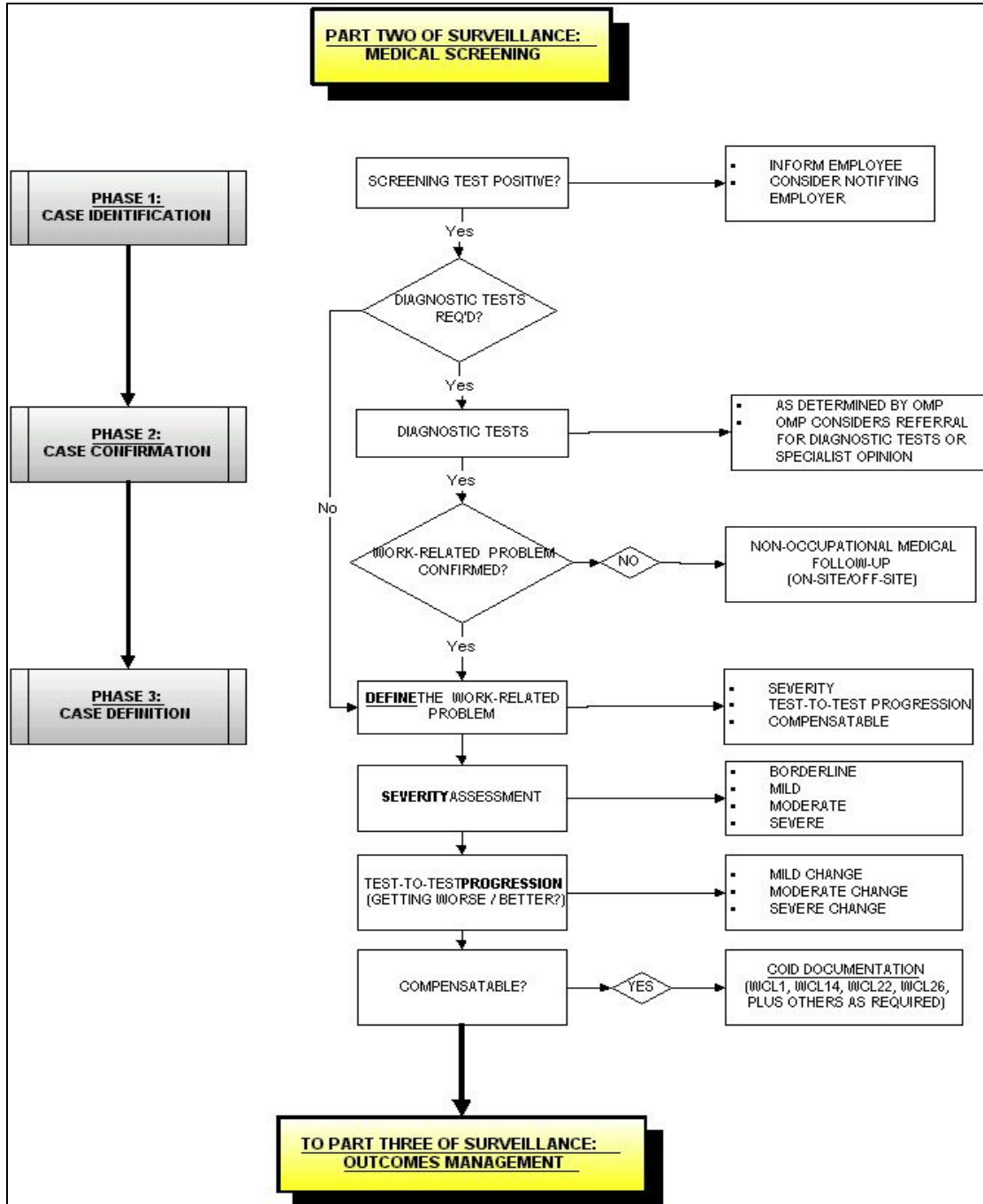
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13 Appendix 2: Flow of the Medical Screening Programme; Parts 1-3.



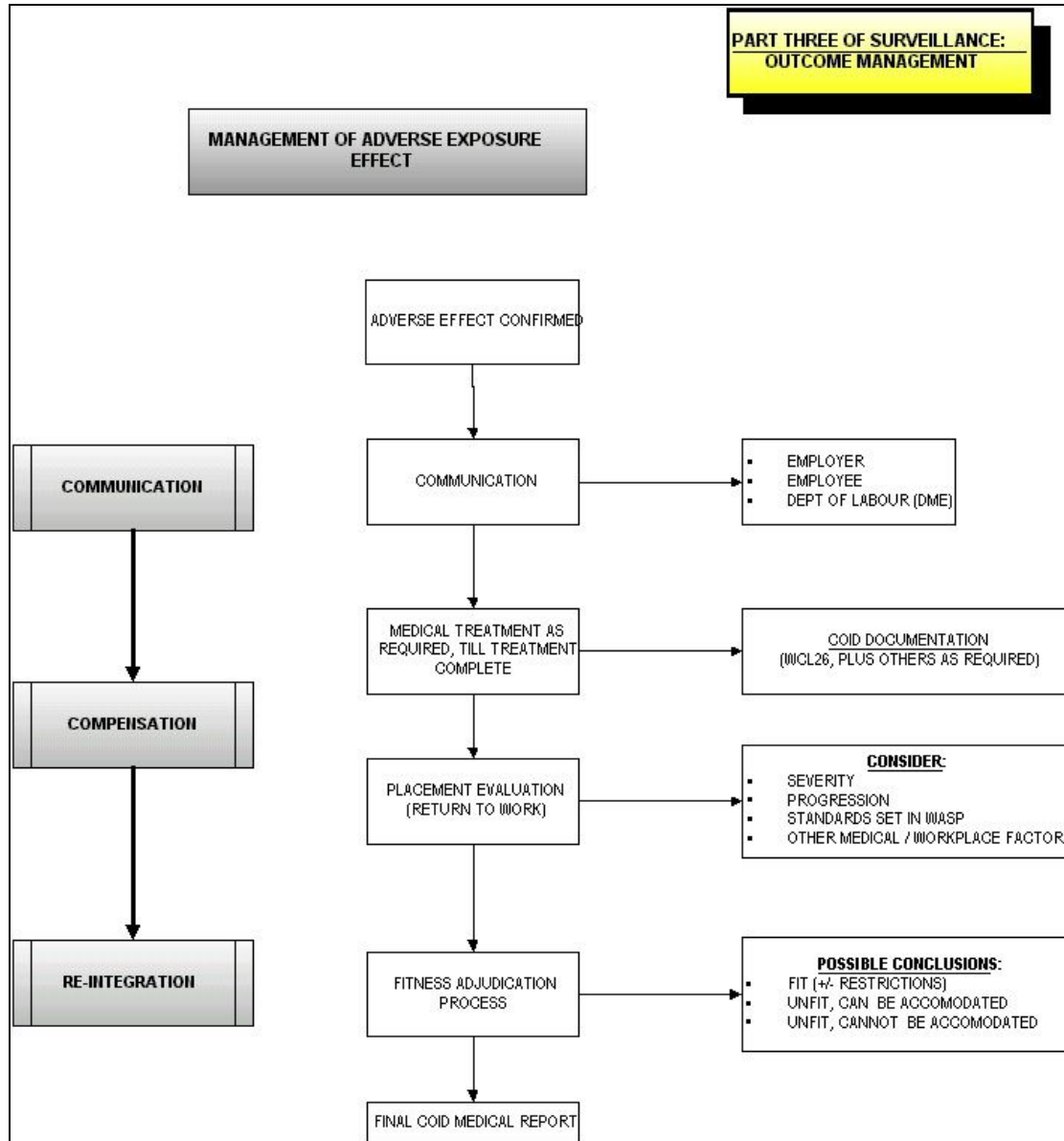
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14 Appendix 3: "Part Two" of Medical Screening Program



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15 Appendix 4: Overview of the Adverse Exposure Effect sequence





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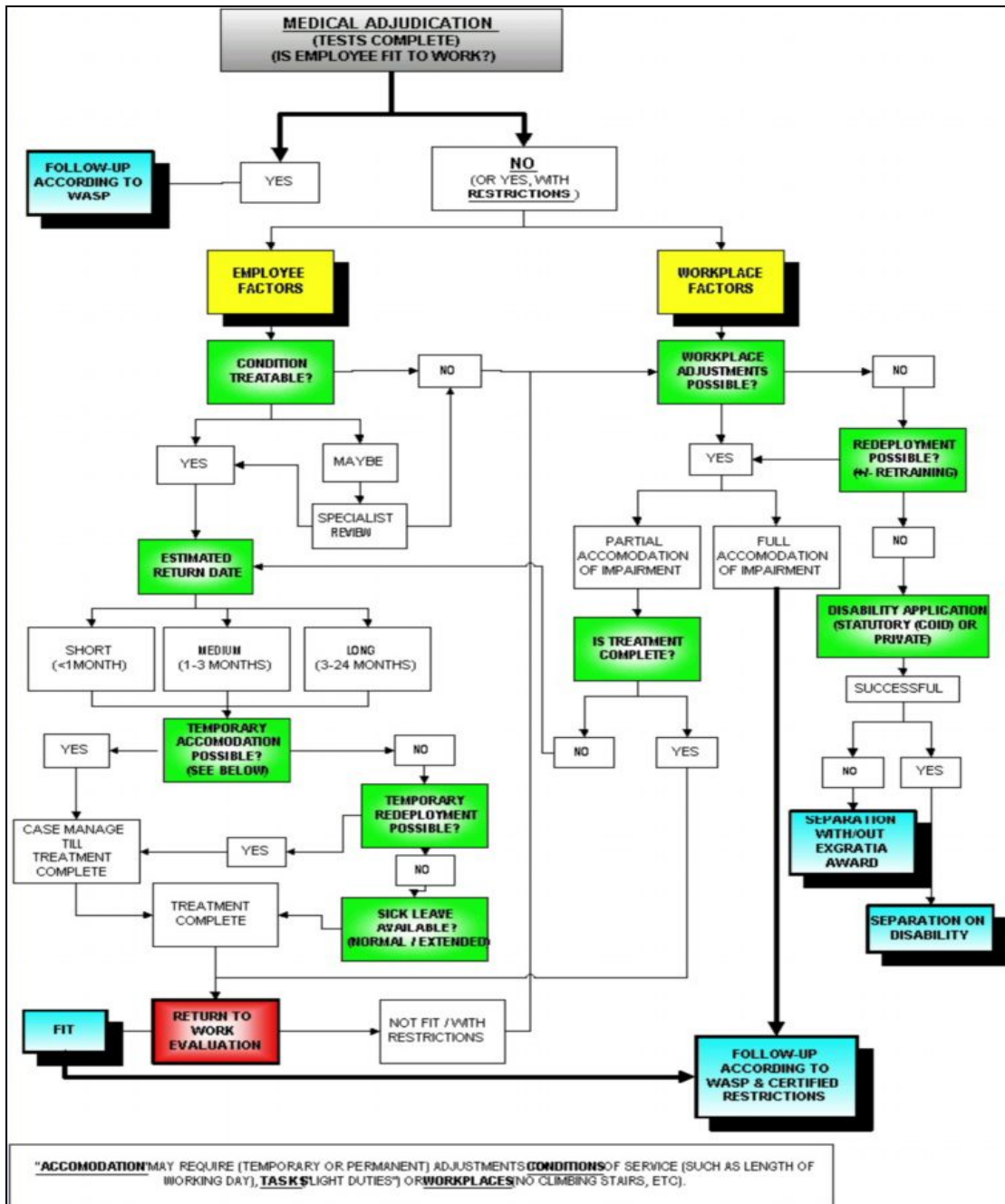
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16 Appendix 5: Overview of the Medical Adjudication sequence





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17 Appendix 6: Reference Tables - Capability Requirements and Standards of Fitness

The following table lists the Capability Requirements as they occur in the OREP. To each of these is allocated graded options of consequence, or importance. Hence, with increasing levels of importance, there are commensurately increased conformance requirements. They are a guideline and are to be used in conjunction with the “importance ratings’ allocated in the OREPs.

Table 1: Test Selection by Functional Capability & Standard Required

OREP CRITERIA	TEST SELECTION		STANDARDS REQUIRED			
	Phase 1 (screening)	Phase 2 (diagnostic)	+	++	+++	++++
			(low requirement) (high tolerance)			(high requirement) (low tolerance)
Hearing:	Interview, Audiometry	Audiometry	Can hear normal spoken speech. Average binaural hearing loss up to 60dB(A). Eg; customer services personnel	-	Completely normal hearing. Average binaural hearing loss up to 25dB(A). Eg; critical occupations responding to auditory signals (crane operators)	-
Balance:	Interview	Clinical balance tests	Clinical tests – eyes open. Eg: frequent walking over uneven terrain (miners, construction work)	-	Clinical tests plus past medical history evaluation. Eg: work amongst dangerous machines.	Neurological evaluation past medical history evaluation. Absence of vertigo. Eg: work on high scaffolding
Vision: Visual Acuity (Near and Far)	Snellen chart, Biopter, Orthorater, clinical reading tests.	Optician (or Specialist) Eye examination.	Snellen chart score of 6/18 for each eye. Or 6/12 for better eye if one is blind. Corrected vision acceptable. Eg; secretarial services	Snellen chart score of 6/12 for each eye. Or 6/9 for better eye if one is blind. Corrected vision acceptable. Eg; light delivery van driver	Snellen chart score of 6/9 for each eye. Binocular vision required. Corrected vision <u>may not be</u> acceptable. Eg; bulk truck driver, forklift operator	Snellen chart score of 6/9 for each eye. Binocular vision required. Corrected vision <u>not</u> acceptable. Eg; fire & rescue workers
Vision: Visual fields	Clinical tests (“Which fingers are moving?”), Orthorater.	(Specialised perimetric visual fields tests).	Binocular vision <u>not</u> required, but a field of 50 degrees nasal & 70 degrees temporal required for good eye. Eg; occasional light delivery van driver	-	Binocular vision required. Field of 50 degrees nasal & 70 degrees temporal in each eye. Eg; bulk truck driver, forklift operator	Binocular vision required.
Vision: Range of motion	Clinical tests (“follow the finger/light”).	-	Impaired movement of one eye acceptable, as long as good eye has full range of movement. E.g.; occasional light delivery van driver	-	Impaired movement of one eye NOT acceptable. Eg; bulk truck driver, forklift operator.	-
Vision: Depth perception	Thread a needle, finger-nose test, on-the-job testing, (Biopter/Orthorater).	-	Non-critical / hazardous tasks requiring stereopsis. Binocular vision required. No specific tests of	-	Critical / hazardous tasks requiring stereopsis Objective evidence of intact stereopsis required.	-



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OREP CRITERIA	TEST SELECTION		STANDARDS REQUIRED			
	Phase 1 (screening)	Phase 2 (diagnostic)	+ (low requirement) (high tolerance)	++	+++	++++ (high requirement) (low tolerance)
			stereopsis required. Eg: Laboratory workers		Eg: Master electricians	
Vision: Colour vision	Ishihara, coloured wire tests, Biopter, Orthorator.	-	Only certain colours required – need to itemise which colours. Eg: electrician – red, green, blue, brown	-	No colour “blindness” acceptable. Eg: textiles & dying industry	-
Vision: Night vision	(Night vision tester)	On the job testing. Ophthalmologic opinion.	-	Occasional occupational night driving. On-the-job testing recommended. Acuity score ++ required.	Frequent occupational night driving. On-the-job testing required. Acuity score of +++ required.	-
Smell	Aroma bottles (cloves, peppermint, garlic).	-	Tasks occasionally require ability to smell. Clinical testing suggested. Eg: analytical chemists	-	-	-
Height: Tall/Med/Short	Measuring tape.	-	No relevant medical tests. Eg: Stores personnel	No relevant medical tests Eg: Certain sports (jockeys, basketball)	No relevant medical tests. Eg: Confined spaces, such as submarines.	No relevant medical tests.
Hand-eye co-ordination	Finger-nose test, button-hole test, thread a needle, dress/undress.	-	General observation indicates satisfactory dexterity. Eg: Packers	On-the-job testing required. Eg: Waitress/Butler, soldering work, jewellery manufacture.	Clinical tests of cerebellar function. Eg: Special equipment operators	Psychomotor tests Eg: Special equipment operators involving complex & critical tasks.
Hand-eye-foot co-ord.	Finger-nose test, on-the-job testing, specifically designed exercises.	-	General observation indicates satisfactory dexterity. Eg: Dicta-typing	On-the-job testing required. Eg: Driving	Clinical tests of cerebellar function. Eg: Special equipment operators (cranes, loaders, etc.)	Psychomotor tests Eg: Special equipment operators, involving complex & critical tasks.
Fine motor control	Write own name, draw shapes (in “Initial Medical Evaluation” document), finger-nose test.	-	General observation indicates satisfactory dexterity. Eg: Clothing industry workers	On-the-job testing required. Consider cerebellar tests. Copy the pre-set diagrams in the Synergie examination sheet. Eg: Laboratory work, electronics, jewellery work.	-	-
Use of both hands	Observation. Are both functional?	-	No tests relevant. Relative requirement.	No tests relevant. Relative requirement.	No tests relevant. Absolute requirement.	No tests relevant. Absolute requirement.
Use of both feet	Observation. Are both functional?	-	No tests relevant. Relative requirement.	No tests relevant. Relative requirement.	No tests relevant. Absolute requirement.	No tests relevant. Absolute requirement.
Strength and endurance	Clinical Musculoskeletal screen. Endurance testing not feasible in a clinic. On	Where relevant, a special evaluation at a biokinetics centre	Occasional heavy manual work. No specific test required.	Frequent heavy manual work. Clinical judgement.	Constant heavy manual work. Physical capability testing	Added difficult environmental circumstances, and/or use of awkward PPE.



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OREP CRITERIA	TEST SELECTION		STANDARDS REQUIRED			
	Phase 1 (screening)	Phase 2 (diagnostic)	+ (low requirement) (high tolerance)	++	+++	++++ (high requirement) (low tolerance)
	the job testing.		Eg: Engineering maintenance	Eg: Construction	(PCT) recommended. Eg: Underground mining	Physical capability testing (PCT) required. Eg: Rescue (proto) teams
Memory / Cognitive function / Clarity of Thought	Generally done by impression only. Mini-mental state test.	"7 from 100" test. Psychomotor tests.	"Mini-mental state" exam Sedatives used in reduced dose (eg. antihistamines).			"Mini-mental state" exam "7 from 100" test. <u>No</u> sedatives.
Clarity of speech	Interview (define the problem – dysarthria / dysphasia).	-	Generally a non-medical evaluation. General verbal interview indicates satisfactory level of speech. A <u>preference</u> . Eg: Office workers	Generally a non-medical evaluation. On-the-job testing <u>recommended</u> . A <u>relative</u> requirement. Eg: Receptionists	Generally a non-medical evaluation. On-the-job testing <u>required</u> . An <u>absolute</u> requirement. Eg: Critical communications tasks, such as customer services centres, emergency call centres.	-
Endocrine function Glucose control	Urine Dipstix. Finger-prick test.	Glucose Tolerance Test Glycated Hb (Hb _{A1C}).	Levels <u>do</u> exceed 15mmol/l. On insulin.	Levels do not exceed 15mmol/l.	Hyperglycaemia, but controllable with diet. Levels do not exceed 10mmol/l.	Impaired glucose tolerance
From this point on, see Table 2 for suggested exclusions						
Climbing ladders/stairs	Interview – vertigo, medicines. On the job testing. <u>Seek exclusions as per Table 2:</u>	Specific tests to confirm degree of vulnerability for the disorders identified in Phase 1.	Self-declared on interview. <u>Relative</u> requirement. Moderate levels of vulnerability will be considered. Eg: Ladders to a height of 1-2m.	Self-declared on interview. <u>Relative</u> requirement. Some degree of vulnerability will be considered. Eg: Ladders to a height of 2-4m.	Self-declared on interview. <u>Absolute</u> requirement. Minor levels of vulnerability will be considered. Eg: Ladders to a height of 4-10m..	Self-declared on interview. <u>Absolute</u> requirement. No tolerance for any levels of vulnerability. Eg: Ladders to a height of over 10m..
Work at heights	Interview – vertigo, medicines. <u>Seek exclusions as per Table 2:</u>	Specific tests to confirm degree of vulnerability for the disorders identified in Phase 1.	Self-declared on interview. Moderate levels of vulnerability will be considered. A degree of vertigo can be allowed. Eg: Office worker in a high-rise building (lift dependent). Scaffolding work at 2-5m.	Self-declared on interview. Some degree of vulnerability will be considered. Vertigo a relative exclusion. Eg: Construction worker on a scaffolding at 5-10m in height.	Self-declared on interview. Minor levels of vulnerability will be considered. Vertigo an absolute exclusion. Eg: Maintenance personnel on rigs and cranes.	Self-declared on interview. <u>Absolute</u> requirement. No tolerance for any levels of vulnerability. Eg: Maintenance & construction workers on high-rise buildings and mine shafts.
Confined spaces	Interview - claustrophobia. On the Job testing. <u>Seek exclusions as per Table 2:</u>	-	A degree of claustrophobia can be allowed. Eg: Office worker in a high-rise building (lift dependent).	No claustrophobia a recommendation (relative exclusion). Eg: Maintenance worker in a high-rise building, where work in confined spaces (lifts) will take place from time to time.	Claustrophobia an absolute exclusion. Eg: Maintenance personnel in enclosed pipes, tanks, wells, etc.	-



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OREP CRITERIA	TEST SELECTION		STANDARDS REQUIRED			
	Phase 1 (screening)	Phase 2 (diagnostic)	+(low requirement) (high tolerance)	++	+++	++++ (high requirement) (low tolerance)
Prolonged sitting, standing, squatting and bending	On the Job Testing. Screen for increased vulnerability – see Table 2.	Specific tests to confirm degree of vulnerability for the disorders identified in Phase 1.	Can maintain the required position temporarily (1 minute).	-	Can maintain the required position for at least an hour.	-
Uneven terrain	On the Job Testing. Screen for increased vulnerability – see Table 2.	Specific tests to confirm degree of vulnerability for the disorders identified in Phase 1.	Adequate combination of balance, co-ordination and mechanical function (limbs and spine). A degree of dysfunction can be allowed, including a limb prosthesis. Eg: Work of a low physical demand at a construction site, or underground.	-	Good combination of balance, co-ordination and mechanical function (limbs and spine). No dysfunction allowed. No prosthesis allowed. Eg: Maintenance personnel in complex workplace, such as engine rooms, underground stopes.	-
Ability to tolerate shift work	On the Job Testing. Screen for increased vulnerability – see Table 2.	Specific tests to confirm degree of vulnerability for the disorders identified in Phase 1.	A <u>preference</u> .	A <u>relative</u> requirement. Relative exclusions will be considered.	-	An <u>absolute</u> requirement. No medical exclusions allowed.


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Table 2A: List of suggested exclusions, by Task / Environmental circumstance

Environment / Tasks	Suggested Exclusions / Restrictions: (standards applied will vary with the risks)
Climbing ladders/stairs	Disorders of balance. Disorders involving level of consciousness (black-outs, epilepsy). Lower limb dysfunction (amputees, severe arthritis).
Work at Heights	Disorders of balance, including lower limb dysfunction (amputees, severe arthritis) where this impairs balance. Disorders involving level of consciousness (black-outs, epilepsy) or that impair clear thinking (including substances of abuse, or medications, whether prescribed or otherwise). Disorders of emotional state, such that an employee might be at risk for suicide.
Confined spaces	Claustrophobia. Disorders that prevent the use of respiratory protective equipment – ensure he can wear a respirator, with no leaks (NO BEARD).
Required to wear a respirator	Disorders of lung function (ie moderate or severe COAD or asthma). Disorders that prevent the use of respiratory protective equipment – ensure he can wear a respirator, with no leaks (NO BEARD).
Near dangerous machinery	Disorders of balance. Disorders involving level of consciousness (black-outs, epilepsy).
Prolonged sitting	Severe vertebral degeneration.
Bending/squatting	Disorders of the spine, hips, knees and ankles.
Prolonged standing	Severe disorders of the spine, hips, knees and ankles.
Uneven terrain	Disorders of balance. Lower limb dysfunction (amputees, severe arthritis).
Slippery floor surfaces	Disorders of balance. Lower limb dysfunction (amputees, severe arthritis).
Shift work	Cardiovascular disorders: hypertension, ischaemic heart disease. Psychiatric disorders: depression, anxiety, sleep disorders, (especially narcolepsy), psychoses, alcoholics & drug addicts. Neurological: epilepsy, severe (not correctible) visual impairment. Respiratory: asthma (esp. if poorly controlled & steroid dependent), active extensive tuberculosis. Gastro-intestinal disorders: relapsing peptic ulcer disease, severe irritable bowel syndrome. Endocrine disorders: insulin-dependent diabetes, thyrotoxicosis.

Table 2B: List of suggested exclusions / restrictions, by Occupational Group

Drivers and Operators of motor vehicles and dangerous equipment.	Disorders of thought and judgement: - mental disorders, substance abuse. Disorders involving level of consciousness: - diabetes, blackouts, epilepsy and substance abuse. Disorders that impair operator's ability to respond to external signals (vision, hearing). Disorders of critical organ function (cardiorespiratory): - hypertension, ischaemic heart disease, dysrhythmias
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	and severe lung impairment. Disorders of musculoskeletal system that may impair the ability to maintain control: - impaired use of limb(s), neuromuscular disease, joint dysfunction (including cervical spine), amputated limbs.
First Aiders	Disorders of immunity (eg. Hepatitis A & B immunity).
Fire fighters / rescue workers	See OREP
Food Handlers	See OREP

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18 Appendix 7: Reference Tables - Adverse Effects of Exposure and Increased Vulnerability

The following two tables are the determinants of tests for identifying the effects of exposure.

Note: These “conditions that increase vulnerability” are important for both effect evaluation, as well as for fitness determination. With regard to effect evaluation, their presence should alert the responsible medical team to the increased likelihood of exposure effects. With regard to fitness adjudication, their presence should alert the responsible medical team to a situation that places the health of the worker at such risk that it precludes employment, or, at least, places a requirement for increased surveillance and vigilance.

[Table 3](#) lists the suggested tests for both phases of Medical Surveillance – Phase One (screening) and Phase Two (diagnostic). The tests are further divided into those that are useful for identifying adverse effects, and those that are useful for determining medical fitness. *Note that the tests for effect identification are simply tests that identify early target organ damage, whilst the tests for fitness determination are tests evaluate how “vulnerable” the person is.*

[Table 4](#) provides a useful reference for test selection for any agent for which the biological effects (or target organs) are known, and is an adjunct to Table 3, by listing suggested tests for identifying early target organ damage. It is ideally applied to the selection of tests for those exposed to hazardous chemical substances.

Table 3: Test Selection – Exposure Effects and Increased Vulnerability.

Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability (“fitness”) (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
This row is to explain the use of the table	This is where there key target organs, that are affected by the hazard, are listed	This is where the main biological effects on the exposed employee, as a consequence of exposure to the hazard, are described.	This is where the medical conditions that affect the employees’ vulnerability to the hazards are listed.	EFFECT: These are the screening tests recommended to identify early exposure adverse effects. FITNESS: These are the screening tests recommended to identify conditions that may restrict or preclude employment, in the presence of this hazard.	EFFECT: These are the diagnostic tests recommended to confirm adverse exposure effects. FITNESS: These are the diagnostic tests recommended to identify conditions that may restrict or preclude employment, in the presence of this hazard.	This is where any regulatory references are listed
Haz. Chemical Substances (HCS): <u>Irritants</u>	Exposed surfaces	Direct chemical burns, corrosion.. Irritation of the mucous membranes (eyes, upper resp tract, lower resp tract).	Sensitive skin & mucous membranes ▪ Eczema, conjunctivitis, rhinitis. Sensitive lungs ▪ Asthma, COAD, ‘bronchitis’. Damage to protective skin through detergent use.	EFFECT: Interview, clin exam (PFT) FITNESS: Same as for effect.	EFFECT: Pre- & Post B’dilator PFT Peak Flow Monitoring FITNESS: Same as for effect.	HCS Regulations



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Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability ("fitness") (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
Haz. Chemical Substances (HCS): Sensitisers, small molecular weight)	Lungs, skin and mucous membranes (upper respiratory tract, eyes)	Allergic effects. <u>Note:</u> Generally non-IgE mediated, so few specific RAST tests available.	Allergic conditions ▪ Eczema, conjunctivitis, rhinitis, asthma, COAD ▪ Latex allergy Damage to protective skin through detergent use.	EFFECT: Interview, clin exam PFT Allergy status: Non-specific - Total IgE Non-specific RAST. FITNESS: Same as for effect.	EFFECT: Pre- & Post B'dilator PFT Peak Flow Monitoring Allergy tests (Specific – RAST) Challenge tests FITNESS: Same as for effect.	HCS Regulations
Haz. Chemical Substances (HCS): Sensitisers, Large molecular weight) (Animal protein, Grain Dust)	Lungs, skin and mucous membranes (upper respiratory tract, eyes)	Allergy, Irritation. <u>Note:</u> Generally IgE mediated, so a number of specific RAST tests are available.	Allergic conditions ▪ Eczema, conjunctivitis, rhinitis, asthma, COAD ▪ Latex allergy Damage to protective skin through detergent use.	EFFECT: Interview, clin exam PFT Allergy status: Non-specific - Total IgE & Phadiotop screen (RAST) Specific – Skin Prick tests FITNESS: Same as for effect.	EFFECT: Pre- & Post B'dilator PFT Peak Flow Monitoring Allergy tests: Specific: RAST & direct challenge tests FITNESS: Same as for effect.	HCS Regulations ^o
Haz. Chemical Subst (HCS): Carcinogens	Target organ dependent	Induction of cancer.	Exposure to other carcinogens, such as smoking, alcohol and other environmental agents.	EFFECT: Interview, clin exam Skin: exam Nose: exam Lungs: CXR, (cytology) (CEA). Urinary tract: dipsticks, (cytology) Liver: AFP (LFT) GIT: CEA Testes: AFP Ovaries: AFP, CA-125). FITNESS: As above – absence of relevant cancer.	EFFECT: CT scan Histology Cytology FITNESS: Relevant specialist.	HCS Regulations
Haz. Chemical Subst (HCS): Teratogens	Developing foetus	Interference with developing organ systems in embryo or foetus.	Exposure to other teratogens, such as medicines, alcohol, viruses and other environmental agents.	EFFECT: Interviews & register of births FITNESS: Interview, pregnancy tests – Exclude pregnancy.	EFFECT: Reproductive health specialist opinion FITNESS: OMP opinion.	HCS Regulations
Haz. Chemical Subst (HCS): Organ / metabolic toxicity	Target organ dependent	Interference with metabolic processes, leading to organ damage.	Exposure to other organ toxins, such as medicines, alcohol, viruses and other environmental agents. Co-existing organ disease of similar nature to the HCS's target organs.	EFFECT: Interview, clin exam SEE TABLE 4!! CNS: exam PNS: exam Liver: AST, ALT, (ALP) Marrow: FBC, diff, retics. Ren: urinalysis, (microalbuminuria). GIT: - Endo: (organ dep) CVS: Exam, (ECG).. Lungs: PFT, CXR. Eyes: Eye screen. Ears: Audio, (Balance). Skin: -	EFFECT: SEE TABLE 4!! Liver: U/S, Biopsy. Marrow: Biopsy. CNS: Psychomotor tests PNS: EMG. CVS: - Lungs: CT scan, biopsy. Kidneys: CEUG, Biopsy	HCS Regulations



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Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability ("fitness") (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
				FITNESS: As above – absence of relevant organ defect.	FITNESS: Relevant specialist.	
Haz. Chemical Subst (HCS): (Dust – Asbestos)	Lungs	Asbestosis, pleural thickening, pleural plaques, lung cancer, mesothelioma.	Other carcinogens – cigarette smoking	EFFECT: Interview, clin exam Lungs: PFT, CXR FITNESS: Interview, clin exam Lungs: PFT, CXR.	EFFECT: CT scan, histology Pulmonologist opinion FITNESS: OMP opinion Pulmonologist opinion	Asbestos & HCS Regs ^o
Haz. Chemical Subst (HCS): (Dust - Silica / Quartz)	Lungs	Silicosis, COAD, PTB.	Other causes of obstructive airways disease – smoking	EFFECT: Interview, clin exam Lungs: PFT, CXR FITNESS: Interview, clin exam Lungs: PFT, CXR.	EFFECT: CT scan, histology Pulmonologist opinion FITNESS: OMP opinion Pulmonologist opinion	ODIMWA & HCS Regs ^o
Haz. Chemical Subst (HCS): (Welding Fumes)	Eyes Respiratory Tract Nervous System	Arc Eyes. Rhinitis, chronic bronchitis, asthma, metal fume fever, pneumonitis, pulmonary siderosis. CNS & PNS damage (lead).	Asthma, severe respiratory impairment.	EFFECT: Interview, clin exam Lungs: PFT, CXR FITNESS: Interview, clin exam Lungs: PFT, CXR.	EFFECT: CT scan, Pulmonologist opinion FITNESS: OMP opinion Pulmonologist opinion	HCS Regulations
Haz. Biological Agents (HBA): Target Organ Toxicity (Sewerage, Lab Health Care workers)	Organism specific	According to target organs See notes under HCS.	Inadequate immunity <ul style="list-style-type: none"> ▪ Not vaccinated ▪ Immune compromise (many conditions, including AIDS) Medical conditions that involve the HBA's target organs <ul style="list-style-type: none"> ▪ E.g.: Hepatitis and tetanus. <p style="text-align: center;">REMEMBER TO IMMUNISE!!!</p>	EFFECT: FBC, incl diff. Target organs dependant – see HCS. FITNESS: FBC, incl diff. Status of Immunity Target organs dependant	EFFECT: Target organs dependant Rising titre. FITNESS: OMP opinion Physician opinion	HBA Regulations
Noise	Ears	Noise Induced Hearing Loss.	<u>Ototoxins:</u> <ul style="list-style-type: none"> ▪ Chemicals: n-butanol, toluene. ▪ Medications: aminoglycosides, lasix, ethacrynic acid, bumetanide. <u>Whole body vibration exposure</u> <ul style="list-style-type: none"> ▪ Vibration at 3 – 8 kHz <u>Non-industrial Noise exposure</u> <ul style="list-style-type: none"> ▪ Disco workers, noisy D-I-Y work 	EFFECT: Audiometry. FITNESS: Interview (vulnerability) Clin Exam (PPE)	EFFECT: Audio Questionnaire. Diagnostic audio. OMP evaluation. ENT specialist opinion FITNESS: OMP evaluation	(NIHL Regulations) SABS 083 COIDA Instruction 171 & supplement.
Heat	CVS CNS Fluid Homeostasis	Heat rash Heat stress Heat exhaustion Heat stroke.	<u>Reduced cardiovascular system reactivity</u> <ul style="list-style-type: none"> ▪ Medications (beta-blockers) ▪ CCF, valvular heart disease, ischaemic heart disease ▪ Diabetes mellitus <u>Impaired thermoregulation</u> <ul style="list-style-type: none"> ▪ Medications (antihistaminic or anticholinergic) 	EFFECT: Interview (checklist) (Exclude Risk Factors)	EFFECT: Post Incident / accident: <ul style="list-style-type: none"> ▪ Hyperthermia ▪ Renal function ▪ Liver Function ▪ Muscle breakdown 	Env. Regulations.



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Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability ("fitness") (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
Cold	Vascular system Skin (secondary to poor blood flow). Lungs	Cold stress. Asthma	<p>properties)</p> <ul style="list-style-type: none"> ▪ Skin conditions that impair thermoregulation (extensive psoriasis) ▪ Pyrexial illness, active pulmonary TB ▪ Very low body weight (<50kg) <p><u>Impaired oxygenation</u></p> <ul style="list-style-type: none"> ▪ Anaemia ▪ Poor lung function <p><u>Disordered fluid homeostasis:</u></p> <ul style="list-style-type: none"> ▪ Dehydration (diarrhoea, vomiting), excessive alcohol consumption, diabetes mellitus. ▪ Medication: Diuretics. <p><u>General:</u></p> <ul style="list-style-type: none"> ▪ Liver impairment, renal impairment, hyperthyroidism. ▪ Excessive body weight (BMI>30) ▪ Poor capillary blood flow ○ Medications (beta-blockers, alpha agonists) ○ Diabetes mellitus, peripheral vascular disease ▪ Raised blood pressure ○ Atherosclerotic disease (cardiac, cerebral, etc). ▪ Impaired thermoregulation ○ Hypothyroidism ▪ Musculoskeletal ○ Arthritis (symptoms are aggravated, but not caused) ○ Vibration injury - Vibrating tools, such as pneumatic drills. 	<p><u>FITNESS:</u> Heat Tolerance Test. Interview (vulnerability). Clin Exam (vulnerability).</p>	<p><u>FITNESS:</u> Stress ECG. Others, as required (CXR, PFT, FBC, GGT).</p>	Env. Regulations.
				<p><u>EFFECT:</u> Interview (Questionnaire) Chilblains Asthma</p>	<p><u>EFFECT:</u> Post Incident / accident: ▪ Hypothermia ▪ Renal function</p>	
				<p><u>FITNESS:</u> Interview Clin Exam</p>	<p><u>FITNESS:</u> OMP opinion. Physician opinion.</p>	
Glare	Eyes.	Eyestrain Headaches (pterygium)	<ul style="list-style-type: none"> ▪ Artificial lens implants ▪ Impaired papillary accommodation (mydriatic medications). 	<p><u>EFFECT:</u> Interview.</p> <p><u>FITNESS:</u> Interview (vulnerability). Clin Exam (vulnerability).</p>	<p><u>EFFECT:</u> On-site evaluation.</p> <p><u>FITNESS:</u> OMP opinion.</p>	N/A
Vibration (Segmental)	Contact points (hands) <u>Note:</u> Low frequency (<50Hz) vibration is transmitted easily, so affects the wrists, elbows & shoulders. High frequency (>50Hz) vibration is transmitted poorly, so affects the fingers & hands.	Bone degeneration Neurovascular damage. (Raynaud's phenomenon) Tendonitis, tenosynovitis.	<p><u>Vascular:</u></p> <ul style="list-style-type: none"> ▪ Poor capillary blood flow ○ Medications (beta-mimetics, alpha agonists) ○ Diabetes mellitus, peripheral vascular disease ▪ Cold exposure <p><u>Arthritis involving distal joints.</u></p>	<p><u>EFFECT:</u> Interview Clin Exam.</p> <p><u>FITNESS:</u> Interview (vulnerability). Clin Exam (vulnerability).</p>	<p><u>EFFECT:</u> X-rays, (Ortho opinion) EMG, (Neurologist opinion)</p> <p><u>FITNESS:</u> OMP opinion.</p>	-
Vibration (Whole)	Neural tissues (>40Hz) Skeleton (spine) (40-50Hz) Vascular system (>40Hz) Female reproductive organs Pregnancy <u>Note:</u> Whole body vibration effects worst at lower frequencies (0.5-100Hz). Below 0.5Hz, the problem is motion sickness.	Vision (data acquisition) Hand / foot control Complex central (cerebral) data processing Bone degeneration Raynaud's Syndrome Ischaemic heart disease, hypertension Increased risk of abortion, menstrual disturbances Anomalies of foetal descent (but no foetal anomalies)	<p><u>Medical conditions:</u></p> <ul style="list-style-type: none"> ○ Peripheral neuropathy ○ Poor hand / foot co-ordination (cerebellar degeneration, long tract damage) ○ Elderly workers ○ Arthritis ○ Vascular disease, hypertension ○ Pregnancy <p><u>Non-medical exposures to vibration:</u></p> <ul style="list-style-type: none"> ○ Motor cycling 	<p><u>EFFECT:</u> Interview. Clin Exam.</p> <p><u>FITNESS:</u> Interview (vulnerability). Clin Exam (vulnerability).</p>	<p><u>EFFECT:</u> X-rays</p> <p><u>FITNESS:</u> OMP opinion.</p>	-



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Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability ("fitness") (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
Radiation (Ionizing)	High turnover organs (skin, hair, GIT, marrow), eyes (lens), thyroid, gonads. <u>Note:</u> Certain radionuclides have specific target organ preferences.	Local energy deposition (generation of free radicals) Direct organ damage Damage to genetic material Cancer, teratogenesis.	<ul style="list-style-type: none"> Pregnancy. Pre-existing target organ damage (target organ determined by the radio source) <ul style="list-style-type: none"> Marrow damage with anaemia Thyroid damage Gonad impairment 	EFFECT: Clin Exam (skin, hair, lenses, thyroid) FITNESS: Interview (vulnerability). Clin Exam (vulnerability).	EFFECT: FBC & diff. Thyroid scan (¹³¹ I) Whole body scan (³ H, ¹⁴ C, ¹³⁷ Cs) Skeletal scan (Ra & ⁹⁰ St) FITNESS: OMP opinion.	Hazardous Substances Act & Regulations
Radiation (Non-Ion) (Ultra-Violet)	Eyes, skin.	Burns, cancer (UVB). Increased skin ageing Photosensitisation (UVA) Retinitis ("solar retinitis") Photokeratitis (acute)	Cancer: - Fair-skinned people, (sun-exposed naevi). Xeroderma pigmentosum – neoplasias of the cornea and conjunctivae. Photosensitisation: <ul style="list-style-type: none"> <u>Medicines</u> (sulphonamides, salicylates, quinine, coal tar derivatives, tetracyclines, tricyclics, NSAIDs, sulphonylureas, phenothiazines, psoralens (PUVA therapy)) <u>Non-medical:</u> Some fragrances, Cyclamates (sweeteners), deodorant & bacteriostatic agents in soaps, sunscreen ingredients, fluorescent brightening agent for cellulose, nylon or wool fibres. 	EFFECT: Interview, examination FITNESS: Interview, examination	EFFECT: Biopsy FITNESS: OMP opinion.	-
Radiation (Non-Ion) (Infra-red)	Eyes.	Cataracts	Pre-existing cataracts Diabetes mellitus.	EFFECT: Interview, examination FITNESS: Interview, examination	EFFECT: Ophthalmologist opinion FITNESS: OMP opinion	-
Radiation (Non-Ion) (LASER)	Eyes.	Class 1: Safe Class 2: Safe Class 3: Eye hazard Class 4: Eye & skin hazard	None.	EFFECT: Visual acuity FITNESS: None	EFFECT: Ophthalmologist opinion FITNESS: None	-
Radiation (Non-Ion) (Radio & microwave)	General body tissues (Cellular phones – ear and brain)	Body warming Parasthaesia in hands & fingers (No convincing evidence for carcinogenesis)	None.	EFFECT: Interview. FITNESS: None.	EFFECT: Exposure measurement. FITNESS: None.	-
Radiation (Non-Ion) (VLF, ELF & Magnetic)	Nerve and muscle tissues.	Neuromuscular junction stimulation	None.	EFFECT: Interview. FITNESS: None.	EFFECT: Exposure measurement. FITNESS: None.	-
Radiation (Non-Ion) (Magnetic fields)	Neurobehavioural.	Not clear	Cardiac pacemakers, and other electronically operated devices.	EFFECT: Interview. FITNESS: None.	EFFECT: Exposure measurement. FITNESS: None.	-
Ergonomic	Musculoskeletal	Repetitive strain injuries Mechanical strain of musculo-tendinous units Muscular strain	<u>Task factors:</u> <ul style="list-style-type: none"> Static posture Excessive movement (frequency, distance, twisting) Excessive load-bearing (object weight, grip) Object shape (distance from centre of gravity) <u>Person factors:</u> <ul style="list-style-type: none"> Previous injury (especially back or RSI) Certain medical conditions (diabetes mellitus, pregnancy, connective tissue disorders, arthritis) 	EFFECT: Interview, examination FITNESS: Interview, examination	EFFECT: OMP opinion Orthopaedic opinion FITNESS: OMP opinion Orthopaedic opinion	N/A



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Hazards	Key Target Organs	Main Biological Effects	Conditions that increase vulnerability ("fitness") (Programme exclusions, Relative & Absolute)	Tests: Phase 1 (screening)	Tests: Phase 2 (diagnostic)	Standard
Shift Work	Psychological Gastro-intestinal Cardiovascular	Sleep deprivation / fatigue, Depression Peptic ulceration Hypertension, ischaemic heart disease. (Social effects)	<p><u>Task factors:</u></p> <ul style="list-style-type: none"> ▪ Poor lighting, isolation, risk of personal injury. <p><u>Person factors:</u></p> <ul style="list-style-type: none"> ▪ Cardiovascular disorders: hypertension, ischaemic heart disease. ▪ Psychiatric disorders: depression, anxiety, sleep disorders, especially narcolepsy, psychoses, alcoholics & drug addicts. ▪ Neurological: epilepsy, severe (not correctible) visual impairment. ▪ Respiratory: asthma (esp. if poorly controlled & steroid dependent), active extensive tuberculosis. ▪ Gastro-intestinal disorders: relapsing peptic ulcer disease, severe irritable bowel syndrome. ▪ Endocrine disorders: insulin-dependent diabetes, thyrotoxicosis. 	<p><u>EFFECT:</u> Interview, examination</p> <p><u>FITNESS:</u> Interview, examination</p>	<p><u>EFFECT:</u> OMP opinion</p> <p><u>FITNESS:</u> OMP opinion</p>	Code of Good Practice – Labour Relations Act.
Visual Display Units	(Eyes)	Eye strain Headaches (Not teratogenic, minimal radiation)	Poorly placed VDU can lead to eye strain and headaches, because of glare (reflection), and chronic neck muscle strain.	<p><u>EFFECT:</u> Interview.</p> <p><u>FITNESS:</u> Vision: Acuity.</p>	<p><u>EFFECT:</u> N/A</p> <p><u>FITNESS:</u> N/A</p>	


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Table 4: Test Selection by Target Organ and Biological Effect

Target organ effects are measured in terms of impairment of function and direct tissue damage.

Target Organs	Biological Effects (Impairment)	Monitoring Phase 1 (screening)	Monitoring: Phase 2 (diagnostic)
Eyes	Impaired vision	Visual acuity (near & far), colour vision (Ishihara)	Split lamp. Specialist evaluation.
Ears	Impaired hearing	Screening Audiometry	Diagnostic audiometry, Special Questionnaire.
	Impaired balance	Clinical tests (on one and two legs)	-
CNS	Impaired thinking	Mini mental state ("OMIJAS")	Psychometric tests
	Impaired fine motor control	Write own name, draw shapes, finger-nose test.	Psychomotor tests
	Impaired co-ordination	Button-hole test, thread a needle, dress/undress.	Psychomotor tests
	Impaired speech	Interview.	-
PNS	Impaired sensation (Light touch, temp, vibration)	Wet/dry cotton wool, tuning fork.	Neurological opinion, EMG conduction tests.
	Impaired motor function	Motor function screening examination.	Neurological opinion, EMG conduction tests.
	Impaired deep tendon reflexes	Tendon reflexes	Neurological opinion, EMG conduction tests.
ANS	Impaired autonomic NS function.	CVS - orthostatic hypotension; GIT - nocturnal diarrhoea	-
CVS	Impaired cardiac output	Symptoms, clinical examination.	Cardiological opinion, tests of
RESP	Impaired lung function	Spirometry	Peak Flow Tracking, pre- and post bronchodilator spirometry.
LIVER	Impaired liver function	Urine dipsticks - bilirubin, urobilinogen.	Laboratory liver function tests (LFT).
	Damaged hepatocytes	Urine dipsticks - bilirubin. Serum enzymes: AST, ALT, LDH.	Liver ultra-sound, biopsy.
	Enzyme induction	Serum GGT	-
Kidney	Impaired renal function	-	Blood urea & electrolytes, creatinine levels.
	Damaged glomeruli	Blood pressure, Dipsticks (haematuria)	Nephrologist opinion, Biopsy.
	Damaged renal tubules	Dipsticks (proteinuria)	Nephrologist opinion, Biopsy.
Immunity	Impaired immune function	Symptoms, WBC count, clinical findings.	Immunoglobulin levels, WBC sub-types (e.g. CD4, CD8), haematologist opinion.
	Allergy - Humeral (Ig E) - mediated.	Non-specific: - Total IgE, eosinophil count, Phadiotop (RAST). Specific: - N/A	Specific: commercially available specific RAST tests.
	Allergy - Cell mediated.	Non-specific: - Symptoms. Specific: - Skin prick tests.	Specific: - Skin prick tests.
	Allergy - direct effects on mast cells.	Symptoms / timing.	Direct challenge tests. (lungs, skin, etc.).
Bone marrow	Impaired blood formation & function	Haemoglobin, FBC, (INR), (bleeding time).	Marrow biopsy, haematologist opinion
Pancreas	Impaired glucose metabolism	Random / fasting glucose	Glucose tolerance test
Thyroid	Impaired thyroid hormone formation	Thyroid function.	-
GIT	Impaired motility (constipation/diarrhoea)	Symptoms.	-




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Target Organs	Biological Effects (Impairment)	Monitoring Phase 1 (screening)	Monitoring: Phase 2 (diagnostic)

Screening generally includes a simple interview with the person, during which the relevant symptoms are addressed in conversation. This is not always the case, as some tests have sufficient positive predictive value not to require the assistance of an interview (i.e. visual function, audiometry). Sometimes, no screening test exists, excepting symptom evaluation. Where relevant, there are Synergiee Questionnaires available to improve the efficacy of the symptom evaluation.

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19 Appendix 8: Screening

Screening has been defined as the presumptive identification of unrecognised disease or defect by the application of tests or examinations. It involves the performance of a relatively simple test on a large population to separate from it a subpopulation with a high likelihood of having a treatable disease.

The operational objective of screening is the accurate classification of persons who do or do not have the disease in question. The goal or outcome objective of screening is the reduction of the consequences of the disease by incidence, morbidity or mortality.


Test characteristics to consider.

The following test characteristics should be considered when selecting appropriate tests for medical surveillance (*Cochrane and Holland criteria*):

- Simple – both in application and in interpretation.
- Acceptable – the methods employed should cause minimum discomfort, and avoid clashes with belief systems.
- Cost-effective – the result should be worth the cost.
- Precise (repeatable) – the result should be reliable, so that repeat testing of the same sample will produce the same result.
- Accurate – the results should be a true reflection of the condition being sought.
- *Sensitive* - the ability of the test to identify the condition, even if it means including a lot of false positives.
- *Specific* - the ability of the test to exclude conditions that are the false positives

The “*positive predictive value*” of a test is a combination of sensitivity and specificity; it’s a test’s ability to accurately identify what it’s looking for (deafness, blindness, etc.); this means without identifying cases incorrectly (“false positives”), and also without missing any (“false negatives”). It can be calculated, by multiplying the sensitivity by the specificity. In general, although not an absolute rule, tests with a high degree of sensitivity are best for screening, and tests with a high degree of specificity are best for confirmatory diagnosis.

However, note that some tests have high specificity but poor sensitivity, which means that, whilst the cases identified may be reliably regarded as “positive”, these tests may miss a significant proportion of “positive” cases, due to the poor sensitivity. These are therefore only useful when positive – when the result is negative, one cannot be certain that this is true. A good example is the CDT test for alcohol consumption. When it is positive, it is generally regarded as a reliable marker of excessive alcohol consumption (high specificity). However, a significant proportion of cases are reported by the test as normal, even when circumstantial evidence indicates the contrary (poor sensitivity). To continue with the same example, GGT is often used as a screening test for alcohol consumption, because it is fairly sensitive. However, it must be remembered that its specificity is poor – there are many conditions that give rise to a raised GGT. To overcome this, tests are combined in a “battery”, so that the combination improves the overall positive predictive value of the examination. Hence the combination of a good

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history, collateral evidence, GGT, MCV and CDT all contribute to improve the combined positive predictive value in establishing the presence of excessive alcohol consumption.

	DISEASE +	DISEASE -	TOTALS:
Screen +	a. (TP)	b. (FP)	a+b
Screen -	c. (FN)	d. (TN)	c+d
TOTALS:	a+c	b+d	a+b+c+d

$$\text{Sensitivity} = a/a+c$$

$$\text{Specificity} = d/b+d$$

$$\text{Positive Predictive Value} = a/a+b$$

$$\text{Negative Predictive Value} = d/d+d$$

Note: **TP** = True Positive; **FN** = False Negative; **FP**= False Positive; **TN** = True Negative


19.1 What Makes Screening A Viable Option?

The Disease

- The diseases being screened for must have serious health consequences in terms of morbidity and mortality.
- The natural history of the disease needs to be reasonably well understood.
- The disease must be treated more successfully in the screen-detected stage than when symptoms have led to the diagnosis. There is no point in screening for a disease that can be successfully treated after symptoms appear.
- The detectable pre-clinical phase of the disease should have a high prevalence among the people screened. Otherwise too few cases will be detected to justify the expense of screening.

The Test

- The screening test should designate people with early disease as positive and those without as negative. Success of a screening programme is at meeting these expectations with sensitivity and specificity. In designing a screening programme one often has to trade between sensitivity and specificity. Sensitivity should necessarily be maximised. One needs to balance the consequences of low sensitivity (missed cases or false negatives) and low specificity (economic, social and psychic costs of false positives).
- A useful indicator of the capabilities of the screening test is the positive and negative predictive values.

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- The test must be acceptable to both the employee and tester. Any unpleasant aspects of the test should be minimised and it should not have hazardous consequences. These characteristics assist in compliance of the programme.
- The test must be cost-effective.

Evaluation

- Proper choice of outcome measure. For cancer and other chronic conditions the objective should be to reduce mortality.
- Problems of comparing survival times of screen detected cases against symptom-detected cases: almost invariably, screen detected cases have a longer survival time. Is this due to the effect of screening or the following biases?
 - Lead time bias: screening has advanced the diagnosis of the disease
 - Selection bias: screening may tend to select cases destined to have a benign clinical course. One will detect those diseases with the longest detectable pre-clinical phase. These lesions tend to also have long clinical phases.
- Thus people with relatively benign lesions and correspondingly good survival tend to be over-represented among cases detected by screening.
- The only valid outcome variable for assessment of the results of a screening programme is the mortality rate from the disease in the total population offered screening in comparison with the mortality rate that would be expected in the same population if screening had not been offered.
- Screening should only be done if there is conclusive evidence that the natural history of the disease will be altered in a significant proportion of people screened.

Monitoring

- Monitoring is the repetitive performance of an observation or measurement used to detect an unfavourable trend, which may be altered by appropriate intervention.
- Screening by definition is cross-sectional and monitoring longitudinal.

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20 Appendix 9: Establishing Work-Related Causality


Occupational Health professionals will, from time to time, be required to make a judgement call regarding a putative exposure and an adverse health outcome and the question which arises is whether or not the exposure really caused the disease. Some times this is simpler than in others such as where a very close relationship exists between an adverse health outcome and a particular exposure eg. mesothelioma and asbestos dust exposure. However, do we establish this with entities for which many possible explanations exist such as anaemia, asthma, dermatitis and other target organ effects such as hepatitis, neuritis etc. the answer does not lie solely in statistics but also in applying a certain degree of logic common sense. The Bradford Hill criteria for assessing causality were established to attempt to address this very issue. These are listed as follows:

- 1 Strength of association
- 2 Consistency
- 3 Specificity
- 4 Appropriate time relationships
- 5 Biological gradient
- 6 Biological plausibility
- 7 Experimental support
- 8 Analogy
- 9 Coherence of the evidence

For ease of committing this to memory a suggested acronym is **aggaccept**, a= strength of association, g = biological gradient, a = analogy, c for consistency, c for coherence, e for experimental evidence, p for plausibility, t for time relationships.

So what do all these entities mean?

- 1 *Strength of an association* is generally measured in epidemiology by estimates of relative risk (RR). By convention a RR of greater than 2, points to the existence of a real relationship that does not occur due to chance alone.
- 2 *Consistency*: This term refers to the degree to which a finding can be reproduced in other situations such as different countries, different times and different work situations.
- 3 *Specificity*: This term refers to the theoretical “ideal” requirement that links an adverse health outcome with one specific exposure. The nearest example to this would be the relationship between asbestos and mesothelioma which, although very strong, is nevertheless not 100% specific. Specificity therefore is a theoretical criterion and is never likely to be fully met.

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- 4 *Appropriate time relationships:* A proposed cause must precede an effect and the latent period between the earliest exposure and the effect manifestation should be what would be expected on the basis of the known biology of the disease in question.
- 5 *Biological gradient:* This term refers the dose response relationship with which the exposure and the outcome can be linked. Therefore, the likelihood of developing the adverse effect increases with the increased exposure. For example, this is one of the strongest elements of evidence linking lung cancer with tobacco smoking.
- 6 *Biological plausibility:* This term refers to the conformity of the outcome with the existing knowledge of the pathophysiology associated with the exposure in question. Therefore, this requires a detailed knowledge of the toxicology of the agent to which exposure takes place.
- 7 *Experimental evidence:* This term refers to the finding in the laboratory setting which ideally should support the findings in the clinical setting. This would include laboratory tests for carcinogenesis for example. One should bear in mind that the animal model or test tube circumstance is not necessarily true for the human model.
- 8 *Analogy:* This term refers to the evolution of similar adverse health outcomes under similar situations with other related chemicals. For example, in the case of benzene exposures, similar aromatics such as xylene and toluene should have not very different effects profiles.
- 9 *Coherence of the evidence:* This term refers to the coherence of all the elements of these criteria when they are summed up together. The more coherence that is found, the greater the strength of the association. However, notwithstanding this, the final decision is always a judgement call informed by epidemiological and other evidence and consequently retains an element of uncertainty.